THE GREEK DEBT CRISIS

IN QUEST OF GROWTH IN TIMES OF AUSTERITY

Edited by Christos Floros and Ioannis Chatziantoniou

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Christos Floros · Ioannis Chatziantoniou
Editors

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In Quest of Growth in Times of Austerity

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Introduction

As we write these words, the Greek debt crisis which has its roots in 2009, still remains one of the main unresolved issues within the Eurozone. While on the surface, the crisis appears to be predominantly related to the financial sphere of operations, there is no doubt that this is a deep political crisis with a multitude of social repercussions.

Understanding how markets can retrospectively punish a country with excessive deficits or how can private sector debt be transformed into debt borne by the official sector is only part of the story. The crisis has raised questions regarding the persistence of inherent distortions and pathogenies afflicting the Greek economy thereby questioning the reliability of the old political establishment. It has also paved the way for growing criticism of the effectiveness of European policies, in the light of specific measures that did not have the anticipated outcomes. It has even cast doubt on the case for a common currency, that is, on the very edifice of the Eurozone.

Some of the most controversial topics of the period include the level and therefore the sustainability of the Greek debt, austerity—as a means for achieving primary budget surpluses—and its effects on domestic demand and investment, the role of the European Central Bank especially in connection with its emergency liquidity assistance policy and its quantitative easing program, the extent of solidarity and of political integration among the Eurozone member countries, the eventuality of the departure of Greece from the single currency, as well as, the capacity of the Greek Government-in-office to effectively promote the reforms necessary to avert further aggravation of the chronic conditions tormenting the economy and to restore markets' confidence in the country.

Against the backdrop of strenuous and tense discussions on such contentious issues, the reality of the Greek economy and society: Capital controls, in an effort to mitigate deposit-hemorrhage; high taxation, including an unprecedented levy on property; pensioners, who are devoid of the full compensation that they deserve based on their contributions to the pension system in the previous years; small and medium-sized enterprises that either scratch a living or are forced to cease operations; lack of investment that generates opportunities for employment. It is needless to say that there is also a humanitarian dimension to the crisis when it comes to low incomes and the most deprived parts of society. Understandably, the question of how Greece can stimulate domestic demand and attract investors remains quite topical.

In effect, it is obvious that there are more than just a few aspects in relation to the crisis that deserve individual attention and further investigation. In this volume, we have included chapters written by prominent academics who examine certain key aspects of the Greek crisis and provide their view on the relevant developments. Although not exhaustive, we strongly believe that this volume adds to the effort of attaining a better understanding of the intricate character and the numerous ramifications of the crisis.

Christos Floros
Ioannis Chatziantoniou

When Did It Go Wrong? The Case of Greek Sovereign Debt

Vasilis Sarafidis, Anastasios Panagiotelis and Theodore Panagiotidis

1 Introduction

It is difficult to overstate the economic, political and societal impact of the crisis in Greece as well as its ramifications for Europe and the wider world. The Greek economy has shrunk by roughly a quarter since the onset of the crisis, showing little sign of recovery. Youth unemployment (40.6% in 2016 viz. 18.2 in 2009, 15.5 viz. 14.4 in EU15 for the same years), poverty (15% in 2015 viz. 2.2% in 2009; see here) and suicide rates (35% increase, from 3.37 to 4.56/100,000 people between 2010 and 2012; see here) have skyrocketed. Since 2008, Greece has had five Prime Ministers (not including two caretakers) and five elections (not including an additional referendum). Fears of contagion have

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undermined economic recovery in several other nations and especially those in the Eurozone.

While the causes and consequences of the Greek economic crisis are complex and multifaceted, no analysis of the situation is complete without understanding the role played by government debt. Some of the key events in the crisis directly involve government debt, such as the downgrading of Greek government bonds to junk status in 2010 and the "haircut" on government debt in 2012. While the impact of the current crisis on Greek government debt has been profound, a focus on recent history only tells part of the story. Indeed, the worsening of Greek government debt could be said to have antecedents throughout the period following the restoration of democracy in Greece in 1974.

In this chapter, we discuss movements in Greek government debt for the period 1974–2016. We also discuss how government debt has been influenced by different macroeconomic phenomena such as economic growth, inflation, government expenditure and revenues, interest rates, currency movements and stock-flow adjustments. Where data are available, we make comparisons with the countries that were members of the European Union just prior to May 2004, namely: Austria, Belgium, Denmark, Finland, France, Germany, Ireland, Italy, Luxembourg, Netherlands, Portugal, Spain, Sweden and the UK (hereafter, the EU15). Comparisons are also made to four other crisis-inflicted European countries, namely Ireland, Italy, Portugal and Spain (hereafter, IIPS).

It is important to note that although macroeconomic variables are inherently linked to one another, it can be difficult to establish the direction of causation between variables without sophisticated econometric techniques. Any associations between variables discussed in this chapter should be understood to be descriptive in nature. Despite this caveat, it is still possible to establish a credible narrative that explains why the crisis has been so pronounced in Greece even compared to IIPS.

Any discussion that is limited to public sector debt risks ignoring the important role of other factors. For example, the government debt-to-GDP ratio of Japan is higher than that of Greece; however, the economies of these two nations differ vastly. To state just two differences, the

Japanese government can fund deficits from a large pool of domestic savings and has a strong export sector, whereas Greece has traditionally relied on international capital inflows and has run trade deficits averaging 6.7 percentage of GDP during 1974–2016. As such, no understanding of the Greek crisis can be complete without an understanding of the role of high levels of private domestic debt, large current account deficits and other issues regarding financial markets and the domestic banking sector. In addition, a study of macroeconomic aggregates ignores microeconomic issues such as the efficient operation of labour markets, the difficulty of starting and running a business, the competitiveness of the export sector, industrial organisation and the effect of bureaucratic red tape. While these issues lie beyond the scope of this chapter, they will be thoroughly investigated in the remainder of the book.

In Sect. 2, the sources of data are introduced as key definitions and issues that potentially compromise the credibility of data. Section 3 focuses on the key variable under investigation, namely General government debt as a percentage of nominal gross domestic product (GDP) including a discussion of trends in GDP and inflation. Attention is then turned towards three factors that contribute to debt accumulation, namely the primary deficit, covered in Sect. 4, interest rates covered in Sect. 5, and stock-flow adjustments covered in Sect. 6. In Sect. 7, general conclusions are made.

2 Data

Data on fiscal aggregates are drawn from two different sources. For the period 1975–1994, we made use of the statistical annex included in the "European Economy" report produced by the European Commission in 2000 (pp. 155–399). These figures are based on ESA 79 (the European System of Integrated Economic Accounts in 1979) and earlier definitions. For the period 1995–2016, the data are drawn from the AMECO online database and they are based on the most recent accounting framework, ESA 2010.[1] The 2016 observation is an estimate and so it is subject to review.

The recording of national statistics is not static but is—and will always be—subject to changes and improvements; the methodological improvements over time across the various accounting frameworks (notably, ESA 79, ESA 95 and ESA 2010) relate mostly to more clearly defined delineations of the general government sector, more up-to-date concepts—such as the recording of leasing—recordings of transactions that are more closely in line with economic criteria (on an accruals and not a cash basis), and other improved measurement practices.

We note that post-1995 Greek fiscal data have been subject to numerous revisions.[2] For instance, in 2010 alone, Eurostat carried out four Excessive Deficit Procedure (EDP) methodological visits to Greece. The main issues addressed in Eurostat's visits concerned the definition of the general government sector, the recording of certain government transactions (notably for off-market swaps and social security funds), and the recording of unpaid obligations (amounts payable of government). Details on these issues are documented in a report published by Eurostat (2010).

Unfortunately, data prior to 1995 could not be subjected to an extensive audit by Eurostat. Therefore, we suggest some caution in directly comparing figures prior to 1995 with those after this date. Nonetheless, these are the best data available, and the broad trends suggested by these data are credible.

Aggregate ratios for the EU15 countries and IIPS have been computed using weighted averages, where the weights are determined by the denominator of the ratio. As an example, the average value of the debt-to-GDP ratio weights the country/time-specific observations on debt-to-GDP by the country/time-specific nominal GDP value. The same methodology is applied for computing aggregate figures for the growth rate of GDP. On the other hand, aggregate figures on inflation rates are computed using simple, arithmetic averages across EU15 and IIPS.

Finally, notice that the Greek government is highly centralised; in 2015, the Central government collected almost 74 percentage of revenues and accounted for about 77 percentage of expenditure, whereas the corresponding figures for the EU15 as a whole are 53 percentage and 55 percentage, respectively. Local governments represent a very

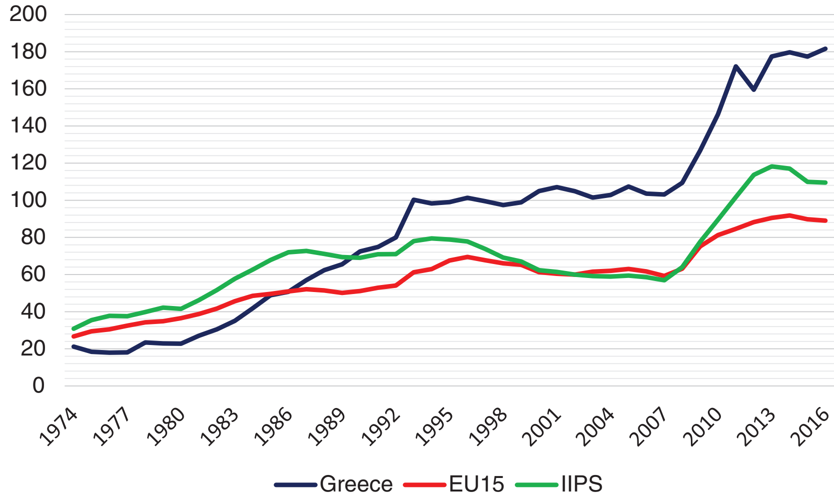

Fig. 1 General government gross debt, % of GDP

small portion of total revenues and expenditure (7.4 percentage and 7.7 percentage of GDP, respectively, for Greece viz. 35.5 percentage and 33.8 percentage for the EU15) and receive most of their revenues as grants from the central government. Social security funds account for about 37.8 percentage of revenues and 33.2 percentage of expenditure, whereas the EU15 average is 33.1 percentage and 31.7 percentage, respectively.

The analysis in this chapter will focus on the General government, which will also be referred to as simply the public sector. The main reason for this is that this measure of the public sector was the focus of the Maastricht criteria, as well as of the Stability and Growth Pact.

3 The Evolution of the Debt-to-GDP Ratio

A characteristic feature of the Greek crisis has been the role of government debt. Figure 1 shows the evolution of Greek government debt as a proportion of nominal GDP in together with figures for the EU15 and IIPS for comparison. In 1974, the General government debt was about 21.2 percentage of GDP and the late 1970s saw government debt remain stable with a modest rise to 22.8 percentage of GDP in 1980. From 1981 onwards, public debt began to accumulate rapidly up until 1993, at which stage it exceeded 100 percentage of GDP. During this period, the Greek debt-to-GDP ratio first surpassed that of the EU15, and eventually surpassed that of IIPS. From 1994 until the onset of the crisis, the Greek debt-to-GDP ratio was relatively more stable, an experience echoed in the EU15, while the debt-to-GDP ratio in IIPS fell. Since 2007, the Greek debt-to-GDP ratio has again accumulated rapidly, and in 2016, it is estimated to be roughly equal to 181.6 percentage of GDP. Although the EU15 and IIPS also experienced substantial increases in the debt-to-GDP ratio after 2008, they had much lower debt-to-GDP ratios than Greece at the onset of the crisis. Furthermore, the debt-to-GDP ratio in IIPS has declined since peaking in 2013. Apart from a modest and temporary dip in 2012, such a correction has not been observed in the case of Greece and at present, both the current Greek government and the IMF regard public debt to be unsustainable; see IMF (2016).

Since public debt is expressed here as a ratio of nominal GDP, Fig. 1 can only be contextualised by understanding trends in both real GDP growth and inflation. In 1950, Greece was one of the poorest countries in Europe; according to Maddison (1995, Tables 1–3), its GDP per capita was about 44 percentage of the average of the countries that later formed the EU15[3] and 68 percentage of the average of IIPS. Consistent with economic convergence theories (see de la Fuente 1997, for a review), Greece subsequently experienced remarkable economic growth; during 1960–1974, the average annual growth rate of the Greek economy was around 11 percentage, relative to 5.6 percentage for the EU15 and 8.8 percentage for IIPS. By 1974, Greece's GDP per capita had reached about 72 percentage of the EU15 average and even exceeded the IIPS average by a small margin of 1.4 percentage.

Figure 2 shows annual growth in real GDP for Greece during the period 1974–2016 compared to both the EU15 and IIPS. Although the GDP growth rate fell in Greece after the restoration of democracy in 1974, it remained high compared to EU15 up until the second oil price shock in 1979. During 1981–1993, Greece grew at an average annual

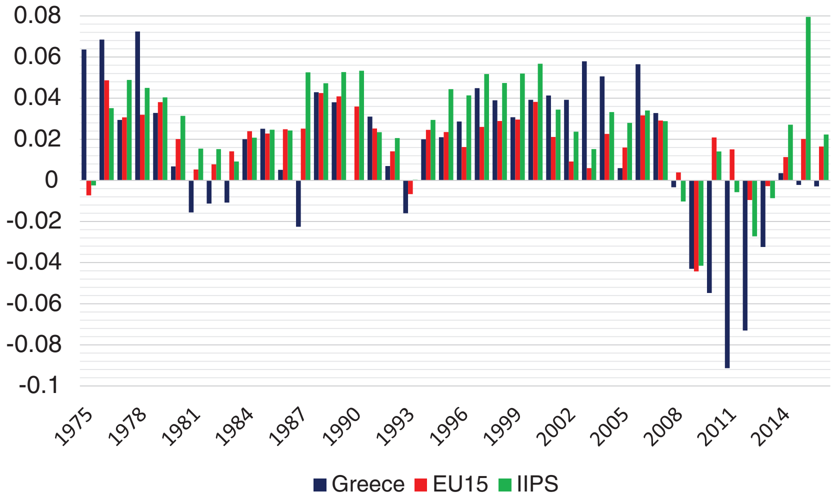

Fig. 2 Growth rate of real GDP

rate of less than 1 percentage compared to almost 3 percentage in EU15 and 2.7 percentage in IIPS. The period from 1994 (which is when the European convergence criteria came into force) until 2007 saw an improvement in Greek GDP growth, which outperformed the EU15 average in almost all years; a notable exception is the year 2005, when the economy exhibited, as expected, signs of cooling off following the 2004 Summer Olympic Games that took place in Athens.

In 2008, GDP fell by similar amounts in Greece, the EU15 and IIPS, with reductions of 4.3, 4.4 and 4.1 percentage, respectively. However, the Greek economy continued to shrink by 5.5 percentage in 2009, 9.1 in 2010, 7.3 in 2011 and 3.2 percentage in 2012. In just 4 years, Greek GDP per capita went from 73.6 percentage of the EU15 average to 57.9 percentage of the EU15 average and from 83.6 percentage of the IIPS average to 68.7 percentage of the IIPS average. Although the drastic decline in Greek GDP has been halted since 2013, GDP growth has been virtually zero despite signs of recovery in the rest of the EU15, and especially in IIPS.

Figure 3 shows the evolution of the annual inflation rate in Greece, relative to the EU15 and IIPS over the period 1974–2016. In the 1980s

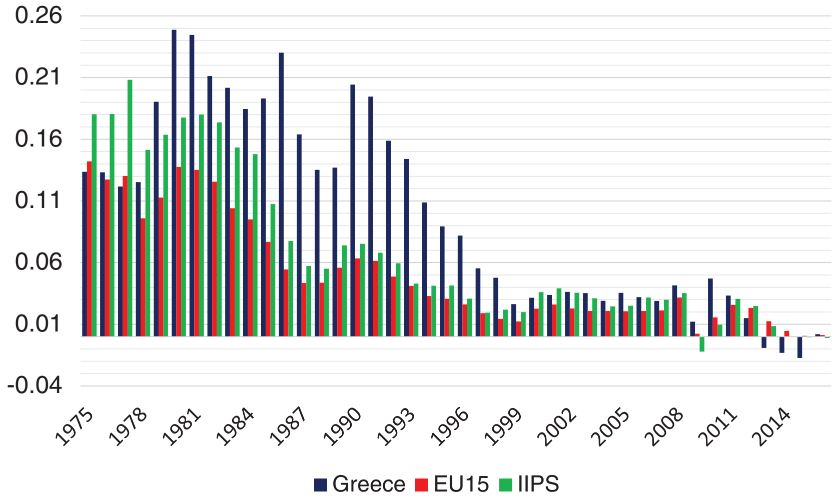

Fig. 3 Inflation rate

Greek inflation surged, averaging about 19.5 percentage per annum compared to just 6.8 percentage in EU15 and 11.3 percentage for IIPS. One explanation for this differential is that Greek wage increases in both the public and private sectors were determined under an automatic indexation system that was linked to inflation. The scheme provided for full inflation indexation of low wages and salaries and for partial indexation of high wages. Although this scheme was modified several times in response to the electoral cycle as well as part of a stabilisation program in 1986–1987, it was only entirely abolished in 1991. After 1990, the inflation rate began to fall in Greece although Greek inflation remained above the European average up until the crisis. For instance, from 1999 to 2007, it averaged 3.2 percentage compared to 2 percentage for EU15 and 3 percentage for IIPS. Despite a shrinking economy, in 2010 and 2011, Greece posted relatively high rates of inflation, mainly due to increases in indirect taxes on goods and services (see Fig. 11). The period from 2013 to 2015 has seen the emergence of deflation which was otherwise only experienced by IIPS during 2009 and not at all in the EU15 during the entire 43-year period under consideration.

Changes in inflation and GDP go some way to explaining movements in the debt ratio. For example, it is noteworthy that during the period 2009–2015 the value of the stock of Greek government debt increased from €301.1bn to €311.7bn, a fairly small change of 3.5 percentage. Hence, the dramatic increase in the debt-to-GDP ratio over this period has been driven mainly by the fall in real GDP, which has shrunk by a quarter over this period. Deflation has also played a role since a decline in wages and prices, aimed at regaining competitiveness, has resulted in a nominal GDP that in some instances shrunk even more that real GDP.[4]

With a complete overview of the debt-to-GDP ratio, real GDP growth and inflation, the following questions deserve consideration:

1. Why did the Greek debt-to-GDP ratio consistently rise from 1981 to 1993?
2. How was a stabilisation of the Greek debt-to-GDP ratio achieved from 1994 to 2007?
3. Why did the Greek debt-to-GDP ratio fail to decline during this period despite strong economic growth?
4. Why has the rise in the Greek debt-to-GDP ratio since 2008 been so dramatic and why have the measures implemented in response to the crisis failed to result in a sustained decrease in the debt-to-GDP ratio?

To analyse these issues, we employ a well-known identity that decomposes debt accumulation into three factors, namely the primary deficit, the interest rate effect and stock-flow adjustments. A more technical description of the method is appended to this chapter. The following sections describe the historical evolution of each of these factors for the Greek economy with comparisons made to EU15 and IIPS.

4 The Primary Deficit

An important distinction when discussing budget deficits is the one between a total deficit and a primary deficit. While the total deficit is simply the difference between expenditure and government revenues,

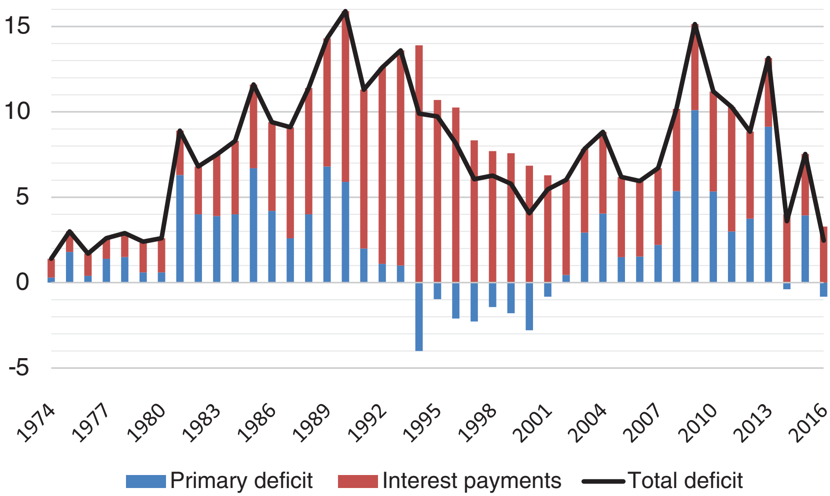

Fig. 4 General government deficit, % of GDP

the primary deficit does not include interest payments as expenditure. In this section, we focus on the primary deficit, which is in some sense a fairer reflection of fiscal policy settings, while interest rates will be discussed in more detail in the following section.

Figure 4 shows how both the primary deficit and total deficit have changed in Greece since 1974. Beginning from a relatively low base, the budget deficit increased rapidly from 2.6 percentage of GDP in 1980 to 8.9 percentage in 1981. Primary deficits remained high for much of the following decade, averaging 4.8 percentage of GDP during 1981–1990. As a result of budget consolidation efforts, the primary deficit began to fall from 1991 onwards, and primary surpluses (shown here as negative deficits) were achieved during 1996–2001. The budget returned to primary deficit in 2002 and rose to as high as 4 percentage in 2004. After smaller deficits from 2005 to 2007, the early phase of the crisis saw the primary deficit climb to 10.1 percentage in 2009. A primary surplus was not achieved again until 2014 and despite a primary deficit in 2015, the following year saw the return to a small primary surplus.

Figure 5 shows the Greek primary deficit compared to the EU15 and IIPS since 1995, highlighting both similarities and differences in

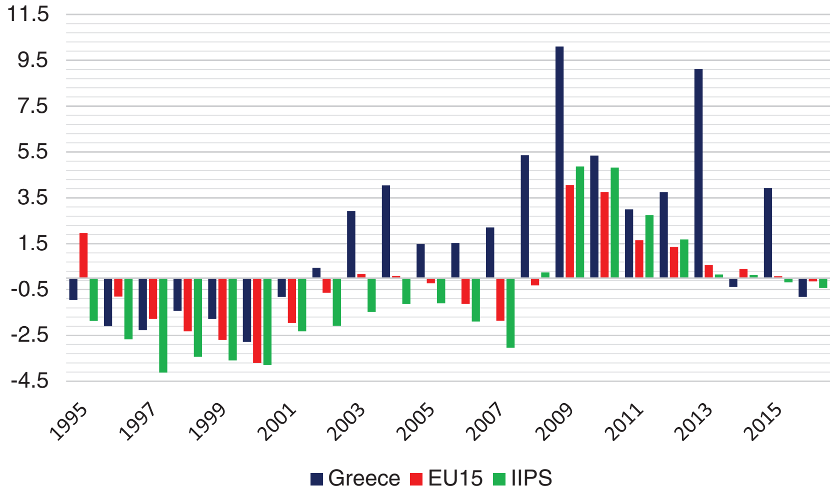

Fig. 5 Primary deficits, % of GDP

the experience of Greece compared to the rest of Europe. Overall, the achievement of primary surpluses in the late 1990s, a loosening of fiscal policy in the early 2000s and deficits blowing out after 2008 was an experience confined not only Greece but to some extent was observed throughout Europe. This similarity can be at least partially explained by common institutional factors associated with the establishment of a single currency.

The Maastricht criteria (also known as the euro convergence criteria) came into force in 1994, setting out the obligations to be fulfilled for membership into the European Monetary Union (EMU). Two such conditions were to keep "sound fiscal policies" with debt limited to 60 percentage of GDP and annual fiscal deficits (which include interest payments) to be no greater than 3 percentage of GDP. This explains primary surpluses in both Greece and more broadly in Europe over the late 1990s. Although Fig. 4 would seem to undermine the case that this was strictly enforced since Greece never achieved a deficit lower than 3 percentage, we remind the reader that Fig. 4 is based on the updated accounting standards of ESA2010. In 1999, Greece achieved a deficit

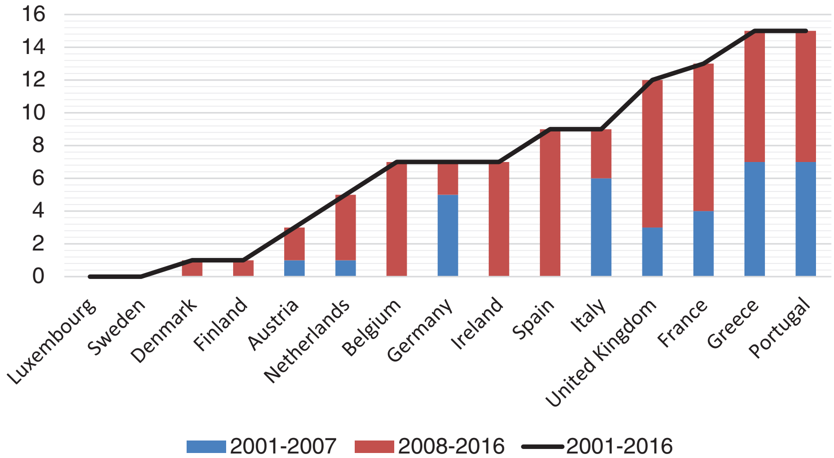

Fig. 6 Number of violations of the fiscal deficit criterion

within the limit of 3 percentage of GDP under the ESA79 standards that could legitimately be used at the time.[5]

The fiscal consolidation process stopped soon after the establishment of the Euro with the "hard-conditionality" of the pre-accession period replaced by a "soft-conditionality" imposed by the Stability and Growth Pact (hereafter, SGP), which, as expected, was characterised by the lack of enforcement of rules. It is noteworthy that during the period 2001–2016, the "annual deficit criterion" that requires fiscal deficits not to exceed 3 percentage of GDP, has been breached by most European countries. For instance, Fig. 6 shows that the "median country" has breached this criterion in 7 out of these 16 years, while Greece and Portugal top the list, breaching in 15 out of 16 years. It is also interesting to note that the first country to violate the SGP was Germany. During the early 2000s, Germany incurred higher deficits, at least to some extent, in order to counteract the political consequences of the Agenda 2010 structural reform package and in particular the Hartz plan for the labour market and welfare state.

What is equally, if not more important is the extent to which fiscal deficits exceed the threshold. For example, a deficit of 3.1 percentage of GDP has very different implications compared to a deficit of

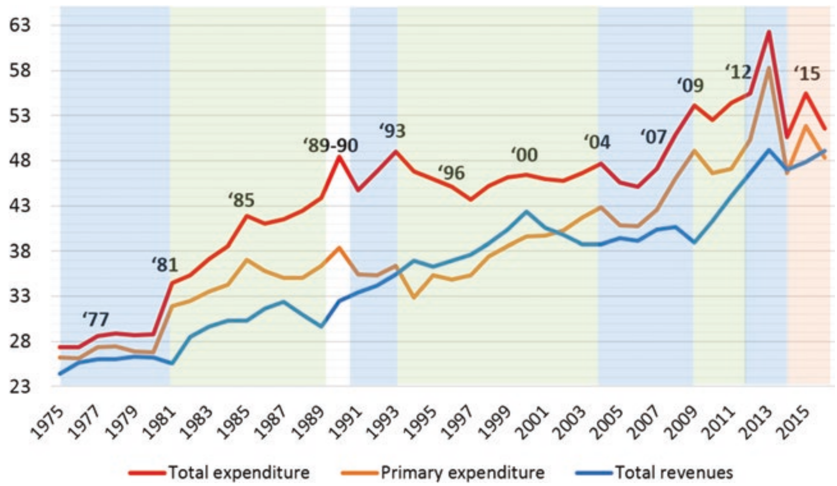

Fig. 7 Revenues and expenditure, % of GDP

9 percentage of GDP. There is indeed a very strong association between the magnitude of deficits and the number of times these deficits exceeded the 3 percentage threshold; in particular, the correlation coefficient of these variables is equal to −0.92 across the EU countries. This means that countries with larger deficits on average breach the 3 percentage threshold more often than others.

In spite of the influence of these common institutional factors, the recent fiscal history of Greece does diverge from Europe in some key ways. In particular, although the period from 2002 to 2007 saw more lax fiscal policy throughout Europe compared to the late 1990s, primary deficits in both the EU15 and IIPS during this period remained fairly close to zero while Greece posted fairly large deficits (Fig. 5). Also, while primary deficits in EU15 and IIPS have steadily declined from their peaks in 2008 and 2010, respectively, Greece's primary deficit peaked in 2009 and experienced further spikes in both 2013 and 2015.

A focus on the primary deficit alone conceals valuable information on primary expenditure, revenues and the composition of both of these aggregates. Revenue and primary expenditure, as well as total expenditure, are shown for Greece in Fig. 7 for the period 1974–2016.

To provide some context about political developments, election years are also included in the plot. Shading in the plot indicates the party with the largest parliamentary representation, which either governed in their own right or as part of a coalition. We add the important caveat that all figures are based on the ESA 2010 standards and may differ from figures available to both the government and greater public at the time. We now focus our attention on primary expenditure and revenue each in turn.

4.1 Expenditure

Figure 8 tracks primary expenditure in Greece relative to EU15 and IIPS for the period 1974–2016. We can see that within the first twenty-year period following the collapse of the dictatorship, public spending rose, dramatically so during the 1980's. The increased amount of public spending as a percentage of GDP over this period made primary expenditure closer to that of the average size in Europe. In particular, in 1980, primary expenditure was equal to 26.8 percentage of GDP, with the corresponding figures for the EU15 and IIPS average being at 42.5 and 35.4 percentage, respectively; however, by 1990 Greece's value of total expenditure had reached 38.4 percentage of GDP, compared to 42.9 and 41.7 percentage for the EU15 and IIPS average, respectively.

Following this period the Greek economy entered a short phase in 1991–1997 which can be uniquely characterised as a period of steady primary expenditure. From 1997, Greek primary expenditure began to rise again even though the equivalent figure for IIPS remained flat. At the onset of the crisis, Greek primary expenditure was 42.2% of GDP compared to 42.2% of EU15 and 39.9% of IIPS. Despite cuts to public spending, with the dramatic decline in GDP, public spending as a percentage of GDP actually peaked in 2013 at 58.3%. This demonstrates that cuts to spending could not keep pace with the fall in GDP during the early phase of the crisis. With further cuts to expenditure and a relatively more stable GDP, the level of expenditure as a percentage of GDP has fallen since 2012 but remains above the levels seen in the EU15 and IIPS.

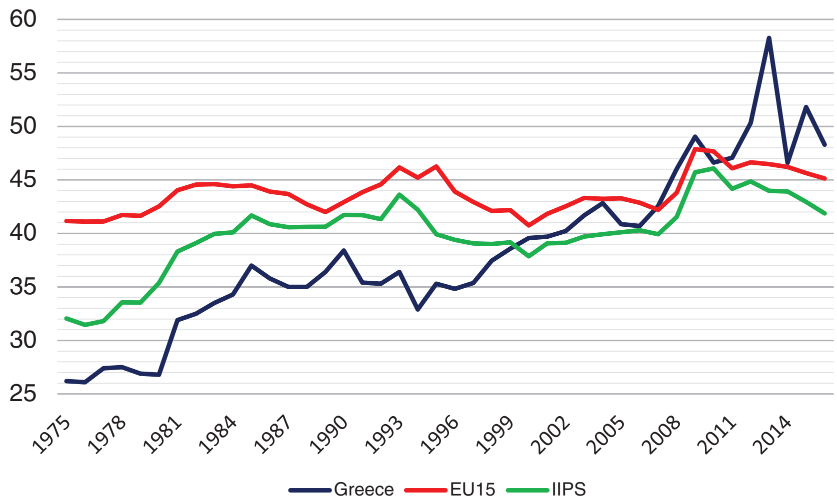

Fig. 8 Primary expenditure, % of GDP

The patterns observed in government expenditure can be explained to some extent by political developments. The restoration of democracy in 1974 released a pent-up demand for a more inclusive approach to public sector consumption and reparations to past injustice. At the same time, the dismantling of the military dictatorship meant that distributive socio-economic measures could be used to improve the chances of winning and maintaining public office. Hence, government spending began to rise in absolute magnitude as well as a percentage of GDP, with a particularly dramatic spike in 1981.

This political dimension is further supported by an apparent regularity that public spending is highly sensitive to political cycles. Throughout the sample, it is evident that expenditure increases during election years, irrespective of the stage of the economic cycle. The only exception to this regularity took place in 1996, where the cost of failing to meet the convergence criteria set out by the Maastricht Treaty was simply too large. The aforementioned observation is consistent with theories that predict the existence of electoral cycles in "new democracies" (see, e.g. Brender and Drazen 2004).[6] It is also interesting to note that spikes in expenditure in election years are often reversed the

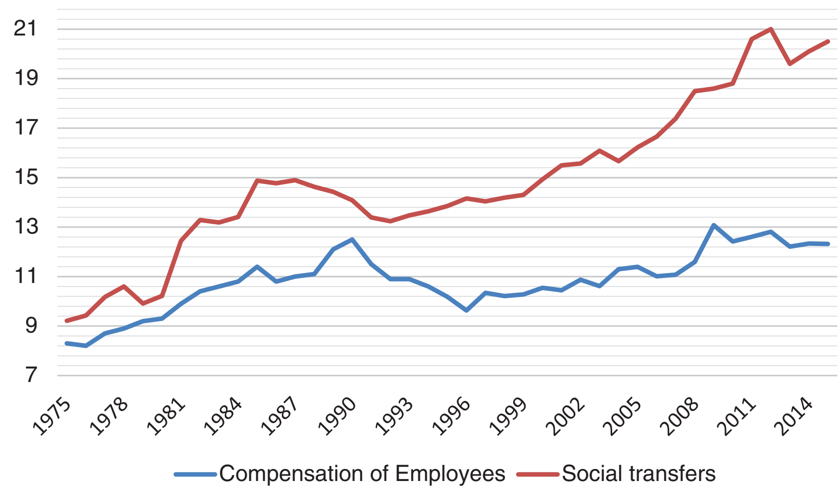

Fig. 9 Wages and social transfers, % of GDP

following year, for example in 1986 and 1991 (which were also years that marked the start of more substantial stabilisation programs) and later on the same phenomenon was observed in 1994, 2005, 2010, 2013 and 2016. The years following elections that did not see such a correction include 1982, 2001 and 2008.

Figure 9 shows two of the largest components of expenditure, namely social transfers and compensation of employees as a percentage of GDP. The increase in primary expenditure during the 1980s was driven by growth in both of these components. Public employee compensation rose from 9.3 percentage of GDP in 1980 to 12.5 percentage in 1990. Moreover, social transfers increased from 10.2 percentage of GDP in 1980 to 14.1 percentage in 1990.

These figures most likely underestimate the growth of wages in the public sector; there exist several reasons why this may be the case. First of all, wages in some public services, such as the telecommunications and electricity sector, did not enter the accounts of the General government for most of the sample: these wages are, on average, substantially higher, and they have also grown faster than other areas of the public sector. Second, in several circumstances, some categories of public employees obtained pay rises retrospectively through court decisions, typically the resulting arrears were paid in the form of government bonds and they were not recorded as employee compensation, neither did they appear in the annual government expenditure accounts or deficit totals. As an example, according to estimates reported by Manessiotis and Reischauer (2001, p. 108), during the 1990s about 200 billion drachmas were paid to judges, as part of such retroactive compensations. Finally, employees in other categories of the public sector often received extra payments that were not recorded in the budget. For example, special payments given to customs officers amounted to about 50% of their regular monthly salaries.

The large growth of spending on compensation is the outcome of considerable increases in the number of public employees, as well as in real wages. According to the EEAG 2010 report (Ch. 3, p. 101), between 1976 and the second quarter of 2010, the number of public employees almost tripled, from about 282,000 to 768,000, whereas employment in the private sector increased only by roughly 24 percentage during the same period (from 2.95 million to 3.66 million).[7] Thus, employment in the general government rose from 8.7 percentage of total employment in 1976 to 17.3 percentage in the second quarter of 2010.

One of the main consequences of such a surge in government spending has been a rise in the reservation wage for private sector employment (e.g. Demekas and Kontolemis 1998). In effect, every public sector job opening attracted an abnormally high number of young applicants, who preferred to stay unemployed waiting for a job in the public sector rather than to get a job in the private sector. Clearly, this has undermined the competitiveness of the Greek economy.

Compensation of public employees peaked in 2009, reaching the level of 13 percentage of GDP, before going down to 12 percentage in 2016. On the other hand, social transfers as a percentage of GDP are higher than ever, and according to the latest estimate for 2016, they amount to about 20.5 percentage of GDP. The main reason for such large reduction in the compensation of public employees in recent years compared to the 2009 peak, as well as the corresponding rise in social transfers, is that from 2011 onwards various incentives for early retirement have been given in order to satisfy—rather perversely—one of the main requirements of the bailout conditions, which is to reduce the number of employees in the public sector.

4.2 Revenues

Figure 10 shows how total revenues as a percentage of GDP have changed since 1974 for Greece the EU15 and IIPS, while Fig. 11 shows the composition of Greek tax revenue over the same period. Although Greek government revenue mostly trended upwards between 1981 and 1993, this was not sufficient to keep up with expenditure during the same period, and often responded with a lapse of time (Fig. 7). Indeed, there is an abundance of evidence confirming that for the case of Greece causation appears to run from spending to tax revenues, i.e. public spending is determined "exogenously" and then the tax burden partially rises to compensate for the rise in spending; see, e.g. Provopoulos and Zambaras (1991), Hondroyiannis and Papapetrou (1996), and Hondroyiannis (1999).

From 1990 onwards, revenues trended steadily upwards and in particular revenues from direct taxes (see Fig. 11); by 2000, total revenues in Greece were roughly 13 percentage points higher compared to 1990, while during the same period, revenues rose less than one percentage point for IIPS and the EU15.

In 2001, revenue began to decline and by 2004 had fallen by 3.5 percentage points. Nearly half of this fall can be attributed to reductions in direct taxes, roughly 40 percentage to reductions in indirect taxes, while social security contributions increased by a small margin. Up until the crisis, revenues as a percentage of GDP remained fairly flat. As illustrated in Fig. 7, the main driver of the derailing of public finances up until 2009 was expenditure. Compared to 2009, revenue, expenditure and GDP have all fallen in absolute terms, but as a proportion of GDP revenue has remained fairly steady (apart from a small dip in 2009) while expenditure has surged. Since 2010, apart from the notable exception of the 2013 budget, the main instrument for achieving fiscal consolidation has been to raise revenue rather than cut expenditure.

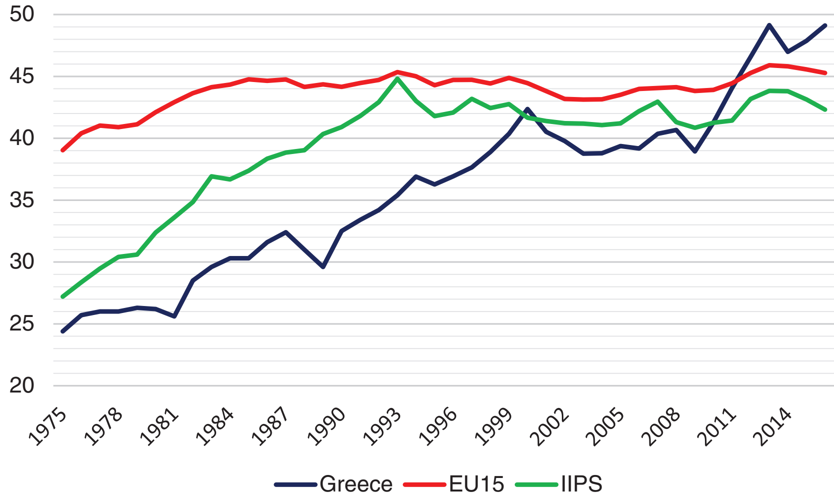

Fig. 10 Total revenues, % of GDP

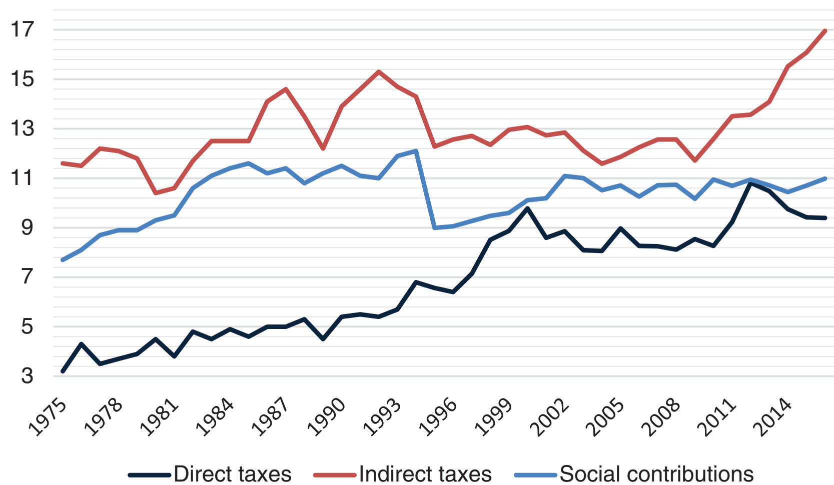

Fig. 11 Composition of taxes, % of GDP

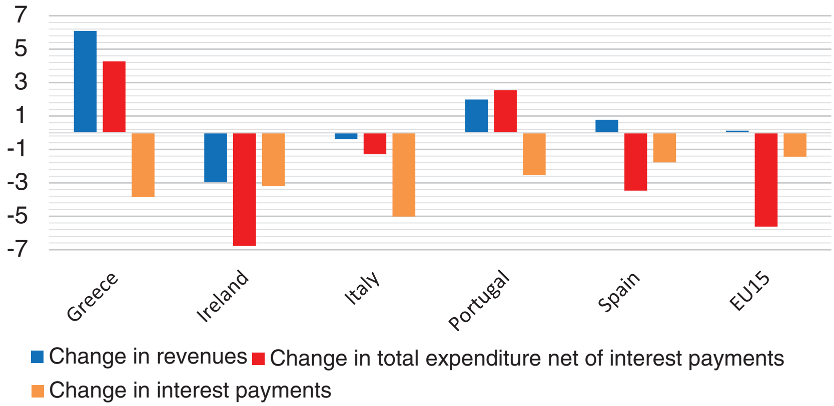

Fig. 12 Change in fiscal aggregates 1995–2000, p.p. of GDP

Since 2012, this has all come in the form of higher indirect taxes as direct taxes have fallen and social security contributions have remained steady.

The period 1995–2000 deserves special attention because it corresponds to a phase of fiscal consolidation that took place across Europe, in an effort to fulfil the obligations for membership into the EMU, set out by the Maastricht criteria. Most European countries run primary surpluses during these years (Fig. 5). However, Greece, and to a lesser extent Portugal, stand out, since fiscal adjustment was achieved in a climate of higher tax burden and a growing public sector. This is summarised in Fig. 12. In contrast, Italy, Spain, Ireland and the EU15 in general achieved primary surpluses either in part or entirely by reducing expenditure.

There is evidence that the quality and sustainability of fiscal adjustment depends crucially on the way fiscal consolidation is attained. In particular, Alesina and Perotti (1997), von Hagen and Strauch (2001), and more recently Attinasi and Metelli (2016) suggested that consolidation efforts based mainly on increasing tax revenues rather than on cutting government spending can have an adverse effect on long-term growth and thus be self-defeating. One reason for this conclusion is that for the adjustment to be successful, policy makers need to ensure that the adopted reforms lead to an increase in the efficiency of the public sector and a reduction in bureaucratic red tape (see Angelopoulos and Philippopoulos 2007).

4.3 Conclusions on Primary Deficits

The period under examination saw a number of structural changes to the Greek economy, including accession to the European Economic Community in 1981 and the European Monetary Union in 2001 as well as technological change and a general trend towards globalisation. Naturally, these changes saw employment shrink in industries that suffered a decline. In the case of Greece, there has been a tendency for the Greek state to act as an employer of last resort rather than for new industries to absorb laid-off employees. Although there may be debate as to the direction of causation between public and private sector employment, it is highly likely that high reservation wages in the public sector, not to mention an adverse regulatory environment, have to at least some degree inhibited the development of a dynamic export-oriented private sector in Greece.

Furthermore, in Greece, expenditure cuts often require certain legal and institutional changes that are difficult to implement, since the political system is plagued by both a consistent lack of consensus and long-term planning. For example, even nowadays, it is virtually impossible to affect redundancies in the public sector, even in those situations where the appointments were made under pure partisan criteria. This may explain a certain "stickiness" in government expenditure which explains why the burden of adjustment fell primarily through rises in tax revenues whenever a process of fiscal consolidation was in place. The preference of policy makers in Greece to unveil tax rises rather than expenditure cuts also reflects the lower political cost of higher taxes compared to spending cuts. In particular, it is plausible to argue that the cost of raising taxes is spread among voters—arguably—independently of political preferences, while expenditure cuts mainly affect the constituency of the party in power, since a large proportion of government expenditure is targeted towards specific interest groups.

Also relevant here is the role of the "twin deficits hypothesis" based on an accounting identity that shows that high government deficits are associated with higher trade deficits when the gap between savings and investment is stable. This suggests that lower budget deficits will be

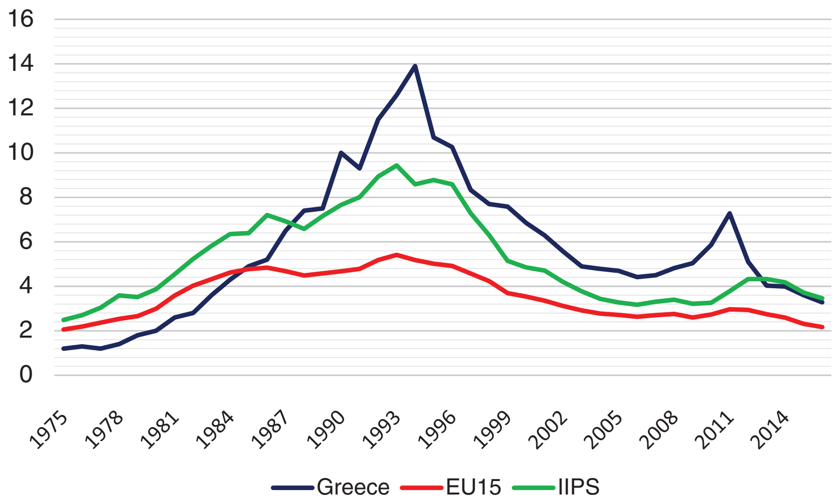

Fig. 13 Interest payments, % of GDP

easier to sustain with a more favourable trade balance and high value-added export industries. Also relevant here is the level of private debt which by the same accounting identity must be offset by higher fiscal and trade deficits. In this context, it is important to note that since 2000 private debt exploded from 53 percentage of GDP to almost 127 percentage in 2015.

5 Interest Rates

Interest rates and payments play a crucial role in understanding the ways that debt can accumulate over time. Figure 13 tracks interest payments as a percentage of GDP made by the Greek government since 1974 compared to EU15 and IIPS. This variable follows a similar trajectory for Greece and IIPS; however, it is much more pronounced in the case of Greece. There are a number of explanations for this phenomenon.

As Greek primary deficits accumulated during the 1980s, the proportion of GDP spent on interest payments grew. Stabilisation programmes in the early 1990s aimed at reducing the fiscal deficit were undermined by higher rates of interest. Higher interest rates were partly a result of financial sector reforms from 1988 to 1992 that saw obligations for Greek banks to purchase government bonds with low yields eventually removed.[8] This period also saw a shift in the composition of Greek government bond holders from banks to the non-bank public. It is important to note that throughout this period real interest rates were considerably lower than nominal rates since this coincided with a period of high inflation. Nonetheless, from 1981 to 1993 first high primary deficits and then higher interest rates led to a sustained increase in interest payments.

From 1994 onwards, interest payments fell as a percentage of GDP as European countries entered into the second stage of the Maastricht Treaty, aimed to achieve the convergence criteria necessary to join the EMU. For Greece, an even greater fall in interest payments was limited by several factors. First, real interest rates did not decline to the same extent as nominal interest rates since inflation also fell during the 1990s. Second, primary deficits were not sustained after 2000. Finally, a debt-to-GDP ratio of 100 percentage in 1993 was arguably already too close to an unsustainable level. As a result, at the onset of the crisis, Greece was still paying a larger proportion of its GDP on interest repayments than the EU15 and IIPS.

Greek government bond yields began to creep upwards after 2006 as the fiscal position of Greece began to show signs of weakness. The proportion of Greek GDP spent by the government on interest repayments climbed to 7.3%. Greek government bonds were downgraded to junk status in 2010. No longer able to issue bonds on capital markets, Greece turned towards international institutions for support. Since then, interest payments have been determined in three separate so-called Economic Adjustment Programmes for Greece.

The interest rate for the so-called Greek Loan Facility (GLF) under the first memorandum was initially similar to the rate the IMF charges for its loans (which is equal to the cost of raising funds from the international capital markets itself plus a premium of 3 percentage), plus a one-time charge of 0.5 percentage for coverage of the fund's expenses. The interest rate was designed to ensure that the financing costs that

Table 1 Borrowing terms

		Interest rate (percentage)	Average length (years)	Grace period (years)
1st Program: GLF	May 2010	4.17[a]	4	3
	June 2011	2	10	4.5
	March 2012	1.5	15	10
	November 2012	0.5	30	10
2nd Program: (EFSF)	November 2012	1.35	17.5	10
	June 2015	1.35	32.5	10
3rd Program (ESM)	August 2015	1	32.5	10

[a]Equivalent to a 3-month Euribor rate of 0.67% in May 2010 + 3% premium + 0.5% one-time charge
Sources ESM (2014, p. 29 and 2016)

would arise for each country contributing to the GLF would be lower than the interest they would receive from Greece. Possibly, there was the impression within the EU, that this relatively high interest rate would incentivise Greece to quickly implement the reform program so that they would be able to return to capital markets in the short term. However, as Greek GDP continued to collapse over the course of successive meetings of the Eurogroup, the lending rate was gradually reduced from 3 percentage to 0.5 percentage the term of the loans was increased from 4 years to 30 years and grace period increased from 3 years to 10 years. These changes are described in detail in Table 1.

The interest rate from the European Financial Stability Facility (EFSF) for the second memorandum was based on the cost of borrowing funds from the IMF plus two charges to cover operational costs of the EFSF, namely a supply “warranty” and supply “service”. In June 2015, the average rate on EFSF loans was around 1.35 percentage while the term of loans was revised up from 17.5 years to 32.5 years. The interest rate of the ESM under the third memorandum is approximately 1 percentage. The situation is summarised in Table 1.

It is worth noting that since November 2012 it has been decided to cancel the procurement “guarantee” for a loan from the EFSF with saving for Greece of around €2.7bn (European Commission 2012).

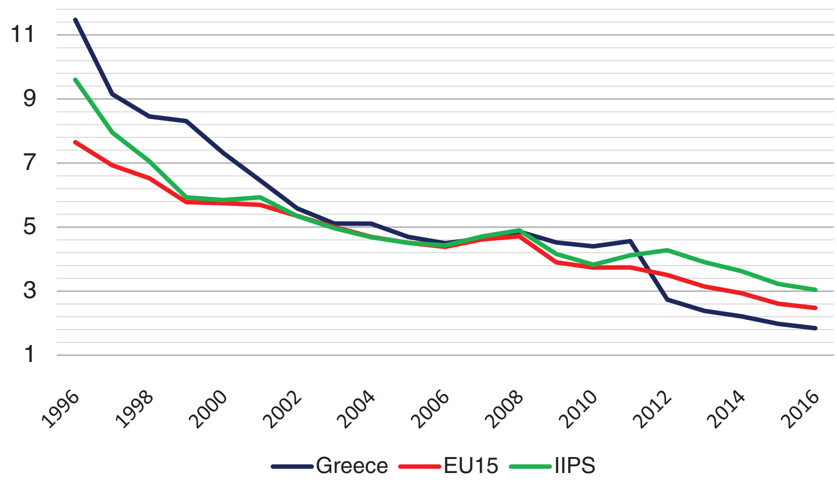

Fig. 14 Implicit interest rate

The ECB and other central banks in Europe have agreed to return to Greece the profits from interest from 2013 onwards.

In conclusion, while the original loans to Greece were made at similar rates to IMF loans, current conditions for Greece are more favourable than loans made even by the World Bank to low-income countries. For this reason, interest payments as a percentage of GDP have declined since their 2011 peak. In particular, since 2013, Greece spends a similar proportion of its GDP on interest payments as other European nations (Fig. 13).

Furthermore, the average interest rate currently paid by Greece on its public debt is significantly lower than that paid by the EU15 average as well as that of IIPS. This is summarised in Fig. 14, which portrays the "implicit interest rate", i.e. the amount of interest payments expressed as a percentage of gross public debt of the previous year. In 2016, Greece's implicit interest rate is about 1.84% versus 2.5% and 3% for the EU15 and IIPS, respectively.

An important factor for the low average interest rate in Greece is the fact that the cost of raising funds from the EFSF/ESM/IMF bodies is low at this time due to low interest rates prevailing internationally. When interest rates return to higher levels, increased borrowing costs

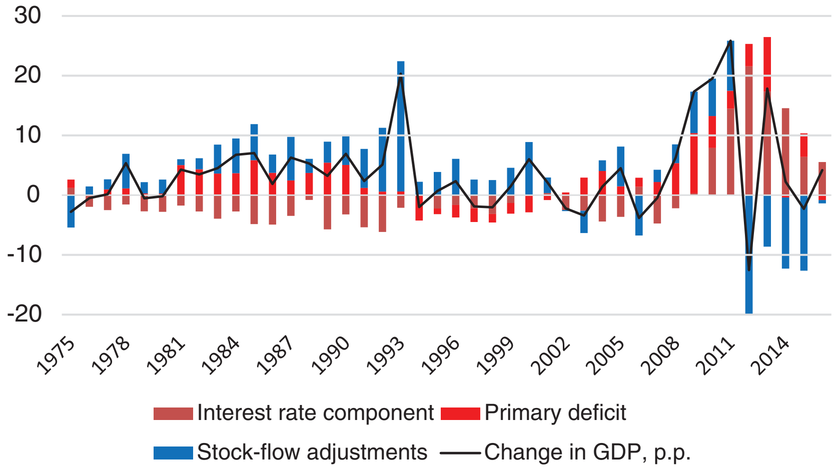

Fig. 15 Decomposition of debt accumulation, p.p. change of debt/gdp

will be passed on to Greece regardless of whether Greece is still receiving assistance from international institutions or issuing its own debt directly on capital markets.

6 Stock-Flow Adjustments

So far, we have established that a possible cause of the debt-to-GDP ratio rising during the 1980s was a persistently high primary deficit. Primary deficits also explain how despite strong growth and low interest rates, the debt-to-GDP ratio failed to decline during in the early 2000s. A combination of high primary deficits and severe deflationary economic contraction explain an increase in the debt-to-GDP ratio since 2008, which has been unable to fall despite austerity measures. However, some puzzles remain. For example, why did the debt-to-GDP ratio remain steady from 1995 until 2000 in spite of primary surpluses and low interest rates? Why was there a slight dip in the GDP ratio in 2012? To answer these questions, it is important to understand the role of different kinds of stock-flow adjustments.

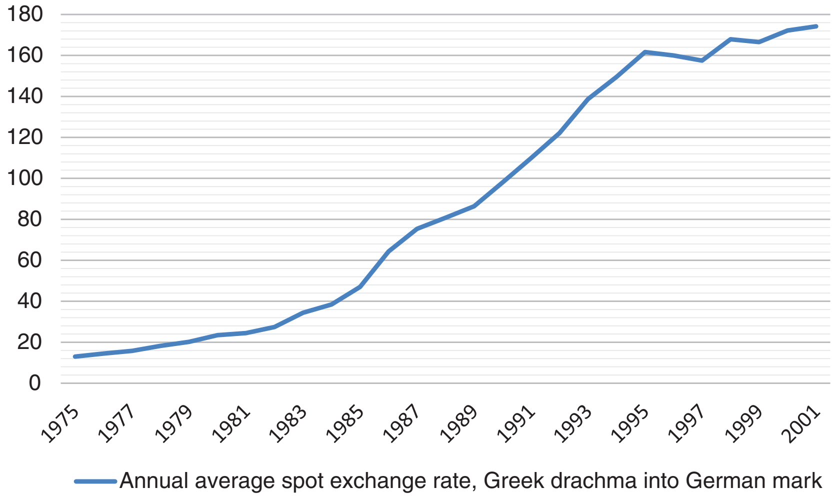

Fig. 16 Exchange rate movements

Figure 15 portrays the annual decomposition of debt accumulation into a primary deficit component, an interest rate component and stock-flow adjustments. Stock-flow adjustments may be caused by exchange rate movements influencing the portion of debt denominated in foreign currency, debt assumptions by the government on behalf of third parties, debt guarantees given by the government for the restructuring of publicly owned enterprises, capital injections to public enterprises, and so on (see e.g. the Eurostat Report 2004).

As we can see, during the 1980's (1990 inclusive), debt accumulation cannot solely be attributed to primary deficits, but also to substantial stock-flow adjustments, which are partly due to the continuous depreciation of the drachma. These may also due to other factors, for example the settlement in 1982 of deficits accumulated through transfers to farmers from 1978 to 1981 managed through an off-budget account (Fig. 15).

Although the primary deficit peaked in 1990 and declined between 1990 and 1993, the debt-to-GDP ratio continued to rise from 73.5% in 1990 to 100.2% in 1993. This phenomenon can be explained by significant stock-flow adjustments. During 1990–1992, the general government took over long-standing liabilities of various public legal entities to the banking system that up to that point were not recorded in the general government debt; these liabilities were converted into government bonds, or “consolidation loans”, which amounted to approximately 1800bn drachmas. On the other hand, the stock-flow adjustment in 1993 can be attributed to a consolidation of three Central Bank of Greece current accounts held by the general government and overdrawn to the sum of 3040bn drachmas. Two of these accounts were closed completely, while the third one remained open subject to being always in surplus. As a result, the General government borrowed an additional amount of approximately 300bn drachmas in excess of its 1993 borrowing requirements. Owing to these institutional arrangements that were necessitated by the Maastricht Treaty, debt increased by 3343bn drachmas within a single year.

Stock-flow adjustments continued to contribute to Greek government debt, for example through a further devaluation of the Drachma in 1998. Since 2000, the largest stock-flow adjustment occurs in 2012. As part of the second memorandum, public debt was subject to two major restructuring operations that reduced the nominal value of debt equal by roughly €90bn; the largest sovereign debt haircut in modern history.

6.1 The 2012 Nominal Debt Haircut

At the end of April 2010, the stock of bonds of the Greek General government, including debt assumptions on behalf of third parties but excluding treasury bills, amounted to €319bn (Xafa 2014, footnote 10). From this stock, bonds worth €58bn were redeemed during May 2010–February 2012, whereas bonds held by the ECB and other national central banks, worth €56bn, were excluded from debt restructuring operations (Fig. 16).

The private sector involvement (PSI) sought to exchange the remaining Greek bonds with bonds valued at 31.5 percentage of their original value. In addition, bond holders taking part in the operation received a “sweetener” consisting of 15 percentage of the nominal value of bonds that were handed in. As a result, the nominal value of the offer reached the 46.5 percentage of the initial requirements, implying a haircut of 53.5 percentage. As part of this deal, €198bn worth of bonds were exchanged for bonds worth €92bn. Creditors holding a total of €7bn refused to take part and were later paid in full.

As a result of the further deterioration of the Greek economy and the slowdown of all European economies, a new restructuring operation took place in December of the same year: Bondholders were offered to sell back the bonds just received in exchange for about a third of their nominal value. The holders of bonds totalling €32bn (from a total of €92bn) accepted the offer and received in exchange short-term bonds worth €11bn.

Therefore, both restructuring operations carried out in 2012 cancelled bonds worth about €127bn out of a total value of €319bn, which implies that the reduction in the nominal value of debt from these two operations represented about 40 percentage of the total value of Greek bonds that were in circulation when the crisis erupted.

In practice, the haircut has been smaller for two main reasons. First, €12.2bn worth of cancelled bonds was held by other public entities that are part of the general government, particularly social security bodies. Second, the cut in the value of general government bonds opened up a substantial gap in the accounts of the Greek banks that were simultaneously being recapitalised by the central government.[9] According to estimates reported by the Bank of Greece, the restructuring operation in 2012 cost approximately €38bn. According to estimates given by Colasanti (2016, p. 51), €11bn of this €38bn can be attributed to losses incurred by Greek banks by the sovereign debt haircut. Given these figures, the impairment of Greek debt is estimated to be worth approximately €98 bn (127-12-17).

7 Conclusions

There are a number of ways in which the government debt crisis in Greece can be differentiated from problems experienced by IIPS that only a long historical perspective can uncover. Beginning from the

1980s, the Greek debt-to-GDP ratio exhibited a strong upward trend, overtaking the equivalent figure for the EU15 and eventually IIPS. In Greece, this period was characterised by growth in government expenditure and an inability for government revenue to keep up with expenditure. Low GDP growth, devaluations of the Drachma and other substantial stock-flow adjustments also played a role during this period. By 1993, a substantial gap had emerged between the debt-to-GDP ratios of Greece and those of IIPS and EU15.

The period from 1993 to 2000 was characterised by fiscal consolidation throughout Europe, including in Greece. However, while debt levels in IIPS converged towards the target of 60% of GDP, Greece's debt-to-GDP ratio remained close to 100% of GDP. During this period, primary surpluses were often offset by stock-flow adjustments caused by drachma devaluation.

Subsequent to joining the monetary union in 2001 and up until the global financial crisis, Greece experienced a period of high growth, low interest rates and strong GDP growth. In principle, these factors could have led to a reduction in the debt-to-GDP ratio; however, government revenues began to fall, and expenditure continued to rise, leading to large primary deficits. The debt-to-GDP ratio remained above 100 percentage of GDP.

This left Greece in a precarious state at the onset of the global financial crisis. Greece was simply unable to absorb an increase in primary deficit associated with an economic contraction when compared to countries with lower debt-to-GDP ratios. Greece suffered a dramatic collapse in GDP that dramatically inflated the debt-to-GDP ratio. Having forgone, the opportunity implements structural reforms to reduce the size of the public sector during a period of consolidation from 1993 to 2007, Greece found it difficult to implement these reforms in a much more challenging economic and political climate. The impact of any debt relief measures, including the 2012 haircut, on reducing the debt-to-GDP ratio has been minor and transitory.

In the current climate, it is difficult to speculate on the future of Greek government debt. At the time of writing, European Commission Vice President Valdis Dombrovskis claimed that Greece was on track to achieve its targeted 3.5 percentage primary surplus in 2018 (Reuters

2017). The IMF on the other hand believes that it is both more likely and more desirable for Greece to attain a primary surplus of 1.5 percentage of GDP in 2018. As we have seen, since 1974, a primary surplus of 3.5 percentage has only been achieved in Greece once in 1994, a year of high growth and inflation that bears little resemblance to the slow growth and deflation of the present. This is just one example of how understanding the historical evolution of debt, and its components, including the primary deficit, can shed light on current policy debates.

Notes

1. See http://ec.europa.eu/economy_finance/ameco/user/serie/SelectSerie.cfm. The data were extracted on 13 February 2017.
2. The same holds for other EU countries, although to a lesser extent.
3. Luxemburg is excluded from Maddison's sample.
4. Of course, a similar effect would have taken place had Greece the option to devalue its currency (external devaluation), to the extent that it sovereign debt was issued in foreign currency.
5. In particular, the 2005 OECD report for Greece clearly states that "The clarification of the recording of capital injections was necessitated by the transition, in 2000, to the current European System of Accounts (ESA95), from ESA79. The impact of the new accounting rules on the fiscal figures for the years 1997–1999 ranged from 0.7 to 1 percentage point of GDP. This retroactive change of methodology was responsible for the revised deficit exceeding 3% in 1999, the year of EMU membership qualification. In its November 2004 report, Eurostat stated that it believed that the capital injections from 2000 to 2003 had been correctly recorded". See OECD (2005, p. 47).
6. The authors would like to unequivocally state that highlighting the influence on elections on fiscal policy should not be understood as an endorsement, tacit or otherwise of any anti-democratic sentiment, and military dictatorships that torture and abuse the human rights of their citizens can never be justified.
7. The figures on the number of employees are approximate. The reason is that until June 2010 there were no consolidated records on the total

number of general government employees. A census of civil servants undertaken in July 2010 under the newly elected government showed that their number is 768,009.
8. In particular, prior to the financial sector deregulation, it was mandatory for banks to invest 37% of their deposits in Treasury Bills. This was reduced to 30 (20)% in July 1991 (1992) and it was abolished in May 2013.
9. Most European countries recapitalised their banking system at about the same period in total EU banks received €671bn in capital and €1288bn in warranties (Adamczyk and Windisch 2015).
10. A more refined decomposition involves splitting the primary balance into a structural component and a cyclical component. However, there seems to be a consensus in the related literature that for the case of Greece the cyclical component is rather small (e.g. Manessiotis and Reischauer 2001, p. 127).

Appendix

The decomposition of debt accumulation used throughout the chapter, although in particular in Sect. 6, is based on the following identity:

$$\frac{Debt_t}{GDP_t} - \frac{Debt_{t-1}}{GDP_{t-1}} = \frac{PB_t}{GDP_t} + \frac{Debt_{t-1}}{GDP_{t-1}} \times \frac{i_t - g_t}{1 + g_t} + \frac{SF_t}{GDP_t}, \quad (1)$$

where $Debt_t$ and GDP_t denote general government debt and GDP at period t, respectively, PB denotes fiscal primary balance (here positive values indicate a primary surplus), i and g denote the implicit nominal interest rate on debt and the growth rate of nominal GDP, respectively, and finally, SF represents the so-called stock-flow adjustments, obtained by solving Eq. (1) in terms of SF.

The implicit interest rate is obtained using the expression

$$i_t = \frac{I_t}{(Debt_t - Debt_{t-1})/2}, \quad (2)$$

where I_t denotes the actual interest payments on debt servicing made by the government at time t.

In this way, we can disentangle the relative importance of three factors in debt accumulation, namely (i) primary balances, (ii) the interest rate component, i.e. the portion of debt accumulation that is due to the interest rate on existing debt being larger that the growth rate of the economy, and finally (iii) the effect of stock-flow adjustments. The latter captures any changes in debt level that are not due to the previous two factors.[10]

Even further, details on this approach can be found in Manessiotis and Reischauer (2001, Appendix 2).

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Asymmetry, Austerity and Anxiety: The Approach to the Greek Debt Crisis

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1 Introduction

In this chapter, we analyse how much of the problem in exiting from the Greek debt crisis stems from the asymmetry of the arrangements that have been put in place, not just for Greece but for the whole of the euro area. We explore how the problem arose, the response to it and the degree of misapprehension of its likely effects, before suggesting a way out.

Individual countries facing adverse shocks in the euro area are both much more constrained than countries outside in how they can reduce the impact and much less able to get assistance than are regions in

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national monetary union. Not merely is there a single monetary policy run by the European Central Bank (ECB) with the objective of price stability in the euro area as a whole and hence a single external exchange rate policy but fiscal policy, the second major tool of adjustment available to governments is also constrained. The constraint does not come only through the original Stability and Growth Pact (SGP) but is further reinforced by the Treaty on Stability, Coordination and Governance in the Economic and Monetary Union (fiscal compact or TSCG) and associated measures introduced from 2012. Inside national monetary unions, all fiscal systems aim at offsetting the impacts of adverse shocks and situations to groups of their citizens, whether based on geography, industry, age or income. Similarly, the European Union's (EU) process of assessment of the structural problems facing Member States, the Macroeconomic Imbalances Procedure,[1] is asymmetric, focusing almost exclusively on the downside discrepancies. While the social and regional funds are a specific help to the disadvantaged and the European Stability Mechanism (ESM) exists to help those Member States in financial distress, the primary responsibility for solving the problem lies with the distressed and disadvantaged and is not spread equally across the EU as a whole.

As is clear, the crucial issue in our analysis is asymmetry. Member States that are not facing fiscal problems do not need to take any action, while those with substantial deficits as a result of the Global Financial Crisis (GFC) need to reduce them before their debt rises to unsustainable levels.[2] Member States that have already reached the point of unsustainability, in the sense that they are having to borrow from the EU/IMF (International Monetary Fund) as markets are effectively closed to them, have an especially harsh task as they have to eliminate their deficits rapidly according to a timetable laid down by the European Commission (EC), ECB and IMF (widely referred to as the 'troika'). This asymmetry is particularly pernicious, as reducing a deficit by cutting expenditure and worse still raising taxes creates a downward spiral in which the Gross Domestic Product (GDP) falls, thereby raising the debt ratio for constant levels of debt, which then requires further cuts to start bringing the debt ratio down. If the less stressed economies were to expand, then the whole euro area would tend to grow faster, reducing the debt spiral for those most affected.[3]

Within a country, the impact is also asymmetric. Those with higher incomes and wealth can absorb a shock without reducing their consumption and quality of life. Those on low incomes with little savings have no option but to cut back as they have little opportunity to borrow except on Dickensian terms. This concentration of the process of adjustment on retrenchment rather than equally on expansion is labelled 'austerity'. We explore how these pressures bite in the EU and the consequences this has for the Member States that have to follow the route of austerity. We define 'austerity' not simply as the downside adjustment cost but as the cost that is borne over and above a symmetric response. We show, in particular, how understanding of these problems has evolved over time in the light of experience and that while some of the horrific unemployment and other social consequences of the 1929 crash have been avoided by learning the lessons other lessons have not been learnt.

However, focusing on the fiscal problem alone is mistaken as most of the countries that are in difficulty face a competitiveness problem as well, so this is the subject of the second section of this chapter. As a facet of their rapid expansion before the crisis, these countries' price levels rose above those in many of their competitors. We look at the asymmetric problem this raises. Lowering relative prices, particularly through lowering relative wages, is much more difficult to do than achieving the same relative outcome by allowing wages in the more competitive areas to rise faster. The problem is not restricted to Greece and other 'Southern' countries, Ireland, the Baltic States and even Finland have faced the same difficulties. We, therefore, provide a comparison of Greece with them.[4] Without the benefit of their own monetary policy or exchange rate policy, these countries have to adjust by a combination of reducing relative prices and altering the structure of their economies towards new growth opportunities even where fiscal constraints are not so tight.[5] Here, we see some striking differences from Greece. Emigration has been much more important in helping adjustment in Ireland[6]; labour market flexibility has also assisted the position in the Baltic States. In many ways, Finland is the most interesting contrast as it has already been through this process in the early 1990s. This time, however, there is no new Nokia on the horizon to help provide the stimulus. In many cases, structural change occurs through closing down the old first and hoping that the new will fill the gap rather than the new driving out the old, which would have much more favourable consequences for unemployment and the fiscal balance.

In the third section, we move on to a further aspect of asymmetry. One of the main problems of the asymmetric requirements for fiscal and relative price adjustments is that people themselves respond asymmetrically, being much more cautious in downturns so a much larger stimulus is needed to achieve the same effect as when an economy is doing well and people are more optimistic. The initial adverse shock and the stream of subsequent bad news create uncertainties and anxiety for people, especially for those least able to cope. This leads to caution and makes recovery more difficult until sentiment changes. We follow the approach of Tom Sargent in suggesting that while economies drop rapidly from optimism into pessimism, the reverse process is slow unless there can be a clear favourable shock.[7] This means that we get two sets of parameters explaining behaviour, one for the upside of the economic cycle and another for the downside. While allowing more variable parameters across the cycle might be more realistic, we do not have sufficient data.

The extent of these anxieties is difficult to measure beyond these changes in behaviour. We can see fairly clearly from spreads in financial markets how likely lenders think it is that they will not be paid back. We can also estimate the expected loss given default. We can show to a limited extent which groups in society are most affected, particularly through unemployment and other indicators of inequality and deprivation but it is difficult to get more direct indicators of well-being except through direct surveys, such as those of happiness (see, e.g. Anand 2016).

We conclude by suggesting a way forward for joint action to address the debt problems of the euro area that is symmetric, reduces the need for austerity and its adverse consequences, thereby offering a route to reducing anxiety. Regrettably, it can only be a better path towards solution and not a guaranteed success.

2 The Fiscal Problem

The detail of the sovereign debt crisis that has gripped Greece since 2009 and its causes have been widely summarised (see, e.g. Lynn 2010; Manolopoulos 2011; Mitsopoulos and Pelagidis 2012; Panagiotarea 2013; Pappas 2014; Christodoulakis 2015; among others) so we do not repeat it. The key issues are fourfold.

- First, Greece started the crisis period with a high level of outstanding government debt, which was around 127% of GDP in 2009 (see Table 3). It, therefore, quickly encountered borrowing constraints.
- Second, the Greek economy does not appear to be very flexible, so that a severe adverse shock results in considerable unemployment with a rapid increase in the fiscal deficit in the short run and only a slow recovery thereafter. The non-fiscal route to change is therefore harsh.
- Third, the troika made considerable mistakes in underestimating the adverse impact.[8] Hence, instead of solving the problem once and for all by decisive action in May 2010, they needed to negotiate two more settlements in March 2012 and August 2015, and even so it is not clear at the time of writing whether this last will succeed.
- Fourth, agreeing to such painful changes, as is necessary for a democracy, is politically very difficult. Since much of the blame for inaction and actions has been placed on the main two political parties, PASOK and New Democracy, their support has fallen away rapidly and they have been replaced by parties which focus on the popular protest—Golden Dawn on the right and Syriza on the left—to the extent that Syriza was voted into power in 2015. In the face of such political weakness, promises to pay back sometime in the future lack credibility and it rapidly becomes difficult to borrow. As a result, lenders, including the troika, have not merely demanded to see quick results but have been unwilling to see debt levels rise substantially.[9]

This has, therefore, meant that Greece has faced relatively high adjustment costs compared to other countries and has had to concentrate the reforms and fiscal changes up front rather than be able to spread them over a longer period of time (see Figs. 6, 7, 8, 9, 10 in the Appendix 2, which set out the experience of Greece compared to Cyprus, Ireland, Italy, Portugal and Spain).

2.1 The Three Packages for Greece

The magnitude and the persistence of the Greek debt crisis are striking. What is more striking is that, although austerity measures failed to bring Greece to a recovery and growth path, as the IMF admitting in early 2012, more austerity measures have imposed by the international lenders. The implementation of those measures is a prerequisite for receiving bailout loans the majority of which went to repaying older debt rather than to productive investments that could drag the Greek economy out of its current situation (see, e.g. Varoufakis and Holland 2012; Christodoulakis 2015).

So, one of the main problems with the three support packages for Greece is that they concentrate on being able to roll over existing debt and on budgetary consolidation to try to prevent the debt rising further. The fiscal measures are not focused on a programme of public investment in infrastructure, human skills and innovation that would get the economy growing again. Indeed, consolidation reduces such investment. While the fiscal measures are supplemented by requirements for structural change, which should help the Greek economy become more flexible, both in the sense of altering the structure of industry and in making firms and labour markets more efficient and lower cost in order to boost competitiveness, their implementation involves further costs in the interim.

Furthermore, privatization of state-owned enterprises in Greece, which was requested by the troika in order to release financial assistance funds to the Greek government, failed to generate enough revenues as the country was in deep recession and the assets were sold at depressed prices or proved unsaleable (see Christodoulakis 2015). Kallianiotis (2013) argues that moderate privatization under normal market conditions can increase efficiency and productivity but under financial distress it can lead to unemployment and dependency on foreign capital and owners. The author also shows that privatization beyond an optimal level makes social welfare negative. Tsafos (2013) suggests that Greece's assets are worth about twice its debt, so the country is solvent and the debt problem could be solved if one wished to sell assets (under normal conditions). However, he also points out that these assets provide socially desirable goods and services but operate at a loss. Selling them, therefore, would not solve the problem as either welfare is reduced because the services are not provided or the government has to continue to subsidize the operation, so the deficit issue is not addressed by privatization. Thus, privatization may not be the right answer in some cases but it may be in others. The IMF report of 2013 admitted that privatization outcomes were disappointing.[10]

The first financial assistance package worth EUR 110 billion was approved in May 2010, where EUR 80 billion came from the euro area Member States while EUR 30 billion was provided by the IMF. Initially, it was agreed that Greece would receive tranches between May 2010 and June 2013 only after implementing the necessary reforms that were expected to put Greece into a sustainable debt path. One major priority was to bring Greece's government deficit from around 15% of GDP to below 3% by the end of the economic adjustment programme in 2013. Those reforms related to tax increases and budget cuts, as well as freezes in wages and pensions for three years.[11]

It is clear that both the Greek government and international lenders underestimated the impact of the first package on the Greek economy. Initial projections showed a relatively limited recession and rapid return to significant growth, which enabled the EU/IMF forecasters at any rate to predict that the debt ratio would peak and then decline, not merely permitting Greece to service its loans but actually start repaying them.[12] Perhaps to some extent, this was simply that the authorities believed their own rhetoric and that they were not going to repeat the disaster after the 1929 stock market crash, when neither monetary policy nor fiscal policy did much to offset the shocks.

However, the forecasting error appears to have two components. The first is that raising taxes is likely to be both a fairer and less damaging route to eliminating deficits than is expenditure cuts as they fall mainly on the richer in society who have the scope to cut back on expenditure without extreme hardship. Second, the degree to which traditional multipliers might change was also underestimated. Hence, cuts of a given size were expected to have a much greater impact on deficits (and hence debt) than they actually did (Christodoulakis 2015). The first package was also extraordinary in that initially the EU lent to Greece at penalty rates rather than taking advantage of its AAA credit rating to lend at low rates even after covering their costs.

It, therefore, became obvious that a second round of measures in Greece was going to be needed as the first package offered far too little to stop debt rising and turn the economy around so that debt could actually begin to fall at least in relation to GDP. In particular, Greece needed additional funds and more time to stabilize its economy, restore market confidence and improve its competitiveness compared to other EU countries. Arguably, if the lenders had realized the degree of downward pressure they were requiring, they might have offered a different package, which kept the structural reforms upfront but slowed the fiscal aspect especially with a weaker requirement to raise taxes. Thus, in March 2012, a new financial assistance package was approved, cancelling the previous package agreement, by euro area finance ministers and the IMF. It was worth EUR 164.5 billion, where 144.7 billion came from the European Financial Stability Facility (EFSF) and the rest from the IMF. Moreover, a deal was agreed with private investors, the so-called Private Sector Involvement (PSI) agreement, to reduce Greece's debt. Tranches would be paid out between March 2012 and December 2014. Again, Greece had to commit to implementing additional reforms, which were front loaded, in order to receive financial assistance.[13]

The second package made a further mistake. It was judged that unless there was a degree of forgiveness, there was no way that Greek debt could begin to fall without unacceptable hardship. The problem for any government is that while it might achieve primary balance in the sense that tax receipts are large enough to pay for government expenditures, it will not stop debt rising in absolute terms until it can also cover the servicing costs. The higher the debt level the greater those costs and hence the greater fiscal retrenchment is necessary even just to stabilize the debt ratio let alone stabilize the debt. In this case, even though the IMF and the other official holders of Greek debt did not accept any write-downs, they were able to persuade the bulk of private sector debt holders to accept a write-down of 53.5%.

The mistake was that the Greek banks were major holders of the Greek debt that was to be written down. With a Greek economy in sharp decline, rapidly increasing unemployment and business failures, the main banks were already vulnerable to substantial non-performing loans. To wipe out a substantial portion of asset values and collateral values for loans through the debt, write-down simply meant that the banks then had to seek recapitalization from the government if they were not to fail, since, like the government itself, it was not possible for them to raise capital through the markets. Similarly, the social security funds were having to pay out at a high rate because of the downturn and needed to draw on the government virtually euro for euro as a result of the write-down in the value of their assets. Thus, from EUR 137.9 billion by which the Greek debt was supposed to be reduced, eventually only EUR 51.5 billion was removed from the stock of the Greek bonds (Christodoulakis 2015).

Taking these two together, the net fiscal gain of EUR 51.5 billion was insufficient to turn the tide of rising debt, meaning that Greece would need a third package as the second one, like the first, was insufficient for the task in hand because of severe miscalculations over its likely impact. A bigger write-down would have been needed to do this, almost certainly involving the public holdings of Greek debt, if agreement was to be achieved. In practice, therefore, this would have constituted a default. A solution without such a default would again have either had to include greater consolidation, bringing forward some of the measures imposed in the third package or required some more generous rescheduling to enable the recovery. Overall, while Greek government debt was written down with one hand, it was increased with the other and the dip in the debt ratio to GDP only lasted for a year. As can be seen in Table 3, the Greek government debt-to-GDP ratio reached 172% in 2011. It dropped to 159.6% in 2012 and then increased to 177.7% in 2013.

Compared to other periphery euro area Member States, Greece's fiscal position, in terms of both deficit and debt levels, was much worse at the onset of the financial crisis in the autumn of 2008. After the implementation of fiscal and structural measures agreed as part of the two support packages, the country's GDP contracted by 25% between 2008 and 2013, while unemployment reached around 30% in 2013 and a staggering 60% among young people, a percentage comparable to that of Spain. Consequently, the aggregate demand shock outweighed the expected positive impact on competitiveness via the supply side. This is not surprising as the growth model of Greece was based on consumption rather than investment all through the way up to the crisis. As Stiglitz (2015) puts it 'forecasts have been wrong not because EU countries failed to implement the prescribed policies, but because the models upon which those policies relied were so badly flawed. In Greece, for example, measures intended to lower the debt burden have in fact left the country more burdened than it was in 2010: the debt-to-GDP ratio has increased, owing to the bruising impact of fiscal austerity on output. At least the International Monetary Fund has owned up to these intellectual and policy failures'.

For Stiglitz, 'austerity' is simply the fiscal consolidation measures. In a sense, this is an over pejorative term for what was required. Greece had got itself out of long-run fiscal balance even on the basis of previous trends and hence a degree of consolidation would have been required without the GFC. That adjustment would have been a simple clawing back of the earlier excess. That would only be 'austere' in so far as it was unduly concentrated in the early years of the crisis. There are no objective rules for how fast one should return to sustainability in this narrow sense. It would be unrealistic to postpone all of it to the next up phase but a progressive programme over five years or so might have sufficed. But this implies that all the calculations were correct.

The third financial assistance agreement worth EUR 180 billion between Greece and troika was reached in August 2015 under the conditionality of continuing the structural reforms in the country (see Arghyrou 2015).

At that point, there was little opportunity for any further relief without a write-down of the officially held Greek debt (not the new loans that had been made in the first and second packages). This is what the IMF has advocated, possibly assisted by the fact that it is not holding it, but the EU authorities have vigorously resisted.[14] The ECB in particular is holding a substantial amount of such debt (above EUR

18 billion or 6% of its total debt as of 2015) and is very reluctant to make losses as in many respects, it has been forced into taking a position because the politicians have been unable to take a strong stand on the subject.[15]

Each stage in the crisis has reflected the unequal bargaining power between a single borrower and the international lenders (Dyson 2014). Unless Greece was realistically prepared to default, ultimately it could do relatively little to alter the terms in its favour. At times during the bargaining, particularly for the third package, it looked as if the lenders might overplay their hand. Throughout the argument, default and leaving the euro area had been equated. It is not clear that this is necessarily the case, although the Greek government would have to balance its books until new lending could be agreed in the event of default. Moreover, it would forego the opportunity to see a substantial external devaluation in its relative prices if it did not leave the euro area. The Greek banking system would also probably collapse and there would be a rush into cash as there was while the third package was being negotiated. Indeed, the ECB's refusal to advance any more, despite collateral being available, was presumably one of the factors leading the Greek government to give in at the end in 2015.

More equitable outcomes would be possible if the troubled countries act as a group because then they have a realistic threat that they could bring the euro area down which the lenders do not want to see. To some extent, an individual country might be able to rely on a domino theory, which suggests if they fail then that will bring other countries nearer to default but such arguments are hypothetical and may turn out not to be persuasive. Not a 'chicken game' a country might want to play.

2.2 Greece Compared

2.2.1 An Overview

In this subsection, we compare Greece to other euro area countries that entered into a financial assistance programme, i.e. Ireland, Portugal, Spain and Cyprus. Table 1 shows the dates when agreement on

Table 1 Agreement on and exit from an economic adjustment programme dates

	Ireland	Portugal	Spain	Cyprus	Greece
Agreement on financial assistance programme with troika	November 2010	May 2011	June 2012	March 2013	May 2010
Exit from financial assistance programme	December 2013	May 2014	January 2014	March 2016	–

receiving financial assistance and its conditionality was reached between each country and the troika as well as the dates of exiting such a programme. In order to receive financial assistance, those countries had to implement austerity and structural measures such as public expenditure cuts, especially those related to the social welfare system, tax increases, as well as pension system, labour and product markets reforms among others. All the countries with exception of Greece managed to exit their respective economic adjustment programmes successfully and resume raising funds for their needs on the markets.[16]

Overall, what all countries had in common before the euro area sovereign debt crisis broke out was that the common currency membership provided the peripheral countries with easy access to foreign funds mainly from German and French banks, which were invested in the domestic real estate or other services sectors rather than the real sector as investing in the latter was less profitable. Private debt reached dangerous levels but these were not addressed by the EU nor by the national governments (Panagiotarea 2013).

Table 2 shows the government budget deficit as a percentage of GDP for the five countries that received financial assistance as well as for Italy—a country that had high debt levels but nevertheless managed to persuade the markets that it would be able to repay its debts—and Germany—an overall surplus country as a benchmark to compare.

Table 2 Government budget deficit as percentage of GDP

	Ireland	Portugal	Spain	Cyprus	Greece	Italy	Germany
2007	0.3	−3	2	3.2	−6.7	−1.5	0.2
2008	−7	−3.8	−4.4	0.9	−10.2	−2.7	−0.2
2009	−13.8	−9.8	−11	−5.5	−15.2	−5.3	−3.2
2010	−32.3	−11.2	−9.4	−4.8	−11.2	−4.2	−4.2
2011	−12.5	−7.4	−9.5	−5.7	−10.2	−3.5	−1
2012	−8	−5.7	−10.4	−5.8	−8.8	−2.9	−0.1
2013	−5.7	−4.8	−6.9	−4.9	−13	−2.9	−0.1
2014	−3.8	−7.2	−5.9	−8.9	−3.6	−3	0.3
2015	−2.3	−4.4	−5.1	−1	−7.2	−2.6	0.7

Source http://www.tradingeconomics.com

Table 3 Government debt as percentage of GDP

	Ireland	Portugal	Spain	Cyprus	Greece	Italy	Germany
2007	23.9	68.4	35.5	53.9	103.1	99.7	63.6
2008	42.4	71.7	39.4	45.1	109.4	102.3	65
2009	61.8	83.6	52.7	53.9	126.7	112.5	72.5
2010	86.8	96.2	60.1	56.3	146.2	115.3	81
2011	109.3	111.4	69.5	65.8	172	116.4	78.4
2012	120.1	126.2	85.4	79.3	159.6	123.3	79.6
2013	120	129	93.7	102.5	177.7	129	77.2
2014	107.5	130.2	99.3	108.2	180.1	132.5	74.7
2015	93.8	129	99.2	108.9	176.9	132.7	71.2

Source http://www.tradingeconomics.com

As can be seen in Table 2, while Greece may be in the most difficulty as a result of the GFC it by no means faced the worst shock. The impact on Ireland, for example, resulted in a deficit of 13.8% of GDP in 2009, over 32% in 2010, and still over 12% in 2011. The increase in the debt ratio by almost 100 percentage points from 23.9% of GDP in 2007 to 120.1% of GDP in 2012 (see Table 3) also exceeded that in Greece. In 2015, the countries with the highest debt to GDP ratio were Greece (177%), Italy (133%) and Portugal (129%).

What is noticeable, however, is that the impact of the crisis on growth is much shorter lived in the case of Ireland compared to Greece; while in 2014 all the countries, with the exception of Italy and Cyprus, exhibited signs of positive growth (see Table 4).

Table 4 GDP growth

	Ireland	Portugal	Spain	Cyprus	Greece	Italy	Germany
2007	5.5	2.5	7.2	9.4	3.3	1.5	3.3
2008	−2.2	0.2	3.3	8.3	−0.3	−1.1	1.1
2009	−5.6	−3	−3.3	−1.8	−4.3	−5.5	−5.6
2010	0.4	1.9	0.2	3.4	−5.5	1.7	4.1
2011	2.6	−1.8	−0.9	2.2	−9.1	0.6	3.7
2012	0.15	−4	−2.6	−0.4	−7.3	−2.8	0.4
2013	1.4	−1.1	−1.1	−7.2	−3.2	−1.8	0.3
2014	5.2	0.9	0.9	−3.7	0.7	−0.4	1.6
2015	Na	1.5	3.8	0.2	Na	Na	1.7

Source Datastream

Table 5 Total unemployment

	Ireland	Portugal	Spain	Cyprus	Greece	Italy	Germany
2007	4.7	8	8.2	3.9	8.4	6.1	15
2008	6.4	7.6	11.3	3.7	7.8	6.7	13.1
2009	12.1	9.4	17.9	5.3	9.6	7.7	13
2010	13.9	10.8	19.9	6.2	12.7	8.4	12
2011	14.7	12.7	21.4	7.9	17.9	8.4	11.3
2012	14.7	15.6	24.8	11.8	24.4	10.7	10.6
2013	13.1	16.2	26.1	15.9	27.5	12.1	10.3
2014	11.3	13.9	24.4	16.1	26.5	12.7	9.7
2015	9.4	12.4	22.1	15	24.9	11.9	9.2

Source Datastream

In Ireland, unemployment rose close to 15% in 2011 but it was less than 10% by 2015, while the respective figures for Greece were approximately 18 and 25%. Unemployment in Spain is comparable to that of Greece, being at around 22% in 2015; while unemployment in Germany during the same year was around 9% (see Table 5).

Table 6 shows the 10-year government bond yield. As can be seen, in 2012, the borrowing cost for the Greek government reached 22.5% compared to 10.5% for Portugal, 7% for Cyprus and 5.9% for Spain. The long-term government bond yield for Ireland was only 2.4% in the same year. By 2015, with the exception of Greece, the 10-year government bond yield was the highest for Cyprus at 4.5% and much lower for the remaining countries. On the contrary, the long-term government bond yield for Greece in the same year was close to 10%.

Table 6 Long-term government bond yield (10 years)

	Ireland	Portugal	Spain	Cyprus	Greece	Italy	Germany
2007	4.3	4.4	4.3	4.5	4.5	4.5	4.2
2008	4.4	4.5	4.4	4.6	4.8	4.7	4.0
2009	3.9	4.2	4.0	4.6	5.2	4.3	3.3
2010	3.2	5.4	4.3	4.6	9.1	4.0	2.8
2011	3.3	10.2	5.4	5.8	15.8	5.4	2.7
2012	2.4	10.5	5.9	7.0	22.5	5.5	1.6
2013	2.0	6.3	4.6	6.5	10.1	4.3	1.6
2014	1.5	3.8	2.7	6.0	6.9	2.9	1.2
2015	0.8	2.4	1.7	4.5	9.7	1.7	0.5

Source Datastream

2.2.2 Ireland

Overall, the Irish economy has clearly turned the corner and while the population has had to undergo considerable hardship, the country appears to have returned to a sustainable path as opposed to Greece.

In part, the explanation lies in the different nature of the shock from that in Greece but it also lies in the resilience and flexibility of the Irish economy. Ireland had experienced an extended period of rapid economic growth (see Fig. 8 in Appendix 2) accompanied by a major boom in property prices involving increasingly risky construction projects. As the boom collapsed and the global crisis struck in late 2008, it became clear that there were crippling losses in the banking system. The Irish government initially reacted by trying to stem the panic by guaranteeing all bank deposits and debts. The extent of the losses turned out to be a factor of ten greater than the government initially anticipated, with the nationalization of the Anglo Irish Bank alone costing Irish taxpayers 25 billion euro.[17]

Ireland hoped to avoid an approach to the troika but the ECB-placed constraints on how the country could finance the losses, in particular, not allowing Ireland to pass the losses to bondholders many of whom were outside the country, particularly elsewhere in the euro area (Blyth 2013). The result was that the Irish taxpayer shouldered the losses rather than sharing them with the private sector across the EU, thus reflecting the weak bargaining power of a small country in a crisis. Thus, while the impact was similar to that in Greece with increased state ownership of banks and increased indebtedness for the country as a result of the agreement with the troika, the result was direct in the Irish case, reflecting a change of attitude by the time of the second agreement with Greece.

What also made Ireland different from Greece though is that an earlier crisis in the 1980s resulted in a redesign of the country's economic policy through a series of four-year 'corporatist' agreements between the government, unions and employers, whereby government reforms and investment were paired with wage restraint, dramatically improving competitiveness, leading Ireland to be labelled the Celtic Tiger. The new economic regime included light regulation and low taxation and focused on attracting foreign direct investment (Murphy 2014).

In the present crisis, wages have had to be reduced but a substantial portion of the workforce has simply emigrated (see Glynn et al. 2015) something which is also traditional for Ireland since the potato famines of the mid-nineteenth century. Thus, Ireland has much more flexibility in the labour market both through wages and mobility and much greater structural flexibility in the real economy than Greece, as well as the willingness to turn the fiscal position round rapidly. Nevertheless, Ireland showed that a noticeable portion of the austerity was imposed involuntarily by the troika. And although they provided funding, the total initial fiscal cost was higher than it would have been in an independent Ireland.

2.2.3 Portugal

After Ireland and Greece, Portugal was the third country that applied for financial assistance from the troika. Like Greece and Cyprus, Portugal had also struggled with high deficits and debt levels since its admission to the euro area. But, as opposed to Greece and Cyprus, Portugal implemented various austerity measures well before the start of the 2008 financial crisis. Nevertheless, those austerity measures did not convince the international markets, which feared contagion and a potential euro area break up after the debt crisis erupted in Greece.

What made things worse for Portugal was that the top three rating agencies downgraded its credit status even after the government signed a Memorandum of Understanding (MoU) with the troika in accepting financial assistance worth EUR 78 billion under the conditionality of implementing measures related to fiscal consolidation, its banking system and structural reforms to improve its competitiveness in late 2011. One of the trigger points of Portugal's credit rating downgrades, as in the case of Ireland, was related to the country's banking problem. In particular, one of its private banks, the Banco Português de Negócios (BPN) was nationalized while the Banco Privado Português (BPP), received rescue funds due to their large registered losses associated with bad investments and accounting fraud (de Sousa et al. 2014).

Furthermore, more than 80% of foreign investment in the period between 1995 and 2007 period went to the real estate sector rather than to manufacturing or other productive activity. Thus, as in the case of other peripheral countries, the contribution of overseas capital to productivity growth was very small. And, as in Greece, the reduction of unit labour costs was mainly due to job cuts (Felke and Eide 2014). The country managed to exit its financial assistance programme in May 2014.

2.2.4 Spain

Compared to Greece, Portugal and Cyprus, Spain never ran a government deficit of more than 3% during the period 1998 and 2007 while its public debt to GDP stood at below 40% when the crisis broke out (see Tables 8, 9 in Appendix 1).

In Spain, the problem arose from the bursting of its real estate and construction market bubbles, which ended up in a banking crisis. Spanish banks were heavily involved in the construction sector, so when the crisis hit the construction industry, this affected the whole financial system (Guardiola and Guillen-Royo 2015). In October 2008, the Spanish government provided a 71 billion euro guarantee fund for its banking sector. Shortly after that, the Spanish government implemented austerity measures to reduce the country's public deficit and regain the trust of the international financial markets in order to lower its bond interest rates as did the next new government after the elections in late 2011 (Kickert and Ysa 2014).

After one of the largest banks Bankia was nationalized in May 2012, Moody's downgraded several Spanish banks, which led to an increase in the risk premium on Spanish debt and consequently the country's funding costs. In June 2012, troika and Spanish government reached an agreement about a bailout of the Spanish banking sector with a EUR 100 billion loan. The main aim of the bailout was to recapitalize and restructure the Spanish banking system (Kickert and Ysa 2014). In this case, austerity had already been imposed 'voluntarily' by the Spanish government, and overall indebtedness was not extreme. However, it was not easy to break the vicious circle between sovereign debt and bank debt. Nevertheless, the country exited its economic adjustment programme successfully in January 2014.

2.2.5 Cyprus

Cyprus, like Greece and Portugal, had a history of fiscal deficits, but, in order to join the euro area, the country applied fiscal discipline and achieved a surplus of 3.5% and a debt to GDP ratio of 48.9% by 2008. The problem was that the country's banking sector was very large compared to the country's GDP. For example, in 2012, its banking sector had liabilities of 800% of GDP. This meant that Cyprus was financing its deficits via foreign capital inflows, which in turn made the country vulnerable to inflow reversals (Phylaktis 2015).

International markets stopped financing the Cypriot government in May 2011. Nevertheless, the government asked for assistance from Troika only in June 2012 after the Cypriot banks made substantial losses as a result of the PSI scheme in Greece, since they held substantial amounts of Greek government debt. The impact of the PSI was estimated at 23% of the country's GDP. On the one hand, the banks did not have enough capital to cover losses while on the other hand, the government could not provide any financial support because it did not have access to the markets. An agreement between the troika and Cyprus was reached only in March 2013. This time the troika had to take a different approach as taxpayer financing of the losses was implausible. The initial rescue plan included a bail in of both insured and uninsured depositors in all Cypriot financial institutions (Phylaktis 2015).

The country's banking system was funded mainly by depositors, deposits constituting 71% of banks' liabilities. 60% of those deposits belonged to non-residents. Up until then the first €100,000 of any depositor's claim in the EU was regarded as inviolable as it was insured. Thus, although the burden might not have fallen so strongly on ordinary Cypriots as taxpayers, it would fall on them as depositors instead. The bailout was rejected by the Cypriot Parliament and the new deal now required the bailing in of just the uninsured depositors of their two largest banks. Moreover, profitable Cypriot bank branches in Greece had to be sold at a loss (Phylaktis 2015). Eventually, the country managed to exit the economic adjustment programme in March 2016.

2.3 Fiscal Asymmetries

A fundamental asymmetry that a less than optimal currency area creates is that countries that are on the upside, with a strong balance of payments, good competitiveness and sound public finances, have no real compulsion to act when the system is under strain, whereas those on the downside, with balance of payment and fiscal deficits, high debt and poor competitiveness, have no choice but to act. Restoring sustainability for such weaker countries is an unpleasant process involving reductions in real wages, budgetary consolidation and unemployment, which may be long-lasting. This applies inside and outside monetary union, but the tools available inside are more limited unless of course the boundary of the monetary union is matched by a fiscal union as well. While the new measures in the six-pack, the two-pack and the TSCG all move in the direction of more sustainable and prudent fiscal policy in the euro area they come nowhere near a fiscal union where the better off regions automatically assist those in difficulty.[18]

The EU has recognized the general problem with the new macroeconomic imbalance procedures, requiring countries not to get too out of line with their partners and to adhere to common minimum standards. However, with the exception of the real exchange rate and the current account balance, these monitored imbalances only relate to the downside. Even in the case of the current account balance, the imbalance limits are not symmetric (+6% compared with −4%). The position that the weaker have to adjust rather than the stronger is thus institutionalized.

However, the macroeconomic indicators are not all of the same nature as some are more macroprudential in character, relating to the size of private sector debt, the growth of private sector credit, house price growth and growth in total financial sector liabilities. Acting on these upside indicators would limit the rates at which real convergence might occur but would also reduce the chance of a financial crisis. Here, the idea that one should also limit contractions in these variables is more difficult as the process itself is highly asymmetric. Credit contractions tend to be slower than credit expansions. Moreover, in downturns, there is huge pressure to avoid a credit crunch as those businesses in temporary trouble need to borrow more to survive not less. The same applies to avoiding a 'collateral crunch' through falling asset prices.

In the EU, banks have been required to raise their equity ratios in the light of the analysis of the causes of their weakness in the crisis. Since it has been difficult to raise equity on the market and indeed existing shareholders are unlikely to be enthusiastic about seeing their holdings diluted, banks have been deleveraging, particularly by reducing foreign lending (Goodhart 2016). This has not merely affected Greece directly through its own banks but indirectly through the restrictions on lending in its markets and the lower subsequent increase in incomes elsewhere in the EU, e.g. reducing tourism.

The requirements for Greece and any other country to be suitable for being in a currency are twofold according to Optimum Currency Area (OCA) theory. The first requirement is to limit their exposure to asymmetric shocks by being similar to their partners in economic structure, openness and intraregional trade, and degree of specialization. The second is to facilitate the adjustment to any asymmetric shocks that do occur. These include homogeneity of preferences to guarantee efficient crisis management, factor mobility and transfer payments to overcome economic shocks (see Jager and Hafner 2013, for more detailed analysis).[19] The problem is that the euro area is far away from being an optimal currency union. The adjustment is smoother when the Member States of the union have flexible labour markets and a federal fiscal system to act as stabilizer. The euro area lacks both (Goodhart 2007).

The SGP was designed to try to make sure that Member States never got near the boundaries of fiscal and debt sustainability. The Excessive Deficit Procedure (EDP) was designed to act as a deterrent. In normal times, countries should organize their fiscal balance such that when there are downward shocks they do not get a worse deficit than 3%, because they know that, if they have to adjust in the down phase, it will be very painful. The problem comes when the deterrent does not work and countries do nevertheless have to adjust in the down phase and reduce their deficit during a time when they need to stimulate their economy, thus making the situation more difficult instead. This problem was made even worse by admitting countries, such as Greece, that had debt ratios well above the level that offered a substantial cushion against the consequences of an adverse shock. Furthermore, since the EDP itself was effectively abandoned after France and Germany threatened to break the limits, it ceased to have value as a deterrent and performance worsened (Mayes and Virén 2011).

Thus, the deterrent having not worked, the euro area was faced with having to decide what to do in circumstances it thought would not occur, namely, that some Member States were so indebted they could not manage to continue to finance their debt in financial markets even if they took exceptionally drastic measures to try to reduce their deficits (Tables 8, 9, in Appendix 1, show the government deficit and debt to GDP ratios, respectively, for the 19 euro area countries, covering the period 1995–2015).[20] In the initial period, when the GFC was at its full force in the last quarter of 2008, the global reaction through the G20 on the UK's initiative was to agree on general fiscal expansion, over and above the increases that would occur as the result of automatic stabilizers as tax revenues fell and social expenditure demands rose with declining activity and rising unemployment. By 2010, when the Greek sovereign debt crisis emerged, countries were already retreating from those exceptional measures. Not only were they worried by how rapidly their debt was increasing and the consequences this was having for debt ratings but they were seeing signs that the worst was over and the world economy was recovering. With interest rates at zero and quantitative easing in some countries, there were worries that the rebound might be so strong that it could become inflationary, so there was a tendency to ease up on the level of stimulation. Indeed, in May 2011, the ECB actually started raising interest rates. Hence, there was reluctance on the part of euro countries without a debt constraint to contemplate an expansion that was additional to their domestic needs. The focus was simply on what should be done to address the danger of default by Greece.

Thus, while the other euro countries helped by providing temporary lending under strict conditionality to give Greece time to return to a sustainable fiscal position, there was little discussion of a fiscal solution, certainly not involving any direct fiscal transfers. The EUR 315 billion (Juncker) plan for investment was not proposed until 2015, and it is still not clear how much of that will be additional investment. The normal response inside a nation state to such problems would not merely be automatic fiscal transfers to help the disadvantaged but an investment programme to help restructuring, providing both physical infrastructure and development assistance for business start-ups, retraining, etc. Monetary policy and consequently exchange rate policy would still be aimed at what was appropriate for the country as a whole and not specifically for the distressed region.

The impact on the distressed countries and Greece, in particular, has therefore been harsher than it would be the case for a region in a full economic and monetary union or for an EU country that was not part of the euro area. While one can of course argue that these countries had already benefitted substantially from their membership of the euro area with low rates of interest, higher demand for their exports and lower transactions costs (but higher inflation), this does not entail that putting the adjustment burden so firmly on them was either the most efficient solution or the most equitable one.

There has been considerable argument for a greater participation by creditors both in expanding their own economies and in restructuring the debt further (see Kregel 2011; Panagiotarea 2013, for example). The more telling argument is that it is actually in those countries' own interests to act in this way. Krugman (2015) argues that 'we're increasingly seeing that the problems of the euro extend well beyond the troubles of southern European debtors. Economic performance has also been very bad in several northern nations with good credit ratings and low borrowing costs—Finland, Denmark (which is not in the euro but shadows it), the Netherlands. We're seeing the classic problems of asymmetric shocks in a currency area that isn't optimal'.

3 The Competitiveness Problem

Many countries that are in fiscal difficulty also face a competitiveness problem. This problem is not restricted only to Greece or other Southern euro area Member States. Finland and the Baltic States, for example, also, face competitiveness related difficulties. The Maastricht convergence criteria for suitability for joining the euro area do not contain any requirement for price level convergence, simply inflation convergence. Nor indeed was there a requirement for convergence of real incomes. Thus, several countries, Greece included, joined with price and income levels well below the euro area average. Assisted by the low interest rates, both price and income levels have increased more rapidly in these countries. While ECB monetary policy was quite successful in achieving its target of a rate of inflation below but close to 2% a year for the euro area as a whole in its first decade of operation, there was no longer any focus on inflation in any of the individual Member States as there was when they had their own monetary policy. Thus, their inflation could and did differ quite significantly from the average. The same problem of an excessive rate of catch up leading to overshooting applied to the Baltic States but other countries, such as Finland, also saw their prices rise compared to that of their competitors as part of a reaction to faster growth that they could not easily control this by fiscal policy alone.

Such imbalances can develop for quite some time in a monetary union as long as they can be financed or offset by investment. Indeed, inside a single country, there will probably not be any statistics on net trade and unemployment and price level discrepancies can be enduring. In the euro area framework, however, limits can be reached and at that point the adjustment required is no longer marginal but involves relatively substantial change. Again, any such imbalance is a two-sided phenomenon. Other countries in the euro area are running corresponding surpluses. Here also the problem of adjustment is asymmetric. The surplus countries are seeing reasonable growth and providing they do not mind accumulating assets they do not need to alter their own competitiveness downwards. This lack of convergence in competitiveness in the euro area and its consequent current account imbalances were financed by the core countries (Panagiotarea 2013). In turn, this led the banking systems in both the core and the periphery euro area countries to become highly leveraged.

Furthermore, such differences in competitiveness will tend to be fostered by differences in structure and in labour market bargaining processes. To reverse the relative change, these structures and processes also need to change and that change has to take place in the deficit countries. It is interesting that one of the main arguments suggested in favour of Finland's membership of the euro area from the outset (Pekkarinen et al. 1997) was that the removal of the opportunity to change the exchange rate would force Finnish wage bargainers to alter their behaviour to avoid losing competitiveness. To an extent this worked and in the early years of the EMU Finland's cost competitiveness remained relatively constant compared with Germany despite the faster growth rate. But this parity was increasingly eroded and then exposed by the adverse structural shocks.

Without the benefit of their own monetary policy or exchange rate policy these countries need to adjust mainly by reducing relative prices. Nevertheless, as the Governor of the Bank of Finland, Erkki Liikanen, argues, current account deficits cannot always be solved by lowering the real exchange rate through reductions in relative wages. Sometimes, structural change of their economies towards new growth opportunities is needed as well (Bank of Finland 2015). In the case of Finland, the country had to reduce its dependence on paper because worldwide usage is going down. Similarly, the decline of Nokia was not due to its being expensive but because it did not back the right technology and produce good enough products. Moreover, the worsening of the bilateral trade balance through the sanctions that the EU is imposing against Russia cannot be solved by altering relative prices.

The Baltic States have been in a similar position to the Member States of the periphery of the euro area. They could not use monetary policy to improve their competitiveness as their interest rates were used to maintain a fixed exchange rate with the euro through their currency boards.[21] The Baltic States' GDP growth was higher in the period 2004–2006 compared to growth in the global economy but dropped significantly in the years 2008–2009. Nevertheless, those countries achieved positive GDP growth in 2010. The main channels through which the GFC was transmitted to the Baltic States were capital flows and international trade. Before the crisis, the Baltic States experienced a significant capital inflow from overseas as in the case of the peripheral countries, which was reversed after the Lehman Brothers collapse in the USA. The main source of economic growth in the Baltic States countries as in Greece was domestic demand but compared to Greece, the Baltic States were more flexible in terms of reducing wages and prices (Matysek-Jędrych 2012). By comparison with Greece and Portugal, the decrease in expenditure on imports was much more severe in the Baltic States while the improvement in competitiveness was mainly due to significant reduction in domestic demand (Lindner 2011).

One of the main problems in Greece has been its low productivity. The country's growth model has been consumption driven, which led to amassing large (mainly public) debt that proved unsustainable. The rapid expansion of the periphery countries before the crisis, which raised their price levels compared to the prices of their competitors was easy to achieve. The asymmetric problem is that lowering relative prices, through lowering relative wages is much more difficult to do than achieving the same relative outcome by allowing wages in the more competitive areas to rise faster. However, the core countries, particularly Germany, were not willing to pursue policies that would have that result. Striving to keep productivity growing and rein in costs makes sense because the euro area is not a closed economy. Germany and the other more successful countries owe a lot of their success to competing successfully in the rest of the world.

Although the Baltic States recovered faster than the peripheral euro area Member States, they still face fiscal and competitiveness problems but they have avoided some of the worst unemployment simply by emigration. It is difficult to stop real wages rising faster than in the wealthier Member States because this is part of the process of catching up. While such an increase in real wages can be offset by a matching faster growth of productivity—again a feature of catching up in some industries—in the service industries it is more difficult to increase productivity as wages are the main cost of production, which is a typical example of the Balassa–Samuelson effect.

What is, therefore, happening in the contracting states is that structural change is occurring through closing down the old and inefficient production without having anything new to replace it rather than the new driving out the old in some sort of Schumpeterian process. In the latter case, one would expect more favourable consequences for unemployment, which is an acute problem for many EU Member States. However, the increasing productivity as well as the transfer of manufacturing production to emerging markets had already created a structural unemployment problem in the EU. So the starting point for the current problems was already challenging. Thus, more people are in need of social support and benefits just at the time when the fiscal cuts reduce the existing system.

4 The Anxiety Problem

In the first section of the chapter, we discussed the euro area asymmetries that impede fiscal recovery in the region; while in the second section, we discussed the competitiveness problem and the asymmetries it creates showing that it is not restricted only to the 'South' of the euro area. However, asymmetry problems are also observed in the way people, mainly those who belong to lower income groups, react to policies depending on the state of the economy. As people are more cautious in downturns, much larger stimulus is needed to achieve the same effect as when an economy is doing well and people are more optimistic. This, in turn, makes recovery more difficult to occur.

But rather than stimulating the economy, the peripheral euro area countries resorted to austerity measures during a downturn due to their debt problems. This has created a range of anxieties for people, additional to those created by the economic crisis itself, due to the uncertainty of people's future financial and social state, which, in turn, has further hampered recovery and has had an enormous impact on the country's population health. Greece, for example, has been introducing austerity measures that hit the majority of the population for six consecutive years. Constant negative news about new austerity measures has created uncertainties and anxiety for people, especially for those least able to cope. The problem is that within the population the burden of austerity is not born equally. The middle class has been gradually evaporating and the number of poor and materially deprived has been substantially increasing (Balourdos 2014). On the other hand, those who are well off did not need to change their lifestyle or their standards of living, thus, widening the gap between rich and poor and raising the chance of social unrest.

D'Errico et al. (2015) find a significant distributional effect due to the crisis observing an increase in inequality in most of the euro area countries and thus recommending customized policies to tackle the problem. For example, using a new inequality measure, they find that the rise of inequality in Greece, Ireland, Italy and Portugal has been larger than previous studies indicate. They also show that labour income is a major source of income for the lowest income percentiles. This implies that austerity measures, which reduce wages and pensions unevenly, affect the lower income population more than the higher income population which has alternative or additional sources of income. Furthermore, austerity measures have created new forms of poverty such as the new poor, severe poor, near poor, materially deprived and persistent poor (for more details, see Balourdos 2014).

Figure 1 shows the materially deprived as a percentage of total population in Greece, Cyprus, Ireland, Portugal, Spain, Italy and Germany. As can be seen in this figure, the percentage of materially deprived increased in most countries with exception of Germany. In the case of Greece, this percentage substantially increased from 2010 and onwards

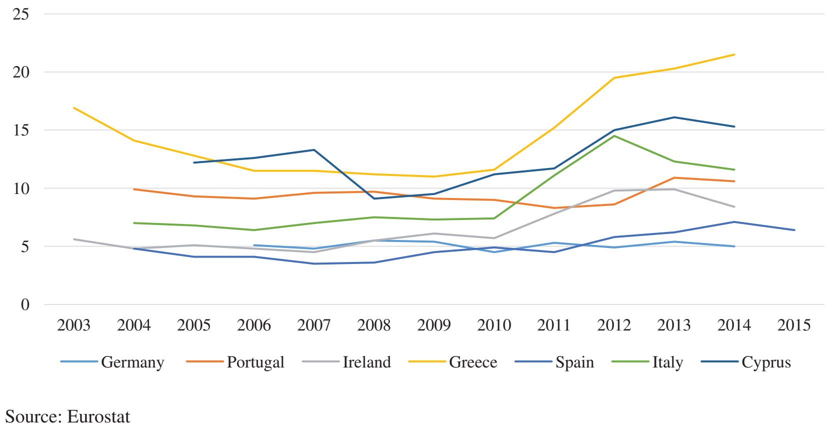


Fig. 1 Material deprivation (in percentage terms of total population). *Source* Eurostat

reaching around 22% in 2014 (comparatively, the average of materially deprived in the euro area in the same year was less than 9%).

As income obtained through labour is usually the main source of earnings for lower socio-economic groups, it is clear how vital employment is for the vast majority of this population. Bergiannaki and Dimitrakopoulos (2014) find that the risk of premature death increases by 63% for someone being unemployed. They also find that the psychological burden of being unemployed among others increases stress levels, anxiety and frustration, which in turn increases the risk of mental disorders. In Greece, for example, suicides and the use of drugs among people who were unable to repay debt increased as did violence, homicide and theft. Overall, findings show that poor population health is related to wealth inequality (see, e.g. Gelormino et al. 2014; Nowatzki 2014). Thus, policies should aim to reduce inequality rather than simply poverty (Navarro 2014a).

One of the many conditions imposed by the troika on Greece and other peripheral euro area countries in order for them to receive financial assistance has been labour market reforms. Research shows that these reforms have health implications for workers. Chung et al. (2014) argue that this is due to the high job insecurity, low pay, limited social benefits and powerlessness that workers feel. What is more, workers are likely to sell their labour for less than subsistence income due to unregulated low wages, which will further undermine their economic security.

There is a huge problem of unemployment and especially youth unemployment that some EU countries face. For example, total unemployment in Greece reached almost 27% with Spain following with 24.4% in 2014 (see Table 5) while the average unemployment in the euro area in the same year was around 11.4%. The numbers for youth unemployment are more striking.

Figure 2 shows the percentage of youth unemployment for Greece, Cyprus, Ireland, Portugal, Spain, Italy and Germany. In 2013, for example, youth unemployment in Greece and Spain was slightly below 60% followed by Italy with 40.1% and Portugal and Cyprus slightly below 40%. On the contrary, youth unemployment was less than 8% in the same year for Germany; while the euro area average was 26.5%. Figure 3 also shows the youth unemployment in the Baltic States and compares it with that of Greece and Finland. As can be seen, youth unemployment started increasing significantly from 2007, peaked in 2013, and after that gradually declined.

The main argument for implementing austerity measures was that peripheral euro area countries have been living beyond their means. However, another argument is that the root cause lies in the regressive

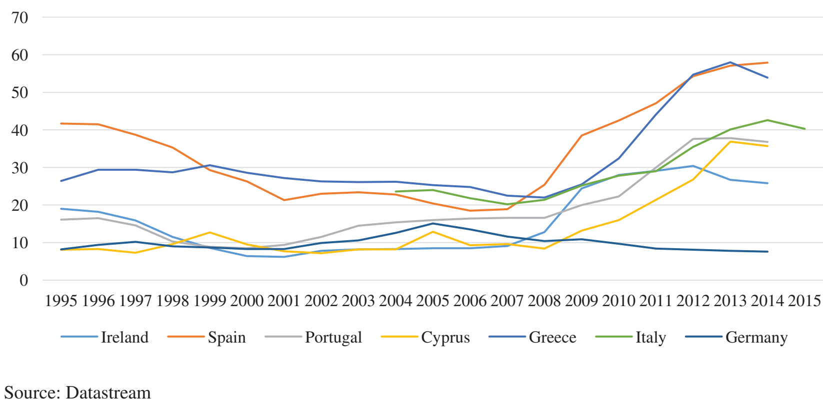
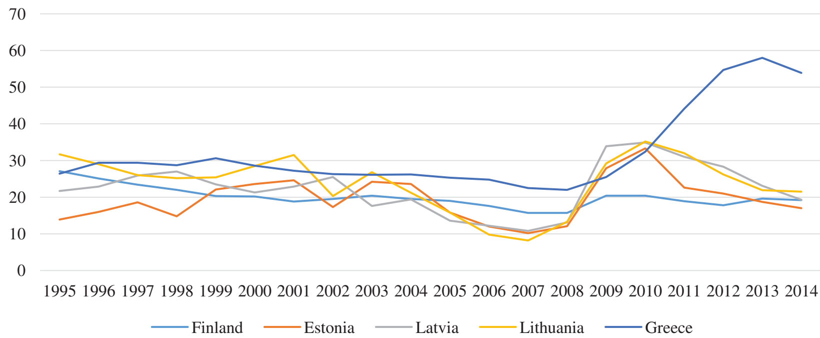


Fig. 2 Youth unemployment (15–24) in percentage terms (1). *Source* Datastream



Source: Datastream

Fig. 3 Youth unemployment (15–24) in percentage terms (2). *Source* Datastream

tax regimes and fiscal fraud that benefit high-income and special interest groups (Navarro 2014b). Business corporations deprive governments of revenue via transferring their funds through offshore tax havens (Smith 2014). Another problem that was not dealt with before the crisis was the accumulation of debt by lower and middle income households greatly assisted by easy access to cheap credit and wide availability of household credit products on offer. Furthermore, the deregulation of the financial sector arguably contributed to the bubble in the real estate sector via speculative investments, which were funded with debt (Smith 2014). Thus, cheap funds were directed towards high yielding sectors rather than the real economy, which was less profitable (Chtouris and Miller 2014).

After the crisis, the introduction of austerity measures in conjunction with rescue packages was not accompanied by investment policies to create jobs, which would increase labour income, policies to deal with household debt overhang that is holding back consumption, and consequently provide the means for increased tax revenues for the governments (Navarro 2014b).

From a market sentiment perspective, there has been great uncertainty that spread from the periphery to the core of the euro area. Figure 4 shows increased uncertainty in the markets, proxied by the

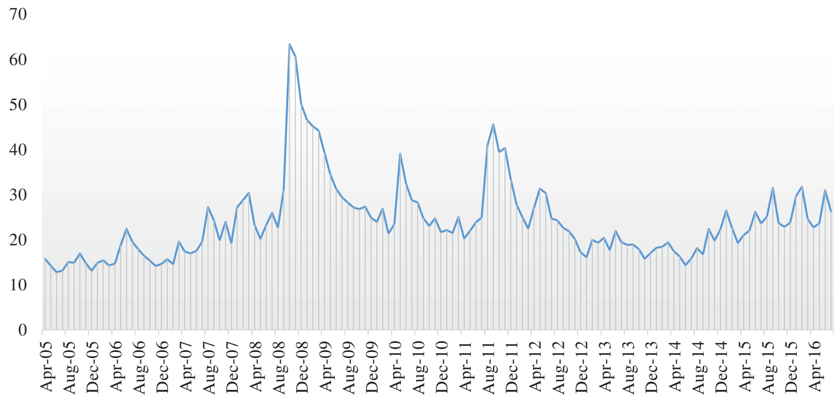


Fig. 4 EURO STOXX 50 Volatility. *Source* SIRCA

Table 7 Average annual value of the EURO STOXX 50 Volatility

Year	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Value	14.4	16.6	19.7	33.7	33.6	26.5	30.1	24.6	18.6	18.2	24.0	27.1

Source SIRCA

volatility of the prices of the 50 European blue chip companies (EURO STOXX 50 Volatility) over the period April 2005–July 2016,[22] while Table 7 shows the average annual value of this volatility.

With weak demand driven by austerity in the periphery and greater uncertainty in the wider area, the euro area faces an increasing problem of deflation as shown in Fig. 5 (Cohen et al. 2015).

Overall, what we see is more fragmentation rather than closer integration, with centrifugal tendencies gaining stronger momentum after the recent Brexit. High unemployment, especially among young people, hampers social integration in the EU. Young (2014) emphasizes the gap between the 'Market Europe' and 'Social Europe' models as well as the absence of a European welfare system at a supranational level, which could ameliorate the tremendous impact of economic crises and subsequent austerity measures on countries' social welfare systems. Singh (2016) argues that austerity measures protect the interests of creditors but not the taxpayers who had to bail out the banks. And while 'critical social functions' are mentioned in the EU policy agenda there is no clear

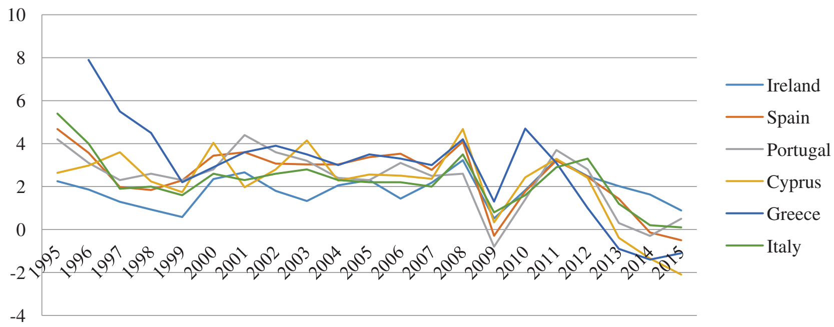


Fig. 5 Inflation rate. *Source* Datastream

strategy how they are going to be achieved. As Tombazos (2011, p. 45) puts it 'for as long as the neo-liberal principle of "competitive austerity" prevails, only "human sacrifice" will placate the centrifugal tendencies of the euro: austerity, unemployment, poverty and social frustration'.

5 A Way Forward

Any successful solution to the problems of an over-indebted borrower involves a compromise between the lenders and the borrowers.

1. The borrower has to offer a credible path forward that suggests to the lenders that they will not lose more in the future than they think acceptable.
2. The lender has to accept terms that reschedule or reduce the debt in a manner that does not lead the borrower to prefer default.

In the case of the euro area, where default and exit have been assumed to go together, the burden on the borrower has been asymmetrically high with the costs of exit. However, both parties bear the costs of default and exit, and in the case of Greece, the lenders came close to provoking Greece to choose default.

Because of this asymmetry, the costs to Greece and to a lesser extent to other countries in the periphery of the euro area, including Finland and the Baltic States, has been high. In a federal state, a much higher proportion of the costs would have been borne by the better off part of the area. Not only would incomes in the periphery not have fallen so much and unemployment would have risen less, but the average impact across the euro area as a whole would have been lower. Thus, making the transfers would provide a net benefit. Indeed, it is arguable that income levels would have been higher right across the area if expansionary fiscal policy in the countries that were not debt-constrained might have offset the transfer costs.

The most important feature in this process is that the anxieties and difficulties entailed by austerity lead to an asymmetric loss of confidence and reluctance to take risks that inhibits a recovery. At the same time, austerity cuts public sector investment and distressed banks are not merely unable to provide new loans for business expansion but have to cut back on lending (Schnabl 2016). Indeed, the focus will tend to be on 'evergreening' the existing non-performing loans to prevent the bank from failing, keeping such loans as are available away from new productive opportunities. Thus, there is little opportunity for internal sources of investment and external sources will also be weak if there is a risk of sovereign default or write-downs. Unless that cycle is broken, the prospects are not good.

The difficulty of exit varies by country. The Baltic States have proven flexible. They have not faced any threat of sovereign default and hence recovery is taking place. Similarly, Ireland has been able to address its banking problems and has been able to attract new external investment, again assisted by a very flexible labour market. The position in Italy, Portugal and Spain looks more questionable but none of these countries faces the extent of the difficulties of Greece, both in the threat of continuing sovereign default and in lack of flexibility.

An approach where Greece has to change first so that it becomes more like the Baltic States and then receives assistance second is not only very onerous but is likely to be politically and socially impossible.

The Baltic States made immense changes after the collapse of the Soviet Union but the prospects of independence and the benefits of a Western-style prosperous democracy were a massive incentive to accept much greater hardship than Greece has been facing. Not only was there the prospect of major benefit but there was major public and private sector assistance for the process. Hence, while there was much greater austerity and anxiety for many, there was a clear signal that this would be a temporary problem and hence there was quickly a rush to invest in the future.

This same turn round in beliefs is necessary for Greece so that both internal and external confidence is boosted and the reinforcing process of difficulty is ended. This implies a compact for Greece that contains a list of ingredients such as the following:

1. A major reduction in the debt burden—say by applying the same haircut to publicly held Greek government debt as was 'agreed' under the PSI. This will take some pressure off the Greek budget, remove the need for further austerity, enable proper recapitalisation of the banks and create some headroom for investment in physical and human capital
2. A reinforced, monitored commitment to continue with the programme of structural change and fiscal reform in Greece so that it can:
   a. Weather further adverse shocks without threatening sovereign default
   b. Increase its potential growth rate
   c. Provide confidence to lenders that the remainder of their loans will be serviced on schedule, i.e. it entails changes in the political framework and clientilism and not simply a change in economic structure
3. An expanded programme of external investment along the lines of the Juncker Plan to help provide the infrastructure to encourage the development of private sector productive investment in Greece.

More controversially, some greater expansion of the core economies would also help. The spectre of inflation is still small, and a reduction of the pressure on extraordinary monetary policy would help a more broadly based recovery. The burden of the recovery needs to fall on those who can most afford it.

Whatever is done, it needs to have the impact of the post-war and post-Soviet Union programmes both jolting Greece out of the cycle of anxiety and deprivation and reinforcing the process of structural change so the problems are not simply repeated again in the future.

Ironically, some of the problems of implementing such a programme are not to do with Greece but with the potential success of recovery in Italy, Portugal and Spain as well. While a dramatic programme can be afforded for Greece and indeed for Portugal, Italy and Spain are much larger economies. Nevertheless, if banks can be properly recapitalised and the euro economy as a whole can begin to grow faster many of these problems will be self-solving. Anxiety and asymmetry can be reduced and austerity replaced by normal budgetary prudence. Nevertheless, the euro area will remain too diverse to meet the criteria for an OCA and the problem of how to handle major adverse shocks to individual countries will remain. While the automatic fiscal transfers of a full federal system may be politically unacceptable, the practice of handling such future shocks will have to involve a much greater contribution by those who are not adversely affected by the shock to those who are or the problems of the last decade will simply recur again in some guise or other.

6 Appendix Tables

See Tables 8, 9 and 10.

7 Appendix Figures

See Figs. 6, 7, 8, 9 and 10.

Table 8 Government budget deficit to GDP (in percentage terms)

	IE	ES	PT	CY	GR	IT	DE	FR	NT	BE	AT	LU	FI	EE	LV	LT	MT	SI	SL
1995	−2.1	−7	−5.2	−0.7	−9.7	−7.3	−9.4	−5.1	−8.6	−4.4	−6.1	2.5	−5.9	1.1	−1.4	−1.5	−3.5	−8.2	−3.3
1996	−0.3	−5.4	−4.7	−3	−8.2	−6.6	−3.5	−3.9	−1.7	−3.9	−4.4	1.3	−3.2	−0.4	−0.4	−3.2	−7.7	−1.1	−9.7
1997	1.3	−3.9	−3.7	−4.8	−6.1	−3	−2.9	−3.6	−1.3	−2.1	−2.4	3.7	−1.2	2.2	1.4	−11.8	−7.1	−2.3	−6.2
1998	2	−2.9	−4.4	−3.8	−6.3	−3	−2.5	−2.4	−0.9	−0.9	−2.7	3.6	1.6	−0.8	0	−3	−9.3	−2.3	−5.2
1999	2.4	−1.3	−3	−4	−5.8	−1.8	−1.7	−1.6	0.3	−0.6	−2.6	3.6	1.7	−3.3	−3.7	−2.8	−6.7	−3	−7.3
2000	4.9	−1	−3.2	−2.2	−4.1	−1.3	0.9	−1.3	1.9	−0.1	−2	5.7	6.9	−0.1	−2.7	−3.2	−5.5	−3.6	−12
2001	1	−0.5	−4.8	−2.1	−5.5	−3.4	−3.1	−1.4	−0.3	0.2	−0.6	6	5	0.2	−2	−3.5	−6.1	−3.9	−6.4
2002	−0.3	−0.4	−3.3	−4.1	−6	−3.1	−3.9	−3.1	−2.1	0	−1.3	2.3	4.1	0.4	−2.2	−1.9	−5.4	−2.4	−8.1
2003	0.7	−0.4	−4.4	−5.9	−7.8	−3.4	−4.2	−3.9	−3	−1.8	−1.8	0.5	2.4	1.8	−1.6	−1.3	−9.1	−2.6	−2.7
2004	1.4	0	−6.2	−3.7	−8.8	−3.6	−3.7	−3.5	−1.7	−0.2	−4.8	−1.1	2.2	2.4	−1	−1.4	−4.4	−2	−2.3
2005	1.3	1.2	−6.2	−2.2	−6.2	−4.2	−3.4	−3.2	−0.3	−2.6	−2.5	0.2	2.6	1.1	−0.4	−0.3	−2.7	−1.3	−2.9
2006	2.8	2.2	−4.3	−1	−5.9	−3.6	−1.7	−2.3	0.2	0.3	−2.5	1.4	3.9	2.9	−0.6	−0.3	−2.6	−1.2	−3.6
2007	0.3	2	−3	3.2	−6.7	−1.5	0.2	−2.5	0.2	0.1	−1.3	4.2	5.1	2.7	−0.7	−0.8	−2.3	−0.1	−1.9
2008	−7	−4.4	−3.8	0.9	−10.2	−2.7	−0.2	−3.2	0.2	−1.1	−1.4	3.3	4.2	−2.7	−4.1	−3.1	−4.2	−1.4	−2.3
2009	−13.8	−11	−9.8	−5.5	−15.2	−5.3	−3.2	−7.2	−5.4	−5.4	−5.3	−0.5	−2.5	−2.2	−9.1	−9.1	−3.3	−5.9	−7.9
2010	−32.3	−9.4	−11.2	−4.8	−11.2	−4.2	−4.2	−6.8	−5	−4	−4.4	−0.5	−2.6	0.2	−8.5	−6.9	−3.2	−5.6	−7.5
2011	−12.5	−9.5	−7.4	−5.7	−10.2	−3.5	−1	−5.1	−4.3	−4.1	−2.6	0.5	−1	1.2	−3.4	−8.9	−2.6	−6.6	−4.1
2012	−8	−10.4	−5.7	−5.8	−8.8	−2.9	−0.1	−4.8	−3.9	−4.2	−2.2	0.3	−2.2	−0.3	−0.8	−3.1	−3.5	−4.1	−4.3
2013	−5.7	−6.9	−4.8	−4.9	−13	−2.9	−0.1	−4	−2.4	−3	−1.3	0.8	−2.6	−0.2	−0.9	−2.6	−2.6	−15	−2.7
2014	−3.8	−5.9	−7.2	−8.9	−3.6	−3	0.3	−4	−2.4	−3.1	−2.7	1.7	−3.2	0.8	−1.6	−0.7	−2	−5	−2.7
2015	−2.3	−5.1	−4.4	−1	−7.2	−2.6	0.7	−3.6	−1.8	−2.6	−1.2	1.2	−2.7	0.4	−1.3	−0.2	−1.5	−2.9	−3

Source http://www.tradingeconomics.com
Notes IE Ireland; *ES* Spain; *PT* Portugal; *CY* Cyprus; *GR* Greece; *IT* Italy; *DE* Germany; *FR* France; *NT* Netherlands; *BE* Belgium; *AT* Austria; *LU* Luxenbourg; *FI* Finland; *EE* Estonia; *LV* Latvia; *LT* Lithuania; *MT* Malta; *SI* Slovenia; *SL* Slovakia. The Maastricht limit is −3% of GDP

Table 9 Government debt to GDP (in percentage terms)

	IE	ES	PT	CY	GR	IT	DE	FR	NT	BE	AT	LU	FI	EE	LV	LT	MT	SI	SL
1995	78.5	61.7	58.3	47.9	98.9	116.9	54.8	55.8	73.1	130.5	68	8.1	55.1	8.2	13.9	11.5	34.4	18.3	21.7
1996	69.9	65.6	59.5	49.2	101.2	116.3	57.6	59.7	71.2	128	68	8	55.3	7.5	13.3	13.9	38.7	21.6	30.5
1997	61.6	64.4	55.2	53.2	99.3	113.7	58.8	61.1	65.6	123.2	63.2	7.9	52.2	7	10.7	15.4	46.6	22.1	33
1998	51.5	62.5	51.8	54.8	97.2	110.8	59.4	61	62.5	118.2	63.6	7.6	46.9	6	9	16.5	51.2	22.8	33.9
1999	46.7	60.9	51	55.1	98.6	109.6	60	60.2	58.2	114.4	66.4	6.7	44.1	6.5	12.1	22.7	62.1	23.7	47.1
2000	36.1	58	50.3	55.1	104.4	105.1	58.9	58.7	51.4	108.8	65.9	6.1	42.5	5.1	12.1	23.5	60.9	25.9	49.6
2001	33.2	54.2	53.4	56.9	106.8	104.7	57.7	58.2	48.7	107.6	66.5	6.6	41	4.8	13.9	22.9	65.5	26.1	48.3
2002	30.6	51.3	56.2	60.1	104.6	101.9	59.3	60.1	48.2	104.7	66.3	6.5	40.2	5.7	13.2	22.1	63.2	27.3	42.9
2003	29.9	47.6	58.7	63.5	101.2	100.4	63	64.2	49.3	101.1	65.5	6.4	42.8	5.6	13.9	20.4	69.1	26.7	41.6
2004	28.2	45.3	62	64.5	102.7	100	64.7	65.7	49.6	96.5	64.8	6.5	42.7	5.1	14.3	18.7	72	26.8	40.6
2005	26.1	42.3	67.4	63.2	107.3	101.9	66.9	67.2	48.9	94.6	68.3	6.3	40	4.5	11.8	17.6	70.1	26.3	33.9
2006	23.6	38.9	69.2	59.1	103.5	102.5	66.4	64.4	44.5	90.9	67	7	38.2	4.4	9.9	17.2	64.6	26	30.8
2007	23.9	35.5	68.4	53.9	103.1	99.7	63.6	64.4	42.4	86.9	64.8	7.2	34	3.7	8.4	15.9	62.4	22.7	29.9
2008	42.4	39.4	71.7	45.1	109.4	102.3	65	68.1	54.5	92.4	68.5	14.4	32.7	4.5	18.7	14.6	62.7	21.6	28.2
2009	61.8	52.7	83.6	53.9	126.7	112.5	72.5	79	56.5	99.5	79.7	15.5	41.7	7	36.6	29	67.8	34.5	36
2010	86.8	60.1	96.2	56.3	146.2	115.3	81	81.7	59	99.6	82.4	19.6	47.1	6.6	47.5	36.2	67.6	38.2	40.8
2011	109.3	69.5	111.4	65.8	172	116.4	78.4	85.2	61.7	102.2	82.2	19.2	48.5	5.9	42.8	37.2	69.8	46.4	43.3
2012	120.1	85.4	126.2	79.3	159.6	123.3	79.6	89.6	66.4	104.1	81.6	22	52.9	9.5	41.4	39.8	67.5	53.9	52.4
2013	120	93.7	129	102.5	177.7	129	77.2	92.4	67.9	105.2	80.8	23.3	55.5	9.9	39.1	38.8	68.6	71	55
2014	107.5	99.3	130.2	108.2	180.1	132.5	74.7	95.3	68.2	106.5	84.3	22.9	59.3	10.4	40.8	40.7	67.1	81	53.9
2015	93.8	99.2	129	108.9	176.9	132.7	71.2	96.1	65.1	106	86.2	21.4	63.1	9.7	36.4	42.7	63.9	83.2	52.9

Source http://www.tradingeconomics.com

Notes *IE* Ireland; *ES* Spain; *PT* Portugal; *CY* Cyprus; *GR* Greece; *IT* Italy; *DE* Germany; *FR* France; *NT* Netherlands; *BE* Belgium; *AT* Austria; *LU* Luxenbourg; *FI* Finland; *EE* Estonia; *LV* Latvia; *LT* Lithuania; *MT* Malta; *SI* Slovenia; *SL* Slovakia. The Maastricht limit is 60% of GDP

Table 10 EU and euro area membership years

	IE	ES	PT	CY	GR	IT	DE	FR	NT	BE	AT	LU	FI	EE	LV	LT	MT	SI	SL
EU	1973	1986	1986	1981	2004	1958	1958	1958	1958	1958	1995	1958	1995	2004	2004	2004	2004	2004	2004
Euro	1999	1999	1999	2001	2008	1999	1999	1999	1999	1999	1999	1999	1999	2011	2014	2015	2008	2007	2009

Source http://europa.eu/about-eu/basic-information/money/euro/index_en.htm

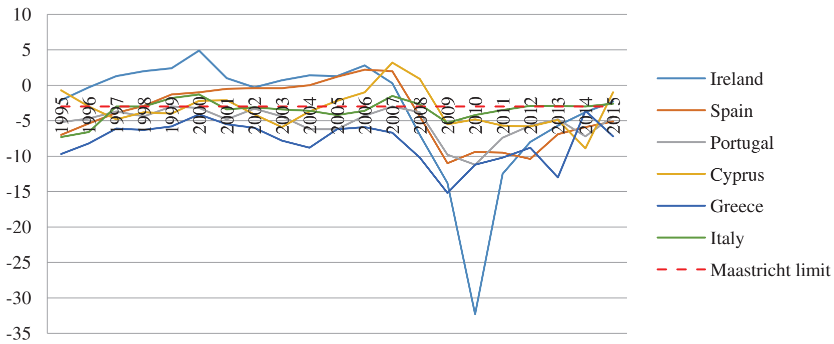


Fig. 6 Government budget surplus/deficit (in percentage terms of GDP). *Source* http://www.tradingeconomics.com

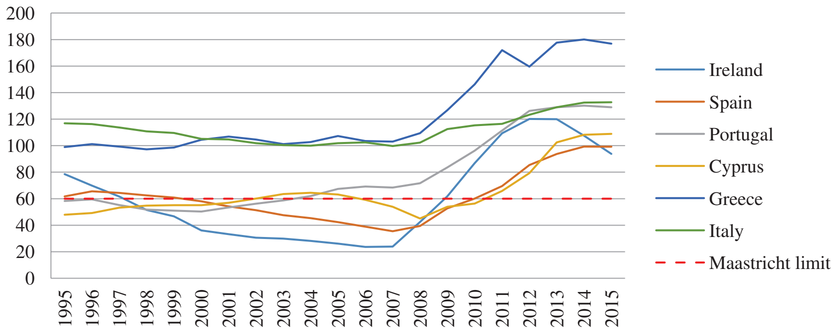


Fig. 7 Government debt (in percentage terms of GDP). *Source* http://www.tradingeconomics.com

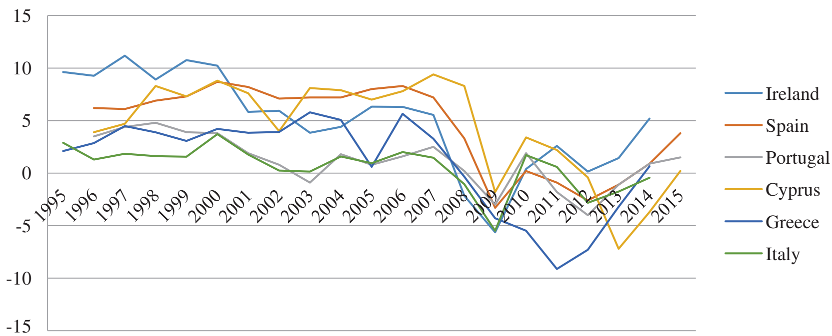


Fig. 8 GDP growth (in percentage terms). *Source* Datastream

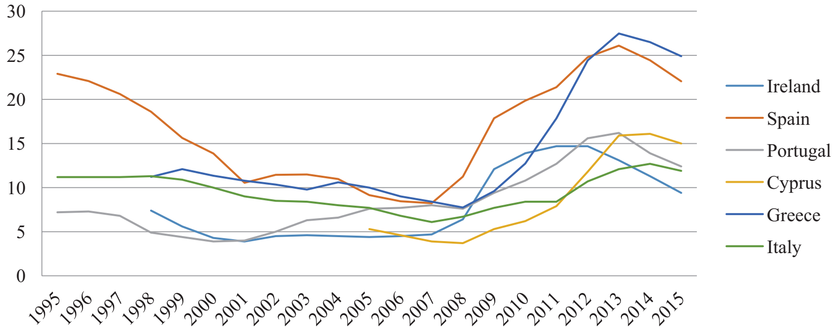


Fig. 9 Total unemployment rate (in percentage terms). *Source* Datastream

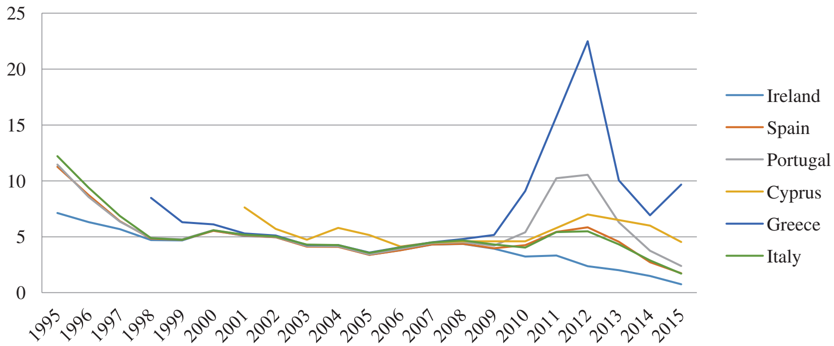


Fig. 10 Long-term government bond yield (10 years). *Source* Datastream

Notes

1. For more details see: http://eur-lex.europa.eu/legalcontent/EN/TXT/PDF/?uri=CELEX:32011R1176&from=EN.
2. Unfortunately, there is no purely objective measure for the limits of sustainability. They depend upon the reactions of potential lenders. When either people will not lend or the spreads become so high that a state would rather default than pay them, then the fiscal position is no longer sustainable. Lenders' views depend upon their belief about their chances of being paid back in the future (see Dyson 2014). Countries can raise the level of sustainability by having a good track record but

ultimately beliefs will depend upon the credibility of possible future governments and political opinion.

3. Of course, this will raise the government debt ratio of the less troubled countries and of the euro area as a whole at a time when the average is already quite high (on average 81% of GDP in 2015). Indeed, in other circumstances, such action could lead to inflation. But in the present depressed state of affairs, this has not been a realistic threat.
4. The Baltic States have turned around and seem set on a renewed growth path, albeit not as rapid as the pre-crisis rate. Finland, on the other hand, is still struggling and the government has been negotiating with the trade unions to help regain competitiveness.
5. The Baltic States, especially Estonia, have constrained themselves to restructure without much access to borrowing, even though they were much less indebted at the time of the GFC.
6. While the adjustment through emigration has been comparatively smaller in Greece, total emigration increased from roughly 38,000 in 2006 to 62,000 in 2010 reaching a peak of 125,000 in 2012 falling to 110,000 in 2015 according to information provided by Eurostat noting a large percentage of those emigrants are young and well educated (see http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=migr_emi1ctz&lang=en).
7. Sargent (2001) argues that people are inherently optimistic and grasp eagerly at any signs that there may be improvements in the economy's long-run ability to grow. This optimism is likely to be partly self-fulfilling as people increase consumption and investment spending on the back of these beliefs. Eventually, they will realise again that this better state of affairs is ephemeral and so the economy will drop back sharply as people adjust from overconsumption and overinvestment and digest their losses. A more striking approach, which adds a speculative financial cycle to the picture, has been developed by Minsky (1986) among others.
8. See for example http://www.wsj.com/articles/SB10001424127887324299104578527202781667088 and http://www.ekathimerini.com/207795/article/ekathimerini/business/lagarde-admits-to-imf-mistakes-urges-greek-govt-to-do-more.
9. The IMF gets paid back first. Indeed, unless the recovery programme is very successful, the ESM will in effect simply be repaying the IMF and will itself only be able to exit once international financial markets have sufficient confidence in the prospects for Greece that they are prepared to lend to Greece again on terms the government finds acceptable.

10. See http://www.imf.org/external/pubs/ft/scr/2013/cr13156.pdf.
11. See for example http://www.imf.org/external/pubs/ft/scr/2012/cr1257.pdf.
12. The initial projected estimate of Greek debt by 2022 was 142% of GDP but by 2015 it had been revised to 170% of GDP (see IMF's update on public debt sustainability analysis at http://www.imf.org/external/pubs/ft/scr/2015/cr15186.pdf).
13. http://www.imf.org/external/pubs/ft/scr/2012/cr1257.pdf.
14. http://www.nytimes.com/2016/05/25/business/international/greece-debt-relief-imf-eurozone-bailout.html?_r=0.
15. http://www.bbc.com/news/world-europe-33325886.
16. Although, as of July 2016, Portugal and Spain were still not compliant with the terms of the SGP.
17. http://www.irishtimes.com/news/banking-crisis-how-the-costs-have-evolved-1.657756.
18. See http://ec.europa.eu/economy_finance/articles/governance/2012-03-14_six_pack_en.htm.
19. Masini (2014) provides interesting review of the history of the theories on OCAs. He divides them to ones based on exogenous and endogenous criteria. Starting with the pioneering paper of Mundell (1961), initially, the focus of creating an OCA was on exogenous criteria that need to be satisfied before joining or creating a currency union. In this case, the arguments were based purely on economics. As time passed by, there was a change to endogenous criteria, mainly through policy debates rather than academic work, which implied that what is important, is not achieving the exogenous criteria per se but a political will to initiate a currency union and create the conditions to smooth the process towards convergence. In this case, politics outweighed economics. The argument is that the potential problems will force countries to change once they are members.
20. Table 10 in the Appendix 1 shows the years when the current euro area Member States joined the EU and the euro area, respectively.
21. All three Baltic States have joined the euro area since the GFC, facilitated in part by their having had to reduce their price levels, which enabled them to meet the Maastricht criteria.
22. The data are obtained from Thomson Reuters Tick History (TRTH) database of Securities Industry Research Centre of Asia-Pacific (SIRCA).

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Debt Supercycle in Greece and Secular Stagnation in the Eurozone: Implications for Policy

Dimitris G. Kirikos

1 Introduction

The anemic recovery of most advanced economies, after eight years into the great recession following the financial crisis of 2008, has given rise to alternative interpretations of the observed growth path. These include Summers' (2014a, b, 2016) secular stagnation hypothesis, Rogoff's debt supercycle approach (Lo and Rogoff 2015), Krugman's (1998) revival of the Keynesian liquidity trap case, Bernanke's (2015) global savings glut thesis, and Gordon's (2015) supply-side headwinds. The most prominent explanations, when compared against the data, seem to be the secular stagnation diagnosis and the debt supercycle notion.

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Secular stagnation is premised on the observed downward trends of long-term interest rates and holds that adverse developments in demographics, income distribution, financial and capital markets, among others, lead to excess savings in the loanable funds market that drive down the full employment real interest rate. If that low rate cannot be achieved through conventional monetary policy, because of the zero lower bound (ZLB) of the nominal rate, then a persistent shortfall in aggregate demand (AD) appears. This deficiency, along with hysteresis effects that erode productive capacity, prevents the economy from reverting to its previous long-run growth path once a cyclical shock occurs.

A persistent demand slump can also arise as a result of excessive deleveraging after a major financial turmoil, like the housing bubble burst of 2008, and high-debt economies are more likely to be adversely influenced. Therefore, a debt overhang may contribute to a prolonged AD fall that generates an economic supercycle. Interestingly, while the debt supercycle approach recognizes possible hysteresis effects, it rather downgrades them and maintains that cyclical influences are not permanent as in the case of secular stagnation. That is, the economy will return to the same long-run path when deleveraging recedes and, thus, the only particular incident is a protracted diversion from trend growth.

In this chapter, we examine the policy implications of a debt overhang and secular stagnation in the context of a simple new Keynesian model consisting of a goods market equilibrium condition, a monetary policy rule (MP) , and a Phillips-curve-based supply side. Comparisons of model assumptions with basic characteristics of the Greek economy and the Eurozone, after 2008, provide compelling signs of a debt supercycle in Greece and secular stagnation in the core of the Eurozone. Then, we are able to evaluate the effectiveness of ongoing policies and even suggest alternative measures that may prove more successful both for restoring the growth rate and for reducing the long-run losses associated with hysteresis effects.

The model and its graphic exposition is put forward in Sect. 2, where we discuss the implications of constrained monetary policy for a debt-ridden small country in a monetary union as well as the consequences of operating at the ZLB of the nominal interest rate for the core of the union. Next, we integrate possible supply-side or hysteresis effects generated by prolonged cyclical fluctuations and show how they may divert the economy to a new long-run growth path. Then, in Sect. 4, ongoing policies in Greece and the Eurozone are evaluated and a more effective alternative policy mix is proposed. A summary and conclusions are presented in the final section.

2 An IS-MP-AS Framework

In this section, we analyze the policy options that emerge from debt overhang and secular stagnation situations similar to those observed over the last years in Greece and the Eurozone. Our approach is based on a graphic exposition of a simple new Keynesian model consisting of a goods market equilibrium condition (IS curve), a monetary policy rule (MP), and an aggregate supply (AS) curve based on the expectations-augmented Phillips curve (see Romer 2013). Even though this framework is simple enough, the same setup can be derived from dynamic general equilibrium settings characterized by nominal rigidities and, thus, it does not lack microeconomic foundation (e.g. Romer 2012; Eggertsson et al. 2016b).[1]

2.1 A Small Country in a Monetary Union

Consider a small open economy that participates in a monetary union and, therefore, next to having the same currency with its main trade partners, it cannot pursue independent monetary policy. Then, the following equations describe the economy:

$$y = c(y) + i(r) + g + x(y^*, \pi^* - \pi) - m(y, \pi^* - \pi) \tag{1}$$

$$r = n - \pi^e, n \geq 0 \tag{2}$$

$$\pi = \pi^e + \theta(y - y_p), \theta > 0 \tag{3}$$

where y is domestic output, c is consumption, i is investment, g is government spending, x denotes exports, and m imports, y^* is foreign income, π^* is realized foreign inflation, π is realized domestic inflation, π^e is expected domestic inflation, r is the real interest rate, n is the nominal interest rate, and y_p is the domestic potential output. Apparently, Eq. (1) is the IS curve, where exports depend positively on foreign income and on the inflation differential, and imports depend positively on domestic income and negatively on the inflation differential $\pi^*–\pi$.[2] Also, the Fisher Eq. (2) essentially represents the "monetary policy rule" (MP) since the real interest rate cannot be varied in response to fluctuations in output, and Eq. (3) is the AS curve derived from the expectations-augmented Phillips curve.

Assuming that inflationary expectations depend positively on realized inflation, i.e., $\pi^e = f(\pi)$ and $f' > 0$, we infer from (2) that, for a given nominal rate n, the real interest rate is determined only by the rate of inflation. Thus, the MP, as depicted in panel (a) of Fig. 1, will shift upwards if inflation falls and vice versa. Also, changes in domestic inflation will alter competitiveness and will cause the IS curve to shift, as is shown in Fig. 1a too. However, there are two possibilities regarding the shift of the IS curve after a fall in domestic inflation and for given levels of y^* and π^*. When the negative effect on investment, due to lower inflation and a higher real interest rate, is larger than the positive effect on net exports, then output finally falls and this case is shown by the shift of IS_o to IS_1 in panel (a) and the upward sloping AD curve AD in panel (b). Alternatively, if the net exports effect is higher than the negative impact of reduced investment, IS_o shifts to IS_2 and output finally rises, as shown at point E_2 of panel (a). The latter case corresponds to the downward sloping aggregate demand curve AD' in panel (b).

The above analysis suggests that when monetary policy is constrained due to membership in a monetary union, there may well be a positive relationship between inflation and total expenditure insofar as the negative effect of disinflation on investment outweighs the benefits from increased competitiveness. Such a positive relationship between inflation and the combined effect of investment and net exports seems to be the case for Greece over the recent years, as can be seen in Fig. 2.[3]

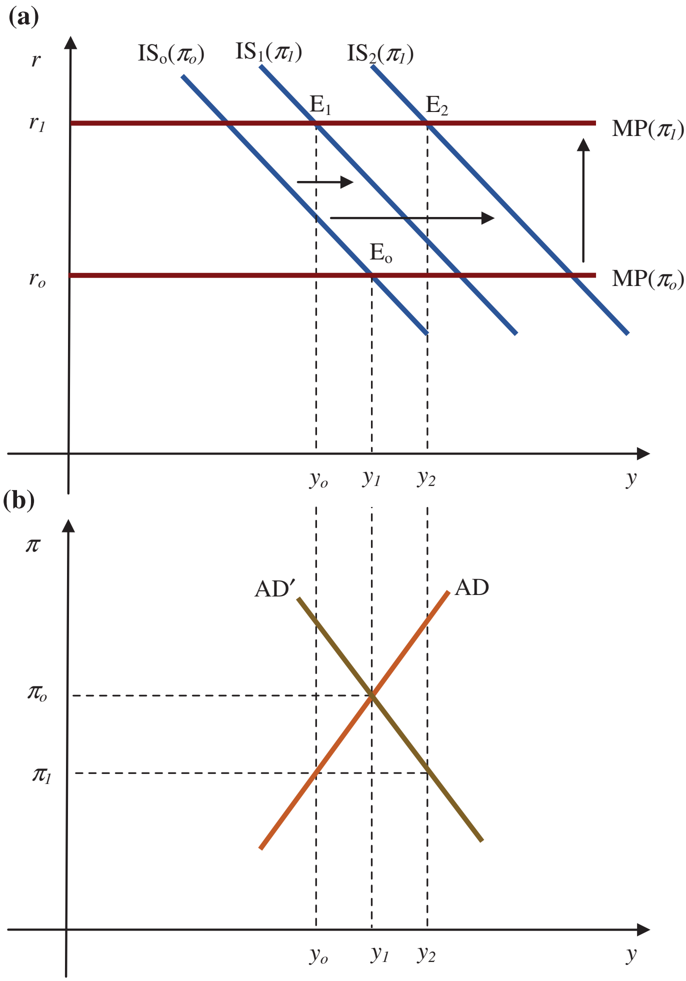

Fig. 1 Aggregate demand for a small country in a monetary union

Thus, AD in Greece appears to be upward sloping since the inception of troika memoranda in 2010.

An AD curve with a positive slope is reminiscent of the liquidity trap case, which appears when the nominal interest rate hits the ZLB and the real interest rate is constrained by $-\pi^e$. The same is true in the case

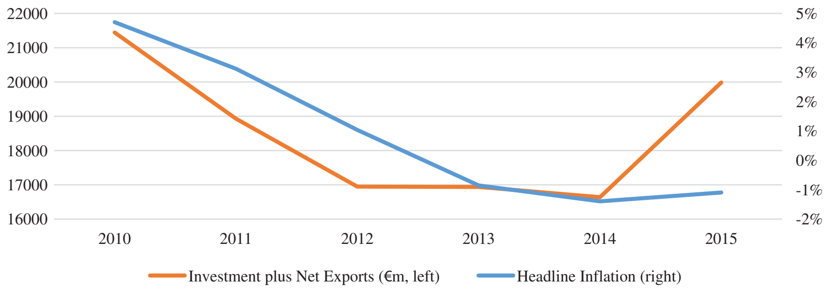

Fig. 2 Investment plus net exports, and inflation for Greece

of secular stagnation whereby the full employment (Wicksellian or neutral) real interest rate falls below its lower bound and a chronic demand deficiency arises, due to adverse trends that lead to excess savings in the loanable funds market. Thus, when there is some constraint in the conduct of monetary policy, as is also the case for a country in a monetary union, a positive relationship between inflation and total expenditure may arise. However, there is a defining difference as well, since monetary policy can be effective if activated for a country in the union, *per se*, as long as its nominal interest rate is above the ZLB. That is, an expansionary monetary policy that can reduce the nominal rate will cause an outward shift of the AD curve even if the latter has a positive slope. But in the cases of secular stagnation or a liquidity trap, monetary policy is rather impotent because the nominal interest rate has already hit its lower bound and monetary expansions cannot push it down to boost AD. In such circumstances, the best a monetary authority can hope for is to reduce the real interest rate through higher inflationary expectations.

The short-run macroeconomic equilibrium is determined by AD and aggregate supply (AS), the latter being based on the short-run Phillips curve (3). Such equilibrium is depicted at point E_o of Fig. 3 and is taken to correspond to full employment output y_p, that is, it is also a long-run equilibrium. However, this equilibrium appears to be unstable since any adverse exogenous demand shock may push the economy into a recessionary spiral. Indeed, a leftward shift of the

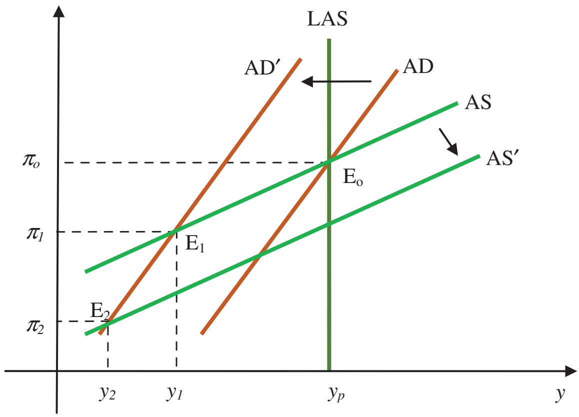

Fig. 3 A recessionary spiral

AD curve causes a short-run fall in output and inflation (point E_1 of Fig. 3) which, nonetheless, cannot initiate a process of reversion to potential output. The disinflation/deflation reduces inflationary expectations and induces a downward shift of the short-run AS curve (3), thus exacerbating the fall in production (point E_2 of Fig. 3). This drives the economy further from the initial long-run equilibrium, that is, away from the long-run AS curve LAS.

A decrease in AD and a leftward shift of the AD curve may be due to contractionary fiscal policy, of course, but hikes in the nominal interest rate *n*, *ceteris paribus*, reinforce this effect. Such interest rate hikes have been observed in the case of Greece since the outbreak of the debt crisis in 2009 and the ensuing deleverage, along with massive fiscal contraction, as can be seen in Fig. 4 which is based on OECD data. Hence, AD must have overall shifted inwards not only up to 2012 but also over 2012–2014 when the decline in the nominal interest rate was combined with excessive fiscal consolidation. That is, an important part of the persistent fall in AD seems to be associated with extensive deleverage which followed the debt crisis and has most likely given rise to a so-called debt supercycle as suggested by Lo and Rogoff (2015).

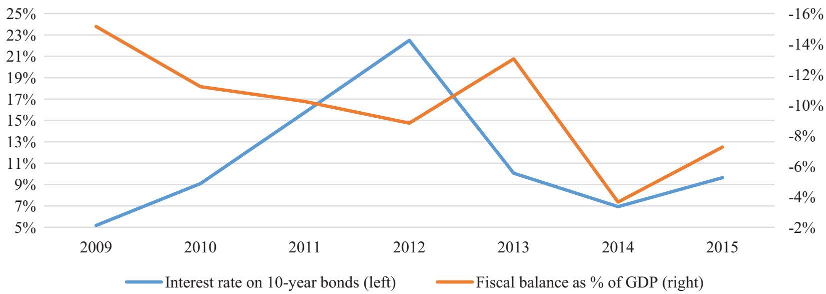

Fig. 4 Nominal interest rate on government bonds and fiscal balance for Greece

In relevant empirical work, Kirikos (2017) uncovered evidence that the potential long-run growth rate of the Greek economy has persistently switched to a lower value and this dynamic shift, along with the observed high-interest rates due to the debt crisis, seems to have indeed contributed to a debt supercycle. If that's the case, however, the debt overhang must have been associated with considerable hysteresis effects, that is, the demand deficiency must have undermined the economy's productive capacity since the potential GDP growth rate has moved downwards.

Furthermore, the observed disinflation over the same period, and indeed deflation since 2013 (see Fig. 2), must have induced diminishing inflationary expectations which are consistent with the downward shift of the short-run AS, thus contributing to the recessionary spiral described in Fig. 3. Similar downward shifts of the AS curve, associated with structural reforms designed to boost output, generate comparable adverse spiral effects whenever monetary policy is constrained and the AD curve slopes upward. This result is also derived by Egertsson et al. (2014) in a new Keynesian dynamic general equilibrium setting for the case of a binding interest rate lower bound.

2.2 The Core of a Monetary Union

Similar relationships to those in Eqs. (1) and (3) describe the IS* and short-run AS* curves, respectively, for the core of a monetary union.

However, monetary policy is now constrained only by the ZLB for the nominal interest rate n^* or by the negative value of expected inflation $-\pi^{e*}$ for the real interest rate r^*. Thus, if the nominal interest rate is set as a positive function of output and inflation, i.e., $n^* = f(y^*, \pi^*)$ with $f_{y^*} > 0$ and $f_{\pi^*} > 0$, then the MP of the core can be broadly represented as:

$$r* = \max[-\pi^e*, f(y*, \pi*) - \pi^e*] \tag{4}$$

Clearly, Eq. (4) shows that when the nominal rate is up against the ZLB, i.e., $n^* = f(y^*, \pi^*) = 0$, the expected inflation π^{e*} determines the negative lower bound of the real rate.

The case of a liquidity trap is associated with a binding ZLB for the nominal rate, and so is the case of secular stagnation. Once the nominal rate falls to the ZLB, further changes to the real interest rate can take place only if inflationary expectations vary. In particular, a decline in realized inflation, followed by a fall in inflationary expectations, increases the real rate and depresses AD. Thus, in a liquidity trap there is a positive relationship between inflation and total expenditure, that is, the AD curve is upward sloping. The same is true under secular stagnation, which occurs when adverse secular trends mainly in demographics and income distribution drive a wedge between desired savings and investment and the resulting low neutral real interest rate cannot be achieved through conventional monetary policy (Summers 2014a, b, 2016). This inability leads to a persistent slump in AD which is exacerbated by the ensuing disinflation/deflation that drives up the real rate, thus giving a positive slope to the AD curve.

However, as pointed out by Krugman (2015) and Summers (2015), there is a crucial difference between a liquidity trap and secular stagnation in that the former is a short-run expectations issue while the latter is a persistent phenomenon which affects the long-run macroeconomic equilibrium through hysteresis effects. More precisely, a liquidity trap could in principle be counteracted by raising inflationary expectations through a "credible promise (of the central bank) to be irresponsible" as put by Krugman (1998). In contrast, the chronic demand deficiency associated with secular stagnation cannot necessarily be remedied by

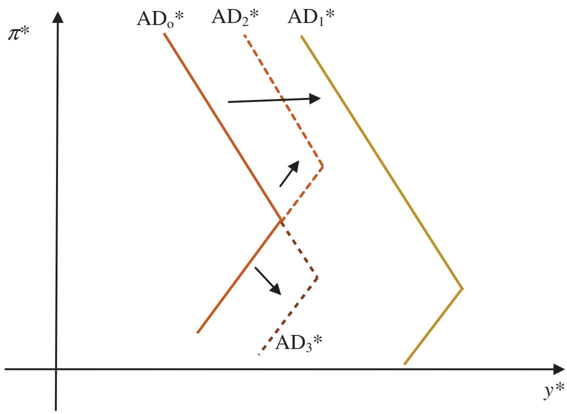

Fig. 5 Shifts in aggregate demand

inflationary policies which often turn out not to be credible. Hence, the prolonged high unemployment and the decline in investment expenditure undermine the productive capacity of the economy and exert a negative impact on potential GDP. Such adverse developments render the restoration of a previous equilibrium growth path impossible and this is the essence of the secular stagnation hypothesis, as emphasized by Summers (2015).

The effects of fiscal, monetary, and inflationary policies on AD are depicted in Fig. 5. Apparently, the upward sloping segment of the AD curve appears when the ZLB is binding and inflationary expectations depend positively on realized inflation, that is, when the economy is in a liquidity trap or is characterized by secular stagnation. The kink of the AD curve occurs at the inflation rate and output level where the nominal interest rate hits the ZLB (see Romer 2013) and, therefore, for lower inflation rates the ZLB will be binding leading to higher real interest rates which reduce investment and output.

A fiscal expansion shifts the initial AD_o^* curve right to AD_1^* and reduces the range of inflation over which the ZLB is binding, since for a higher value of y^* the zero value of the nominal rate, $n^* = f(y^*, \pi^*) = 0$, is satisfied for a lower π^*. Also, the AD_o^* curve shifts right to AD_2^* in Fig. 5 when there is monetary easing which expands the range of the liquidity trap and secular stagnation (upward segment) as the ZLB of the nominal rate can then be hit at a higher inflation rate and output. Hence, monetary easing moves the kink of the AD curve upwards unlike the case of an increase in inflationary expectations which shifts the kink downwards. Indeed, at the nominal rate ZLB, higher inflationary expectations drive the real interest rate down and output up. Then, with increased output y^* it takes a lower actual inflation rate π^* for the nominal rate ZLB to be binding, that is, the initial $AD_o{}^*$ curve shifts to $AD_3{}^*$ in Fig. 5 and the upward segment shrinks. Of course, contractionary fiscal or monetary interventions, as well as diminishing inflationary expectations, will deliver opposite shifts of the AD curve.

Although the empirical record on secular stagnation is not extensive, there are firm indications of the phenomenon that have been reported by several empirical studies. These signs provide necessary evidence which, nonetheless, shows that secular stagnation cannot be ruled out empirically. For example, Lukasz and Smith (2015) argue that a 400 basis points fall in the global neutral real rate, over the past 30 years, can be attributed to secular drivers and similar results are reported in Rawdanowicz et al. (2014) who present evidence in favor of secular stagnation and hysteresis effects in the Eurozone. Declining rates seem to characterize indeed the Eurozone and its principal economy, Germany, as can be seen in Fig. 6 which depicts the long-term real interest rate on 10-year government bonds.[4]

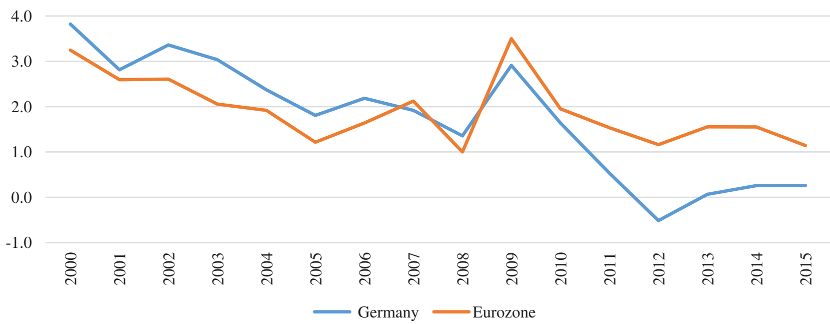

Fig. 6 Long-term real interest rate on government bonds (percent)

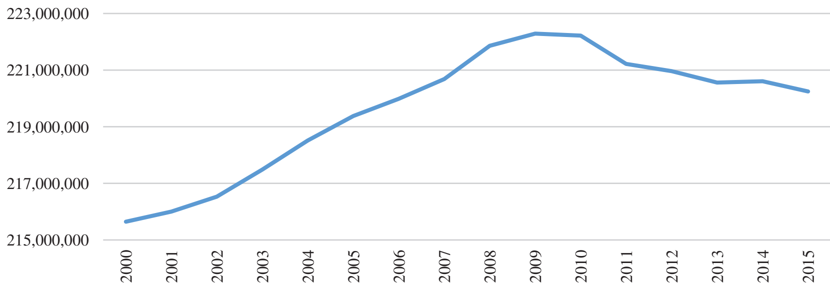

Fig. 7 Eurozone working age (15–64) population

Also, there appear to be adverse demographic developments in the Eurozone, after 2008, which may have contributed to an excess savings problem and the demand slump that followed the financial crisis. Indeed, the decline of the working age (15–64) population in the Eurozone after 2008, shown in Fig. 7, is awesomely compatible with the secular stagnation hypothesis.[5]

Besides, Kirikos (2017) has provided evidence of switching regimes for the potential GDP growth rate by estimating a Markov switching process for the long-run potential growth rate of different countries. This approach has the advantage that it lets the data say if and when a switch in the long-run growth path has occurred as well as whether such a shift is persistent. For the Eurozone, in particular, there is compelling evidence that potential growth dynamics is characterized by a change in regime that took place after 2008, in complete accordance with the adverse turn in demographics. In addition, the new low growth regime is rather persistent since the estimated probability of the high growth regime is nearly zero after 2008, as shown in Fig. 8.[6] This evidence is compatible with secular stagnation and points to hysteresis effects as well, because inflation declined throughout the period considered and, therefore, the persistent slowdown of the potential growth rate seems to be associated with the demand slump.

In the presence of secular stagnation, the short-run equilibrium is located on the upward sloping segment of the AD* curve and, most importantly, the economy cannot revert to the previous long-run

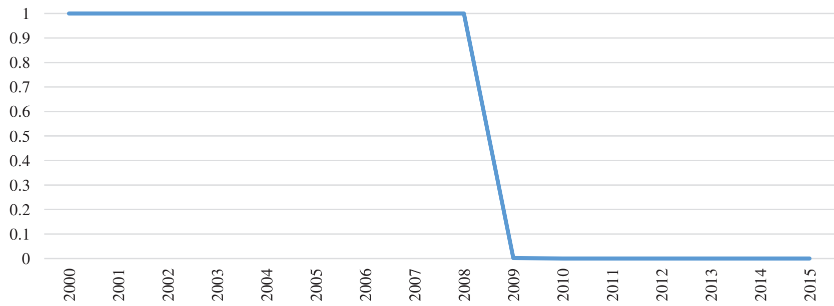

Fig. 8 Probability of a high potential growth rate for the Eurozone

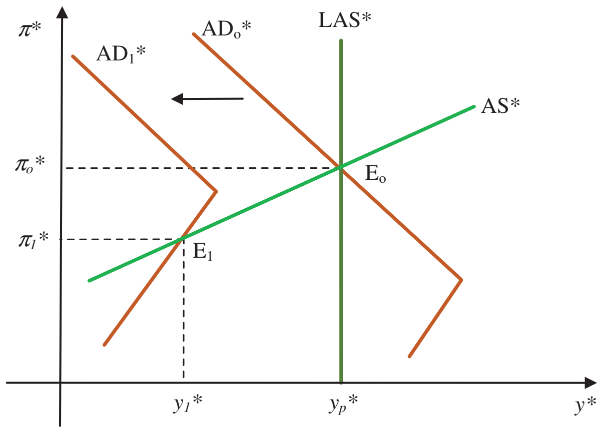

Fig. 9 Long-run equilibrium and secular stagnation

equilibrium, as suggested by Summers (2015). This is shown in Fig. 9 where an initial long-run equilibrium is at point E_o and a fall in AD shifts the AD_o* curve to AD_1* so that the new short-run equilibrium moves to point E_1. Evidently, the economy is unable to return to a new long-run equilibrium at the previous potential output y_p* through disinflation. Rather, further declines in inflation below π_1* cause the AS* curve to shift downwards, because of the adjustment in inflationary expectations, and push the economy into a recessionary spiral along the positively sloped segment of AD_1*.

3 Hysteresis

A burgeoning literature on cyclical fluctuations has recently stressed the importance of hysteresis effects after deep recessions, that is, the long-run negative impact of cyclical demand shortfalls on potential output. Such adverse effects on productive capacity are associated with declines in labor and capital productivity which follow periods of high unemployment and low investment expenditure. Accordingly, the financial crisis of 2008 and the ensuing great recession seem to have profoundly undermined the productive capacity of many advanced economies, since the loss of potential output has recently averaged at 8.4% for 23 OECD countries (Ball 2014). Especially for the Eurozone, it appears that the fiscal consolidation in the aftermath of the crisis has had a serious long-run impact, because for every 1% decline in real GDP there is more than a proportionate fall in potential output according to recent estimates (Fatás and Summers 2016). Also, Blanchard et al. (2015) reported evidence that most recessions, over the past fifty years, have been followed by lower long-run growth rates, thus pointing to hysteresis.

The gravity of possible long-run impacts of transitory demand shocks has been emphasized by DeLong and Summers (2012) who have analytically argued that, in the presence of even modest hysteresis effects, countercyclical fiscal policy at the ZLB is self-financing or, alternatively, fiscal consolidation aiming at a lower debt-output ratio is self-defeating when the lower bound of the nominal interest rate is binding. The essence of this argument is that, under hysteresis, mitigation of cyclical fluctuations has long-run benefits in terms of lower or null potential output losses, while only countercyclical fiscal policy can be effective at the ZLB.

Integration of hysteresis effects into our graphical exposition implies that the long-run aggregate supply (LAS) curve should shift leftwards following a persistent demand shock.[7] Therefore, even when normal conditions are restored, total production is unable to revert to its previous long-run growth path and a lower growth rate becomes the new standard, for the economy is now revolving around a lower potential output. This is shown in Fig. 10 for the case of an economy whose monetary policy is constrained, because of its membership in a

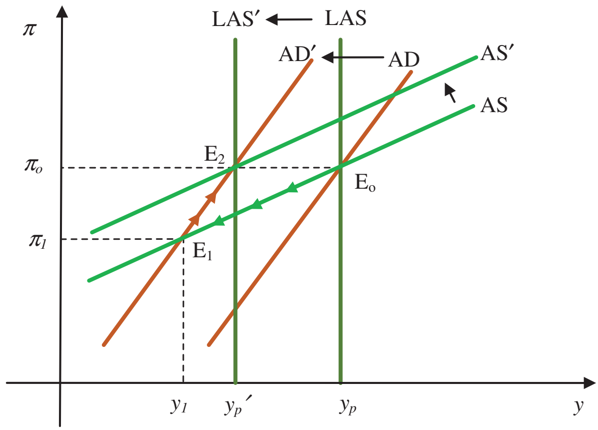

Fig. 10 Hysteresis for a country in a monetary union

monetary union, and has an upward sloping AD curve. Then, an initial long-run equilibrium at point E_o, which is disturbed by a demand shock that shifts AD to AD′, is followed by a new long-run equilibrium at point E_2, with potential output $y_p{}'$, when hysteresis effects shift the AS and LAS curves to AS′ and LAS′, respectively. However, before reaching the new long-run equilibrium the economy follows a bigger cycle through point E_1 in Fig. 10.

A similar analysis applies to the case of the core of a monetary union when the nominal interest rate is up against the ZLB and a prolonged demand deficiency gives rise to hysteresis effects. This is depicted in Fig. 11 where the initial long-run equilibrium is at point E_o and adverse secular trends shift the $AD_o{}^*$ curve to $AD_1{}^*$ and drive the short-run equilibrium to point E_1. If hysteresis effects set in, the $AS_o{}^*$ and $LAS_o{}^*$ curves shift to $AS_1{}^*$ and $LAS_1{}^*$, respectively, and a new long-run equilibrium is reached at point E_2 with a lower level of potential output $y_p{}^{*\prime}$.

In both cases depicted in Figs. 10 and 11, the long-run equilibrium, resulting after hysteresis sets in, is rather 'unstable' in the sense that any adverse demand shock or a fall in inflationary expectations, which shifts the AS curve downwards and the positively sloped segment of the AD curve leftwards, may push the economy again into a recessionary spiral as the one described earlier in Fig. 3. Thus, dealing with the source of

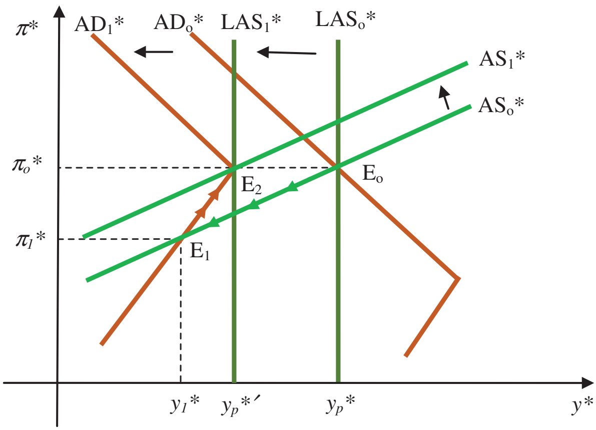

Fig. 11 Hysteresis for the core of a monetary union

hysteresis, i.e., the persistent shortfall in AD, early on, may be the best strategy both in terms of avoiding a supercycle and in terms of preserving the long-run growth path of the economy.

4 Policy Implications

Let us now turn to an evaluation of policies pursued since the outbreak of the great recession as well as to policy recommendations, using the methodological tools developed above. In particular, we focus on policies followed by Greece and the Eurozone in an environment of constrained monetary policy for the former and of secular stagnation for the latter. As we saw in the second section, these settings reproduce fundamental characteristics of the economies in question and imply that soon after the downturn of 2008, macroeconomic equilibrium was attained at the upward sloping section of the respective AD curves.

The deleverage that followed the financial crisis of 2008 turned into a debt crisis when Greece was confronted with nominal interest rate hikes on government bonds which exerted a negative impact on AD. At the same time, fiscal consolidation policies imposed on the country by troika memoranda since 2010 (see Fig. 12),[8] along with the ensuing

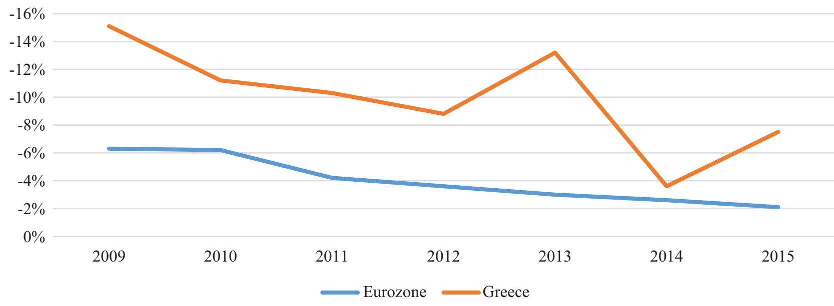

Fig. 12 Fiscal balance as percent of GDP

disinflation/deflation and the weak export performance, exacerbated the leftward shift of a positively sloped AD curve and pushed the economy into a recessionary spiral, as shown previously in Fig. 3. A slowdown to this spiral occurs only when hysteresis effects reduce AS and a new lower employment long-run equilibrium is established, as shown in Fig. 10. Thus, the persistent fall in Greek output since 2009 seems to be compatible with the debt supercycle approach (Lo and Rogoff 2015), whereby a persistent slump in demand is brought about by a debt crisis that follows a financial turmoil (like a bubble burst).

On the other hand, as seen earlier in Sect. 2, the Eurozone seems to be plagued by unfavorable secular trends that increased desired savings over investment and caused a decline in demand which, nevertheless, was worsened by fiscal policies over the period 2009–2015 (see Fig. 12). Having hit the ZLB, the Eurozone also lies in the upward sloping segment of the AD curve (see Fig. 9) and hysteresis effects may eventually lead to a new long-run equilibrium with a lower potential output (see Fig. 11).

Evidently, the ongoing policies have trapped both the Greek economy and the core of the Eurozone to a lower long-run growth path. Even the monetary expansion through the quantitative easing (QE) program of the European Central Bank (ECB), initiated in March 2015, seems to be ill-targeted as it excludes Greece on the grounds of low credit ratings, while alone is unable to drag the core of the monetary union out of secular stagnation. As argued in Sect. 2, the positively sloped AD curve in the case of Greece is due to monetary constraints

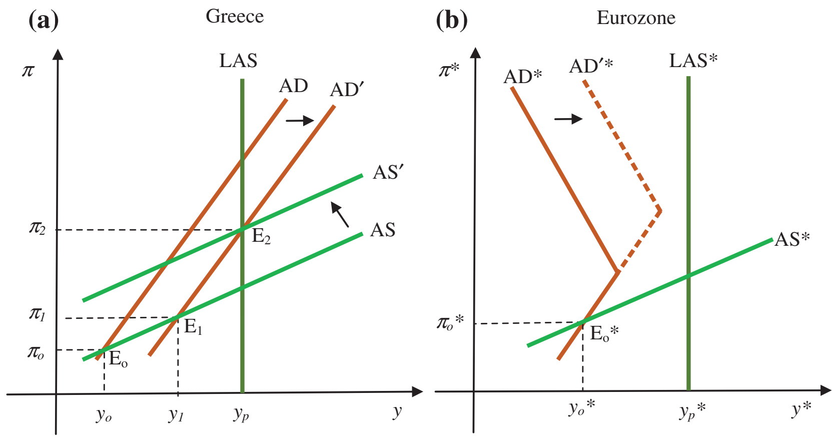

Fig. 13 Effects of expansionary monetary policy

and not due to a binding ZLB. Thus, monetary expansion can shift the upward sloping AD curve right (see Fig. 13a), whereas it cannot do the same for the positively sloped segment of the AD* curve of the core union, which corresponds to a binding ZLB (see Fig. 13b).

As can be seen in Fig. 13a, expansionary monetary policy may be effective, even with a positively sloped AD, as long as the ZLB is not binding. Hence, starting with a short-run equilibrium at point E_o, a monetary expansion shifts the AD curve to AD′ and the short-run equilibrium moves to point E_1 while the increase in inflation raises inflationary expectations which then cause the AS curve to shift upwards to AS′. Thus, the economy would eventually revert to potential output at point E_2. If, however, the core of the union has hit the ZLB, then expansionary monetary policy shifts the AD* curve to AD′* and the short-run equilibrium remains at point E_o* of Fig. 13b, rendering monetary policy impotent. Only if the monetary expansion raises inflationary expectations, will there be some effect of monetary policy by shifting right the positively sloped segment of the AD* curve as well (to AD′*), as shown in Fig. 14. But, even though monetary policy gets traction under changed inflationary expectations, it may not be capable of pushing the economy out of secular stagnation (observe that the equilibrium at point E_1 of Fig. 14 is on the segment AD′* with positive

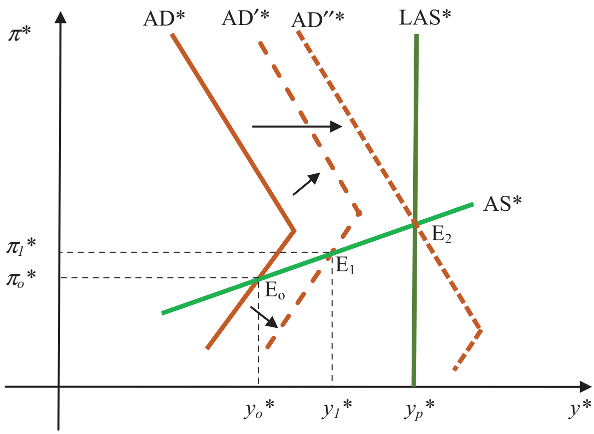

Fig. 14 Expansionary fiscal and monetary policies and increased inflationary expectations

slope), particularly when inflationary policies are not credible and their influence on expectations is limited.

The above analysis reveals why the current Public Sector Asset Purchase Program (PSPP) or QE program of the ECB is ill-targeted. It excludes Greek sovereign bonds and targets core Eurozone assets, whereas, as suggested by our analysis, it should primarily focus on Greek assets and only secondarily on core union bonds to counteract effectively the consequences of persistent demand deficiencies. Also, rather than relying on monetary policies of null or limited effectiveness when the economy operates at the ZLB, the Eurozone core would be better off by combining QE with fiscal expansion to attain the required *escape velocity* (as put by Krugman 2015) that would lift the economy out of secular stagnation. This case of fiscal expansion is presented in Fig. 14 by a shift like that of the AD* curve to AD″* which moves the economy back to a long-run equilibrium at point E_2.

A stronger recovery of the Eurozone through fiscal expansion that combats unfavorable secular trends would also help Greece's recovery in several ways. First, an increase in Eurozone's output (y^*) and inflation (π^*), as the core union escapes stagnation, would help boost periphery's exports without Greece having to increase competitiveness exclusively through disinflation/deflation which, along with high nominal rates and a massive fiscal consolidation, drags the economy into recessionary spirals (see Sect. 2). Second, improved export performance relative to declines in investment expenditure, after a fall in inflation, can turn the AD function into a negatively sloped curve (again see Sect. 2). By restoring normal conditions, the latter allows disinflation/deflation to turn into a stabilizing mechanism that helps move the economy back to its long-run path and, thus, counteracts hysteresis effects. Third, debt relief would not be necessary for the short-run, as long as a monetary policy could keep nominal rates low, even though it could have positive medium-and long-term supply-side effects. But even under the current exclusion of Greece from the ongoing ECB's monetary expansion, a smaller debt write-off would be enough to bring nominal rates down and push the economy out of the debt supercycle.

In summary, the ongoing fiscal consolidation and monetary expansion in the Eurozone seem to be improper responses to strong signs of secular stagnation. Likewise, while fiscal consolidation is indispensable for Greece due to a soaring debt, the exclusion of the country from a drastic monetary expansion and/or the creditors' denial of a debt relief have pushed the economy into a recessionary spiral. An appropriate policy mix that addresses Eurozone's secular stagnation and Greece's debt supercycle seems to be a reversal of main actions, that is, the pursuit of fiscal expansion in the Eurozone and the adoption of monetary expansion in Greece.

5 Concluding Remarks

In the context of a simple new Keynesian model, we have explored the policy implications of AD shortages arising from a debt overhang or secular stagnation. Such phenomena seem to plague the Greek economy and the Eurozone, respectively, since the beginning of the great recession in 2008, and policy actions have dealt with them rather ineffectively as revealed by the anemic recovery after eight years.

A debt overhang for a country that cannot pursue independent monetary policy, due to membership in a monetary union, is very likely to drive the economy into a falling output spiral as the demand slump leads to disinflation/deflation and raises the real interest rate. If the latter is not offset by a fall in the nominal interest rate, the economy ends up with the lower aggregate demand to the extent that increased exports fall short of the decline in investment expenditure as seems to be the case with Greece. Obviously, for a debt-ridden economy that does not control liquidity, a fall in the nominal rate is impossible and a persistent decline in demand is inevitable. Thus, under such circumstances, only exogenously driven expansionary monetary policy or debt relief can reduce the nominal interest rate and offset the fall in demand. Of course, an increase in net exports would be a positive influence too, as far as it does not rely on deflationary policies that exert a negative impact on investment and generate a vicious recessionary circle.

A chronic AD deficiency can also arise if adverse secular trends increase the propensity to save and decrease the propensity to invest, thus driving the full employment (or neutral) real interest rate below that corresponding to the nominal rate ZLB, so that conventional monetary policy cannot attain it. This is the case of secular stagnation which seems to characterize the core of the Eurozone, as shown by convincing indications concerning developments in demographics, inflation, long-run interest rates, and potential GDP growth. Besides, the persistent cyclical demand shortfall may have supply-side effects, through hysteresis, which prevent reversion of the economy to its previous long-run growth path. Under such long-run dynamics, anti-cyclical monetary policy becomes largely ineffective and expansionary fiscal actions gain prominence in dealing with the chronic demand slump and its possible adverse effects on productive capacity.

Our analysis suggests that policies pursued in the aftermath of the financial crisis in Greece and the Eurozone should be reversed. More precisely, instead of the ongoing exclusion of Greece from ECB's QE, a monetary expansion, while the economy is off the ZLB, is expected to be a demand-enhancing intervention that offsets the effects of the inevitable fiscal consolidation due to a soaring debt. Also, instead of the current fiscal consolidation and loose monetary policy in the Eurozone core, a fiscal expansion is rather needed to mitigate secular stagnation effects and, at the same time, help Greece increase its competitiveness without resorting to recessionary policies. Of course, the need for more concrete (sufficient) empirical evidence on debt supercycles and secular stagnation remains. However, it is our conjecture that additional pertinent research outcomes will only strengthen the policy proposals advanced herein.

Notes

1. A similar IS-MP-AS framework is adopted by Egertsson et al. (2016a) in analyzing how secular stagnation is internationally transmitted.
2. Given that the nominal exchange rate is fixed, due to the monetary union, changes in competitiveness arise solely from changes in the inflation differential $\pi^{*}-\pi$. Hence, the real exchange rate is defined here as the relative price of foreign to domestic goods.
3. Data for Fig. 2 are drawn from the OECD database. stats.oecd.org.
4. Data depicted in Fig. 6 are drawn from the OECD database.
5. Data for Fig. 7 are drawn from the Eurostat database. ec.europa.eu/eurostat/data/database.
6. Estimates of the probabilities in Fig. 8 are taken from Kirikos (2017) and correspond to the smoothed non-linear inferences about the regime at any given period based on the information from the full sample (1991–2017) of potential GDP values.
7. It should be pointed out that in a dynamic setting hysteresis effects are associated with a decline in the growth rate of potential output rather than a fall in its level.
8. Data shown in Fig. 12 are drawn from the Eurostat database.

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The Effects of the Financial Crisis on the Creditworthiness of Banks

Anestis C. Ladas, Christos I. Negкakis and Angeliki D. Samara

1 Introduction

The financial crisis that started in 2010 in Europe led to a number of adverse outcomes for the affected countries' economies. Since the crisis began as a credit crisis, the financial system's cash drainage put the banks of some Eurozone countries (i.e. Greece, Portugal, Spain and Italy) in a very difficult position. A number of the macroeconomic measures taken were targeted at providing support to the financial system since a collapse would fuel a dramatic downward spiral for these countries' economies. As Blankespoor et al. (2013) argued accounting fundamentals may provide information on the prediction of financial distress, thus helping investors avoid pitfalls.

Previous studies have provided evidence on the presence of a number of accounting fundamentals that affect credit ratings. Among those are return

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on equity, leverage, size and operating cash flows which have been found to provide information on future credit risk (i.e. Edwards 2011; White 2014). However, apart from those fundamentals another accounting fundamental that is specifically related to the financial crisis and is likely important for banks are deferred tax assets. Specifically, one key aspect of the financial crisis was the big losses suffered by the affected banks and, as a result of these losses, the recording of significant deferred tax assets, especially for the banks domiciled in the affected countries. However, this kind of asset is not useful in the likely event of a bank's poor financial performance (Gallemore 2012).

Given the debate on the usefulness of banks' deferred tax assets, especially during periods of poor financial performance, a relevant research question emerges: How useful are deferred tax assets in increasing banks' creditworthiness? In contrast with other asset increases, which may signify a better capital structure and in turn higher creditworthiness, deferred tax assets are not considered useful because they do not protect banks in the case of insolvency (Gallemore 2012). In a relevant US study, Edwards (2011) showed that increases in valuation allowance lead to decreases in firms' creditworthiness. According to the author, this is because of increases in the valuation allowance, which shows the portion of deferred tax assets that the firm does not expect to realise, in turn, signal more persistent future losses and, thus, lower creditworthiness. Therefore, deferred tax assets provide useful information about firms' creditworthiness, as they reveal information about changes in the cost of equity.

The scope of the chapter is to examine the relationship between changes in creditworthiness and accounting fundamentals with special interest on deferred tax assets for a sample of banks domiciled in the Eurozone. In this respect, the research setting aims to examine if any portion of the decrease in banks' creditworthiness during the financial crisis is related to increases in deferred tax assets. The study is motivated by previous studies and media reports, which have sparked a debate on the usefulness of deferred tax assets, especially for banks (Gallemore 2012).

The study results reveal that while the ratio of deferred tax assets to total assets is not significant in explaining future credit risk, a dummy variable that ranks firms based on the level of the change in deferred tax assets in relation to the total assets is significant and has a positive coefficient for future credit risk (or a negative coefficient for creditworthiness). However, banks domiciled in crisis-affected countries that have a high increase in deferred tax assets have a lower future credit risk. This result may imply that investors see this as a signal of future profitability, since in order to record the deferred tax assets, a firm should expect future profitability in order to offset these assets. Moreover, additional analysis shows some indications of increased future credit risk for banks domiciled in crisis-affected countries, especially for highly leveraged banks with high increases in deferred tax assets. Therefore, in this case, the contemporaneous presence of an increase in deferred tax assets and high leverage likely indicates that the high deferred tax assets may not provide any protection in the case of default.

The rest of the chapter is organised as follows: Sect. 2 provides the literature review and the development of the research hypothesis; Sect. 3 provides the methodological framework; Sect. 4 reports the sample description and the empirical results analysis; and Sect. 5 offers the study conclusion.

2 Literature Review

The recent financial crisis brought risk to the epicentre, especially for banks. The crisis began as a debt crisis with rapidly escalated sovereign spreads (De Santis 2012). This was followed by several countries' credit down-ratings, which in turn led to credit problems in the economy, and in particular, the banking systems of the countries that were most heavily influenced by the crisis. These circumstances made the crisis-affected banking systems more volatile, so much so that their respective governments had to take measures to support the banks. Moreover, another question emerged: Which accounting measures could be used to predict credit risk? Blankespoor et al. (2013) argued that accounting fundamentals may provide information for predicting financial distress, thus helping investors avoid pitfalls.

Following the financial crisis, many researchers studied credit rating determinants. This may be because of the important role credit ratings play in valuation and contracting (Edwards 2011). Among these determinants, according to Collin-Dufresne et al. (2001), are changes in leverage and return on equity, which should be positively and negatively related, respectively, to credit spreads. Recent studies also highlight that book-tax differences seem to be related to credit risk, as large book-tax difference signal negative firm qualities (Edwards 2011). Crabtree and Maher (2009) found that firms at both extremes regarding their tax planning (either low or high management of taxable income in relation to book income) had lower credit ratings. Ayers et al. (2010) provided additional support for the negative relationship between credit rating changes and book-tax differences, revealing that such findings are related to lower earnings quality. On the one hand, the likely relationship between deferred tax assets and risk may also be related to earnings management, as proposed by Skinner (2008) and others, who found that banks may use discretionary deferred tax assets to present a better financial picture. On the other hand, Wilson (2009, 2010), in his discussions on Crabtree and Mahers's (2009) and Ayers et al.'s (2010) research, called for additional research on the matter.

In many instances, the large losses suffered by the banks led them to record deferred tax assets in their financial statements. As a result, deferred tax assets constituted a significant portion of their balance sheets. Deferred tax assets stem from either deductible temporary differences, carryforward of unused losses or carryforward of unused tax credits (IAS 12, par. 5). Moreover, any benefits related to deferred tax assets may be realised only if the bank has future taxable profits to offset these assets.

As explained above, the distinctive nature of deferred tax assets may make them less useful than other assets in acting as a buffer against the negative effects of financial turmoil. Therefore, it is not surprising that such an asset may be related to risk, as Henry (2014) found. Amir and Sougiannis (1999) argued that even though investors positively value deferred tax assets stemming from loss carryforwards, as they represent future tax reductions, these assets may also signal deteriorating financial conditions. This happens because recording deferred tax assets is triggered by the presence of losses, which in turn may signal a higher likelihood of future losses.

White (2014) attempted to respond to Wilson's (2009, 2010) call for additional research on the relationship between book-tax differences and credit risk by examining whether deferred tax assets are related to credit risk changes. His results indicate a negative relationship, likely because analysts do not see deferred tax assets as assets. Gallemore (2012) offered additional support by showing that banks that recorded deferred tax assets during the financial crisis had a higher likelihood of financial distress. He argues that deferred tax assets are not useful, as they provide no protection in the unfavourable event of default. In such a case, banks are not able to realise these deferred tax assets unless they have future profits to offset them. The discussion inspired this study's first research hypothesis, which aims to examine the effects of recording deferred tax assets on credit ratings especially for banks. Specifically, following White (2014), we hypothesise that increases in deferred tax assets may partly explain future credit risk faced by financial institutions. Therefore, the first research hypothesis is as follows:

H$_1$ Increases in deferred tax assets are positively related to future credit risk.

We specifically aim at examining future credit risk due to the fact that credit analysts may need time in order to incorporate changes in accounting fundamentals into their predictions and thus current credit risk may not include this type of information in a timely manner (White 2014).

The next research hypothesis is related to banks' leverage level and the contemporaneous presence of deferred tax assets. We hypothesise that any negative influence of deferred tax assets on banks' creditworthiness will be enhanced if the bank is highly leveraged. In other words, highly leveraged banks that have recorded large amounts of deferred tax assets have a higher likelihood of future credit risk compared to less-leveraged banks; this effect is due to the combined effects of leverage and deferred tax asset recording. This is expected, as recorded deferred tax assets do not provide any protection in the case of insolvency. Therefore, for banks with a significant change of deferred tax assets, credit risk may increase faster when combined with likely capital problems. Therefore, our second research hypothesis is as follows:

H_2 In the case of highly leveraged banks, a large change of deferred tax assets leads to higher future credit risk.

3 Research Methodology

The study's research methodology aims to uncover the financial crisis's effects on credit risk, with respect to certain attributes. We focus on the variables that were found to be related to credit risk in previous studies (i.e. Kaplan and Urwitz 1979; Edwards 2011; White 2014). Specifically, following Edwards (2011; see also White 2014), our base model relates future credit ratings with current credit ratings, the number of consecutive periods with losses, leverage, profitability (using the return on assets ratio), size, the book-to-market ratio, the interest coverage ratio and the ratio of deferred tax assets to total assets. In algebraic terms, the following ordered logistic regression is estimated using period-fixed effects:

$$\begin{aligned} CR\_Rate_{i,t+1} = f(&\alpha_0 + \alpha_1 CR\_Rate_{i,t} + \alpha_2 Loss_{i,t} + \alpha_3 SIZE_{i,t} \\ &+ \alpha_4 ROA_{i,t} + \alpha_5 LEV_{i,t} + \alpha_6 BtM_{i,t} + \alpha_7 CFO_{i,t} \\ &+ \alpha_8 INTER\_COVER_{i,t} \\ &+ \alpha_9 CGIIPS_{i,t} + \alpha_{10} DTAtoTA_{i,t} + \varepsilon_{i,t+1}) \end{aligned} \qquad (1)$$

where *CR_Rate* is the assessment of the risk class assigned by Bloomberg for bank *i* at the end of year *t*; *Loss* is an indicator variable that takes the value of 1 if bank *i* experiences a loss in year *t* and 0 otherwise; *SIZE* is a proxy for size, calculated as the natural logarithm of total assets of bank *i* at year *t*; *ROA* is a proxy for profitability, calculated as the ratio of net income to opening total assets of bank *i* at year *t*; *LEV* is a proxy for leverage, calculated as the ratio of long-term debt to total assets of bank *i* at year *t*; *BtM* is the ratio of book value of equity to market capitalisation of bank *i* at year *t*; *CFO* is the ratio of operating cash flows to opening total assets of bank *i* at year *t*; *INTER_COVER* is the interest coverage ratio (in a logarithmic form), calculated as earnings before interest and tax to total interest expenses of bank *i* at year *t*; *CGIIPS* is a dummy variable that takes the value of 1 for crisis-affected countries (Cyprus, Greece, Italy, Ireland, Portugal and Spain) and 0 otherwise; and *DTAtoTA* is the ratio (in a percentage form) of deferred tax assets to total assets of bank *i* at year *t*. *CR_Rate* is provided by Bloomberg in a 22-scale format, and we assigned the higher values of the variable to the higher ratings. In turn, higher values of this variable signify lower credit risk.

Moreover, in our robustness checks, we also used Bloomberg's five-year credit default swap spread (denoted as *CDS*_Spread), which shows the likelihood of default, as implied by Bloomberg's Default Risk model. However, in this case, the credit risk is directly related to the dependent variable. Put differently, the higher the *CDS*_Spread, the higher the credit risk, and the lower the bank's creditworthiness. The regressions using *CDS*_Spreads are estimated using ordinary least squares with robust standard errors and period effects.

The second model examines the effects of the financial crisis, the recording of deferred tax assets and their combined effects on banks' creditworthiness. For the task at hand, we used a difference in differences research methodology (see Ashenfelter and Card 1985), where the first difference concerns cases where a country has been influenced by the financial crisis and the second concerns cases where a bank belongs to the higher 50% of the banks grouped by the ratio of the change in the deferred tax assets to total assets. Therefore, the model is as follows:

$$\begin{aligned} CR\_Rate_{i,t+1} = f(&\beta_0 + \beta_1 CR\_Rate_{i,t} + \beta_2 Loss_{i,t} + \beta_3 SIZE_{i,t} \\ &+ \beta_4 ROA_{i,t} + \beta_5 LEV_{i,t} + \beta_6 BtM_{i,t} + \beta_7 CFO_{i,t} \\ &+ \beta_8 INTER\_COVER_{i,t} \\ &+ \beta_9 CGIIPS_{i,t} + \beta_{10} DTA\_Dummy_{i,t} \\ &+ \beta_{11} CGIIPS_{i,t} \times DTA\_Dummy_{i,t} + \omega_{i,t+1}) \end{aligned} \tag{2}$$

where *DTA_Dummy* is a dummy variable that takes the value of 1 if a bank belongs to the higher 50% of banks in a given year, ranked by the ratio of the change in deferred tax assets to total assets ratio, and 0 otherwise, and the rest of the variables are estimated as described above.

The third model is similar to Eq. (2). However, in this case, the model replaces the *LEV* variable with a third dummy variable for leverage level. The rationale is that banks with high leverage are less capitalised and thus, the existence of high deferred tax assets may have more pronounced positive effects for future credit risk. The model is as follows:

$$\begin{aligned} CR\_Rate_{i,t+1} = f(&\gamma_0 + \gamma_1 CR\_Rate_{i,t} + \gamma_2 Loss_{i,t} + \gamma_3 SIZE_{i,t} \\ &+ \gamma_4 ROA_{i,t} + \gamma_5 BtM_{i,t} + \gamma_6 CFO_{i,t} \\ &+ \gamma_7 INTER\_COVER_{i,t} \\ &+ \gamma_8 CGIIPS_{i,t} + \gamma_9 LEV\_Dummy_{i,t} + \gamma_{10} DTA\_Dummy_{i,t} \\ &+ \gamma_{11} CGIIPS_{i,t} \times LEV\_Dummy_{i,t} \\ &+ \gamma_{12} CGIIPS_{i,t} \times DTA\_Dummy_{i,t} \\ &+ \gamma_{13} LEV\_Dummy_{i,t} \times DTA\_Dummy_{i,t} \\ &+ \gamma_{14} CGIIPS_{i,t} \times LEV\_Dummy_{i,t} \times DTA\_Dummy_{i,t} + \upsilon_{i,t+1}) \end{aligned} \tag{3}$$

where *LEV_Dummy* is a dummy variable that takes the value of 1 if a bank belongs to the higher 50% of banks ranked by the leverage ratio and 0 otherwise.

The last model is based on White (2014) and in this case the variables are used in changes in order to examine how changes in the credit risk attributes affect future credit ratings. The model is as follows:

$$\begin{aligned} \Delta CR\_Rate_{i,t+1} = f(&\delta_0 + \delta_1 Loss_{i,t} + \delta_2 \Delta SIZE_{i,t} \\ &+ \delta_3 \Delta ROA_{i,t} + \delta_4 \Delta LEV_{i,t} + \delta_5 \Delta BtM_{i,t} \\ &+ \delta_6 \Delta CFO_{i,t} + \delta_7 \Delta INTER\_COVER_{i,t} \\ &+ \delta_8 CGIIPS_{i,t} + \delta_9 \Delta DTAtoTA_{i,t} \\ &+ \delta_{10} CGIIPS_{i,t} \times \Delta DTAtoTA_{i,t} + \psi_{i,t+1}) \end{aligned} \tag{4}$$

where all variables are estimated as changes of the respective variables reported above. A similar regression is also estimated using ordinary least squares with robust standard errors and period effects for future *CDS*_Spread.

4 The Sample and Empirical Results

4.1 The Sample

The primary data sources were Compustat Global, which provided the accounting data, except for the deferred tax assets data, which was unavailable; and Bloomberg, which provided the credit rating, CDS spreads, stock prices and deferred tax assets data. The sample comprised banks domiciled in Eurozone countries, and the data spanned from 2005 to 2015. Moreover, we deleted two types of observations from our sample. First, observations corresponding to banks with a negative book value of equity in a certain year were deleted from the sample. Second, observations corresponding to the upper and lower 1% of the distribution of each variable were deleted to avoid outlier effects in our results.

The number of observations and banks in the final sample are reported in Tables 3–8. The values range from 366 to 400 observations and 68 to 73 banks, depending on the estimation model. The Appendix provides definitions for the study's main variables. Table 1 provides descriptive statistics for the sample and indicates that the deletion of the extreme observations was likely successful. Table 2 presents the correlation coefficients, along with their statistical significance. The results indicate that both the deferred tax asset variables (*DTAtoTA* and *DTA_Dummy*) have the expected correlation coefficients with the lead credit risk measures (negative for *CR_Rate* and positive for *CDS*_Spread). These results provide some first indications on the likely negative relation between deferred tax assets and creditworthiness.

Table 1 Descriptive statistics

	Mean	Median	Q1	Q3	Std. Dev.
CR_Rate_Lead	13.36	13.00	12.00	15.00	2.10
*CDS*_Spread_Lead	0.23	0.14	0.07	0.21	0.25
CR_Rate	13.56	14.00	13.00	15.00	1.99
*CDS*_Spread	0.21	0.13	0.04	0.19	0.23
LOSS	0.17	0.00	0.00	0.00	0.37
SIZE	11.12	10.99	9.04	11.88	1.72
ROA	0.00	0.00	0.00	0.01	0.01
LEV	0.17	0.15	0.07	0.30	0.12
BTM	4.21	1.48	0.76	3.95	7.04
CFO	0.01	0.01	−0.02	0.03	0.04
INTER_COVER	0.82	0.86	0.77	0.98	0.27
DTAtoTA	0.80	0.49	0.25	1.00	0.84
CGIIPS	0.56	1.00	0.00	1.00	0.50
DTA_Dummy	0.51	1.00	0.00	1.00	0.50

Notes The sample includes all banks domiciled in Eurozone countries for the period 2005–2015. Variables' definitions are provided in the Appendix

Table 2 Correllation matrix

	CR_Rate_Lead	*CDS_Spread_Lead*	*CR_Rate*	*CDS_Spread*	*LOSS*	*SIZE*	*ROA*	*LEV*	*BTM*	*CFO*	*INTER_COVER*	*DTAtoTA*	*CGIIPS*	*DTA_Dummy*
CR_Rate_Lead	1.00													
CDS_Spread_Lead	−**0.56**	1.00												
CR_Rate	**0.71**	**−0.38**	1.00											
CDS_Spread	**−0.42**	**0.70**	**−0.60**	1.00										
LOSS	**−0.34**	**0.26**	**−0.47**	**0.36**	1.00									
SIZE	−0.09	−0.02	−0.10	−0.04	−0.05	1.00								
ROA	**0.46**	**−0.24**	**0.64**	**−0.44**	**−0.65**	**−0.21**	1.00							
LEV	−0.03	0.10	0.00	0.03	0.05	**0.16**	−0.17	1.00						
BTM	**−0.32**	**0.23**	**−0.45**	**0.41**	**0.10**	**−0.25**	**−0.16**	**−0.19**	1.00					
CFO	0.10	0.03	**0.16**	−0.07	**−0.15**	0.03	**0.21**	**0.14**	0.02	1.00				
INTER_COVER	**0.46**	**−0.20**	**0.58**	**−0.34**	**−0.61**	**−0.24**	**0.78**	**−0.21**	−0.08	**0.19**	1.00			
DTAtoTA	**−0.22**	**0.38**	**−0.32**	**0.47**	**0.32**	**0.11**	**−0.38**	**0.27**	0.01	−0.12	−0.25	1.00		
CGIIPS	−0.10	**0.43**	−0.01	**0.28**	**0.22**	0.03	**−0.20**	**0.50**	**−0.26**	0.05	**−0.20**	**0.55**	1.00	
DTA_Dummy	**−0.14**	**0.22**	−0.09	**0.16**	**0.18**	0.01	**−0.14**	**0.28**	−0.03	**0.11**	**−0.11**	**0.36**	**0.32**	1.00

Notes The sample includes all banks domiciled in Eurozone countries for the period 2005–2015. Variables' definitions are provided in the Appendix. Correlation coefficients in bold show significance at least at the 5% level of significance

4.2 Empirical Results

The first set of results concerns the base regression, Eq. (1), which regresses the lead credit rating variable on a set of credit risk determinants. The results are provided in Table 3. The coefficient of current credit rating is positive and significant, which indicates that higher current credit ratings are related to higher future credit ratings; this result agrees with the previous literature (i.e. Edwards 2011). The *SIZE* and *BtM* ratios were both significant (at least at the 10% level of statistical significance) and negative, whereas *CGIIPS* is marginally insignificant (and negative). Therefore, based on these results, the level of deferred tax assets does not seem to affect banks' credit ratings.

To further investigate this issue, we move to the estimation of Eq. (2). The *DTA_Dummy* used in this model ranks firms according to the ratio of the change in deferred tax assets to total assets; the results are reported in Panels A and B of Table 4. Panel A shows that *SIZE* becomes insignificant, while *BtM* remains negative and significant. Moreover, *CGIIPS* becomes significant and is negative, which indicates that banks domiciled in crisis-affected countries had lower credit ratings.

Table 3 Determinants of future credit ratings

	Coef.	*z*-stat	*p*-value
CR_Rate	1.04***	9.21	0.00
LOSS	0.27	0.53	0.59
SIZE	−0.12*	−1.91	0.06
ROA	32.87	1.13	0.26
LEV	−0.61	−0.57	0.57
BtM	−0.04**	−2.25	0.02
CFO	0.82	0.29	0.77
INTER_COVER	0.70	1.10	0.27
CGIIPS	−0.49	−1.61	0.11
DTAtoTA	0.12	0.54	0.59
Pseudo R^2	0.23		
Obs		400	
Period effects		Included	

Notes The sample includes all banks domiciled in Eurozone countries and covers the period 2005–2015. *, ** and *** indicates significance at the 10%, 5% and 1% level of significance. Variables' definitions are provided in the Appendix

Table 4 Determinants of future credit ratings using the DiD approach

Panel A: *Results using CGIIPS and DTA_Dummy*				***Panel B:*** *Results using CGIIPS, DTA_Dummy and LEV_Dummy*			
	Coef.	*z*-stat	*p*-value		Coef.	*z*-stat	*p*-value
CR_Rate	1.04***	8.99	0.00	*CR_Rate*	1.06***	9.07	0.00
LOSS	0.43	0.76	0.45	*LOSS*	0.45	0.79	0.43
SIZE	−0.07	−1.16	0.25	*SIZE*	−0.08	−1.31	0.19
ROA	21.86	0.74	0.46	*ROA*	17.73	0.64	0.52
LEV	−0.40	−0.34	0.74	*BTM*	−0.03**	−2.07	0.04
BTM	−0.03**	−1.97	0.05	*CFO*	−0.05	−0.02	0.99
CFO	0.18	0.06	0.95	*INTER_COVER*	1.20*	1.74	0.08
INTER_COVER	1.18	1.62	0.11	*CGIIPS*	−1.53***	−2.82	0.00
CGIIPS	−0.91***	−2.68	0.01	*LEV_Dummy*	−0.28	−0.81	0.42
DTA_Dummy	−0.97***	−3.57	0.00	*DTA_Dummy*	−0.98***	−3.00	0.00
CGIIPS×DTA_Dummy	1.34***	2.93	0.00	*CGIIPS×LEV_Dummy*	1.04	1.62	0.11
				CGIIPS×DTA_Dummy	2.14***	2.76	0.01
				LEV_Dummy×DTA_Dummy	−0.02	−0.04	0.97
				CGIIPS×LEV_Dummy×DTA_Dummy	−1.18	−1.26	0.21
Pseudo *R*-squared		0.24		Pseudo *R*-squared		0.24	
Obs		346		Obs		348	
Period effects		Included		Period effects		Included	

Notes The sample includes all banks domiciled in Eurozone countries and covers the period 2005–2015. *, ** and *** indicates significance at the 10%, 5% and 1% level of significance. Variables' definitions are provided in the Appendix

More importantly, however, are the findings regarding the *DTA_Dummy* and its cross-term with *CGIIPS*. Specifically, the *DTA_Dummy* is negative and significant, which implies that the change in deferred tax assets (to total assets) is negatively related to credit ratings (or positively related to credit risk). This result supports research hypothesis H_1 and is in agreement with previous findings in the literature (i.e. Edwards 2011). This result provides the first indication of deferred tax assets' influence on banks' creditworthiness. However, the cross-term *CGIIPSxDTA_Dummy* is positive and significant, which implies that deferred tax assets seem to be related to higher creditworthiness (lower credit risk) among the banks in crisis-affected countries. This result may be related to the large losses recognised by banks domiciled in those countries during the crisis, which led to the recording of deferred tax assets. As Amir and Sougiannis's (1999) argue, deferred tax assets may be valued positively by investors under certain circumstances, as they may represent future tax reductions.

To shed further light on the above result, we considered the effects of high leverage. The results are provided in Panel B of Table 4 and are in agreement with the results shown in Table 3. However, in this case, the interest coverage ratio is positive and statistically significant. Therefore, thus far, the results show that deferred tax assets are negatively related to credit ratings, but for banks domiciled in crisis-affected countries, the direction of this relationship changes.

4.3 Robustness Checks and Further Tests

To examine the robustness of the results, we re-estimated Eqs. (1)–(3) by using the lead of *CDS*_Spread as the dependent variable, as well as using ordinary least squares with robust standard errors and period effects. The results are provided in Tables 5–6. It should be noted that in this case, the dependent variable is negatively related to creditworthiness (directly related to credit risk).

Table 5 and Panel A of Table 6 show that our primary conclusions about the effects of deferred tax asset levels (*DTAtoTA*) and the change in deferred tax assets (*DTA_Dummy*) continue to hold.

Table 5 Determinants of future CDS spread

	Coef.	*t*-stat	*p*-value
Intercept	0.29***	2.73	0.01
*CDS*_Spread	0.52***	5.74	0.00
LOSS	−0.02	−0.42	0.67
SIZE	−0.01	−1.31	0.19
ROA	−2.11	−0.66	0.51
LEV	−0.23**	−2.22	0.03
BtM	0.00	−0.95	0.34
CFO	0.59*	1.87	0.06
INTER_COVER	−0.15	−1.55	0.12
CGIIPS	0.11***	3.97	0.00
DTAtoTA	0.00	0.11	0.91
Adjusted *R*-squared	0.57		
Obs		388	
Period effects		Included	

Notes The sample includes all banks domiciled in Eurozone countries and covers the period 2005–2015. *, ** and *** indicates significance at the 10%, 5% and 1% level of significance. Variables' definitions are provided in the Appendix

Moreover, in Panel B of Table 6, the cross-term of *CGIIPS* and *LEV_Dummy* is negative and significant, which indicates that banks with high leverage in crisis-affected countries have lower credit risk. Even though this result is surprising, Blankespoor et al. (2013) report similar findings and call for further research on this issue. Moreover, the triple integration term of *CGIIPS*, *LEV_Dummy* and *DTA_Dummy* (*CGIIPSxLEV_DummyxDTA_Dummy*) is positive and marginally significant, which offers some support to the contention that the contemporaneous presence of high leverage and high changes in deferred tax assets may lead to higher future credit risk. Moreover, this result provides some support to research hypothesis H_2.

To provide further evidence on the relationship between accounting fundamentals and future credit risk, we also estimated the model of Eq. (2) using a model in changes. The rationale was to examine if changes in accounting fundamentals, including deferred tax assets, led to a change in credit risk. The results for *ΔCR_Rate* and *ΔCDS*_Spread are reported in Tables 6 and 7, respectively, and they agree with the previously reported findings. Moreover, they show that changes in leverage have a positive but statistically insignificant coefficient (Table 8).

Table 6 Determinants of future CDS spread using the DiD approach

Panel A: *Results using CGIIPS and DTA_Dummy*

	Coef.	*t*-stat	*p*-value
Intercept	0.33**	2.47	0.01
*CDS*_Spread	0.53***	5.23	0.00
LOSS	−0.04	−0.72	0.47
SIZE	−0.01*	−1.73	0.08
ROA	−1.32	−0.34	0.74
LEV	−0.23**	−2.05	0.04
BTM	0.00	−1.17	0.24
CFO	0.52*	1.89	0.06
INTER_COVER	−0.18	−1.42	0.16
CGIIPS	0.14***	3.59	0.00
DTA_Dummy	0.04**	2.09	0.04
CGIIPS×DTA_Dummy	−0.07*	−1.94	0.05
Adjusted *R*-squared		0.56	
Obs		336	
Period effects		Included	

Panel B: *Results using CGIIPS, DTA_Dummy and LEV_Dummy*

	Coef.	*t*-stat	*p*-value
Intercept	0.32**	2.46	0.01
*CDS*_Spread	0.54***	5.28	0.00
LOSS	−0.04	−0.82	0.41
SIZE	−0.01*	−1.94	0.05
ROA	−0.41	−0.10	0.92
BTM	0.00	−0.65	0.52
CFO	0.49*	1.86	0.06
INTER_COVER	−0.18	−1.47	0.14
CGIIPS	0.21***	3.49	0.00
LEV_Dummy	0.01	0.45	0.66
DTA_Dummy	0.04	1.57	0.12
CGIIPS×LEV_Dummy	−0.15***	−2.75	0.01
CGIIPS×DTA_Dummy	−0.14**	−2.10	0.04
LEV_Dummy×DTA_Dummy	−0.01	−0.37	0.71
CGIIPS×LEV_Dummy×DTA_Dummy	0.12*	1.68	0.09
Adjusted *R*-squared		0.56	
Obs		338	
Period effects		Included	

Notes The sample includes all banks domiciled in Eurozone countries and covers the period 2005–2015. *, ** and *** indicates significance at the 10%, 5% and 1% level of significance. Variables' definitions are provided in the Appendix

Table 7 Determinants of future change of credit ratings

	Coef.	*z*-stat	*p*-value
LOSS	0.95**	2.03	0.04
Δ*SIZE*	−2.02	−1.25	0.21
Δ*ROA*	22.69	0.45	0.65
Δ*LEV*	−0.56	−0.37	0.71
Δ*BTM*	−0.30***	−2.98	0.00
Δ*CFO*	5.25***	2.65	0.01
Δ*INTER_COVER*	2.03	1.35	0.18
CGIIPS	−0.86***	−3.47	0.00
Δ*DTAtoTA*	−1.86	−1.56	0.12
CGIIPS×Δ*DTAtoTA*	2.75**	2.05	0.04
Pseudo *R*-squared		0.14	
Obs		311	
Period effects		Included	

Notes The sample includes all banks domiciled in Eurozone countries and covers the period 2005–2015. *, ** and *** indicates significance at the 10%, 5% and 1% level of significance

5 Conclusions

The present study examines the financial crisis's effects on banks' creditworthiness. The sample includes banks domiciled in the Eurozone between 2005 and 2015. In particular, we aimed to assess the effects of increased deferred taxation as a result of the large losses suffered by banks domiciled in crisis-affected countries during the crisis period. The results reveal that banks that recorded high changes in deferred tax assets had higher future credit risk (lower creditworthiness). However, if these banks were domiciled in crisis-affected countries, the direction of the relationship changed. Additional analyses found some evidence that less-capitalised banks that recorded deferred tax assets during the crisis had lower creditworthiness.

This study's results extend previous studies by showing that, under certain conditions, deferred taxation holds information for assessing future risk. Moreover, it has shown that the contemporaneous presence of high leverage with high changes in deferred tax assets may lead to higher future credit risk. The results of the study shed some light on the usefulness of accounting determinants of credit risk and should prove useful for academics, regulators and practitioners.

Table 8 Determinants of future change of CDS spread

	Coef.	*t*-stat	*p*-value
Intercept	0.16***	3.94	0.00
LOSS	0.10	0.69	0.49
Δ*SIZE*	1.39**	2.17	0.03
Δ*ROA*	−3.45	−0.43	0.67
Δ*LEV*	0.44	0.64	0.52
Δ*BTM*	0.05***	2.84	0.00
Δ*CFO*	−0.48	−0.62	0.54
Δ*INTER_COVER*	−0.63	−1.54	0.12
CGIIPS	0.46***	4.51	0.00
Δ*DTAtoTA*	0.32	1.37	0.17
CGIIPS×Δ*DTAtoTA*	−0.81***	−3.03	0.00
Adjusted *R*-squared	0.68		
Obs	307		
Period effects:	Included		

Notes The sample includes all banks domiciled in Eurozone countries and covers the period 2005–2015. *, ** and *** indicates significance at the 10%, 5% and 1% level of significance. Variables' definitions are provided in the Appendix

Appendix

Variable	Definition
CR_Rate	The assessment of the risk class assigned by Bloomberg for bank *i* at the end of year *t*
CDS_Spread	Bloombe rg's five-year credit default swap spread for bank i at the end of year *t*
Loss	A dummy variable that takes the value of 1 if the firm suffers a loss and zero otherwise
SIZE	Is the logarithm of total assets of bank *i* at year *t*
ROA	Is the return on assets ratio of bank *i* at year *t*
LEV	Is the ratio of long-term debt to total assets of bank *i* at year *t*
BtM	Is the Book-to-Market ratio of bank *i* at year *t*
CFO	Is the ratio of operating cash flows to opening total assets of bank *i* at year *t*
INTER_COVER	Is the ratio (in a logarithmic form) of earnings before interest and tax to total interest expenses of bank *i* at year *t*
DTAtoTA	Is the ratio (in a percentage form) of deferred tax assets to total assets of bank *i* at year *t*
CGIIPS	A dummy variable that takes the value of 1 for the crisis-affected countries (Cyprus, Greece, Ireland, Italy, Portugal and Spain) and zero otherwise

Variable	Definition
DTA_Dummy	Is a dummy variable that takes the value of one if a bank is ranked at the higher 50% based on the ratio of the change in deferred tax assets to total assets and zero otherwise
LEV_Dummy	Is a dummy variable that takes the value of one if a bank is ranked at the higher 50% based on the leverage ratio and zero otherwise

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On the Split of Social Security Contributions Between Funded and Pay-as-You-Go Pension Schemes; Contribution to Growth

Thomas Poufinas and Effrosyni Kouskouna

1 Introduction

There is an ongoing discussion about the contribution of pensions to the total expenditure of the country. According to the EU rules, the pension benefits that are being paid are accounted as fiscal cost and as such are measured as a percentage of the gross national product. Pension expenditure as a percentage of GDP is a quantity whose height is a criterion of the sustainability of the pension system.

At the same time, the growing demographic problem and the distressed economic environment in the country have exercised a suffocating pressure to the social security system, since pension payments are an important factor of the fiscal cost evolution. The pension expenditure,

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as well as the relevant deficit, as a percentage of GDP, appears significant due to the big cumulative reduction of GDP. The aging of the population, the economic downturn, the slowdown in the economic growth and the increasingly rising unemployment led on one hand to higher cost for pensions and on the other hand to the creation of deficits. Consequently, unemployment has contributed to the creation of a deficit in pension funds. However, especially in the case of Greece, one needs to consider that total pension expenditure (as presented in statistics) includes welfare benefits (lump sum).

In addition to the aforementioned picture, the policies followed, on top of the changes in the demographic data, eventually led the pay-as-you-go systems in difficult positions. As the workforce kept reducing, also assisted by more flexible working relations, the generation of full-time employment began to retire. As a result, the employee contributions did not suffice to finance the increasing number of retirees, creating the need for the financing of pension schemes from other sources.

One such possible path is the gradual shift of part of the second pillar (auxiliary) pensions from pay-as-you-go to funded pension schemes. This approach has two benefits for the state; on the one hand, allows for the reduction of the financing that the state provides and the other hand fosters the investment of the contributions to the funded schemes in the real economy. The latter has a clear contribution to the growth of the country (Poufinas and Kouskouna 2016).

So far the solutions offered for the debt of the country focused on the reduction of the debt. The achievement of real growth has not been given the full attention it deserves. This is that we will try to highlight in the present chapter.

2 Background Discussion

2.1 Defined Benefit Versus Defined Contribution Pension Plans

The main types of pensions schemes used are the pay-as-you-go and funded. Pay-as-you-go pension schemes use the current contributions that are made by the insured (employees, workers, employers) to pay the pensions of the current pensioners. Funded pension schemes direct the contributions of each insured to a dedicated fund, whose accumulated value is paid to them as their pension at the end of their professional life.

Pay-as-you-go schemes are usually Defined Benefit (DB) schemes, whereas funded schemes are usually defined contribution (DC) schemes. At retirement, the insured will receive as their pension in DB schemes a specific promised amount, whereas in DC schemes the amount that has been accumulated through their contribution. In both schemes, pensions can be paid out as annuities or lump-sum payments or a combination of the two.

Pay-as-you-go schemes pay the benefits to the pensioners primarily from the contributions of the insured, whereas funded schemes create a dedicated account for each individual and allocate his or her contributions to this account. Consequently, in pay-as-you-go schemes, the contributions may not suffice to pay the pensions, in particular, when the insured are decreasing or the pensioners are increasing. Would this happen, additional financing is required, especially if the pension is guaranteed. In contrast, funded schemes pay to each pensioner the value of his or her account at the time of their retirement.

As a result, in the pay-as-you-go schemes, if the fund is run by the state, then it is the state that can provide the financing. However, when the financing that has been provided by the state over the years has significantly grown, then as an alternative either the contributions can be increased or the pension payments can be reduced or both. In the funded schemes, there is no such need, as although there is no guarantee, the fund is managed in such a way that its value will be maximized with respect to the limitations that the risk profile of the insured and the applicable regulations impose (Poufinas and Kouskouna 2016).

The switch from DB to DC schemes has been discussed in the past by a series of authors, emphasizing on the *why*, the *how* and *for whom*. Broadbent et al. (2006) explain *why* this has happened in several countries. The primary reasons are the workforce mobility, the portability of benefits, the pension underfunding due to low long-term interest rate, the market-based accounting standards, the increased regulatory requirements and reforms, the uncertainty caused by increased longevity, the improved ability to predict the share of payroll represented by

DC contributions compared with the DB contributions and the reduced long-term balance sheet and earnings volatility for the employers.

Forman (1999) presents *how* this switch can take place. The main ways are keeping the DB plan and adding a supplemental plan, offering both a DB plan and a new plan at the same time, closing entry to the FB plan and adding a new plan, closing entry to the DB plan, adding a new plan and shifting employees not holding vested rights under the old plan to the new plan, freezing the DB plan at current salary levels and adding a new plan and finally terminating the existing DB plan and replacing it with a new plan.

Consequently, it was in the interest of the responsible authorities of the different countries to set the framework within which the switch from a DB to a DC plan takes place for the employed workforce (*for whom*). In Canada (Office of the Superintendent of Financial Institutions, 2001), two options are available to the plan administrator with respect to the treatment of benefits accrued prior or up to the conversion date. These are (a) to retain the accrued defined benefits, with either maintaining a pension fund for the defined benefit or purchasing annuities to guarantee the accrued benefits; (b) to offer each member the option to substitute a lump sum of equal value to the accrued benefit and transfer this lump sum to a defined contribution account. In the US, the different states have also legislated in a similar manner (see, for example, Utah Retirement Services 2007; Texas Pension Review Board 2012) taking into consideration all possible stakeholders and dimensions. The objective is to (a) ensure that employees are financially prepared for retirement, and (b) to maintain the fiscal solvency of retirement plan structures.

In the US, the switch from DB to DC pension plans is evident as in the years from 1979 to 2004 the private sector workers who had a DC plan only grew from 16 to 63%, with the DB only percentage dropping from 62 to 10% and the portion that had both growing from 22 to 27% (VanDerhei et al. 2006).

In parallel, a series of articles attempts to justify the choice of DC over DB (or vice versa) using quantitative criteria. In this line, Bodie et al. (1988) develop a model that uses utility functions to compare DC and DB plans. The relative merits of DC versus DB plans are examined, with an emphasis on the risk aspects of the two plan types for the individual. Bodie (1989) combines the best of the DB and DC approaches proposing and enhancement of DB plans by adding the DC features that they miss. These DC features are inflation protection, as well as transparency in the accumulated fund value so that no ambiguity exists in case the employee changes jobs or the plan is terminated. This combination results in a hybrid plan.

Later on, Poufinas and Kouskouna (2016) determine the optimal split of the contribution between an existing pay-as-you-go (DB) pension scheme and a new (to be introduced) funded (DC) scheme. They do by finding the percentage contribution to the DC scheme and time of contribution to both schemes by entrants to the DC scheme such that an appropriate utility function is maximized and simultaneously the assets of the DB scheme reach (equal or exceed for the first time) the liabilities of the DB scheme. They apply that to a population of 100,000 insured, with a fixed time of contribution to both schemes of ten years to find that 50% of the contribution should be allocated to the DB plan to ensure that its liabilities are covered within that time horizon.

2.2 Contribution to Growth

The switch from DB to DC has an impact on asset allocation and growth. A study performed for the UK, Australia, Canada, and the US (Broadbent et al. 2006) shows that in the US DC schemes have increased investment in mutual funds while DB schemes have continued to favor direct holdings of private equity, whereas both DC and DB schemes have moved away from fixed income. In Canada, both DC and DB schemes have increased investment towards mutual funds and equity holdings, whereas both DC and DB schemes have decreased their bond holdings.

This preference in mutual funds indicates that funded pension schemes can further contribute to economic growth. This happens due to the increased competition that private management brings in, which maximizes investment returns and the productivity of capital. This, in turn, leads to higher GNP and economic growth. In Chile, for example, the switch to a funded scheme assisted in increasing the rate of national saving and total factor productivity by 1% per annum (James 1997). Blackburn (1962) mentions that "the level of pension saving carries implications for the rate of capital formation and economic growth as well as for levels of production and employment."

The importance of private pensions to economic growth is recognized by the OECD (2013), as in 2012 pension funds confirmed their growth among institutional investors, with 28% of total assets held by institutional investors. Pension fund assets exhibited average annual growth of 7.4% during 2009–2012. In most OECD countries for which asset allocation figures for 2012 were available, bonds, and equities remained the two most important asset classes in which pension funds invested. The same direction is supported by Pensions Europe (2015) according to which, under the appropriate conditions, pension funds' capital can contribute to the development of the real economy and act as a driver of growth through long-term investments. Pension funds invest from 50 to 75% of their assets in Europe and many pension funds already invest in SMEs and start-ups, primarily via funds, venture capital, and private equity.

The contribution of pension funds in economic growth is supported by the existing literature. Davis and Hu (2008) find that there is a positive link between pension assets and economic growth using various appropriate econometric methods, with somehow larger effects in Emerging Market Economies than OECD countries.

Rocholl and Niggemann (2010) conclude that a country's pension system significantly determines the development of its capital markets, which in turn allows for higher economic growth, as pension funding reforms lead to larger stock and corporate bond markets relative to both before the reforms and to other countries without such reforms.

Davis (2005) argues that pension funds can contribute to the development of financial markets, helping move the economy from the bank to the market phase of financial development. As a result, economic growth is accelerated, with quantitative and qualitative benefits to financial markets, which are only partly offset by certain potential costs.

Bijlsma et al. (2014) find that growing pension savings lead to deeper capital markets, which in turn positively affect economic growth by allowing firms more dependent on external financing to grow faster.

Corsetti and Schmidt-Hebbel (1995) further support the contribution of funded schemes to growth. They ran simulations using an overlapping-generations model, suggesting that replacing a pay-as-you-go system with a fully funded system can substantially raise long-term growth rates by eliminating the incentives (under the pay-as-you-go system) to informalize production and employment.

On a different direction, the contribution to growth is supported by the role pension funds play as investors in venture capital (VC) and private equity. Gompers and Lerner (2001) find that pension funds are important players in venture capital investments, even reaching 50% of the venture capital participation by the mid-1980s. Jeng and Wells (2000) realize that the significance of pension funds as venture capital investors varies across countries, partly due to the different regulatory environments that apply to them. However, pension funds are a growing source of venture capital funds in various countries, as is evidenced by relevant studies (Mayer et al. 2005). The allocation of pension funds to private equity appears to have increased during 2008–2012 (Talmor and Vasvari 2014). This has significantly increased the global value of private equity fund investments. As pension funds allocate a small part of their capital to private equity compared with other institutional investors, even though increasing over time, there is still room for them to become more effective in deploying their capital in private equity. This can increase their importance as investors and consequently their contribution to growth.

3 Methodology and Data

We attempt to capture the importance of funded pension schemes as contributors to the growth of the country. Although this has been highlighted in the background discussion preceding this section, we do that by investigating the correlation between GDP and the Investments held by funded pension schemes, as well as the correlation between GDP and Exchange Traded Funds (ETFs) that invest in small and medium enterprises (SMEs) and VC.

Although the first route is pretty much straight forward, the second approach indicates implicitly the role of funded pension schemes; would they invest more in ETFs and VC, then growth will be further supported and their contribution to growth will be more evident.

To assess the aforementioned relationships we use linear regression. Our regressions at this stage of our research involve one dependent and one independent variable. The general form of the regression equation is

$$y = \beta_0 + \beta_1 \cdot x + u$$

Where y is one of the dependent variables and x is one of the independent variables described below. We use the Stata econometric software to run these linear regressions.

Our data in the first case are for the 35 countries of OECD for which we had the available information with regard to GDP and Investments via funded pension schemes. Our dataset in the second case is for the 27 countries for which we could also retrieve ETF and VC data (OECD 2011–2016). In the first case, we used data for the period 2001–2015, whereas in the second case for 2015–2016 for ETFs and 2007–2014 for VC.

3.1 Regressions Run

3.1.1 Invested Funds

1. We regress the GDP with the funded pension investment assets as a percent of GDP, with the funded pension investments and with the funded pension holdings (%) in shares (direct and through mutual funds) individually.
2. We run regressions of the GDP growth with the same independent variables as above.
3. We regress the GDP per capita with the above independent variables.
4. We run regressions of the GDP per capita growth with the same independent variables as above.

For all the above—with the exception of share holdings (in %)—we try three variants, namely, for the year 2015 (Table 1), the average of years 2001–2015 (Table 2), and the average for the years 2010–2014

(Table 3). For the share holdings, data were available only for 2015. For each of the variants, we assessed the relation with all countries (Tables 1, 2, 3), excluding the USA (Table 4, 5, 6), which is an outlier, as well as focusing on Europe only (Tables 7, 8, 9).

3.1.2 ETFs & VC

1. We regress the number of ETFs available per country (No of ETFs (available per country)) with the GDP amount (GDP amount (B$)), GDP amount per capita (GDP amount per capita ($)), individually (Table 10), as well as excluding USA (Table 11), recalling that the US is an outlier.
2. We regress the number of ETFs domiciled per country (No of ETFs Domiciled in Country) with the Venture Capital Amount (VC Avg. Amount (M$)) and the GDP amount (GDP amount (B$)) (Table 10).
3. We run regressions of the total ETF assets (Total Assets Avg. Amount 2015–2016) with the Venture Capital Amount (VC Avg. Amount (M$)) and the GDP amount (GDP amount (B$)) (Table 10).
4. We regress the Venture Capital Amount (VC Avg. Amount (M$)) with the GDP amount with (GDP amount (B$)) (Table 10) and without the USA (GDP amount ex-USA (B$)) (Table 11).
5. We run regressions with the ETF amount invested per country (Total ETF amount invested per country) as the dependent variable and the Venture Capital Amount (VC Avg. Amount (M$)) and the GDP amount (GDP amount (B$)) (Table 10).

4 Results

4.1 Invested Funds

1. We realize that the correlation of GDP and investment assets as a percent of GDP is not statistically significant, that there is a positive correlation between the GDP and the investments made by funded pension schemes, that is statistically significant at all levels and that there is a negative correlation between the GDP and the funded pension

Table 1 Regressions for 2015

Dependent/independent	Investment assets as % of GDP 2015	Investments 2015	Shares direct and MFs 2015
GDP 2015	1.10e+10	1,212,765***	−3.08e+10**
	(0.98)	(21.93)	(−2.65)
	8.22e+11	3.96e+11***	2.15e+12***
	(1.22)	(2.84)	(3.52)
	34	34	12
	−0.0013	0.9356	0.3528
GDP growth 2015	0.0026986	−6.69e−08	0.0285107
	(0.17)	(−0.22)	(1.73)
	2.922424	3.069417***	0.7285342
	(3.06)	(3.95)	0.84
	34	34	12
	−0.0303	−0.0297	0.1524
GDP per capita 2015	172.8046**	0.0018403	−126.8699
	(2.30)	(1.19)	(−0.29)
	30419.51***	35607.13	51158.53*
	(6.73)	(9.15)	(2.19)
	34	34	12
	0.1151	0.0127	−0.0911
GDP per capita growth 2015	−0.0017357	−9.09e−08	0.0232471
	(−0.11)	(−0.30)	(1.46)
	2.460956**	2.458823***	0.3388964
	(2.58)	(3.17)	(0.41)
	34	34	12
	−0.0309	−0.0284	0.0931

Note 1 The figures presented are: coefficient, *t*-value in parenthesis; constant, *t*-value in parenthesis; number of observations; adjusted R-squared
Note 2 The statistical significance is noted as: ***statistically significant at the 1% level; **statistically significant at the 5% level; *statistically significant at the 10% level
Note 3 Regressions are in pairs, i.e. each dependent variable has been regressed with each independent variable individually

holdings in shares, which is statistically significant at the 5% level, when we regress all countries, for all three variants (Tables 1, 2, 3). The same holds true if we exclude the USA (Tables 4, 5, 6), as in the case of Europe (Tables 7, 8, 9). In the latter, the significance levels drop to 5 and 10%, respectively. This indicates that GDP and investments made by funded pensions schemes move somehow in parallel, whereas GDP and the percentage invested in shares in opposite directions. The latter

Table 2 Regressions for the average of years 2001–2015

Dependent/ independent	Investment assets as % of GDP average 2001–2015	Investments average 2001–2015	Shares direct and MFs 2015
GDP average 2001–2015	1.22e+10	1,305,331***	−2.85e+10**
	(1.04)	(14.24)	(−2.58)
	8.14e+11	5.10e+11***	1.98e+12***
	(1.49)	(3.03)	(3.43)
	35	35	12
	0.0024	0.8558	0.3401
GDP growth average 2001–2015	−0.0002772	−6.06e−08	0.0257205
	(−0.05)	(−0.50)	(1.50)
	2.190505***	2.213087***	0.929866
	(7.92)	(9.90)	(1.03)
	35	35	12
	−0.0302	−0.0226	0.1019
GDP per capita average 2001–2015	183.182**	0.0017526	−101.3972
	(2.07)	(0.92)	(−0.24)
	28842.55	33269.01***	46766.91*
	(7.05)	(9.54)	(2.15)
	35	35	12
	0.0886	−0.0044	−0.0934
GDP per capita growth average 2001–2015	−0.006195	−9.54e−08	0.0175837
	(−1.01)	(−0.75)	(0.75)
	1.744948***	1.613522***	0.7924303
	(6.14)	(6.95)	(0.64)
	35	35	12
	0.0006	−0.0128	−0.0415

Note 1 The figures presented are: coefficient, *t*-value in parenthesis; constant, *t*-value in parenthesis; number of observations; adjusted R-squared

Note 2 The statistical significance is noted as: ***statistically significant at the 1% level; **statistically significant at the 5% level; *statistically significant at the 10% level

Note 3 Regressions are in pairs, i.e. each dependent variable has been regressed with each independent variable individually

could be possibly explained by the fact that countries with smaller GDP have also smaller investments and the portion of shares is higher in order to achieve an amount that is substantial.

2. We see that there is no statistically significant correlation between GDP growth and any of the independent variables for all countries, for all three variants (Tables 1, 2, 3). The same holds true if we

Table 3 Regressions for the average of years 2010–2014

Dependent/ independent	Investment assets as % of GDP average 2010–2014	Investments average 2010–2014	Shares direct and MFs 2015
GDP average 2010–2014	1.18e+10	1,246,259***	−3.40e+10**
	(0.98)	(14.30)	(−2.67)
	9.73e+11	5.74e+11***	2.37e+12***
	(1.57)	(3.02)	(3.56)
	35	35	12
	−0.0012	0.8569	0.3582
GDP growth average 2010–2014	0.0030014	3.70e−08	0.005335
	(0.38)	(0.24)	(0.24)
	1.661395***	1.73626***	1.721344
	(4.07)	(5.25)	(1.45)
	35	35	12
	−0.0258	−0.0285	−0.0939
GDP per capita average 2010–2014	176.3049*	0.0015008	0.199.3173
	(1.81)	(0.77)	(−0.39)
	34420.11***	39239.93***	59700.84**
	(6.83)	(9.27)	(2.25)
	35	35	12
	0.0626	−0.0120	−0.0832
GDP per capita growth average 2010–2014	−0.0019329	2.75e−09	0.0019519
	(−0.27)	(0.02)	(0.08)
	1.268704***	1.203791***	1.359681
	(3.49)	(4.09)	(1.07)
	35	35	12
	−0.0279	−0.0303	−0.0993

Note 1 The figures presented are: coefficient, *t*-value in parenthesis; constant, *t*-value in parenthesis; number of observations; adjusted R-squared
Note 2 The statistical significance is noted as: ***statistically significant at the 1% level; **statistically significant at the 5% level; *statistically significant at the 10% level
Note 3 Regressions are in pairs, i.e. each dependent variable has been regressed with each independent variable individually

exclude the USA (Tables 4, 5, 6) or if we limit ourselves to Europe (Tables 7, 8, 9). This indicates that GDP growth does not seem to be affected by the funded pension schemes investments, although GDP and investments seem to move in parallel.

3. We find that there is a positive correlation of the GDP per capita with the investment assets as a percent of GDP at the 5% significance level for the first two variants and at the 10% significance level for the

Table 4 Regressions for 2015

Dependent/ independent	Investment assets as % of GDP 2015	Investments 2015	Shares direct and MFs 2015
GDP 2015	1.41e+09	749964.5***	−3.08e+10**
	(0.44)	(3.32)	(−2.65)
	6.73e+11***	5.14e+11***	2.15e+12***
	(3.56)	(3.57)	(3.52)
	33	33	12
	−0.0258	0.2384	0.3528
GDP growth 2015	0.0030155	−6.85e−07	0.0285107
	(0.18)	(−0.51)	(1.73)
	2.927364***	3.227521***	0.7285342
	(3.02)	(3.77)	0.84
	33	33	12
	−0.0311	−0.0236	0.1524
GDP per capita 2015	165.7833**	0.0092071	−126.8699
	(2.16)	(1.40)	(−0.29)
	30310.04***	33723.93	51158.53*
	(6.63)	(8.02)	(2.19)
	33	33	12
	0.1026	0.0288	−0.0911
GDP per capita growth 2015	−0.0014257	−9.04e−07	0.0232471
	(−0.09)	(−0.68)	(1.46)
	2.465788**	2.666768***	0.3388964
	(2.54)	(3.13)	(0.41)
	33	33	12
	−0.0320	−0.0172	0.0931

Note 1 The figures presented are: coefficient, *t*-value in parenthesis; constant, *t*-value in parenthesis; number of observations; adjusted R-squared
Note 2 The statistical significance is noted as: ***statistically significant at the 1% level; **statistically significant at the 5% level; *statistically significant at the 10% level
Note 3 Regressions are in pairs, i.e., each dependent variable has been regressed with each independent variable individually

third variant. There is no statistically significant correlation between GDP per capita and any of the other independent variables (Tables 1, 2, 3). The same holds true if we exclude the USA. However, in that case, the significance level is 5% for the first variant and 10% for the other two (Tables 4, 5, 6). If we stay in Europe, then we realize that for the first variant the significance level of the investment assets as a percent of GDP becomes 10%, whereas there is no statistical significance for the other two variants (Tables 7, 8, 9). This finding indicates

Table 5 Regressions for the average of years 2001–2015

Dependent/ independent	Investment assets as % of GDP Average 2001–2015	Investments average 2001–2015	Shares direct and MFs 2015
GDP average 2001–2015	−8.35e+08	1195703***	−2.85e+10**
	(−0.16)	(2.92)	(−2.58)
	8.05e+11	5.31e+11***	1.98e+12***
	(3.40)	(2.83)	(3.43)
	34	34	12
	−0.0304	0.1860	0.3401
GDP growth average 2001–2015	0.0001011	−4.83e−07	0.0257205
	(0.02)	(−0.90)	(1.50)
	2.190759***	2.295141***	0.929866
	(7.81)	(9.30)	(1.03)
	34	34	12
	−0.0312	−0.0060	0.1019
GDP per capita average 2001–2015	178.2926*	0.0105004	−101.3972
	(1.95)	(1.26)	(−0.24)
	28839.26	31570.21***	46766.91*
	(6.95)	(8.27)	(2.15)
	34	34	12
	0.0779	0.0174	−0.0934
GDP per capita growth average 2010–2015	−0.0058147	−6.76e−07	0.0175837
	(−0.91)	(−1.22)	(0.75)
	1.745203***	1.726228***	0.7924303
	(6.05)	(6.78)	(0.64)
	34	34	12
	−0.0050	0.0143	−0.0415

Note 1 The figures presented are: coefficient, *t*-value in parenthesis; constant, *t*-value in parenthesis; number of observations; adjusted R-squared
Note 2 The statistical significance is noted as: ***statistically significant at the 1% level; **statistically significant at the 5% level; *statistically significant at the 10% level
Note 3 Regressions are in pairs, i.e., each dependent variable has been regressed with each independent variable individually

some relevance between the level of GDP per capita and the pension fund investment assets (as a percent of GDP).

4. We conclude that there is no statistically significant correlation between GDP per capita growth and any of the independent variables for all countries, for all 3 variants (Tables 1, 2, 3). The same

Table 6 Regressions for the average of years 2010–2014

Dependent/ independent	Investment assets as % of GDP Average 2010–2014	Investments average 2010–2014	Shares direct and MFs 2015
GDP average 2010–2014	−1.65e+08 (−0.03) 9.27e+11*** (3.42) 34 −0.0312	1082966*** (3.11) 6.16e+11*** (2.92) 34 0.2080	−3.40e+10** (−2.67) 2.37e+12*** (3.56) 12 0.3582
GDP growth average 2010–2014	0.0028429 (0.35) 1.660793*** (4.01) 34 −0.0285	1.78e−07 (0.29) 1.699767*** (4.61) 34 −0.0285	0.005335 (0.24) 1.721344 (1.45) 12 −0.0939
GDP per capita average 2010–2014	173.4214* (1.72) 34409.18*** (6.73) 34 0.0562	0.0095218 (1.24) 37161.48*** (8.01) 34 0.0162	−199.3173 (−0.39) 59700.84** (2.25) 12 −0.0832
GDP per capita growth average 2010–2014	−0.002076 (−0.29) 1.268161*** (3.44) 34 −0.0286	−6.44e−08 (−0.12) 1.221194*** (3.72) 34 −0.0308	0.0019519 (0.08) 1.359681 (1.07) 12 −0.0993

Note 1 The figures presented are: coefficient, *t*-value in parenthesis; constant, *t*-value in parenthesis; number of observations; adjusted R-squared
Note 2 The statistical significance is noted as: ***statistically significant at the 1% level; **statistically significant at the 5% level; *statistically significant at the 10% level
Note 3 Regressions are in pairs, i.e., each dependent variable has been regressed with each independent variable individually

holds true if we exclude the USA (Tables 4, 5, 6) or if we limit ourselves to Europe (Tables 7, 8, 9). This indicates that GDP per capita growth does not seem to be affected by the funded pension schemes investments, although GDP and investments seem to move in parallel.

Table 7 Regressions for 2015

Dependent/ independent	Investment assets as % of GDP 2015	Investments 2015	Shares direct and MFs 2015
GDP 2015	8.75e+08	779711.3**	−3.57e+10*
	(0.23)	(2.72)	(−2.18)
	6.53e+11***	4.98e+11***	2.37e+12**
	(2.87)	(2.79)	(2.76)
	25	25	10
	−0.0411	0.2108	0.2938
GDP growth 2015	0.0072285	−5.39e−07	0.0322714
	(0.35)	(−0.31)	(1.38)
	2.94971**	3.311772***	0.6065915
	(2.41)	(3.00)	(0.50)
	25	25	10
	−0.0380	−0.0393	0.0916
GDP per capita 2015	158.6364*	0.0069908	60.74234
	(1.76)	(0.87)	(0.10)
	33473.09***	36988.79	45278.08
	(6.29)	(7.36)	(1.45)
	25	25	10
	0.0804	−0.0104	−0.1236
GDP per capita growth 2015	0.0031357	−7.57e−07	0.0245788
	(0.15)	(−0.43)	(1.13)
	2.680185**	2.960221**	0.4045718
	(2.21)	(2.72)	(0.36)
	25	25	10
	−0.0424	−0.0350	0.0298

Note 1 The figures presented are: coefficient, *t*-value in parenthesis; constant, *t*-value in parenthesis; number of observations; adjusted R-squared
Note 2 The statistical significance is noted as: ***statistically significant at the 1% level; **statistically significant at the 5% level; *statistically significant at the 10% level
Note 3 Regressions are in pairs, i.e. each dependent variable has been regressed with each independent variable individually

4.2 ETFs & VC

1. We find that the number of ETFs is positively correlated at all levels with the GDP and at the 5% significance level with the GDP per capita when regressed individually (Table 10). When excluding the USA, the GDP amount and the GDP per capita remain significant,

Table 8 Regressions for the average of years 2001–2015

Dependent/ independent	Investment assets as % of GDP average 2001–2015	Investments average 2001–2015	Shares direct and MFs 2015
GDP average 2001–2015	1.72e+08	923594.4**	−3.33e+10*
	(0.04)	(2.38)	(−2.14)
	6.43e+11***	4.87e+11**	2.20e+12**
	(2.94)	(2.78)	(2.71)
	25	25	10
	−0.0434	0.1628	0.2840
GDP growth average 2001–2015	−0.0008036	−3.66e−07	0.0239912
	(−0.12)	(−0.60)	(1.04)
	1.973303***	2.016049***	0.8505853
	(6.30)	(7.26)	(0.71)
	25	25	10
	−0.0428	−0.0276	0.0100
GDP per capita average 2001–2015	180.0809	0.0078049	112.4958
	(1.68)	(0.77)	(0.20)
	32059.48***	35394.27***	39468.82
	(6.50)	(7.68)	(1.37)
	25	25	10
	0.0706	−0.0176	−0.1192
GDP per capita growth average 2001–2015	−0.0060201	−5.67e−07	0.0100368
	(−0.78)	(−0.81)	(0.30)
	1.691063***	1.632904***	1.119793
	(4.77)	(5.16)	(0.64)
	25	25	10
	−0.0165	−0.0145	−0.1124

Note 1 The figures presented are: coefficient, *t*-value in parenthesis; constant, *t*-value in parenthesis; number of observations; adjusted R-squared
Note 2 The statistical significance is noted as: ***statistically significant at the 1% level; **statistically significant at the 5% level; *statistically significant at the 10% level
Note 3 Regressions are in pairs, i.e. each dependent variable has been regressed with each independent variable individually

however, the first becomes significant at the 10% level and the second at all levels (Table 11). This implies that countries with higher GDP are good environments for ETF availability.

2. The number of ETFs domiciled per country is positively correlated with the Venture Capital Amount at all significance levels, and is also positively

Table 9 Regressions for the average of years 2010–2014

Dependent/ independent	Investment assets as % of GDP average 2010–2014	Investments average 2010–2014	Shares direct and MFs 2015
GDP average 2010–2014	2.68e+08 (0.06) 7.37e+11*** (2.97) 25 −0.0433	784317.2** (2.24) 5.72e+11*** (2.86) 25 0.1439	−3.86e+10* (−2.15) 2.57e+12** (2.74) 10 0.2865
GDP growth average 2010–2014	0.0022645 (0.27) 1.096029** (2.56) 25 −0.0401	2.58e−07 (0.39) 1.105444*** (2.90) 25 −0.0367	−0.0083061 (−0.32) 2.078733 (1.53) 10 −0.1109
GDP per capita average 2010–2014	152.5655 (1.28) 38082.95*** (6.20) 25 0.0261	0.0059488 (0.61) 41245.65*** (7.34) 25 −0.0271	9.75852 (0.01) 52929.16 (1.48) 10 −0.1250
GDP per capita growth average 2010–2014	−0.0014752 (−0.18) 0.874347* (2.05) 25 −0.0420	2.34e−08 (0.04) 0.8258579** (2.17) 25 −0.0434	−0.0159709 (−0.51) 2.051641 (1.26) 10 −0.0896

Note 1 The figures presented are: coefficient, *t*-value in parenthesis; constant, *t*-value in parenthesis; number of observations; adjusted R-squared
Note 2 The statistical significance is noted as: ***statistically significant at the 1% level; **statistically significant at the 5% level; *statistically significant at the 10% level
Note 3 Regressions are in pairs, i.e. each dependent variable has been regressed with each independent variable individually

correlated with the GDP amount at all significance levels (Table 10). The aforementioned results show that the same countries seem to attract both ETFs to be domiciled and Venture Capital investments, indicating that they most likely have investor friendly conditions. In addition, countries with higher GDP bring in ETFs to be domiciled there.

Table 10 Regressions of all countries

Dependent/ independent	GDP amount (B$)	GDP amount per capita ($)	VC avg. amount (M$)
No of ETFs (available per country)	0.0083366*** (13.17) 0.4570229 (0.20) 27 0.8690	0.0010772** (2.08) −31.08879 (−1.41) 27 0.1138	
No of ETFs domiciled in country	0.0102178*** (8.40) −6.107752 (−1.00) 13 0.8529		0.0057731*** (16.53) 3.871345 (1.31) 13 0.9578
Total assets avg. amount 2015–2016	13.03112*** (10.13) −15748.35** (−2.45) 13 0.8943		7.33192*** (47.66) −2933.019** (−2.25) 13 0.9947
VC avg. amount (M$)	1.710499*** (15.66) −1225.533*** (−3.17) 27 0.9037		
Total ETF amount invested per country	11.08743*** (14.16) −9184.354*** (−3.31) 27 0.8847		6.539639*** (96.46) −1325.627*** (−3.32) 27 0.9972

Note 1 The figures presented are: coefficient, *t*-value in parenthesis; constant, *t*-value in parenthesis; number of observations; adjusted R-squared
Note 2 The statistical significance is noted as: ***statistically significant at the 1% level; **statistically significant at the 5% level; *statistically significant at the 10% level
Note 3 Regressions are in pairs, i.e. each dependent variable has been regressed with each independent variable individually

3. The total ETF assets (for the countries of domiciliation) are positively correlated with the Venture Capital Amount and the GDP amount at all significance levels (Table 10). The results are in line

Table 11 Regressions countries ex-USA

Dependent/ Independent	GDP amount (B$)	GDP amount per capita ($)	VC Avg. Amount (M$)
No of ETFs (available per country)	0.0017582* (1.89) −7.583001 (−1.61) 26 0.3161	0.0003431*** (3.13) Jointly with GDP amount	
VC Avg. Amount (M$)	0.3088096*** (6.71) 55.32971 (0.78) 26 0.6378		

Note 1 The figures presented are: coefficient, *t*-value in parenthesis; constant, *t*-value in parenthesis; number of observations; adjusted R-squared
Note 2 The statistical significance is noted as: ***statistically significant at the 1% level; **statistically significant at the 5% level; *statistically significant at the 10% level

with the findings when using the number of ETFs, thus indicating that the same countries seem to attract both ETFs to be domiciled and Venture Capital investments. Moreover, countries with higher GDP are better placed to attract high asset ETFs for their domiciliation.

4. The venture capital amount is positively correlated with all significance levels with the GDP amount both with (Table 10) and without USA (Table 11). The above findings show that countries with higher GDP amounts seem to be more appealing environments for VC activity.
5. The ETF amount invested per country is positively correlated with the Venture Capital Amount at all levels, and is positively correlated with the GDP amount at all levels (Table 10).

A further examination of the above is due in the future with the use of panel data in an attempt to deeper analyze our findings and establish more concretely the relation between growth and funded pension scheme investments.

5 Conclusions

Our findings indicate that there seems to be a relationship between the investments made by funded pension schemes (as amount or as a percentage of GDP) and the level of GDP (as amount or GDP per capita). This makes us believe that one drives the other and they move interconnected. Therefore, funded pensions schemes can contribute in reaching higher levels of GDP. Although there does not appear to be a direct relation between GDP growth and the investments made by funded pensions schemes, there is implicit evidence for that as ETF and VC activity seems to be positively related to GDP levels.

Summing up all the above, we can conclude that as funded pension schemes can invest in all asset classes but more specifically in ETFs and VC, they can direct funds to the real economy and thus contribute to higher GDP levels, hence assisting the growth of the country.

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Appendix: Regression Tables

Invested Funds

All Countries

See Table 1, 2, and 3.

Countries Ex-USA

See Table 4, 5, and 6.

European Countries Only

See Table 7, 8, and 9.

ETFs & VC

All Countries

See Table 10.

Countries Ex-USA

See Table 11.

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The Role of Sovereign CDS Spreads for Stock Prices: Evidence from the Athens Stock Exchange Over a 'Default' Period

Nicholas Apergis

1 Introduction

Borensztein and Panizza (2009) explore four possible costs of economies that experience default: loss of reputation, reductions in trade, costs to the domestic economy, and political costs. In particular, they document that in reference to reputational costs, defaulting countries suffer in terms of access to the international capital markets. When a default episode occurs, then an immediate drop of credit rating, as well as a jump in sovereign spreads is illustrated. However, this effect is short-lived and disappears between three and five years after the default episode. In terms of trade costs, their results are close to those reached by Rose (2005) that default episodes are associated with a drop in bilateral trade, though the literature has not managed to identify the channel through which default has an effect on trade. When the effect of default

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on GDP growth is explored, the authors find that, on average, default episodes are associated with a decrease in output growth of 2.5 percentage points in the year of the default episode. However, they detect no significant growth effect in the years that follow the default episode.

Perez (2011) makes use of an incomplete markets model of sovereign debt in order to investigate the potential welfare improving properties of the option to default. The new feature of the model is the introduction of events of strong negative shocks representing economic crises. Those events are in relevance to the opportunity in which the option to default could be welfare improving by providing insurance, which may reduce the precautionary savings motive of a sovereign government that anticipates the huge burden of debt repayment after output contractions. His findings document that the option to default and the associated costs are actually limiting the country's ability to borrow. The welfare could be improved only if the default decision generates harsher punishments, while it must result in the elimination of higher levels of debt.

Levy-Yeyati and Panizza (2011) find that output generally falls in anticipation of a sovereign default, while this default marks the beginning of the recovery. Acharya et al. (2014) examine the effect of the European sovereign debt crisis on syndicated loan supply and firm behavior, while Bocola (2013), Gennaioli et al. (2014), and Perez (2014) present models of the disruptive effect of default on the financial system, and the consequences for macroeconomic activity. Schumacher et al. (2014) study sovereign debt litigation across a range of countries over the past 40 years, while Fuchs-Schundeln and Hassan (2015) survey the literature on natural experiments in macroeconomics. Nevertheless, the economic costs of default may not be as high as it is commonly thought, and that economic recovery has often started soon after default. It is worth noting, however, that in all defaults episodes, the economic recovery was helped by exchange-rate depreciations. Since this does not seem to be an option for countries that belong to the Eurozone (Eichengreen 2007), Greece may pay a steep cost if it were to default.

In another strand of the empirical literature, a number of works quantify the impact of sovereign defaults on the availability of foreign finance to the corporate sector, especially in the case of emerging economies. These works allow for both price and credit rationing effects. More specifically, the doctrine of 'sovereign ceiling,' popular in the finance literature, is precisely predicated on the impact of defaults on the prices of private assets. According to this doctrine, private debtors cannot have a better credit than their sovereign, an assertion confirmed by some empirical evidence about the pricing of corporate bonds in emerging nations (Cavallo and Valenzuela 2010; Grandes et al. 2010). Other studies test for the direct impact of defaults or market measures of sovereign risk (spreads and ratings) on capital inflows to private corporations. Their findings clearly highlight the presence of a strong negative impact of sovereign risk (as measured by spreads) on lending to the corporate sector (Kaminsky and Schmukler 2002; Reinhart and Rogoff 2004; Das et al. 2010). Moreover, price rationing of defaulters is a well-established reaction, as past repayment records are among the determinants of spreads in emerging economies (Eichengreen et al. 2001; Gelos et al. 2011). The literature has also shown that the impact on spreads tends to be short-lived or small after the settlement of defaults (Sandleris 2012).

The literature has also considered a number of mechanisms to justify spillovers from sovereign defaults to the access of the private sector to foreign funds. One interpretation, consistent with the Bulow and Rogoff (1989) model, considers this extension as part of the overall penalty imposed on the sovereign, that is naturally not indifferent to the condition of the economy (Mitchener and Weidenmier 2010; Flores 2011). Alternatively, others trace the link between default and private credit to balance-sheet effects (Broner and Ventura 2010) or interpret it as a reputational loss for the private sector that extended beyond the repeated game played between sovereign and foreign creditors (Andrade 2009; Sandleris 2014).

Based on the above discussion on the economic effects of sovereign default, this study explores the causal effect of the hidden sovereign 'default' (because no formal default has been claimed so far) on stock prices and returns of Greek firms listed on the Athens Stock Exchange (ASE), by exploiting changes in the probability of the Greek sovereign default. The mechanism that links sovereign default and stock prices and returns are related to the fact that the information revealed to market participants by the changes in sovereign default can affect firms' stock returns occurs through the effect on the sovereign's risk-neutral probability of default. To this end, the analysis makes use of credit default swaps (CDS) spreads to measure the change in the risk-neutral probability of default. The rapid growth of this market, along with the severe financial crisis experienced in Europe, induced a relevant discussion in the literature on the impact of credit risk derivatives on financial stability. The linkage between credit spreads and stock prices is sustained by credit risk-structural models, such as the Merton (1974) model, in which both equity and debt are valued as contingent claims over the firm's assets.

The literature that associates CDS and stock prices is quite extensive. To mention a few of them, Avramov et al. (2009) document that the effects of rating downgrade on stock prices and CDS spreads are higher amid financially distressed firms, while Forte and Peña (2009) show that the stock market leads the CDS market in price discovery. Forte and Lovreta (2009) show that price discovery process changes with the financial situation of firms. Stock markets appear to lead CDS markets, but that leadership has been decreasing over time. The correlation between the two markets also appears to be asymmetric. Gatfaoui (2007) and Dupuis et al. (2009) provide supportive evidence that in the automobile industry, stocks returns, and CDS spreads are negatively correlated, with the correlation being higher in the tails of the probability density function.

To foreshadow our results, the obtained evidence documents that CDS spreads turn out to exert a negative effect on stock prices, while they turn out to be statistically significant only over the period following the sovereign debt crisis in the country. In that sense, the study contributes to the literature that examines the costs of sovereign default, surveyed in Borensztein and Panizza (2009).

This chapter is structured as follows: Sect. 2 discusses the case of the Greek sovereign debt crisis, while Sect. 3 describes the data. Section 4 presents the empirical analysis and results, and finally, Sect. 5 concludes.

2 The Greek Sovereign Debt Experience

Despite that Greece participated as an equal member in the family of the Eurozone countries, its governments did not implement sound (and wise) economic (fiscal) policies, thus, allowing the deterioration of fiscal metrics (Arghyrou and Tsoukalas 2011). At the same time, the event of the recent financial crisis has been also significant for Greece because of the country's uncompetitive economy, administrative weaknesses, and rampant tax evasion in key sectors. When the international financial crisis spread out, Greece's performance of low-reform capacity was matched by inherited economic weaknesses that made the country very vulnerable. In that sense, the economy experienced substantial paucity of competitiveness, while sustained significant current account deficits in foreign trade occurred (Featherstone 2011). When the Greek government became incapable of paying back their debts (October 2009), this led to declining Greek bonds prices, while the Greek government did not take any corrective actions, acting irresponsibly with its fiscal policy and debt accumulation. The market erroneously assumed that the sustainability of Greek debt would be indirectly guaranteed by the other Eurozone members, while the European Central Bank (ECB) would ensure that the Greek debt would not become inflated in the first place (Schulte 2011). The country has received bailouts (i.e., three programs) in the form of voluntary loans. A great number of economists, market participants, and governments advocate that Greece should take responsibility for its government's irresponsible actions after the introduction of the euro. The Greek tax-collecting mechanism is incredibly weak, the civil service sector is large and inefficient, and domestic wages are too high to be competitive. These issues were hoped to get resolved through the continuous bail-out programs, but the first components continue to generate stressful times for the country.

The future of the Greek crisis involves three alternative scenarios: (i) **exiting the Eurozone**, however, a 'Grexit' case would bring the mother of all financial crises, given that many (if not all) financial assets would leave Greece, most of the debt-holding private sector entities would go bankrupt, and the new central bank would have very little credibility

(Darvas 2011), leading to long-term high real interest rates and high inflation (Darvas 2011). These huge disadvantages would hugely outweigh the short-term gains that Greece would receive by exiting the Eurozone, (ii) **if Greece defaults**, the economy may suffer in the short-term, while external credit will be virtually non-existent, implying that the country will have to live within its means. This will require slashed pay-scales and benefits for civil servants and drastic cuts in the number of such jobs (Miron 2010). However, such actions, though they can make the country more competitive on international markets, could lead to prolonged recession, and (iii) **the country remains in the Eurozone** with financial assistance from the EU, the ECB, and the IMF (which has already occurred three times). However, given that the austerity measures that accompany such programs are not very popular; this activates the defense mechanism of the political system. As a result, only a minority of actions required to modernize the economy have actually taken place to formalize the required reforms that accompany the bail-out programs.

Greece needs to become more economically competitive, while reducing substantially its debts and deficits. At the same time, the European Union (EU) can help by encouraging growth through fostering domestic policy reforms and increasing employment and productivity levels, particularly in the tradable sector; in that sense, the country's exports will expand and generate sufficient resources that will allow not only the growth plan to get delivered, but also the country to be capable of repaying its high debt (Sapir et al. 2011).

3 Data

The dataset consists of daily observations of stock prices, spanning the period from January 2, 2005 to December 31, 2015. The time span includes both the period prior to the sovereign debt crisis (January 2, 2005–October 18, 2009) and the period after the crisis (October 19, 2009–December 31, 2015). The beginning of the second period coincides with the day the former socialist Prime Minister George Papandreou announced in the Parliament the potential fiscal problems of the Greek economy. The sample contains 129 firms, all listed on the ASE. The number of firms has been determined through the primary criterion that these firms were continuously listed over the time period under study. The Appendix provides the list of the firms used in the empirical analysis. The returns series is calculated as: $[(\log SP_t - \log SP_{t-1})/\log SP_{t-1}] \times 100$, with SP representing stock prices.

The analysis also uses daily sovereign CDS spreads to measure the market-implied risk-neutral probability of default. A CDS is a financial derivative where the seller of the swap agrees to insure the buyer against the possibility that the issuer defaults. Once a third party, the International Swaps and Derivatives Association, declares a credit event, an auction occurs to determine the price of the defaulted debt. The CDS seller then pays the buyer the difference between the face and auction value of the debt. This type of derivatives may be used to hedge risk or for speculation and allow investors to transact separately the credit risk of the reference entity and to split funding from default risk. The analysis makes use of the 5-year cumulative default probability, i.e., the risk-neutral probability that Greece defaults within 5 years of the CDS contract initiation.

The methodology also controls for other determinants that could affect both variables. In particular, to proxy for global risk aversion, we use daily data on the VIX index, the S&P 500 to measure global equity returns, and the MSCI Emerging Markets Asia ETF to proxy for factors affecting emerging markets generally. In addition, the analysis controls for aggregate credit market conditions by making use of daily data of the Markit CDX High Yield (CDXHY) and Investment Grade CDS (IGCDS) indices. Daily data on oil prices (OILP, proxied by the West Texas Intermediate prices) are also included as an additional control variable. Finally, the data are completed with individual firm characteristics, i.e., daily data on market capitalization—CAP. All data were obtained from the Datastream database.

4 Empirical Analysis

Given the literature, the empirical analysis explores and evaluates the following two hypotheses concerning the intertemporal relationship between stock prices and CDS spreads:

H1 Positive stock prices are associated with negative sovereign CDS spread changes,
and

H2 The impact of CDS spread changes turns out to be statistically significant only over the sovereign debt crisis period.

The first part of the empirical analysis examines the unit root properties of the panel of stock prices. To this end, panel unit root tests of the first generation can lead to spurious results (because of size distortions), if significant degrees of positive residual cross-sectional dependence exist and are ignored. Consequently, the implementation of second-generation panel unit root tests is desirable only when it has been established that the panel is subject to a significant degree of residual cross-sectional dependence. In the cases, where cross-sectional dependence is not sufficiently high, a loss of power might result if second-generation panel unit root tests that allow for cross-sectional dependence are employed. Therefore, before selecting the appropriate panel unit root test, it is crucial to provide some evidence on the degree of residual cross-sectional dependence.

The cross-sectional dependence (CD) statistic by Pesaran (2004) is based on a simple average of all pair-wise correlation coefficients of the OLS residuals obtained from standard augmented Dickey-Fuller regressions for each variable in the panel. Under the null hypothesis of cross-sectional independence, the CD test statistic follows asymptotically a two-tailed standard normal distribution. The results reported in Table 1 uniformly reject the null hypothesis of cross-sectional independence, providing evidence of cross-sectional dependence in the data given the statistical significance of the CD statistics regardless of the number of lags (from 1 to 4) included in the ADF regressions.

The next part employs the Ng and Perron (2001) unit root test strategy to test all the variables, except the panel set of stock prices, for stationarity (Panel I). The choice of the Ng-Perron procedure is propelled by its superiority to both Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) tests, while it is built on the work by Elliott et al. (1996) that yields substantial power gains over the standard ADF unit root test.

Table 1 Cross-sectional dependence (CD) tests

Variables	1	2	3	4
SP	[0.00][a]	[0.00][a]	[0.00][a]	[0.02][b]

Notes SP denotes stock prices. Under the null hypothesis of cross-sectional independence, the CD statistic is distributed as a two-tailed standard normal. Results are based on the test of Pesaran (2004). Figures in parentheses denote *p*-values. [a]significant at 1%, [b]significant at 5%

Two second-generation panel unit root tests (Panel II) are employed to determine the degree of integration in the respective variable. The Pesaran (2007) panel unit root test does not require the estimation of factor loading to eliminate cross-sectional dependence. Specifically, the usual ADF regression is augmented to include the lagged cross-sectional mean and its first difference to capture the cross-sectional dependence that arises through a single-factor model. The null hypothesis is a unit root for the Pesaran (2007) test. The bootstrap panel unit root tests by Smith et al. (2004) utilize a sieve sampling scheme to account for both the time series and cross-sectional dependence in the data through bootstrap blocks. All four tests by Smith et al. (2004) are constructed with a unit root under the null hypothesis and heterogeneous autoregressive roots under the alternative hypothesis. The results are reported in Table 2 (over both the period prior and after the crisis). The null hypothesis is that a unit root is present in the level of the series. The findings indicate the presence of a unit root in the levels of all the variables (i.e., time series and panel) under study across both periods, while the presence of a unit root is rejected when first differences are considered.

Next, the analysis employs panel cointegration methodologies to investigate the long-run equilibrium across the variables under study. Under the presence of cross-sectional dependence, the study makes use of the Durbin-Hausman test, recommended by Westerlund (2008), to explore the presence of cointegration. In particular, this test is applied under very general conditions because it does not rely heavily on a priori knowledge of the integration order of the variables included in the modeling approach. Additionally, it allows for cross-sectional dependence modeled by a factor model in which the errors are obtained by

Table 2 Unit root tests

I. Ng-Perron unit root tests				
Variables	MZa	MZt	MSB	MPT
Period: Jan 2, 2005–Oct 18, 2009				
CDS	−3.48	−2.62	0.395	28.714
Δ*CDS*	−75.59[a]	−6.89[a]	0.052[a]	1.208[a]
VIX	−3.26	−2.48	0.427	30.409
Δ*VIX*	−79.86[a]	−6.95[a]	0.048[a]	1.185[a]
SP500	−3.11	−2.40	0.403	33.922
Δ*SP500*	−74.60[a]	−6.68[a]	0.042[a]	1.103[a]
ETF	−3.48	−2.56	0.435	36.139
Δ*ETF*	−85.61[a]	−6.88[a]	0.039[a]	1.124[a]
CDXHY	−3.27	−2.39	0.397	31.925
Δ*CDXHY*	−76.18[a]	−6.29[a]	0.044[a]	1.173[a]
IGCDS	−3.36	−2.50	0.378	32.009
Δ*IGCDS*	−79.94[a]	−6.63[a]	0.055[a]	1.194[a]
OILP	−3.41	−2.58	0.411	33.508
Δ*OILP*	−82.43[a]	−6.77[a]	0.042[a]	1.209[a]
Period: Oct 19, 2009–Dec 31, 2015				
CDS	−3.72	−2.84	0.429	34.452
Δ*CDS*	−79.92[a]	−7.05[a]	0.043[a]	1.185[a]
VIX	−3.69	−2.41	0.406	28.936
Δ*VIX*	−88.61[a]	−7.36[a]	0.040[a]	1.062[a]
SP500	−3.06	−2.33	0.384	31.209
Δ*SP500*	−80.04[a]	−6.87[a]	0.037[a]	1.074[a]
ETF	−3.41	−2.50	0.414	32.085
Δ*ETF*	−88.14[a]	−7.20[a]	0.034[a]	1.101[a]
CDXHY	−3.35	−2.47	0.438	36.525
Δ*CDXHY*	−85.82[a]	−6.95[a]	0.036[a]	1.075[a]
IGCDS	−3.45	−2.59	0.396	35.914
Δ*IGCDS*	−90.43[a]	−6.98[a]	0.046[a]	1.117[a]
OILP	−3.58	−2.69	0.436	36.814
Δ*OILP*	−89.35[a]	−7.12[a]	0.033[a]	1.158[a]

II. Panel unit root tests					
Pesaran	Pesaran	Smith et al.	Smith et al.	Smith et al.	Smith et al.
CIPS	CIPS*	*t*-test	LM-test	max-test	min-test
Period: Jan 2, 2005–Oct 18, 2009					
SP					
−1.18	−1.29	−1.19	2.99	−1.25	1.36
r					
−5.69[a]	−5.84[a]	−5.79[a]	21.28[a]	−6.13[a]	7.02[a]
CAP					
−1.20	−1.34	−1.28	3.17	−1.30	1.41

(continued)

Table 2 (continued)

II. Panel unit root tests					
Pesaran CIPS	Pesaran CIPS*	Smith et al. *t*-test	Smith et al. LM-test	Smith et al. max-test	Smith et al. min-test
ΔCAP					
−5.78[a]	−6.03[a]	−5.95[a]	24.85[a]	−6.40[a]	7.30[a]
Period: Oct 19, 2009–Dec 31, 2015					
SP					
−1.21	−1.33	−1.24	3.04	−1.28	1.40
r					
−5.94[a]	−5.99[a]	−5.92[a]	25.82[a]	−6.42[a]	7.25[a]
CAP					
−1.25	−1.39	−1.33	3.30	−1.38	1.47
ΔCAP					
−6.01[a]	−6.16[a]	−6.10[a]	26.52[a]	−6.73[a]	7.58[a]

Δ denotes first differences. *SP* denotes stock prices, *r* is stock returns, *VIX* is the *VIX* index, *SP500* is the S&P 500 index, *ETF* is the *MSCI* Emerging Markets Asia *ETF*, *CDXHY* is the Markit *CDX* High Yield index, *IGCDS* denotes the Investment Grade *CDS* index, *OILP* represents oil prices, and *CAP* denotes market capitalization. A constant is included in the Pesaran (2007) tests. Rejection of the null hypothesis indicates stationarity in at least one country. CIPS* = truncated CIPS test. Critical values for the Pesaran (2007) test are −2.40 at 1%, –2.22 at 5%, and −2.14 at 10%, respectively. 'a' denotes rejection of the null hypothesis of the presence of a unit root. Both a constant and a time trend are included in the Smith et al. (2004) tests. Rejection of the null hypothesis indicates stationarity in at least one country. For both tests, the results are reported at lag = 3

idiosyncratic innovations and unobservable factors that are common across units of the panel (Auteri and Constantini 2005). Thus, the errors (ε_{it}) are modeled as follows:

$$\varepsilon_{it} = \lambda_i' F_t + e_{it} \tag{1}$$

$$F_{jt} = \rho_j + F_{j(t-1)} + u_{jt} \tag{2}$$

$$e_{it} = \varphi_i + e_{i(t-1)} + \eta_{it} \tag{3}$$

where F_t is a $1 \times K$ vector of common factors, F_{jt} with $j = 1,\ldots, k$ and λ_i is a conformable vector of factor loadings. It is ensured that F_t is stationary by assuming that $\rho_j < 1$ across all js. In this case, the integration order of the composite regression error ε_{it} depends only on the integrated pattern of the idiosyncratic disturbance e_{it}. Thus, testing the null hypothesis of nocointegration is equivalent to testing whether $\phi_i = 1$. Two panel cointegration tests can perform the job: the panel test and the group mean test. The panel test is constructed under the maintained assumption that $\phi_i = \phi$ for all is, whereas the group mean test assumes that $\phi_i \neq \phi$ for all is. Both tests are based on two estimators of ϕ_i, which have different probability limits under the cointegration alternative hypothesis, while sharing the property of consistency under the no-cointegration null hypothesis. Thus, the statistics of $\mathrm{DH_g}$ and $\mathrm{DH_p}$ tests can be formulated as:

$$\mathrm{DH}_g = \sum_{i=1}^{N} \hat{s}_i(\varphi_{1i} - \varphi_{2i})^2 \sum_{t=2}^{T} \hat{e}^2_{i(t-1)} \tag{4}$$

$$\mathrm{DH}_p = \hat{s}_n(\varphi_1 - \varphi_2)^2 \sum_{i=1}^{N} \sum_{t=2}^{T} \hat{e}^2_{i(t-1)} \tag{5}$$

where φ_{2i} is the OLS estimator of ϕ_i in Eq. (3) and φ_2 denotes its pooled counterpart. The corresponding individual and pooled instrumental variable (IV) estimators of ϕ_i, denoted φ_{1i} and φ_1, respectively, are obtained by simply instrumenting $\hat{e}_{i(t-1)}$ with $\hat{e}_{it}$. For the panel test ($\mathrm{DH_p}$), the null and alternative hypotheses are formulated as H_0: $\phi_i = 1$ for all $i = 1, \ldots, N$ versus $H^1{}_p$: $\phi_i = \phi$ and $\phi < 1$ for all i. A common autoregressive parameter is assumed both under the null and alternative hypotheses. In contrast, for the DH_g test, H_0 is tested versus the alternative hypothesis defined as $H^1{}_g = \phi_i < 1$ for at least some i. In this case, heterogeneous autoregressive parameters are assumed across panel members. Thus, the rejection of null hypothesis indicates that there is a long-run relationship for at least some of the panel units (Table 3).

Provided that the panel unit root test results confirm that all the variables are integrated in the same order, the presence of cointegration across them is justified. The results of the DH_g and DH_p tests, across

Table 3 Westerlund's cointegration tests

Time period: Jan 2, 2005–Oct 18, 2009	
DH_g	0.837 [0.48]
DH_p	0.925 [0.45]
Time period: Oct 19, 2009–Dec 31, 2015	
DH_g	5.919 [0.00][a]
DH_p	6.815 [0.00][a]

p-values are reported in brackets. The criterion used in this chapter is $IC_2(K)$ with the Maximum number of factors (*K*) set equal to 5. For the bandwidth selection, M was chosen to represent the largest integer less than $4(T/100)^{2/9}$, as suggested by Newey and West (1994) [a]indicates the rejection of no-cointegration null hypothesis at the 1% level of significance

energy groups, are reported in Table 4. These findings illustrate that the null hypothesis of no-cointegration is accepted over the period prior to debt sovereign crisis and is rejected at the 1% significance level for both tests.

Next, we apply a methodology which takes into account both cross-sectional and time dimensions of the data to estimate the long-run relationship described as:

$$\begin{aligned} \mathrm{SP}_{it} &= a_i + b_1\, CDS_t + b_2\, VIX_t + b_3\, SP500_t + b_4\, ETF_t \\ &\quad + b_5\, CDXHY_t + b_6\, IGCDS_t + b_7\, OILP_t + b_8\, CAP_{it} + \varepsilon_{it} \end{aligned} \tag{6}$$

where a_i denotes fixed stock price effects. However, when the errors of a panel regression are cross-sectionally correlated then standard estimation methods can lead to inconsistent estimates and incorrect inference (Phillips and Sul 2003). In order to take into account the cross-sectional dependence, we implement a novel econometric methodology, namely the Common Correlated Effects (CCE) by Pesaran (2006). He suggests a new approach for estimation that takes into account cross-sectional dependence. The proposed methodology allows individual specific errors to be serially correlated and heteroskedastic. Pesaran (2006) adopts a multifactor residual model, such as:

$$\begin{aligned} \mathrm{SP}_{it} &= a_i + b_1\, CDS_t + b_2\, VIX_t + b_3\, SP500_t + b_4\, ETF_t \\ &\quad + b_5\, CDXHY_t + b_6\, IGCDS_t + b_7\, OILP_t + b_8\, CAP_{it} + \varepsilon_{it} \end{aligned} \tag{6}$$

Table 4 Common Correlated Effects Mean Group (CCE-MG) long-run estimates

Variables	Coefficient	*p*-value
Time period: Jan 2, 2005–Oct 18, 2009		
Intercept	1.084	0.01
CDS	0.063	0.24
VIX	−0.268	0.00
SP500	0.329	0.00
ETF	0.273	0.00
CDXHY	0.295	0.00
IGCDS	0.219	0.00
OILP	−0.418	0.00
CAP	0.269	0.00
Diagnostics: R^2-adjusted = 0.67		
Time period: Oct 19, 2009–Dec 31, 2015		
Intercept	0.857	0.04
CDS	0.284	0.00
VIX	−0.451	0.00
SP500	0.366	0.00
ETF	0.304	0.00
CDXHY	0.538	0.00
IGCDS	0.285	0.00
OILP	−0.163	0.03
CAP	0.082	0.08
Diagnostics: R^2-adjusted = 0.75		

$$\varepsilon_{it} = \lambda_i' F_t + u_{it} \tag{7}$$

where subscript it is the ith cross-sectional observation at time t, for $t = 1, 2, \ldots, T$ and $i = 1, 2, \ldots, N$. F_t is the m × 1 vector of unobserved common factors. Pesaran (2006) considers the case of weakly stationary factors. However, Kapetanios et al. (2011) show that Pesaran's CCE approach continues to yield consistent estimation and valid inference even when common factors are unit root processes (I(1)). To deal with the residual cross-sectional dependence, Pesaran (2006) uses cross-sectional averages across all variables in (6), as observable proxies for common factors F_t. Slope coefficients as well as their means can be consistently estimated within the following auxiliary regression:

$$
\begin{aligned}
SP_{it} = & a_i + b_1 CDS_t + b_2 VIX_t + b_3 SP500_t + b_4 ETF_t \\
& + b_5 CDXHY_t + b_6 IGCDS_t + b_7 OILP_t + b_8 CAP_{it} \\
& + \overline{b_9 VIX_t + b_{10} SP500_t + b_{11} ETF_t + b_{12} CDXHY_t} \\
& + \overline{b_{13} IGCDS_t + b_{14} OILP_t + b_{15} CAP_t + e_{it}}
\end{aligned} \tag{8}
$$

where a bar above the variable denotes its mean value. Pesaran (2006) refers to the resulting OLS estimators $\hat{B}_{j,CCE}$ of the individual specific slope coefficients $B_j = (\beta)'$, as the 'Common Correlated Effect' (CCE) estimators:

$$
\hat{B}_{j,CCE} = \left(X_j' \bar{D} X_j\right) X_j' \bar{D} E_j
$$

where: $X_j = (x_{j1}, x_{j2}, \ldots, x_{jT})'$, $x_{jt} = \left(Y_{jt}, Y_{jT}^2\right)'$, $E_j = (E_{j1}, E_{j2}, \ldots, E_{jT})'$, $\bar{D} = I_T - \bar{H}\left(\bar{H}'\bar{H}\right)^{-1}$, $\bar{H} = (h_1, h_2, \ldots, h_T)'$, and

$h_t = (1, CDS_t, VIX_t, SP500_t, ETF_t, CDXHY_t, IGCDS_t, OILP_t, CAP_{it})$ as the 'Common Correlated Effect' (CCE) estimators. The 'Common Correlated Effects Mean Group' (CCEMG) estimator is the average of the individual CCE estimators $\hat{B}_{j,CCE}$:

$$
\hat{B}_{CCEMG} = \sum_{j=1}^{N} \hat{B}_{j,CCE}
$$

The new CCEMG estimator follows asymptotically the standard normal distribution. Specifically:

$$
\sqrt{N}(\hat{B}_{CCEMG} - B) \longrightarrow dN(0, \Sigma_{MG}). \tag{9}
$$

In a series of Monte Carlo experiments, Pesaran (2006) and Kapetanios et al. (2011) show that the CCE estimators have the correct size, and in general have better small-sample properties than alternatives that are available in the literature. Furthermore, they have shown that small-sample properties of the CCE estimators do not seem to be much affected by the residual serial correlation of the errors.

Therefore, given that the two variables are cointegrated, we proceed to obtain the long-run estimates. The results are reported in Table 4. These empirical findings provide solid evidence in favor of both of the hypotheses: H1 (i.e., CDS spreads are negatively associated with stock prices) and H2 (i.e., the impact of CDS spread changes turns out to be statistically significant only over the sovereign debt crisis period). More specifically, the results document that over the period prior to the sovereign debt crisis; the Greek sovereign CDS spreads have no effect on stock prices listed on the ASE. By contrast, over the period after the sovereign debt crisis, the impact of Greek CDS spreads has significantly increased, while they turn out to be statistically significant.

In terms of the remaining control variables, VIX plays a negative role in driving stock prices across both periods, while all four economic activity indexes have a positive impact on stock prices. Oil prices are shown to exert a statistically significant negative effect on stock prices across both periods, albeit the size of the coefficient has substantially declined in the later period, indicating the lower oil prices experienced by the global economy. Finally, although capitalization retains its positive effect on stock prices across both periods, its size has substantially decreased, which also provides robust evidence of the negative macroeconomic environment imposed by the gloomy fiscal position of the country, as well as the role of the bail-out programs for the course of the real economy and the prospects of the Greek economy.

Overall, these long-run empirical findings highlight that the stressful fiscal environment and the implementation of consecutive bail-out programs (given that a single program was not adequate to drive the economy into the 'green zone') have created a type of shortages with respect to the Greek-specific expert capital (Gabaix and Maggiori 2015; Hébert and Schreger 2015). Moreover, the findings could indicate that the negative effect on stock prices could be also attributed to an increase in the 'beta' factor, implying a decline in the value of the firms, as valued by the market, while the austerity programs (and the quasi-defaulted environment) also contributed to making the performance of the Greek real economy more exposed to priced risk factors, leading to a declining future output. Finally, the findings could reflect that in the period during the austerity programs and 'near' default, the

Table 5 ARDL causality tests

Dependent variable	Wald test	*P*-value
Time period: Jan 2, 2005–Oct 18, 2009		
CDS →stock returns	1.48	0.42
Stock returns →*CDS*	0.62	0.79
Time period: Oct 19, 2009-Dec 31, 2015		
CDS →stock returns	49.85[a]	0.00
Stock returns →*CDS*	1.19	0.54

[a]denotes significant at 1%

negative impact of CDS spreads on stock prices highlights the cost of 'default' that could include the consequences of whatever policies the government is expected to employ, to satisfy the conditions the bail-out programs require, plus the costs of firms, households, and other agents who are forced to change their behavior as a result of the stressful fiscal environment. Such policies could potentially include renegotiating with creditors, finding other sources of borrowed funding, balancing budgets via severe tax increases or painful spending reduction, and imposing capital controls (as it happened toward the end tails of the sample), among other actions.

The final step of the empirical analysis consists of analyzing the direction of the causal links across the variables of interest, i.e., stock prices and CDS spreads across both periods under examination, to find out whether the long-run results receive any short-run robustness support. To this end, this part of the analysis applies the Pooled Mean Group (PMG) estimator recommended by Pesaran et al. (2001). An Autoregressive Distributed Lagged (ARDL 1,1,1) model assists in generating the causality results reported in Table 5. We could notice that the non-causality hypothesis is rejected only in the period after the debt sovereign crisis, which provides robustness evidence for the long-run results obtained earlier. More specifically, in the second period, there is univariate causality, running from CDS spreads to stock returns, indicating that these CDS spreads exemplify the country's idiosyncratic risk as being under consecutive austerity programs. This changes investors' stochastic discount factors, which is captured by changes in the returns of stocks listed on the ASE market.

5 Conclusion

This chapter explored the role of Greece's sovereign CDS spreads on the stock prices listed on the ASE over the period prior and after the adopted (or imposed) austerity programs that virtually indicated the 'default' status of the country. Employing a panel of listed firms, spanning the period 2005–2015, and the empirical findings indicated that CDS spreads exerted a negative and statistically significant impact on stock prices only over the period initiating the stressful fiscal (default) environment for the Greek economy. These findings identify that the 'default' status of the economy caused a persistent decline in expected future output, which had a detrimental effect on stock prices and returns.

The implications derived from the empirical findings have to do with the need the country to adopt institutional reforms to promote growth, while this seems necessary for the EU's institutions as well, in a sense they also need strong political leadership and the support of national publics (Garton 2004). However, the mother of all priority solutions is that the country needs to adopt policies consistent with a growth strategy (Apergis and Cooray 2013), while including a substantial and adequate cleaning up of bank balance sheets, and structural reforms.

Appendix: List of Firms Listed on the ASE (129)

Banks (7) = Bank of Greece, National Bank of Greece, Alpha Bank, Attica Bank, Eurobank Ergasias, Piraeus Bank, Hellenic Post Bank.

Chemicals (9) = Crete Plastics, Cyclon, Daios Plastics, Druckfarben, Elton, Eurodrip, Petzetakis, Spirou, Thrace Plastics.

Gaming (1) = OPAP.

Holding companies (14) = Albio Holdings, Alfa-Alfa Holding, Attica Holdings, Axon Holding, Elbisco Holding, Lamda Development, Marfin Investment Group, Mytilineos Holdings, Sciens International Investments and Holdings, Viohalco, Delta Holdings, Technical Olympic, Fourlis Holding, Hadjioannou Holding.

Insurance (5) = Agrotiki Asfalistiki, Aspis Pronoia, Ethniki Asfalistiki, Europaiki Pisti, Phoenix Metrolife.

Leasing (2) = Alpha Leasing, Piraeus Leasing.

Oil and gas (3) = Motor Oil Hellas, Hellenic Petroleum, Elinoil.

Personal and household goods (34) = Fourlis, FG Europe, Zamba, Benrubi, Sanyo Hellas, Vell Group, Yalco-Constantinou, DROMEAS, SATO, VARANGIS, BIOKARPET, Alsinco, DUR, Elmec Sport, ETMA Rayon, ELFICO, ELVE, Epilektos-Stiafilco, Fashion Box, Fieratex, Fintexport, Folli Follie, Hatzioannou, Hellenic Fabrics, Lanakam, Maxim-Pertsinidis, Mouzakis, Minerva Knitwear, Nafpaktos Textile, Texapret, Tria Alfa Wools, United Textiles, Varvaressos, Centric Multimedia

Retail trade (16) = Jumbo S.A., Microland, Moda Bagno, Sprider stores, AB Vasilopoulos, Vardas, Ikona-Hxos, Elektroniki, Philippos Nakas Music, AS Toys Company, Revoil, Microland Computers, Hellenic Duty Free Shops, Motodynamiki, Vivere, Sfakianakis.

Telecommunications (1) = OTE.

Technology (13) = Plaisio, Hellas Online, Intracom, MLS Multimedia, Quest Holdings, Space Hellas, Quality & Reliability S.A., PROFILE Systems and Software, Altec Holdings, Byte Computer, Ideal Group, ILYDA, PC SYSTEMS.

Utilities (4) = Public Power Corporation, Terna Energy, EYDAP SA-Athens Water supply and Sewage Co, EYATH SA-Thessaloniki Water and Sewage Co.

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History of Greece's Debt Crisis and the Banking Policy

Alexandros Garefalakis, Christos Lemonakis, George Alexopoulos and Efthalia Tabouratzi

1 Literature Review

1.1 Bankruptcies in the Greek History

Greece started since its foundation, as a state, with a bankruptcy. The first official act of the new state in 1827 was the default statement. Overall, **Greece bankrupted four times** and was under receivership for over 50 years across its historic route. The second official bankruptcy was in 1893, and then the first financial control was imposed on Greece with tragic consequences for the economy and the social cohesion.

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The second official bankruptcy was declared and became known by the phrase "unfortunately we bankrupted" by Ch. Trikoupis in 1893. There were then foreign lenders who, in 1898, after the Greek-Turkish War of 1897, imposed the International Financial Control and committed the basic resources of the Greek public. The International Auditing was maintained for many years and in 1932, for the third time, Greece was driven into bankruptcy. Finally, the fourth bankruptcy starts from the years from 2010 to 2012. In the run-up to all four debt crisis episodes, Greece lost access to external borrowing and faced "lack of trust" which means that foreign investors do not have any confidence in the underlying soundness of the country's monetary and fiscal institutions.

The primary default of 1826 spread over an amazing 54 years, while the third default of 1932 was settled just 30 years afterward (in 1964). In addition, the fourth obligation emergency which began in 2010 is still exceptionally a long way from being settled.

What clarifies these long deferrals in crisis determination in Greece? The reasons are obviously complex, including extended subsidences and also political. Part of the postponements, though, can be unmistakably ascribed to the lender side. This is most apparent when concentrating on the greater "passable" default of 1826 and how it was settled. We realize that the terms of the autonomy advances of 1824 and 1825 (contracted even before Greece turned into a sovereign nation) were exceptionally horrible. Of the aggregate ostensible estimation of 2.7 million British pounds obtained by right, under 1.2 million streamed to Greece. The rest were high commissions and held sums because of the issuance cost of under 60% of standard.

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In 1829, the organization of the lately settled Hellenic Republic moved toward credit supervisors offering them to settle the commitment so that the repayments would relate more to the genuine totals lent. In any case, creditors declined to agree to any face regard haircut and asked for the full repayment of the legitimately agreed aggregates notwithstanding interest portions. With a commitment of more than 100% to GDP, these solicitations were difficult to meet in a war-torn and recently settled state. The refusal to permit commitment help continued after Otto was expelled and exchanges got yet again.

Finally, in 1878, the credit managers (or their recipients) agreed to settle the commitment at 1.1 million pounds (close to the 1.2 million really loaned) and to exonerate the more than 9 million of accumulated financing expenses and past due obligations that had gathered since the 1820s. Finally, this modified commitment was then totally repaid upon the heaviness of the Great Powers which connected a strong effect on Greece in the late nineteenth century. Finally, the bank finally recouped their money, yet with a long delay. The disadvantages for Greece were 50 years of commitment shade, outside impedance and continued with dismissal from global markets.

The crisis determination process would undoubtedly have been less extended and obligation help would have doubtlessly been allowed before if the leasers had been local. The legislature would have had more chances to weight residential holders into an understanding, and local lenders may have had more motivating forces to rebuild the obligation of their recently free nation. Rather, Greece confronted outside banks that made a special effort to utilize their money related and political impact to weight Greece for reimbursement and at last to a great extent prevailing with regard to doing as such.

After recovering market access in 1879, Greece obtained intensely from outside financial specialists, incompletely to meet commitments on the old obligation from the 1878 obligation settlement. Besides, in the mid-1890s, the administration contracted new advances abroad, ran high spending deficiencies and saw a crumple of its fares to Europe. The drop in fares was mostly because of the subsidence in Northern European nations additionally on the grounds that France, Germany, and Russia forced an obligation on currents, which represented 2/3 of

Greek fares at the time (current trades diminished by over half in the vicinity of 1891 and 1893). The outcome was a crumple of the conversion scale and expanding trouble to benefit the vast supply of outer obligation. Greece proclaimed a one-sided default in parliament in 1893 subsequent to losing market access abroad. Greece's monetary circumstance additionally crumbled therefore of its choice to participate in a war against the Ottoman Empire in 1897.

In April 1932, Greece leaves the Gold standard, bringing about a half deterioration of the drachma and a multiplying of outer obligation adjusting costs. In parallel, Greece singularly suspended all installments on outside obligation in April 1932.

In addition, the fourth financial crisis period, which originally broke out in the USA in autumn 2008 with the collapse of the Lehman Brothers investment bank, evolved into a global economic crisis as a consequence of interlinked globalized economies, causing the greatest recession period since the 1932s and a serious deterioration of public finances in most Western countries. Especially since its dramatic deterioration in October 2008, the global financial crisis started to negatively affect the Greek economy and particularly the Greek banking sector as well, leading to a considerable weakening of expectations in terms of liquidity and viability of the banking sector in general.

1.2 History Repeats Itself

In a research conducted in September 2015, two business analysts, Carmen Reinhart and Christoph Trebesch, examined the obligation crises that Greece has been through since the 1820s and freedom, from the point of view of reliance on foreign financing. The two creators, scholastics with a positive state of mind toward the industrialist framework, underscore how the obligation crises that have more than once hit Greece are for the most part the consequence of inflow of private remote capital took after by discontinuance of the stream. They support that the crisis influencing Greece and other fringe nations is not an open obligation crisis, yet rather an emergency of outer obligation. They take note of that the most prosperous period for the Greek economy was in the vicinity of 1950 and 2000, when financing was for the most part in light of the nation's interior assets and did not rely on outsiders.

Then again, they demonstrate that at every crisis of outside obligation that Greece has known (they list four noteworthy ones), when the capital spill out of outer private lenders (i.e., banks) has become scarce, the legislatures of a few European forces have to loan cash to Greece and safeguard the remote banks. The coalition of forces directed strategies to Greece that served their own advantages and those of a couple of enormous private ones manage an account with which they intrigued. Each time, the point of the strategies was to free up the monetary (budgetary) assets required to reimburse the obligation. This implied a lessening in social spending and open ventures. In this way through an assortment of ways and means, Greece and the Greek individuals have been precluded the practice from securing their sway. This is the manner by which Greece as a nation has been kept subordinate and fringe. My own particular recorded research. on Greek obligation since the 1820s, achieves conclusions that are not altogether different. Carmen Reinhart and Christoph Trebesch demand the requirement for an exceptionally critical lessening of Greek obligation, and they dismiss arrangements that comprise of rescheduling obligation reimbursements. For my part, in the present review, I presume that the obligation asserted by the Troika (the IMF, ECB, and the European Commission) must be wiped out.

1.3 The Modern Transformation of the Greek Banking System During the Fourth Crisis

During the last decade, a significant transformation has occurred in the financial environment. The key roles of the banking industry's operations are fierce competition, market liberalization, internalization and integration, technology expansion, development of new specialized financial products, and growth of financial derivatives' market (Ansi and Ben Ouda 2009). These challenges have led financial institutions to alter its operational context for effective deployment of all its prospects in the financial markets (Iatridis 2010). As mentioned by Bernanke and Blinder (1992), there is a strong association between the banks' liquidity provided and the measures of the economic activity.

Evidently, the potency and economic steadiness of the financial institutions play a critical role in national economies worldwide. On the one hand, a vigorous banking sector accelerates the economic growth of a nation. On the other hand, the financial instability in financial institutions causes numerous deficiencies in the macroeconomic level of a country (Kashyap and Stein 1994).

The Greek economy is characterized as bank based. The Greek banks, operating as mediating institutions, offer a wide range of services extending from portfolio management and suitable saving opportunities to exceptional funding prospects not only to individuals but also to enterprises, leading to modernization and growth alternatives (Zopounidis et al. 1995; Pasiouras et al. 2008).

In the last 8 years, the Greek banking system has changed radically (Dimitras et al. 2013, 2017). All the restrictions regarding the movement of capital and the terms of its operation have been suppressed. At the beginning of 2008, there were several banking institutions operating in Greece (Garefalakis et al. 2017). More specifically, there were 19 commercial and 16 cooperative banks supervised by the Bank of Greece, 23 branches of European credit institutions supervised by the Central Bank of their origin, five branches of credit institutions from countries outside the European Union (EU) also supervised by the Bank of Greece and one credit institution of special form (National Bank of Greece 2008). During the first two years of the fourth financial crisis, the Greek banks appeared to be more powerful than the banks abroad due to their lesser exposure to problematic elements of the asset (Garefalakis and Dimitras 2016). At the beginning of 2010, the markets began to dispute the viability of the Greek economy and the settlement of Greek bonds due to the monetary crisis. In order to overcome the increasing difficulty in borrowing, the Greek Government decided to adopt a financing program under the instructions of the EU and the International Monetary Fund (IMF). The lack of liquidity and creditability influenced intensely the Greek banking sector mainly during 2010. In 2010, most Greek commercial banks tried to improve their capital adequacy. Though cooperative banks did not, still they appeared less influenced by the economic crisis. It should be taken into account, however, that Greek cooperative banks own nearly twice the number of non-profit loans when compared with commercial banks (National Bank of Greece 2010).

In 2012, Greece decided and began the process of private sector involvement (PSI), a deal for the haircut on the Greek bonds. The PSI has resulted in the reduction of the nominal value of the Greek bonds at nearly 53.5%. This has a negative impact on the capital adequacy of the Greek banks that possess the specific bonds. The Greek Government, in collaboration with the EU and the IMF, has programmed the reinforcement of the capital adequacy of the Greek banks until the end of 2012. Most commercial banks in Greece present various financial activities, products, and services beyond the basic ones (credit and deposit) whereas the cooperative banks do not. Most cooperative banks in Greece were established in the last 8 years and appear to be more efficient than bigger banks due to the small size of their assets and the limited range of their activities. Commercial banks have more sources of liquidity and profits but increased operational cost due to their size which affects their profitability negatively, especially in periods of economic recession. in our days, only four Greek systemic banks and control collectively over 90% of the assets of the banking system, compared with 63% in 2008.

2 Suggestions—Conclusion

Fiscal adjustment is considered as a necessary amplification process or recovery reliability, and thus the solvency of national economic policy in the money and capital markets. It is also considered as a critical parameter to maintain the external borrowing costs low, and the economy has access to bond markets to refinance its debt obligations and growth. In the context of non-conventional economic thinking, the ideas of fiscal consolidation and the reliability does not have a particular role and importance beyond their ideological nature and use. So, conventional economic thinking fails to grasp that fiscal austerity is likely to destabilize the financial system, delaying fiscal consolidation or even leading to higher deficit rates and debt to GDP, substantially undermining the solvency and credibility of the national economy.

The plan to create an "asset management company" that will facilitate the sales of "red" loans over EUR 1 trillion found on the balance sheets of European banks is also proposed by the European Banking Authority (EBA). According to the head of the ESM, Klaus Regling: "the creation of a European bad bank that would absorb bad loans incurred by banks in many Eurozone countries is a 'precious' movement to improve the financial stability of the Eurozone." Regling welcomed the proposals of the EBA and called for some kind of support from the public sector in a pan-European "bad bank."

The new entity will have the aim of acquiring non-performing loans amounting 250 billion Euros from EU banks. The plan of the EBA does not provide for sharing of banking risks between the EU, stressing that it "is political advantage." Germany, the largest EU economy, is long opposed to plans of sharing the risks faced by banks, fearing that German taxpayers will end up paying the bank rescues in other countries. According to the data of EBA, Italy, Greece, Cyprus, Portugal, and Slovenia are among the EU countries with the highest "red" loans in the banking system. The «bad banks» with state support can provide a rapid consolidation of bank balance sheets. At the regional level, they will be able to create small domestic bad banks. Joint management will provide a satisfactory level of information on all collateral guarantee and the extent of operations carried out by each bank, in order to promote further commonly accepted solutions. A common stance, given the different guarantees, constitutes the greatest challenge that the banks are called to earn, either move the idea of joint management or not. Specifically, in Greece, it is proposed to create a «bad bank» from the four banks for problematic syndicated loans. Practically, it is a joint management and refinancing company as the loans remain on the balance sheet of banks. Banks will opt out of the "tank" troubled syndicated loans worth over 52 billion Euros (pp of them 40 billion relating to large and medium-sized enterprises), those that will go under shared management. The shape will be able either to manage internal loans or assign some of them to specialized platforms (National Bank of Greece 2011).

The shift of banks against the idea of joint management of difficult syndicated loans assigned by the market to the difficulty of achieving the reduction targets of non-performing exposures and rigid line taken on the matter by the supervisory authority. Banks pledge to reduce by the end of 2019 by 41 billion Euros from their current levels of NPEs and certainly cope with all the new defaults that will arise until then. Given that aggressive management is expected to start from 2017 when it is expected to complete the remaining changes in the institutional framework, banks will have three years (2017–2019) to reduce NPEs by 13.5 billion Euros per annum. If the new NPEs are taken into account, the amount of the annual arrangements outruns, at least for 2017, 15 billion Euros. This year the new NPEs are expected to reach 5 billion Euros, but the rate of creating new is projected to slow gradually from 2017.

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The Market Reaction on Ex-return of Capital Dates During Financially Constraint Periods

Apostolos Dasilas

1 Introduction

Since the seminal paper of Miller and Modigliani (1961) according to which under a perfect market with no frictions (i.e., taxes, commissions, etc.) the value of a firm is unaffected by its dividend policy, several empirical and theoretical studies have been published to explicate the dividend policy puzzle. Among the issues that have been at the epicenter of the academic research was the stock price behavior around ex-dividend dates, the so-called ex-dividend day phenomenon, where stock prices fall by less than the amount of the dividend distributed. This price imbalance surrounding ex-dividend dates has been proven to furnish notable gains to those trading around these dates and stimulating more investors to capture dividends.

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Campbell and Beranek (1955) were the first researchers who found that stock prices did not fall by the dividend amount around ex-dividend dates, using data from a small sample of NYSE firms. Since then, the ex-dividend phenomenon intrigued several academics to gauge the wealth effects emanating from the stock price abnormality surrounding ex-dates and delve into the drivers of this market reaction. The first hypothesis that was put forward to decode the market reaction around ex-dates was the tax-effect of Elton and Gruber (1970) according to which the favorable tax treatment of capital gains compared to dividends creates dividend clienteles where low (high) dividend yield stocks are held by high (low) tax bracket investors (Bali and Francis 2016). However, the tax-effect hypothesis has been disputed by several authors. First by Kalay (1982) who claimed that the differences detected in stock price drops can be explained by the transaction costs of potential arbitrageurs (Munoz and Rodriguez 2017). In particular, when transaction costs are low enough, any deviation from a one-for-one price drop-to dividend relationship creates an arbitrage opportunity for those investors facing low transaction costs (i.e., stock brokers, traders, endowments, etc.). This explanation has been known as “the short-term trading hypothesis”. Finally, a strand of studies has proposed market microstructure explanations such as bid-ask spread, price discreteness due to minimum tick sizes, or absence of electronic settlement systems (Asimakopoulos et al. 2015).

This study examines the stock price reaction and the ensuing wealth effects surrounding ex-dates of a special profit distribution known as a return of capital which is considered to be an alternative cash distribution to shareholders. In specific, the return of capital is a cash payment to shareholders from capitalized retained earnings that are tax free and are paid out in lieu of cash dividends. This special profit distribution became the dominant mechanism of payout policy for the majority of the Greek listed firms since 2009 when for the first time, dividend income was taxed at both corporate and investor level, and the sovereign debt crisis of Greece was on the way. Very soon, the tax rate on dividends saw an unprecedented increase that led most of the profitable firms to seek alternative ways of distributing profits to their shareholders such as the return of capital. Using a unique dataset of 149 returns of capital that the Greek listed firms distributed between 2002 and 2015, I explore the stock price behavior surrounding the ex-dates and gauge the wealth effects using the classical event study methodology. The investigation of the stock price behavior on ex-return of capital dates is extended in the pre- and post-debt crisis period in order to identify potentially different market reaction during these two discernible periods. Finally, I delve into the drivers of the stock price abnormality surrounding the ex-return of capital dates.

The Greek capital market presents some unique institutional characteristics that are rarely observed in other developed markets. According to Asimakopoulos et al. (2015) and Dasilas (2009), market microstructure impediments (i.e., bid-ask spread, market makers, price discreteness, tick size, and limit order adjustment mechanism) that prevent stock prices from falling the full amount of dividend distributed on ex-dividend dates are not present. Moreover, until 2008, both dividends and capital gains were tax free. A flat tax rate of 10% on dividend income was imposed for the first time in 2009. Since then, the tax treatment of dividends underwent several changes raising the tax rate on dividend income to 25% and in some cases even more (based on the tax bracket of investors). During the whole period, capital gains were tax free. The heavy tax treatment of dividends coincided in a period when Greece was inflicted by the sovereign debt crisis; the bank lending was squeezed, and the access to international markets was interrupted. At the same time, there were massive sell-offs on the part of investors thus driving down the market value of almost all Greek listed firms to rock-bottom levels. In such adverse investment environment, the distribution of tax-free cash money to shareholders was pivotal for the Greek listed firms in an attempt to keep investors' interest alive. The appropriate mechanism was the payment of return of capital to shareholders.

This study contributes to the existing literature in several ways. To the best of my knowledge, this is the first study that investigates the market reaction of this special cash payment (i.e., return of capital) to investors. Furthermore, this is the first study that gauges the wealth effects of cash payments after the outbreak of the sovereign debt crisis in Greece. Moreover, it provides a better understanding of the market pricing in a tax-free environment that offers profitable strategies to investors to exploit capital gains surrounding cash distributions. Finally, the current study explains how firms can disgorge tax-free cash streams to their shareholders taking advantage of the loops of the corporate law.

The remainder of this paper is organized as follows. Section 2 presents a brief literature review regarding the ex-dividend day phenomenon. Section 3 describes the legal framework of the profit distribution in Greece. Section 4 outlines the methodology and data employed in this study. Section 5 presents the empirical results, and Sect. 6 summarizes the main finding of the study and discusses their implications.

2 Prior Research

The empirical investigation of the stock price reaction on ex-dividend days dates back to 1955 when Campbell and Beranek, using data from NYSE stocks, found that stock prices dropped 90% of the dividend amount on ex-dates. Five years later, Durand and May (1960) found that the average price change from the cum-dividend day (the last day that the stockholder has the right to receive the dividend) to the ex-dividend day was 4% less than the dividend distributed by the American Telephone and Telegraph stock (AT&T). However, the aforementioned studies did not examine the determinants of the ex-dividend day phenomenon.

The study of Elton and Gruber (1970) set the foundations for the tax-effect or long-term trading' hypothesis according to which the unfavorable tax treatment of dividends vis-`a-vis capital gains was responsible for the smaller stock price drop compared to the dividend paid on ex-dividend dates. Elton and Gruber (1970) claimed that an investor would be indifferent to sell his stock that pays dividends on the cum-dividend date or on the ex-dividend date if the following relationship holds:

$$P_c - (P_c - P_o) * t_g = P_e - (P_e - P_o) * t_g + D * (1 - t_d) \quad (1)$$

Rearranging Eq. (1) we get:

$$\frac{P_c - P_e}{D} = \frac{1 - t_d}{1 - t_g} \quad (2)$$

where, P_c is the stock price on the last cum-dividend day, P_e is the stock price on the ex-dividend day, P_o is the price at which the stock was acquired, D is the total dividend amount, and t_d and t_g are the tax rates on dividend income and capital gains, respectively. According to Elton and Gruber (1970), the ratio $\frac{P_c - P_e}{D}$ (or $\Delta P/D$) reflects the marginal tax rates of the marginal shareholders. The authors also found that the drop-off ratio ($\Delta P/D$) generally increases with dividend yield, suggesting that investors in lower tax brackets prefer stocks with higher dividend yields, while higher-bracket investors prefer lower-yield stocks, thus confirming Miller and Modigliani's (1961) dividend clientele effect.

The tax-effect hypothesis of Elton and Gruber (1970) was disputed by Kalay (1982) who proposed the short-term trading hypothesis according to which short-term, tax-neutral traders would arbitrage away any deviation from the theoretical value of the drop-off ratio (Bali and Francis 2016). In particular, if the expected stock price drop is greater than the dividend, the investor could sell short cum-dividend and buy back ex-dividend. In this case, the investor gains the amount of the price drop since he or she buys back at a lower price to close the short position (Dasilas 2009). If the stock price drop is less than the dividend, the investor will buy cum-dividend and sell ex-dividend.

Apart from the heterogeneous tax treatment of dividend income and capital gains and the existence of transaction costs, market microstructure impediments (such as tick size, bid-ask spread and limit order adjustment mechanism) were also propounded to explain the ex-dividend day phenomenon. Bali and Hite (1998) employed a sample of both cash dividends and nontaxable distributions from the NYSE and AMEX and found that the ex-dividend day price drop is restricted by tick size. This happens because the market systematically rounds down the dividend to the nearest tick, while the dividend is continuous. In this case, the stock price on the ex-dividend day will be less than the dividend distributed thus furnishing positive abnormal returns on the ex-day (Asimakopoulos et al. 2015).

Frank and Jagannathan (1998) explored the ex-dividend day stock price behavior on the Hong Kong Stock Market (HKSE), where neither dividends nor capital gains were taxed,[1] and there were no market makers until 1993. Their results revealed that stock prices dropped on the ex-dividend day by half the amount of dividend paid. The authors attributed this to the bid-ask spread effect. This happens because the process of collecting and reinvesting dividends is nuisance for the average investor. Contrarily, market makers prefer to receive dividends and buy stocks on the cum-dividend day and resell them after the stock goes ex-dividend. Therefore, the price drop on the ex-dividend day is caused by the bid-ask bounce since most of the transactions occur at the bid price before the ex-dividend date and at the ask price on the ex-dividend date. This mechanism is responsible for the existence of positive abnormal returns surrounding ex-days. Graham et al. (2003) and Jakob and Ma (2004) supported the bid-ask bounce as an explanation of the ex-dividend stock price anomaly. They found that as the discreteness was eliminated in the US markets, the ex-dividend price drop anomaly was actually increased, contrary to what the price-discreteness hypothesis predicted.

Jakob and Ma (2007) examined stocks listed on the Toronto stock exchange (TSX) and concluded that the lack of an order adjustment mechanism along with relatively low trading volume resulted in incomplete price adjustments on ex-dividend days. Akhmedov and Jakob (2010) examined the ex-dividend day behavior of stocks listed on the Copenhagen Stock Exchange, and their findings were consistent with the limit order adjustment explanations of Dubofsky (1992) and Jakob and Ma (2007). In particular, Dubofksy (1992) investigated the effect of NYSE Rule 118 and AMEX Rule 132 on the ex-dividend day stock price anomaly. According to NYSE 112 and AMEX 132, open limit orders to buy stocks are reduced by the cash dividend amount on ex-dividend days. If the resulting price is not a tick multiple, it is further lowered to the next tick. Prices in limit sell orders are not adjusted. For example, if the tick size is $0.125 ($1/8) and the dividend is $0.15, then the price of limit buy orders will be adjusted down by $0.25 and limit sell orders will not be adjusted.

Dasilas (2009) delved into the ex-dividend stock price and trading volume behavior in the Greek stock market for the period 2000–2004. During this period, both dividend income and capital gains were tax free, and market makers were essentially absent from the market. Employing different methods to gauge the stock price drop on ex-dates, he found that the mean drop-off ratio was significantly less than the amount of the dividend paid. Moreover, he found excess returns of more than 9% on the ex-dividend day. By sorting the ex-dividend day abnormal returns and trading volume according to dividend yield and transaction costs, the author found a positive relationship between the ex-dividend day abnormal returns, transaction costs, and dividend yield. On the other hand, the relationship between the ex-dividend day abnormal trading volume and dividend yield was positive, whereas that between the ex-dividend day abnormal trading volume and transaction costs was negative. These results were in line with the predictions of the short-term trading hypothesis as described by Lakonishok and Vermaelen (1986). Finally, the author performed a cross-sectional regression analysis and found that dividend yield and transaction costs were the main determinants of stock price behavior on ex-dividend days.

More recently, Asimakopoulos et al. (2015) investigated the ex-dividend day stock price behavior for a sample of 50 listed firms on the Athens Stock Exchange (ASE) from 1996 to 2005. The authors divided the examination period into two subperiods; the first subperiod (1996–2000) was referred to the period before the introduction of the new ex-dividend day price adjustment method,[2] and the second period (2001–2005) comprised the years after the initiation of the adjustment method. The focus of the study was the stock price and trading volume around ex-dividend dates as well as the determinants of the abnormal behavior around these dates. Asimakopoulos et al. (2015) demonstrated that the new adjustment method significantly altered the ex-dividend day stock price behavior on the ASE. In fact, the drop-off ratio increased from 37 to 62%, and the ex-day abnormal returns decreased from 2.26 to 1.18%, though statistically significant as they were before the initiation of the adjustment method. Abnormal volume remained unaltered between the two periods, though slightly smaller in the period 2001–2005. The authors did not observe any clientele effect during the whole period; however, the share illiquidity was found to be the dominant driver of ex-day returns.

The current study examines the ex-day stock price behavior of a special cash distribution knows as return of capital. This profit distribution is tax free for the whole period under examination. Capital gains are also tax free and therefore, the tax-effect hypothesis of Elton and Gruber (1970) could not find fertile ground for the Greek listed firms. Moreover, the tick size is minimal for the majority of stocks traded on the ASE, thus precluding the existence of the tick size effect and the price discreteness on ex-dates. Market making was first introduced in June of 2001 and remains limited to very few large firms based on market capitalization.[3] Finally, the ASE operates in an electronic system; however, there is no adjustment mechanism that affects the price drop on the ex-dividend day as described by Dubofsky (1992). In such tax-neutralized environment with the absence of microstructure impediments, the so-called ex-day stock price phenomenon for returns of capital should not exist, and the implied drop-off ratio should be equal to 1.

3 Institutional Framework

3.1 Distribution of Profits

Unlike the USA and the UK where dividends are paid on a quarterly and semi-annually basis respectively, dividends in Greece are paid on a yearly basis. Moreover, the Greek corporate Law 148/1967 (as modified by Laws 2753/1999, 2789/2000 and 3460/2006) clearly posits that at least 35% of net profits should be distributed to shareholders as minimum (first) dividend after deducting regular reserves. Minimum dividend distribution does not take place when 70% of the shareholders vote for no distribution at the annual shareholders' meeting. This mandatory dividend distribution is an institutional peculiarity that deprives much of the surprising component of the payout policy of the Greek listed firms.

Apart from the commonly known cash distribution in the form of dividends, an alternative conduit of cash disgorgement to shareholders has been emerged in the last 15 years. In particular, in 2002, Iaso medical center was the first Greek listed company that distributed a cash payment in the form of return of capital to its shareholders. Return of capital is a special cash distribution that occurs when firms capitalize retained earnings of the current and previous years' profits and at the same time decide on decreasing equities by the amount of capitalized retained earnings. The decrease of equities is materialized through the disgorgement of cash to shareholders in the form of return of capital. Return of capital is neither a special nor a script dividend as documented by prior studies (e.g., Balachandran et al. 2008).

3.2 Dividends, Return of Capital, and Taxation

The tax treatment of dividends underwent dramatic changes that resulted in the upsurge of return of capital as the prevailing payout mechanism of the Greek listed firms. An important turning point was the introduction of Law 3842/2010 according to which dividends were taxed at 20% and were further burdened by additional tax applying to the investor's tax bracket as an individual which could bring the overall taxation to 45%. Corporate tax rates as well as tax on dividends have undergone significant changes through this turbulent period partly coinciding with the sovereign debt crisis and the pressure on the Greek government to raise additional corporate taxes while maintaining an attractive investor environment. Until 2008, dividends were not liable to tax other than the tax applying to corporate pretax profits. In 2009, dividend income was taxed by a further 10% (Law 3697/2008), and in 2011, this tax raised to 25% (Law 3943/2011), while individual further taxation still held for dividend recipients. In 2012, the new introduced legislation (Law 4038/2012) called for no further tax for dividend recipients, while the taxation for distributed profits remained at 45% (25% corporate tax plus an additional 20% for distributed profits). Distributed profits of 2013 were taxed at 35% (25% corporate tax plus an additional 10% for distributed profits). Since 2016, the corporate tax is 29%, and dividends are taxed by additional 15%.[4]

While the preceding analysis lends support to an ever changing dividend taxation environment, the return of capital has experienced a fairly stable tax treatment since it does neither entail the further tax included in distributed profits nor has it ever been taxed at the individual shareholder level given the tax bracket applying. For this reason, the return of capital has been considered an attractive cash distribution on the part of companies in a period that both corporate profits and dividend income were heavily taxed, while returns of capital were still tax free.

3.3 Market Microstructure Features

The ASE presents some market microstructure idiosyncrasies that are rarely observed in other capital markets. The ASE is an order-driven electronic market that allows multiple market makings for all stocks. Market making was initially introduced in June 2001 and was opted by a small number of listed firms.[5] Therefore, bid-ask spreads were available for a limited number of listed companies. The ASE has adopted the decimalized quotation of both stock prices and cash distributions,[6] and therefore, the price discreteness hypothesis of Bali and Hite (1998) could not find fertile ground in Greece. Moreover, tick size is €0.01 for stocks with closing prices between €0.01 and €2.99, €0.02 for stocks with closing prices between €3 and €55.99, and €0.05 for stocks with closing prices above €60.[7] However, since October 31, 2007, Greek stocks are experiencing a downward trend reaching rock-bottom levels in June of 2012 and in February of 2016 with a handful of stocks trading above of €60. Therefore, tick size cannot be considered as a significant microstructure impediment on ex-dividend days. Since 1996, commission costs have been deregulated and are freely set by brokerage firms. However, the Association of Securities Firms has set a maximum percentage of 1%. In fact, for transactions less than €8800, the commission does not exceed 0.5%, while for large transactions by institutional investors commission fees are between 0.10 and 0.20%. According to the Laws 2579/1998 and 3296/2004, a flat tax is imposed on every stock sale equal to 0.15%.

The tax is calculated on the basis of trade value of the stocks sold and is withheld upon the settlement of the transactions by the ASE. Since April 1, 2011, the flat tax is equal to 0.20% (Law 3943/2011). Finally, the automatic adjustment of stock prices on ex-dividend days ended on April 2, 2001. Therefore, the limit order adjustment mechanism as described by Dubofsky (1992) does not affect stock prices on ex-return of capital dates in Greece.

4 Research Design

4.1 Sample

The investigation of the ex-day stock price behavior of returns of capital covers the years between 2002 and 2015. Searching on the Web site of the ASE, I extracted the ex-days and the amount of the return of capital for all Greek listed firms. I identified 149 returns of capital which are the whole population. Both daily closing and opening prices for the listed firms distributing returns of capital were extracted from Bloomberg. In particular, stock price data were downloaded for the period commencing 250 days prior and ending 10 days subsequent to the ex-day. For the same period, I downloaded closing stock prices for the main stock index of the ASE. There were no missing data for the universe of returns of capital. Table 1 presents the distribution of returns of capital. In 2002, the first return of capital was distributed by Iaso medical center. Until 2008, 41 (27.5%) returns of capital had been distributed. The introduction of the flat tax rate in 2009 and the subsequent changes in the tax treatment of the dividend income provided the impetus to the Greek listed firms to start disgorging tax-free returns of capital to their shareholders. For the period 2009–2015, the number of returns of capital was 108 (72.5%) with the highest number of observations (23) occurring in 2011. In sum, the outbreak of the sovereign debt crisis that hit severely the Greek economy coincided with the introduction of taxes on dividends and the increase of return of capital distributions.

Table 1 Returns of capital distribution per year

Year	No.	%
2002	1	0.7
2003	2	1.34
2004	3	2.01
2005	12	8.05
2006	7	4.70
2007	8	5.37
2008	8	5.37
2009	10	6.71
2010	12	8.05
2011	23	15.44
2012	19	12.75
2013	16	10.74
2014	13	8.72
2015	15	10.07
Total	149	100

4.2 Methodology

To investigate the stock price behavior around the ex-return of capital dates, I follow the model proposed by Elton and Gruber (1970) according to which in a market without market frictions such as transaction costs and taxes, the stock price fall on the ex-dividend day (P_e) should be equal to the amount of the return of capital (*RC*), that is, $P_e - P_c = RC$, where P_c is the price on the cum-return of capital day. Dividing both sides by *RC*, I get the raw price ratio (*RPR*) which theoretical value should be equal to one:

$$RPR = \frac{P_c - P_e}{RC} = 1 \tag{3}$$

Following prior studies[8] I calculate *RPR* using closing prices both on cum- and ex-return of capital days ($RPR_{c\text{-}c}$). Furthermore, *RPR* is calculated using closing prices on cum-return of capital days and opening prices[9] on ex-return of capital days ($RPR_{c\text{-}o}$). Finally, *RPR* is computed using closing prices on both cum- and ex-return of capital days, but adjusting the latter for stock market movements. Kalay (1982), Michaely (1991) and Naranjo et al. (2000) well recognized that the closing price on ex-days is affected by the stock's normal daily return and attempted to adjust for this drift. Following prior research, I address this problem by adjusting the ex-return of capital day closing price for the daily market return (R_m) as proxied by the main index of the ASE. This ratio is known as the market-adjusted price ratio (*MAPR*) and is computed as follows:

$$MAPR = \frac{P_c - [P_e/(1 + R_m)]}{RC} \tag{4}$$

Several researchers (i.e., Eades et al. 1984; Barclay 1987; Michaely 1991; Boyd and Jagannathan 1994; Bell and Jenkinson 2002) have asserted that the traditional ratio *RPR* suffers from heteroskedasticity and independence. Heteroskedasticity arises because the ratio is scaled by the dividend amount, which means that the weight given to changes in observations where dividends are low is excessive (Dasilas 2009). For that reason, I also compute the price change from the cum- to ex-return of capital day as scaled by the cum-return of capital day $\frac{P_c - P_e}{P_c}$ (or $\Delta P/P$). Following Milonas et al. (2006) and Dasilas (2009), I define this ratio as the raw price drop ratio (*RPDR*):

$$RPDR = \frac{P_c - P_e}{P_c} \tag{5}$$

Similar to RPR, RPDR is calculated in three ways. First, I calculate *RPDR* using (a) closing prices both on cum- and ex-return of capital days ($RPDR_{c\text{-}c}$), (b) closing prices on cum-return of capital days and opening prices on ex-return of capital days ($RPDR_{c\text{-}o}$), and (c) closing prices on both cum- and ex- return of capital days by adjusting the latter for stock market movements. This ratio is called the market-adjusted price drop ratio (*MAPDR*) and is calculated as follows:

$$MAPDR = \frac{P_c - [P_e/(1 + R_m)]}{P_c} \tag{6}$$

All raw price drop ratios have a theoretical value equal to the return of capital yield (*RCY*), which is computed as the return of capital per share divided by the stock price on the last cum- return of capital day.

$$RCY = \frac{RC}{P_c} \tag{7}$$

To examine the market reaction on and around ex-return of capital days, the standard event study methodology is employed. In particular, I estimate the stock price reaction for an event window of 20 days around the ex-dividend day ($t = 0$), that is, from day -10 to day +10. In particular, abnormal returns (*AR*) around ex-return of capital days are computed using the market model and the market-adjusted return model. Market model parameters are estimated by regressing (using OLS) the stock returns on the market return proxied by the main index of the ASE for the estimation period that ranges from $t-250$ to $t-11$, where $t = 0$ is the ex-return of capital date.

I compute average abnormal returns (*AAR*) as below:

$$AAR_t = \sum_{i=1}^{N} \frac{AR_{it}}{N} \tag{8}$$

where, N is the number of returns of capital.

I also calculate cumulative abnormal returns (*CARs*) as the sum of the abnormal returns for a specific period T:

$$CAR_{iT} = \sum_{t=1}^{T} AR_{it} \tag{9}$$

Cumulative abnormal returns are computed for the following event windows: (-10, -1), (+1, +10), (-5, -1), (+1, +5), (-1, +1), and (-1, 0).

Following prior studies,[10] we regress abnormal returns on ex-dividend days (AR_0) against a number of independent variables, including systematic risk (*BETA*), *RCY*, transaction costs (*TC*), and a dummy variable (Crisis) which takes the value of 1 for the period that covers Greece's sovereign debt crisis (2010–2015) and zero otherwise (2002–2009). The cross-sectional model is as follows:

$$AAR_{0,i} = a_0 + a_1 * BETA_i + a_2 * RCY_i + a_3 * TC_i + a_4 * Crisis_i + e_i \tag{10}$$

Systematic risk (*BETA*) is estimated 240 days before the event window (−250, −11), employing the market model. An arbitrageur is looking for an extra compensation (risk premium) for taking the risk to trade around ex-days, and therefore, a positive coefficient on systematic risk is expected. The *RCY* is measured as the ratio of the return of capital paid (*RC*) over the stock price on the cum-return of capital day (P_c). Lakonishok and Vermaelen (1986) and Karpoff and Walkling (1988) claimed that higher-yield stocks attract more short-term trading since the net benefits (after deducting transaction costs) of the dividend capture are larger. Therefore, a positive association between ex-day abnormal returns and *RCY* is expected. Following Karpoff and Walkling (1988), Naranjo et al. (2000), Dhaliwal and Zhen Li (2006), Yahyaee et al. (2008), Dasilas (2009) and Asimakopoulos et al. (2015), transactions costs are proxied by the inverse of the stock price on the last cum-return of capital day ($1/P_c$). These studies argue that a stock with high level of transaction costs prevent dividend (or return of capital) capture. Therefore, a positive relationship between ex-day abnormal returns and transaction costs is expected.

5 Empirical Findings

5.1 Drop-off Ratios

Panel A of Table 2 provides descriptive statistics for the entire population of returns of capital. The mean (median) return of capital per share is €0.413 (€0.125) much higher than the mean (median) dividend per share of €0.064 (€0.050) found by Dasilas (2009) for the period 2000–2004. The mean (median) *RCY* is 16.2% (7.1%) which is also higher than that found by Dasilas (2009) and Asimakopoulos et al. (2015). Panels B and C show descriptive statistics for the periods 2002–2009 and 2010–2015, respectively. The return of capital amount (€0.829 vs. €0.201) and yield (0.241% vs. 0.120%) in the period before the outbreak of the sovereign debt crisis period is remarkably higher compared to the crisis period, thus confirming the adverse consequences of

Table 2 Descriptive statistics

Panel A: Full period (2002–2015)					
$N = 149$	*RC*	*RC Yield*	P_c	P_{ex}	P_c–P_{ex}
Mean	0.413	0.162	4.205	4.246	−0.041
Median	0.125	0.071	2.473	2.550	−0.024
St. deviation	0.974	0.252	4.855	4.919	0.183
Max	10.920	1.338	25.393	26.058	0.776
Min	0.020	0.003	0.322	0.336	−1.105
Panel B: Before Greece's debt crisis period (2002–2009)					
$N = 50$	*RC*	*RC Yield*	P_c	P_{ex}	P_c–P_{ex}
Mean	0.829	0.241	5.586	5.602	−0.016
Median	0.500	0.164	3.443	3.407	0.015
St. deviation	1.561	0.304	5.587	5.655	0.233
Max	10.920	1.338	25.393	26.058	0.458
Min	0.020	0.005	0.620	0.600	−1.105
Panel C: After Greece's debt crisis period (2010–2015)					
$N = 99$	*RC*	*RC Yield*	P_c	P_{ex}	P_c–P_{ex}
Mean	0.201	0.120	3.486	3.540	−0.054
Median	0.100	0.054	2.026	2.043	−0.034
St. deviation	0.269	0.211	4.285	4.355	0.152
Max	1.460	1.238	21.221	21.840	0.776
Min	0.020	0.003	0.322	0.336	−0.619

Note RC is the return of capital per share. *RC yield* is the return of capital yield measured as the ratio of return of capital over the price on the cum-return of capital day P_c is the stock price on the cum-return of capital day and P_{ex} is the stock price on the ex-return of capital day. P_c–P_{ex} is the difference between the stock price on the cum-and ex-return of capital days

the debt crisis to shareholders. Finally, the mean closing stock price on the cum-return of capital date is €5.586 in the first period, whereas it is equal to €3.486 in the second period. Similar stock price drop between the two periods is observed when looking at the closing prices on the ex-return of capital dates (€5.602 vs. €3.540). Interestingly, the stock price difference between cum- and ex-dates is negative (€−0.016) in the period before debt crisis implying that shareholders buying stocks on cum-dates benefit more than those buying on ex-dates.

Table 3 presents both theoretical and observed mean and median values for $RPR_{c\text{-}c}$, $RPR_{c\text{-}o}$, *MARP*, $RPDR_{c\text{-}c}$, $RPDR_{c\text{-}o}$, and *MAPDR*. The differences of the means from their corresponding theoretical values are

Table 3 Ex-dividend day stock price behaviour

Panel A: Whole period (2002–2015)						
$N = 149$	Theoretical value	Mean	*t*-statistic	Theoretical value	Median	Wilcoxon signed rank *p*-value
$RPR_{c\text{-}c}$	1.000	−0.365***	−16.49	1.000	−0.143***	0.000
$RPR_{c\text{-}o}$	1.000	−0.406***	−9.59	1.000	−0.133***	0.000
MAPR	1.000	−0.356***	−14.08	1.000	−0.102***	0.000
$RPDR_{c\text{-}c}$	0.161	−0.012***	−48.54	0.068	−0.011***	0.000
$RPDR_{c\text{-}o}$	0.161	−0.012***	−39.91	0.068	−0.010***	0.000
MAPDR	0.161	−0.009***	−46.68	0.068	−0.013***	0.000
RC Yield		0.161			0.068	
Panel B: Before Greece's debt crisis period (2002–2009)						
$N = 50$	Theoretical value	Mean	*t*-statistic	Theoretical value	Median	Wilcoxon signed rank *p*-value
$RPR_{c\text{-}c}$	1.000	−0.175***	−8.32	1.000	0.013***	0.000
$RPR_{c\text{-}o}$	1.000	−0.241***	−3.70	1.000	−0.011***	0.000
MAPR	1.000	−0.114***	−8.56	1.000	0.023***	0.000
$RPDR_{c\text{-}c}$	0.241	0.001***	−43.14	0.164	0.003***	0.000
$RPDR_{c\text{-}o}$	0.241	−0.001***	−33.16	0.164	−0.001***	0.000
MAPDR	0.241	0.004***	−42.55	0.164	0.004***	0.000
RC Yield		0.241			0.164	
Panel C: After Greece's debt crisis period (2010–2015)						
$N = 99$	Theoretical value	Mean	*t*-statistic	Theoretical value	Median	Wilcoxon signed rank *p*-value
$RPR_{c\text{-}c}$	1.000	−0.461***	−14.44	1.000	−0.266***	0.000
$RPR_{c\text{-}o}$	1.000	−0.487***	−10.79	1.000	−0.230***	0.000
MAPR	1.000	−0.476***	−11.61	1.000	−0.291***	0.000
$RPDR_{c\text{-}c}$	0.120	−0.019***	−31.52	0.054	−0.017***	0.000
$RPDR_{c\text{-}o}$	0.120	−0.018***	−26.13	0.054	−0.016***	0.000
MAPDR	0.120	−0.016***	−29.99	0.054	−0.019***	0.000
RC Yield		0.120			0.054	

Notes $RPR_{c\text{-}c}$ is the raw price ratio using closing prices both on cum- and ex-return of capital days. $RPR_{c\text{-}o}$ is the raw price ratio using closing prices on cum-return of capital days and opening prices on ex-return of capital days. *MARP* is the market-adjusted price ratio using closing prices both on cum- and ex-return of capital days, but adjusting the latter for market movements. $RPDR_{c\text{-}c}$ is the raw price drop ratio using closing prices both on cum- and ex-return of capital days. $RPDR_{c\text{-}o}$ is the raw price drop ratio using closing prices on cum-return of capital days and opening prices on ex- return of capital days. *MAPDR* is the market-adjusted price drop ratio using closing prices both on cum- and ex-return of capital days, but adjusting the latter for market movements. *RC Yield* is the return of capital yield measured as the ratio of return of capital over the price on the cum-return of capital day. *** denotes statistically significant at the 0.01 level tested using the *t*-test, and the differences of the medians from their theoretical values are tested employing the Wilcoxon signed rank test. Panel A reports the results for the whole period examined (2002–2015). The results document a mean (median) $RPR_{c\text{-}c}$ of −0.365 (−0.143), statistically different from the theoretical value of unity at the 1% level. The mean (median) $RPR_{c\text{-}o}$ is −0.406 (−0.133), statistically different from its theoretical value of unity at the 1% level. Similarly, the mean (median) *MARP* is −0.356 (−0.102), statistically different from unity at the 1% level. The above results imply that stock prices increase on ex-dates, and this is in sharp contrast with prior studies which display that stock prices drop on ex-dates.

$RPDR_{c\text{-}c}$, $RPDR_{c\text{-}o}$, and *MAPDR* also document a negative sign when are tested against their theoretical value (*RC yield*). In particular, the mean (median) $RPDR_{c\text{-}c}$, $RPDR_{c\text{-}o,}$ and *MAPDR* is −0.012 (−0.011), −0.012 (−0.010), and −0.009 (−0.013), respectively, all statistically different from the *RC yield*. Overall, the above results show that stock prices do not drop on ex-dates. This result is at odds with those found by Dasilas (2009) and Asimakopoulos et al. (2015) who documented positive but lower than unity drop-off ratios. This unexpected stock price behavior around ex-dates implies that the big winners of trading around these dates are those who buy on cum-dates and sell on ex-dates taking advantage of the price appreciation on ex-dates and the capture of the amount distributed.

Panel B of Table 3 reports the results from all drop-off ratios in the pre-debt crisis period. All *RPR*s display a negative value between −0.241 and −0.114, statistically different from unity. *RPDR*s are also statistically different from the RC yield (0.241%). Panel C presents the results from the ongoing debt crisis period. Again, all *RPR*s are statistically different from their theoretical value. Interestingly, the mean of *RPR*s is around −0.5 implying that stock prices increase even more on ex-dates compared to the pre-debt crisis period. This is more apparent when comparing the RC yields between the two periods. In fact, in the pre-debt crisis period, the mean RC yield is 0.241%, while that of the debt crisis period is 0.120%. In other words, shareholders trading around ex-return of capital dates reap more benefits in the debt crisis period. This can be attributed to selling pressures on the part of investors during periods of financial turmoil and liquidity constraints. Under such harsh economic conditions, risk lover investors seem to be compensated by high amounts of distributed profits.

5.2 Stock Price Behavior

Table 4 reports the stock price behavior 20 days surrounding ex-return of capital days for the whole period under examination. For robustness reasons, the market reaction around ex-dates is gauged by the market model as well as by the market-adjusted return model. The results show an average abnormal return (*AAR*) that exceeds 12% as measured by the two return models, statistically significant at the 1% level. This market reaction is considerably higher than that found by Dasilas (2009) (0.968%) and Asimakopoulos et al. (2015) (2.257 and 1.179%) who investigated the ex-dividend day stock price behavior in Greece. Moreover, the stock price response on ex-return of capital dates is stronger compared to any other known studies around the world.

As already mentioned, returns of capital and capital gains were tax free for the whole period under examination. Moreover, the decimalized quotation of stock prices and distributed amounts, the relatively small tick size and the absence of an order adjustment model on ex-dates preclude the tax-effect hypothesis of Elton and Gruber (1970), the price discreteness hypothesis of Bali and Hite (1998), and the limit order adjustment mechanism of Dubofsky (1992). Even the argument of Frank and Jagannathan (1998) that bid-ask spreads are responsible for the ex-dividend stock price anomaly could not find empirical support in the current study due to the weak presence of market making for the majority of Greek stocks. The only hypothesis that seems to offer a possible explanation is the short-term trading hypothesis of Kalay (1982). I assess the impact of the short-term trading on ex-dividend day returns by analyzing the stock price behavior around the ex-return of capital dates. Kalay (1982) asserts that if short-term traders capture dividends, then ex-dividend day returns should not be confined solely to ex-dividend dates. Instead, they should be positive on the pre ex-dividend date and negative on the post-ex-dividend date to reflect the buying

Table 4 Abnormal returns around ex-return of capital days

$N = 149$	Market model		Market-adjusted	
Days	AAR%	*t*-statistic	AAR%	*t*-statistic
−10	0.117	0.53	0.488	1.38
−9	−0.178	−0.81	−0.470	−1.39
−8	0.141	0.64	0.061	0.27
−7	0.306	1.39	0.388	1.61
−6	0.634***	2.88	0.549***	2.57
−5	−0.007	−0.03	−0.081	−0.34
−4	−0.213	−0.97	0.126	0.49
−3	0.456**	2.07	0.803***	3.16
−2	0.320	1.45	0.638**	2.48
−1	0.397*	1.80	0.668*	1.72
0	12.390***	5.29	12.355***	8.81
1	−0.662***	−3.01	−0.594*	−1.67
2	−0.067	−0.31	0.090	0.35
3	0.383*	1.74	0.306	1.24
4	−0.263	−1.20	−0.029	−0.12
5	−0.146	−0.66	−0.112	−0.49
6	0.068	0.31	−0.102	−0.39
7	−0.069	−0.31	−0.169	−0.69
8	−0.493**	−2.24	−0.724***	−2.56
9	0.033	0.15	0.120	0.50
10	0.084	0.38	0.109	0.55
	CARs %	*t*-statistic	CARs %	*t*-statistic
CAR (−10 −1)	1.973***	2.84	3.170**	2.52
CAR (+1 +10)	−1.133	−1.63	−1.105	−1.08
CAR (−5 −1)	0.953*	1.94	2.154**	2.50
CAR (+1 +5)	−0.756	−1.54	−0.339	−0.46
CAR (−1 +1)	12.124***	7.40	12.429***	8.54
CAR (−1 0)	12.786***	7.71	13.022***	9.04

Notes This table shows the average abnormal returns (AARs) of returns of capital firms for 20 days around the ex-date ($t = 0$). It also shows the cumulative abnormal returns (CARs) for various event periods around the ex-return of capital date ($t = 0$). * indicates a significant difference from zero at the 10% level, ** indicates a significant difference from zero at the 5% level, and *** indicates a significant difference from zero at the 1% level

(selling) behavior in the pre- (post-) event period. Short-term traders are also expected to target high-yield and low transaction cost stocks.

Table 4 reports CARs across various event periods around ex-return of capital dates. In line with the predictions of the short-term trading hypothesis, I find evidence of statistically significant positive *CAR*s in the pre-event periods [−10 to −1 and −5 to −1]. In particular, *CAR*s are 1.973% ($t = 2.84$) and 0.953% ($t = 1.94$) for periods [−10, −1], and [−5, −1], respectively based on the market model. On the other hand, *CAR*s in the post-event period for the event windows [+1 to +10 and +1 to +5] are negative, but statistically insignificant at any conventional level of significance. These results suggest that investors buy stocks in the pre-event period and sell them after the ex-day in order to capture the tax-free return of capital distribution.

Tables 5 and 6 present the market reaction around ex-return of capital days for the periods before (2002–2009) and after (2010–2015) the outbreak of Greece's sovereign debt crisis. The *AAR* on day 0 is 17.598% in the first period and 10.323% in the second period, both statistically significant at the 1% level. Unreported results demonstrate that the difference between the *AAR*s in the two periods is also statistically significant at the 1%. Moreover, the CAR of two days (−1, 0) is 19.740% in the first period, while it is equal to 11.147% in the period that the debt crisis inflicted Greece. Looking at all pre- and post-event windows, the greater market reaction in the pre-debt crisis period is considerably stronger vis-à-vis in the period of financial turbulence. In particular, the market reaction of two days (−1, 0) in the first period is almost twice as that in the second period. These results are in line with prior evidence documenting that under bull market conditions, capital gains are high, whereas in bear markets, capital gains are partly wiped out by the selling pressures and market downsizing.

5.3 Regression Results

Table 7 reports the regression results of the ex-return of capital day returns against the systematic risk (*BETA*), the *RCY*, *TC*, and a dummy variable (crisis) that takes the value of 1 for the period 2010–2015 (debt crisis) and zero otherwise. In the first model, the dependent variable is *AAR*s of day 0 as measured by the market model, and in the second model, *AAR*s of day 0 is based on the market-adjusted. The cross-sectional results from the first regression show that the coefficient of the systematic risk (*BETA*) is positive and statistically significant at the

Table 5 Abnormal returns around ex-return of capital days before Greece's debt crisis period (2002–2009)

$N = 50$	Market model		Market-adjusted	
Days	AAR%	*t*-statistic	AAR%	*t*-statistic
−10	−0.169	−0.50	0.054	0.09
−9	0.369	1.10	−0.128	−0.37
−8	0.051	0.15	−0.069	−0.21
−7	0.194	0.58	0.201	0.76
−6	0.165	0.49	0.392	1.46
−5	−0.115	−0.34	−0.324	−0.95
−4	0.244	0.73	0.207	0.65
−3	0.943***	2.81	1.296***	3.26
−2	0.771**	2.30	0.935**	2.17
−1	2.141***	6.39	−0.140	−0.40
0	17.598***	6.48	16.913***	5.65
1	−1.226***	−3.66	−0.702	−1.26
2	−0.558*	−1.66	−0.301	−0.68
3	−0.145	−0.43	0.129	0.34
4	−0.228	−0.68	0.272	0.86
5	−0.715**	−2.13	−0.193	−0.59
6	0.446	1.33	−0.107	−0.33
7	0.094	0.28	−0.048	−0.12
8	−0.406	−1.21	−0.494	−1.50
9	0.204	0.61	0.378	1.25
10	0.219	0.65	0.103	0.37
	CARs %	*t*-statistic	CARs %	*t*-statistic
CAR (−10 −1)	4.595***	4.33	2.423	1.50
CAR (+1 +10)	−2.315**	−2.18	−0.962	−0.90
CAR (−5 −1)	3.985***	5.31	1.973	1.27
CAR (+1 +5)	−2.873***	−3.83	−0.793	−0.93
CAR (−1 +1)	18.513***	4.76	16.070***	5.04
CAR (−1 0)	19.740***	5.10	16.772***	5.56

Notes This table shows the average abnormal returns (*AAR*s) of returns of capital firms for 20 days around the ex-date ($t = 0$). It also shows the cumulative abnormal returns (CARs) cumulative abnormal returns for various event periods around the ex-return of capital date ($t = 0$). * indicates a significant difference from zero at the 10% level, ** indicates a significant difference from zero at the 5% level, and *** indicates a significant difference from zero at the 1% level

10% level in both models. This result is consistent with the notion that short-term trading is constrained by risk and, therefore, excess returns on ex-days should contain a risk premium (Asimakopoulos et al. 2015). Consistent with the expectations and prior evidence, the coefficient of

Table 6 Abnormal returns around ex-return of capital days after Greece's debt crisis period (2010–2015)

$N = 99$	Market model		Market-adjusted	
Days	AAR%	*t*-statistic	AAR%	*t*-statistic
−10	1.056***	3.15	0.719*	1.68
−9	−0.676**	−2.01	−0.645	−1.35
−8	0.181	0.54	0.129	0.43
−7	0.365	1.09	0.487	1.43
−6	0.909***	2.71	0.632**	2.15
−5	0.027	0.08	0.048	0.15
−4	−0.540	−1.61	0.083	0.23
−3	0.171	0.51	0.541*	1.67
−2	0.063	0.19	0.481	1.50
−1	0.630*	1.88	1.072*	1.94
0	10.323***	3.74	10.076***	7.02
1	−0.331	−0.99	−0.536	−1.17
2	0.160	0.48	0.292	0.91
3	0.607*	1.81	0.396	1.24
4	−0.366	−1.09	−0.185	−0.56
5	0.039	0.12	−0.071	−0.24
6	−0.248	−0.74	−0.100	−0.28
7	−0.103	−0.31	−0.231	−0.76
8	−0.531	−1.58	−0.846**	−2.13
9	−0.117	−0.35	−0.016	−0.05
10	−0.085	−0.25	0.112	0.42
	CARs %	*t*-statistic	CARs %	*t*-statistic
CAR (−10 −1)	2.186***	3.14	3.547**	2.37
CAR (+1 +10)	−0.973	−1.40	−1.184	−1.02
CAR (−5 −1)	0.351	0.71	2.225**	2.39
CAR (+1 +5)	0.110	0.22	−0.104	−0.12
CAR (−1 +1)	10.622***	6.75	10.611***	7.16
CAR (−1 0)	10.953***	6.95	11.147***	7.28

Notes This table shows the average abnormal returns (*AAR*s) of capital firms for 20 days around the ex-date ($t = 0$). It also shows the cumulative abnormal returns (*CAR*s) for various event periods around the ex-return of capital date ($t = 0$). * indicates a significant difference from zero at the 10% level, ** indicates a significant difference from zero at the 5% level, and *** indicates a significant difference from zero at the 1% level

the *RCY* is positive and statistically significant at the 5% level in both models. This finding lends support to the predictions of the short-term trading hypothesis. Kato and Loewenstein (1995), Michaely and Vila (1996), Wu and Hsu (1996), Naranjo et al. (2000), Dasilas (2009), and

Table 7 Regression analysis on ex-day abnormal returns

$AAR_{0,i} = a_0 + a_1 * BETA_i + a_2 * RCY_i + a_3 * TC_i + a_4 * Crisis_i + e_i$

	Market model AARs	Market-adjusted AARs
Intercept	0.091	0.098
	(2.24)***	(2.37)**
BETA	0.077	0.075
	(1.80)*	(1.74)*
RCY	0.117	0.121
	(1.99)**	(2.13)**
TC	−0.006	−0.006
	(−1.98)**	(−2.05)**
Crisis	−0.028	−0.031
	(−2.83)***	(−2.92)***
N	149	149
Adj-R^2	0.054	0.056
F-statistic	3.07***	3.19***

Notes In the first model, the dependent variable is *AAR*s of day 0 as measured by the market model, and in the second model, AARs of day 0 based on the market-adjusted. *BETA* is the systematic risk computed by the market model in the estimation period (–250, –11). *RCY* is the return of capital yield calculated as the ratio of return of capital per share over the stock price on the cum-return of capital day. *TC* is the transaction costs calculated as the reciprocal of stock price on the cum-return of capital day ($1/P_c$). Crisis is a dummy that takes the value of 1 for the period 2010–2015 (debt crisis) and zero otherwise (2002–2009). Standard error estimates are robust to heteroskedasticity (Huber/White). ***significant at 1% level, **significant at 5% level, and *significant at 10% level

Asimakopoulos et al. (2015) have found a positive coefficient for the dividend yield variable in their studies. Consistent with the short-term trading hypothesis, a positive association between ex-day returns and transaction costs is found. Similar result was reported by Karpoff and Walkling (1988, 1990) lending support to the assertion that the higher the level of transactions costs, the lower the trading around ex-days and consequently the higher the market reaction on ex-dates. Finally, the dummy variable that measures the effects of debt crisis on ex-day abnormal returns is negative and statistically significant at the 1% level. This result corroborates the stronger market reaction around ex-dates in the "quiet" period (2001–2009).

Overall, my results clearly show that ex-day returns are higher for higher-yield stocks with higher transaction costs. Moreover, my results reveal that shareholders who invest their money in stocks with high systematic risk are compensated with higher profits around ex-dates. Finally, the adverse consequences of Greece's sovereign debt crisis were apparent for investors receiving profit distributions in the form of either a dividend or a return of capital as shown by the lower excess returns around ex-dates.

6 Conclusion

Since 2010, Greece is experiencing an unprecedented fiscal crisis and one of the most astonishing reversals of fortunes a country has ever experienced. Gross domestic product (GDP) has declined by 26% since 2008, and the economic prospects of the country have been in stalemate. During these harsh economic conditions, the majority of listed companies were encountering severe financial constraints such as limited access to external finance (i.e., bank lending and international financial markets), high cost of capital, diminishing investor interest, and remarkable operating losses. Altogether, they have a negative impact on the firm value which fell in rock-bottom levels in 2012 and in 2015. Many listed firms opted for delisting from the ASE in an attempt to avoid further market collapse. The outbreak of Greece's fiscal crisis partly coincided with significant structural reforms regarding the tax treatment of dividend income. Up to 2008, the common corporate practice was the distribution of a minimum dividend that was considered tax free for the recipients. However, in 2009, a flat tax rate of 10% on the dividend income was imposed. Since then, the tax rate on dividends underwent several changes that led Greek corporations to seek alternative ways of distributing tax-free profits to their shareholders. The conduit was the return of capital which has not been come across as profit distribution practice in other developing or developed markets.

The focus of the current study is the stock price behavior around ex-return of capital dates which is examined before and after the eruption of the fiscal crisis in Greece. The market idiosyncrasies prevailing the ASE (i.e., no taxes on return of capital, small tick size, lack of an adjustment model mechanism, and limited market making) neutralize most of the explanations offered by prior researchers to interpret the ex-dividend day phenomenon. The results show a stock price appreciation on ex-dates which is at odds with prior findings from the stock price behavior around ex-dividend dates in Greece and across the world. This unexpected stock price reaction on ex-dates furnishes notable excess returns to those trading around these dates that exceed 12%. Excess returns are significantly higher in the period before debt crisis, though considerably high during the period of fiscal constraints. Finally, excess returns are concentrated on high-yielded stocks with high transaction costs and systematic risk. These results seem to corroborate most of the predictions of the short-term trading hypothesis as set by Kalay (1982).

The results of the current study bring new evidence to the field and provide some managerial implications to firms and investors. First of all, firms can "pump and dump" their stocks by distributing tax-free cash to shareholders even in days that a downward adjustment was expected. On the other hand, investors may enjoy considerable capital gains and yields when strategically trading around ex-return of capital days. Finally, the risk undertaken to invest in financially constrained periods is adequately compensated by high yields.

Notes

1. Yahyaee et al. (2008) found similar results using data from Oman where there were no taxes on dividends and capital gains.
2. On April 2, 2001, the ASE ended the automatic adjustment of the opening stock price on the ex-dividend day by the amount of dividend paid.
3. According to Asimakopoulos et al. (2015), until 2005, only 6 stocks had appointed market makers.
4. Since January 1, 2017, the tax rate on dividends is 10%.
5. According to Asimakopoulos et al. (2015, p. 3), until 2005, market making was applied only in 6 firms in their sample. More recent data from the Web site of the ASE (www.helex.gr) shows that market making was primarily offered to the 25 largest companies in terms of market capitalization.

6. Stock prices are quoted in three digits, while dividends and returns of capital are quoted in four digits.
7. See www.helex.gr.
8. See Milonas et al. (2006), Dasilas (2009) among others.
9. I use opening prices on ex-return of capital days in order to control for overnight market movements between the cum- and ex-return of capital day.
10. See Kato and Loewenstein (1995), Michaely and Vila (1996), Wu and Hsu (1996), Naranjo et al. (2000), Dhaliwal and Zhen Li (2006), Yahyaee et al. (2008), Dasilas (2009), and Asimakopoulos et al. (2015) among others.

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The Impact of Greek Economic News on European Financial Markets. Evidence from the European Sovereign Debt Crisis

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1 Introduction

The start of the financial crisis was a banking crisis. European governments rescued troubled banks (headquartered in their countries) mostly either by equity injections or setting up of bad banks (Stolz and Wedow 2010). Either type of rescue plans deteriorated the governments' public finances (IMF 2009). The risk transfer from the private banks to sovereign treasuries increased the country risk considerably, especially for Portugal, Ireland, Greece, and Spain. Downgrading of the

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affected countries caused bond and CDS spreads to widen considerably with consequences on other financial markets (IMF 2011). During crash periods, findings support the existence of a contagion effect. In most of the related empirical studies, contagion is measured by correlation. Some recent papers that studied contagion in crisis periods are Buttner and Hayo (2011), Kenourgios et al. (2011), Bosma et al. (2012), Gross and Kok (2013), De Bruyckere et al. (2013), Caporin et al. (2013), and Alter and Beyer (2014), among others,[1] however.

This chapter provides evidence in favor of such a contagion effect, as far as Greek economic news affects the returns, volatility, volatility jumps, correlations, and correlation jumps of the 2-year, 5-year, and 10-year government bonds, CDS, and stock indices of seven European countries. The other way around relation (in specific, the impact of EU/ECB/IMF on the Greek stock market) has been examined by Kosmidou et al. (2015). They also examined the effect of Greek economic news releases on return and risk of the Greek stock market. As far as the ECB failed to promptly signal to the financial markets that the Greek government debt would be eligible for servicing as collateral in the provision of liquidity,[2] any news release for the Greek economy can probably affect the European financial markets. Based on the recommendations of Kosmidou et al. (2015) for future research, this chapter provides evidence whether the Greek economic news affected other European financial markets.

An important source of news releases and events for financial markets comes from central banks. A recent paper on the importance of central banks announcement is Glick and Leduc (2012). It is argued that monetary policy has created a system of easy credit (pre-taper) and artificially

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low interest rates that are affecting investors by pushing out their individual risk curves. Liquidity, as produced by loose monetary policy, is argued as incentivising speculative activity in riskier asset classes. Rosa (2013) found that asset prices react to new information via a surprise component in asset prices. This represents an expansion of the EMH. Cukierman (2013) described the changes that occurred in major central banks monetary policy when the crisis hit. Belgacem et al. (2014) tested the efficient market hypothesis (EMH) on commodities markets. The test concerns the role of market and US macroeconomic announcements and the impact they have upon crude oil prices. Apergis (2014) researched the role of FOMC minutes for US asset prices before and after the 2008 crisis in a GARCH volatility framework. Ricci (2014) assessed the impact of ECB monetary policy announcements on the stock price of large European banks. In this chapter, many of the Greek economic news are related to events and news releases from the European Central Bank and the central banks of European countries.

Another significant in-magnitude part of announcements literature is papers concerning responses of news releases on bond yields. Goldberg and Klein (2010) investigated the news responses on euro area bond yields after the introduction of the euro. More recently, literature concentrates on the impact of announcements in credit default swaps (CDS). Ismailescu and Kazemi (2010) examined the daily effect of sovereign credit rating change announcements on the CDS spreads of twenty-two emerging markets. Finnerty et al. (2013) examined the impact of credit rating announcements on 5-year credit default swap (CDS) spreads. In specific, credit rating change (RC) announcements that do have a significant impact on CDS spreads, among other results. This study examines the impact of the existence of news related to Greek bonds and the impact of the magnitude of surprise components of 10-, 5- and 2-year Greek government bonds and Greek CDS. Mink and de Haan (2013) found no relation between abnormal returns and Greek economic news. According to their findings, most of Greek economic news has been considered favorably by the markets as sign of the willingness of European governments to face the crisis, by examining the impact of excess returns of European banks on Greek economic events. Beetsma et al. (2013) showed that European yield spreads change in response to the crisis news. Bhanot et al. (2014) found that abnormal returns are driven by Greek news releases. This chapter studies the effect of announcements on standardized returns. Rangel (2011) provided evidence in favor of the effect of announcements on volatility and volatility jumps via a parametric GARCH-J model. Vortelinos and Gkillas (2016) examine the impact of all European economic news releases to the US financial markets, for the main crisis period. Their study used Sharpe ratios, as well as magnitude and frequency of volatility jumps for the periods before and after a news release. This study researches the effect of news releases on nonparametric volatility measures (range, realized range) as recently researched in Molnar (2012).

Moreover, the detection and magnitude of volatility jumps are examined in two different ways, both following the nonparametric realized volatility literature. In specific, volatility jumps are detected and quantified as (i) in Corsi et al. (2010) and Andersen et al. (2012) based on the median realized variance ($MedRV_t$) as from the best alternative jump-robust estimators, or (ii) in Balter (2014) and Bekaert and Hoerova (2014) based on the threshold bipower variation ($TBPV_t$) jump-robust estimator.

A variety of different methods has been employed in the literature for evaluating the impact of announcements. The most heavily used regression-based method of evaluating the impact of announcements is the ordinary least squares (OLS) method. Recent literature that employed such method is Rosa (2011), Elder et al. (2012), Gospodinov and Jamali (2012) and Marshall et al. (2012). Another method of evaluating the impact of announcements is the flexible Fourier form (FFF). Apart from Andersen and Bollerslev (1998), a recent study with the FFF method is Bedowska-Sojka (2011). Furthermore, Elliot and Muller (2006) and Muller and Petalas (2010) introduced the quasi-local level method for evaluating news impact, with Goldberg and Grisse (2013) recently applied it on US macro announcements, two spot exchange rates, as well as 2-year, 5-year, and 10-year bond yields of USA, Germany, UK, and France. Another method to evaluate the impact of announcements is within a GARCH model framework. Recently, Hanousek et al. (2009), Rangel (2011) examined the impact of announcements in a GARCH framework.

Andersen and Bollerslev (1998) in principle and in a greater extent, Andersen et al. (2003 and 2007) introduced the two-step weighted least squares (WLS) method for evaluating the news releases impact. Nowak et al. (2011) examined the impact on the intraday return and volatility series of sovereign Eurobonds of four emerging markets from the news of macro fundamentals of Germany, USA, and these four emerging markets, via a WLS method. Fatum et al. (2012) researched the impact of Japanese and US macro news on JPY/USD exchange rate via a WLS method. Based on the foundations of the WLS method, Lahaye et al. (2011) used tobit-GARCH and probit models to determine that US macro announcements explain jumps and co-jumps in equity, bond and foreign exchange markets, where jumps are detected via the Lee and Mykland (2008) detection scheme. In the present study, a tobit-RV model is employed where volatility is incorporated as a realized volatility process. The same method is employed for volatility jumps.

The remainder of this chapter is organized as follows. In Sect. 2, we discuss the data employed. In Sect. 3, the employed methodologies are deployed. In Sect. 4, we refer to our empirical results, and finally in Sect. 5, we summarize results, provide concluding remarks, and outline the major policy implications.

2 Data

The sample starts from 1 July 2009 and ends on 1 June 2015. Data is in daily sampling frequency. Table 1 reports the data employed in this chapter. Panel A depicts the events examined in this chapter. Events are split into three categories (D_1, D_2, and D_3) and all events together (D_4). The first three categories concern: (i) events with direct impact on Greece, (ii) events with plausible impact on Eurozone, and (iii) events with an international effect, respectively. Panels B, C, and D depict the symbols and description of the data series of Greece, Spain, Portugal, Ireland, Italy, Germany, and France for the 2-year, 5-year, and 10-year generic government bonds as well as stock indices and CDS, accordingly. The data for the European financial markets was acquired from Datastream.

In the literature, US announcements have been mostly examined. Nguyen (2011) investigated the spillover effect of the US macroeconomic news on the first two moments of the Vietnamese stock market returns. Kilian and Vega (2011) provided evidence that energy prices

Table 1 Data

Panel A. Events			Panel B. Generic Government Bonds		Panel C. Stock indices		Panel D. Credit Default Swaps (CDS)	
Symbol	Days	Months	Symbol	Description	Symbol	Description	Symbol	Description
D_1	35	22	GR_{10Y}	Greece 10-Year	DE_{Stock}	Germany DAX index	GR_{CDS}	GREECE CDS USD SR 5Y CBIN Corp
D_2	22	15	GR_{5Y}	Greece 5-Year	ESP_{Stock}	Spain IBEX index	ESP_{CDS}	SPAIN CDS USD SR 5Y cbin Corp
D_3	55	22	GR_{2Y}	Greece 2-Year	P_{Stock}	Portugal BVLX index	P_{CDS}	PORTUG CDS USD SR 5Y cbin Corp
D_4	112	38	P_{10Y}	Portugal 10-Year	I_{Stock}	Italy FTSEMIB index	IRL_{CDS}	IRELND CDS USD SR 5Y cbin Corp
			P_{5Y}	Portugal 5-Year	IRL_{Stock}	Ireland ISEQ index	I_{CDS}	ITALY CDS USD SR 5Y cbin Corp
			P_{2Y}	Portugal 2-Year	GR_{Stock}	Greece ASE index	DE_{CDS}	GERMAN CDS USD SR 5Y cbin Corp
			ESP_{10Y}	Spain 10-Year	F_{Stock}	France CAC index	F_{CDS}	FRANCE CDS USD SR 5Y cbin Corp
			ESP_{5Y}	Spain 5-Year				
			ESP_{2Y}	Spain 2-Year				
			IRL_{10Y}	Ireland 10-Year				
			IRL_{5Y}	Ireland 5-Year				
			IRL_{2Y}	Ireland 2-Year				
			F_{10Y}	France 10-Year				
			F_{5Y}	France 5-Year				
			F_{2Y}	France 2-Year				
			DE_{10Y}	Germany 10-Year				
			DE_{5Y}	Germany 5-Year				
			DE_{2Y}	Germany 2-Year				
			I_{10Y}	Italy 10-Year				
			I_{5Y}	Italy 5-Year				
			I_{2Y}	Italy 2-Year				

Notes Table 1 reports the data employed in the paper. Panel A depicts the events examined in the paper. Events are split into three categories (D_1, D_2, and D_3) and all events together (D_4). The first three categories concern: (i) events with direct impact on Greece and plausible impact on Eurozone, (ii) events with global impact, and (iii) other important events, respectively. Panels B, C, and D depict the symbols and description of the data series of Greece, Spain, Portugal, Ireland, Italy, Germany, and France for the generic government bonds, stock indices[12] and CDS, accordingly

respond instantaneously to macroeconomic news, and there is no feedback from US macroeconomic aggregates to monthly innovations in energy prices. Jumps in asset prices occur as new information arrives as revealed in Rangel (2011), Evans (2011), Jiang et al. (2011) and Lahaye et al. (2011). Moreover, Kapetanios et al. (2014) investigated the relation between jumps and US macroeconomic announcements in the e-mini S&P 500 option market. Nguyen and Ngo (2014) investigated the spillover effect of 14 US key macroeconomic news on the first two moments of 12 Asian stock market returns. However, they are periodically published with the timing of announcements being strictly predetermined to the date and hour. The European news releases are more appropriate for European financial markets because of the time difference between USA and Europe. So, the majority of European economic news is not predetermined; so, most of Greek economic news will deploy significant surprises for European financial markets. The Greek sovereign debt crisis and the ECB monetary policy have been discussed by, among others, Mink and de Haan (2013), Bhanot et al. (2014), and Kosmidou et al. (2015) as well as Cukierman (2013) and Rici (2014), respectively.

The classification of Greek economic news depends on the related literature[3] and authors judgments. Greek economic news starts from July 2009 because the Bank of Greece's statistical bulletin showed that the central government deficit for the 6 months was high enough at 7.5% of GDP ($17.9 bn). They finish in June 2013 because there have not been any too significant such news thereafter. There is no classification between good and bad news as far as we are mostly interested in the existence and magnitude of the news effect and not in its asymmetric behavior. The Greek economic news has been selected as significant after complying with some indicators from professional practice. These indicators are based on: (i) actions/news taken by the ECB/IMF/European Union for Greece, (ii) actions/news taken by the Greek government, (iii) actions/news taken by ECB/IMF/EU and Greek government officials, (iii) actions/news from rating agencies (S&P, Moody's and Fitch), (iv) actions/news for other members of the EU (e.g. Ireland, Italy, Portugal, and Spain).

The information from the Greek economic news is employed in the following forms: (i) four dummy variables in a simple regression (D_1, D_2, D_3, and D_4), (ii) three dummy variables in a multiple regression ($D_1 - A$, $D_2 - A$, and $D_3 - A$), (iii) four variables of number of events of the four respective groups of news (V_1, V_2, V_3, and V_4), (iv) three variables of number of events of the three respective groups of news in a multiple regression ($V_1 -A$, $V_2 –A$, and $V_3 -A$), and (v) four series of news surprises of generic government bonds as well as CDS (SUR_{2Y},

SUR_{5Y}, SUR_{10Y}, and SUR_{CDS}). News surprises ($SUR_{i,t}$) are deployed as in Balduzzi et al. (2001), Kurov (2010), Rangel (2011), and Kapetanios et al. (2014), among others. $A_{i,t}$ denotes the *ith* news item's actual figure released at time t, and $F_{i,t}$ is the forecast[4] for this figure.

$$SUR_{i,t} = \frac{A_{i,t} - F_{i,t}}{\sigma_i} \tag{1}$$

where σ_i is the sample standard deviation of the surprise component for the *ith* news item. Standardization helps us compare different news items. Surprises ($SUR_{i,t}$) are employed upon the Greek government bonds in maturities of 2 years (2Y), 5 years (5Y), and 10 years (10Y) as well as upon the Credit Default Swap (CDS).

3 Empirical Methodology

This section describes in detail (i) the nonparametric estimators of volatility and volatility jump, as well as (ii) the impact-of-news methods (tobit-R, tobit-RV, tobit-VJ, tobit-RC, and tobit-CJ) employed.

3.1 Nonparametric Estimation of Volatility and Volatility Jump

Volatility and volatility jumps have to be accurately estimated. Most of the studies on the literature of announcements estimate volatility parametrically: from those, most use a GARCH model. However, the most natural way is to nonparametrically estimate the second moment of a time series, based on the strength of the data. The most heavily employed nonparametric estimation method of volatility is realized volatility. However, the literature recently used range-based measures to nonparametrically estimate volatility. All range estimators (even the simple range) are compatible to realized volatility estimators because they use data from a higher sampling frequency without needed to know all prices from the highest frequency. We only need to know the highest and lowest (max and min, respectively) prices. The realized range estimator employed data from two frequencies higher than the one of the volatility estimates. For example, monthly realized range estimates use intraday data from the highest and lowest daily (within a day) prices. This chapter employs two nonparametric volatility measures based on range. Todorova (2012), Molnar (2012), and Todorova and Husmann (2012) provided evidence in favor of range-based estimators compared to other nonparametric volatility estimators. Here, the employed estimators are (i) range as introduced by Parkinson (1980) and examined in Alizadeh et al. (2002), and (ii) realized range as introduced in Brunetti, and Lildholdt (2002) and researched in Christensen and Podolskij (2007 and 2012) and Todorova (2012), among others.

3.1.1 Realized Volatility Estimators

With the use of the monthly high and low prices (highest and lowest daily close prices per month, respectively), the monthly range volatility estimator can be estimated. The range estimator was introduced in Parkinson (1980). Brunetti and Lildholdt (2002) examined its properties. Monthly range (Ra_t):

$$Ra_t = \frac{1}{4ln2}\left[ln\left(p_t^h \middle/ p_t^l\right)\right]^2 \tag{2}$$

where p_t^h is the highest daily price and p_t^l is the monthly lowest daily price within t month. Next, the realized range estimator of volatility was first proposed by Martens and van Djik (2007). In their paper, they extended the range estimator of Parkinson (1980) for use with intraday data. Their estimator is entitled as realized range estimator. It incorporates the benefits of the range estimation as well as those of the realized volatility without the effects of the microstructure noise (coming from the incorrect sampling frequency). Christensen and Podolskij (2007 and 2012) thoroughly examined the properties of realized range. Todorova and Husmann (2012) found that the bias correcting procedure developed by Christensen and Podolskij (2007) appears to consistently outperform all other alternatives, including the scaled version of Martens and van Dijk (2007) and provide evidence of the relative advantages of the realized range. That is why the Christensen and Podolskij (2007) version of the realized range estimator is employed in this chapter. The monthly realized range-based variance (or just realized range) estimator is defined as:

$$RRa_t = \frac{1}{\pi^2/6} \sum_{i=1}^{22} \left(R_{t,i}^h - R_{t,i}^l \right)^2 \tag{3}$$

where $R_{t,i}^h$ and $R_{t,i}^l$ are the highest and lowest i daily (for $i = 1,\ldots,22$) price returns for each day, based on intraday data.

3.1.2 Volatility Jumps

Two volatility-jumps detection schemes are employed in this study. Barndor-Nielsen et al. (2006) was from the first studies to introduce limit theorems for bipower variation. Barndor Nielsen and Shephard (2006) introduced the estimator for bipower variation. Corsi et al. (2010) showed that the threshold bipower variation estimator substantially reduces the small-sample bias that the standard bipower variation exhibit.[5] Balter (2014) examined threshold multipower variation, which is structured like the threshold bipower variation. The threshold bipower variaton ($TBPV_t$) is given by:

$$TBPV_t = \sum_{i=2}^{22} \left| R_{t,i-1} \right| \cdot \left| R_{t,i} \right| \cdot I_{\left| R_{t,i-1} \right|^2 \leq \vartheta_{i-1}} \cdot I_{\left| R_{t,i} \right|^2 \leq \vartheta_i} \tag{4}$$

where $I_{\{\cdot\}}$ is the indicator function and the threshold function, $R_{t,i}$ is the daily return series. Christensen et al. (2010) examined the stochastic threshold ϑ_t. It is dependent on the local spot variance $\vartheta_t = c_\vartheta^2 \cdot \hat{V}_t$, where c_ϑ is a scale-free constant and $\hat{V}_t$ is a local variance that is estimated via a range estimate from the data within the neighborhood. Bekaert and Hoerova (2014) employed the $TBPV_t$ dependent jumps detection scheme successfully for their research questions. Barndor-Nielsen and Shephard (2006) developed the jumps detection scheme based on bipower variation and the adjusted jump ratio statistic of Huang and Tauchen (2005).

$$ZJ_t^{(TBPV)} = \sqrt{22} \cdot \frac{\left(RV_t - TBPV_t^{-1}\right)}{\left(\left(\xi_1^{-4} + 2\xi_1^{-2} - 5\right) max\left\{1, TQ_t TBPV_t^{-2}\right\}\right)^{1/2}} \quad (5)$$

where TQ_t is the realized tripower quarticity which writes $TQ_t = 22 \cdot \xi_{4/3}^{-3} \cdot \sum \left|R_{t,i}\right|^{4/3} \left|R_{t,i+1}\right|^{4/3} \left|R_{t,i+2}\right|^{4/3}$ $i = 1$and converges in probability to integrated quarticity. The $ZJ_t^{(TBPV)}$ statistic follows a standard normal distribution. A jump is considered to be significant if the test statistic exceeds the appropriate critical value of the standard normal distribution, denoted by Φ_α, at α level of significance. A 95% significance level is employed.[6] The jump component is:

$$J_t^{(TBPV)} = [RV_t - TBPV_t] \times I\left[ZJ_t^{(TBPV)} > \Phi_a\right] \quad (6)$$

where $I\,[\cdot]$ is the indicator function of the $ZJ_t^{(TBPV)}$ statistic in excess of a given critical value of the Gaussian distribution F_a. The summation of the squared jump component and the continuous component of the RV_t estimator equals to RV_t.

Nevertheless, the $TBPV_t$ has drawbacks in empirical applications, as discussed in Corsi et al. (2010). Andersen et al. (2012) suggest the median realized variance ($MedRV_t$) as from the bestalternative jump-robust estimators of realized variance.

$$MedRV_t = \frac{\pi}{6 - 4\sqrt{3} + \pi} \cdot \frac{22}{22 - 2} \cdot \sum_{i=2}^{21} med\left(\left|R_{t,i-1}\right|, \left|R_{t,i}\right|, \left|R_{t,i+1}\right|\right) \quad (7)$$

According to Andersen et al. (2012), the test statistic becomes:

$$ZJ_t^{(MedRV)} = \sqrt{2} \cdot \frac{(RV_t - MedRV_t)RV_t^{-1}}{\left(0.96 \cdot max\left\{1, MedRQ_t MedRV_t^{-2}\right\}\right)^{1/2}} \quad (8)$$

with $MedRQ_t$ is an estimate of the integrated quarticity based on $MedRV_t \cdot MedRQ_t = \frac{3\pi}{9\pi+72-52\sqrt{3}} \cdot$

$$\left(\frac{22}{20}\right) \cdot \sum_{i=2}^{21} med\left(\left|R_{t,i-1}\right|, \left|R_{t,i}\right|, \left|R_{t,i+1}\right|\right)^4$$

When $ZJ_t^{(MedRV)}$ is significant, the difference between RV_t and $MedRV_t$ is too large and should be considered as jump. The jump component of RV_t is:

$$J_t^{(TBPV)} = [RV_t - MedRV_t] \times I\left[ZJ_t^{(MedRV)} > \Phi_a\right] \tag{9}$$

where $I[\cdot]$ is the indicator function of the $ZJ_t^{(MedRV)}$ statistic in excess of a given critical value of the Gaussian distribution F_a. The summation of the squared jump component and the continuous component of the RV_t estimator equals to RV_t. A 95% significance level is employed.[7] In both detection schemes of jumps in volatilities, RV_t is realized volatility series and can be either monthly range (Ra_t) or realized range (RRa_t).

3.2 Impact of Announcements

Both simple and multiple regressions are employed to reveal the significance of economic events. Lahaye et al. (2011) use tobit-GARCH and probit models to determine that US macro announcements explain jumps and co-jumps in equity, bond and foreign exchange markets, where jumps are detected via the Lee and Mykland (2008) detection scheme. In this study, tobit-R, tobit-RV, tobit-VJ, tobit-RC, and tobit-CJ are employed, which are as a usual tobit model for return, volatility, and volatility jump. Returns series are classifieded in extremes and non-extremes, and standardized returns series are employed. Volatility series are classified into two different series from two respective range-based estimators, based on the relative magnitude of each country's volatility to all seven European countries. Volatility-jumps series are classified into two different volatility jumps from two respective volatility jump detection schemes, based on the relative magnitude of each country's volatility to all seven European countries.

3.2.1 Return

$$SR^{*}_{t,i} = \mu + \mu_{t,i} + \varepsilon_{t,i} \tag{10}$$

where i is each of the seven European countries' 2-year, 5-year or 10-year government bond, stock index or CDS spread; t is the time period in months. $\frac{R_{t,i}}{max_{1\to 7}(RRa_{t,i})} = SR^{*}_{t,i}$ if $\left|R^{*}_{t,i}\right| \in 0.10\left\{min\left(R_{t,i}\right),\ max\left(R_{t,i}\right)\right\}$ and $\frac{R_{t,i}}{RRa_{t,i}} = SR^{*}_{t,i}$ if $\left|R^{*}_{t,i}\right| \in (1-0.10)\left\{min\left(R_{t,i}\right), max\left(R_{t,i}\right)\right\}$; $e_{t,i}$ is NID (0,1).

The descriptive statistics of return series indicate non-normality and volatility clustering as evident in the literature (see, Andersen et al. 2003). This evidence is more strong for outliers. Outliers are considered the 10% lowest negative returns and the 10% highest of positive returns of each return series. The sample kurtosis of the outliers indicates that the standardized returns are well approximated by a Gaussian distribution which clearly convey the approximate normality. Moreover, the standardized returns display no evidence of volatility clustering. The normality of the standardized returns suggests a different approach: a fat-tailed normal mixture distribution governed by realized volatility. In the standardization of outliers, the maximum value of realized range ($max_{1\to 7}$ ($RRa_{t,i}$)) across the seven European countries is used for standardizing outliers. In the rest of return series, the volatility ($Ra_{t,i}$, $RRa_{t,i}$) estimator of the specific country is employed. In all tables of results, the impacts on standardized returns are entitled as raw impacts. Moreover, aggregated raw impacts are provided; such impact is each country's raw relative impact aggregated across all seven European countries.

This equation can be either a simple or multiple regression. $\mu_{t,i}$ is either dummy variable (direct impact on Greece, events with plausible impact on Eurozone, events with a plausible global impact and all three categories), numerical variable (number of events per month for each respective category), or news surprise (on 2-year, 5-year, and 10-year Greek government bonds). In the simple regression form, $\mu_{t,i}$ can be any one of the following from any of the three groups: (i) D_1, D_2, D_3, or D_4; or (ii) V_1, V_2, V_3, and V_4; or (iii) SUR_{2Y}, SUR_{5Y}, SUR_{10Y}, or SUR_{CDS}.

In the multiple regression, all related variables are included. In the multiple regression form, $\mu_{t,i}$ can be any of the following three groups of independent variables: (i) $D_1 - A$, $D_2 - A$, and $D_3 - A$; or (ii) $V_1 - A$, $V_2 - A$, and $V_3 - A$. In specific,

$$\mu_{t,i} = \sum_{j=1}^{3} \lambda_j X_{t,i}^{j} \tag{11}$$

where λ_j is the coe cient of each j of the three independent variables, and $X_{t,i}^{j}$ is each j of the three independent variables.

3.2.2 Volatility

$$V_{t,i}^{*} = \mu + \mu_{t,i} + \varepsilon_{t,i} \tag{12}$$

where $V_{t,i}^{*} = Ra_{t,i}$ if $SV_{t,i} > \overline{SV}_{t,i}$ and $V_{t,i}^{*} = RRa_{t,i}$ if $SV_{t,i} \leq \overline{SV}_{t,i}$; $e_{t,i}$ is NID (0,1); $\mu_{t,i}$ is the independent variable as described in Sect. 4.2.1.

$$SV_{t,i} = \frac{RV_{t,i}}{\sqrt{\frac{1}{6}\sum_{i=1}^{7}\left(RV_i - \overline{RV}_i\right)^2}} \tag{13}$$

and

$$RV_{t,i} = \frac{1}{21}\sum_{i=1}^{22}\left(R_i - \bar{R}_i\right)^2 \tag{14}$$

This equation can be either a simple or multiple regression. The criterion depends on the relative magnitude of each country's monthly volatility aggregately standardized on the respective volatility series across all seven European countries, for each t monthly observation. The realized volatility estimator ($RV_{t,i}$) is employed for estimating the monthly volatility aggregately standardized realized volatility ($SV_{t,i}$). For the most significant (in-magnitude) European volatility series, the Ra_t is employed, while, for the least significant (in-magnitude) European volatility series, the RRa_t is employed. In the multiple regression, all related variables are included as above.

4 Jump

$$J^*_{t,i} = \mu + \mu_{t,i} + \varepsilon_{t,i} \tag{15}$$

where only significant jumps are included; $J_t^{(MedRV)} = J^*_{t,i}$ if $SV_{t,i} > \overline{SV}_{t,i}$ and $J_t^{(TBPV)} = J^*_{t,i}$ if $SV_{t,i} \leq \overline{SV}_{t,i}$; $e_{t,i}$ is $NID(0,1)$; $J_t^{(MedRV)}$ is the significant jumps series according to the volatility-jumps detection scheme based on $MedRV_t$ volatility estimator, and $J_t^{(TBPV)}$ is the significant jumps series according to the volatility-jumps detection scheme based on the $TBPV_t$ volatility estimator Corsi et al. (2010).

$$SV_{t,i} = \frac{RV_{t,i}}{\sqrt{\frac{1}{6}\sum_{i=1}^{7}\left(RV_i - \overline{RV}_i\right)^2}} \tag{16}$$

The criterion depends on the relative magnitude of each country's monthly volatility aggregately standardized on the respective volatility series across all seven European countries, for each t monthly observation. For the most significant (in-magnitude) European volatility series, the Ra_t is employed, while, for the least significant (in-magnitude) European volatility series, the RRa_t is employed. In the multiple regression, all related variables are included as above. Jumps from either detection schemes are detected at the 5% significance level. This equation can be either a simple or multiple regression. In the multiple regression, all related variables are included as above.

5 Empirical Results

This section explains the impact of Greek economic events on return, volatility, and volatility jump of 2-year, 5-year, and 10-year Greek government bonds, as well as CDS and stock indices. The third subsection discusses the policy implications because of the relation (contagion) of Greek economic news with the European government bonds, CDS, and stock indices.

6 Impact of Greek Economic Events

The impact of the Greek economic events (Tables 2–16B) is revealed via four dummy variables (D_1, D_2, D_3, and D_4), the three dummy variables in a univariate regression ($D_1 - A$, $D_2 - A$, and $D_3 - A$), variables of number of events (V_1, V_2, V_3, and V_4), the three variables of number of events in a multiple regression ($V_1 - A$, $V_2 - A$, and $V_3 - A$), and four news surprises of generic government bonds (SUR_{2Y}, SUR_{5Y}, SUR_{10Y}, and SUR_{CDS}). The indication of 1 concerns the group of events with direct impact on Greece; the indication of 2 concerns the group of events with plausible impact on Eurozone; 3 concerns the group of events with a plausible global impact; and 4 concerns all Greek economic events, respectively. It is also reported the percentage (%) of the coefficients of the seven dummy variables with negative impact. Panel A provides raw impacts, whereas Panel B provides aggregated impacts across all European countries.[8]

The impact of the most important events of the Greek economy on the European generic government bond, CDS, and stock markets is answered by the results depicted in Table 2 up to 16B. Impact is classified into the impact on returns (Tables 2, 3, 4, 5, 6, 7), volatility

(Tables 8, 9, 10, 11, 12, 13), and volatility jumps (Tables 14, 15, 16, 17, 18, 19). The impacts on returns are split into dummy variables (Tables 2, 3), variables of number of events (Tables 4, 5), and news surprises (Tables 6, 7). The impacts on volatilities are split into dummy variables (Tables 8, 9), variables of number of events (Tables 10, 11), and news surprises (Tables 12, 13). The impacts on volatility jumps are split into dummy variables (Tables 14, 15), variables of number of events (Tables 16, 17), and news surprises (Tables 18, 19).

6.1 Returns

Tables 2 and 3 report the impact of the Greek events in the return series of the European financial markets (generic government bonds, CDS, and stock markets) via the four dummy variables (D_1, D_2, D_3, and D_4) as well as the first three dummies all included in a regression (D_1 –A, D_2 –A, and D_3 –A). It is also reported the percentage (%) of the coefficients of the seven dummy variables. The magnitude (in raw level) of the effects of each of the three groups of Greek economic news on returns is higher in a multiple regression ($D_1 - A$, $D_2 - A$, and $D_3 - A$) than in a simple regression (D_1, D_2, and D_3), accordingly. The dummy variable with all Greek economic news (D_4) has the fewest effects on returns with the highest magnitude. Very few impacts are not statistically significant. Most of the impacts across dummy variables and European financial markets are positive. When dummy variables are employed as explanatory variables, the highest impacts to the returns of European financial markets come from the events important to the Greek economy (1 − *Greece*). Results are consistent in simple and multiple regression frameworks: D_1 and $D_1 - A$ variables, respectively. Results are further consistent because we have the same results for the aggregated raw impacts (Panel B) of Tables 2 and 3.

Tables 4 and 5 report the impact of the Greek events in the return series of the European financial markets (generic government bonds, CDs and stock markets) via the variables of number of the four different categories of events per month (V_1, V_2, V_3, and V_4) as well as the first three such variables all included in a regression ($V_1 - A$, $V_2 - A$, and $V_3 - A$).

Table 2 Impact of Greek announcements/events in return—Dummy variables—Generic government bonds

	10-Year							5-Year							2-Year						
	DE_{10Y}	GR_{10Y}	P_{10Y}	ESP_{10Y}	I_{10Y}	IRL_{10Y}	F_{10Y}	DE_{5Y}	GR_{5Y}	P_{5Y}	ESP_{5Y}	I_{5Y}	IRL_{5Y}	F_{5Y}	DE_{2Y}	GR_{2Y}	P_{2Y}	ESP_{2Y}	I_{2Y}	IRL_{2Y}	F_{2Y}
Panel A. Raw impacts																					
% neg. coeff.	57.14%	0	28.57%	14.29%	0	57.14%	57.14%	71.43%	0	28.57%	42.86%	14.29%	28.57%	28.57%	28.57%	0	28.57%	28.57%	28.57%	42.86%	57.14%
D_1	-0.0097*	0.0176*	0.0449*	0.0070*	0.0454*	-0.0096*	-0.0022*	-0.0158*	0.1118*	0.0784*	0.0115*	0.0871*	0.0426*	0.0203*	0.2103*	0.0718*	0.1296*	0.0621*	0.1386*	0.0940*	-0.0116
D_2	-0.0154*	0.0569*	-0.0085*	0.0211*	0.0139*	-0.0016*	-0.0106*	-0.0936*	0.1112*	-0.0220*	-0.0125*	-7.76e-4	-0.0205*	-0.0270*	-0.3010*	0.0300*	-0.0382*	-0.0169*	-0.0380*	-0.0734*	-0.1615*
D_3	0.0065*	0.0116	0.0404*	0.0539*	0.0268	0.0026*	0.0107	0.0016*	0.1395*	0.0622*	0.0908	0.0607*	0.0755*	0.0332*	0.3204*	0.1535	0.0961*	0.0929*	0.0963*	0.0251*	0.1078
D_4	0.0049*	0.0442*	0.0479*	0.0414*	0.0499*	0.0089*	0.0164*	-0.0115*	0.1838*	0.0623*	0.0611*	0.0816*	0.0779*	0.0426*	0.1474*	0.1230*	0.0913*	0.1008*	0.1029*	0.1007*	0.0628*
$D_1 - A$	-0.0172*	0.0219*	0.0334*	-0.0177	0.0438*	-0.0134*	-0.0095*	-0.0307*	0.0768*	0.0620*	-0.0354*	0.0758*	0.0106*	0.0046*	0.0580*	0.0108*	0.1058*	0.0259*	0.1168*	0.0955*	-0.0894*
$D_2 - A$	-0.0171*	0.0598*	-0.0034*	0.0212*	0.0197*	-0.0030*	-0.0112*	-0.0970	0.1247*	-0.0130*	-0.0130*	0.0097*	-0.0166*	-0.0253*	-0.2834*	0.0368*	-0.0232*	-0.0107*	-0.0218*	-0.0622*	-0.1675*
$D_3 - A$	0.0134	0.0040*	0.0259*	0.0622*	0.0085*	0.0083*	0.0145*	0.0120*	0.1100*	0.0351*	0.1057*	0.0283*	0.0705*	0.0305*	0.2872*	0.1500	0.0498*	0.0815*	0.0453*	-0.0179*	0.1415*
Panel B. Aggregated raw impacts																					
D_1	12.04%	44.43%	6.66%	16.50%	10.86%	1.26%	8.26%	32.56%	38.66%	7.66%	4.33%	0.27%	7.12%	9.40%	45.68%	4.56%	5.79%	2.56%	5.76%	11.14%	24.50%
D_2	7.10%	12.90%	32.91%	5.14%	33.33%	7.01%	1.60%	4.30%	30.42%	21.34%	3.12%	23.70%	11.60%	5.52%	29.29%	10.00%	18.06%	8.64%	19.30%	13.09%	1.62%
D_3	12.03%	7.64%	26.46%	35.37%	17.55%	1.71%	7.01%	0.34%	30.10%	13.42%	19.59%	13.10%	16.30%	7.16%	35.91%	17.21%	10.77%	10.41%	10.80%	2.81%	12.08%
D_4	2.28%	20.68%	22.44%	19.40%	23.37%	4.15%	7.69%	2.21%	35.29%	11.97%	11.73%	15.68%	14.95%	8.18%	20.22%	16.88%	12.53%	13.83%	14.12%	13.82%	8.61%
$D_1 - A$	10.95%	13.94%	21.27%	11.27%	27.90%	8.57%	6.09%	10.37%	25.96%	20.94%	11.97%	25.63%	3.57%	1.56%	11.55%	2.15%	21.07%	5.15%	23.26%	19.01%	17.81%
$D_2 - A$	12.61%	44.16%	2.54%	15.64%	14.53%	2.20%	8.31%	32.40%	41.65%	4.35%	4.36%	3.24%	5.54%	8.46%	46.80%	6.08%	3.83%	1.77%	3.60%	10.27%	27.66%
$D_3 - A$	9.82%	2.90%	18.93%	45.49%	6.19%	6.09%	10.59%	3.05%	28.06%	8.95%	26.96%	7.21%	17.98%	7.78%	37.14%	19.40%	6.44%	10.53%	5.86%	2.32%	18.30%

(continued)

Table 2 (continued)

Notes Table 2 reports the impact of Greek news announcements/economic events in the return series of the European generic government bonds via dummy variables. % neg. coeff. is the percentage (%) of negative coefficients across all dummy variables. The D_1, D_2, and D_3 coefficients concern the three dummy variables with one regression per dummy. The $D_1 - A$, $D_2 - A$, and $D_3 - A$ coefficients concern the three dummies where all are included in a multiple regression. Panel A reports raw impacts, and Panel B reports the impacts aggregated across all European countries. The relative (Europe-aggregated) impacts are based on absolute raw impacts. * indicates significance of coefficient estimate at a 5% level of significance[13]

Table 3 Impact of Greek announcements/events in returns—Dummy variables—Stock market and Credit default swaps (CDS)

	Stock market							CDS						
	DE_{Stock}	GR_{Stock}	P_{Stock}	ESP_{Stock}	I_{Stock}	IRL_{Stock}	F_{Stock}	DE_{CDS}	GR_{CDS}	P_{CDS}	ESP_{CDS}	I_{CDS}	IRL_{CDS}	F_{CDS}
Panel A. Raw impacts														
% neg. coeff.	71.43%	1	1	71.43%	85.71%	71.43%	71.43%	42.86%	0	28.57%	28.57%	28.57%	42.86%	28.57%
D_1	-0.0172*	-0.0677*	-0.0187*	-0.0359*	-0.0337*	-0.0028*	-0.0197*	0.1308*	0.1262*	0.0835*	0.1351*	0.1572*	0.0715*	0.1279*
D_2	-0.0193*	-0.0014*	-0.0025*	0.0018*	-0.0151*	-0.0105*	-0.0040*	-0.0420*	0.0278*	-0.0578*	-0.0319*	-0.0429*	-0.0551*	-0.0159*
D_3	0.0118	-0.0362*	-0.0127*	-0.0146*	-0.0031*	-5.37e-4	-0.0015*	0.0488*	0.0985*	0.0717	0.0826*	0.0824*	0.0357*	0.0653*
D_4	-0.0056*	-0.0330*	-0.0185*	-0.0200*	-0.0180*	0.0022*	-0.0067*	0.0526*	0.1157*	0.0660*	0.0940*	0.0948*	-7.98e-6*	0.0602*
$D_1 - A$	-0.0298*	-0.0651*	-0.0168*	-0.0366*	-0.0419*	-0.0043*	-0.0242*	0.1321	0.1075*	0.0593*	0.1206*	0.1468	0.0638*	0.1225*
$D_2 - A$	-0.0221*	-0.0098*	-0.0048*	-0.0028*	-0.0198*	-0.0111*	-0.0067*	-0.0258*	0.0432*	-0.0488*	-0.0158*	-0.0240*	-0.0468*	-2.08e-4
$D_3 - A$	0.0241*	-0.0084*	-0.0056*	0.0012*	0.0144*	0.0010*	0.0087*	-0.0089*	0.0533*	0.0448*	0.0301*	0.0184*	0.0068*	0.0125*
Panel B. Aggregated Raw impacts														
D_1	8.81%	34.59%	9.55%	18.32%	17.24%	1.42%	10.09%	15.72%	15.17%	10.03%	16.24%	18.89%	8.59%	15.37%
D_2	35.31%	2.49%	4.60%	3.24%	27.71%	19.32%	7.35%	15.35%	10.18%	21.14%	11.66%	15.71%	20.13%	5.83%
D_3	14.73%	44.98%	15.74%	18.11%	3.88%	0.67%	1.89%	10.07%	20.30%	14.79%	17.02%	16.99%	7.36%	13.47%
D_4	5.37%	31.71%	17.81%	19.23%	17.28%	2.13%	6.46%	10.89%	23.94%	13.66%	19.45%	19.61%	1.65e-3%	12.46%
$D_1 - A$	13.64%	29.75%	7.67%	16.75%	19.17%	1.97%	11.05%	17.55%	14.29%	7.88%	16.02%	19.51%	8.48%	16.28%
$D_2 - A$	28.71%	12.68%	6.23%	3.58%	25.74%	14.34%	8.71%	12.62%	21.11%	23.85%	7.71%	11.72%	22.89%	0.10%
$D_3 - A$	38.04%	13.25%	8.79%	1.83%	22.73%	1.58%	13.77%	5.07%	30.51%	25.60%	17.23%	10.53%	3.91%	7.15%

(continued)

Table 3 (continued)

Notes Table 3 reports the impact of Greek news announcements/economic events in the return series of the European stock markets and credit default swaps (CDS) via dummy variables. % neg. coeff. is the percentage (%) of negative coefficients across the four dummy variables. The D_1, D_2, and D_3 coefficients concern the three dummy variables with one regression per dummy. The $D_1 - A$, $D_2 - A$, and $D_3 - A$ coefficients concern the three dummies where all are included in a multiple regression. Panel A reports raw impacts, and Panel B reports the impacts aggregated across all European countries. The relative (Europe - aggregated) impacts are based on absolute raw impacts. * indicates significance of coefficient estimate at a 5% level of significance[14]

Table 4 Impact of Greek announcements/events in return—Variables of number of events per month—Generic government bonds

	10-Year							5-Year							2-Year						
	DE_{10Y}	GR_{10Y}	P_{10Y}	ESP_{10Y}	I_{10Y}	IRL_{10Y}	F_{10Y}	DE_{5Y}	GR_{5Y}	P_{5Y}	ESP_{5Y}	I_{5Y}	IRL_{5Y}	F_{5Y}	DE_{2Y}	GR_{2Y}	P_{2Y}	ESP_{2Y}	I_{2Y}	IRL_{2Y}	F_{2Y}
Panel A. Raw impacts																					
% neg. coeff.	85.71%	28.57%	14.29%	14.30%	14.29%	57.14%	85.71%	85.71%	0	14.29%	28.57%	14.29%	23.06%	71.43%	42.86%	28.57%	14.29%	14.29%	42.86%	57.14%	71.43%
V_1	-0.0045*	-0.0037*	0.0236*	-3.92e-4*	0.0222*	-0.0046*	-0.0039*	-0.0025	0.0325*	0.0366*	-0.0035*	0.0410*	0.0169*	0.0056*	0.1752*	-0.0021	0.0658*	0.0097*	0.0682*	0.0124*	0.0013*
V_2	-0.0082*	0.0435*	0.0043*	0.0267*	0.0042*	0.0068	-0.0115*	-0.0478*	0.0758*	0.0106*	0.0173*	0.0032*	0.0029*	-0.0208*	-0.1518*	0.0365*	0.0170*	0.0196*	-0.0138*	-0.0173*	-0.0934*
V_3	-0.0085	0.0035*	0.0062*	0.0072*	0.0053*	-0.0014*	-0.0064*	-0.0226*	0.0228*	0.0107*	0.0093*	0.0095*	0.0099*	-0.0146*	0.0037*	0.0191*	0.0199*	0.0152*	0.0183*	-5.90e-5	-0.0223*
V_4	-0.0058*	0.0057*	0.0073*	0.0063*	0.0066*	-7.08e-4	-0.0050*	-0.0166*	0.0244*	0.0122*	0.0059*	0.0116*	0.0079*	-0.0085*	0.0138*	0.0130*	0.0221*	0.0111*	0.0185*	1.37e-4	-0.0206*
$V_1 - A$	0.0049*	-0.0073*	0.0259*	-0.0090*	0.0252*	-0.0042*	0.0027*	0.0252*	0.0205*	0.0390*	-0.0172*	0.0466*	0.0108*	0.0275*	0.2398*	-0.0278*	0.0691*	-0.0060*	0.0725*	0.0169*	0.0269*
$V_2 - A$	-0.0097*	0.0441*	0.0077*	0.0278*	0.0073*	0.0062*	-0.0128*	-0.0511*	0.0831*	0.0160*	0.0182*	0.0089*	0.0059*	-0.0220*	-0.1339*	0.0388*	0.0268*	0.0225*	-0.0044	-0.0161*	-0.0970*
$V_3 - A$	-0.0104*	0.0077*	-0.0016*	0.0113*	-0.0023*	2.09e-4*	-0.0079*	-0.0328*	0.0201*	-9.12e-4	0.0156*	-0.0048*	0.0067*	-0.0243*	-0.0780*	0.0296*	-7.21e-4	0.0181*	-0.0048*	-0.0061*	-0.0351*
Panel B. Aggregated Raw impacts																					
V_1	21.88%	41.34%	4.08%	25.40%	3.98%	6.44%	10.94%	26.78%	42.50%	5.94%	9.71%	1.78%	1.63%	11.66%	43.46%	10.45%	4.86%	5.60%	3.96%	4.94%	26.74%
V_2	7.15%	5.93%	37.52%	0.62%	35.39%	7.24%	6.15%	1.80%	23.47%	26.41%	1.56%	29.61%	12.18%	4.01%	52.34%	0.63%	19.66%	2.91%	20.38%	3.69%	0.39%
V_3	7.82%	9.08%	16.13%	18.81%	13.79%	3.60%	16.71%	22.73%	22.97%	10.75%	9.39%	9.55%	9.93%	14.68%	3.72%	19.40%	20.20%	15.38%	18.59%	0.06%	22.64%
V_4	15.42%	15.18%	19.48%	16.92%	17.69%	1.90%	13.42%	19.06%	28.00%	14.03%	6.77%	13.27%	9.06%	9.81%	13.93%	13.07%	22.26%	11.20%	18.64%	0.14%	20.76%
$V_1 - A$	25.07%	18.66%	3.93%	27.27%	5.63%	0.50%	18.95%	31.21%	19.07%	0.87%	14.80%	4.59%	6.40%	23.06%	45.26%	17.17%	0.42%	10.47%	2.78%	3.54%	20.37%
$V_2 - A$	8.42%	38.12%	6.64%	24.06%	6.33%	5.37%	11.06%	24.92%	40.49%	7.81%	8.86%	4.33%	2.87%	10.73%	39.43%	11.43%	7.89%	6.64%	1.29%	4.75%	28.57%
$V_3 - A$	6.18%	9.13%	32.75%	11.33%	31.90%	5.27%	3.43%	13.49%	10.97%	20.88%	9.21%	24.97%	5.76%	14.73%	52.25%	6.05%	15.05%	1.31%	15.80%	3.68%	5.86%

(continued)

Table 4 (continued)

Notes Table 4 reports the impact of Greek news announcements/economic events in the return series of the European generic government bonds via variables of number of the four different categories of events per month. % neg. coeff. is the percentage (%) of negative coefficients across the four variables. The V_1, V_2, and V_3 coefficients concern the three variables with one regression per variable. The $V_1 - A$, $V_2 - A$, and $V_3 - A$ coefficients concern the three variables where all are included in a multiple regression. Panel A reports raw impacts, and Panel B reports the impacts aggregated across all European countries. The relative (Europe-aggregated) impacts are based on absolute raw impacts. * indicates significance of coefficient estimate at a 5% level of significance.[15]

Table 5 Impact of Greek announcements/events in return—Variables of number of events per month—Stock market and Credit default swaps (CDS)

	Stock market							CDS						
	DE_{Stock}	GR_{Stock}	P_{Stock}	ESP_{Stock}	I_{Stock}	IRL_{Stock}	F_{Stock}	DE_{CDS}	GR_{CDS}	P_{CDS}	ESP_{CDS}	I_{CDS}	IRL_{CDS}	F_{CDS}
Panel A. Raw impacts														
% neg. coeff.	71.40%	1	1	1	1	1	1	28.57%	1	0	0	28.57%	28.57%	14.29%
V_1	-0.0051*	-0.0084*	-0.0076*	-0.0178*	-0.0076*	-0.0153*	-0.0097*	0.0761*	-0.0101*	0.0632*	0.0476*	0.0317*	0.0410*	0.0387*
V_2	-0.0061*	-0.0090*	-0.0014*	-0.0046*	-0.0014*	-0.0067*	-0.0048*	-0.0157*	-0.0033*	0.0096	0.0285*	-0.0126*	-0.0166*	-0.0047*
V_3	1.59e-4	-0.0052*	-0.0059*	-0.0078*	-0.0059*	-0.0068*	-0.0037*	0.0381*	-0.0041*	0.0338*	0.0313*	0.0236*	0.0308*	0.0175*
V_4	-0.0014*	-0.0048*	-0.0043*	-0.0072*	-0.0043*	-0.0065*	-0.0039*	0.0294*	-0.0040*	0.0278*	0.0261*	0.0155*	0.0201*	0.0144*
$V_1 - A$	-0.0082*	-0.0055*	-0.0027*	-0.0151*	-0.0027*	-0.0131*	-0.0092*	0.0555*	-0.0093*	0.0448*	0.0269*	0.0116*	0.0147*	0.0312*
$V_2 - A$	-0.0068*	-0.0106*	-0.0029*	-0.0075	-0.0029*	-0.0093*	-0.0063*	-0.0033*	-0.0050*	0.0205*	0.0376*	-0.0067*	-0.0090*	0.0015*
$V_3 - A$	-0.0069*	-0.0039*	-0.0052*	-0.0034*	-0.0052*	-0.0031*	-0.0063*	0.0205*	-0.0014	0.0206*	0.0245*	0.0197*	0.0257*	0.0077*
Panel B. Aggregated Raw impacts														
V_1	7.19%	11.70%	10.65%	24.89%	10.65%	21.36%	13.57%	24.66%	3.29%	20.49%	15.43%	10.29%	13.30%	12.55%
V_2	18.04%	26.31%	4.12%	13.48%	4.12%	19.93%	13.99%	17.20%	3.66%	10.57%	31.33%	13.85%	18.25%	5.13%
V_3	0.45%	14.56%	16.70%	22.05%	16.69%	19.15%	10.40%	21.27%	2.27%	18.85%	17.48%	13.18%	17.17%	9.77%
V_4	4.24%	14.91%	13.29%	22.22%	13.29%	20.10%	11.95%	21.42%	2.90%	20.28%	19.02%	11.28%	14.64%	10.47%
$V_1 - A$	14.48%	9.68%	4.84%	26.73%	4.84%	23.11%	16.33%	28.61%	4.78%	23.10%	13.85%	6.00%	7.58%	16.08%
$V_2 - A$	14.68%	22.84%	6.27%	16.17%	6.27%	20.13%	13.64%	3.94%	5.93%	24.49%	45.03%	8.07%	10.77%	1.77%
$V_3 - A$	10.07%	16.11%	21.40%	13.95%	21.40%	12.72%	4.35%	17.05%	1.14%	17.12%	20.43%	16.37%	21.44%	6.45%

(continued)

Table 5 (continued)

Notes Table 5 reports the impact of Greek news announcements/economic events in the return series of the European stock markets and credit default swaps (CDS) via variables of number of the four different categories of events per month. % neg. coeff. is the percentage (%) of negative coefficients across the four variables. The V_1, V_2, and V_3 coefficients concern the three variables with one regression per variable. The $V_1 - A$, $V_2 - A$, and $V_3 - A$ coefficients concern the three variables where all are included in a multiple regression. Panel A reports raw impacts, and Panel B reports the impacts aggregated across all European countries for each financial market (stock market and CDS). * indicates significance of coefficient estimate at a 5% level of significance.[16]

Table 6 Impact of Greek announcements/events in return—News surprises (*SUR*i)—Generic government bonds

	10-Year							5-Year							2-Year						
	DE_{10Y}	GR_{10Y}	P_{10Y}	ESP_{10Y}	I_{10Y}	IRL_{10Y}	F_{10Y}	DE_{5Y}	GR_{5Y}	P_{5Y}	ESP_{5Y}	I_{5Y}	IRL_{5Y}	F_{5Y}	DE_{2Y}	GR_{2Y}	P_{2Y}	ESP_{2Y}	I_{2Y}	IRL_{2Y}	F_{2Y}
Panel A. Raw impacts																					
% neg. coeff.	50.00%	1	25.00%	25.00%	25.00%	75.00%	50.00%	50.00%	50.00%	50.00%	25.00%	25.00%	25.00%	50.00%	50.00%	25.00%	25.00%	50.00%	25.00%	75.00%	50.00%
SUR_{2Y}	0.0130*	-0.0107*	-0.0030*	-0.0027*	-0.0019*	-0.0021*	0.0106	0.0277*	5.29e-4*	-0.0092*	-0.0035*	-0.0072*	-0.0148*	0.0144*	0.1398*	0.0037*	-0.0164*	-0.0094*	-0.0184*	-0.0217*	0.0341*
SUR_{5Y}	-0.0093*	-0.0015*	0.0029*	0.0071*	0.0023*	-0.0010*	-0.0035*	-0.0252*	-9.23e-4*	0.0017*	0.0110*	9.00e-4	0.0016*	-0.0081*	-0.0770*	4.08e-4	0.0032*	0.0077*	0.0033*	-0.0050*	-0.0222*
SUR_{10Y}	-0.0013*	-0.0032*	5.42e-4*	4.07e-5*	2.85e-4*	-6.28e-4*	-2.65e-4*	-0.0044*	0.0011*	7.30e-4*	2.21e-4*	7.18e-4*	8.63e-5*	-6.11e-4*	-0.0099*	3.09e-4*	6.09e-4*	-9.48e-4*	0.0020*	-0.0013*	-0.0033*
SUR_{CDS}	5.75e-6*	-8.23e-5*	6.10e-5*	4.59e-6*	7.83e-5*	2.25e-5*	6.17e-5*	1.49e-6*	-8.36e-5*	6.10e-5	3.75e-5	1.04e-4*	4.76e-5*	5.24e-5*	8.25e-5*	-6.09e-5*	9.09e-5*	2.60e-5*	1.33e-4*	1.03e-4	3.34e-5*
Panel B. Aggregated Raw impacts																					
SUR_{2Y}	29.57%	24.38%	6.72%	6.08%	4.38%	4.71%	24.15%	35.80%	0.68%	11.88%	4.58%	9.26%	19.14%	18.65%	57.44%	1.52%	6.73%	3.86%	7.55%	8.90%	14.00%
SUR_{5Y}	33.72%	24.38%	10.36%	25.62%	8.22%	3.72%	12.81%	50.91%	1.86%	3.50%	22.27%	1.82%	3.27%	16.37%	64.84%	0.34%	2.69%	6.48%	2.76%	4.20%	18.69%
SUR_{10Y}	20.58%	51.21%	8.68%	0.65%	4.57%	10.06%	4.25%	55.78%	14.44%	9.19%	2.78%	9.03%	1.09%	7.69%	53.75%	1.69%	3.32%	5.17%	10.79%	7.05%	18.23%
SUR_{CDS}	1.82%	26.02%	19.29%	1.45%	24.78%	7.13%	19.51%	0.38%	21.54%	15.72%	9.67%	26.91%	12.27%	13.50%	15.57%	11.49%	17.15%	4.91%	25.14%	19.45%	6.30%

Notes Table 6 reports the impact of Greek news announcements/economic events in the return series of the European generic government bonds via news surprises (SUR_i). % neg. coeff. is the percentage (%) of negative coefficients across the four variables. News surprises concern the 2-Year, 5-Year, and 10-Year Greek government bonds as well as the Greek CDS. Panel A reports raw impacts, and Panel B reports the impacts aggregated across all European countries for each financial market (10-Year, 5-Year, and 2-Year). * indicates significance of coefficient estimate at a 5% level of significance.[17]

It is also reported the percentage (%) of the coefficients of the seven dummy variables with negative impact. Panel A provides raw impacts, whereas Panel B provides aggregated impacts across all European countries.[9] The magnitude (in raw level) of the effects of each of the three groups of Greek economic news on returns in a multiple regression ($V_1 - A$, $V_2 - A$, and $V_3 - A$) is compatible and very close to the ones in a simple regression (V_1, V_2 and V_3), accordingly. The variable of the number of all Greek economic news per month (V_4) has the fewest effects on returns with the highest magnitude. Very few impacts are not statistically significant. Most of the impacts across variables and European financial markets are positive, with a single exception the European stock market. When variables of number of news releases are employed as explanatory variables, the highest impacts to the returns of European financial markets come from the events important to the Greek economy ($1 - Greece$). Results are consistent in simple and multiple regression frameworks: V_1 and $V_1 - A$ variables, respectively. Results are further consistent because we have the same results for the aggregated raw impacts (Panel B) of Tables 4 and 5.

Tables 6 and 7 report the impact of the news surprises on 2 years, 5 years, 10 years, and CDS Greek government bonds (SUR_{2Y}, SUR_{5Y}, SUR_{10Y}, and SUR_{CDS}) in the return series of the European financial markets (generic government bonds, CDS, and stock markets). Very few impacts are not statistically significant. Most of the impacts across the surprises of the Greek government bonds (SUR_{2Y}, SUR_{5Y}, SUR_{10Y}, and SUR_{CDS}) and European financial markets are positive. When surprises are employed as explanatory variables, the highest raw impacts to the returns of European financial markets come from the surprises of the 2-year Greek government bond (SUR_{2Y}). Based on aggregated raw impacts (Panel B of Tables 6, 7), the Greek CDS (SUR_{CDS}) have the highest impact on returns of European financial markets.

6.2 Volatility and Volatility Jumps

Tables 8 and 9 report the impact of the Greek events in the volatility series of the European financial markets (generic government bonds,

Table 7 Impact of Greek announcements/events in return—News surprises (*SUR*i)—Stock market and Credit default swaps (CDS)

	Stock market							CDS						
	DE_{Stock}	GR_{Stock}	P_{Stock}	ESP_{Stock}	I_{Stock}	IRL_{Stock}	F_{Stock}	DE_{CDS}	GR_{CDS}	P_{CDS}	ESP_{CDS}	I_{CDS}	IRL_{CDS}	F_{CDS}
Panel A. Raw impacts														
% neg. coeff.	0	0	50.00%	50.00%	50.00%	0	25.00%	1	75.00%	50.00%	50.00%	25.00%	50.00%	75.00%
SUR_{2Y}	0.0048*	0.0100*	0.0018*	0.0059*	0.0065*	0.0025*	0.0035*	-0.0019*	3.10e-4*	-0.0070*	-0.0065*	-0.0073*	-0.0060*	-0.0024*
SUR_{5Y}	0.0036*	0.0012*	-0.0018*	-0.0045*	0.0065*	0.0011*	4.80e-4	-0.0077*	-0.0068*	0.0101*	0.0027*	0.0034*	0.0019*	-0.0019*
SUR_{10Y}	4.75e-4*	8.04e-5*	-2.72e-4*	-0.0011	-4.63e-4*	2.71e-4*	-7.26e-5*	-0.0020*	-0.0015*	4.68e-4*	0.0010	3.63e-4*	-2.80e-4*	-4.49e-4*
SUR_{CDS}	5.49e-5*	3.25e-5*	5.66e-6*	1.89e-5*	2.97e-5*	1.58e-5*	2.72e-5*	-6.66e-5*	-4.04e-5*	-4.39e-5*	-1.45e-5*	7.15e-5*	2.15e-5*	-4.49e-4*
Panel B. Aggregated Raw impacts														
SUR_{2Y}	13.82%	28.53%	5.09%	16.78%	18.71%	7.14%	9.94%	6.11%	0.98%	22.19%	20.69%	23.27%	19.10%	7.64%
SUR_{5Y}	25.96%	8.68%	13.13%	31.95%	9.12%	7.74%	3.42%	22.26%	19.85%	29.51%	7.78%	9.76%	5.46%	5.38%
SUR_{10Y}	17.25%	2.92%	9.90%	40.63%	16.83%	9.83%	2.64%	32.53%	24.74%	7.78%	16.82%	6.02%	4.65%	7.45%
SUR_{CDS}	29.74%	17.58%	3.06%	10.24%	16.10%	8.54%	14.73%	24.82%	15.07%	16.37%	5.42%	26.67%	8.02%	3.63%

(continued)

Table 7 (continued)

Notes Table 7 reports the impact of Greek news announcements/economic events in the return series of the European stock markets and credit default swaps (CDS) via news surprises. % neg. coeff. is the percentage (%) of negative coefficients across the four variables. News surprises concern the 2-Year, 5-Year, and 10-Year Greek government bonds as well as the Greek CDS. Panel A reports raw impacts, and Panel B reports the impacts aggregated across all European countries for each financial market (stock market andCDS). * indicates significance of coefficient estimate at a 5% level of significance.[18]

Table 8 Impact of Greek announcements/events in volatility—Dummy variables—Generic government bonds

	10-Year							5-Year							2-Year						
	DE_{10Y}	GR_{10Y}	P_{10Y}	ESP_{10Y}	I_{10Y}	IRL_{10Y}	F_{10Y}	DE_{5Y}	GR_{5Y}	P_{5Y}	ESP_{5Y}	I_{5Y}	IRL_{5Y}	F_{5Y}	DE_{2Y}	GR_{2Y}	P_{2Y}	ESP_{2Y}	I_{2Y}	IRL_{2Y}	F_{2Y}
Panel A. Raw impacts																					
% neg. coeff.	0	28.57%	0	28.57%	0	0	0	0	1	0	28.57%	0	57.14%	0	0	28.57%	0	28.57%	0	28.57%	0
D_1	0.0019*	0.0224*	8.04e-4	0.0062*	7.24e-4	0.0025*	0.0011*	0.0083*	-0.0124*	0.0014*	0.0094*	0.0031*	-0.0052*	0.0125*	0.7733	0.0666*	0.0058*	0.0340*	0.0128*	0.0383*	0.1339*
D_2	0.0020*	0.0237*	0.0010*	0.0068*	7.98e-4	0.0026*	0.0021*	0.0105*	-0.0120*	0.0033*	0.0129*	0.0038*	0.0186*	0.0129*	0.6021	0.0593*	0.0054*	0.0411*	0.0093*	0.0225*	0.2005*
D_3	0.0016*	-0.0105*	0.0041*	-0.0042*	0.0032*	0.0030*	7.45e-4	0.0116*	-0.0349*	0.0071*	-0.0070*	0.0019*	-0.0078*	0.0085*	0.7331	-0.0257*	0.0084*	-0.0348*	0.0018*	-0.0366*	0.0706*
D_4	0.0017*	0.0156*	0.0024*	0.0049*	0.0021*	0.0043*	0.0012*	0.0090*	-0.0430*	0.0043*	0.0075*	0.0032*	0.0113*	0.0109*	1.0066	0.0422*	0.0059*	0.0254*	0.0100*	0.0058*	0.1210*
$D_1 - A$	0.0014*	0.0141*	8.83e-4*	0.0037*	8.25e-4*	0.0020*	2.91e-4*	0.0060*	-0.0128*	7.75e-4	0.0040*	0.0021*	-0.0172*	0.0096*	0.7208	0.0485*	0.0053*	0.0166*	0.0112*	0.0317*	0.0674*
$D_2 - A$	0.0018*	-0.0081*	0.0042*	-0.0036*	0.0033*	0.0034*	8.53e-4*	0.0127*	-0.0367*	0.0073*	-0.0061*	0.0023*	-0.0090*	0.0100*	0.8343	-0.0183*	0.0092*	-0.0315*	0.0034*	-0.0324*	0.0853*
$D_3 - A$	0.0015*	0.0174*	7.88e-4*	0.0051*	5.40e-4*	0.0018*	0.0020*	0.0083	-0.0076*	0.0032*	0.0110	0.0029*	0.0257*	0.0090*	0.3156	0.0378*	0.0034	0.0331*	0.0045*	0.0079*	0.1740*
Panel B. Aggregated Raw impacts																					
D_1	5.27%	62.98%	2.26%	17.54%	2.03%	6.94%	2.98%	15.83%	23.66%	2.72%	17.98%	6.01%	9.87%	23.94%	72.63%	6.26%	0.54%	3.19%	1.21%	3.60%	12.57%
D_2	5.90%	38.39%	14.81%	15.33%	11.72%	11.13%	2.72%	14.73%	44.26%	8.97%	8.93%	2.44%	9.91%	10.75%	80.47%	2.82%	0.93%	3.81%	0.20%	4.02%	7.74%
D_3	5.21%	60.74%	2.69%	17.40%	2.04%	6.58%	5.33%	14.16%	16.23%	4.48%	17.48%	5.09%	25.12%	17.43%	64.04%	6.31%	0.57%	4.37%	0.98%	2.40%	21.33%
D_4	5.34%	48.29%	7.39%	15.19%	6.51%	13.42%	3.85%	10.07%	48.24%	4.81%	8.38%	3.57%	12.66%	12.26%	82.72%	3.47%	0.48%	2.09%	0.82%	0.48%	9.90%
$D_1 - A$	6.14%	60.65%	3.80%	15.87%	3.55%	8.74%	1.25%	11.40%	24.38%	1.48%	7.69%	4.02%	32.70%	18.34%	79.96%	5.38%	0.58%	1.84%	1.25%	3.51%	7.48%
$D_2 - A$	7.31%	32.15%	16.60%	14.07%	13.18%	13.32%	3.38%	15.04%	43.68%	8.65%	7.30%	2.72%	10.72%	11.89%	82.25%	1.80%	0.91%	3.10%	0.34%	3.19%	8.41%
$D_3 - A$	5.06%	59.85%	2.72%	17.53%	1.86%	6.17%	6.82%	12.20%	11.17%	4.72%	16.27%	4.32%	37.98%	13.35%	54.76%	6.57%	0.59%	5.74%	0.78%	1.38%	30.19%

(continued)

Table 8 (continued)

Notes Table 8 reports the impact of Greek news announcements/economic events in the volatility series of the European generic government bonds via dummy variables. % neg. coeff. is the percentage (%) of negative coefficients across the four dummy variables. The D_1, D_2, and D_3 coefficients concern the three dummy variables with one regression per dummy. The $D_1 - A$, $D_2 - A$, and $D_3 - A$ coefficients concern the three dummies where all are included in a multiple regression. Panel A reports raw impacts, and Panel B reports the impacts aggregated across all European countries for each financial market (10-Year, 5-Year, and 2-Year). * indicates significance of coefficient estimate at a 5% level of significance[19]

Table 9 Impact of Greek announcements/events in volatility—Dummy variables—Stock market and Credit default swaps (CDS)

	Stock market							CDS						
	DE_{Stock}	GR_{Stock}	P_{Stock}	ESP_{Stock}	I_{Stock}	IRL_{Stock}	F_{Stock}	DE_{CDS}	GR_{CDS}	P_{CDS}	ESP_{CDS}	I_{CDS}	IRL_{CDS}	F_{CDS}
Panel A. Raw impacts														
% neg. coeff.	0	0	0	0	0	28.57%	0	0	28.57%	28.57%	0	0	28.57%	0
D_1	0.0014*	0.0022*	0.0017*	0.0024*	0.0024*	0.0012*	0.0017*	0.0160*	0.0315*	0.0424*	0.0173*	0.0117*	0.0169*	0.0082*
D_2	8.86e-4	1.36e-4	0.0011*	0.0038*	0.0026*	-2.78e-4	0.0016*	0.0098*	-0.0289*	-0.0301*	0.0041*	0.0091*	-0.0084*	0.0113*
D_3	0.0019*	0.0013*	0.0017*	0.0028*	0.0027*	0.0011*	0.0021*	0.0147*	0.0270*	0.0369*	0.0217	0.0119*	0.0182*	0.0069
D_4	0.0010*	0.0028*	0.0014*	0.0028*	0.0025*	1.44e-4*	0.0017*	0.0185*	0.0039*	0.0227*	0.0182*	0.0141*	0.0097*	0.0140*
$D_1 - A$	8.18e-4*	0.0020*	0.0013*	0.0019*	0.0018*	9.38e-4*	0.0011*	0.0131*	0.0217*	0.0298*	0.0103*	0.0092*	0.0104*	0.0078*
$D_2 - A$	0.0010*	4.01e-4*	0.0013*	0.0041*	0.0029*	-1.37e-4*	0.0018*	0.0118*	-0.0256*	-0.0255*	0.0060*	0.0105*	-0.0066*	0.0124*
$D_3 - A$	0.0016*	4.29e-4	0.0012*	0.0021*	0.0020*	6.76e-4	0.0016*	0.0094*	0.0169	0.0233*	0.0174	0.0083*	0.0136*	0.0039*
Panel B. Aggregated Raw impacts														
D_1	10.78%	16.52%	13.15%	18.70%	18.54%	9.55%	12.76%	11.08%	21.91%	29.45%	11.98%	8.15%	11.72%	5.71%
D_2	8.44%	1.29%	10.52%	36.33%	25.21%	2.65%	15.55%	9.68%	28.44%	29.57%	4.00%	8.94%	8.26%	11.10%
D_3	14.11%	9.42%	12.73%	20.62%	19.91%	7.97%	15.25%	10.68%	19.63%	26.88%	15.80%	8.69%	13.29%	5.03%
D_4	8.27%	22.57%	11.50%	22.75%	19.98%	1.17%	13.76%	18.31%	3.84%	22.39%	18.02%	13.97%	9.61%	13.85%
$D_1 - A$	8.16%	20.01%	13.24%	19.44%	18.42%	9.36%	11.37%	12.80%	21.22%	29.12%	10.11%	9.03%	10.12%	7.60%
$D_2 - A$	8.85%	3.40%	11.12%	34.98%	24.96%	1.16%	15.53%	12.00%	25.99%	25.91%	6.09%	10.71%	6.72%	12.59%
$D_3 - A$	16.61%	4.46%	12.45%	21.68%	20.77%	7.02%	17.01%	10.10%	18.17%	25.15%	18.79%	8.90%	14.66%	4.22%

(continued)

Table 9 (continued)

Notes Table 9 reports the impact of Greek news announcements/economic events in the volatility series of the European stock markets and credit default swaps (CDS) via dummy variables. % neg. coeff. is the percentage (%) of negative coefficients across the four dummy variables. The D_1, D_2, and D_3 coefficients concern the three dummy variables with one regression per dummy. The $D_1 - A$, $D_2 - A$, and $D_3 - A$ coefficients concern the three dummies where all are included in a multiple regression. Panel A reports raw impacts, and Panel B reports the impacts aggregated across all European countries for each financial market (stock market and CDS). * indicates significance of coefficient estimate at a 5% level of significance.[20]

Table 10 Impact of Greek announcements/events in volatility—Variables of number of events per month—Generic government bonds

	10-Year							5-Year							2-Year						
	DE_{10Y}	GR_{10Y}	P_{10Y}	ESP_{10Y}	I_{10Y}	IRL_{10Y}	F_{10Y}	DE_{5Y}	GR_{5Y}	P_{5Y}	ESP_{5Y}	I_{5Y}	IRL_{5Y}	F_{5Y}	DE_{2Y}	GR_{2Y}	P_{2Y}	ESP_{2Y}	I_{2Y}	IRL_{2Y}	F_{2Y}
Panel A. Raw impacts																					
% neg. coeff.	28.57%	28.57%	28.57%	28.57%	28.57%	0	14.29%	28.57%	28.57%	0	28.57%	14.29%	71.43%	14.29%	28.57%	28.57%	0	28.57%	0	28.57%	14.29%
V_1	7.91e-4*	-0.0048*	0.0028*	-0.0022*	0.0017*	0.0012*	8.24e-4*	0.0071*	-0.0175*	0.0049*	-0.0043*	0.0021*	-0.0042*	0.0074*	0.9277*	-0.0133*	0.0074*	-0.0200*	0.0049*	-0.0187*	0.0688*
V_2	8.24e-4*	0.0160*	5.16e-4*	0.0050*	2.10e-4*	0.0024*	5.40e-4*	0.0056*	0.0047*	0.00204*	0.0094*	0.0020*	-0.0026*	0.0068*	0.4065*	0.0577*	0.0063*	0.0352*	0.0080*	0.0372*	0.0664*
V_3	-3.39e-4*	0.0091*	-3.74e-5*	0.0034*	-4.82e-5	0.0015*	7.90e-5*	-0.0030*	0.0045*	7.59e-4	0.0089*	5.41e-4*	0.0010*	2.71e-4*	-0.0747*	0.0353	0.0029*	0.0294*	0.0028*	0.0238*	0.0161
V_4	4.41e-5*	0.0065*	3.58e-4*	0.0023*	1.83e-4*	0.0012*	2.11e-4*	1.30e-4*	0.0012*	0.0012*	0.0055*	8.11e-4*	-3.50e-4*	0.0020*	0.1238*	0.0253*	0.0032*	0.0181*	0.0032*	0.0158*	0.0257*
V_1-A	0.0018*	0.0101*	0.0010*	0.0023*	5.00e-4*	0.0015*	7.38e-4*	0.0130*	-9.25e-4*	0.0023*	6.49e-4*	0.0023*	-0.0056*	0.0101*	0.7708*	0.0328*	0.0056*	0.0078*	0.0080*	0.0189*	0.0792*
V_2-A	8.62e-4*	-0.0021*	0.0029*	-0.0013*	0.0017*	0.0017*	9.06e-4*	0.0076*	-0.0168*	0.0053*	-0.0024*	0.0025*	-0.0045*	0.0083*	0.9804*	-0.0032*	0.0085*	-0.0133*	0.0061*	-0.0123*	0.0791*
V_3-A	-8.54e-4	0.0058*	-2.29e-4*	0.0026*	-1.30e-4	0.0011*	-1.14e-4*	-0.0068*	0.0041*	2.83e-4	0.0086*	-8.39e-5	0.0026*	-0.0026*	-0.2744*	0.0248*	0.0015*	0.0264*	5.88e-4	0.0173*	-0.0054*
Panel B. Aggregated Raw impacts																					
V_1	3.23%	62.65%	2.02%	19.72%	0.82%	9.44%	2.12%	16.85%	14.19%	6.15%	28.34%	6.06%	7.86%	20.54%	65.86%	9.35%	1.02%	5.70%	1.29%	6.03%	10.75%
V_2	2.35%	62.75%	0.26%	23.56%	0.33%	10.19%	0.55%	15.81%	23.82%	3.99%	46.81%	2.84%	5.31%	1.42%	40.34%	19.07%	1.58%	15.91%	1.53%	12.88%	8.69%
V_3	5.51%	33.44%	19.73%	15.54%	11.59%	8.47%	5.73%	14.98%	36.82%	10.37%	9.02%	4.50%	8.87%	15.44%	87.45%	1.25%	0.69%	1.89%	0.46%	1.77%	6.49%
V_4	0.41%	60.37%	3.30%	20.84%	1.68%	11.45%	1.94%	1.17%	10.57%	10.91%	49.17%	7.28%	3.14%	17.76%	57.53%	11.77%	1.50%	8.43%	1.48%	7.35%	11.94%
V_1-A	7.47%	56.18%	5.70%	12.99%	2.79%	8.42%	4.13%	37.32%	2.65%	6.48%	1.86%	6.67%	15.99%	29.02%	83.50%	3.56%	0.61%	0.85%	0.86%	2.04%	8.58%
V_2-A	9.79%	18.39%	25.43%	11.63%	14.82%	14.41%	7.85%	16.00%	35.55%	11.27%	5.01%	5.21%	9.48%	17.49%	88.88%	0.29%	0.77%	1.20%	0.56%	1.12%	7.17%
V_3-A	7.91%	53.65%	2.12%	24.16%	1.20%	9.91%	1.05%	27.18%	16.34%	1.13%	34.47%	0.34%	10.30%	10.24%	78.31%	7.07%	0.44%	7.53%	0.17%	4.95%	1.54%

(continued)

Table 10 (continued)

Notes Table 10 reports the impact of Greek news announcements/economic events in the volatility series of the European generic government bonds via variables of number of events per month. % neg. coeff is the percentage (%) of negative coefficients across the four variables. The V_1, V_2, and V_3 coefficients concern the three variables with one regression per variable. The $V_1 - A$, $V_2 - A$, and $V_3 - A$ coefficients concern the three variables where all are included in a multiple regression. Panel A reports raw impacts, and Panel B reports the impacts aggregated across all European countries for each financial market (10-Year, 5-Year, and 2-Year). * indicates significance of coefficient estimate at a 5% level of significance[21]

Table 11 Impact of Greek announcements/events in volatility—Variables of number of events per month—Stock market and Credit default swaps (CDS)

	Stock market							CDS						
	DE_{Stock}	GR_{Stock}	P_{Stock}	ESP_{Stock}	I_{Stock}	IRL_{Stock}	F_{Stock}	DE_{CDS}	GR_{CDS}	P_{CDS}	ESP_{CDS}	I_{CDS}	IRL_{CDS}	F_{CDS}
Panel A. Aggregated Raw impacts														
% neg. coeff.	0	0	0	0	0	14.29%	0	0	28.57%	28.57%	0	0	28.57%	0
V_1	5.58e-4*	5.39e-4*	9.74e-4*	0.0012*	0.0014*	0.0011*	8.38e-4*	0.0098*	0.0195*	0.0331*	0.0129*	0.0116*	0.0117*	0.0047*
V_2	4.43e-4*	1.23e-4*	8.07e-4*	0.0024*	0.0016*	-8.85e-5*	9.98e-4*	0.0038*	-0.0148*	-0.0162*	0.0035*	0.0042	-0.0048*	0.0045*
V_3	3.94e-4*	3.59e-4*	6.60e-4*	5.73e-4*	5.88e-4*	6.24e-4	4.94e-4	0.0069*	0.0113*	0.0260*	0.0118*	0.0060*	0.0102*	0.0031*
V_4	3.31e-4*	2.77e-4*	5.67e-4*	7.34e-4*	6.87e-4*	4.68e-4*	4.83e-4*	0.0054*	0.0072*	0.0165*	0.0083*	0.0053*	0.0064*	0.0027*
$V_1 - A$	2.84e-4*	2.84e-4*	5.39e-4*	0.0012*	0.0014*	6.41e-4*	5.93e-4*	0.0048*	0.0112*	0.0099*	0.0022*	0.0086*	0.0022*	0.0028*
$V_2 - A$	5.54e-4*	2.24e-4*	9.98e-4*	0.0027*	0.0018*	9.46e-5*	0.0012*	0.0057*	-0.0116*	-0.0100*	0.0063*	0.0062*	-0.0025*	0.0055*
$V_3 - A$	3.29e-4*	2.79e-4*	5.34e-4	3.26e-4*	2.35e-4*	4.26e-4*	3.59e-4*	0.0056*	0.0073	0.0225*	0.0114*	0.0036*	0.0094*	0.0024*
Panel B. Aggregated Raw impacts														
V_1	8.41%	8.14%	14.68%	18.55%	21.68%	15.89%	12.64%	9.49%	18.85%	32.03%	12.53%	11.20%	11.37%	4.53%
V_2	6.80%	1.90%	12.41%	37.58%	24.61%	1.36%	15.34%	7.39%	28.49%	31.28%	6.73%	8.06%	9.31%	8.74%
V_3	10.68%	9.71%	17.88%	15.51%	15.93%	16.90%	13.39%	9.11%	15.01%	34.55%	15.71%	8.02%	13.54%	4.07%
V_4	9.32%	7.80%	15.98%	20.70%	19.37%	13.21%	13.61%	10.36%	13.85%	31.87%	16.03%	10.18%	12.42%	5.29%
$V_1 - A$	5.82%	5.83%	11.04%	23.79%	28.26%	13.13%	12.14%	11.52%	26.82%	23.76%	5.35%	20.58%	5.29%	6.68%
$V_2 - A$	7.32%	2.96%	1.320%	35.46%	24.47%	1.25%	15.34%	11.98%	24.34%	20.98%	13.08%	12.95%	5.26%	11.42%
$V_3 - A$	13.23%	11.21%	21.48%	13.09%	9.45%	17.12%	14.42%	9.01%	11.67%	36.13%	18.37%	5.80%	15.12%	3.91%

(continued)

Table 11 (continued)

Notes Table 11 reports the impact of Greek news announcements/economic events in the volatility series of the European stock markets and credit default swaps (CDS) via variables of number of events per month. % neg. coeff. is the percentage (%) of negative coefficients across the four variables. The V_1, V_2, and V_3 coefficients concern the three variables with one regression per variable. The $V_1 - A$, $V_2 - A$, and $V_3 - A$ coefficients concern the three variables where all are included in a multiple regression. Panel A reports raw impacts, and Panel B reports the impacts aggregated across all European countries for each financial market (stock market and CDS). * indicates significance of coefficient estimate at a 5% level of significance.[22]

Table 12 Impact of Greek announcements/events in volatility—News surprises (*SUR*i)—Generic government bonds

	10-Year							5-Year							2-Year						
	DE_{10Y}	GR_{10Y}	P_{10Y}	ESP_{10Y}	I_{10Y}	IRL_{10Y}	F_{10Y}	DE_{5Y}	GR_{5Y}	P_{5Y}	ESP_{5Y}	I_{5Y}	IRL_{5Y}	F_{5Y}	DE_{2Y}	GR_{2Y}	P_{2Y}	ESP_{2Y}	I_{2Y}	IRL_{2Y}	F_{2Y}
Panel A. Raw impacts																					
% neg. coeff.	25.00%	25.00%	25.00%	25.00%	0	0	0	50.00%	50.00%	25.00%	25.00%	50.00%	1	50.00%	1	0	25.00%	25.00%	50.00%	25.00%	50.00%
SUR_{2Y}	-3.20e-5*	-9.40e-5*	7.80e-5*	8.71e-4*	1.09e-5*	2.16e-4*	1.42e-4*	-9.95e-4*	0.0013*	3.31e-4*	0.0012*	-1.61e-4*	-7.28e-4*	-6.32e-4*	-0.1402*	0.0043*	8.97e-7*	0.0031*	-0.0015*	5.08e-4*	-0.0249*
SUR_{5Y}	3.18e-4*	0.0013*	3.37e-4*	9.06e-4*	4.75e-4*	4.49e-4*	3.61e-4*	0.0013*	-5.13e-4*	0.0016*	8.16e-4*	8.19e-4*	-0.0010*	0.0018*	-0.0694*	0.0039*	0.0025*	0.0028*	0.0015*	0.0019*	0.0189*
SUR_{10Y}	8.12e-5*	8.71e-4	6.72e-5*	1.10e-4*	9.40e-5*	1.49e-6	7.30e-5*	4.69e-4*	-2.57e-4*	2.55e-4*	-1.97e-6	1.34e-4*	-2.70e-4*	4.75e-4	-0.0187*	3.09e-4*	3.35e-4*	-1.00e-4*	2.77e-4*	-3.20e-4	0.0042*
SUR_{CDS}	4.33e-6*	1.59e-5*	-2.53e-6*	-1.76e-6*	8.52e-6*	8.21e-6*	4.00e-6*	-9.29e-6*	8.52e-6	-3.97e-6*	1.06e-5*	-2.12e-6*	-5.62e-7*	-5.48e-6	-0.0011*	5.81e-5*	-9.12e-6	3.21e-5*	-8.04e-6*	6.12e-5*	-1.13e-4*
Panel B. Aggregated Raw impacts																					
SUR_{2Y}	2.08%	6.10%	5.06%	56.51%	7.05%	14.00%	9.20%	18.46%	24.62%	6.15%	22.56%	2.99%	13.50%	11.72%	80.33%	2.49%	5.14e-4%	1.76%	0.85%	0.29%	14.28%
SUR_{5Y}	7.74%	30.64%	8.21%	22.09%	11.58%	10.93%	8.80%	16.67%	6.53%	20.34%	10.38%	10.41%	12.75%	22.93%	68.82%	3.86%	2.49%	2.70%	1.48%	1.87%	18.75%
SUR_{10Y}	6.25%	67.10%	5.17%	8.50%	7.24%	0.11%	5.62%	25.19%	13.79%	13.67%	0.11%	7.22%	14.50%	25.52%	77.06%	1.27%	1.38%	0.41%	1.14%	1.32%	17.41%
SUR_{CDS}	9.57%	35.10%	5.60%	3.89%	18.84%	18.15%	8.86%	22.90%	21.01%	9.79%	26.18%	5.22%	1.39%	13.51%	79.31%	4.30%	0.67%	2.37%	0.59%	4.52%	8.23%

Notes Table 12 reports the impact of Greek news announcements/economic events in the volatility series of the European generic government bonds via news surprises (SUR_i). News surprises concern the 2-Year, 5-Year, and 10-Year Greek government bonds as well as the Greek CDS. Panel A reports raw impacts, and Panel B reports the impacts aggregated across all European countries for each financial market (10-Year, 5-Year, and 2-Year). * indicates significance of coefficient estimate at a 5% level of significance.[23]

CDS, and stock markets) via the four dummy variables (D_1, D_2, D_3, and D_4) as well as the first three dummies all included in a regression ($D_1 - A$, $D_2 - A$, and $D_3 - A$). It is also reported the percentage (%) of the coefficients of the seven dummy variables. The magnitude (in raw level) of the effects of each of the three groups of Greek economic news in a multiple regression ($D_1 - A$, $D_2 - A$, and $D_3 - A$) on volatility is close to the one in a simple regression (D_1, D_2, and D_3), accordingly. The dummy variable with all Greek economic news (D_4) has the fewest effects on volatility series with the highest magnitude. Very few impacts are not statistically significant. Most of the impacts across dummy variables and European financial markets are positive. When dummy variables are employed as explanatory variables, the highest impacts to the volatilities of European financial markets come from the events important to the European economy ($2 - Europe$). Results are consistent in simple and multiple regression frameworks: V_2 and $V_2 - A$ variables, respectively. Results are further consistent because we have the same results for the aggregated raw impacts (Panel B) of Tables 8 and 9.

Tables 10 and 11 report the impact of the Greek events in the volatility series of the European financial markets (generic government bonds, CDS, and stock markets) via the variables of number of the four different categories of events per month (V_1, V_2, V_3, and V_4) as well as the first three such variables all included in a regression ($V_1 - A$, $V_2 - A$, and $V_3 - A$). It is also reported the percentage (%) of the coefficients of the seven dummy variables with negative impact. Panel A provides raw impacts, whereas Panel B provides aggregated impacts across all European countries.[10] The magnitude (in raw level) of the effects of each of the three groups of Greek economic news on volatility series is higher in a multiple regression ($V_1 - A$, $V_2 - A$, and $V_3 - A$) than in a simple regression (V_1, V_2, and V_3), accordingly. The variable of the number of all Greek economic news per month (V_4) has the fewest effects on volatility series with the highest magnitude. Very few impacts are not statistically significant. Most of the impacts across variables of events per month and European financial markets are positive. When variables of events per month are employed as explanatory variables, the highest impacts to the volatilities of European financial markets come from the events important to the European economy ($2 - Europe$).

Table 13 Impact of Greek announcements/events in volatility—News surprises (*SUR*i)—Stock market and Credit default swaps (CDS)

	Stock market							CDS						
	DE_{Stock}	GR_{Stock}	P_{Stock}	ESP_{Stock}	I_{Stock}	IRL_{Stock}	F_{Stock}	DE_{CDS}	GR_{CDS}	P_{CDS}	ESP_{CDS}	I_{CDS}	IRL_{CDS}	F_{CDS}
Panel A. Raw impacts														
% neg. coeff.	0	1	25.00%	50.00%	0	0	0	25.00%	0	25.00%	0	0	50.00%	0
SUR_{2Y}	1.59e-4*	-7.70e-4*	3.12e-6*	-1.06e-4*	1.34e-4*	8.35e-5*	1.37e-4*	-7.27e-5*	0.0028*	0.0020*	7.11e-4*	5.63e-4*	-2.35e-4*	8.91e-4*
SUR_{5Y}	1.18e-4*	-1.97e-4*	3.58e-5*	1.61e-4*	4.62e-4*	6.16e-5*	1.67e-4*	0.0017*	0.0017*	8.01e-4*	9.59e-4*	0.0014*	8.38e-5*	9.81e-4*
SUR_{10Y}	4.66e-5*	-1.23e-4*	9.79e-6	4.50e-5*	9.02e-5*	1.46e-5*	4.74e-5*	2.77e-4*	1.46e-4*	-1.61e-4*	3.56e-5	4.95e-5*	-1.66e-4*	1.43e-4*
SUR_{CDS}	1.56e-6*	-3.64e-6*	-1.06e-7*	-9.48e-7*	2.63e-6*	1.66e-6	1.32e-6*	3.32e-5	5.09e-5*	3.28e-5*	4.15e-6*	2.09e-5*	3.16e-5*	1.70e-7
Panel B. Aggregated Raw impacts														
SUR_{2Y}	0.1142%	55.30%	0.22%	7.63%	9.59%	6.00%	9.84%	1.00%	38.70%	27.45%	9.73%	7.71%	3.22%	12.20%
SUR_{5Y}	9.84%	16.38%	2.98%	13.40%	38.39%	5.11%	13.90%	22.27%	22.58%	10.36%	12.40%	18.61%	1.08%	12.69%
SUR_{10Y}	12.36%	32.69%	2.60%	11.95%	23.93%	3.88%	12.59%	28.35%	14.97%	16.43%	3.64%	5.06%	16.95%	14.59%
SUR_{CDS}	13.11%	30.67%	0.89%	7.99%	22.20%	13.99%	11.14%	19.14%	29.29%	18.87%	2.39%	12.02%	18.19%	0.10%

(continued)

Table 13 (continued)

Notes Table 13 reports the impact of Greek news announcements/economic events in the volatility series of the European stock markets and credit default swaps (CDS) via news surprises (SUR_i). % neg. coeff. is the percentage (%) of negative coefficients across the four variables. News surprises concern the 2-Year, 5-Year, and 10-Year Greek government bonds as well as the Greek CDS. Panel A reports raw impacts, and Panel B reports the impacts aggregated across all European countries for each financial market (stock market and CDS). * indicates significance of coefficient estimate at a 5% level of significance.[24]

Table 14 Impact of Greek announcements/events in jumps of volatilities—Dummy variables—Generic government bonds

	10-Year							5-Year							2-Year						
	DE_{10Y}	GR_{10Y}	P_{10Y}	ESP_{10Y}	I_{10Y}	IRL_{10Y}	F_{10Y}	DE_{5Y}	GR_{5Y}	P_{5Y}	ESP_{5Y}	I_{5Y}	IRL_{5Y}	F_{5Y}	DE_{2Y}	GR_{2Y}	P_{2Y}	ESP_{2Y}	I_{2Y}	IRL_{2Y}	F_{2Y}
Panel A. Raw impacts																					
% neg. coeff.	71.43%	28.60%	42.86%	28.57%	29.00%	14.30%	29.00%	1	1	28.60%	28.57%	57.00%	42.86%	0	57.14%	28.57%	0	42.86%	28.57%	28.57%	57.14%
D_1	-2.56e-4*	0.0063*	-3.03e-4*	0.0041*	-8.94e-5*	0.0017*	1.87e-4*	-0.0033*	-0.0032*	-2.06e-4*	0.0023*	-5.90e-5*	0.0017*	0.0018*	-0.0116*	0.0245*	0.0033*	0.0053*	0.0033*	0.0252*	-0.0141*
D_2	-1.69e-4*	0.0087*	8.23e-4*	-0.0014*	7.33e-4*	-6.49e-5*	-3.19e-5*	-0.0033*	-0.0110*	0.0017*	-4.99e-4*	-2.92e-5*	-0.0027*	0.0015*	0.0131*	-0.0103*	0.0011*	-0.0105*	-0.0031*	-0.0171*	-0.0103*
D_3	2.29e-4*	-0.0032*	-2.06e-5	0.0028*	1.58e-4*	0.0018*	3.85e-4*	-0.0036*	-0.0044*	0.0014*	0.0041*	6.45e-4*	0.0022*	0.0028*	-0.0065*	0.0158*	0.0020*	0.0142*	0.0014	0.0190*	0.0110*
D_4	-4.19e-4*	0.0049*	9.34e-5*	0.0027*	3.31e-4*	0.0013*	5.98e-5*	-0.0050*	-0.0129*	0.0011*	0.0045*	4.19e-4*	-4.97e-5*	0.0024*	0.0040*	0.0150*	0.0027*	0.0094*	0.0018*	0.0139*	0.0047*
$D_1 - A$	-4.58e-4*	0.0028*	-2.76e-4*	0.0034*	-1.16e-4*	0.0012*	2.40e-5	-0.0026*	-0.0029*	-8.34e-4*	6.86e-4*	-4.20e-4*	6.74e-4*	9.18e-4*	-0.0095*	0.0209*	0.0032*	-0.0021*	0.0031*	0.0194*	-0.0245*
$D_2 - A$	-2.11e-4*	-0.0026*	7.93e-4*	-9.27e-4	7.27e-4*	1.32e-4	-1.54e-5*	-0.0037*	-0.0114*	0.0017*	-2.76e-4	-5.16e-5	-0.0026*	0.0017*	0.0118*	-0.0075*	0.0015*	-0.0102*	-0.0027*	-0.0143*	-0.0126*
$D_3 - A$	4.20e-4*	0.0074*	1.22e-4*	0.0013*	2.29e-4*	0.0013*	3.74e-4*	-0.0026	-0.0035*	0.0018*	0.0038*	8.25e-4	0.0018*	0.0024*	-0.0020	0.0066*	6.52e-4*	0.0148*	6.16e-6	0.0102*	0.0212*
Panel B. Aggregated Raw impacts																					
D_1	1.98%	48.45%	2.34%	31.64%	0.69%	13.45%	1.44%	26.18%	25.49%	1.62%	18.47%	0.46%	13.56%	14.22%	13.28%	28.00%	3.81%	6.10%	3.83%	28.87%	16.12%
D_2	4.26%	49.80%	12.82%	21.83%	11.41%	1.01%	0.50%	15.96%	52.89%	8.30%	2.42%	0.14%	13.17%	7.12%	20.00%	15.81%	1.62%	16.00%	4.70%	26.08%	15.79%
D_3	1.62%	61.62%	0.15%	20.20%	1.12%	12.56%	2.73%	18.81%	22.85%	7.52%	21.36%	3.37%	11.48%	14.59%	9.26%	22.64%	2.84%	20.36%	2.01%	27.17%	15.71%
D_4	2.63%	50.14%	0.95%	27.41%	3.37%	13.26%	0.61%	18.82%	48.91%	4.28%	17.16%	1.59%	0.19%	9.06%	7.79%	29.07%	5.34%	18.21%	3.58%	26.95%	9.07%
$D_1 - A$	5.50%	33.87%	3.32%	17.22%	1.39%	14.58%	0.29%	28.63%	32.09%	9.28%	7.63%	4.67%	7.49%	10.21%	11.55%	25.24%	3.87%	2.54%	3.72%	23.46%	29.62%
$D_2 - A$	3.91%	66.39%	14.74%	41.06%	13.50%	2.45%	0.27%	17.37%	53.38%	7.85%	1.29%	0.24%	12.04%	7.83%	19.52%	12.39%	2.44%	16.82%	4.44%	23.57%	20.81%
$D_3 - A$	3.77%	47.90%	1.09%	12.10%	2.06%	11.23%	3.36%	15.47%	20.61%	11.01%	22.53%	4.91%	10.91%	14.57%	3.62%	11.92%	1.17%	26.74%	0.01%	18.41%	38.13%

(continued)

Table 14 (continued)

Notes Table 14 reports the impact of Greek news announcements/economic events in the jumps of volatilities of the European generic government bonds via dummy variables. % neg. coeff. is the percentage (%) of negative coefficients across the four dummy variables. The D_1, D_2, and D_3 coefficients concern the three dummy variables with one regression per dummy. The $D_1 - A$, $D_2 - A$, and $D_3 - A$ coefficients concern the three dummies where all are included in a multiple regression. Panel A reports raw impacts, and Panel B reports the impacts aggregated across all European countries for each financial market (10-Year, 5-Year, and 2-Year). * indicates significance of coefficient estimate at a 5% level of significance[25]

Table 15 Impact of Greek announcements/events in jumps of volatilities—Dummy variables—Stock market and Credit default swaps (CDS)

	Stock market							CDS						
	DE_{Stock}	GR_{Stock}	P_{Stock}	ESP_{Stock}	I_{Stock}	IRL_{Stock}	F_{Stock}	DE_{CDS}	GR_{CDS}	P_{CDS}	ESP_{CDS}	I_{CDS}	IRL_{CDS}	F_{CDS}
Panel A. Raw impacts														
% neg. coeff.	57.10%	57.10%	0	0	0	1	57.14%	0	28.60%	28.60%	28.57%	57.00%	28.60%	28.60%
D_1	5.37e-5*	-5.56e-4*	2.39e-4*	2.01e-4*	8.13e-5*	-2.37e-4*	-7.97e-5*	0.0017	0.0053*	0.0093*	0.0038*	8.46e-5*	0.0029	-0.0024*
D_2	-1.25e-4*	6.70e-4*	4.81e-4*	0.0011*	2.27e-4	-1.78e-4*	1.44e-4*	0.0041*	-6.86e-4*	-0.0111*	-0.0028*	-9.56e-4*	-0.0052*	4.25e-4
D_3	1.35e-4*	-6.10e-4	3.56e-4*	6.25e-4*	2.88e-4*	-1.10e-4*	-2.51e-5*	0.0042*	0.0062*	0.0112*	0.0058*	2.79e-4*	0.0040*	0.0019*
D_4	-2.06e-4*	5.00e-4*	2.86e-4*	2.21e-4*	3.16e-5*	-3.48e-4	-1.08e-4	0.0052*	0.0047*	0.0053*	0.0025*	-3.85e-4*	5.12e-4*	0.0010*
$D_1 - A$	-1.85e-5*	-2.93e-4*	1.60e-4	3.67e-5	-2.72e-5*	-2.55e-4*	-7.00e-5*	3.24e-4*	0.0033*	0.0043*	0.0013*	-1.48e-4*	8.89e-4*	-0.0039*
$D_2 - A$	-1.22e-4	6.16e-4*	5.12e-4	1.13e-3*	2.34e-4*	-2.10e-4*	1.35e-4*	0.00428*	-1.07e-4*	-0.0102*	-0.0025*	-9.63e-4*	-0.0050*	7.05e-4
$D_3 - A$	1.39e-4*	-4.66e-4*	3.02e-4*	6.42e-4*	3.06e-4*	-6.09e-6*	9.00e-6*	0.0042*	0.0048*	0.0091*	0.0051*	3.15e-4	0.0035*	0.0036*
Panel B. Aggregated Raw impacts														
D_1	3.71%	0.3842	16.52%	13.87%	5.62%	16.36%	5.50%	6.65%	20.97%	36.42%	14.95%	0.3%3	11.43%	9.26%
D_2	4.26%	0.2291	16.47%	37.58%	7.76%	6.10%	4.92%	16.17%	2.72%	43.92%	11.15%	3.78%	20.57%	1.68%
D_3	6.27%	0.2840	16.56%	29.10%	13.38%	5.12%	1.17%	12.43%	18.41%	33.39%	17.24%	0.83%	12.05%	5.65%
D_4	12.13%	0.2940	16.81%	12.98%	1.86%	20.48%	6.34%	26.32%	23.77%	27.12%	12.93%	1.96%	2.61%	5.28%
$D_1 - A$	2.15%	0.3406	18.62%	4.26%	3.16%	29.63%	8.13%	2.29%	23.00%	30.54%	9.41%	1.04%	6.28%	27.45%
$D_2 - A$	4.12%	0.2085	17.32%	38.09%	7.93%	7.11%	4.58%	18.53%	0.46%	44.34%	10.69%	4.17%	21.49%	0.31%
$D_3 - A$	7.44%	24.90%	16.14%	34.34%	16.37%	0.33%	0.48%	13.62%	15.64%	29.64%	16.84%	1.03%	11.52%	11.71%

(continued)

Table 15 (continued)

Notes Table 15 reports the impact of Greek news announcements/economic events in the jumps of volatilities of the European stock markets and credit default swaps (CDS) via dummy variables. % neg. coeff. is the percentage (%) of negative coefficients across the four dummy variables. The D_1, D_2, and D_3 coefficients concern the three dummy variables with one regression per dummy. The $D_1 - A$, $D_2 - A$, and $D_3 - A$ coefficients concern the three dummies where all are included in a multiple regression. Panel A reports raw impacts, and Panel B reports the impacts aggregated across all European countries for each financial market (stock market and CDS). * indicates significance of coefficient estimate at a 5% level of significance.[26]

Table 16 Impact of Greek announcements/events in jumps of volatility—Variables of number of events per month—Generic government bonds

	10-Year							5-Year							2-Year						
	DE_{10Y}	GR_{10Y}	P_{10Y}	ESP_{10Y}	I_{10Y}	IRL_{10Y}	F_{10Y}	DE_{5Y}	GR_{5Y}	P_{5Y}	ESP_{5Y}	I_{5Y}	IRL_{5Y}	F_{5Y}	DE_{2Y}	GR_{2Y}	P_{2Y}	ESP_{2Y}	I_{2Y}	IRL_{2Y}	F_{2Y}
Panel A. Raw impacts																					
% neg. coeff.	28.60%	28.60%	28.60%	28.60%	28.60%	0	14.30%	28.60%	42.90%	0	28.60%	14.30%	71.40%	14.30%	28.60%	28.60%	0	3.52%	0	28.60%	14.29%
V_1	8.24e-4*	0.0160*	5.16e-4*	0.0050*	2.10e-4	0.0024*	5.40e-4*	0.0056*	0.0047*	0.0020*	0.0094	0.0020*	-0.0026*	0.0068*	0.4065*	0.0577*	0.0063*	-0.0200*	0.0080*	0.0372*	0.0664*
V_2	7.91e-4*	-0.0048*	0.0028*	-0.0022*	0.0017*	0.0012*	8.24e-4*	0.0071*	-0.0175*	0.0049*	-0.0043*	0.0021*	-0.0042*	0.0074*	0.9277*	-0.0133*	0.0074*	0.0294	0.0049*	-0.0187*	0.0688*
V_3	-3.39e-4*	0.0091*	-3.74e-5*	0.0034*	-4.82e-5*	0.0015*	7.90e-5	-0.0030*	0.0045*	7.59e-4*	0.0089*	5.41e-4	0.0010*	2.71e-4*	-0.0747*	0.0353*	0.0029*	0.0181	0.0028*	0.0238	0.0161*
V_4	4.41e-4*	0.0065*	3.58e-4*	0.0023*	1.83e-4*	0.0012*	2.11e-4*	1.30e-4*	0.0012*	0.0012*	0.0055*	8.11e-4*	-3.50e-4*	0.0020*	0.1238*	0.0253	0.0032*	0.0078*	0.0032*	0.0158	0.0257*
$V_1 - A$	0.0018*	0.0101*	0.0010*	0.0023*	5.00e-4	0.0015*	7.38e-4*	0.0130*	-9.25e-4	0.0023*	6.49e-4	0.0023*	-0.0056*	0.0101*	0.7708*	0.0328*	0.0056*	-0.0133*	0.0080*	0.0189*	0.0792*
$V_2 - A$	8.62e-4	-0.0021*	0.0029*	-0.0013*	0.0017*	0.0017*	9.06e-4*	0.0076*	-0.0168*	0.0053*	-0.0024*	0.0025*	-0.0045*	0.0083	0.9804*	-0.0032*	0.0085*	-0.0133*	0.0061*	-0.0123*	0.0791
$V_3 - A$	-8.54e-4*	0.0058*	-2.29e-4	0.0026*	-1.30e-4*	0.0011*	-1.14e-4*	-0.0068*	0.0041*	2.83e-4	0.0086*	-8.39e-5	0.0026	-0.0026*	-0.2744*	0.0248	0.0015*	0.0264*	5.88e-4*	0.0173*	-0.0054*
Panel B. Aggregated Raw impacts																					
V_1	1.29%	34.53%	1.20%	39.84%	1.51%	19.87%	1.76%	26.89%	38.20%	2.46%	4.96%	1.04%	17.22%	9.24%	8.42%	37.73%	1.91%	3.27%	2.17%	35.30%	11.18%
V_2	1.63%	36.52%	20.31%	28.22%	7.35%	5.55%	0.41%	15.03%	42.73%	13.24%	6.36%	0.37%	12.82%	9.45%	9.03%	16.73%	5.61%	19.01%	5.12%	29.11%	15.39%
V_3	0.75%	40.17%	0.09%	37.56%	0.24%	19.91%	1.27%	13.46%	35.00%	5.11%	31.07%	0.46%	14.10%	0.80%	3.17%	36.10%	0.32%	16.84%	1.43%	37.62%	4.50%
V_4	0.79%	36.30%	2.28%	37.62%	0.61%	20.77%	1.62%	26.02%	21.21%	10.74%	23.57%	0.86%	11.08%	6.51%	4.36%	37.23%	1.62%	10.48%	1.21%	35.86%	9.22%
$V_1 - A$	1.81%	35.36%	28.16%	22.60%	9.93%	0.88%	1.27%	17.59%	40.78%	14.06%	5.08%	0.45%	11.78%	10.27%	9.30%	4.47%	8.59%	22.72%	6.22%	22.47%	26.22%
$V_2 - A$	2.03%	25.80%	1.45%	43.74%	3.67%	20.69%	2.63%	29.61%	10.41%	0.17%	32.79%	1.17%	7.97%	17.89%	11.41%	31.01%	3.30%	11.27%	2.24%	24.75%	16.02%
$V_3 - A$	0.11%	43.50%	1.68%	32.73%	2.33%	18.96%	0.71%	5.23%	27.56%	7.05%	43.62%	0.11%	10.28%	6.14%	3.27%	28.83%	1.34%	28.97%	0.29%	34.19%	3.11%

(continued)

Table 16 (continued)

Notes Table 16 reports the impact of Greek news announcements/economic events in the jumps of volatility series of the European generic government bonds via variables of number of events per month. % neg. coeff. is the percentage (%) of negative coefficients across the four variables. The V_1, V_2, and V_3 coefficients concern the three variables with one regression per variable. The $V_1 - A$, $V_2 - A$, and $V_3 - A$ coefficients concern the three variables where all are included in a multiple regression. Panel A reports raw impacts, and Panel B reports the impacts aggregated across all European countries for each financial market (10-Year, 5-Year, and 2-Year). * indicates significance of coefficient estimate at a 5% level of significance.[27]

Table 17 Impact of Greek announcements/events in jumps of volatility—Variables of number of events per month—Stock market and Credit default swaps (CDS)

	Stock market							CDS						
	DE_{Stock}	GR_{Stock}	P_{Stock}	ESP_{Stock}	I_{Stock}	IRL_{Stock}	F_{Stock}	DE_{CDS}	GR_{CDS}	P_{CDS}	ESP_{CDS}	I_{CDS}	IRL_{CDS}	F_{CDS}
Panel A. Raw impacts														
% neg. coeff.	0	0	0	0	0	14.30%	0	0	28.60%	28.60%	0	0	28.60%	0
V_1	5.58e-4	5.39e-4*	9.74e-4*	0.0012*	0.0014*	0.0011*	8.38e-4*	0.0098*	0.0195*	0.0331	0.0129*	0.0116*	0.0117*	0.0047*
V_2	4.43e-4*	1.23e-4*	8.07e-4*	0.0024*	0.0016*	-8.85e-5*	9.98e-4*	0.0038*	-0.0148*	-0.0162*	0.0035	0.0042*	-0.0048*	0.0045*
V_3	3.94e-4*	3.59e-4*	6.60e-4*	5.73e-4	5.88e-4	6.24e-4*	4.94e-4	0.0069*	0.0113*	0.0260*	0.0118*	0.0060	0.0102	0.0031
V_4	3.31e-4*	2.77e-4*	5.67e-4*	7.34e-4*	6.87e-4*	4.68e-4*	4.83e-4*	0.0054*	0.0072*	0.0165*	0.0083*	0.0053*	0.0064*	0.0027*
$V_1 - A$	2.84e-4	2.84e-4*	5.39e-4*	0.0012*	0.0014*	6.41e-4*	5.93e-4*	0.0048*	0.0112*	0.0099*	0.0022*	0.0086*	0.0022*	0.0028*
$V_2 - A$	5.54e-4*	2.24e-4*	9.98e-4*	0.0027*	0.0018*	9.46e-5*	0.0012*	0.0057*	-0.0116*	-0.0100*	0.0063	0.0062*	-0.0025*	0.0055*
$V_3 - A$	3.29e-4*	2.79e-4	5.34e-4*	3.26e-4	2.35e-4	4.26e-4*	3.59e-4	0.0056*	0.0073*	0.0225*	0.0114*	0.0036*	0.0094	0.0024*
Panel B. Aggregated Raw impacts														
V_1	3.40%	12.14%	18.85%	21.06%	18.85%	16.76%	8.95%	1.76%	0.35%	7.45%	35.07%	16.42%	24.02%	14.93%
V_2	6.75%	3.98%	16.92%	38.91%	16.92%	12.56%	3.95%	8.01%	0.54%	8.62%	3.77%	23.90%	49.80%	5.36%
V_3	21.18%	20.36%	11.84%	24.29%	11.84%	6.42%	4.08%	1.16%	0.15%	15.35%	21.82%	8.38%	38.96%	14.19%
V_4	0.05%	11.31%	19.06%	35.70%	19.06%	14.50%	0.32%	0.27%	0.13%	14.08%	28.05%	7.77%	32.87%	16.83%
$V_1 - A$	10.26%	9.04%	6.97%	23.39%	20.74%	19.11%	10.49%	0.02%	0.29%	21.40%	17.84%	10.15%	47.14%	3.16%
$V_2 - A$	6.45%	4.49%	17.14%	38.49%	17.14%	12.82%	3.48%	7.95%	0.50%	5.96%	11.13%	21.68%	43.49%	9.29%
$V_3 - A$	29.25%	5.54%	12.71%	3.07%	12.71%	16.69%	20.03%	0.84%	0.07%	18.20%	17.48%	5.27%	43.95%	14.19%

(continued)

Table 17 (continued)

Notes Table 17 reports the impact of Greek news announcements/economic events in the jumps of volatility series of the European stock markets and credit default swaps (CDS) via variables of number of events per month. % neg. coeff. is the percentage (%) of negative coefficients across the four variables. The V_1, V_2, and V_3 coefficients concern the three variables with one regression per variable. The $V_1 - A$, $V_2 - A$, and $V_3 - A$ coefficients concern the three variables where all are included in a multiple regression. Panel A reports raw impacts, and Panel B reports the impacts aggregated across all European countries for each financial market (stock market and CDS). * indicates significance of coefficient estimate at a 5% level of significance.[28]

Table 18 Impact of Greek announcements/events in jumps of volatility—News surprises (*SUR*i)—Generic government bonds

10-Year

	DE_{10Y}	GR_{10Y}	P_{10Y}	ESP_{10Y}	I_{10Y}	IRL_{10Y}	F_{10Y}
Panel A. Raw impacts							
% neg. coeff.	50.00%	50.00%	25.00%	25.00%	0	25.00%	0
SUR_{2Y}	-1.01e-4*	-5.17e-4*	6.24e-6*	3.99e-4*	7.06e-5*	6.50e-5*	5.88e-5*
SUR_{5Y}	5.01e-5*	2.12e-5*	2.00e-6*	3.98e-4*	1.24e-4	9.30e-5*	6.09e-5
SUR_{10Y}	7.21e-6*	5.85e-4*	4.07e-6*	5.33e-5*	2.26e-5*	-2.29e-6*	1.74e-5*
SUR_{CDS}	-5.97e-7	-1.85e-6*	-1.01e-6	-5.54e-7	5.98e-6*	4.54e-6*	1.56e-6*
Panel B. Aggregated Raw impacts							
SUR_{2Y}	8.25%	42.49%	0.51%	32.79%	5.80%	5.33%	4.83%
SUR_{5Y}	6.69%	2.83%	0.27%	53.12%	16.54%	12.42%	8.13%
SUR_{10Y}	1.04%	84.55%	0.59%	7.70%	3.27%	0.33%	2.52%
SUR_{CDS}	3.71%	11.47%	6.30%	3.44%	37.14%	28.25%	9.69%

5-Year

	DE_{5Y}	GR_{5Y}	P_{5Y}	ESP_{5Y}	I_{5Y}	IRL_{5Y}	F_{5Y}
Panel A. Raw impacts							
% neg. coeff.	75.00%	50.00%	25.00%	0	25.00%	50.00%	75.00%
SUR_{2Y}	2.19e-5*	3.80e-4*	1.24e-4*	3.49e-4*	1.25e-4*	4.24e-5*	-1.59e-4*
SUR_{5Y}	-1.95e-4*	-1.94e-4*	4.36e-4	1.63e-4*	2.84e-4*	-8.53e-6*	-7.52e-5*
SUR_{10Y}	-4.88e-5*	-9.98e-5*	7.02e-5*	8.54e-6*	3.20e-5*	-4.00e-5*	7.45e-5
SUR_{CDS}	-1.91e-6*	2.77e-6*	-2.45e-6*	9.73e-7	-5.07e-7*	8.01e-6	-4.07e-6*
Panel B. Aggregated Raw impacts							
SUR_{2Y}	1.82%	31.64%	10.34%	29.04%	10.40%	3.53%	13.23%
SUR_{5Y}	14.38%	14.28%	32.15%	12.02%	20.98%	0.63%	5.55%
SUR_{10Y}	13.05%	26.71%	18.78%	2.28%	8.56%	10.69%	19.93%
SUR_{CDS}	9.22%	13.40%	11.83%	4.70%	2.45%	38.71%	19.70%

2-Year

	DE_{2Y}	GR_{2Y}	P_{2Y}	ESP_{2Y}	I_{2Y}	IRL_{2Y}	F_{2Y}
Panel A. Raw impacts							
% neg. coeff.	50.00%	0	50.00%	80.00%	50.00%	25.00%	50.00%
SUR_{2Y}	-5.68e-4*	0.0017*	-3.91e-4*	9.11e-4*	-2.81e-4*	9.01e-4*	9.36e-4*
SUR_{5Y}	2.51e-4*	0.0014*	8.78e-5*	-3.29e-4*	3.53e-4*	0.0015	-1.55e-4*
SUR_{10Y}	2.00e-5	9.38e-5*	3.05e-5*	-2.39e-4	3.54e-5*	-2.07e-5*	7.47e-5
SUR_{CDS}	-5.63e-6	1.94e-5	-7.00e-6*	-1.68e-6*	-1.71e-6	3.80e-5*	-1.74e-5*
Panel B. Aggregated Raw impacts							
SUR_{2Y}	9.96%	30.11%	6.85%	15.97%	4.92%	15.80%	16.40%
SUR_{5Y}	6.09%	34.98%	2.13%	7.99%	8.57%	36.47%	3.77%
SUR_{10Y}	3.89%	18.27%	5.94%	46.45%	6.90%	4.02%	14.54%
SUR_{CDS}	6.20%	21.33%	7.71%	1.85%	1.89%	41.88%	19.15%

Notes Table 18 reports the impact of Greek news announcements/economic events in the jumps of volatility series of the European generic government bonds via news surprises (SUR_i). % neg. coeff. is the percentage (%) of negative coefficients across the four variables. News surprises concern the 2-Year, 5-Year, and 10-Year Greek government bonds as well as the Greek CDS. Panel A reports raw impacts, and Panel Breports the impacts aggregated across all European countries for each financial market (10-Year, 5-Year, and 2-Year). * indicates significance of coefficient estimate at a 5% level of significance.[29]

Results are consistent in simple and multiple regression frameworks; V_2 and $V_2 - A$ variables, respectively. Results are further consistent because we have the same results for the aggregated raw impacts (Panel B) of Tables 10 and 11.

Tables 12 and 13 report the impact of the news surprises on 2 years, 5 years, 10 years, and CDS Greek government bonds (SUR_{2Y}, SUR_{5Y}, SUR_{10Y}, and $SUR_{CDS)}$ in the volatility series of the European financial markets (generic government bonds, CDS, and stock markets). Very few impacts are not statistically significant. Most of the impacts across surprises and European financial markets are positive. When surprises variables are employed as explanatory variables, the highest impacts to the volatility series of European financial markets come from the news surprises of the 5-year Greek government bonds ($SUR_{5Y)}$. Results are consistent because we have the same results for the aggregated raw impacts (Panel B) of Tables 12 and 13 as well.

Tables 14 and 15 report the impact of the Greek events in the volatility-jumps series of the European financial markets (generic government bonds, CDS, and stock markets) via the four dummy variables (D_1, D_2, $D_{3,}$ and D_4) as well as the first three dummies all included in a regression ($D_1 - A$, $D_2 - A$, and $D_3 - A$). It is also reported the percentage (%) of the coefficients of the seven dummy variables. There is no added value (new information) coming from a multiple compared to a simple regression framework in assessing the magnitude (in raw level) of the effects of each of the three groups of Greek economic news on volatility-jumps, across the three categories of Greek economic news ($D_1 - A$, $D_2 - A$, and $D_3 - A$) and (D_1, D_2, and D_3), accordingly. The dummy variable with all Greek economic news (D_4) has the fewest effects on volatility jumps with the highest magnitude. Very few impacts are not statistically significant. Most of the impacts across dummy variables and European financial markets are positive, writhe single exception of the European stock market. When dummy variables are employed as explanatory variables, the highest impacts to the volatility jumps of European financial markets come from the events important to the European economy ($2 - Europe$). Results are consistent in simple and multiple regression frameworks: D_2 and $D_2 - A$ variables, respectively.

Table 19 Impact of Greek announcements/events in jumps of volatility—News surprises (*SUR*i)—Stock market and Credit default swaps (CDS)

	Stock market							CDS						
	DE_{Stock}	GR_{Stock}	P_{Stock}	ESP_{Stock}	I_{Stock}	IRL_{Stock}	F_{Stock}	DE_{CDS}	GR_{CDS}	P_{CDS}	ESP_{CDS}	I_{CDS}	IRL_{CDS}	F_{CDS}
Panel A. Raw impacts														
% neg. coeff.	0	1	25.00%	50.00%	0	0	0	25.00%	0	25.00%	0	0	50.00%	0
SUR_{2Y}	1.59e-4*	-7.70e-4*	3.12e-6*	-1.06e-4*	1.34e-4*	8.35e-5*	1.37e-4*	-7.27e-5*	0.0028*	0.0020*	7.11e-4*	5.63e-4*	-2.35e-4*	8.91e-4*
SUR_{5Y}	1.18e-4*	-1.97e-4*	3.58e-5*	1.61e-4*	4.62e-4*	6.16e-5*	1.67e-4*	0.0017*	0.0017*	8.01e-4*	9.59e-4*	0.0014	8.38e-5*	9.81e-4*
SUR_{10Y}	4.66e-5*	-1.23e-4*	9.79e-6*	4.50e-5*	9.02e-5*	1.46e-5	4.74e-5	0.0017*	1.46e-4*	-1.61e-4*	3.56e-5*	4.95e-5*	-1.66e-4*	1.43e-4*
SUR_{CDS}	1.56e-6	-3.64e-6*	-1.06e-7*	-9.48e-7	2.63e-6*	1.66e-6*	1.32e-6	3.32e-5*	5.09e-5*	3.28e-5*	4.15e-6	2.09e-5*	3.16e-5*	1.70e-7
Panel B. Aggregated Raw impacts														
SUR_{2Y}	6.54%	65.25%	4.39%	17.06%	3.78%	2.61%	0.36%	27.55%	19.61%	1.89%	4.32%	9.92%	8.11%	28.60%
SUR_{5Y}	6.53%	40.08%	10.91%	15.82%	23.53%	0.57%	2.57%	19.76%	1.20%	29.51%	9.40%	7.46%	7.06%	25.60%
SUR_{10Y}	6.90%	52.36%	0.35%	22.70%	16.18%	0.63%	0.87%	11.17%	11.33%	25.96%	6.17%	8.77%	21.27%	15.33%
SUR_{CDS}	7.83%	31.16%	20.39%	24.72%	5.50%	1.57%	8.82%	15.47%	15.51%	4.11%	16.09%	6.12%	31.90%	10.81%

(continued)

Table 19 (continued)

Notes Table 19 reports the impact of Greek news announcements/economic events in the jumps of volatility series of the European stock markets and credit default swaps (CDS) via news surprises (SUR_i). % neg. coeff. is the percentage (%) of negative coefficients across the four variables. News surprises concern the 2-Year, 5-Year, and 10-Year Greek government bonds as well as the Greek CDS. Panel A reports raw impacts, and Panel B reports the impacts aggregated across all European countries for each financial market (stock market and CDS). * indicates significance of coefficient estimate at a 5% level of significance.[30]

Results are further consistent because we have the same results for the aggregated raw impacts (Panel B) of Tables 14 and 15.

Tables 16 and 17 report the impact of the Greek events in the volatility-jumps series of the European financial markets (generic government bonds, CDS, and stock markets) via the variables of number of the four different categories of events per month (V_1, V_2, V_3, and V_4) as well as the first three such variables all included in a regression ($V_1 - A$, $V_2 - A$, and $V_3 - A$). It is also reported the percentage (%) of the coefficients of the seven dummy variables with negative impact. Panel A provides raw impacts, whereas Panel B provides aggregated impacts across all European countries.[11] There is no difference in the magnitude (in raw level) of the effects of multiple regression ($V_1 - A$, $V_2 - A$, and $V_3 - A$) than in a simple regression (V_1, V_2, and V_3), accordingly. The variable of the number of all Greek economic news per month (V_4) has the fewest effects on volatility jumps with the highest magnitude. Very few impacts are not statistically significant. Most of the impacts across variables of events per month and European financial markets are positive. When variables of events per month are employed as explanatory variables, the highest impacts to the returns of European financial markets come from the events important to the Greek economy (1 − *Greece*). However, this is valid only in a simple regression. In a multiple regression framework, the events important to the European economy (2 − *Europe*) have the highest impacts. The latter is true for aggregated raw impacts (Panel B) of Tables 16 and 17.

Tables 18 and 19 report the impact of the news surprises on 2 years, 5 years, 10 years, and CDS Greek government bonds (SUR_{2Y}, SUR_{5Y}, SUR_{10Y}, and SUR_{CDS}) in the volatility-jumps series of the European financial markets (generic government bonds, CDS, and stock markets). Very few impacts are not statistically significant. Most of the impacts across surprises and European financial markets are positive. When surprises are employed as explanatory variables, the highest impacts on volatility jumps of European financial markets come from the surprises of the 2-year Greek government bond (SUR_{2Y}). Concerning aggregated raw impacts (Panel B of Tables 18, 19), the surprises of the Greek CDS (SUR_{CDS}) have the highest effect.

7 Concluding Remarks

The Greek debt crisis after the global financial crisis in 2008 led to the use of a financial support rescue mechanism by the European Monetary Union (EMU) and the International Monetary Fund (IMF). Political uncertainty in conjunction with the fiscal problems, led the Greek economy into an unprecedented crisis culminating the impositions of capital controls in outflow funds from the domestic authorities as well as a short-term banking holiday. This chapter examines the impact of Greek economic news on European government bond, CDS, and stock markets. The impact of three categories of news is examined via the respective number of dummy variables, number of news per month, and news surprises of 2-year, 5-year, and 10-year government bonds and CDS on return, volatility and volatility jump of government bonds, CDS, and stock indices of seven European countries, within a tobit regression framework.

The direction of most of the impacts on returns for all European countries except for Germany and France is positive. For all European countries except for Greece and Spain, the highest impacts on returns come from the news important locally for Greece. The impacts of surprises on returns are highest for the 2-year Greek government bonds for the European countries except for Portugal and Ireland. The direction of most of the impacts on volatility series for all European countries is positive. For all European countries except for Spain, the highest impacts on volatility series come from the news important for Europe. The impacts of surprises on volatility series are highest for the 5-year Greek government bonds for the European countries except for Greece and Ireland. The direction of most of the impacts on volatility jumps for all European countries is positive. For all European countries except for Greece and Spain, the highest impacts on volatility jumps come from the news important for Europe. The impacts of surprises on volatility jumps are highest for the 2-year Greek government bonds for the European countries except for Spain, Italy, and France. The category of Greek economic news with the highest probability of occurrence of Greek economic news on volatility jump months and the highest probability of occurrence of volatility jumps on months with Greek economic news is the Greek news with International impact for the European countries except for Portugal.

The direction of most of the impacts on returns for all European financial markets except for the European stock market is positive. For all European financial markets except for the 5-year Greek government bonds, the highest impacts on returns come from the news important locally for Greece. The impacts of surprises on returns are highest for the 2-year Greek government bonds for the European financial markets except for the 10-year and 2-year Greek government bonds. The direction of most of the impacts on volatility series for all European financial markets is positive. For all European financial markets except for the 5-year Greek government bonds, the highest impacts on volatility series come from the news important for Europe. The impacts of surprises on volatility series are highest for the 5-year Greek government bonds for all European financial markets. The direction of most of the impacts on volatility jumps for all European financial markets is positive. For most of the European financial markets except for the 2-year Greek government bond and stock markets, the highest impacts on volatility jumps come from the news internationally important. The impacts of surprises on volatility jumps are highest for the 2-year Greek government bonds for the European financial markets except for the stock market. The category of Greek economic news with the highest probability of occurrence of Greek economic news on volatility jump months and the highest probability of occurrence of volatility jumps on months with Greek economic news is the Greek news with International impact for the European financial markets except for the 2-year Greek government bond and stock markets. Results are consistent to Kosmidou et al. (2015) that provided evidence of positive effect of news releases on risk and a negative on returns.

This chapter has various implications for the market participants and policy makers (troika and of the Greek Government). Overall, these results have important implications for financial sector regulators. There are tree suggestions. If the European financial markets must have a higher risk, the Greek economic news must continue. Otherwise, fewer such news will result in lower risk. However, more Greek economic news also results in higher correlation in European financial markets, further resulting in upgrading the European financial markets. Thinking of both effects, European policy makers should examine which of the two effects is more significant for the European financial markets. Regardless of European policy makers, the Greek government should try to decrease the risk of the Greek (and European) financial markets. A second suggestion is either to decrease the European unsystematic risk with increasing the systemic risk and retaining the existing total risk or to increase the expected return of European financial markets even with higher total risk (either systemic or unsystematic). If policy actions result in a higher systemic risk, new financial markets will either provide solutions or de-float the current European sovereign debt crisis, as far as the new stabilization mechanism has been activated for Ireland, Portugal, Spain, and Cyprus. Finally, the third suggestion arises from the fact that Greek crisis is a European crisis after all. The Greek instability has a direct impact on European financial markets, as our empirical results had shown. The policy interventions should target on the real economy enhancing the liquidity, in order to show the Greek economy signs of recovery, to reduce the high volatility in the Greek markets. This will be achieved by mutual concessions, by providing the support mechanisms the requisite expertise.

Notes

1. For a detailed analysis of the dynamics of the Greek debt crisis, see Ardagna and Caselli (2014) and Gkillas (Gillas) et al. (2016).
2. See Arghyrou and Tsoukalas (2011).
3. Papers indicated before as well as Jiang et al. (2012) and Kutan et al. (2012), among others.
4. As forecast, we employ the figure of the next announcement/event time.
5. It is quite plaussible that this estimator may perform better in high-frequency intraday data, because of higher number of observations.
6. Intensity and magnitude of volatility jumps does not change significantly, when a 99% significance level has been employed.
7. Intensity and magnitude of volatility jumps does not change signifuicantly, when a 99% significance level has been employed.

8. The relative (Europe-aggregated) impacts are based on absolute raw impacts.
9. The relative (Europe-aggregated) impacts are based on absolute raw impacts.
10. The relative (Europe-aggregated) impacts are based on absolute raw impacts.
11. The relative (Europe-aggregated) impacts are based on absolute raw impacts.
12. Additionally, the EuroArea SX5E index is included, concerning the Euro Area.
13. Heteroscedasticity and autocorrelation consistent (Newey-West) standard errors are employed in the calculation of the cor-responding significance level and are available upon request.
14. Heteroscedasticity and autocorrelation consistent (Newey-West) standard errors are employed in the calculation of the cor-responding significance level and are available upon request.
15. Heteroscedasticity and autocorrelation consistent (Newey-West) standard errors are employed in the calculation of the cor-responding significance level and are available upon request.
16. Heteroscedasticity and autocorrelation consistent (Newey-West) standard errors are employed in the calculation of the cor-responding significance level and are available upon request.
17. Heteroscedasticity and autocorrelation consistent (Newey-West) standard errors are employed in the calculation of the cor-responding significance level and are available upon request.
18. Heteroscedasticity and autocorrelation consistent (Newey-West) standard errors are employed in the calculation of the cor-responding significance level and are available upon request.
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22. Heteroscedasticity and autocorrelation consistent (Newey-West) standard errors are employed in the calculation of the cor-responding significance level and are available upon request.

23. Heteroscedasticity and autocorrelation consistent (Newey-West) standard errors are employed in the calculation of the cor-responding significance level and are available upon request.
24. Heteroscedasticity and autocorrelation consistent (Newey-West) standard errors are employed in the calculation of the cor-responding significance level and are available upon request.
25. Heteroscedasticity and autocorrelation consistent (Newey-West) standard errors are employed in the calculation of the cor-responding significance level and are available upon request.
26. Heteroscedasticity and autocorrelation consistent (Newey-West) standard errors are employed in the calculation of the cor-responding significance level and are available upon request.
27. Heteroscedasticity and autocorrelation consistent (Newey-West) standard errors are employed in the calculation of the cor-responding significance level and are available upon request.
28. Heteroscedasticity and autocorrelation consistent (Newey-West) standard errors are employed in the calculation of the cor-responding significance level and are available upon request.
29. Heteroscedasticity and autocorrelation consistent (Newey-West) standard errors are employed in the calculation of the cor-responding significance level and are available upon request.
30. Heteroscedasticity and autocorrelation consistent (Newey-West) standard errors are employed in the calculation of the cor-responding significance level and are available upon request.

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Innovation and SMEs Financial Distress During the Crisis Period: The Greek Paradigm

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1 Introduction

In modern economies characterized as "knowledge-based," the main factor determining the performance of a firm in terms of survival and productivity is innovation (Markatou 2011). In literature, many writers are expressing similar contexts. According to Sum (2013), innovation is an important factor for firms' success and competitiveness especially

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for those located in environments where changes in the market are continuing and, as reported by Kumral et al. (2006), in such environments, a firm's ability to innovate and to become financially viable is closely connected with the formation of a comparative advantage. Tödtling and Trippl (2005) include innovation as an essential component of economic growth and firms' financial effectiveness, and Dressler (2013) considers innovation as a "key factor" in order for businesses to grow, consolidate and to ensure durable profitability in a competitive environment. Moreover, Klomp and Van Leeuwen (2001) linked the innovation with firms' revenues performance, productivity and employment growth, while Soriano and Huarng (2013) argued that innovation is "the only business related more closely than anything else to economic growth."

According to Eurostat (2004), innovation is "the introduction of a new or significantly improved product (good or service) or the application of a new or significantly improved process, organizational a market enterprise marketing process or method." Still, according to Kumral et al. (2006), innovation is "a complex sequence of events that include all activities to develop or create new products, services or processes on the market." Further, the Keupp et al. (2012) define innovation as "a new product, a new service, a new technology in the production process, a new structure or management system, or a new plan or program for organizational members."

According to Sengupta (2012), innovation involves changes in organizational and managerial competencies, developing new markets and new products. The Lee et al. (2010) describe innovation as a process divided

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into two parts: the "search technology" for technological opportunities and the "technology exploitation" of market opportunities, while also point out that the second part is mainly directed at SMEs. Another description given by Freeman and Soete (1997), where, according to which, the innovation consists of two parts: the recognition of a potential market for a new product or process and the technical knowledge that is either generally available or is new scientific and technological knowledge derived from research activity. Finally, Smits (2002) attempts to provide a simplistic definition of innovation, noting however that this is a complex process that takes place in terms of products, companies, industries, and at national and international communities.

2 Types of Innovation

Guan and Zhao (2013) separated innovation in open and closed ones. In open innovation, a firm opens its "borders" in order to circulate knowledge and from the external environment in order to create opportunities for cooperation with various institutions and actors, such as universities, government, customers, or suppliers, aimed at introducing new innovations. According to Fontana et al. (2006), firms designated as "open" are more likely to consider the knowledge generated in universities as important for their innovation and, yet, for those who are willing to share their innovation are more likely to work with universities. They also argue that firms that opening their borders often voluntarily disclose important pieces of knowledge they possess, through scientific publications, conferences, and through patents and the Internet. This practice is followed, both to enable firms to gain feedback from the external environment and also to expand their reputation and their collaborative networks and, secondly, to ensure that others "know that you know." On the other hand, the closed innovation, an enterprise remains self-sufficient as it is argued that "successful innovation requires control" and that "no one can be sure about the quality of the ideas of others." Especially for SMEs, S. Lee et al. (2010) conclude that their participation in collaborative networks is an effective way to facilitate open innovation and, through it, to highlight their potential activity.

2.1 Innovation and Knowledge

In literature, it is clear that knowledge is one of the main components of the innovation (Davenport 2005; De Faria et al. 2010; Kim and Huarng 2011). As highlighted by Sarvan et al. (2011), the real strength of the business, in terms of competitiveness, depends on their ability to access information and create knowledge. The importance given by the successful firms in the systems' knowledge management, through which the process of creation is achieved, organizing, diffusion, use and exploitation of knowledge is not accidental. According to Lai et al. (2014), the knowledge management system is the intermediary between the collaborative networks and corporate performance of the participants in innovation. Through such a system, firms face favorable conditions when taking strategic decisions, because the assessment and solution of a problem are based on knowledge (Sedziuviene and Vveinhardt 2010).

A firm's ability to recognize the importance of new information, to assimilate, and to exploit it for commercial purposes is broadly described by the term "absorption capacity" (Gebauer et al. 2012). It is therefore evident that the greater absorptive capacity has a business, the greater the ability to access and operate more knowledge and the less financial distress it faces. The De Faria et al. (2010) have linked this capacity for innovation, arguing that the ability of a company to exploit the knowledge not produced by the same, but from a research institute, has a positive effect on the probability that the company be a successful innovator and a viable organization. Similarly, Wei et al. (2009) described the absorptive capacity of an enterprise as a fundamental element for innovation, while Kang and Park (2012) pointed out that business innovation is affected by costs in R&D (Research and Development) and research personnel, through the absorption capacity they generate. However, as indicated by Gebauer et al. (2012), it is not enough not only to manage the accumulation of external knowledge for a successful innovation strategy, but also to adopt more operational capabilities, such as systematization, coordination, and socialization of knowledge are needed.

Finally, according to López-Nicolás and Meroño-Cerdán (2011), knowledge management is an important mechanism to enhance the absorptive capacity, innovation, and business performance.

2.2 Innovation and SMEs

Small and medium-sized enterprises (SMEs) are considered by many authors as engines for economic development of a country (Lee et al. 2012; Sawers et al. 2008; Zeng et al. 2010) and cover a significant part of interest of the policy makers, as the majority of the economic structure and, compared with large enterprises, SMEs are the main employers in a state (Hoffman et al. 1998; Lee et al. 2010, 2012; Muscio and Nardone 2012; Solleiro and Gaona 2012; Lemonakis et al. 2013a). According to Villa and Antonelli (2009), the proportion of SMEs in any domestic industry is close to 90% of all enterprises, while the share of employees in these personnel is more than 60% of the working population. The fact that they represent the majority of businesses is an important reason chosen as sample in most surveys and studies, including the present book chapter.

In general, SMEs are described as reflective, without plan or at best opportunistic (Hagen et al. 2012). Still, Sawers et al. (2008) characterize these businesses as flexible as they have the ability to react quickly to changing needs and environment and argue that their successful development strengthens a country's competitiveness. However, although the flexibility of SMEs is an advantage for accelerating innovation, few of them have the ability to manage the entire innovation process by themselves in order to turn their inventions into products or services. They often lack resources and capacities at the stages of manufacturing, distribution, promotion, and research, and this leads to cooperate with other firms in order to reduce the risk, cost, time completion of the procedures required for an innovation process, as well as to gain access to sales and marketing networks (Lee et al. 2010).

Still, because, according to Hall and Lerner (2010) and based on theories, research, and empirical calculations, smaller businesses face higher capital costs compared with larger ones, turning to financing through venture capital and partnerships. Also, as mentioned by Sawers et al. (2008), because of the limited ability of smaller firms to compete with their larger competitors, due to lack of knowledge, employees' skills, lack of capital, low levels of human resources management, and external issues as well (presence of major players in the market), partnerships aimed at innovation is a way for smaller firms to overcome these barriers. Moreover, Revilla and Fernández (2012) argue that the partnerships allow small businesses on the one hand to supplement the existing resources and to overcome the financial obstacles they face because of their small size and, secondly, to gain access to new knowledge. Still, according to Ozman (2009), the companies forming alliances because they are not self-sufficient and can cooperate in order to reduce uncertainty and gain access to resources. Zeng et al. (2010) note that SMEs have limited financial resources, which implies less investment in R&D and generally more uncertainty undertaken in terms of financial viability and barriers to innovation; they also require some additional resources, such as marketing knowledge and managerial skills. They conclude that cooperation networks are on these businesses a means to address those barriers and to reduce the uncertainty in innovation. Therefore, they argue that it is necessary for small businesses to connect to different firms, research facilities, suppliers, and customers in an innovation network that will allow them to share knowledge and benefit from the available skills provided within the network. These external skills and resources through partnerships are available for exploitation by SMEs, and they can give them the right boost and the ability to innovate, looking for ideas, knowledge, and resources, essential for creating successful product and services.

3 SMEs and Financial Distress

Beaver in 1966 first defined the financial distress as “the inability of a firm to pay its financial obligations as they mature.” Gestel et al. (2006) characterized financial distress more broadly as the result of chronic losses which cause a disproportionate increase in liabilities accompanied by shrinkage in the asset value (Gestel et al. 2006). According to Platt and Platt (2002), a firm is considered to be financially distressed if it experiences for a period of years negative net operating income or suspension of its dividend payments (Platt and Platt 2002). More generally, financial distress appears when a firm cannot pay off the debt to its creditors. This financial failure can produce either the firms’ default or even bankruptcy. Default is a firm's failure to meet its legal obligations of a loan or other credit form undertaken. On the other hand, bankruptcy is a legal procedure involving a legal representative or a business that is unable to repay outstanding debts. The bankruptcy process begins a law process where all of the debtor's assets are measured and evaluated in order to be used to repay a portion or the entire amount of outstanding debt.

SMEs play a crucial role in European economy accounting for nearly 99% of all firms and contributing to more than half of the value-added created by businesses. SMEs remain largely unexplored by the academia, mainly due to the challenges they face in modeling their credit risk profile. Unlike large corporations, SMEs frequently have limited or even no access to the capital markets. As a result, widely used structural market-based models for credit evaluation such as the distance-to-default measure inspired by Merton (1974) cannot be applied to them. Instead, empirical models such as credit-scoring approaches (i.e., Altman 1968) are the most commonly used. In the early credit-rating literature, academics mostly use accounting ratios to predict firm distress. Altman and Sabato (2007) developed a default prediction model for SMEs using only accounting information on a sample of nearly 2000 US firms over the period 1994–2002. They found that their model outperforms other commonly used corporate models such as Altman's z'-score (Altman and Hotchkiss 2006). Lehmann (2003), Grunert et al. (2004), and Altman and Karlin (2010) examine key financial factors for SMEs. Glennon and Nigro (2005) and Altman and Karlin (2010) are the first to examine business cycle effects on SMEs defaults, while Glennon and Nigro (2005), using a dataset of US loans guaranteed by SMEs, find that success or failure of a loan is associated with both regional and industrial economic conditions.

4 Methodology

The sample of this study consists of 158 small unlisted Greek firms from the manufacturing industry, which participated in field research, by completing an electronic questionnaire. The data analysis used the years 2009–2013.

In this study, we use the Altman's Z-score, to formulate the distress factor for Greek SMEs. More specifically, this criterion is a linear combination of five sub-indicators, with different participation rates, which have been determined in advance by Professor Altman (Altman's 1968 with amendments in Altman and Sabato 2007). More specifically, the sub-indices are: working capital/total assets (X_1), retained earnings/total assets (X_2), profit before interest and taxes/total assets (X_3), brokerage shares/total liabilities value (X_4), and sales/total assets (X_5).

Thus, the index Z is as follows: $Z = 1.2X_1 + 1.4X_2 + 3.3X_3 + 0.6X_4 + 0.999X_5$.

According to Altman, the bigger the Z-score, the better for the firm in terms of financial distress. Firms with Z-score above 3.00 are considered healthy, while those with less than 1.80 are confronted with a significant probability of bankruptcy in the next two years (80–90%). Firms with Z-score within the range of 1.81–2.70 face the possibility in the next two years from the publication of the balance sheet to be in financial difficulty (distress). Finally, firms whose Z index range from 2.71 to 2.99 should take steps to avoid future financial problems.

According to Altman's index Z, taken the total of 158 sample firms, 101 of them are located in the safe zone (63.9%), while 25 of them are in the gray area (15.8%), and the remaining 32 are in the default zone (20.3%). In Table 1, sample firms' Z-score descriptives are shown.

Table 2 lists the average values of the Z-score per year for the sample of companies. From this table, it is evident that as the years go to 2013, scores reveal a lower level of risk undertaken by firms, in other words, lowering the risk factor during the crisis period.

Table 3 shows the average values of the Z-score according to the size of companies, namely[1]:

1. **Micro-enterprises—Firms' type 0**: fewer than 10 employees and an annual turnover (the amount of money taken in a particular period) or balance sheet (a statement of a firm's assets and liabilities) below €2 million.
2. **Small enterprises—Firms' type 1**: fewer than 50 employees and an annual turnover or balance sheet below €10 million.

Table 1 Sample firms *Z*-score descriptives

Elements	*Z*-score
Mean	5.008907
Median	3.528773
Maximum	165.7912
Minimum	−4.148076
Std. Dev.	8.528052
Skewness	10.19623
Kurtosis	170.4646
Jarque-Bera	936,816.8
Probability	0.000000

Table 2 *Z*-score average values per year for sample firms

Years	Average scores
2009	4.106124551
2010	4.234974537
2011	4.721238542
2012	5.546187816
2013	6.436011904

Table 3 *Z*-score average values per year for each sample firms' size

Firms' type	Average Altman's *Z*-score per firms' size (sample firms)
Firms' type 0	6.909649379
Firms' type 1	4.916812615
Firms' type 2	4.382580504

3. **Medium-sized enterprises—Firms' type 2**: fewer than 250 employees and annual turnover below €50 million or balance sheet below €43 million.

Most firms in the sample are located in the Attica region (39.87% of the sample) and Thessaloniki (13.29% of the sample), as shown in Table 4.

In Table 5, the percentage of sample firms categorized by their ownership status is shown. The table shows that the majority of our sample firms concerns family run businesses.

Table 4 Number of firms per prefecture

Prefecture	Number of firms per prefecture	Percentage (%)
Argolis	1	0.63
Arta	2	1.27
Attica	63	39.87
Achaia	2	1.27
Boeotia	5	3.16
Drama	1	0.63
Dodecanese	4	2.53
Evros	3	1.90
Euboea	5	3.16
Ilia	1	0.63
Imathia	1	0.63
Heraklion	4	2.53
Thessalonica	21	13.29
Janina	1	0.63
astride	2	1.27
Karditsa	1	0.63
Kastoria	6	3.80
Kilkis	2	1.27
Kozani	1	0.63
Corinthia	2	1.27
Cyclades	1	0.63
Laconia	1	0.63
Larissa	3	1.90
Lasithi	1	0.63
Lefkada	1	0.63
Magnesia	2	1.27
Blonde	2	1.27
Pieria	2	1.27
Rethimno	1	0.63
Rodopi	1	0.63
Serres	3	1.90
Sindos	3	1.90
Trikala	1	0.63
Fthiotida	2	1.27
Florina	1	0.63
Chalcidice	4	2.53
Chania	1	0.63
Grand total	158	

Table 5 Sample firms' category by ownership type

Property type	Number of firms	Percentage (%)
Family run	96	60.76
Stock company unlisted	44	27.85
Other type	10	6.33
Listed firm	8	5.06
Total	158	100.00

The average age of the sample firms by geographic prefecture is listed in Table 6. Newer firms are located in Larissa and Trikala, while older ones in Magnesia and Chania prefectures.

4.1 Proposed Model

The initial form of the model equation is given by the form:

$$\Upsilon_{i,t} = \beta_0 + \beta_1 \mathrm{X}1_{i,t} + \beta_2 \mathrm{X}2_{i,t} + \ldots + e_{i,t}$$

Altman's *Z*-score is used as the dependent variable. The model used for our analysis is described subsequently for $t = 2009$, 2010, 2011, 2012, and 2013 (5 consecutive years), for the i-th firm:

$$\begin{aligned} Z - Score_i = {} & a_0 + a_1 AGEi + a_3 LN(Intangibles)i + a_4 LN(EQUITY)i \\ & + a_5 SHORT\_TERM\_DEBTi + a_6 ERPi \\ & + a_7 COOPERATION\ WITH\ UNIVERSITIES\ AND\ RESEARCHi \\ & + a_8 PATENDSi + a_9 NUMBER\ OF\ WOMEN\ IN\ THE\ BOARDi + \varepsilon_i \end{aligned}$$

wherein the variables used are shown in Table 7, and ε_i represents the error term.

Below, in Table 8, descriptive statistics of the variables used are shown while in Table 6 the Correlation Matrix for the variables used is also presented (Table 9).

The estimation of a regression in panel is important to determine the way they will treat the data. There are two options: fixed effects and random effects, often with significant differences in the results.

Table 6 Sample forms average age per prefecture

Prefecture	Average age of sample companies per prefecture
Argolis	19
Arta	16
Attica	25
Achaia	20
Boeotia	21
Drama	27
Dodecanese	26
Evros	18
Euboea	23
Ilia	32
Imathia	15
Heraklion	29
Thessalonica	27
Janina	16
astride	17
Karditsa	33
Kastoria	18
Kilkis	18
Kozani	17
Corinthia	42
Cyclades	14
Laconia	34
Larissa	15
Lasithi	34
Lefkada	15
Magnesia	58
Blonde	28
Pieria	33
Rethimno	33
Rodopi	42
Serres	24
Sindos	19
Trikala	11
Fthiotida	19
Florina	30
Chalcidice	19
Chania	63
Average	24.92993631

We run the Hausman test to take the choice of using between Fixed and Random effects. In the event that probability <0.05, we reject the null hypothesis and choose the Fixed Effects model. The resulting Prob equals to $0.0051 < 0.05$ (see Table 10); thereby we select the Fixed

Table 7 Variables used

Variables	Meaning
*Z*_score Dependent variable Independent variables	Altman's *Z*-score for each firm
Age	Age of the firm, calculated as year 2014—Year of firm's establishment
Intangibles	An intangible asset is an asset such as firm's intellectual property (i.e., trademarks, copyrights, goodwill, brand recognition) This is a proxy for Innovation in this study.
Equity	Equity = Assets—Liabilities as taken from firms' financial statements
Short-term debt	Any firm's debt that is due within a period of one year, such as short-term bank loans or other kinds of debt.
Use of Enterprise Resource Planning (ERP) systems	ERPs use (0 = No, 1 = Yes)
Cooperation with universities and research centers	Partnerships with Universities and Research Institutes (1 = Poor… 5 = High)
Patents use	Patents use (0 = No, 1 = Yes)
Women in board	Number of women in board (Representation of women in board as directors or even members in the board)

Effects model for the analysis. This model will be used for the analysis and interpretation of the regression results.

Furthermore, based on the control (Breusch-Pagan-Godfrey), the existence of heteroskedasticity shown in the above model made us use of the consistent estimators White (White cross-section standard errors and covariance, df corrected), for typical error rates, in order to reduce heteroskedasticity.

In Table 11, the results of the model are shown.

The fitting of the model is good ($R^2 = 0.47$) and based on the Akaike criterion equals to 5.06 < 667.36 (Akaike info criterion calculated by $AIC = 2 * k - 2\ln(L) = 2 * 9 - (-649.36) = 667.36$), where L: the maximum value of the maximum likelihood function of the model and k the number of parameters in the model (Table 12).

Important findings taken from the econometric model show significant and positive correlation (+) at 1% significance level of *Z*-score with SMEs key variable factors such as "Age", "Equity", "ERP", "Cooperation

Table 8 Descriptive statistics

	Age	Intangibles	Equity	Short-term debt	ERP systems	Cooperation with universities and research centers	Patents use	Women in board
Mean	22.1	10.1	14.2	2136169	3.69	2.17	0.48	1.22
Median	19.00000	10.31679	14.27936	1436678.	4.00000	2.00000	0.00000	1.00000
Maximum	53.00000	14.17460	16.62712	12057807	5.00000	5.00000	1.00000	4.00000
Minimum	10.00000	−4.605170	8.013399	92693.25	1.00000	1.00000	0.00000	0.00000
Std. Dev.	8.830687	2.560328	1.231980	2025426	1.34813	1.28071	0.50078	1.001959
Observations	259	259	259	259	259	259	259	259

Table 9 Correlation matrix

Variables	Age	Intangibles	Equity	Short-term debt	ERP systems	Cooperation with universities and research centers	Patents use	Women in board
Age	1.000000	0.160224	0.141281	0.190038	0.143872	0.174256	−0.081384	0.127009
Intangibles	0.160224	1.000000	0.186888	0.311555	0.137790	0.172135	0.214066	−0.125288
Equity	0.141281	0.186888	1.000000	0.269573	0.043213	0.110825	0.313086	−0.003566
Short-term debt	0.190038	0.311555	0.269573	1.000000	0.250824	0.190877	0.245427	0.023727
ERP systems	0.143872	0.137790	0.043213	0.250824	1.000000	0.042629	0.309827	0.048005
Cooperation with universities and research centers	0.174256	0.172135	0.110825	0.190877	0.042629	1.000000	0.034705	−0.100065
Patents use	−0.081384	0.214066	0.313086	0.245427	0.309827	0.034705	1.000000	−0.198882
Women in board	0.127009	−0.125288	−0.003566	0.023727	0.048005	−0.100065	−0.198882	1.000000

Table 10 Hausman test

Test summary	Chi-Sq. Statistic	Prob.
Cross-section random	14.820569	0.0051

Table 11 Regression results

Variable	Coefficient	Std. Error	*t*-Statistic	Prob.
C	−18.11081	3.233132	−5.601629	0.0000 (**)
Age	0.039157	0.005378	7.280598	0.0000 (**)
Intangibles	−0.154751	0.033506	−4.618655	0.0000 (**)
Equity	1.591816	0.245471	6.484744	0.0000 (**)
Short_term_debt	−1.05E-06	1.27E-07	−8.262750	0.0000 (**)
ERP	0.191813	0.045821	4.186159	0.0000 (**)
Cooperation with universities and research	0.433730	0.092807	4.673470	0.0000 (**)
Patends	0.724167	0.231380	3.129776	0.0020 (**)
Number of women in the board	0.232625	0.075048	3.099672	0.0022 (**)

R-squared = 0.476729, (**): Significance at 1%

Table 12 Aggregate results

Variable	Polarity	Significance
Age	(+)	0.0000(**)
Intangibles	(–)	0.0000(**)
Equity	(+)	0.0000(**)
Short_term_debt	(–)	0.0000(**)
ERP	(+)	0.0000(**)
Cooperation with universities and research	(+)	0.0000(**)
Patends	(+)	0.0020(**)
Number of women in the board	(+)	0.0022(**)

with Universities and research centers", "Patents" and "Number of women in the board", while significant negative correlation (–) of *Z*-score with the model factors, at 1% significance level, is with variables "Intangibles" (i.e. a proxy of Firms' Innovation) and "Short_Term_Debt".

5 Analysis of the Results

The methodology described above is used in order to predict the financial distress factors in Greek SMEs firms. The implementation of the proposed models is done in order to analyze firms' core characteristics in case of bankruptcy. We used financial data obtained from the largest Greek business information services, database and a questionnaire for taking feedback for other factors taking into account for SMEs financial viability, such as cooperation with Universities and Research Centers, ERP and Patents use, firms' short-term debt, Equity level. In depth, econometric analysis applied for taking out core characteristics for firms' financial distress in the Greek SMEs.

The economic crisis in the recent years has brought significant failures in almost any kind of business. It has shown that exogenous factors, such as political instability and country risk acting as catalysts in the markets. A consequence of such an economic phenomenon was to highlight the importance of creating models for detecting potential future financial problems. Our research is focused on describing correlation of *Z*-score (a dummy for financial distress or firms' potential bankruptcy) and other explanatory variables.

Bearing the above issues in mind, we see that robust evidence is reported insinuating a negative relationship between financial distress and innovation implemented in sample firms, revealing contrary to what was initially expected that innovative characteristics increase potential firms' distress levels, due to the fact that Greek SMEs are mainly "importing clients" of innovation rather than producers. This happens because, also, either because of the sample that based upon mainly on micro-firms that deal with middle technology-level products and services, or because their inability to produce primarily innovative products and services due to lack of adequate funding to support their R&D schemes.

Also, a strongly negative effect of Short-Term Debt is shown, as expected, with financial distress, where firms with less debt are in a healthier position than other with high volumes of short-term debt, especially in crisis periods, where credit lines for SMEs are shortening; in that sense, firms tend to reshape their operation with better use of their cash cycle. This is why firms' Equity becomes highly important factor in crisis period and therefore has a positive correlation to *Z*-score. In other words, better-capitalized firms face less financial distress events.

Another important finding is the notably less-risky performance of firms with more women in their board. This result demonstrates the very strong correlation between corporate financial viability and gender diversity. Smart firms appreciate that diversifying their boards with women can lead firms to more financial stability, with less distress effects undertaken.

On the other hand, firms that cooperate with universities and research centers include governmental and other institutions can provide specialized training, education, information, research, and technical support to SMEs, minimizing their distress effect. Also, this cooperation facilitates overall the business process and creates externalities and potential cooperation with other firms, as the direct observation of them is also facilitated. The isolated firms, by contrast, face higher costs and a greater risk in doing business with an effective and productive way.

Also, the positive relationship of the dependent variable with the age of the firm means that the oldest firms are more conservative and established in the marketplace; therefore, they face not so difficult issues related to financial risk and though they appear less distress behavior than their younger counterparts. The fact that the age of the firm has a positive effect on the firms' financial viability is because older firms may not be able to change their operation as quickly as their younger counterparts do after entering in a distress event.

Moreover, in that direction, Enterprise Resource Planning (ERP) systems are being used as significant strategic tools that provide competitive advantages in SMEs and lead them to operational excellence. This is—by default—an asset for their operation that ends up to firms' less distress behavior, even though that, ERP implementation projects are complicated, costly, and include high failure risks.

On the other hand, the propensity of small- and medium-sized enterprises (SMEs) to place their patents at first sight shows that small firms use their patents as a source of innovation, improving their efficiency and positioning in the marketplace, which is the reason for the positive correlation of Patents to *Z*-score, emphasizing the less distress effect their encounter after all.

Finally, younger SMEs in our sample, even though they are more flexible than the older ones, they record higher probability in facing a distress event, during their operation. The cost of financial distress is likely to be particularly severe for small-sized firms in terms of revenues, due to the fact that they are undercapitalized that tends to deteriorate the effects in case of financial distress. In order to avoid size consequences, smaller firms should gain easier access to funding, preserving the ability of smaller firms to be growing faster in an extremely hostile for business environment.

6 Policy Implications

Nowadays, financial viability is inextricably linked with innovation and collaboration. The aim of this work was to identify the main factors associated with the financial viability of Greek SMEs. To achieve this objective, we gathered and processed quantitative and qualitative information through databases and fieldwork. The results of this work show that the size, age, and business cooperation with universities and research centers are determinants of firms' financial viability, in agreement with the literature (see: Lemonakis et al. 2013b, Belderbos et al. 2004; Cai and Fan 2011; De Faria et al. 2010; Zeng et al. 2010, etc.).

The success obtained through business partnerships and universities or research institutes is in most cases given. Therefore, policies that promote and enhance such cooperation is particularly important (Tödtling et al. 2009). As it is commonly accepted that government policies strongly influence the effectiveness of universities and research institutions, regarding innovation processes (Zeng et al. 2010), the policy makers should develop policies that will strengthen the ties between universities and the private sector (Solleiro and Gaona 2012), to provide a sound basis for cooperation, through which there will be exchanges of information between businesses and universities. Such an example is the science parks (Guan and Zhao 2013).

In addition, the state, especially during the crisis period, should ensure the development of existing universities and research centers, and the establishment of new high-quality research institutions. Particularly for Greece, academics should be motivated to remain in the country and for reforms to strengthen the education system (Herrmann and Kritikos 2013). Also, in order to have in place, a restructured national innovation system should be established and new structures that will allow private and public organizations to participate in voluntary knowledge-sharing communities (Papadopoulos et al. 2013). Moreover, governments should promote innovation targeting policies to facilitate international links in order to establish cooperation and across borders (Kang and Park 2012) and to promote the innovation capacity of cluster composed of SMEs promoting open innovation in universities and research centers (Cai and Fan 2011).

Ultimately, policy makers face a serious dilemma. On the one should facilitate the development of innovation to provide firms financial viability and minimizing distress events, and the economy, on the other, should introduce policies without large costs for the country (Papadopoulos et al. 2013).

Note

1. Commission Recommendation of May 6, 2003, concerning the definition of micro-, small-, and medium-sized enterprises (notified under document number C(2003) 1422) (OJ L 124, 20.5.2003, pp. 36–41), URL: http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=URISERV:n26026.

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