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Summary

The Global Financial Crisis (GFC) of 2007-2009 highlighted the devastating impact both public and private debt can have on an economy. This doctoral dissertation is situated in the broad research agenda of analyzing how debt, and in particular excessive levels of debt, negatively affects economic performance. Although the research on the potential harmful effect of debt has vastly expanded over the past ten years, there is by no means a consensus in the literature on what type of debt (e.g. public or private) is more damaging, at which level it becomes a drag on growth and/or investment and through which channels. In our research, we try to advance the literature by conducting a cross-country empirical analysis on the impact of debt on economic performance in the European Union (EU).

It appears intuitive that excessive debt levels can hurt economic growth. However, scholars have struggled to specify at what point public debt becomes detrimental for growth. Following the highly influential 2010 paper by Reinhart & Rogoff, the assertion that debt levels in excess of 90% of GDP bring about economic mayhem and hence need to be avoided by all means, was treated as received wisdom and this threshold swiftly became ammunition in political debates on austerity, on both sides of the Atlantic.

We first study whether there indeed is a tipping point for public indebtedness, beyond which economic growth is dramatically compromised. We find little evidence to support the hypothesis that a critical debt threshold exists after which economic output is substantially reduced. Instead, our research shows growth performance deteriorates progressively as the level of total debt-to-GDP increases. Moreover, this relationship is stronger for short-term growth than for medium- to long-term growth, which suggests the causality most likely runs from low growth to high debt, rather than vice versa. If such a threshold does exist, it presumably varies from country to country, fluctuates over time and depends on a plethora of different factors (e.g. a country's potential growth rate, debt servicing costs, institutional capabilities and the willingness and ability of the private sector to save).

Even if there is no 'magical' debt threshold after which economic output collapses, excessive debt levels might still have a negative impact on a broad array of macroeconomic indicators. For example, as public debt levels soared after the

GFC, public investment plummeted. Therefore, we examine to what extent higher public debt results in lower public investment. Our results indicate a significant negative impact of sovereign debt on public investment: if public debt levels in the EU would be 10 percentage points lower, public investment would be around €18.5 billion higher. Moreover, we find that this debt overhang effect is only prevalent in high debt countries. This suggests that, when sovereign debt rises, public investment is crowded out by the increase in debt servicing costs. When faced with the need to curtail spending, governments have a bias for reducing investment spending rather than current spending, as the political cost of deferring investment projects is generally lower than the political cost of trimming current expenditure since the latter often benefits politically influential interest groups (e.g. civil servants). As a result, highly indebted governments spend less on public capital. Hence, from an economic policy perspective, fiscal consolidation measures might be justified, if the aim is to boost public investment.

The decline in public investment in the EU since the GFC has generally been acknowledged by policymakers and is starting to draw attention of the academic community. However, private investment collapsed even more than public investment did, most notably in Europe's Southern periphery. Coinciding with this reduction in private investment, public and private debt levels soared. Hence, we examine to what extent higher debt results in lower private investment. We find scant evidence to support the hypothesis that high private debt leads to low private investment. However, we do find that inflated levels of public debt result in diminished private investment: should public debt levels in the EU decrease by 10 percentage points, investment would increase by €65 billion. In addition, this debt overhang effect is again stronger in countries characterized by high levels of public debt.

We identify three potential channels through which higher public debt can result in lower private investment. Firstly, as government debt rises, companies and households expect future taxes to increase as well and decide to reduce investment spending now. Secondly, the private sector considers public debt to be an indicator of economic uncertainty: if sovereign debt goes up, economic prospects are dismal. In a future mired in economic uncertainty, the incentive to invest will be lower. Thirdly, higher levels of public debt will, ceteris paribus, bring

about higher borrowing costs for the sovereign, as this implies a higher risk of default. This increase in borrowing costs feeds through to the private sector and crowds out private investment.

Our research shows that debt *per se* is not a good predictor of future GDP growth, but that it does have a negative impact on a variety of macroeconomic indicators, such as public and private investment. Hence, we advocate a more comprehensive view of fiscal sustainability and public wealth, which goes beyond debt and deficits and takes into account the entire public sector balance sheet. Shifting the attention from one component of a public sector's balance sheet, i.e. debt, to the entirety of government assets and liabilities will yield a more accurate account of the health and sustainability of public finances, is likely to lead to better management of state assets and will draw attention to nondebt liabilities (e.g. unfunded pension obligations) that are often neglected in standard fiscal analyses.

Moreover, we show that countries characterized by high levels of public debt tend to devote less resources to public investment. Decreased public investment, for example in education and roads, hurts the long-term productive potential of a country and has obvious negative implications for the private sector. Thus, countries, especially highly indebted ones, should be incentivized to allocate sufficient resources towards public investments. Therefore, we propose to rewrite the Stability and Growth Pact (SGP) by exempting spending on public investment from the deficit rule. More specifically, we advocate the introduction of a 'golden rule' at the European level, which would allow a government to borrow with the purpose of financing public investment but would require current spending to be covered by current revenues.

As noted, the GFC wreaked havoc on the European economy and led to a deterioration in the public finances of nearly every EU country. The marked increase in sovereign debt forced most governments to push through stringent austerity measures, including cuts in social security spending and laying off civil servants. Moreover, monetary policy reacted by implementing a host of conventional and unconventional policy measures to contain the fall-out of the crisis. These events also brought about an unprecedented increase in uncertainty for households and severely dented consumer confidence: in the spring of 2009, at the height of the crisis, overall consumer confidence reached a three-decade

low. People are less sure whether they will be able to keep their job, what return they can expect on their savings and to which extent they will have to provide for their own health insurance and pension plans. Therefore, we study the effect the Global Financial Crisis has had on consumer confidence and in turn how this evolution in consumer sentiment influenced household saving behavior.

We find that confidence in the financial situation of households has a substantially larger effect on household saving than confidence in the general economic situation. More specifically, if the indicator measuring the confidence in households' current financial situation decreases by 1 standard deviation, household saving increases by 12.43 percentage points. This compares to a 2.82-3.81 percentage points increase in the saving rate of households if the indicator measuring the general economic situation decreases by 1 standard deviation. As the household saving rate averages 10.72% in our sample, this effect is quite substantial. Households are hence more concerned with how their personal financial situation develops than with the state of the general economy. Indeed, it is the evolution of a household's finances over the past year, and their outlook for the coming year, which ultimately drives their spending decisions. If they experience a deterioration in their financial situation, and/or expect it to deter further, they will postpone the consumption of durable consumer goods (e.g. a car) to a time when their finances, or at least the perception thereof, have improved.

Moreover, our results suggest the impact of consumer confidence on household saving has increased after the Global Financial Crisis: a broader array of sub-indicators of consumer sentiment impact household saving and their impact is stronger post 2008. More research is needed to establish the mechanisms behind this. We posit that a threshold effect might be in place: after the GFC, consumer confidence dropped to such a low level, that it altered how households incorporate consumer sentiment in their saving decisions: consumer confidence plays a more important role and households incorporate a larger set of confidence indicators to determine their economic or financial situation.

When consumer confidence is low, for example during or shortly after a recession, policymakers should be very careful not to implement measures intended to counteract this fall in consumer sentiment but in reality prove to aggravate a dire

economic situation. With regards to fiscal policy, governments need to show a clear commitment to long-run debt sustainability. If governments proceed with a budgetary stimulus to counter a recession that is regarded by citizens as being excessive and jeopardizing the long-term health of public finances, households might respond more sluggishly to this demand stimulus. With regards to monetary policy, central banks need to tread carefully as to not worsen consumer sentiment. Highly accommodative monetary policy, especially unconventional policy measures, might be viewed by the public as an indicator that the economic future looks very bleak, in the process negatively affecting household expectations about the economic outlook.

In the final part of this doctoral dissertation, we explore what has driven the increase in public debt and what policy lessons can be drawn from studying the evolution of public debt. In order to do so, we carry out a case study on one of the most highly indebted countries when the Maastricht Treaty was signed by European leaders in 1992: Belgium. More specifically, we assess the main drivers of Belgium's debt dynamics between 1995 and 2014.

As a result of its historically high debt burden, Belgium had ample experience in running primary surpluses. Already during the 1980s, the Belgium government had to realize substantial primary surpluses, as to avoid debt snowballing out of control. When Belgium decided to enter the EMU, the risk premium on Belgian bonds decreased and interest rates on government bonds started to fall substantially. Both elements combined with an uptick in international growth and the 'stars aligned' for an impressive debt reduction episode: the ratio of public debt-to-GDP declined from a peak of 138% in 1993 to 87% in 2007. We do not claim the Belgium government refrained from implementing important reforms to establish these relatively high primary surpluses. However, the latter were not significantly larger than the surpluses it had historically realized. Of course, maintaining a primary surplus also requires taking difficult, and often unpopular, measures, but Belgium had extensive experience in doing so. Then, the GFC caused the worst economic disaster since the Great Depression and forced governments across the globe to bail out large parts of the financial sector. Also in Belgium, the federal government had to inject capital in several large, failing banks, causing a sizeable increase in the public debt-to-GDP ratio. Moreover,

anemic growth combined with the cost of servicing a large stock of legacy debt, resulted in public debt to rise even further.

Subsequently, we take a brief look at what, if any, lessons can be learned from the Belgium experience and applied to Greece, a country which would certainly benefit from a comparable, or preferably even larger, reduction in sovereign debt. Whether Greece can achieve a similar reduction in its public debt ratio is not clear-cut. Certain factors speak in favor of Greece emanating the Belgium experience. For example, even at the heights of the GFC, the Greek people showed an unequivocal desire to remain part of the common currency block, even if this meant stringent austerity measures. As staying part of the Eurozone seems as important to the Greek people as entering it was for the Belgian people, they are likely willing to make considerable sacrifices to this end. Other aspects are less favorable. Whereas only around a quarter of Belgium's stock of sovereign debt was held by non-residents when it entered the Eurozone, approximately 83% of Greece's debt was owed to official, foreign creditors at the end of 2014. Running continued primary surpluses to pay down debt constitutes a massive transfer of Greek wealth to other counties. If Greek citizens take the view that these transfers are unfair, as future generations will have to continue to "pay for mistakes made by previous governments", this will significantly hamper their willingness to tolerate painful austerity measures.

In the current economic environment, where the nominal growth rate exceeds the yield on government bonds, the intertemporal budget constraint facing the government no longer binds, absent primary deficits. Hence, public debt has limited to no fiscal costs. However, excessive levels of sovereign debt still have welfare costs because they reduce capital accumulation, as our research has shown. Moreover, although at present interest rates are at subdued levels, they can, and most likely will, rise in the future, for example due to a positive shock to productivity resulting from advances in artificial intelligence and robotics, or because of a reassessment of risk premia on government bonds caused by the global rise in populism. Furthermore, unless substantial policy changes are implemented, a rapidly ageing population will put sovereign debt on an upward trajectory in most advanced economies as spending on pensions and healthcare is forecasted to grow considerably. Thus, sound debt management and prudent

fiscal policy is still warranted. Nevertheless, further research is required to assess the cost of public debt in the current environment of low interest rates, as well as the implications for fiscal rules that guide governments' tax and spending decisions.

Contents

CHAPTER 1

Introduction and research questions

1. General introduction

In the 1970s advanced economies entered a period of stagflation, a bleak combination of low growth and high inflation. This episode of dismal economic performance came to an end by the mid-1980s, as the volatility of output and price growth in all OECD economies declined markedly (McConnel & Perez-Quiros, 2000). A period of extraordinary macro-economic stability commenced. In the literature, three different hypotheses on why this happened have been floated: (i) changes in the structure of the economy, (ii) improvements in economic policy, and (iii) a matter of luck.

Changes in the structure of the economy can reduce macroeconomic volatility in various ways, such as the shift from manufacturing to services, as the former tends to be more volatile and the introduction of 'just-in-time' inventory management to reduce volatility in the inventory chain (Ćorić, 2011). Moreover, the widespread adoption of advanced information and communication technology (ICT) enabled companies to improve the efficiency and effectiveness of their production, resulting in less volatile production, and consequently output (Summers, 2005). In addition, product and labor market deregulation allowed economies to better absorb negative shocks, resulting in more economic stability (Clark, 2009). Finally, the vast increase in international trade, and the associated capital flows made economies more interconnected and, so the argument went, less volatile (Bernanke, 2012).

Improved macroeconomic stabilization policy is the second potential reason for the reduction in volatility of output and inflation. Increased confidence in central bank's ability to successfully combat inflation, is believed to have played a crucial role. In the United States, for example, inflation peaked at over 12% in the mid-1970s After taking over the helm as head of the Federal Reserve, Paul Volcker managed to bring inflation back down to 4% in the 1980s. There is a large consensus in the literature that more credible monetary policy has played an essential role in the volatility decline as the central bank's commitment to price stability managed to anchor inflation expectations (e.g. Ahmed, Levin & Wilson, 2004; Cogley & Sargent, 2005).

A final explanation for the Great Moderation might simply be a matter of luck; advanced economies were hit by less severe exogenous shocks, such as the stark increases in the cost of oil in the 1970s. This argument was strongly advanced by Stock & Watson (2003) who showed that, although most developed economies were hit by numerous adverse shocks, it was pure luck that their economies did not react negatively to these adverse developments. Rather unsurprisingly, policymakers refuted the good luck hypotheses (e.g. Mojon, 2007; Giannone, Lenza & Reichlin, 2008; Hakkio, 2013).

As the two decades since the mid-1980s were characterized by relatively low volatility in GDP and price growth, policymakers believed they had finally contained the business cycle. A general belief emerged that economists had discovered the Holy Grail of Macroeconomics, i.e. a regime of steady economic growth where short periods of slow growth could still occur, but where sharp and deep recessions were a thing of the past.

Advanced economies experienced a protracted period of unprecedented stability. As a result, both economists and policymakers alike lulled themselves into a false sense of complacency. Moreover, the longer this stability persisted, the more financial markets became convinced that low output and inflation volatility was here to stay, which caused risk premia to plummet to extremely low levels (Bean, 2010). The combination of low perceived risk and loose monetary policy (e.g. Taylor, 2007) created strong incentives for both the public and the private sector to become highly leveraged. To give just one example, gross total (i.e. public plus private) external debt as a percentage of GDP increased more than fivefold in advanced economies over two decades, from approximately 50% in 1985 to over 250% in 2007 (Reinhart, Reinhart & Rogoff, 2012).

But, to paraphrase the late Hyman Minksky: “stability breeds instability”. As Minsky – who once was derided as an obscure economist, but became somewhat of a posthumous star as the Global Financial Crisis (GFC) unfolded - argued persuasively in his Financial Instability Hypothesis, periods of economic prosperity bring about excessive availability of credit, resulting in credit-fueled asset-price bubbles (Minsky, 1982). Moreover, these credit booms are generally followed by banking crises (Reinhart & Rogoff, 2004; Mendoza & Terrones, 2014). When the elevated debt levels become excessive, a ‘Minksy moment’ ensues, the bubble

bursts, a financial crisis is initiated and this inevitably brings about a reduction in economic activity. Whereas this explanation for financial crises has now become part of the conventional wisdom on financial panics after the 2008 US subprime mortgage crisis, his economic theories were generally ignored by mainstream economics up until then.

The Global Financial Crisis of 2007-2009 sparked renewed interest on the role debt can play in destabilizing an economy (e.g. Reinhart & Rogoff, 2010; Chatterjee, 2013; Mian & Sufi, 2014; Jorda, Schularick & Taylor, 2016). The potential detrimental effect of excessive debt levels are however quite apparent. According to the Ricardian equivalence theorem (Barro, 1996), high levels of public debt can lower long-term growth prospects, as households and corporations anticipate future elevated taxes, which results in reduced consumption and investment, and thus economic output. Similarly, if a company is overindebted, investors anticipate the proceeds from any new project to be (in part) expropriated to serve legacy debt. Hence, excessive private debt levels can equally result in lower investment and lower growth (Corsetti, Feld, Lane, Reichlin, Rey, Vayanos & di Mauro, 2015). Moreover, countries with high levels of public debt are exposed to self-fulfilling debt crises and liquidity problems (Cole & Kehoe, 2000; De Grauwe & Ji, 2013). Indeed, as debt levels creep up and the risk of a default increases, government debt holders will demand higher interest rates, which makes it even harder for a government to service its debt. Finally, an overindebted private sector will try to repair its balance sheet (Koo, 2009). Households will save more and spend less, weighing heavily on consumption - which is the largest component of GDP – whereas corporations will cut back on investment, which of course also reduces economic output.

2. Research questions

This doctoral dissertation can be situated in the broad research agenda of analyzing how debt, and in particular excessive levels of debt, can harm an economy. More specifically, we focus on the impact of debt on economic growth and investment. Although the research on the potential negative effect of debt has vastly expanded over the past ten years, there is by no means a consensus in the literature on what type of debt (e.g. private or public) is more detrimental, at which level it becomes a drag on growth and/or investment and through which channels. In our research, we try to advance the literature on the impact of debt on economic performance. The remainder of this section discusses the different research questions we attempted to tackle.

It appears intuitive that excessive debt levels can hurt economic growth. But when does debt become excessive? Is there a tipping point for public indebtedness, beyond which economic growth is dramatically compromised? That is what we study in our first research question:

RQ1: Is there a debt threshold after which growth declines significantly?

This part of our research was heavily influenced by the (now in)famous Reinhart & Rogoff paper *Growth in a time of debt* 2010, which was part of a much larger empirical analysis they completed in their book *This time is different: eight centuries of financial folly* (2009). The methodology the authors use is appealingly simple: Reinhart & Rogoff group country-years in four categories according to their ratio of public debt-to-GDP: 0-30%, 30%-60%, 60%-90%, more than 90%. Subsequently, they compare real GDP growth rates across these different groups and find that, for debt levels exceeding 90% of GDP, median growth rates decrease by around 1% and average growth declines even more steeply.

Although Reinhart & Rogoff's research was later refuted by Herndon, Ash & Pollin (2014)[1], it nevertheless proved to considerably dominate the thinking of US and

[1] Herndon, Ash & Pollin (2014) uncovered "*data omissions, questionable methods of weighting and elementary coding errors*" and assert that, when these errors are corrected, average growth at public debt levels above the 90% threshold does not vary dramatically from average growth at lower debt levels.

EU policymakers in the aftermath of the crisis[2]. An excellent illustration is the emphasis on austerity to deal with the outfall of the global financial crisis, both in Europe and in the United States and advocated by international institutions such as the IMF (e.g. IMF, 2010).

We argue that one should not only look at public debt, but that private debt also needs to be taken into account as both are intimately interlinked. Indeed, if in case of failure in the private sector (e.g. the near-bankruptcy of a large financial institution), the public sector steps in and assumes some of the liabilities of the private sector, this amounts to an implicit government guarantee, making private debt indistinguishable from public debt, as liabilities are simply transferred from the private sector's balance sheet to that of the public sector (Bhandari, Haque & Turnovsky, 1990)[3].

Public and private debt are not only interlinked, and hence need to be studied concurrently, they are also generally interchangeable and therefore need to be aggregated in order to be able to fully appreciate the extent to which debt impacts an economy. A straightforward example of this argument is provided by tuition fees for higher education. Organizing tertiary education brings about certain costs, such as paying salaries to faculty and building (and maintaining) the required infrastructure. These costs can be borne by the state, in the form of providing free higher education for all, or by the (parents of) the students by paying full cost fees. Who ultimately foots the bill does not affect the size of the bill[4]. Hence, it

[2] We cite a few examples for the UK, the US and the EU. George Osborne, who later became the Chancellor of the Exchequer, cited Reinhart & Rogoff explicitly by name in a key 2010 speech in which he explained his policy proposals, including large reductions in government spending. Paul Ryan inserted a reference to Reinhart & Rogoff in the United States Republican Party's budget proposal "The Path to Prosperity" (Ryan, 2013). Finally, Ollie Rehn, who was at the time EU Commissioner for Economic Affairs, referred to the research by Reinhart & Rogoff in his 2013 address to the International Labour Organisation, arguing that "*public debt in Europe is expected to stabilize only by 2014 and to do so at above 90% of GDP. Serious empirical research has shown that at such high levels, public debt acts as a permanent drag on growth*" (Rehn, 2013).

[3] This is, for example, illustrated by the bailouts of the financial sector in Spain in the wake of the Global Financial Crisis. A large construction bubble had been building up, fueled by cheap credit, which resulted in private debt levels soaring from around 125% of GDP at the start of the decade to more than 220% when the crisis struck in 2007-2008. As a result, the Spanish government had to bailout the financial sector to the tune of €54 billion and applied for a €100 billion bank recapitalization package in June 2012. These funds were provided by its Eurozone partners, amongst which was the newly created European Stability Mechanism (ESM).

[4] Whether the provision of higher education is better left to the private sector or the state, is beyond the scope of our research.

follows that either the government assumes debt in order to finance free higher education, or college attendants take on a student loan to pay for their tuition[5].

Essentially, this amounts to transfers on the same side of a consolidated balance sheet of society. One can argue on whether the public or the private sector should organize and/or pay for these services on the basis of cost efficiency or ideology, but this does not alter the overall need that these projects and services need to be financed.

In summary, public and private credit are communicating vessels and should not be studied separately; emphasizing just one of both will likely result into an inaccurate view of how indebted a society is as well as the impact debt will have on an economy. Thus, we study the link between the total level of debt and GDP growth. More specifically, using a dataset of annual data on 26 developed economies over the period 1961-2012, we analyze whether we can predict the future level of growth, merely by looking at (changes in) the total level of debt in an economy.

Whereas the original Reinhart & Rogoff paper simply looks at GDP growth the year after which a certain debt threshold is breached, we also include medium- and long-term growth. The rationale for this is straightforward. High debt might not be the cause of sluggish growth, but rather the result. For example, if a country enters a recession (e.g. after having experienced a financial crisis), GDP growth is low, or even negative, by definition. At the same time, debt levels will almost mechanically increase, as automatic stabilizers kick in (e.g. increased spending on unemployment benefits and lower receipts from income taxes). Therefore, we also analyze the long-term relationship between the level of total debt to GDP in year t and subsequent GDP growth in the years t+1, t+5, t+10, t+15. Expanding our analysis to include this longer-term horizon allows for tempering the effects of potential reverse causality that a recession has on short-term economic growth and debt.

Even if there is no 'magical' debt threshold after which economic output collapses, excessive debt levels might still have a negative impact on a broad array of

[5] Similar arguments can be made for a wide variety of services that can be either be provided by the public or the private sector, such as the provision of health care and the construction and/or exploitation of public infrastructure (e.g. toll roads).

macroeconomic indicators. Therefore, the second research question of this doctoral dissertation is:

RQ2: To what extent does higher public debt result in lower public investment?

After the Sovereign Debt Crisis, the EU experienced a marked increase in public debt. Compared to the debt levels prevalent in 2007, the public-debt-to-GDP ratio increased by 66.66% in the EU, by 70.23% in the Eurozone and even by a staggering 86.52% in the so-called PIIGS countries (i.e. Portugal, Italy, Ireland, Greece and Spain). As already discussed, this generated vast amounts of research on the impact of these elevated debt levels on economic growth (e.g. Checherita-Westphal & Rother, 2012; Baum, Checherita-Westphal & Rother, 2013). However, very little research has been devoted to studying whether these increased debt levels impacted public investment. This is rather surprising, as concurrently with public debt levels in Europe surging, public investment plummeted. From 2007 to 2015, public gross fixed capital formation (GFCF) decreased by 6.32% in the EU, by 11.08% in the Eurozone and by 37.87% in the PIIGS. Policymakers *have* recognized that the overall volume of public investment has declined over the past decade. Moreover, a broad array of policies and institutional arrangements to close the European investment gap are being considered (e.g. Dauderstädt, 2015)[6].

Having an adequate level of public investment is paramount for a variety of reasons. Firstly, well-targeted public investments are conducive to increase labor productivity and long-term economic growth (Ganelli & Tervala, 2016; OECD, 2016). Secondly, investing in public goods such as education generates important spillover effects for the private sector, as companies have a better educated workforce at their disposal. Thirdly, public investment can also crowd in private investment, for example if governments invest in physical infrastructure (e.g.

[6] The European Commission has launched the European Fund for Strategic Investments (EFSI) which is the central pillar of the Investment Plan for Europe, also dubbed the 'Juncker Plan' (Juncker, 2015). EFSI "*aims to tackle the lack of confidence and investment which resulted from the economic and financial crisis, and to make use of liquidity held by financial institutions, corporations and individuals at a time when public resources are scarce… [and] supports strategic investments in key areas such as infrastructure, energy efficiency and renewable energy, research and innovation, environment, agriculture, digital technology, education, health and social projects. It also helps small businesses to start up, to grow and to expand by providing risk finance.*"

roads) which allows firms to deliver their products more rapidly and at a lower cost to their customers. Fourthly, in order for a society to be able to protect itself, be it from terrorists or foreign threats, sufficient investment in defense capabilities is essential. Fifthly, in nearly all (advanced) economies, it is the government's responsibility to invest in basic infrastructure, i.e. the services and facilities necessary for the economy to function properly, such as water supply, sewerage and the electricity grid. Finally, public investment works are the archetypical Keynesian response to a looming depression and hence can also be used as a useful counter-cyclical fiscal tool[7].

Given the lack of thorough empirical analysis on the decline in public investment, there is no broad-based consensus on the drivers of this investment drop. Reduced investment could on the one hand mainly be due to cyclical factors; most EU countries had to adopt stringent austerity measures in the wake of the GFC. When decisions have to be made on which outlays to reduce, public investment is an easy target, rather than public expenditure, as they are the least rigid component of expenditure (Roubini & Sachs, 1989). Put differently, when debt and debt servicing costs surge, it becomes increasingly difficult to direct government revenues towards new investment projects. Hence, funds that otherwise would have been available for investment may be crowded out by increased interest expenditure. The drop in public investment could on the other hand also be driven by more secular factors, such as an ageing economy which simply has less need for investment in public infrastructure.

We add to the literature by examining whether Europe suffers from a so-called 'debt overhang', in which high public debt leads to low public investment, exploiting a panel dataset for 26 countries over the period 1995-2015. Moreover, we compare this effect in high debt countries vs. low debt countries and Eurozone countries vs. non-Eurozone countries. To tackle this research question and the accompanying endogeneity concerns[8], we employ diverse econometrical

[7] However, recent research shows that governments have a tendency to *reduce* public investment in a recession. Thus, public investment often times works pro-cyclical (e.g. Fatas & Summers, 2018).

[8] Certain variables we include in our regression (e.g. public debt and public expenditure) are determined simultaneously with our dependent variable. Hence, the causality might also run from public investment to one of these variables. For example, public investment might be a determinant of public debt and hence could bias the coefficients of the regression.

approaches, such as a basic Pooled Ordinary Least Squares (POLS) model, next including fixed effects (FE) and finally we apply an instrumental variable (IV) approach and estimate our model using the Generalized Method of Moments (GMM).

The decline in public investment in the EU since the GFC has generally been acknowledged by policymakers (e.g. European Commission, 2013) and is starting to draw the attention of the academic community (Picarelli, Vanlaer & Marneffe, 2018). However, private investment collapsed even more than public investment did, most notably in the PIIGS. Between 2006 and 2013, private investment decreased by 20% in Italy, by 34% in Portugal, by 38% in Spain, by 39% in Ireland and by a staggering 51% in Greece. This fall in private investment, however, has been less recognized and as a result the potential drivers of this private investment drop have only been studied to a limited extent (e.g. EIB, 2013; Rognlie, Shleifer & Simsek, 2018). Coinciding with this reduction in private investment debt levels, both public and private, soared; public debt increased by around 54% between 2008 and 2016, whereas private debt tripled between 1995 and 2015. Therefore, the third research question of this doctoral dissertation is:

RQ3: To what extent does higher debt result in lower private investment?

The benefits of maintaining a sufficient level of private investment are plentiful. When companies invest in research & development, this results into technological improvements and consequentially increases in productivity. As Krugman (1994) notes: "*Productivity isn't everything, but, in the long run, it is almost everything. A country's ability to improve its standard of living over time depends almost entirely on its ability to raise its output per worker*". Moreover, in a healthy economy, private investment flows are an integral part of reallocating resources from less productive sectors to more productive ones. Indeed, companies with higher prospective returns obtain financing to expand their physical investment, which allows them to compete more successfully, and ultimately expand production (Durnev, Li, Mørck & Yeung, 2004). If private investments are impeded, for whatever reason, this process, which is essential for a well-functioning market economy, gets disrupted. In addition, private investments are a large share of economic output. For example, private gross fixed capital

formation in the EU-28 was 20.1% in 2017 (Eurostat, 2018). Thus, if private investment drops by a significant amount, this culminates into lower, or even negative GDP growth. Also, if companies choose not to invest, e.g. because they perceive the future as being highly uncertain, capital sits idle on these companies' balance sheet, which reduces social welfare as that money can be used for more productive purposes. Finally, it is imperative, from an EU policy perspective, to have high levels of investment in specific, targeted sectors (e.g. renewable energy, artificial intelligence) to remain globally competitive as this is paramount to sustain high levels of income in the European Union (EIB, 2017).

There are various ways how high private debt can result into low private investment. Highly indebted firms have little incentive to invest, as the returns on these investments will be directed towards the debt holders (i.e. the creditors), rather than the owners of the company (i.e. the shareholders) (Myers, 1977). Moreover, companies with higher debt levels will have, ceteris paribus, higher debt servicing costs, simply leaving less capital available to invest (Maki, 2002). In addition, companies who finance their activities mainly by issuing debt are generally perceived as being more risky (Merton, 1974). As a result, investors will demand a higher risk premium, which generates higher bond yields. This increase in the cost of capital brings about fewer potential investment projects where the expected return exceeds the cost of funding it, and hence lower investment.

Public debt can also have a detrimental impact on private investment. The textbook explanation goes as follows: resources are scare and the pool of loanable funds is limited. Hence, the public sector competes with the private sector when it attempts to attract some of these funds (e.g. by government bond issuance). The more a government increases its borrowing, the fewer funds remain available for the private sector, pushing up borrowing costs which then results into lower investment (Majumder, 2007). Furthermore, should a government increase its debt stock with the purpose of delivering goods and services that compete with private sector offerings, this erodes private sector confidence, emanating into lower private investment (Traum & Yang, 2015). The final argument again relates to Ricardian equivalence: if public sector debt reaches levels which are perceived as being unsustainable, companies and household will anticipate future increases in taxes, and consume and invest less.

We further the literature on the drivers of the decline in private investment, with a specific focus on the potential detrimental effect debt can have on investment. More specifically, we exploit a panel dataset of 28 EU countries over the period 1995-2016 to study whether high debt leads to low private investment. In addition, we study whether financial sector bailouts and the amount of non-performing loans on banks' balance sheets played a role in the private investment decrease. We use different econometric techniques to test our hypothesis, such as a FE model and an instrumental variable approach (GMM) to tackle the potential endogeneity between private investment and debt.

From the perspective of EU policymakers, cross-country studies on private investment are highly relevant. If high debt results in low private investment, this impacts the long-term productive potential of the European Union and consequently the living standards of European citizens. Hence, if the European Union has a clear interest in ensuring a sustained increase in the prosperity of its populace, acquiring a detailed understanding of a potential debt overhang effect is critically important.

Whereas the first three research questions focus on the economic impact of high and increasing debt levels, we now turn to what has driven this increase in public debt. To do so, we perform a case study on one of the most highly indebted countries when the Maastricht Treaty was signed by European leaders in 1992: Belgium (Buiter, Corsetti & Roubini, 1993). Therefore, the fourth research question of this doctoral dissertation is:

RQ4: What were the main drivers of Belgium's debt dynamics between 1995 and 2014?

In most Eurozone countries, general government debt was on a slightly declining path the first decade after the introduction of the single currency, averaging around 65% in 2007 (Eurostat, 2018). Then, the Global Financial Crisis caused debt levels to skyrocket to 93% in 2015. Hence, bringing public debt back down to more sustainable levels has taken center stage in the public policy debate. When it comes to debt reduction, Belgium serves as a model country for three main reasons. Firstly, Belgium succeeded in one of the largest European debt

reductions since 1985[9]; only Ireland and Denmark brought debt down more[10]. Secondly, it managed to perform this impressive feat by keeping government revenues as a percentage of GDP practically unaltered and substantially reducing government spending[11]. To put it differently, Belgium did not significantly increase taxes in order to bring debt down. Thirdly, Belgium's experience of reducing debt over this time frame is often referred to as a "textbook example of debt reduction" (e.g. Fabrizio, 2008; IMF, 2012).

We add to the literature by formalizing a debt accounting framework to study public debt dynamics of Belgium between 1995 and 2014. More specifically, we use the framework introduced by Budina & Fiess (2005), but adapt it to include multilateral exchange rates which allows for analyzing the effect of changes in the exchange rate on debt dynamics, as suggested by Burnside (2005).

Carrying out such an *ex-post* analysis on the most important drivers of debt dynamics can be conducive to establish *ex-ante* policy advice on how to bring down debt in the future. Hence, we draw policy lessons from the Belgium experience for a country which is currently also highly indebted and could benefit from a similar positive evolution of its sovereign debt: Greece. Even if no direct parallels can be drawn, the attitudes of European creditors on what can reasonably be demanded of the Greek government, and by extension of Greek citizens, is to a considerable degree influenced by the past achievements of other countries. Therefore, as a recent report by the Peterson Institute for International Economics (Zettelmeyer, Kreplin & Panizza, 2017) puts it: "*Hence, even if the behavior of other countries were irrelevant in a predictive sense (because Greece turns out to be structurally highly atypical), it could be important in a normative sense, from the vantage point of creditors*."

We do not attempt to prove that Greece and Belgium are exactly alike; although both countries have a similar population size as well similarly high levels of tax-

[9] The ratio of public debt-to-GDP diminished rapidly after peaking at 138% in 1993 to 87% in 2007 (Sapir, 2018).
[10] Denmark managed to decrease its debt ratio from 80.1% in 1994 to 26.8% in 2007, a reduction of 53.2%. Ireland realized an impressive 69.2%reduction, from 94.1% in 1994 to 24.9%in 2006 (Nickel, Rother and Zimmermann, 2010).
[11] General government revenues stayed more or less constant around 48% of GDP between 1995 and 2007, whereas general government spending dropped from more than 52% of GDP in 1995 to close to 48% in 2007 (OECD, 2018).

and-spending[12], there are substantial differences, most notably with regards to economic output[13]. Rather, our aim is to both identify the similarities and highlight the differences between Belgium and Greece, allowing both to be appreciated and managed carefully. Combining this political economy perspective with a public finance point of view is imperative in being able to recommend the right policy mix to deal with the Greek debt crisis, as argued by Featherstone (2011).

As noted, the Global Financial Crisis wreaked havoc on the European economy and led to a deterioration in the public finances of nearly every EU country. In our first three research questions, we studied the impact of the resulting increase in debt on economic growth and investment. In the fifth and final research question, we look at the effect the GFC has had on consumer confidence and in turn how this evolution in consumer confidence influenced household saving behavior. More specifically, the fifth research question of this doctoral dissertation is:

RQ5: To what extent does consumer confidence explain household saving and if so, which specific sub-indicators of consumer sentiment are most significant?

The decade after the GFC has been characterized by striking changes in the overall economic environment. Although real GDP growth in the EU in 2017 was at its highest level since the crisis erupted, the recovery from the Global Financial Crisis has generally been rather timid (Taylor, 2014). To combat low inflation and spur economic growth, central banks cut interest rates to zero[14], followed by unconventional policy measures such as Quantitative Easing (QE), forward guidance and Negative Interest Rate Policy (NIRP). Only a decade ago, these measures were regarded as nearly unimaginable. The result of these actions can hardly be called an unwavering success and an increasing number of scholars have expressed concerns that this policy mix generates substantial financial instability (Lambert, 2012; Adrian & Liang, 2014; Borio, 2014). Moreover, the increase in government debt that resulted from the GFC forced a large number of

[12] In 2015, total general government expenditure amounted to around 54% of GDP in both countries (OECD, 2016).
[13] In 2014, Belgium's GDP per capita (in PPS) was €34,700 while that of Greece was just €21,200, which makes Belgian citizens around 40% richer than their Greek counterparts (Eurostat, 2016).
[14] The Federal Reserve, for example, introduced its Zero Interest Rate Policy (ZIRP) already in 2008.

EU governments to push through stringent austerity measures, such as reducing the number of civil servants and cutting social security outlays. Consequently, citizens are expected to finance a bigger part of their pension provisions and healthcare costs.

There are various channels through which this changing economic environment can influence saving behavior. Ricardian equivalence (Barro, 1996) implies that the rise in government debt and deficits after the GFC would lead to an increase in saving due to an expectation of higher taxes in the future. Moreover, the downpayment motive, which is the desire to accumulate lump sums to use as a down payment for large purchases (e.g. a car or an apartment), would suggest that households increase their saving as interest rates fall, as not to compromise their preconceived target amount of savings (Browning & Lusardi, 1996). In contrast, according to the life cycle hypothesis, households will reduce their saving during or after a recession, as long as they perceive any drop in income to be temporary (Ando & Modigliani, 1963). In conclusion, the classical theories pertaining to household saving do not allow to predict *a priori* which effect is dominant. Hence, it remains unclear whether the effect of the changing macroeconomic environment is to increase the saving rate or to push it down.

These events also brought about an unprecedented increase in uncertainty for households and severely dented consumer confidence: in the spring of 2009, at the height of the crisis, overall consumer confidence reached a three-decade low. People are less sure whether they will be able to keep their job, what return they can expect on their savings and to which extent they will have to provide for their own health insurance and pension plans. We exploit a panel dataset of 18 EU countries over the period 2001-2014 to examine whether this decrease in consumer sentiment, as measured by 13 consumer confidence indicators of the Joint Harmonised EU Consumer Survey[15], has had an impact on households'

[15] The surveys are conducted by national institutes in the different Member States and the candidate countries. With these data, the Directorate-General for Economic and Financial Affairs (DG ECFIN) builds composite indicators to track the evolution of consumer sentiment. The consumer survey serves two main aims (DG ECFIN, 2016): (i) collecting information on the spending and saving intentions of households; and (ii) assessing households' perception of the factors which influence their decisions on saving and spending. To fulfil these aims, the questions are grouped around four topics: (i) the households' financial situation; (ii) the general economic situation; (iii) saving intensions; and (iv) intentions regarding major purchases. As it is crucial to have comparable data for each country, harmonization is

saving behavior and if so, which sub-indicators of consumer sentiment (e.g. confidence in their own financial situation or confidence in the general economic situation) were most important. We deal with the potential endogeneity between the saving rate of households and consumer confidence by adopting an instrumental variable approach.

The literature on the role of uncertainty in explaining saving behavior in general (Skinner, 1988; Lusardi, 2000; Cagetti, 2003; Bartzsch, 2008) as well on the specific impact of precautionary saving (Guiso, Jappelli & Terlizzese, 1992; Murata, 2003; Basselier & Langenus, 2014; Klopocka, 2016) is vast. However, the effect on household saving of the specific consumer confidence indicators which we use to measure consumer sentiment, has hardly been studied[16]. Moreover, despite theirs being crucial from an EU policy perspective, there are only a very limited number of cross-country studies on the saving behavior of households (Mody, Ohnsorge & Sandri, 2012; Rodriguez-Palenzuela & Dées; 2016). If a decrease in consumer confidence results in increased saving (and consequently lower consumption), this deepens a recession. Thus, if European policymakers want to speed up the economic recovery, they need to deal with the decline in consumer confidence on an EU wide level. Indeed, EU policymakers are mainly interested in the *average* impact of consumer confidence on household saving in EU-countries, less in the specific impact in single member states. A clear appreciation of how consumer confidence impacts household saving is a prerequisite for targeted and evidence-based action[17].

ensured by using a single questionnaire for all national institutions and by scheduling the national surveys and the subsequent reporting of results according to a fixed timetable.

[16] Klopocka (2017), studying the effects of consumer confidence on household saving and borrowing behavior in Poland, is a rare exception.

[17] As expansionary fiscal policy improves consumer and business confidence (e.g. Konstantinou & Tagkalakis (2011)), an example of such EU-wide policy would be the announcement of a concerted fiscal stimulus in response to an economic downturn, similar to what was presented at the 2009 G20 summit in London, where global leaders agreed to inject $1.1 trillion in the world economy.

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CHAPTER 2

Does debt predict growth?

An empirical analysis of the relationship between total debt and economic output

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ABSTRACT

Although the recent Global Financial Crisis has stimulated a vast amount of research on the impact of public debt on economic growth and also increasingly on the role of private credit, the total levels of indebtedness of an economy have largely been ignored. This paper studies the impact of the total level of and increases in debt-to-GDP on economic growth for 26 developed countries in the short, medium and longer term. We analyze whether we can predict the future level of growth, simply by looking at the total level of debt, or increases in that debt level. We find that there is a negative correlation between high levels of debt and short-term economic growth, but that this effect tapers off in the medium and long term. Similarly, we find that rapid debt accumulation is negatively related to economic growth over the short term, the impact is less pronounced over the medium term and is non-existent over the long term.

Keywords

Public Debt, Government Debt, Private Debt, Growth, OECD Countries

1. Introduction

Scholars and policymakers agree in general that debt, both public and private, has played an important role in the build up to the recent Global Financial Crisis (e.g. Reinhart & Rogoff, 2010; Mian & Sufi, 2014). An increasing number of researchers assert that the high levels of debt commonly found in developed economies, play an important role in the subsequent slow recovery (e.g., Reinhart, Reinhart & Rogoff, 2012; Chatterjee, 2013).

One important strand of research looks into the role of public debt in destabilizing an economy. When there are increasing doubts about the fiscal sustainability of a country, households and corporations anticipate future elevated taxes, which results in reduced consumption and investment[18]. Subsequently, as the risk of a default increases, government debt holders will demand higher interest rates, which makes it even harder for a government to service its debt. This point of view has dominated public policy – and research – in the immediate aftermath of the crisis. An excellent illustration is the preeminence of austerity measures to deal with the outfall of the Global Financial Crisis (GFC), both in Europe and in the United States and advocated by international institutions such as the IMF (e.g. IMF, 2010).

Only in the last few years, research has looked into the role of private debt, or credit[19], on economic growth (e.g. Taylor, 2014). Previously, the narrative of hyperrational private households and companies who make decisions in their own interest that also benefit society as a whole, had prevailed. Moreover, as net world debt is zero, the consensus view was that losses to creditors are automatically cancelled out by gains to debtors. The fallout of the collapse in house prices in the United States in 2007 clearly proved this assumption to be erroneous.

[18] This line of thinking is heavily influenced by the Ricardian equivalence theorem which states that consumers take the budgetary constraints of the government into account when making consumption decisions (Barro, 1996). Consequently, higher budget deficits now result in higher taxation in the future. Forward looking consumers anticipate this and hence increase their saving to pay for these higher taxes.

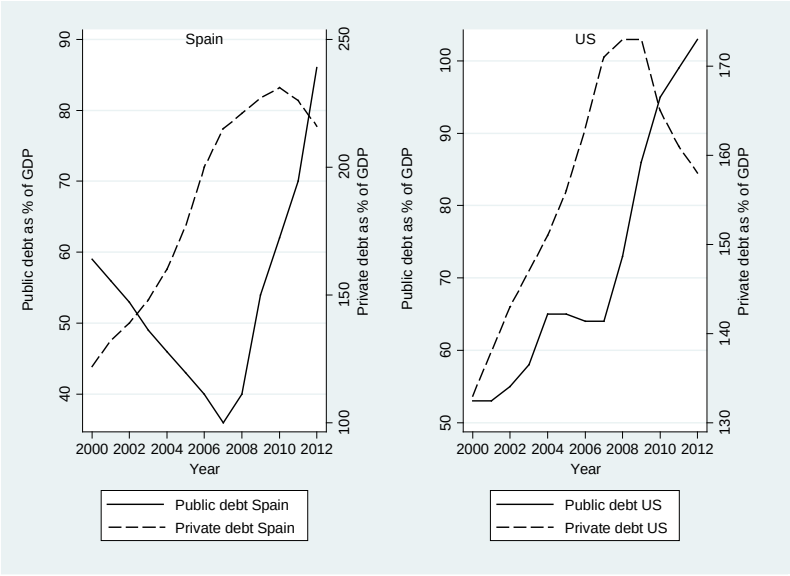
[19] In the remainder of this paper, private debt and credit will be used interchangeably.

Little research, however, has been pursued on the impact of the total level of debt[20] on an economy. Nevertheless, public debt and private credit are interlinked. One example is provided by the recent bailouts of the financial sector in Spain. As shown in Figure 1 below, simply focusing on the level of public debt-to-GDP would erroneously give the impression that Spain did not have a problem of excessive debt in the run-up to the GFC, as it strictly adhered to the Maastricht criterion of public debt levels of below 60%. Simultaneously however, a large construction bubble was building up, as private debt levels soared from around 125% of GDP at the start of the decade to more than 220% when the crisis struck in 2007-2008. Hence, if in case of failure of the private sector the public sector steps in, it can be argued that this amounts to an implicit government guarantee, making private debt indistinguishable from public debt (Bhandari, Haque & Turnovsky, 1990). The recent financial crisis has indeed shown, both in the United States and in Europe, the willingness of the sovereign to stand behind its banking sector. Investors considered too-big-to-fail banks as creditworthy as the government of its host country. These financial institutions could borrow at near identical rates as the sovereign, which made their debt very similar to sovereign debt (see e.g. Schich & Lindh, 2012).

Similarly, a narrow focus on the level of public debt would suggest that the US economy is in dire straits as its public debt-to-GDP levels skyrocketed from 53% in 2000 to close to 103% in 2012. On the other hand, American households and companies managed to deleverage after the crisis – albeit by a relatively small amount – which is likely to be beneficial for the long run sustainability of its economy.

[20] In this article, we define the total level of debt in an economy as the sum of gross general government debt and private credit to households and non-financial companies. We exclude interbank lending in our analysis.

Figure 1: Evolution of public and private debt: examples



At a more fundamental level, Schmidt (1943) asserted that public and private debt are essentially equivalent. An argument which was further elaborated by Buchanan (1958). The latter challenged the dominant theory on the distinction between public and private debt which hinges on the claim that private debt repayment represents a reduction in private net worth of the individual, but that public debt repayment does not constitute a reduction in the cumulative wealth of the community. However, when the taxpayer is taxed for servicing the public debt, this reduces his net worth, which is quite similar to private debt – and interest – repayments. This reduction in net worth must be offset, not against the increase in net worth enjoyed by the bondholder, but against the productivity of the public investments which are financed by the debt. Indeed, the increase in net worth of the bondholder will take place, *regardless* of the productivity of the public project. It follows that the taxpayer (i.e. the public borrower) is at no time in a different position from the private borrower. If the latter invests foolishly, his real income is reduced when interest payments are due. Similarly, if the state uses borrowed funds in an ill-advised way, this reduces the aggregate wealth of the community (Bhatt, 1959).

Backhaus & Wagner (2006) make a similar claim, stating that "*public debt is just a particular form of private debt, where the borrower is especially powerful*". Whereas a private citizen, responding to an unexpected drop in income, might borrow to smooth out this decline in spending power, so might the sovereign increase its borrowing when confronted with falling revenues, for example due to a recession. Both for the sovereign and the private citizen, debt does not alter its net worth; it simply affects the timing of expenditure.

Public and private debt are not only interlinked and should therefore be examined simultaneously, they are also often interchangeable and should in many cases thus be aggregated to fully appreciate the extent to which debt has an impact on the economy. Tuition fees for higher education exemplify this reasoning. A college education entails certain costs (e.g. paying salaries to teachers, building the necessary infrastructure). Whether these costs are borne by the state, by providing free higher education, or by the students by paying full cost fees, does not change this fact[21]. So, it may follow that either the government has to take on debt in order to finance higher education, or that the individual has to take on a student loan to pay for school.

A similar argument can be made for the provision of health care, which can be arranged by the state, e.g. in the form of single-payer healthcare, or via private insurers. Likewise, governments can choose to outsource the exploitation of public infrastructure, such as toll roads, to private partners in exchange for co-financing of the initial investment. In essence, these are basically transfers on the same side of a consolidated balance sheet of the society. Arguments on who – the public or the private sector - should pay may depend on cost efficiency[22] or ideology[23]. However, they do not alter the overall need for financing these projects and services.

Public debt and private credit are therefore communicating vessels and should not be analyzed separately. Focusing on only one is likely to yield a distorted view of

[21] Of course, one can argue that a private institution is better managed than a college that is run by the state and that thus the total cost for society is lower in the former case, but that discussion is beyond the scope of this paper.
[22] In some instances, it may be more efficient if the state pays for a particular service (e.g. health care), while in – many - other case the private market produces more efficient outcomes (e.g. telecoms services).
[23] Some people simply prefer a smaller or a larger state than others.

the level indebtedness in and its impact on an economy. Therefore, this paper studies the link between the total level of debt-to-GDP, and changes in that level, and economic growth. We analyze whether we can predict the future level of growth, simply by looking at the total level of debt, or increases in that debt level.

2. Review of literature

The debate on the relationship between public debt and economic growth was revived by Carmen Reinhart and Kenneth Rogoff in their paper *Growth in a time of debt* (2010), which was part of a much larger empirical analysis they performed in their book *This time is different: eight centuries of financial folly* (2009). Their methods are temptingly straightforward. Reinhart & Rogoff group country-years in four categories by public debt-to-GDP ratios: 0-30 percent, 30-60 percent, 60-90 percent, and more than 90 percent. Next, they compare real GDP growth rates across these different groups. They find that this relationship is rather weak for public debt-to-GDP ratios below a threshold of 90%. For debt levels above 90%, however, median growth rates go down by around one percent and average growth falls even more. This has subsequently been referred to as the nonlinear relationship between public debt and economic growth (Minea & Parent, 2012).

Afterwards, in a critical attempt to replicate the results of Reinhart & Rogoff's 2009 paper, Herndon, Ash & Pollin (2014) uncovered "*data omissions, questionable methods of weighting and elementary coding errors*". They assert that, when these errors are corrected, average growth at public debt levels above the 90% threshold does not vary dramatically from average growth at lower debt levels.

In a study by Woo & Kumar (2015), the impact of the initial debt-to-GDP level on subsequent GDP growth was explored. The authors find that a 10 percentage point increase in the initial public debt level reduces GDP per capita by around 0.2 percentage points a year.

Baum, Checherita-Westphal & Rother (2013) analyzed the impact of public debt on GDP in the EMU by using a dynamic threshold panel methodology. They identify an inverse u-shaped relationship between public debt and growth as their findings suggest that the short-run impact of debt is positive, decreases to zero at a public

debt/GDP ratio of around 67% and is significantly negative at debt ratios above 90%.

Critics of the original Reinhart & Rogoff (2009) paper reply that, while there may very well be a negative relationship between public debt and economic growth, the effect works in the opposite direction to what the supporters of austerity claim. It is low growth that causes the state revenues to fall and public expenditures to rise, thus resulting in a higher level of public debt.

Lof & Malinen (2014) tried to tackle the issue of reverse causality by using panel vector autoregressions that represent the dynamic relationship between GDP and public debt, decomposing cause and effect. They indeed conclude that the negative correlation between both variables is mainly driven by the impact of economic growth on sovereign debt, not the other way around.

A recent paper by three economists at the IMF research department (Pescatori, Sandri & Simon, 2014) refuted the existence of debt thresholds after which economic growth significantly deteriorates. They used a novel empirical approach to determine the relationship between debt thresholds and growth prospects. More specifically, they take a sample of all episodes where public debt increases above a particular threshold and calculate real GDP growth per capita over the following *h* years, varying *h* from 1, 5, 10 to 15. Although their method is quite similar to the one applied by Reinhart & Rogoff (2012), it differs in two crucial aspects. Firstly, the range of debt thresholds being analysed is much broader than the 90 percent threshold on which the Reinhart & Rogoff paper focuses. Secondly, economic growth over a particular time span is analyzed, regardless of the debt outcome. In contrast, Reinhart & Rogoff only consider the period when debt persists above a certain threshold.

Taylor (2012) illustrated the importance of private credit in developed economies. He argues that past growth in private debt contains predictive information about the likelihood of a crisis occurring in the future. Moreover, he finds that the recession after a credit boom is more severe than a 'normal' recession.

Jorda, Schularick & Taylor (2013) built on this work by analyzing the co-evolution of sovereign debt and credit in developed countries. They find that the risks to economic and financial stability mainly come from booms in private debt rather

than increases in public debt. Nevertheless, when a country enters a crisis period with an already elevated level of public debt, this intensifies the crisis, presumably by the limited ability to introduce fiscal stimulus to uphold aggregate demand.

A paper by Randveer, Uusküla & Kulu (2011) researched the link between economic recovery after a crisis and growth of credit before a crisis. They find, quite counterintuitively, that rapid credit expansion before a crisis is related with higher economic growth after the crisis. This contrasts with the widespread belief that, after a crisis and especially after a balance sheet recession like the one we have recently experienced, household debt overhang and the subsequent process of deleveraging acts as a serious drag on economic recovery.

That is also precisely what Gärtner (2013) found in her study of the Great Depression. Debt overhang of households was indeed an important factor in holding back the economic recovery after the very severe drop in output that followed the stock market crash of October 1929.

In their widely praised book *House of Debt* (2014), Atif Mian and Amir Sufi provided compelling evidence for the case that the buildup of household debt was the main culprit for the recent recession. Additionally, when they analyze previous economic downturns, the increase in consumer debt often plays a very important role. They conclude that the bigger the increase in debt, the harder the fall in spending.

Cecchetti, Mohanty & Zampolli (2011) analyzed government debt, corporate debt and household debt and find that each of these three types of debt becomes a drag on growth when it reaches a level above 85-90% of GDP. They conclude that debt improves welfare but can be damaging to the economy when levels are very high.

As mentioned, the initial response to the Global Financial Crisis was to focus on excessive government debt. Afterwards, the focus shifted to private credit. Our study aims to further the literature by looking at the overall debt level in an economy. This paper provides empirical evidence on the relationship between total debt and economic growth. We explore whether there is a specific debt threshold after which growth plummets. Section 3 describes the data and methodology used in our analysis. In Section 4, we provide empirical evidence on the link between

total debt levels and growth for our panel of 26 OECD countries from 1961-2012 in. Section 5 analyses changes in total debt-to-GDP and real GDP growth. In the subsequent Section, we discuss our main findings. Finally, Section 7 presents the conclusions.

3. Data and methodology

We have gathered data on public debt levels from a comprehensive database on gross government debt, which is compiled by the IMF Fiscal Affairs Department[24]. Data on private debt comes from a recent BIS database[25] on credit to the private non-financial sector. We acquire GDP data from the AMECO database of the European Commission. Our dataset comprises annual data on 26 developed economies over the period 1961-2012.

Appendix 1 provides the summary statistics for public, private and total debt-to-GDP levels, yearly increases in total debt-to-GDP levels and real GDP per capita growth rates. Appendix 2 gives an overview of the database coverage. In our sample, the average total debt-to-GDP level is 168%, the average yearly increase in debt is 3.65% and average real growth equals 2.48%. However, these averages disguise large discrepancies between countries. Whereas countries like Turkey and Mexico have average total debt-to-GDP levels of around 70%, countries such as Japan and Luxembourg[26] have an average debt level which is several times larger (363% and 257% respectively).

We need to discuss several methodological issues when examining the relationship between debt and growth. Firstly, it seems highly implausible that there is one common debt threshold after which growth plummets. If there exists a 'dangerous' debt threshold, this will most likely vary across countries and across

[24] See Horton et al. (2010) for a complete description of the database, which can be found online on www.imf.org/external/datamapper/index.php?db=DEBT.
[25] See Dembiermont, Drehmann & Muksakunratana (2013) for a detailed description of the database: http://www.bis.org/statistics/credtopriv.htm.
[26] Luxembourg is a particular case due to its heavy reliance on financial services, resulting in a very high level of private debt.

time, and will be dependent on numerous other factors (e.g. potential growth rate[27] or willingness to save of the private sector).

Another issue pertains to the causality between debt and growth. Rather than being the cause, high debt may be the result of anemic growth. If it is sluggish growth that causes high debt, it is less probable that a specific threshold is discerned. Hence, if such a threshold is found, the likelihood that it is driven by a causal effect of debt on growth is relatively high.

Moreover, elevated debt levels might conceal an omitted variable, a common factor both increasing debt and reducing growth (e.g. a financial crisis or a war). This applies particularly when analyzing the short-term relationship between debt and growth, since a recession almost mechanically results in a higher debt ratio due to the denominator shrinking.

One way to address the issue of causality is by adopting instrumental techniques. For example, Panizza & Presbitero (2014) use an instrument variable that takes into account valuation effects resulting from the interplay between exchange rate volatility and foreign currency debt. They find no evidence that debt has a causal effect on growth.

Next to the short-term relationship between debt and growth, which is the focus in most of the literature, we consider the long-term link. More concretely, we analyze the long-term relationship between today's level of total debt to GDP, b_t, and subsequent GDP growth in the next h-years, $g_{it}(h) = y_{t+h}/y_t$. This longer-term horizon allows for tempering the effects of reverse causality that a brief recession or boom might have on short-term economic growth.

We apply the framework provided by Pescatori, Sandri & Simon (2014). Our analysis starts by taking a sample of all country episodes[28] where total debt rose above a threshold τ. Next, we look at real GDP per capita growth over the next h years, where $h \in [1, 5, 10, 15]$. Countries can have multiple episodes, but not overlapping ones. We consider the start of a rising debt episode to be the first

[27] As Larry Summers (2014) has argued repeatedly in his discussion of *secular stagnation*, in a world with economic output chronically below potential, debt-financed public projects might be needed to generate growth levels which are consistent with full employment and stable inflation.
[28] A country episode is a combination of h consecutive country years (cf. supra).

year in which the total debt level exceeds the threshold τ, conditional on the level being below the threshold in the previous year. To put it more formally, for a country i and a threshold τ, the start of an episode has to meet the following conditions:

$$b_{it} \geq \tau,\ b_{it-1} < \tau \text{ and } \nexists\ j \in [1, \ldots, h] \text{ s.t. } b_{it-j} \geq \tau,\ b_{it-j-1} < \tau.$$

There are several features of this model which are important to note. Firstly, by analyzing economic performance over a given period regardless of the debt outcome, we avoid the truncation problem which arises when we only look at the period when debt remains above a certain level, in effect solely selecting 'failures'. In our analysis, we admit countries that succeed in reducing total debt levels after surpassing a particular debt threshold along with the 'failures', i.e. countries whose debt level remains elevated. Secondly, we allow each country to only have a limited number of episodes, due to the fact that we rule out overlapping episodes and by requiring that an episode starts when total debt exceeds the threshold from below. When calculating averages, the episodes are pooled together and weighted equally[29]. Finally, in contrast to the growth regressions adopted in most other papers, our methodology does not impose a linear relationship between debt and economic growth.

4. Total debt levels and economic growth

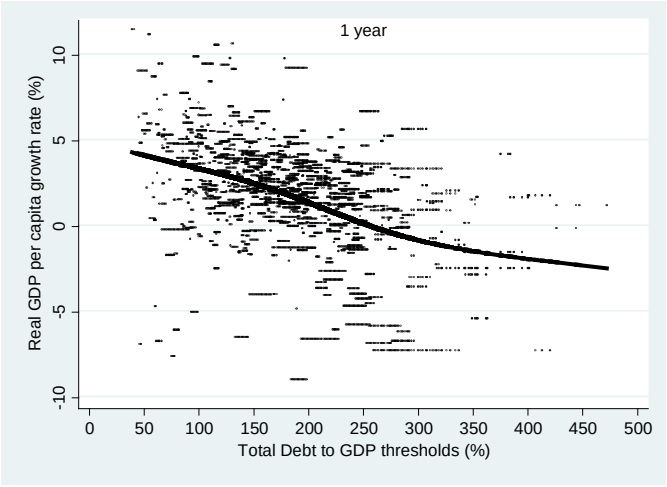
4.1 Short-term (1 year)

Our analysis starts with the short-term relationship between the total debt level and economic growth. In Figure 2, we present the average real GDP per capita growth rate in the year after the total debt level exceeds a certain threshold, i.e. $h = 1$. More precisely, we show a scatterplot of all the observations, plotting economic growth against total debt-to-GDP. We also include a locally fitted regression function[30]. We can observe that there are countries with higher debt

[29] The methodology adopted by Reinhart & Rogoff (2010) resulted in several countries having a lot more observations than other countries. Alternative weighting methods can subsequently bring about significantly different conclusions.
[30] The locally smoothed regression function is estimated with the general additive model with integrated smoothness estimation using the *gamfit* package in Stata.

which experience sound growth rates. Reversely, there are countries with lower debt levels that display limited or even negative economic growth[31]. In general, however, a higher level of debt leads to lower economic growth, but this relationship becomes less pronounced at very high total debt levels. In addition, a Spearman's correlation was calculated to determine the relationship between debt and growth. It showed there was moderate, negative monotonic correlation between the two variables ($\rho = -0.42$).

Figure 2: Total debt and short-term economic growth



4.2 Medium- and longer-term (5, 10 and 15 years)

However, it would be ill-advised to draw conclusions about the link between total debt and economic growth simply by analyzing the year after a particular debt threshold is exceeded. The reason for this is straightforward: instead of increased debt leading to lower growth, the relation could run the other way, i.e. lower growth resulting in higher debt levels. This argument has been extensively discussed by critics of the original Reinhart & Rogoff paper (2009) (e.g. Herndon,

[31] Our methodology can produce multiple observations for one country-year. For example, if a country's total debt level jumps from 100% to 115% in one year, multiple thresholds (e.g. 102%, 104%, 106%, etc.) will be exceeded.

Ash & Pollin, 2013; Pescatori, Sandri & Simon, 2014). When growth significantly slows down, and the economy enters into a recession, government revenues decline, e.g. due to a fall in personal taxes and income taxes. Similarly, government expenditures increase, as more people rely for instance on unemployment insurance. Absent severe cuts in spending on other policy areas – which would deepen the recession – this results in a larger budget deficit and consequently a higher level of government debt. Correspondingly, job losses caused by the recession render households less able to service their debt, which in the short run makes it very hard to deleverage. Some households will even have to take on additional loans in order to make ends meet. In summary, when economic growth slows down, or even becomes negative, the debt-to-GDP ratio almost mechanicaly increases; debt (i.e. the numerator) soars due to lower revenues and higher expenditures as GDP (i.e. the denominator) shrinks.

We try to eliminate the bias which potentially arises from reverse causality as well as mitigate the effects of outliers by extending the horizon of our analysis. If high levels of total debt in an economy significantly hold back growth over the medium to long term, we would foresee that growth is not only supressed in the first year that debt surpasses the threshold, but also in the ensuing years.

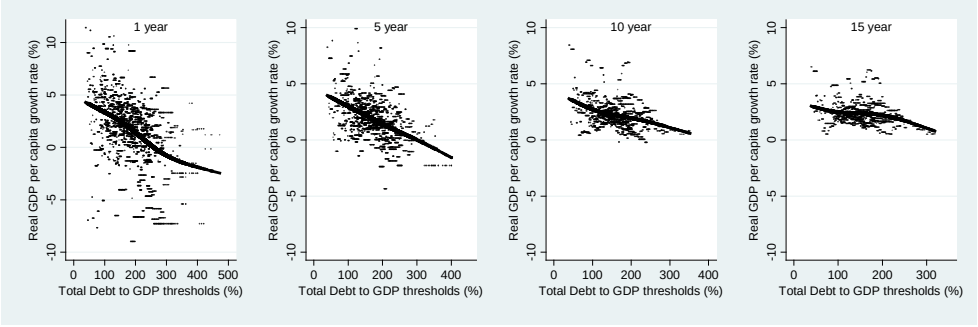
Figure 3 shows economic growth over 5, 10 and 15 years respectively after a certain debt threshold has been reached[32]. To complete the picture, we have added the results from our previous analysis, i.e. short-term growth. When looking at economic growth over a 5-year horizon, the result of our previous analysis is confirmed; more debt results in lower growth. Although growth performance improves noticably in the longer run, higher debt levels are still related to a lower growth rate. This is confirmed by Spearman's rank correlation coefficient, which declines from -0.45 for 5-year growth to -0.20 for growth over a 15-year horizon, which is a rather weak correlation. Additionally, we compared the regression coefficients among these four groups to test the null hypothesis:

H_0: $B_1 = B_2 = B_3 = B_4$

[32] The exclusion window for the different horizons depends on the level of *h*, i.e. for h = 1/5/10/15 we look at episodes until 2012/2007/2002/1997.

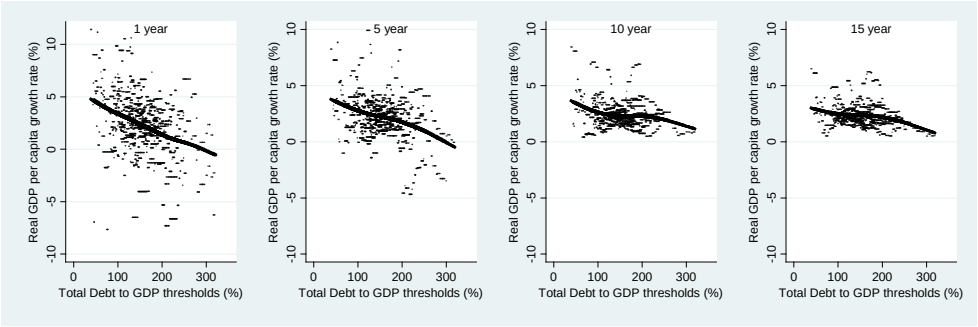
where B_1 is the regression for 1-year growth, B_2 for 5-year growth, B_3 for 10-year growth, and B_4 for 15-year growth. Our analysis reveals that the null hypothesis can be rejected ($F = 105.07$, $p = 0.0000$). This means that the regression coefficients between debt and growth do significantly differ across the 4 groups (1 year, 5 year, 10 year, 15 year). We also tested the regression coefficients between two groups pairwise (e.g. comparing 10-year growth with 15-year growth). All regression coefficients significantly differ from each other ($p = 0.0000$).

Figure 3: Total debt and medium- to long-term economic growth



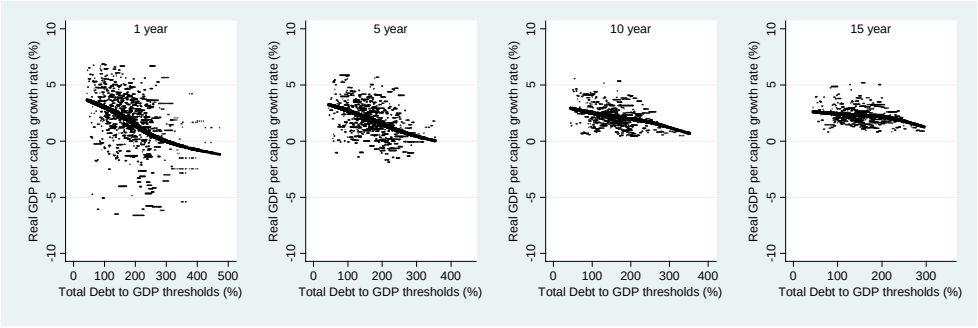
As a robustness test, we have rerun our analysis on a homogenous set of data. Whereas we varied our exclusion window in Figure 3 in correspondence with the period over which we calculate the average growth rate (e.g. the exclusion window for h = 1 is 2012 and for h = 15 is 1998), in Figure 4 the exclusion window is the same for each curve, i.e. 1998. In other words, each of the four graphs looks at the exact same debt episodes; only the period over which economic growth is averaged, varies. The results are strikingly similar, with Spearman's rank correlation varying from -0.40 to -0.20.

Figure 4: Total debt and medium- to long-term economic growth (homogenous dataset)



Of course, our study could be influenced by outliers. For example, several episodes of very low growth might skew our results. Therefore, in Figure 5 we repeat our analysis, but eliminate the observations with 2.5% lowest and 2.5% highest growth levels[33]. Our previous results remain unaltered. In the short term, there is a relatively strong negative correlation between debt and growth, but this correlation attenuates when growth over a longer period is taken into consideration.

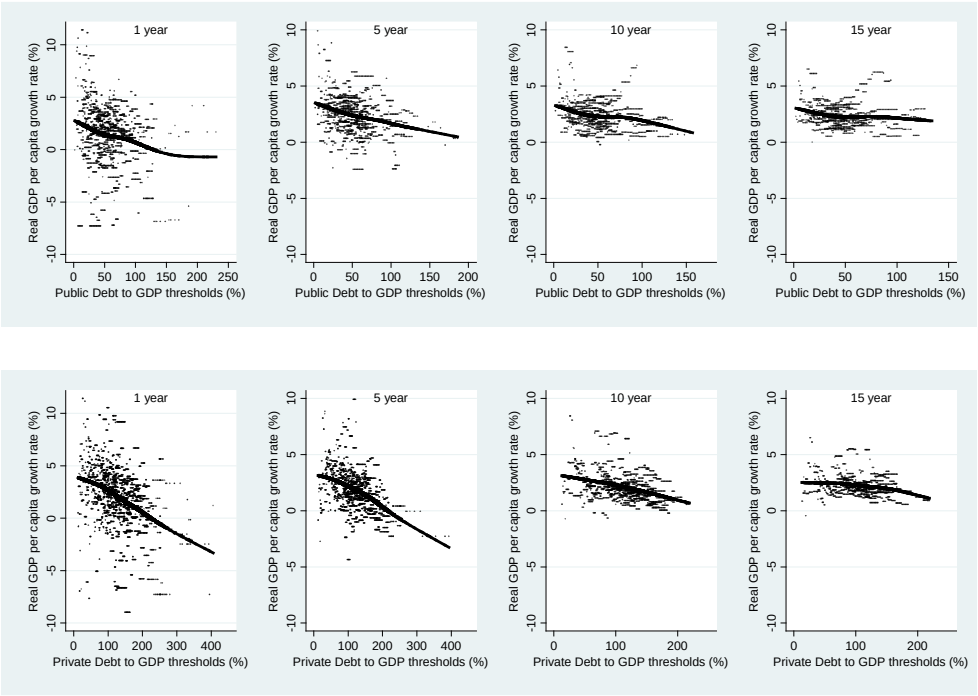
Figure 5: Total debt and medium- to long-term economic growth (outliers removed)



[33] We get similar results if we eliminate only the 1.25% highest and lowest values or if we eliminate the 5% highest and lowest values.

Comparing the impact of public debt and private debt levels is beyond the scope of this paper. Nevertheless, it is interesting to note that the general relationship between total debt and growth – relatively strong negative correlation in the short term, much less so on the long term – also holds for public and private debt, as can be seen in Figure 6. However, the strength of the negative relationship with growth is more pronounced for private debt than for public debt.

Figure 6: Public debt & private debt levels and medium- to long-term economic growth



4.3 Debt trajectory

Hitherto, our analysis has focused solely on episodes where the total debt level has exceeded a threshold. Now, we look at the impact of decreasing total debt levels on economic growth. Therefore, we study all episodes where the total debt level declines below a given threshold:

$b_{it} \leq \tau$, $b_{it-1} > \tau$ and $\nexists\ j \in [1, \ldots, h]$ s.t. $b_{it-j} \leq \tau$, $b_{it-j-1} > \tau$.

In Figure 7, we compare short-term economic growth (h = 1) in these episodes with the ones identified in Figure 2. We can observe that the trajectory of growth performance is quite similar between countries that exceed or fall below a debt threshold. Yet countries on a declining debt path have slightly higher growth rates at high debt levels compared to those on an increasing path. In other words, high levels of debt are negatively associated with growth, but if these high debt levels are falling, growth performance improves slightly. In addition, when debt is falling, there appears to be no impact on growth until debt levels reach 200% of GDP, after which real GDP growth steadily deteriorates.

Figure 7: Debt trajectory and short-term economic growth

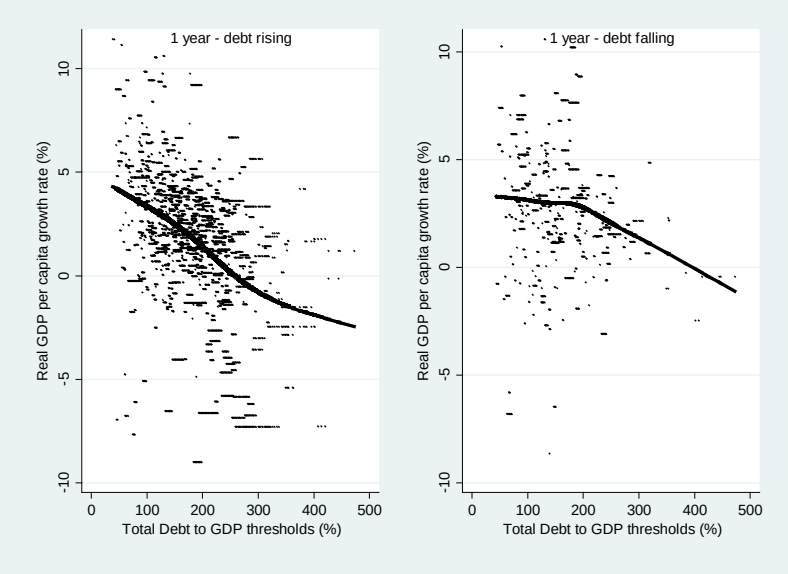
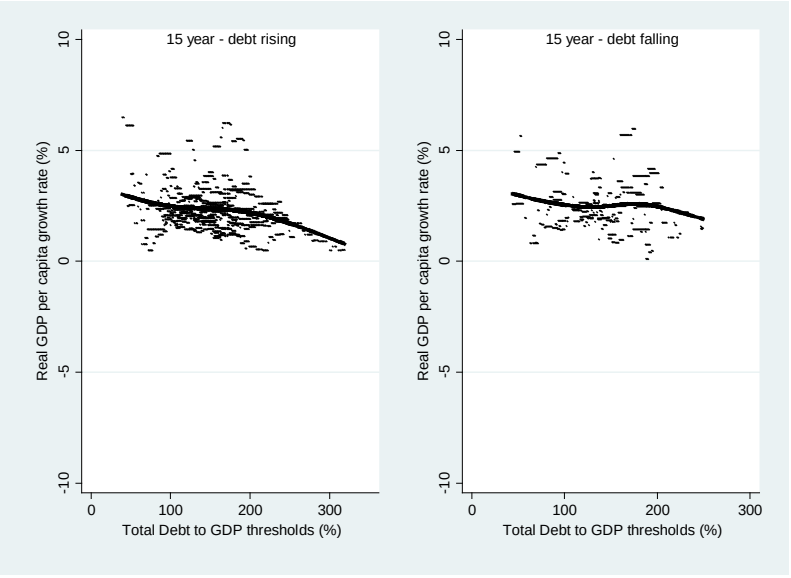


Figure 8 presents the results for h = 15[34]. We now find that the evolution of economic growth is very similar for countries with increasing and decreasing debt levels. Higher levels of debt are still correlated with somewhat lower growth, but

[34] We get similar results for h = 5 and h = 10.

there is no impact on economic performance stemming from the increase or decrease of debt levels.

Figure 8: Debt trajectory and long-term economic growth



5. Changes in total debt levels and economic growth

5.1 General

In our previous analysis, we have found that in the short term, high total debt levels in an economy are correlated to lower economic growth, but the effect becomes less pronounced in the medium and long run. Moreover, we have concluded that the debt trajectory has little to no impact on growth. In this section, we evaluate whether changes in debt levels have a significant impact on GDP per capita growth. Heretofore, we have looked at the stock of debt; we will now scrutinize debt flows.

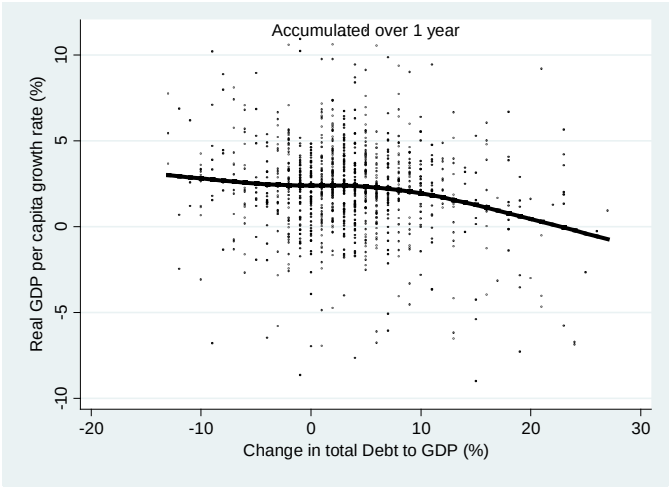
5.2 Short-term (1 year)

In Figure 9, we plot the average growth rate of countries the year after they reached a particular change in total debt level θ, that is[35]:

$b_{it} - b_{it-1} = \theta$.

The graph does show that a rapid accumulation of debt is correlated with lower economic growth, but the relationship is rather weak. This is also confirmed by Spearman's rank correlation coefficient, which is only -0.08.

Figure 9: Change in total debt and short-term economic growth



We now extend our analysis in two ways. Firstly, we look at changes in total debt-to-GDP levels over multiple years *d*, with $d \in [1, 5, 10, 15]$. Secondly, we study

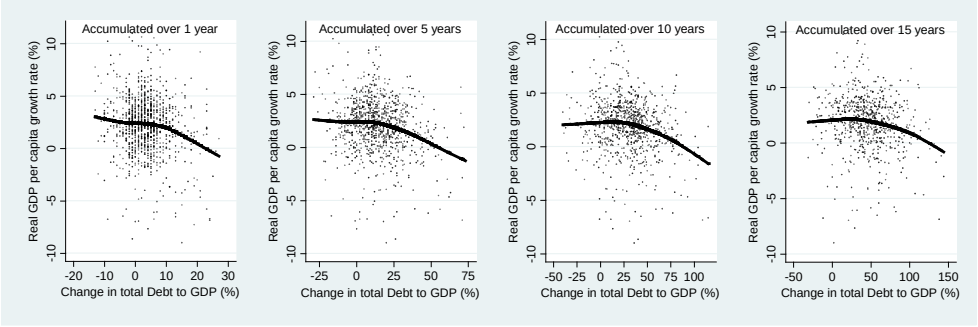
[35] The reason why we use "=" in this part of our analysis instead of "≥" is twofold. Firstly, we have positive as well as negative values for θ, which renders the notion of "exceeding a certain threshold" less straightforward to interpret. Secondly, if we would use "≥", then exceeding a threshold of e.g. 1% would imply that we use all observations not just where there is a debt increase of 1%, but also where debt increases by 2%, 3%, 4%, etc. This way, certain thresholds would have hundreds of observations, which would make our analysis rather meaningless.

the growth performance of countries over the medium to long term h, with $h \in [1, 5, 10, 15]$:

$b_{it} - b_{it-d} = \theta$ and $\nexists j \in [1, \ldots, h]$ s.t. $b_{it-j} - b_{it-d-j} = \theta$.

Figure 10 shows short-term economic growth ($h = 1$) and debt accumulated over 1, 5, 10 and 15 years (i.e. $d = 1, 5, 10, 15$).

Figure 10: Growth performance over 1 year with debt accumulation over 1-15 year ($h = 1$ and $d = 1, 5, 10, 15$)

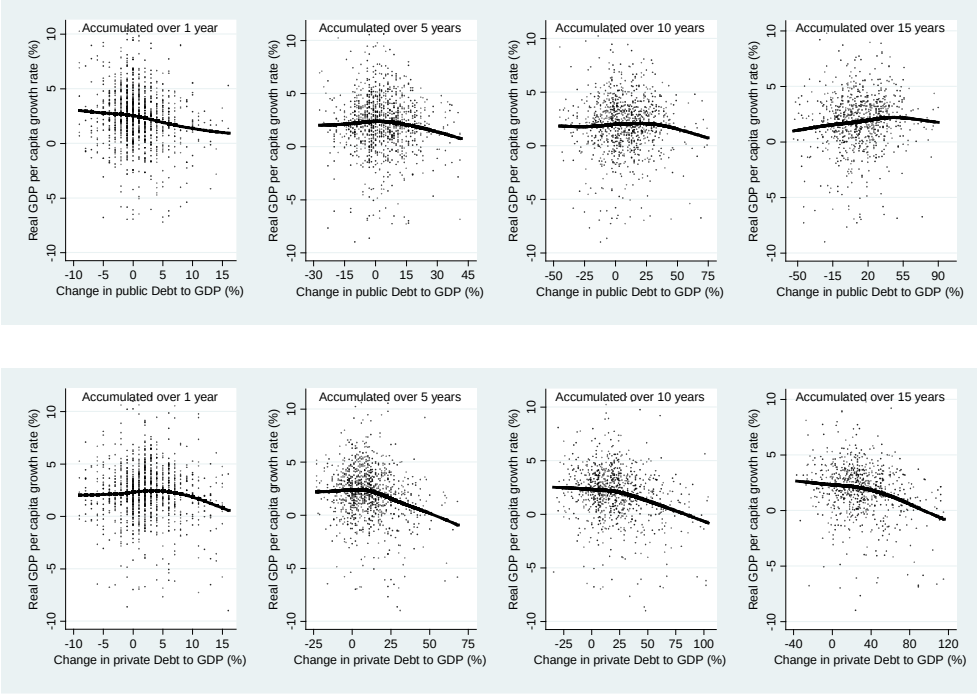


Firstly, the graphs show that a rapid accumulation of debt is associated with lower growth. All four curves have a negative slope. It can be observed that this correlation is not particularly strong, as shown by Spearman's rank correlation coefficient, which never exceeds -0.17. Secondly, the period of time over which debt has been built up matters. Logically, an increase in the total debt-to-GDP level of 20% over 1 year is more negatively correlated to growth than a 15 year building up period. Thirdly, whereas deleveraging (i.e. negative values of changes in total debt-to-GDP levels) does not appear to impact growth, economic performance starts to deteriorate as debt accumulates (i.e. positive values of changes in total debt-to-GDP levels). This holds for all four curves. The threshold for which growth starts to slow down, increases as the period over which debt is accumulated is extended. For example, economic performance remains quite constant for $d = 5$ until a 25% increase in debt. For $d = 15$, an increase in debt of 50% must be reached before we see a negative impact on growth. Finally, all

regression coefficients were compared and found to be significantly different across the four groups (p = 0.0000). Again, our analysis does not change if we exclude the 2.5 lowest and 2.5% highest values of growth, as shown in Appendix 3.

When comparing the difference between public and private debt, it is noteworthy that private debt again has the strongest negative correlation with economic growth, as can be seen in Figure 11.

Figure 11: Growth performance over 1 year with debt accumulation over 1-15 year (*h* = 1 and *d* = 1, 5, 10, 15) – Public & private debt



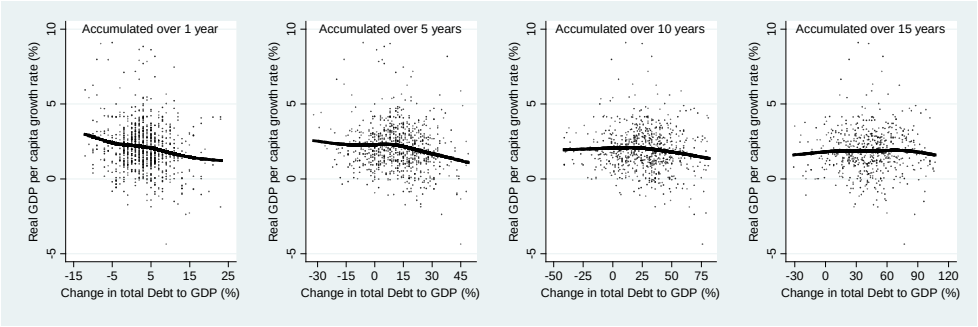
5.3 Medium-term (5 years)

From the analysis so far, we cannot conclude that the causal direction runs from the accumulation of debt to sluggish growth. As argued, a period of low growth may result into a rapid build-up of debt. In addition, an increase in debt in the

order of magnitude of over 10% in one year is very likely to be accompanied by a severe crisis, which in itself slows down growth. Therefore, we will analyze the link between debt accumulation and medium- to long-term growth.

In Figure 12, we provide the results for economic growth over 5 years (h = 5) after reaching a threshold change in total debt levels, that has been accumulated over 1, 5, 10 and 15 years (i.e. d = 1, 5, 10, 15) respectively.

Figure 12: Growth performance over 5 year with debt accumulation over 1-15 year (h = 5 and d = 1, 5, 10, 15)

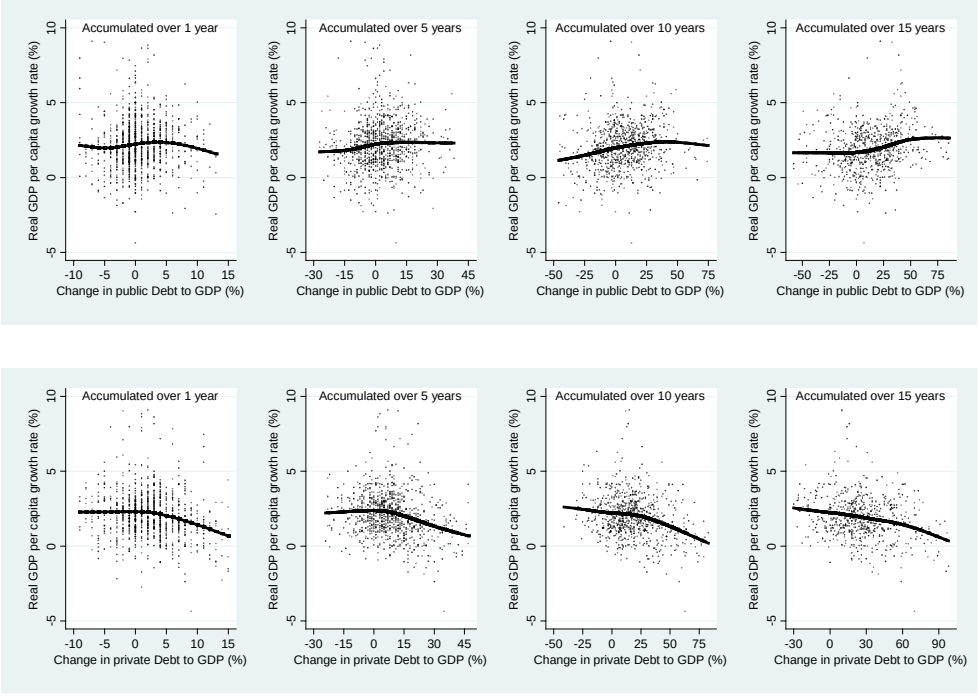


Again, we find that the period over which debt is accumulated is relevant. The shorter this period, the more negative the economic growth. However, this relationship is much less strong in the medium term than in the short term. When debt has been built up over 10 or 15 years, the relationship becomes practically non-existent[36].This is supported by Spearman's rank correlation, which is a mere -0.06 for d = 10 and 0.03 for d = 15 and fails to be statistically significant (p = 0.09 and 0.49 respectively). Hence, there appears to be no negative impact of a large increase in debt compared to a smaller increase in debt, when debt is built up over an extended period. These outcomes do not change when we exclude outliers or when medium-term growth is defined as growth over a 10-year horizon, as shown in Appendices 4-6.

[36] The null hypothesis that both coefficients are the same also could not be rejected (p = 0.09).

There is a clear difference between public and private debt[37]. Accumulation of public debt is not negatively correlated with medium-term grow; Spearman's rank correlation is positive and ranging between 0.10 and 0.20. In contrast, a negative relationship between private debt accumulation and medium-term growth is observed and verified by Spearman's rank correlation, which ranges between -0.16 and -0.22.

Figure 13: Growth performance over 5 years with debt accumulation over 1-15 year (h = 1 and d = 1, 5, 10, 15) – Public & private debt



[37] Again, we get the same results when we look at growth performance over 10 years, as Appendix 7 shows.

5.4 Long-term (15 years)

Finally, Figure 14 presents the results of our analysis on growth performance over a 15-year horizon (h = 15) and debt accumulating over 1, 5, 10 and 15 years (d = 1, 5, 10, 15). We find that countries experiencing a significant increase in their total debt level do not record worse economic performances over the longer term than countries with a constant or declining total debt level. If anything, there is a slightly positive relationship between debt accumulation and longer term growth; Spearman's rank correlation is positive for all four curves and ranges between 0.01 and 0.13. Appendix 8 demonstrates that we get similar results once extreme values are removed. Moreover, we compared the regression coefficients among the four groups. They do not differ significantly (F = 1.36, p = 0.2540), which means that the period over which debt is accumulated is not relevant. The regression coefficients between two groups were also compared pairwise (e.g. comparing debt accumulation over 1 year with debt accumulation over 10 years). The null hypothesis could not be rejected for any comparison.

Figure 14: Growth performance over 15 year with debt accumulation over 1-15 year (h = 15 and d = 1, 15)

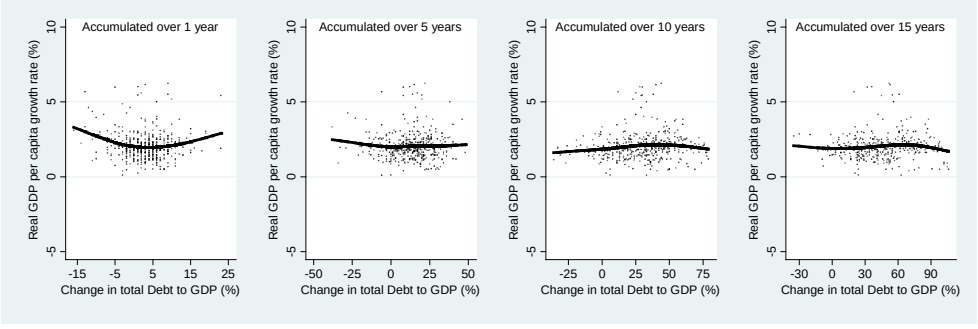
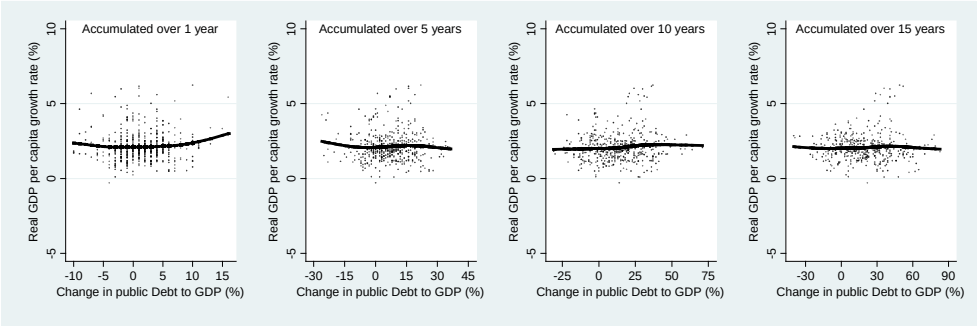
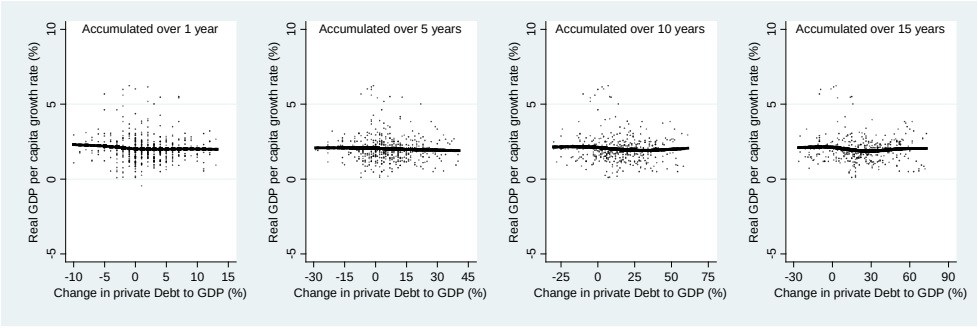


Figure 15 shows that there is hardly any difference in the correlation between debt and long-term growth between public debt and private debt, with the only exception being public debt accumulated over 1 year.

Figure 15: Growth performance over 15 years with debt accumulation over 1-15 year (h = 15 and d = 1, 5, 10, 15) – Public & private debt





6. Discussion of results

Although the recent Global Financial Crisis has produced a vast amount of research on the impact of public debt on economic growth and increasingly also on the role of private credit, the total levels of indebtedness of an economy have largely been ignored. Our paper for the first time attempts to fill that void by analyzing the link between total debt-to-GDP levels and economic growth for a panel of 26 OECD countries between 1961 and 2012. We investigate whether we can predict the future level of growth, simply by looking at the total level of debt, or increases in that debt level.

We found little evidence to support the hypothesis that there is a critical threshold of the total debt-to-GDP ratio above which economic growth plummets. Rather, growth performance worsens gradually as debt levels rise. In addition, this

relationship is more pronounced for short-term growth than for medium- to long-term growth. It follows that the causal direction most likely runs from low growth to higher debt levels, not the other way around.

Another explanation is that, on average, the return on the investments financed by this debt compensates their cost. For example, companies take on more debt to improve their machinery, which raises their debt level in the short run. However, in the longer run, this results in higher productivity and consequently higher profits, with the increase in profits offsetting the interest payments on the debt. A similar argument can be made for public investments that increase public debt-to-GDP in the short run, but improves the long-term economic potential of a country.

One can also argue that it is not so much the level of debt, or increases in that level, which matters. Rather, the cost of servicing debt, i.e. bond yields on both corporate and government debt[38], plays a far more important role. At lower interest rates, it will be easier to service debt. Simultaneously, certain investment projects become profitable due to the lower cost of financing it, which results in higher growth. Of course, there is a feedback loop between the level of debt and the level of interest paid on it, but, ceteris paribus, a lower yield on bonds improves investments prospects and hence economic growth.

We have also looked at the impact of the pace of debt accumulation on subsequent economic growth. We find that rapid debt accumulation is negatively related to economic growth over the short term, but this effect is less pronounced over the medium term and is non-existent over the long term. This could be explained by the fact that countries experiencing a fast rising debt level are typically hit by an exogenous shock, which causes the public and private sector to take on more debt in the short term, without significantly altering the long-term fundamentals of the country.

In our analysis, we have applied a non-parametric method to demonstrate the correlation between debt and growth. The appeal of this method is that the results can be interpreted rather intuitively. However, further research is warranted to

[38] We assume that low levels of corporate and government bond yields are also translated into lower levels of interest on consumer loans.

identify the complex structural relationship between total debt levels and GDP growth.

Another area for future research is to decompose the aggregate level of debt in an economy in its composing parts and debt holders to find out what type of debt has significant impact on economic growth. For example, public debt can be disaggregated into internal and external debt, private debt into mortgage debt, credit card debt and others. This way, the impact of borrowing in a foreign currency, both for the public and private sector, can be studied.

7. Conclusions

In summary, this paper has two main contributions. The first is that the current emphasis on public debt is too narrow and that private debt should be included in analyzing the level of indebtedness of an economy. As public and private debt in many cases are interchangeable, it is the effect of aggregated debt on growth that should be explored. Second, it shows that there is no critical total debt-to-GDP ratio after which medium-term economic performance significantly worsens. Hence, the excessive focus on a target value such of the debt-to-GDP ratio is misguided. There are other, more important factors which determine the impact of debt and growth, such as bond yields. An abstract level of debt does not have predictive power for the outlook of growth.

Although we find some evidence that, in the short term, higher debt levels are associated with lower growth, the relationship weakens significantly when we expand the time horizon. This supports the hypothesis that it is lower growth that leads to more debt and not vice versa. Similarly, we find that the pace of debt accumulation negatively correlates to short-term economic growth and that this relationship weakens for medium-term growth. For long-term growth, the speed at which debt is building up does not substantially alter longer-term growth prospects.

Of course, our results do not imply that a country or the private sector can pile on large amounts of debt without careful analysis of the projects financed by this debt accumulation. Our research simply suggests that historically, on average,

government debt and private credit are mainly used in such a way that is conducive to economic growth.

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Appendices

Appendix 1: Descriptive statistics

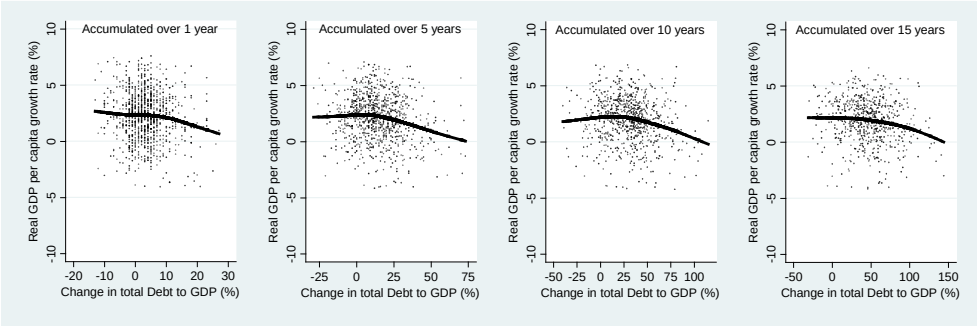
Country	Public debt to GDP	Private debt to GDP	Total debt to GDP	Yearly increase in total debt	Real GDP per capita growth
Australia	23,81%	103,66%	128,36%	2,11%	2,05%
Austria	44,86%	96,39%	142,33%	3,76%	2,57%
Belgium	88,24%	132,83%	229,69%	4,71%	2,34%
Canada	69,22%	129,70%	198,92%	2,49%	2,01%
Czech Republic	25,58%	69,27%	94,85%	1,40%	1,82%
Denmark	36,36%	156,07%	192,49%	4,23%	2,01%
Finland	25,79%	119,74%	149,83%	3,34%	2,68%
France	39,86%	106,58%	151,33%	3,88%	2,23%
Germany	42,71%	109,07%	151,96%	2,12%	2,17%
Greece	65,48%	54,84%	120,78%	5,26%	2,70%
Hungary	80,91%	86,14%	165,86%	5,42%	1,95%
Ireland	58,50%	139,23%	201,05%	7,75%	3,42%
Italy	79,09%	80,27%	159,36%	3,23%	2,27%
Japan	83,33%	168,83%	256,93%	5,99%	3,46%
Luxembourg	8,25%	351,04%	363,05%	15,47%	2,74%
Mexico	38,43%	23,52%	70,57%	0,18%	1,92%
Netherlands	58,17%	122,26%	180,44%	3,78%	2,11%
Norway	36,62%	143,06%	181,38%	2,01%	2,61%
Poland	51,53%	46,08%	94,65%	1,85%	3,77%
Portugal	45,00%	137,92%	182,92%	5,87%	3,08%
Spain	36,18%	124,02%	164,03%	4,82%	2,74%
Sweden	48,24%	148,32%	197,14%	3,53%	2,13%
Switzerland	45,51%	156,64%	207,46%	2,13%	1,41%
Turkey	36,78%	26,85%	70,08%	1,53%	4,27%
United Kingdom	60,39%	111,60%	169,91%	2,39%	2,01%
United States	55,25%	116,43%	172,02%	2,41%	2,06%
Average	**48,61%**	**116,51%**	**168,17%**	**3,65%**	**2,48%**

Appendix 2: Database coverage

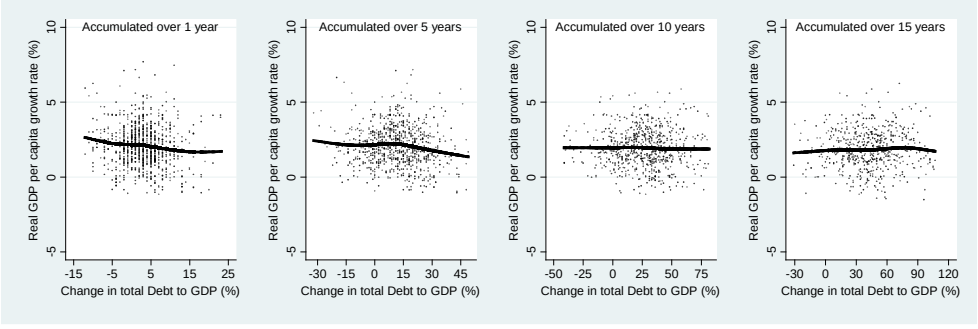
Country	Public debt to GDP	Private debt to GDP	Total debt to GDP	Real GDP per capita growth
Australia	1961-2012[1]	1961-2012	1961-2012[1]	1961-2012
Austria	1961-2012[1]	1961-2012	1961-2012[1]	1961-2012
Belgium	1961-2012[2]	1970-2012	1970-2012[2]	1961-2012
Canada	1961-2012	1961-2012	1961-2012	1961-2012
Czech Republic	1993-2012	1993-2012	1993-2012	1991-2012
Denmark	1961-2012[3]	1961-2012	1961-2012[3]	1961-2012
Finland	1961-2012[4]	1970-2012	1970-2012[4]	1961-2012
France	1961-2012[5]	1970-2012	1970-2012[5]	1961-2012
Germany	1961-2012[6]	1961-2012	1961-2012[6]	1961-2012
Greece	1961-2012[7]	1961-2012	1961-2012[7]	1961-2012
Hungary	1982-2012[8]	1989-2012	1989-2012[8]	1992-2012
Ireland	1961-2012	1971-2012	1971-2012	1961-2012
Italy	1961-2012	1961-2012	1961-2012	1961-2012
Japan	1961-2012	1964-2012	1964-2012	1961-2012
Luxembourg	1974-2012[9]	2003-2012	2003-2012	1961-2012
Mexico	1961-2012[10]	1980-2012	1980-2012[11]	1961-2012
Netherlands	1961-2012	1961-2012	1961-2012	1961-2012
Norway	1961-2012[12]	1961-2012	1961-2012[12]	1961-2012
Poland	1986-2012	1992-2012	1992-2012	1991-2012
Portugal	1961-2012	1961-2012	1961-2012	1961-2012
Spain	1961-2012[13]	1970-2012	1970-2012	1961-2012
Sweden	1961-2012[14]	1961-2012	1961-2012[14]	1961-2012
Switzerland	1961-2012	1961-2012	1961-2012[15]	1961-2012
Turkey	1961-2012	1986-2012	1986-2012	1961-2012
United Kingdom	1963-2012	1961-2012	1963-2012	1961-2012
United States	1961-2012	1961-2012	1961-2012	1961-2012

[1]Missing data for 1965
[2]Missing data for 1965, 1980, 1981 and 1989
[3]Missing data for 1997
[4]Missing data for 1964-1966, 1979 and 1980
[5]Missing data for 1978 and 1979
[6]Missing data for 1976
[7]Missing data for 1976-1978
[8]Missing data for 1993 and 1994
[9]Missing data for 1990
[10]Missing data for 1962-1964, 1969 and 1981
[11]Missing data for 1981
[12]Missing data for 1966, 1981 and 1982
[13]Missing data for 1963 and 1964
[14]Missing data for 1965, 1966 and 2003

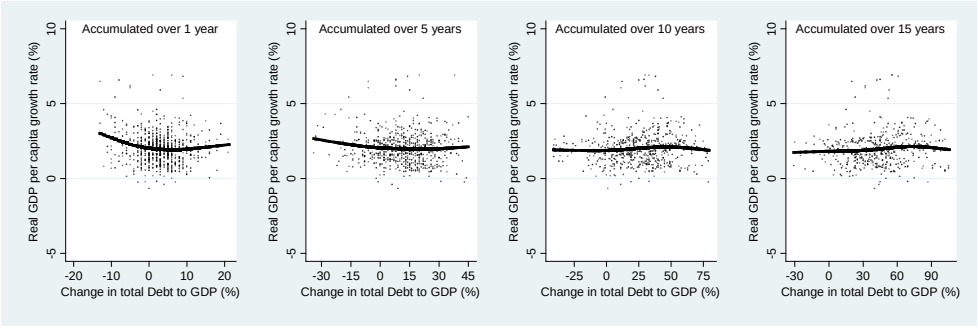
Appendix 3: Growth performance over 1 year with debt accumulation over 1-15 year (h = 1 and d = 1, 5, 10, 15) – outliers removed



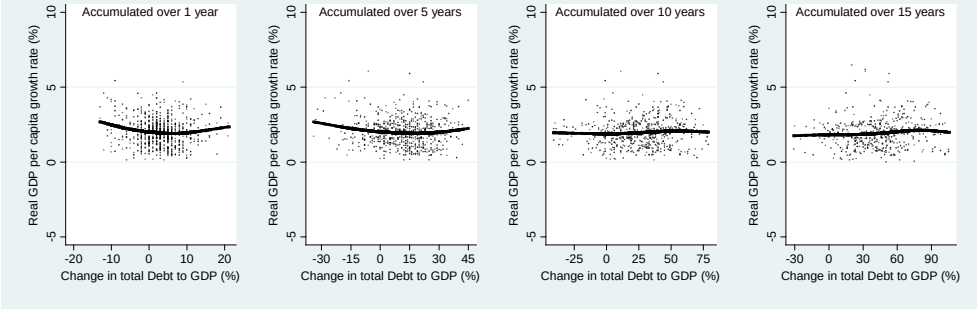
Appendix 4: Growth performance over 5 years with debt accumulation over 1-15 year (h = 5 and d = 1, 5, 10, 15) – outliers removed



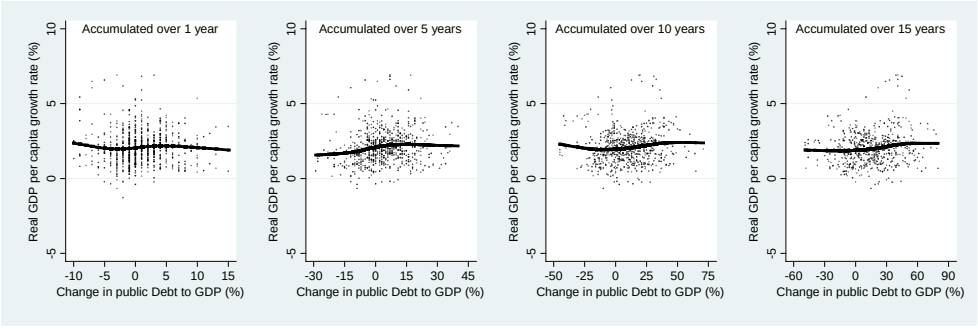
Appendix 5: Growth performance over 10 years with debt accumulation over 1-15 year (h = 10 and d = 1, 5, 10, 15)

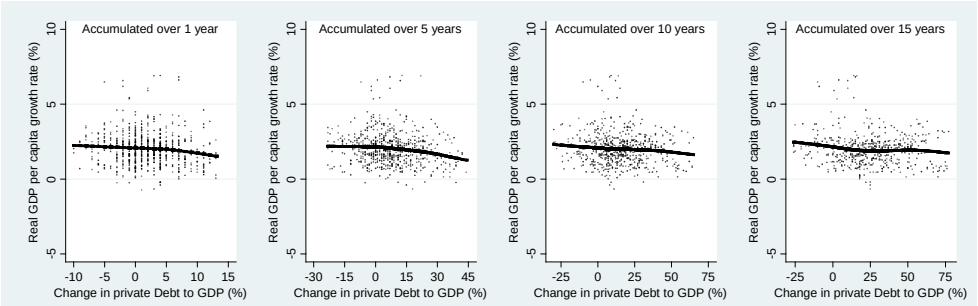


Appendix 6: Growth performance over 10 years with debt accumulation over 1-15 year (h = 10 and d = 1, 5, 10, 15) – outliers removed

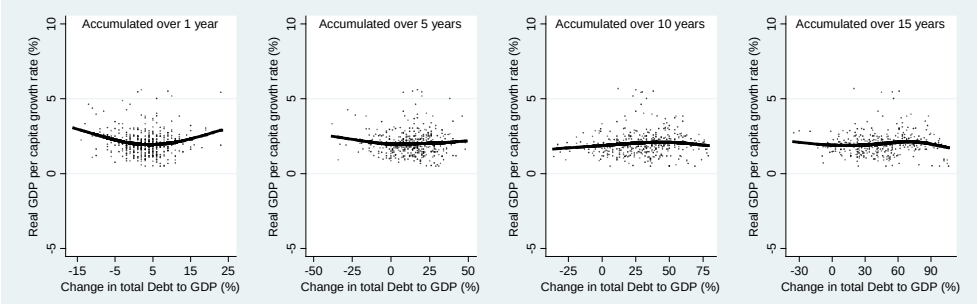


Appendix 7: Growth performance over 10 years with debt accumulation over 1-15 year (h = 10 and d = 1, 5, 10, 15) – Public & private debt





Appendix 8: Growth performance over 15 years with debt accumulation over 1-15 year (h = 15 and d = 1, 5, 10, 15) – outliers removed



CHAPTER 3

Does public debt produce a crowding out effect for public investment in the EU?

This chapter will be published as:

Vanlaer, W., Picarelli, M., & Marneffe, W. (XXXX). Does Public Debt Produce a Crowding Out Effect for Public Investment in the EU?. ESM Working Paper Series, forthcoming.

ABSTRACT

The combination of the sovereign debt crisis that started in 2009 in the EU and the fiscal consolidation policies that were implemented as a result, has significantly hampered economic growth and inflated debt levels. This paper exploits a panel dataset for 26 EU countries between 1995 and 2015 to examine the extent to which increased levels of public debt have led to reduced public investments, the so-called 'debt overhang' hypothesis. To address endogeneity concerns, we use an instrumental variable approach based on a GMM estimation. Our results validate the debt overhang hypothesis and remain robust across various estimation techniques; the GMM estimation with year dummies, for example, indicates that a 1 percentage point increase in public debt in the EU brings about a reduction in public investment of around 0.30 percentage points. Given the level of public investment prevalent in 2015, this is equivalent to a €1.85 billion euro drop. Interestingly, we find evidence that the impact of this causal relationship exists only for high debt countries. In addition, our results suggest that the negative impact of debt on investment is slightly smaller in the Eurozone than in the entire EU, which might suggest that the institutional framework of the Eurozone does not act as a 'straightjacket' for countries that experience high debt levels. Moreover, we find that both the stock and flow of debt have played a role in reducing public investment, and that the latter's impact was more profound.

Keywords

Public Investment, Debt Overhang, Credit Rationing

1. Introduction

The European Union (EU) has experienced a considerable increase in public debt as a result of the Sovereign Debt Crisis. A significant amount of literature has been devoted, especially in the last decade, to studying the impact of this rise in debt on economic growth (e.g. Reinhart & Rogoff, 2010; Baum, Checherita-Westphal & Rother, 2013). In general, higher levels of debt can result in lower growth in three ways. Firstly, given the finite pool of financial resources, the more the government taps into the pool of loanable funds, the less capital there will be available for private enterprises, which pushes up their borrowing cost, essentially crowding out private investment (Spencer & Yohe, 1970). Secondly, if financial markets start questioning the sustainability of a country, they will demand higher interest rates in order to compensate for the increased default risk. Higher interest rates for the sovereign, in turn, get transmitted to the private sector as government bonds are perceived as the safest investment, in effect acting as a lower bound for interest rates (Das, Papaioannou & Trebesch, 2010). Finally, Ricardian equivalence suggests that companies and households might anticipate a tax increase when the fiscal sustainability of a country is in doubt, resulting in reduced investment and consumption (Barro, 1996).

In addition, recent research has shown that at least part of the lacklustre recovery after the recent Global Financial Crisis (GFC) can be attributed to the elevated levels of public debt (e.g. Reinhart, Reinhart & Rogoff, 2012; Chatterjee, 2013). When a country with a high level of sovereign debt faces a crisis, its ability to respond to that crisis, for example by adopting countercyclical fiscal policy, is severely impeded (Jordà, Schularick & Taylor, 2014).

Little research, however, has been devoted to the causal impact of high debt levels on the flow of public investment. This is rather surprising, as policymakers have clearly recognized the fact that the volume of public investment has declined over the past decade and that considerable efforts need to be undertaken to bridge this investment gap (e.g. Juncker, 2015). Moreover, there is little consensus, both in academic and policy circles, on the factors driving this drop in investment. On the one hand, the decrease in public investment might be primarily caused by the GFC as countries choose the path of least resistance when implementing fiscal

austerity, and simply cut public investment rather than reducing public expenditure. On the other hand, the decline might be caused by more secular factors and driven by economic fundamentals: an advanced and aging economy has less need for investment in public infrastructure.

The literature which does focus on the impact of sovereign debt on investment has mainly been applied to developing countries, and more specifically on highly indebted and poor countries (HIPCs). The Latin-American debt crisis of the 1980s brought about a considerable amount of contributions on the effect of high public debt on investment in less developed countries (LDCs) (e.g. Krugman, 1988; Sachs, 1989).

Focusing on 26 EU countries over the period 1995-2015, this paper studies whether Europe suffers from a 'debt overhang'. We analyze whether the increase in public debt in Europe resulted in a decrease in public investment, offering a richer specification than the existing literature. More specifically, we study whether this effect is more pronounced (i) in high debt than in low debt countries, (ii) pre crisis vs. post crisis, (iii) in Eurozone than in non-Eurozone countries, and (iv) whether there is a threshold effect. Finally (v), we analyze whether it is only the stock of debt that matters, or also the flow of public debt. To tackle this research question and the accompanying endogeneity concerns, we employ diverse econometrical approaches: we estimate our model starting with a basic Pooled Ordinary Least Squares (POLS), after which we include fixed effects (FE). Finally we apply an instrumental variable approach and estimate our model using GMM (Generalized Method of Moments). We contribute to the existing literature by incorporating a broader set of explanatory variables to explain public investment. Moreover, we address the issue of reverse causality by using a GMM model, based on the linear GMM estimator of Arellano & Bond (1991).

The paper proceeds as follows: Section 2 provides some background on the sovereign debt crisis; Section 3 makes a literature review; Section 4 describes the empirical analysis and its extensions and we conclude in Section 5.

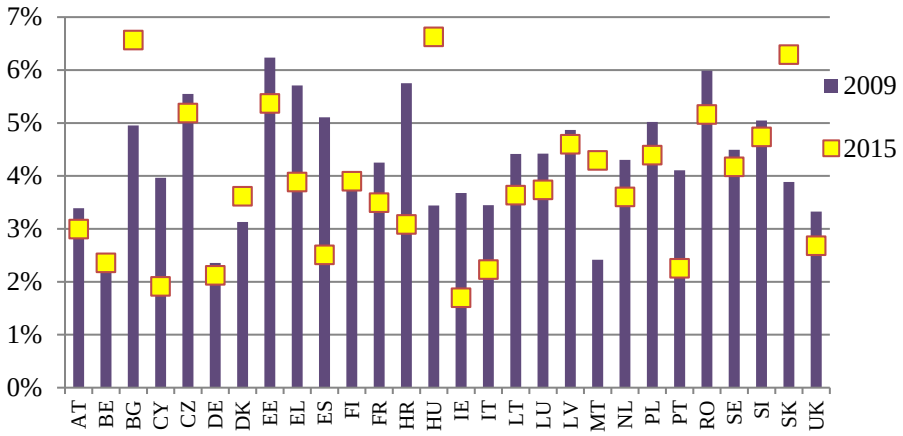
2. Background on sovereign debt crisis

At the end of 2009, the European Union started to suffer from a sovereign debt crisis. The causes of this crisis are rather diverse and extend beyond the scope of this paper (see e.g. Albanesi, De Giorgi & Nosal, 2017; Bayoumi, 2017; Martin & Philippon, 2014). To deal with this crisis, some governments implemented fiscal consolidation policies, raising taxes and lowering spending. However, these measures mainly resulted in lowering growth further, especially in the short run, which pushed up debt levels even higher; since 2007, the average public debt-to-GDP level has increased by 66.66% in the European Union and by 70.23% in the Eurozone. However, some countries experienced an even steeper growth in public debt; in the so-called PIIGS countries (i.e. Portugal, Italy, Ireland, Greece and Spain) the debt-to-GDP ratio has increased by 86.52% since 2007.

At the same time public debt levels in Europe surged, public investment plummeted. This decline in public investments is quite puzzling given the highly accommodative monetary policy implemented by the European Central Bank (ECB) over the past years. Public investment, measured by gross fixed capital formation (GFCF), decreased by 6.32% in the EU since 2007. In the Eurozone (EZ), the decrease was more pronounced; public investment, as a percentage of GDP, declined by 11.08% since 2007. The PIIGS suffered an even sharper decline; GFCF-to-GDP decreased by 37.87% since 2007.

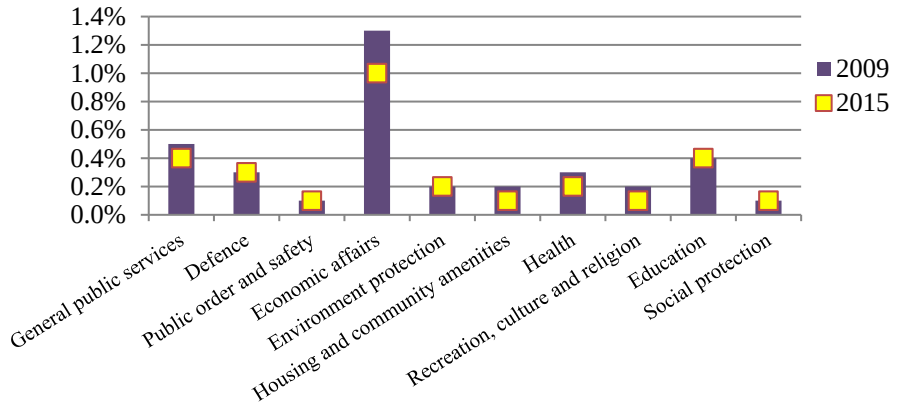
Figure 1 shows public investment (as a percentage of GDP) declined substantially between 2009 and 2015 for 21 out of 28 European countries. In Figure 2, we decompose public gross fixed capital formation expenditure by its socio-economic function in order to see how its main components have changed since 2009. Five out of the ten groups used in this classification show a clear decline, while the other five categories remain relatively unaltered. In particular, the current level in health investments is quite low, which is especially worrisome, given that this is found to be a very significant determinant of long-term growth (OECD, 2016).

Figure 1: Public investment-to-GDP ratio



Source: Eurostat[39]

Figure 2: European Union (EU28) public investment-to-GDP ratio divided by function



Source: Eurostat (COFOG database)

There are numerous reasons why a sufficient level of public investment is warranted. Firstly, as mentioned before, public investments can positively impact long-term growth and labour productivity (e.g. OECD, 2016, Abiad, Furceri &

[39] All Eurostat data in this paper are retrieved from the *National Accounts* database or the *Government Statistics* database.

Topalova, 2015; Ganelli & Tervala, 2016). Secondly, public investment in areas such as education can produce significant spillover effects for the private sector, as firms benefit from a highly educated workforce. Thirdly, government investment in transport, for example, can lead to a crowding in effect of private investment, as companies can more easily get their products to consumers. Fourthly, an adequate level of public investment in defence and security helps in dealing with terrorist threats. Fifthly, investment in basic infrastructure, such as water supply, are preconditions for a normal life. Finally, public investment can also be considered as a potentially useful counter-cyclical fiscal tool, something which has not been considered extensively in the literature. Most studies show that public investment is pro-cyclical, mainly due to political motivations (Bove, Efthyvoulou & Navas, 2017). Political considerations might even result in too large cuts in public investment when consolidation measures need to be introduced during or after an economic downturn, increasing the pro-cyclicality of public investment. This suggests a certain degree of state-dependency for GFCF, which is important to contemplate, especially when hysteresis is a concern (OECD, 2016a; Fatas & Summers, 2018)[40].

The aforementioned benefits of public investment are also reflected in 'Europe 2020' (EC, 2010), the 10-year strategy proposed by the European Commission for advancement of the economy of the EU as it promotes "*public funding for R&D*", "*efficient investment in education and training systems at all levels*" and "*key infrastructure investments in cross-border energy and transport networks, and low-carbon technology*". It also says that "*budgetary consolidation programmes should prioritise growth-enhancing items such as education and skills, R&D and innovation and investment in networks, e.g. high-speed internet, energy and transport interconnections*".

[40] In presence of hysteresis, the effect of a public investment stimulus might indeed be stronger (OECD, 2016b).

3. Literature review

The debt overhang hypothesis was initially introduced by Myers (1977) when analyzing the determinants of corporate borrowing and more specifically in the context of the impact of having excessive debt on investment decisions at the firm level. Due to the Latin-American debt crises of the 1980s, several studies extended the analysis on debt overhang from a corporate context to a country based approach. The aim of these studies was to explain the effect of higher sovereign debt on investment in less developed countries (e.g. Krugman, 1988; Krugman, 1989; Obstfeld & Rogoff, 1996). Subsequently, the scope of this theory was extended to consider also how high debt might reduce the government's incentives to undertake structural reforms (Clements, Bhattacharya & Nguyen, 2003).

Table 1 shows a brief overview of papers which are relevant to our research. We have focused solely on empirical literature, as this is most relevant to our paper. To the authors' knowledge, this overview is exhaustive. The different papers will be discussed in more detail in the following subsections.

3.1 Debt overhang, only in developing countries?

The debt overhang hypothesis has been tested mainly for highly indebted and poor countries. In general, two ways to test the debt overhang hypothesis have been used. In the first one, an investment function is estimated, in which a specific term is added to account for debt overhang. In a second one, different econometric techniques are used to study the causal relationship between high debt and low investment.

A seminal paper in the first category is Borensztein (1990a) in which the topic is studied first from a theoretical point of view, followed by an empirical approach (Borensztein, 1990b). The author estimates a neoclassical investment function, introducing various types of debt (e.g. sovereign debt, private debt or excess debt) as explanatory variables to test the debt overhang hypothesis in the Philippines in the 1980s. He finds that the stock of foreign debt acted as a disincentive to private investment, and especially so after 1982.

Table 1: Overview of relevant literature

Author	Countries	Dependent Variable	Econometric approach	Debt variable
Antonakis (2014)	12 EZ countries	GDP growth	2SLS, GMM	Public debt
Balassone et al. (2011)	Italy	GDP growth	OLS, 2SLS	External debt
Borensztein (1990)	Philippines	Private investment	OLS	Private debt
Clements et al. (2003)	55 HIPCs	GDP growth, public investment	FE, GMM	External debt, external debt service
Checherita & Rother (2012)	12 EZ countries	GDP growth, public investment	FE, 2SLS, GMM	Public debt
Cohen (1993)	81 LDCs	Domestic investment	OLS	Debt service, debt-to-export ratio
Cordella et al. (2010)	79 HIPCs	GDP growth	OLS, FE, GMM	External debt, public debt, debt service, private debt
Deshpande (1997)	13 SICs	Domestic investment	OLS, FE, LSDV	External debt
Eberhardt & Presbitero (2015)	118 DCs, EMs and AEs	GDP growth	Error Correction Model	Total debt (external plus domestic)
Heinemann (2006)	16 OECD countries	Public investment	OLS, FE	Public debt
Reinhart et al. (2012)	26 AEs	GDP growth	Descriptive analysis	Public debt
Reinhart & Trebesch (2016)	12 AEs and 41 EMs	GDP growth	Difference-in-difference regression	Public debt, external debt, debt service
Turrini (2004)	14 EU countries	Public investment	FE, IV	public debt
Välilä & Mehrotra (2005)	14 EU countries	Public investment	OLS, FE	Public debt
Vanlaer et al. (2015)	26 developed countries	GDP growth	Descriptive analysis	Public debt, private debt, total debt

Note: EZ stands for Eurozone, HIPCs for highly indebted and poor countries, LDCs for least developed countries, SICs for severely indebted countries, AEs for advanced economies and EMs for emerging markets.

One of the most important contributions in the second category is provided by Deshpande (1997). The author uses a panel approach to find a significant negative impact of debt on investment for 13 severally indebted countries (SICs) during 1971-1991. She also introduces a time variable in order to capture the different investment climates over the period studied. She finds that this time variable had a positive impact on investment until 1984, after which it largely became negative. In another paper (Despande, 1993), the author shifts the focus to several HIPCs over the period 1970-1990 and again finds significant evidence for a negative link between debt and investment.

There are also several contributions to the literature that do not find evidence for the debt overhang hypothesis. Cohen (1991, 1993) finds no evidence of debt overhang for the LDCs in the 1980s. His results suggest that it is not the level of debt, but rather the debt servicing costs[41] which act as a drag on growth: 1% of GDP paid abroad reduces domestic investment by 0.3% of GDP. Hence, according to this paper, high debt cannot be seen as a predictor of low investment. Similarly, Karagol (2005) argues that it is misguiding to make generalizations on the relationship between (external) debt and growth as each country has an idiosyncratic combination of social, economic and political elements.

Testing the link between debt and investment is also important from a policymaking perspective. Indeed, if a high stock of debt results in decreased investment, debt relief might be an effective way to aid heavily indebted countries. Several papers investigate the empirical validity of the debt overhang hypothesis for HIPCs. Arslanalp & Henry (2004, 2005) show the effectiveness of debt relief where debt overhang, and not weakness of institutions or poor infrastructure, is the main impediment to growth. Similarly, Cordella, Ricci & Ruiz-Arranz (2010) find that the effectiveness of debt relief depends on a country's characteristics, such as the quality of its policies and institutions.

[41] However, Deshpande (1993) argues against the use of debt service as an explanatory variable because it may be influenced by a rescheduling process allowed in the past from creditor countries.

3.2 What is the link between debt and growth?

Another strand of literature takes a broader view and looks at the link, not between debt and investment, but between debt and growth (see Panizza & Presbitero (2013) for a review). This is relevant for our research in two ways. Firstly, the literature on the link between debt and growth helps identifying control variables for our model. Secondly, one channel through which high debt can result in low growth is through reduced public investment, which is exactly the focus of this paper. Some papers identify a non-linear relationship between (external) debt and growth, the so-called Debt Laffer curve[42] (e.g. Pattillo, Poirson & Ricci, 2011; Clements et al., 2003; Reinhart et al., 2012).

Clements et al. (2003), focusing on 55 low income countries (classified as eligible for the IMF's Poverty Reduction and Growth Facility) in 1970-1999, show that high external debt can negatively affect growth through both a direct and an indirect effect. A direct effect is in place if a certain threshold is reached (50% for the ratio of external debt-to-GDP and 20-25% for the present value of this ratio) after which growth significantly slows down. An indirect effect works through the investment channel; the authors find that a 1% reduction in the external debt service results in a 0.2% increase in investment, which in turn leads to higher growth through an increase of the capital stock and the immediate impact on aggregate demand. Hence, the authors conclude that a debt reduction initiative for HIPCs might be useful as it results in an increase in the growth rate.

Reinhart et al. (2012) study 26 cases of public debt accumulation in advanced countries since 1800. They find that the relationship between real GDP growth and the public debt-to-GDP ratio is rather weak for sovereign debt below 90% of GDP. For debt levels above 90% however, economic growth reduces by around 1.2%. This 90% threshold for the negative effect of debt over growth is also observed in Checherita-Westphal & Rother (2012). Conversely, Eberhardt & Presbitero (2015) find evidence for the negative relation between debt and growth but not for the presence of a common debt threshold. Their research indicates

[42] The Debt Laffer curve is a concept often used in the sovereign debt restructuring literature. It refers to an inverse U-shaped curve that links the amount of debt of a debtor country to the creditor's expected repayment. This curve is used to explain that creditors have an interest in forgiving part of the debt of a debtor country since it will increase their expected repayment.

that the link between total debt (domestic plus external debt) and long-run growth differs significantly across countries. Hence, this suggests that there is substantial heterogeneity in the long-run relationship between these two variables. Balassone, Francese & Pace (2011) also study the negative link between debt and growth focusing on Italy for the period 1861-2009. They find that external debt had a large negative effect on GDP growth, in particular before WWI. Critics argue that, while there may very well be a negative relationship between public debt and economic growth, the effect might work in the opposite direction: low growth causes the state revenues to fall and public expenditures to rise, thus resulting in a higher level of public debt (e.g. Vanlaer, Marneffe, Vereeck & Van Overtveldt, 2015).

3.3 What determines public investment?

Due to the Sovereign Debt Crisis in Europe, several EU countries, notably Portugal, Italy, Ireland, Greece and Spain, have faced or are facing debt problems similar to the ones that the HIPCs have faced. In order to test whether high sovereign debt results in low public investment, we must first develop a framework that incorporates the different determinants of public investment in general. Only a relatively small amount of studies investigate which factors have an impact on the evolution of public investment, especially for AEs. In addition, most studies focus on one country (e.g. Aubin, Berdot, Goyeau & Lafay (1988) on France, Herenkson (1988), Kirchgassner & Pommerehne (1988) on Germany and Switzerland, Sorensen (1988) on Norway), with only a limited number of papers looking at a panel of different countries (e.g. Haan, Sturm & Sikken (1996) for 22 OECD countries). The explanatory variables that are used in the literature can be categorized into two groups. The first category includes macroeconomic variables, such as the rate of unemployment or the growth rate of real GDP (Turrini, 2004), whereas the second category includes politico-institutional variables, such as the degree of fiscal federalism and the size of the public sector.

The number of papers which specifically examine the determinants of public investment in Europe is even more limited. Välilä & Mehrotra (2005), using a panel co-integration model, study the evolution of public investment and public capital stock over the period 1972-2003 for 14 EU countries. They find that public

investment has been mainly determined by national income, the fiscal stance and considerations on fiscal sustainability whereas the Maastricht criteria required to join the EMU do not seem to play a significant role.

Going one step further, there are hardly any papers that look at whether public debt has an impact on public investment in Europe. Heinemann (2006) tries to explain the declining level of public investment in 16 OECD countries, most of which are European. The results indicate that increases in public debt since the 1970s severely restricted the ability to finance new investments. Similarly, Bacchiocchi, Borghi & Missale (2011) shows how high debt levels result in a decrease in public investments in all OECD countries, without specific differences between EZ/EU countries and non-EZ/EU countries. With a focus on just 12 EZ countries, Checherita-Westphal & Rother (2012) claim that public investment is one of the main channels through which debt can negatively affect economic growth.

In summary, the existing literature on debt overhang suffers from three major limitations. Firstly, most research focuses on developing economies (e.g. Borensztein, 1990b; Desphande, 1993) and those papers which do devote attention to developed economies, only look at a limited number of countries or at least not at the entire European Union (e.g. Heinemann, 2006; Checherita-Westphal & Rother, 2012). Secondly, the problem of endogeneity is not always tacked properly (e.g. Välilä & Mehrotra, 2005); a rudimentary OLS regression is not sufficient to capture the potential endogeneity between public investment (i.e. the dependent variable) and several explanatory variables, such as public debt and the government deficit. Thirdly, the literature on the determinants of public investment, especially in advanced economies, is rather limited and generally focuses on just one country (e.g. Herenkson, 1988; Kirchgassner & Pommerehne, 1988). Hence, we add to the existing literature by taking into account a richer set of explanatory variables to determine public investment, focusing on 26 EU countries and address the issue of endogeneity by using a GMM model exploiting the instrumental variable approach based on the linear GMM estimator of Arellano & Bond (1991).

4. Analysis

4.1 Data Description

As discussed above, the central aim of this paper is to test the debt overhang hypothesis in developed countries, rather than in developing ones, where most literature focuses on. More specifically, we study whether, in Europe over the period 1995-2015, higher levels of public debt produced a crowding out effect for public investment. In order to do so, we start from an empirical model containing the determinants of public investment. Hence, in this section, we discuss all the different variables which are included in our model. These variables were identified through the literature review discussed in Section 3. Table 2 below provides a description of the variables in our dataset.

Table 2: Variables description

Variable name	Description
Public investment	Government gross fixed capital formation in percentage of GDP
Borrowing rate (LT)	Sovereign long-term nominal interest rate
Public debt	General consolidated government gross debt in percentage of GDP
Public expenditure	General government total expenditure in percentage of GDP
Trade openness	Summation of export and import divided by GDP
Private investment	Private gross fixed capital formation in percentage of GDP
Income	Gross national disposable income per capita
Business cycle	Deviation of the actual from the trend GDP growth rate
Production expectations	Production expectations for the 3 months ahead + Selling price expectations for 3 the months ahead

Given that our variable of interest is public investment, we focus on general government[43] gross fixed capital formation (GFCF)[44]. More specifically, we

[43] According to Eurostat, the general government sector includes the central government, state governments, local governments, and social security funds.
[44] Data comes from Eurostat, which defines GFCF as resident producers' investments, less disposals, of fixed assets plus the additions to the value of non-produced assets deriving from the productive activity of government producer or institutional units. Fixed assets are

consider this variable as a percentage of GDP in order to overcome differences deriving from countries' welfare level.

For what concerns the determinants of public investment, we can categorize our control variables in three groups: (i) variables related to the government's balance sheet, (ii) variables explaining the country's relationship with the rest of the world, and (iii) variables related to a country's internal characteristics.

In the first group, we consider the interest rate, debt, and public expenditure. For interest rates, we focus on the long-term interest rate[45] and more specifically the 10-year government bond yield[46], which is included as a measure of long-term funding costs. Higher borrowing costs put pressure on government's finances as interest expenses increase, in turn potentially affecting the government's decision on how much to spend on public investment (i.e. a country's fiscal space). For debt[47], we look at general government consolidated gross debt[48] as a percentage of GDP. As explained before, this variable is taken into account to test the public debt overhang hypothesis, which is the focus of this paper.

For public expenditure, we focus on general government total expenditure[49] expressed as a percentage of GDP[50]. This variable is taken into account to test whether the total amount of public expenditure can influence its composition. In particular, when there is a necessity to adjust government expenditure, public investments might be postponed and/or reduced. It is often 'politically easier' to

considered as the produced assets used continuously in the production processes for more than one year. They do not include inventory investments (that might introduce a large degree of volatility), the ownership of companies, public-private partnerships projects (PPPs) and investment by state-owned enterprise.

[45] Data come from Eurostat.

[46] This is an important rate because it is the basis of the Maastricht criterion for the long-term interest rates that must be respected by the EMU candidate countries.

[47] In the empirical literature on debt overhang, External Debt is generally used as the main explanatory variable. This is due to the fact that this hypothesis has mainly been tested for emerging market or less developed countries where basically external debt is the most important debt component. In this paper instead, we focus on a group of advanced countries. Hence, the most important debt component to consider is represented by general government consolidated gross debt.

[48] It is defined in the Maastricht Treaty as the outstanding consolidated general government gross debt at nominal value at the end of the year. According to ESA2010, it is made up of the following categories of government liabilities: currency and deposits, debt securities and loans.

[49] According to the IMF, it is defined as total expense plus the net acquisition of nonfinancial assets.

[50] Data come from the IMF's WEO database and from Eurostat, respectively.

cut government investments than it is to reduce other expenditure components, such as the wages of civil servants. Large expenditure now might in fact lead to restrictive future fiscal policies and there is strong evidence (see Oxley & Martin, 1991; Roubini & Sachs, 1989; Haan et al., 1996; Keman, 2010) that during periods of fiscal consolidation capital expenditure is often reduced, sometimes in a drastic way.

From an international point of view, the interactions between countries might also play an important role in explaining the flow of public investment. Therefore, in the second group of variables, we consider trade, which is defined as the sum of exports and imports of goods and services (as a percentage of GDP)[51]. In particular, we consider the trade-to-GDP ratio as a proxy for the openness of a specific country. The rationale behind this being that countries that are more open to trade are subject to more foreign competition and consequently need larger public investments in order to compete in international markets (e.g. by offering appropriate public infrastructure) (Sturm, 2001).

In the third group of variables, we consider private investment, gross national disposable income (GNDI) per capita, production expectations and a proxy for the business cycle. For private investment we consider gross fixed capital formation of the private sector[52] at current prices in euro and we divide it by the level of GDP[53]. This variable is taken into account in order to see if there is a potential displacement effect for public gross fixed capital formation; larger investments from the private sector might produce a crowding-in (i.e. an increase) or crowding-out (i.e. a decrease) effect for public investments. In other words, this allows for testing whether private and public investments are substitutes or complements.

The variable GNDI per capita[54] is taken into account in order to measure the 'maturity' of the economy[55]. In a country with low GNDI per capita (such as a less

[51] Data come from the IMF and WDI, respectively.
[52] It includes financial and non-financial corporations, households and non-profit institutions serving households.
[53] Both data are taken from AMECO.
[54] It is defined as "*Gross national income (at market prices) minus current transfers (current taxes on income, wealth etc., social contributions, social benefits and other current transfers) payable to non-resident units, plus current transfers receivable by resident units from the rest of the world*".
[55] Data come from AMECO.

advanced economy), one might expect that the investment needs are larger than those in a more mature economy. However, a priori it is difficult to establish the causal relation between this variable and public investments since it might also be that a less developed economy has a lower demand for infrastructures from its population and therefore investments will be lower.

Next, we compute the following variable in order to proxy the business cycle (Hallerberg & Strauch, 2002):

$$\Delta \log y_{it} - \Delta \log \bar{y}_{it}$$

where Δ is the first-difference operator, y_{it} is the real output and $\bar{y}_{it}$ is the trend output[56]. Basically, this measure represents the deviation of the actual from the trend GDP growth rate. It might also provide information on whether a government uses public investment as counter-cyclical policy tool, in which case we would observe a negative relation between this measure and GFCF.

In order to deepen the discussion about pro-cyclicality, we also take into account a proxy for expectations on the economic outlook. More specifically, we want to consider whether a positive outlook can influence the investment decisions of the government today. If governments increase their public investment efforts when they have a positive view on the future, this would suggest that public investment decisions are generally pro-cyclical. More specifically, we consider production expectations that are computed by the European Commission as the summation between production and selling price expectations for the 3 months ahead[57]. These expectations are evaluated through qualitative surveys and the final values are computed as simple average of the answers to specific questions[58].

Descriptive statistics for all variables in the period studied are displayed in Table 3 below. A detailed descriptive analysis of the two variables which are most essential to examine whether high debt leads to low investment, i.e. public investment and public debt, is provided in Section 4.2. Most control variables show substantial variation. For example, whereas average trade openness (i.e. the sum of imports and exports, expressed as percentage of GDP) is 108.62, it ranges from

[56] Data come from AMECO and they are computed taking 2010 reference levels.
[57] Data are taken from the European Commission.
[58] For more information see European Commission (2017).

37.11 to 438.16. Similarly, the proxy for the business cycle averages -0.04, but reaches a low of -18.85 and goes as high 17.50.

Table 3: Descriptive statistics

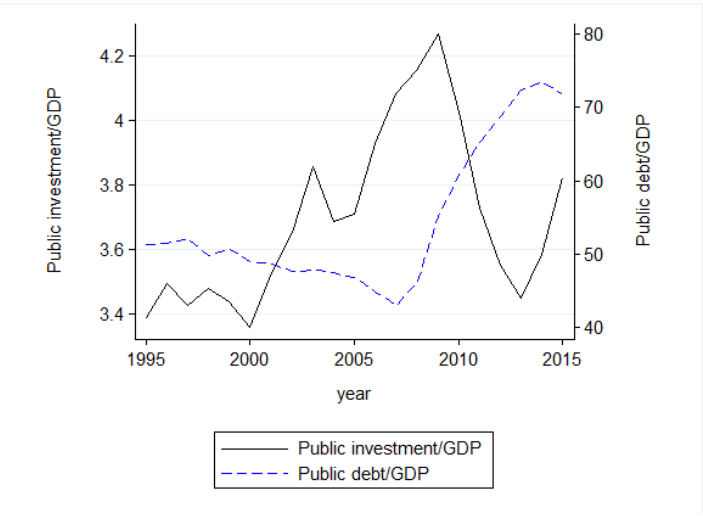
Variable	No. Obs.	Mean	Std. Dev.	Min.	Max.
Public investment	582	3.70	1.10	0.56	7.33
Public debt	574	54.57	31.95	3.70	179.70
GNDI per capita	588	19.61	13.10	0.84	64.04
Business cycle	560	-0.04	2.87	-18.85	17.50
Private investment	582	18.72	3.69	4.73	32.29
Public expenditure	577	44.49	6.84	29.47	65.29
Borrowing rate (LT)	484	4.86	2.32	0.37	22.50
Trade openness	588	108.62	60.54	37.11	438.16
Production expectations	536	8.91	11.28	-24.10	55.43

4.2 Descriptive analysis

The two most important variables that must be considered in order to test the debt overhang hypothesis are (i) public gross fixed capital formation and (ii) general government consolidated gross debt. Appendix 1 contains some descriptive statistics of these variables for each EU country included in our analysis. Public GFCF averaged 3.66% over the period under consideration but is subject to a considerable degree of variation, even within one country. For example, in Hungary public investment hit its peak in 2003 at 7.33% but went as low as 0.56% in 1995. The variability in public debt is even more substantial, averaging 56.24% but reaches 3.70% in Estonia in 2007 and 197.70% in Greece in 2015.

Figure 3 below shows the evolution of public investment (scale represented on the left hand axis) and public debt (scale represented on the right hand axis). As of the start of the GFC in 2007, it indeed appears as if public debt increases, whereas public investment decreases.

Figure 3: Public investment and public debt as a percentage of GDP for 26 EU countries, 1995-2015

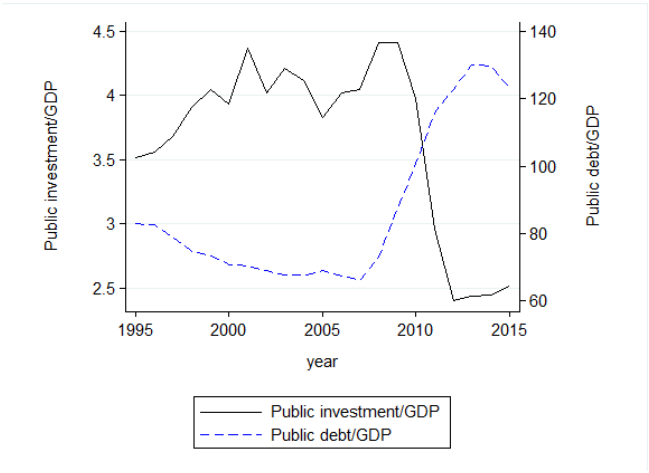


Source: Eurostat (2017)

While average public debt in the EU has increased by 66.67% since 2007 and by 30.43% since the Eurozone Sovereign Debt crisis in 2009, average public investment in the EU has moved in the opposite direction, decreasing by 6.30% since 2007 and by 10.40% since 2009. Another important stylized fact that can be derived from Appendix 2, which shows the individual paths of the public investment-to-GDP ratios for all EU countries, is that average public investment has been quite volatile, especially until 2009.

Figure 4 depicts the situation for the most highly indebted EU countries, the so-called PIIGS: Portugal, Ireland, Italy, Greece and Spain. From this picture, it is even more apparent that public debt and public investment have taken opposite paths since 2008.

Figure 4: Public investment and public debt as a percentage of GDP for the PIIGS, 1995-2015



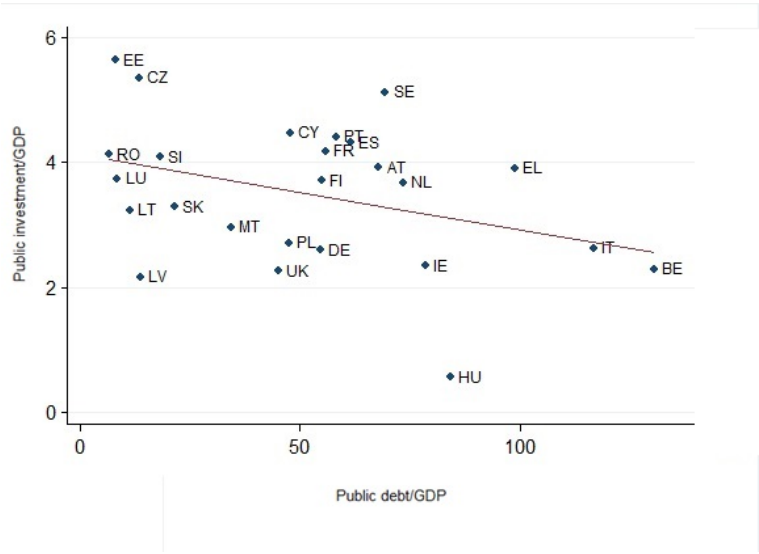
Source: Eurostat (2017)

For these countries the increase in the average debt level and the decrease in the average public investment have been quite extraordinary: public debt rose by 86.52% since 2007 and by 41.09% since 2009 while public investment fell by 37.87% since 2007 and by 42.97% since 2009.

In Appendix 3, we compute the correlation between public debt and public investment. These results demonstrate that the simple correlation between public debts and public investments does not provide much explanatory power. No clear pattern emerges from these correlations.

Finally, in Figure 5, we plot the average public debt and the average public investment (i.e. the country averages) for each country for the period 1995-2015, which again shows a negative link between both variables.

Figure 5: Relationship between the average debt-to-GDP ratio and the average investment-to-GDP ratios for 26 EU countries, 1995-2015



Authors' computation based on Eurostat (2017)

4.3 Model specification: static model

In order to test the debt overhang hypothesis, we start by using a Pooled Ordinary Least Squares (POLS) estimator[59]. The equation that we want to estimate, builds on Checherita-Westphal & Rother (2012) and can be represented as follows:

$$Public\ investment_{it} = \beta Public\ debt_{it-1} + \sum_{c=1}^{4} \gamma_c\ (Controls1)_{it-1}^{c} + \sum_{j=1}^{2} \gamma_j\ (Controls2)_{it}^{j}$$

$$+ \rho Production\ expectations_{it+1} + \varepsilon_{it} \qquad \text{(Eq. 1)}$$

for i = 1, …, 26 EU countries[60] and t = 1995, …, 2015. $Public\ investment$ is the public gross fixed capital formation-to-GDP ratio, $Public\ debt$ the public debt-to-GDP ratio and $Controls1$ is a set of control variables for which we take lagged

[59] We use standard errors clustered at country level, asymptotically robust to both heteroscedasticity and autocorrelation.
[60] Estonia is dropped because of missing data for 10-year government bond yields and Ireland is dropped because of missing data for production expectations.

values and includes the following variables: $Private\ investment$ is private gross fixed capital formation-to-GDP ratio, $Public\ expenditure$ is the public expenditure-to-GDP ratio, $Borrowing\ rate$ is the yield on the 10-year government bond, $Trade\ openness$ is the amount of trade in percentage of GDP. $Controls2$ is a set of control variables for which we look at contemporaneous relation with public investment and includes the following variables: $Income$, which is the logarithm of gross national disposable income per capita and $Business\ cycle$ that represents the business cycle measure. $Production\ expectations\ is$ the proxy for the economic outlook[61] and ε_{it} represents the observation-specific errors (i.e. the disturbance terms). Then we augment this equation adding a year dummy that controls for year fixed effects and captures factors that varies over time but affects all countries (e.g. the effects of the Global Financial Crisis).

A first important issue that must be acknowledged is the reverse causality that can appear in the relationship between public investment and several explanatory variables. Indeed, variables like public debt, private investments and government public expenditure are determined simultaneously with our dependent variable and therefore the causality can also work in the opposite direction. For example, public investment might be a determinant of a larger public debt or of higher public expenditure and this could bias the coefficients of the regression[62]. In order to mitigate this reverse causality problem, we follow Checherita-Westphal & Rother (2012) and take the (1-year) lagged value for the first set of control variables[63]. Next to endogeneity concerns, there is a second reason to take lagged value for our explanatory variables, as discussed in Välilä & Mehrotra (2005): the fiscal authority generally decides the amount of public investment in year t based on information for most variables from year t-1[64]. More specifically, we take 1-

[61] Due to the way this variable is constructed, we take the values for year t+1.
[62] Public investment is usually financed through government debt issuances. Therefore, public investment (which is a flow variable) will not affect *directly* public debt (which is a stock variable) but rather the change in public debt. Hence, there is reverse causality in the sense that public investment is funded through debt issuance and then this translates in a larger stock of debt.
[63] Even if taking lagged values of potentially endogenous variables is not a proper way to tackle reverse causality, this is standard practice in the literature on debt overhang (e.g. Greene & Villanueva, 1991; Cordella, Ricci & Ruiz-Arranz, 2010).
[64] For example, when the government decides to invest a certain amount in the year 2010, information on variables such as trade openness or private investment for that year is not yet available. Hence, if the government incorporates information on these variables in its investment decision, it will be based on data from 2009.

year lagged values for all explanatory variables, except for $Income$, $Business\ cycle$ and $Production\ expectations$.

Results are presented in column 1 of Table 4 below. Subsequently, we estimate Equation 1 adding year dummies. Results are reported in column 2. Next, we include country dummies to account for the existence of unobserved social and economic characteristics that are specific to each country in the sample but that stay broadly constant over time:

$$Public\ investment_{it} = \beta Public\ debt_{it-1} + \sum_{c=1}^{4} \gamma_c\ (Controls1)_{it-1}^{c} + \sum_{j=1}^{2} \gamma_j\ (Controls2)_{it}^{j}$$

$$+ \rho Production\ expectations_{it+1} + v_i + \varepsilon_{it} \qquad \text{(Eq. 2)}$$

with v_i representing the unobserved time invariant country-specific effects. Results are reported in column 3. Finally, we also estimate Equation 2 adding year dummies. Results are reported in column 4. Summary statistics for the subsample used in these regressions are reported in Appendix 4[65].

4.4 Static model: estimation results

The results from our initial analysis support the debt overhang hypothesis in the EU. The coefficient of the debt-to-GDP ratio is negative and significant across every estimation. More specifically, a 1 standard deviation increase in public debt reduces public investment between 0.40 and 0.58 percentage points.

Another interesting result relates to the coefficient of the 10-year government bond yield. As this variable represents the long-term funding cost, it can also be considered as a proxy of a credit rationing effect for a debtor country. The lower is the rating of a specific country (i.e. the higher its riskiness) the higher will be the price that this country needs to pay in the financial markets in order to raise money. Our results provide suggestive evidence for a credit rationing effect in the EU, in particular when country fixed effects and year dummies are taken into account. More specifically, a 1 standard deviation increase in the 10-year

[65] Descriptive statistics for the subsamples used in subsequent regressions do not alter materially. Hence, we do not report them.

government bond yield is associated with a decrease in public investment by 0.14 percentage points.

Table 4: Baseline regression results for 26 EU countries: POLS and fixed effects

Explanatory variables	**(1)**	**(2)**	**(3)**	**(4)**
$Public\ debt_{t-1}$	-0.014*	-0.015**	-0.019***	-0.013*
	(0.007)	(0.007)	(0.006)	(0.006)
$Business\ cycle_t$	0.002	0.052**	0.013	0.060**
	(0.014)	(0.025)	(0.014)	(0.022)
$Income_t$	-0.528**	-0.453**	1.050*	2.222***
	(0.216)	(0.200)	(0.600)	(0.760)
$Private\ investment_{t-1}$	0.030	0.028	0.060***	0.030
	(0.034)	(0.035)	(0.020)	(0.021)
$Public\ expenditure_{t-1}$	0.041	0.043	0.070***	0.066***
	(0.025)	(0.025)	(0.020)	(0.023)
$Borrowing\ rate_{t-1}$	0.016	0.056	-0.020	-0.066**
	(0.030)	(0.036)	(0.033)	(0.028)
$Trade\ openness_{t-1}$	0.001	0.000	-0.006	-0.008
	(0.002)	(0.002)	(0.005)	(0.005)
$Production\ expectations_{t+1}$	0.003	0.010	0.006*	0.013
	(0.009)	(0.016)	(0.003)	(0.008)
Constant	3.478**	2.718	-1.935	-3.676
	(1.343)	(1.712)	(2.276)	(2.698)
N	404	404	404	404
Time FE	NO	YES	NO	YES
Country FE	NO	NO	YES	YES
R^2	0.259	0.310	0.269	0.379

Dependent variable: Public investment. Heteroscedasticity–robust standard errors clustered at country level are in parentheses. *, **, and *** indicate significance at the 10%, 5%, and 1% level respectively. In the POLS, Year FE are significant in 2009 and 2010, in the FE they are significant in 1997, 1999, 2000, from 2002 to 2007 and from 2010 to 2014.

In addition, the coefficient of GNDI is positive and significant in the estimation where country fixed effects are included. This might indicate that more 'mature' countries (i.e. countries with higher GNDI per capita), prefer a larger role for the

government, which results in a higher level of public investments[66]. Regarding public expenditure, we do not find evidence that, between 1995 and 2015, more government expenditure implied a reduction in the level of public investment. In contrast, there is a positive relationship between public expenditure and public investment when country fixed effects are included. Put differently, when government expenditure rose, this was not compensated for by lower public investment. Finally, we also find that the business cycle measure is significant with a positive sign in both specifications with year dummies, providing suggestive evidence for pro-cyclicality of public investment[67].

4.5 Model specification: GMM and dynamic estimation

The estimation described in the previous section presents two important drawbacks. The first one is related to the problem of endogeneity in terms of reverse causality. In the previous paragraphs, we claimed that in order to mitigate the potential reverse causality of some variables we considered their lagged values. Although it is common practise in applied econometrics to replace a suspected endogenous variable with its lagged values (e.g. Green, Malpezzi & Mayo, 2005; Vergara, 2010; Stiebale, 2011), lagging an endogenous variable does not enable one to escape simultaneity bias[68]. These problems are even more pronounced when the potentially endogenous variable is characterised by serial correlation.

In order to solve this problem, we use an instrumental variable approach (GMM). A positive feature of this GMM approach is that it allows to deal with the endogeneity problem we mentioned before. A GMM technique is in fact based on a set of orthogonality restrictions (i.e. the moment conditions) and it finds estimates of the parameters in order to come as close as possible to achieve these orthogonality properties. In particular, we follow Antonakakis (2014) Checherita-Westphal & Rother (2012) and instrument the lagged value of public debt for each

[66] The results are the opposite compared to the estimation which excludes country fixed effects (i.e. the coefficient is significant but with a negative sign), which suggest these country fixed effects have an important role and country-specific factors do matter.
[67] This finding is in line with Guerguil, Mandon & Tapsoba (2017) and Hallerberg & Strauch (2002).
[68] See Reed (2015) for a detailed discussion on why the associated estimates are still distorted by simultaneity bias, and hypothesis testing is invalid.

country through the average of the debt levels of the other countries in the sample[69]. Results are presented in columns 1 (without year dummies) and 2 (with year dummies) of Table 5.

A second important drawback of the previously used estimations, is that they do not capture the potential persistence in the public investment data. It might very well be the case that public investment today is in part determined by public investment in the past. In order to address this shortcoming we use a dynamic estimation, i.e. we include the lagged value of the dependent variable (public investment) in our specification. The addition of the lagged dependent variable as a regressor of the current level of public investment is aimed to capture its path dependence.

However, this addition produces the so-called 'dynamic panel bias' (Nickell, 1981). Since the fixed effects contained in the error term are by construction correlated with the lagged dependent variable, the predictive power belonging to a country's fixed effects might instead be attributed to the lagged dependent variable. In order to overcome this problem, we will use a difference-GMM approach that first transforms all the regressors taking their first differences[70] and then applies a Generalized Method of Moments (see Roodman, 2009). More specifically, we will use the Arellano-Bond estimator with clustered standard errors[71]. Moreover, as we did in our initial estimation (i.e. the POLS and the FE model), we take the lags of most other explanatory as the decision to invest in year t is based on information for most variables from year t-1[72].

Since the difference-GMM generates a large number of instruments and this would weaken the power of the endogeneity's test of the instruments, we follow the approach suggested by Roodman (2009) to limit the number of instruments. In particular, we use a collapsed instruments set based on a limited number of lags of the endogenous variables[73]. According to the difference-in-Sargan test, we can

[69] This can be considered as a good instrument if debt spillovers between EU countries are absent.
[70] All country fixed effects will then be removed since they do not vary over time.
[71] In all the specifications that follow, all control variables except for $Income_t$ and $Production\ expectations_{t+1}$, are considered to be endogenous.
[72] Again, we take 1-year lagged values for all explanatory variables, except for *Income*, *Business cycle* and *Production expectations*.
[73] Conversely, using all available instruments, their number would increase quickly with the time dimension of the panel. Using just a reduced number of instruments, we can also

assume that the instruments used in this estimation can be considered as exogenous[74]. Results are presented in column 3 of Table 5.

4.6 GMM and dynamic model: estimation results

We again find support for the debt overhang hypothesis in all three estimations. A 1 standard deviation increase in public debt results in a decrease in public investment of 0.37 to 0.92 percentage points. Equivalently, if public debt increases by 1 percentage point, public investment decreases by around 1.85 billion euro in the dynamic estimation with year dummies[75].

Moreover, as expected, our results show that public investment in the current year is significantly and positively influenced by GFCF in the previous year. Hence, there is a certain degree of persistence in public investment that should be taken into account and this justifies the use of a dynamic estimation (column 3).

Although the coefficients of the other control variables are not consistently significant across all three estimations, the results suggest that: public investment is rather pro-cyclical; there is a positive relationship between the maturity of an economy (measured by GDNI per capita) and public investment; public investment and private investment act as complements; public expenditure does not crowd out public investment; higher borrowing costs reduce public investment; countries more open to trade have less public investment; and a positive economic outlook is associated with higher public investment.

mitigate the problem related to the fact that too many instruments can create an overfitting for the endogenous variables (Roodman, 2009).

[74] Additional confirmation for the validity of the GMM instruments comes from the serial correlation tests. According to the Arellano-Bond test for autocorrelation, we can reject at a 1% level of significance the null hypothesis of no autocorrelation of order 1 in first differenced-errors and we cannot reject the hypothesis of no autocorrelation of order 2.

[75] According to the literature on dynamic models, we can also compute the long-run effect of public debt on investments applying the following approximation: $\frac{\beta}{1-\delta}$ where $(1-\delta)$ represents the rate of convergence. If debt permanently increases by one percentage point, public investment will be reduced by 0.066 percentage points in the long run.

Table 5: GMM regression results for EU countries

Explanatory variables	(1)	(2)	(3)
$Public\ investment_{t-1}$	-	-	0.544***
			(0.112)
$Public\ debt_{t-1}$	-0.017***	-0.012*	-0.030***
	(0.006)	(0.007)	(0.009)
$Business\ cycle_t$	0.014	0.042**	0.072***
	(0.014)	(0.020)	(0.025)
$Income_t$	0.957*	2.039***	0.693
	(0.528)	(0.724)	(0.494)
$Private\ investment_{t-1}$	0.066***	0.031	0.012
	(0.018)	(0.020)	(0.026)
$Public\ expenditure_{t-1}$	0.057***	0.091***	0.019
	(0.022)	(0.020)	(0.045)
$Borrowing\ rate_{t-1}$	-0.040	-0.091***	-0.033
	(0.028)	(0.029)	(0.049)
$Trade\ openness_{t-1}$	-0.006	-0.007	-0.015***
	(0.005)	(0.005)	(0.006)
$Production\ expectations_{t+1}$	0.007*	0.013*	0.011*
	(0.004)	(0.007)	(0.006)
N	390	390	378
Country FE	YES	YES	-
Time FE	NO	YES	YES
Hansen J (p-value)	0.496	0.444	-
Difference-in-Sargan	-	-	0.362
R^2	0.281	0.376	-

Dependent variable: Public investment. Heteroscedasticity–robust standard errors clustered at country level are in parentheses. *, **, and *** indicate significance at the 10%, 5%, and 1% level respectively. In the second specification, Year FE are positive and significant from 1997 to 2003, in 2008 and 2009; in the third specification, Year FE are negative and significant in 2000 and from 2004 to 2007.

4.6.1 Robustness check: common shock

In this section, we check the robustness of our results to potential bias coming from omitted variables. In particular, we test for the presence of a common shock that could have simultaneously affected both public investment and the regressors described above (i.e. the determinants of public investment), and as a consequence the link between both. Following Erce (2015), we take the CBOE

Volatility Index (VIX)[76], which is generally considered as a barometer of volatility and uncertainty in financial markets, as a proxy for global shocks. As we can see from the results presented in Appendix 4, even if a common shock is taken into account, the negative link between public investment and public debt still exists and is significant.

4.6.2 Extension: high vs. low debt countries

As an additional exercise, we divide the sample into three groups, according to their average debt level over the period 1995 and 2015 (high debt, medium debt, low debt), to test whether the debt overhang effect is stronger in the high debt group. As we can see from Figure 6 below, the patterns of both variables are indeed quite different in the high debt group than in the low debt group. The estimation results are presented in Appendix 5.

These results indicate that the impact of public debt on public investment is indeed stronger for high debt countries than for low debt countries where the coefficient is even positive (but not significant)[77]. For high debt countries, a 1 standard deviation increase in public debt reduces public investment by 0.318 percentage points. Equivalently, for an average country in the high debt group, a 1 percentage point rise in public debt is associated with a decline in public investment of €286 million (given the public investment levels prevalent in 2015). This provides some credence to the claim that excessive debt levels should be avoided and, if necessary, need to be addressed by fiscal consolidation measures.

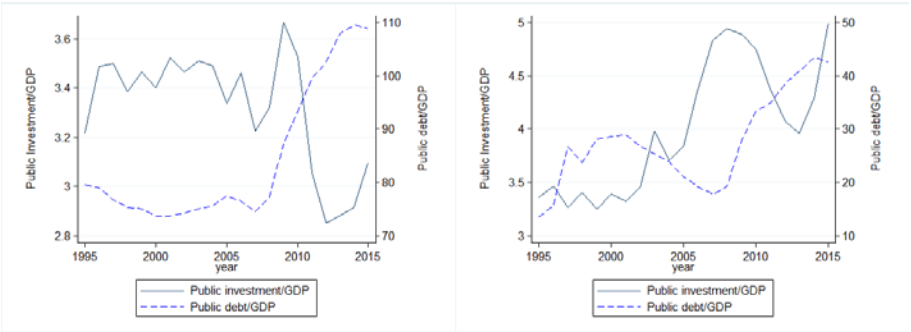
For countries with medium levels of debt, we do not find evidence of a debt overhang effect but only of credit rationing in, which suggests that for this group of countries, the cost of servicing debt is more important, with respect to determining the level of public investment, than the level of public debt is.

[76] This index is computed from the S&P 500 stock index option prices. Data come from Haver Analytics.

[77] To test the robustness of these findings, we included interaction terms between $Public\ debt_{t-1}$ and dummy variables for the different country groups in our main specification. Although the coefficient for the high debt group is negative, it is not significant. In addition, the results of the Wald test do not reject the null hypothesis of equality between the coefficients of the debt variables in the different country groups.

Figure 6: Public investment and public debt as a percentage of GDP for 26 EU countries, 1995-2015

High debt group **Low debt group**



Three other results require further discussion. Firstly, public investment is quite pro-cyclical in countries with large and medium levels of debt. This is not the case for countries with low levels of debt, where production expectations play a more important role. Secondly, the maturity of the economy has a significant (positive) impact on public investment in countries with medium and low levels of debt, not so when countries are characterized by high levels of debt. Thirdly, trade openness of countries with high debt results in more public investment whereas the opposite is true for countries with medium levels of debt.

4.6.3 Extension: pre vs. crisis period

In this section, we want to test whether the sovereign debt crisis had a significant impact on public investment. As shown in Section 2, sovereign debt increased markedly in nearly all EU countries over the period 2009-2015. We study whether the debt overhang effect is more pronounced after the crisis of 2007-2009. In order to do that, we add a crisis dummy for the period 2009-2015 and we again run the dynamic regression.

As can be seen from the results in Appendix 6, public debt still has a negative impact on investment and the crisis dummy is not significant[78]. The most likely reason for this is that there is a lot of heterogeneity with regards to the period that the crisis affected a particular country. Some countries (e.g. Ireland) experienced an early crisis whereas other countries were affected by the crisis later. Moreover, public investment has been characterized by large volatility in a substantial amount of European countries (see Appendix 2)[79] and this makes it difficult to find a specific effect during the years of the crisis over our entire sample.

4.6.4 Extension: threshold effect

In Section 4.6.2, we tested whether the negative impact of debt on investment differed between countries when we group these countries according to their average level of public debt. Put differently, we investigated whether the debt overhang effect is stronger in countries which, on average, have high debt levels than in countries which have low average debt levels. In this section, we test for the presence of a threshold effect in the relation between public debt and public investment. More specifically, we want to see whether public investment is considerably lower if the ratio of public debt-to-GDP ratio exceeds a specific threshold.

In contrast to Section 4.6.2, where we divide our sample into different country-groups according to their average level of debt, in this section, we pool all country-year observations and create a dummy variable $Debt90$ that assumes a value of 1 when the level of public debt exceeds 90% (following Reinhart & Rogoff, 2010) and 0 otherwise. We follow the related literature on this topic (described in Section 3.2.) which generally focuses on the relation between debt and growth, and which

[78] We also tested whether the impact of debt on investment differed in crisis years vs. non-crisis years by interacting $Public\ debt_{t-1}$and the crisis dummy, but we again did not find a significant impact.

[79] We tried all the combinations starting in 2007/2008/2009/2010/2011 and ending in 2012/2013/2014/2015 and also for shorter periods 2007/2008/2009 – 2008/2009/2010/2011 but none of them comes out to be significant.

provides tentative evidence that debt levels larger than a specific threshold indeed reduce economic performance (see Égert (2015) for an overview).

As we can see from the results in Appendix 7, the coefficient of the debt threshold (i.e. $Public\ debt_{t-1}$*$Debt90$) is negative but not significantly different from zero[80]. Moreover, the results of the Wald test do not reject the null hypothesis of equality between the coefficients of the debt variables in the country-years where debt exceeds 90% vs. the country-years where debt does not exceed this threshold. Thus, our results do not provide evidence for the hypothesis that there is one common debt threshold for all countries and across all years, after which economic performance, in this case measured by public investment, is dramatically compromised.

4.6.5 Extension: focus on the EZ

In this section, we focus only on the countries which are part of the **Eurozone** (EZ) in order to see if the adoption of a common currency has had a different impact on the relationship between debt and investment. In other words, we want to see whether the institutional arrangements of the EZ have had a specific impact on how debt-burdened countries allocate resources to public investment. For example, one of the euro convergence criteria stipulates that the annual government budget deficit must not exceed 3%. If a crisis hits, and government revenues fall and/or its expenditures rise, the government might have no other option than to cut spending on public investment, simply to adhere to the deficit requirement. Moreover, since the adoption of a single common currency implies respecting the Maastricht convergence criteria, this can be considered as a way to group countries that are more (economically) similar to each other. Therefore, we focus on the 19 EZ member countries.

According to the regression results (Appendix 8) from the dynamic estimation, we once again find evidence of the **debt overhang** hypothesis. Interestingly, the negative effect of debt on investment is larger[81] in the EU as a whole than in the

[80] We tried also using 60% as a threshold (following the Maastricht's criteria) but this yields similar results.
[81] The average coefficient is 0.0258 for the EZ and 0.0226 for the EU.

Eurozone which might suggest that the institutional framework of the EZ actually does not act as a 'straightjacket' for countries that experience high debt levels. The results for the other variables are in line with our previous analysis.

4.6.6 Extension: stocks vs. flows

In this last section, we test another hypothesis: is it only a matter of the stock of outstanding debt negatively impacting investment or does the flow of debt also play a role? Put differently, does rapid debt accumulation lead to lower investment? In debt sustainability analysis (DSA), the speed at which debt accumulates is an important parameter and is generally evaluated in conjunction with the growth rate of a country and its real interest rate (Guzman & Heymann, 2015). Gabriele, Erce, Athanasopoulou & Rojas (2017) show that considering both stock and flow[82] measures of debt, such as the ratio of gross general government debt-to-GDP and the gross financing needs (GFN), gives a more accurate picture of debt sustainability risks for a specific country.

In order to consider a flow-approach, we add the first difference of the public debt variable in order to see how its change can explain the change in public investment. Since the change in debt cannot be considered as an exogenous variable (because public investment is usually financed through government debt issuances), we instrument the change in debt with the GFN-to-GDP ratio[83,84]. This variable represents the summation of interest expenses, the primary balance and debt maturing in less than one year. Then, we run an instrumental variable approach (GMM) as explained in Section 4.5 using standard errors clustered at country level.

As shown in Appendix 9, the link between the change in public debt and public investment is negative and significant, as expected. A 1 standard deviation increase in the flow of debt produces a 0.157 decrease in public investment. Thus,

[82] They focus on gross financing needs as flow variable that adds up interest payments, principal repayments, and primary deficit.
[83] GFN data for 26 countries (UK and LU are missing) are downloaded from the ECB Data Warehouse.
[84] More specifically, we use its second and third lagged values as instruments. The second and third lagged values of this variable can be considered correlated with the change in debt but uncorrelated with the amount of investment today, which makes it a suitable instrument.

this suggests that both the stock and flow of public debt matter in reducing the public investment. The results for the other determinants are in line with our initial analysis.

5. Conclusions

Identifying the determinants of public investments in EU countries is a topical subject given the downward trend showed by government investments in the past decade. Moreover, the recent sovereign debt crisis that affected the whole EU, but especially the southern European countries, caused public debt to rise significantly in nearly every EU country. We test whether the slump in investment was caused by the increase in public debt.

Surprisingly, the literature on which variables might have an impact on public investment in Europe is rather limited. Our paper furthers this literature, analysing a wide array of potential determinants of public investment and considering nearly the entire European Union. In particular, we focus on the link between public debt and public investment in order to study the debt overhang hypothesis, according to which high public debt results in low public investment. In order to perform this exercise, we tackle the potential issue of reverse causality between debt and investment by using a GMM model, exploiting the instrumental variable approach based on the linear GMM estimator of Arellano & Bond (1991).

The results of our empirical analysis show a significant negative link in the EU between general government consolidated gross debt and gross fixed capital formation[85]. The results of the dynamic GMM estimation, for example, indicate that a 1 standard deviation increase in public debt results in a decrease in public investment of 0.92 percentage points. Equivalently, if public debt increases by one percentage point, public investment is reduces by €1.85 billion, given the level of public investment prevalent in 2015. As our results show that high debt

[85] This paper shows clear evidence that governments are inclined to reduce public investment when debt is high. A possible policy instrument to counter this inclination could be to increase EU funds available for investment in times of crises. See Carnot (2017) for the recent literature on the establishment of a European Stabilization Fund.

can negatively affect public investments, fiscal consolidation measures might be justified from a policy perspective[86].

Two other interesting results can be derived from our analysis. Firstly, it is quite difficult to explain the behaviour of public investment focusing only on macroeconomic variables. The explanatory power of the models used is indeed quite low which might suggest other factors play an important role in driving public investment, such as politics and the electoral cycle. Secondly, we find tentative evidence that the credit rationing channel has a significant impact on public investment. The consequent policy implication might be that a measure focused on debt reduction alone would be less effective than one which includes an additional lending strategy - for example with a 'concessional' interest rate - in order to restore public investments and subsequently growth. Since the evidence is not robust across all the estimations used, the impact of credit rationing warrants further analysis.

In our research, we focus on the average relation between debt an growth. According to part of the related literature (e.g. Eberhardt & Presbitero, 2015; Reinhart et al., 2012), this is potentially misleading. The impact of a high level of debt on growth might in fact be influenced by country-specific characteristics such as past crisis episodes, the institutional framework (Manasse & Roubini, 2009) and debt composition (i.e. short-term versus long-term debt), domestic versus external debt, the currency denomination, (Dell'Erba, Hausmann & Panizza, 2013), etc. Nevertheless, since we focus on countries that are members of the European Union and are hence characterized by a common EU policy - which leaves little room for large differences between countries - we believe that studying the average relation between public investments and public debt is an appropriate approach.

In conclusion, this paper offers an interesting contribution to the literature in various ways. We analyze the debt overhang effect through a broad variety of estimations, incorporating a rich set of explanatory variables. Moreover, we study the link between public debt and public investment using different econometric

[86] This paper does not offer a definitive answer to this discussion as a wide variety of issues needs to be considered, such as the extent to which these measures (i.e. fiscal consolidation) could negatively affect growth in the short-run.

approaches (i.e. (P)OLS, FE and GMM) and comparing high vs. low debt countries, pre vs. post crisis period, EU countries vs. EZ countries and stock vs. flow measures. More specifically, we find that the debt overhang effect (i) is observed only in high debt countries, (ii) is not significantly stronger during and after the crisis (2009-2015), (iii) is slightly less strong inside the EZ than in the entire EU, (iv) there is no threshold effect; and (v) both the flow and stock of debt have a negative effect on investment.

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Appendices

Appendix 1: Country-specific descriptive statistics for the ratio of public debt-to-GDP and public investment-to-GDP

Mean (standard deviation)

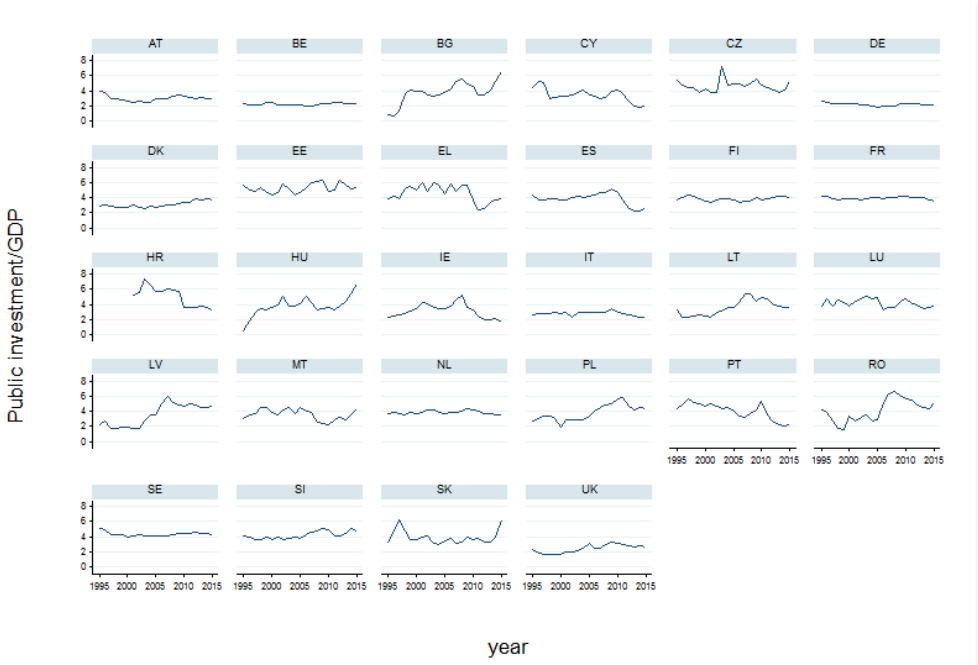
Country	Public debt	Public investment
Austria (AT)	71.78 (8.07)	2.99 (0.38)
Belgium (BE)	105.83 (11.66)	2.24 (0.15)
Bulgaria (BG)	37.79 (26.13)	3.79 (1.46)
Cyprus (CY)	64.18 (18.8)	3.95 (0.94)
Czechia (CZ)	27.86 (11.04)	4.64 (0.81)
Germany (DE)	66.31 (8.27)	2.21 (0.18)
Denmark (DK)	41.96 (6.78)	3.08 (0.37)
Estonia (EE)	6.62 (2.09)	5.27 (0.61)
Greece (EL)	122.86 (31.02)	4.57 (1.08)
Spain (ES)	61.5 (19.43)	3.78 (0.82)
Finland (FI)	46.63 (8.45)	3.82 (0.27)
France (FR)	70.77 (13.51)	3.92 (0.18)
Croatia (HR)	55.09 (19.53)	4.99 (1.33)
Hungary (HU)	67.72 (10.06)	3.80 (1.24)
Ireland (IE)	60.13 (32.78)	3.16 (0.94)
Italy (IT)	111.77 (10.50)	2.78 (0.29)

Appendix 1 (cont.): Country-specific descriptive statistics for the ratio of public debt-to-GDP and public investment-to-GDP

Mean (standard deviation)

Country	Public debt	Public investment
Lithuania (LT)	24.57 (10.24)	3.57 (1.00)
Luxembourg (LU)	12.19 (6.45)	4.17 (0.54)
Latvia (LV)	21.87 (13.90)	3.54 (0.98)
Malta (MT)	61.48 (10.23)	3.54 (0.73)
Netherlands (NL)	58.00 (9.16)	3.85 (0.22)
Poland (PL)	46.09 (5.70)	3.79 (1.06)
Portugal (PT)	78.05 (29.35)	4.00 (1.08)
Romania (RO)	22.71 (10.05)	4.12 (1.46)
Sweden (SE)	49.55 (11.22)	4.36 (0.28)
Slovenia (SI)	35.56 (19.94)	4.20 (0.48)
Slovakia (SK)	40.34 (9.52)	3.93 (0.91)
United Kingdom (UK)	54.32 (20.57)	2.42 (0.53)
European Union (EU)	54.48 (9.86)	3.70 (0.27)

Appendix 2: Public investment-to-GDP ratios for EU28, 1995-2015



Appendix 3: Correlation table

Country	Public investment and public debt
AT	0.26
BE	0.31
BG	-0.58*
CY	-0.72*
CZ	0.01
DE	-0.24
DK	0.01
EE	0.20
EL	-0.70*
ES	-0.88*
FI	0.66*
FR	-0.10
HR	-0.88*
HU	-0.20
IE	-0.77*
IT	-0.66*
LT	0.24
LU	-0.37
LV	0.58*
MT	-0.04
NL	-0.51*
PL	0.75*
PT	-0.83*
RO	0.15
SE	0.40
SI	0.53*
SK	0.05
UK	0.61*
EU	-0.15

* indicates significance at the 5% level

Appendix 4: Regressions results for analysis of a common shock: GMM

Explanatory variables	**(1)**
$Public\ investment_{t-1}$	0.544***
	(0.112)
$Public\ debt_{t-1}$	-0.030***
	(0.009)
$Business\ cycle_{t}$	0.072***
	(0.025)
$Income_{t}$	0.693
	(0.494)
$Private\ investment_{t-1}$	0.012
	(0.026)
$Public\ expenditure_{t-1}$	0.019
	(0.045)
$Borrowing\ rate_{t-1}$	-0.033
	(0.049)
$Trade\ openness_{t-1}$	-0.015***
	(0.006)
$Production\ expectations_{t+1}$	0.011*
	(0.006)
VIX_{t-1}	-0.030*
	(0.017)
N	378
Time FE	YES
Difference-in-Sargan	0.362

Dependent variable: Public investment. Heteroscedasticity–robust standard errors clustered at country level are in parentheses. *, **, and *** indicate significance at the 10%, 5%, and 1% level respectively. Year FE are significant and negative in 2000 and from 2004 to 2011.

Appendix 5: Regressions results for country groups: GMM

Explanatory variables	High debt (1)	Medium debt (2)	Low debt (3)
$Public\ investment_{t-1}$	0.214*	0.678***	0.167
	(0.111)	(0.090)	(0.141)
$Public\ debt_{t-1}$	-0.012**	-0.000	0.019
	(0.006)	(0.008)	(0.013)
$Business\ cycle_t$	-0.514	2.088***	3.174***
	(0.873)	(0.680)	(0.977)
$Income_t$	0.149***	0.085**	0.045
	(0.029)	(0.034)	(0.030)
$Private\ investment_{t-1}$	0.052*	-0.007	0.088**
	(0.028)	(0.046)	(0.039)
$Public\ expenditure_{t-1}$	-0.043	-0.011	-0.010
	(0.036)	(0.040)	(0.048)
$Borrowing\ rate_{t-1}$	-0.057*	-0.163**	0.145**
	(0.033)	(0.076)	(0.073)
$Trade\ openness_{t-1}$	0.017***	-0.009*	-0.007
	(0.007)	(0.005)	(0.010)
$Production\ expectations_{t+1}$	-0.005	-0.008	0.019*
	(0.008)	(0.007)	(0.011)
N	150	133	95
Time FE	YES	YES	YES
Difference-in-Sargan	0.685	0.096	0.408

Dependent variable: Public investment. Heteroscedasticity–robust standard errors clustered at country level are in parentheses. *, **, and *** indicate significance at the 10%, 5%, and 1% level respectively. The thresholds for the debt averages (expressed as percentage of GDP), used to identify the three groups are: 40.3381 and 61.47619. The group of high debt countries includes: AT, BE, CY, DE, EL, FR, HU, IT, PT; the group of medium debt countries includes: DK, FI, ES, HR, MT, NL, PL, SE, UK; the group of low debt countries includes: BG, CZ, , LT, LU, LV, RO, SI, SK. Year FE are negative and significant in the high debt from 1997 to 2008, in 2011 and 2014; in medium debt group they are positive and significant in from 1996 to 1999, from 2001 to 2003, in 2005 and 2009; in the low debt group they are never significant.

Appendix 6: Regressions results for analysis of the impact of the crisis: GMM

Explanatory variables	**(1)**
$Public\ investment_{t-1}$	0.545***
	(0.127)
$Public\ debt_{t-1}$	-0.014*
	(0.008)
$Business\ cycle_t$	0.009
	(0.023)
$Income_t$	0.178
	(0.420)
$Private\ investment_{t-1}$	0.034
	(0.028)
$Public\ expenditure_{t-1}$	0.003
	(0.047)
$Borrowing\ rate_{t-1}$	-0.049
	(0.039)
$Trade\ openness_{t-1}$	-0.002
	(0.004)
$Production\ expectations_{t+1}$	0.008*
	(0.004)
$Crisis$	0.076
	(0.220)
N	378
Difference-in-Sargan	0.516

Dependent variable: Public investment. Heteroscedasticity–robust standard errors clustered at country level are in parentheses. *, **, and *** indicate significance at the 10%, 5%, and 1% level respectively.

Appendix 7: Regressions results for analysis of a debt treshold: GMM

Explanatory variables	**(1)**
$Public\ investment_{t-1}$	0.476***
	(0.102)
$Public\ debt_{t-1}$	-0.021**
	(0.010)
$Business\ cycle_{t}$	0.070***
	(0.023)
$Income_{t}$	0.733
	(0.470)
$Private\ investment_{t-1}$	0.039
	(0.027)
$Public\ expenditure_{t-1}$	0.038
	(0.039)
$Borrowing\ rate_{t-1}$	-0.019
	(0.041)
$Trade\ openness_{t-1}$	-0.015**
	(0.006)
$Production\ expectations_{t+1}$	0.008
	(0.006)
$Public\ debt_{t-1} * Debt90$	-0.016
	(0.011)
N	378
Time FE	YES
Difference-in-Sargan	0.311

Dependent variable: Public investment. Heteroscedasticity–robust standard errors clustered at country level are in parentheses. *, **, and *** indicate significance at the 10%, 5%, and 1% level respectively. Year FE are significant and negative in 1999, 2000, from 2003 to 2008 and from 2010 to 2012.

Appendix 8: Regressions results for the EZ countries: GMM

Explanatory variables	**(1)**
$Public\ investment_{t-1}$	0.543***
	(0.112)
$Public\ debt_{t-1}$	-0.018**
	(0.007)
$Business\ cycle_t$	0.038**
	(0.019)
$Income_t$	1.543***
	(0.520)
$Private\ investment_{t-1}$	0.001
	(0.022)
$Public\ expenditure_{t-1}$	-0.038
	(0.041)
$Borrowing\ rate_{t-1}$	0.005
	(0.039)
$Trade\ openness_{t-1}$	-0.008**
	(0.004)
$Production\ expectations_{t+1}$	0.013**
	(0.006)
N	269
Time FE	YES
Difference-in-Sargan	0.101

Dependent variable: Public investment. Heteroscedasticity–robust standard errors clustered at country level are in parentheses. *, **, and *** indicate significance at the 10%, 5%, and 1% level respectively. Year FE are significant and negative starting from 1999 to 2008 and from 2010 to 2012.

Appendix 9: Regressions results for analysis of the impact of stocks vs. flows: GMM

Explanatory variables	**(1)**
$\Delta Public\ debt_{t-1}$	-0.029*
	(0.017)
$Public\ debt_{t-1}$	-0.018**
	(0.007)
$Busines\ cycle_t$	0.009
	(0.013)
$Income_t$	1.896***
	(0.630)
$Private\ investment_{t-1}$	0.050*
	(0.026)
$Public\ expenditure_{t-1}$	0.077***
	(0.024)
$Borrowing\ rate_{t-1}$	0.002
	(0.029)
$Trade\ openness_{t-1}$	-0.011*
	(0.006)
$Production\ expectations_{t+1}$	0.009**
	(0.003)
N	314
R^2	0.314
Country FE	YES
Hansen J (p-value)	0.98

Dependent variable: Public investment. Heteroscedasticity–robust standard errors clustered at country level are in parentheses. *, **, and *** indicate significance at the 10%, 5%, and 1% level respectively.

CHAPTER 4

Debt and private investment

Does the EU suffer from a debt overhang?

This chapter is under review as:

Vanlaer, W., Picarelli, M., & Marneffe, W. (XXXX). Debt and private investment - does the EU suffer from a debt overhang?. The World Economy.

ABSTRACT

In the aftermath of the Global Financial Crisis, the decline in public investment has been researched extensively by scholars. However, the substantial drop in private investment has rarely been studied. Moreover, this decline in private investment has been matched by an increase in debt, both public and private. This paper exploits a panel dataset for 28 EU countries over the period 1995-2016 to examine whether the EU suffers from a debt overhang, in which higher debt results in lower private investment. We use different econometric techniques to test our hypothesis, such as a fixed effects model and an instrumental variable approach based on the linear GMM estimator of Arellano & Bond. The latter deals with the potential endogeneity between private investment and debt. Our results do not indicate that an increase in private debt unambiguously results in lower private investment. However, we do find that an increase in public debt results in decreased private investment. A rise in general government debt of 1 standard deviation point brings about a reduction in private investment of 3.96 percentage points. Equivalently, if public debt in the EU would be 10 percentage points lower, private investment would rise by €65 billion. Moreover, this effect is more profound in countries with high levels of public debt.

Keywords

Debt Overhang, Global Financial Crisis, Dynamic Panel Data, Difference GMM

1. Introduction

Since the Global Financial Crisis (GFC), public investment in the European Union (EU) has dropped significantly. However, there is surprisingly little research on the precise drivers of this decline in public investment. In a recent paper, Picarelli, Vanlaer & Marneffe (2018) find that the increase in public debt that accompanied the GFC has played a significant role in the decrease in public investment. This is similar to the findings of Heinemann (2006), Bacchiocchi, Borghi & Missale (2011) and Checherita-Westphal & Rother (2012).

Policymakers have acknowledged the drop in public investment since the GFC and realize that considerable efforts are required to overcome this investment gap (e.g. Juncker, 2015). Less recognized is the steep decline in *private* investment over the past decade. Moreover, there is scant research on what has driven the post-crisis drop in private investment. EIB (2013), for example, reported that the most critical factor driving this decline, was uncertainty about the world economy after the GFC. Until this uncertainty dissipated, investors took a 'wait-and-see' approach and delayed large investments.

Nevertheless, it is important to have a sufficient level of private investment for a variety of reasons. Investment in R&D results in technological progress which in turn yiels productivity increases. As Krugman (1994) notes: "*Productivity isn't everything, but, in the long run, it is almost everything. A country's ability to improve its standard of living over time depends almost entirely on its ability to raise its output per worker*". In addition, a sufficient level of private investment is helpful in reallocating resources from less productive sectors to more productive ones[87]. Moreover, private investment is a relatively large share of GDP. Hence, large drops in investment result in lower, or even negative GDP growth. Furthermore, if capital sits idle on companies' balance sheet, as they choose not to invest for any reason whatsoever, this reduces social welfare as that money could be put to better use. Finally, from a policy perspective, high levels of investments in targeted sectors (e.g. renewable energy, artificial intelligence) are

[87] Recent research has shown that high levels of private leverage in fact do the opposite: credit booms tend to undermine productivity growth by inducing labour reallocations towards lower productivity growth sectors (Borio, Kharroubi, Upper & Zampolli, 2016).

required to ensure EU competitiveness in those areas with the ultimate goal of sustaining high income levels (EIB, 2017).

While public investment in the EU was more or less stable at slightly over 3% of GDP for 10 years, starting in 1995, it began to increase after 2005 to close to 4% in 2009[88]. Then, the crisis forced government to cut spending and they did so by saving on investment in gross fixed capital formation (GFCF): public investment dropped to nearly 2.5% in 2015 and remains flat or is even declining in a number of countries. This EU average masks vast differences between countries. The euro periphery has seen the largest drop in public investment. Between 2010 and 2016, the decline in public investment amounted to 13.5% in Greece, 24.6% in Italy, 50.4% in Spain and 65.3% in Portugal.

The evolution of private investment is more cyclical; it started at around 18% in 1995, peaked at the top of the dot.com bubble, after which it dropped back to the level of 1995. Next, private investment started to boom reaching 20% in 2007. The GFC also had a significant impact on private investment, as it dropped to 17% in 2008[89]. This decline partly reflected a swift adjustment of the capital stock succeeding the investment boom (especially in construction) before the Global Financial Crisis. Private investment recovered somewhat in recent years but is not yet back to pre-crisis levels.

This paper aims to further the literature on what has driven the collapse in private investment, particularly focusing on the potential detrimental impact of debt, both private and public, on investment. This so-called debt overhang hypothesis was first identified by Myers (1977) and pertains to the negative impact of excessive corporate debt on corporate investment: companies with high debt levels have little incentive to invest, because the returns on the investment mostly, if not all, accrue to the debt holders, and not the owners of the company[90]. Next to this incentive channel, there are two other mechanisms through which high corporate debt might be an impediment to investment. Firstly, ceteris paribus, companies with a higher debt load also have higher debt servicing costs, which simply leaves

[88] All the data discussed in this section are extracted from AMECO, the macro-economic database from the European Commission.
[89] For a more elaborate discussion of the evolution of private investment, see Section 2.
[90] For a detailed, numerical illustration of how a debt overhang impacts corporate investment, see Appendix 1.

less funds available for investment (e.g. Maki, 2002). Secondly, companies with high levels of debt are generally perceived to be more risky (Merton, 1974) and the resulting increase in risk premium generates a higher bond yield. Hence, the cost of capital for a project increases, which results in a lower number of projects for which the expected return is higher than the cost of funding it. Due to this decrease in profitable investment opportunities, companies will invest less.

Although business investment is the largest component of private investment, investment by households is non negligible[91]. Thus, we include the household sector in our analysis. Indebted households will try to deleverage and cut back on consumption, which results in decreased demand for a company's products. Hence, they will not invest in additional production capacity. Moreover, households that struggle to make ends meet, will not invest in housing, which is the largest component of household investment (Benjamin, Chinloy & Jud, 2004). In addition, highly leveraged households are vulnerable to interest rate shocks; if their cost of borrowing increases, this will reduce consumption and investment more than households with limited leverage. Finally, if these highly indebted households default on their mortgage *en masse*, the banks which have lent to them potentially get into trouble. Subsequently, they are less willing to supply credit, even to viable borrowers, which also hurts investment (Aiyar, Bergthaler, Garrido, Ilyina, Kang, Kovtun & Moretti, 2017).

High levels of *public* debt might also negatively impact private investment and this relationship can work through a variety of channels (Majumder, 2007; Traum & Yang, 2015). Firstly, if the pool of loanable funds is limited, the public and private sector compete for scarce resources when they tap the financial market to issue bonds. As the government increases its borrowing, this leaves fewer funds available for the private sector, which pushes up their borrowing costs, resulting in lower private investment. Secondly, if the government increases its debt and borrows money to produce goods and services that compete with the goods and services produced by the private sector, this erodes private sector confidence and private investment is lower as a result. Finally, high levels of public debt can lead

[91] In 2015 for example, private GFCF in the EU28 was 17.2% of GDP, of which 12% was business investment and 5.2% was household investment.

to doubts about the fiscal sustainability of country. In anticipation of future increases in taxes, households and companies will consume and invest less.

We study whether the EU suffers from a debt overhang, in which high debt results in low private investment, exploiting a panel dataset of 28 EU countries over the period 1995-2016. All data are extracted from AMECO, Eurostat or the World Bank. Moreover, we analyze whether this debt overhang effect is stronger in high debt than in low debt countries. In addition, we control for two important drivers of private investment related to credit supply. First, we study whether bailouts of financial institutions have resulted in a decrease in private investment. Second, we control for the role of non-performing loans (NPLs) on banks' balance sheets. We use different econometric techniques to test our hypothesis, such as a FE model and an instrumental variable approach (GMM); the latter helps in dealing with the potential endogeneity between private investment and private debt.

The paper proceeds as follows: Section 2 describes some trends in private investment. In Section 3, we provide a review of the literature and in Section 4 we describe the data. Sections 5 – 7 contain the econometric approach, the main results and several extensions. Finally, Section 8 concludes.

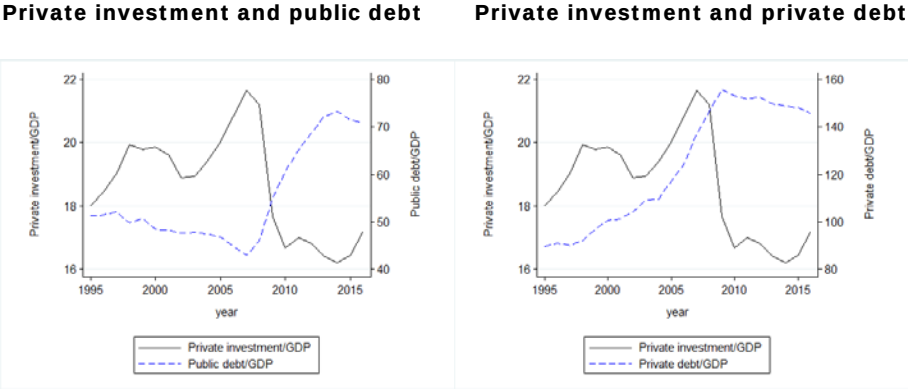
2. Trends in private investment

As we can see from Figure 1 below, private investment in the EU has fallen significantly since the eruption of the sovereign debt crisis in 2008 and currently is still below the pre-crisis levels. The decline in private investment between 2008 and 2016 is around 18.8% and was even somewhat mitigated by the rebound of private investment in 2016. See Appendix 2 for the country-specific paths. This graph shows that there is quite some persistence in private investment. Moreover, this figure illustrates that a significant number of countries experienced a drop in private investment around the time of the Global Financial Crisis.

Since the focus of this paper is on the debt overhang hypothesis, we plot private investment and different debt measures in the same chart. Of course, this will not provide us with a definitive answer on whether an increase in debt causes investment to decrease, but it does yield a first impression of how debt and

investment have evolved over time. Figure 1 shows that private investment has in general been low during period of high debt levels. The left side chart of Figure 1 shows that public debt has increased vastly (around 53.7%) between 2008 and 2016. The picture is more mixed when private debt is taken into account (right side chart of Figure 1). The two variables move together between 1995 and 2006, plausibly because private debt can be considered as the source of funding for private companies' investment. When the Global Financial Crisis erupted however, private debt remained quite stable at high level whereas private investment has dropped significantly.

Figure 1: Private investment and debt as a percentage of GDP for the EU28, 1995-2016



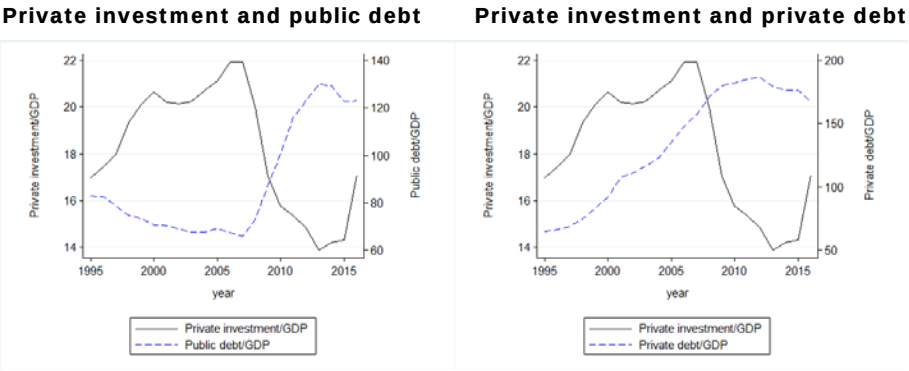
Source: AMECO

As we can see from Figure 2, the picture is almost the same for the group of most indebted countries (PIIGS[92]) as it is for the whole European Union. For these countries, the drop in private investment has been slightly lower (around 14.4%), mainly thanks to the large increase by 2.5 percentage points of private investment observed between 2015 and 2016. Average public debt in the PIIGS instead

[92] The countries which are included in this group are Portugal, Ireland, Italy, Greece and Spain or PIIGS.

increased by 40% between 2008 and 2016 whereas private debt was reduced by 2.4% as the private sector succeeded to some extent in deleveraging.

Figure 2: Private investment and debt as a percentage of GDP for the PIIGS, 1995-2016



Source: AMECO

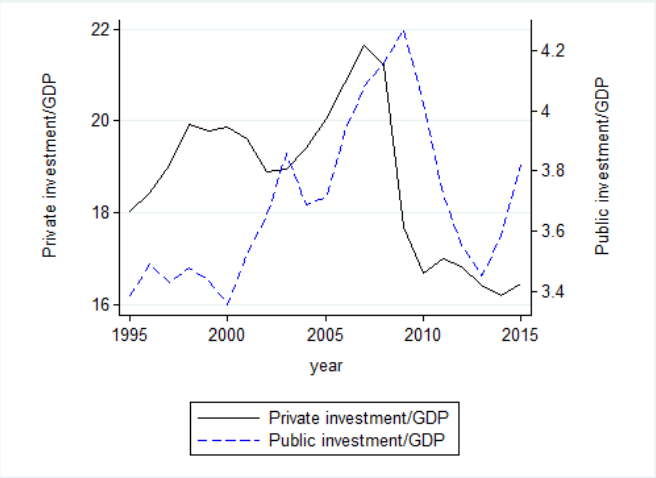
Computing the correlations between private debt and private investment for each individual country yields no clear picture on whether both always move in the opposite direction[93], as can be seen from Appendix 3; for some countries the correlation is positive and significant whereas for other countries, there is a negative and significant correlation between private debt and private investment. This is likely due to the fact that private debt is often used as a source of funding for private investment. The second column of Appendix 3 instead shows that the correlation between public debt and private investment is almost always negative and significant and quite strong.

Figure 3 shows the link between private and public investment. Both variables move together until the eruption of the GFC in 2007. Then private investment collapsed whereas the reduction of public investment occurred only a couple of years later. Public investment also experienced a significant uptick between 2014

[93] Again, we do not attempt to prove or reject the debt overhang hypothesis by looking at simple correlations; we use it as a tool to get a rudimentary idea of whether the evolution of debt is somewhat akin to that of investment.

and 2015 whereas private investment has stayed at a subdued level since 2010. This suggests a potential complementarity between private and public sector investment spending: the public sector tries to compensate the low level of private investment by keeping its investment spending at a relatively high level. However, over the entire period, it is quite difficult to identify a common link between public and private investment from studying their simple correlation (see column 3 of Appendix 3).

Figure 3: Paths of private and public investment

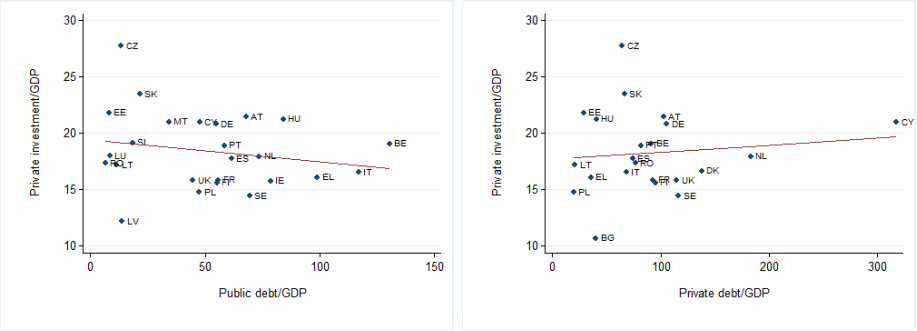


Source: AMECO

Finally, in Figure 4, we plot the average public debt and the average public investment (i.e. the country averages) for each country for the period 1995-2016, which again shows a negative link between public and private investment, but, rather surprisingly, a positive link between private debt and private investment.

Figure 4: Relationship between the average debt-to-GDP ratio and the average investment-to-GDP ratios for EU28 over the period 1995-2016

Private investment and public debt **Private investment and private debt**



Source: AMECO

3. Literature review

This section provides an overview of the relevant literature on testing the debt overhang hypothesis in Europe. First, we discuss those papers that analyze the link between corporate debt and corporate investment, which is the general focus of the literature, and subsequently we examine the research on the potential negative effects of high levels of household debt. Finally, we elaborate on the potential relationship between high levels of public debt and low levels of private investment.

Surprisingly, relatively few studies perform an empirical analysis of how high corporate debt impacts corporate investment decisions, notwithstanding the fact that this mechanism was already identified in 1977[94]. In addition, all studies focus on one country or on a limited group of countries[95]. Kalemli-Özcan, Laeven & Moreno (2015) find a negative link between corporate indebtedness and investment that was already prevalent before the GFC, but got even stronger

[94] The debt overhang hypothesis has been tested mainly for developing economies and generally with regards to the potential negative effect of debt on economic growth. For example, Sen, Kasibhatla & Stewart (2007) find that for a sample of Latin American borrowers over the period 1970–2000, debt severely impeded economic growth.
[95] This does allow for employing firm-level data (which are not available on an EU-wide scale).

during the crisis. Similarly, Lawless, O'Connell & O'Toole (2015) show that outstanding debt in Ireland impacts a broad array of firm performance indicators, such as investment and employment. Aivaziana, Ying & Jiaping (2005) establish that high levels of debt are negatively related to investment in Canada and this effect is particularly strong for companies with low growth opportunities. Focusing on five peripheral euro area countries, Gebauer, Setzer & Westphal (2017) find a non-linearity (a leverage ratio of 80-85%) after which debt exerts a negative impact on investment.

Jarmuzek & Rozenov (2017) add to this literature by proposing a methodology to quantify excessive debt - in the corporate sector - beyond using simple thresholds. Put differently, they try to determine when debt is excessive, as 'debt overhang' is a concept which is used rather loosely in the literature. More specifically, the authors identify four groups of variables that are potential candidates for explaining the differences in excessive debt, which is measured by the difference between actual and sustainable debt, and subsequently conduct a dynamic multivariate regression analysis to consider simultaneously various variables that are likely to be correlated with private sector borrowing.

The negative effect of high levels of household debt has only recently been studied and generally with regards to its impact on household expenditure and subsequently on economic growth. Mian & Sufi (2015) argue persuasively that the GFC, as well as the slow recovery from it, was caused by a substantial run-up in household debt followed by a significantly large drop in household spending. Similarly, Brown & Lane (2011) find that mortgage debt, which is the largest portion of household debt, has had significant adverse impact on household consumption and investment in Emerging Europe during the crisis. In addition, Dynan, Mian & Pence (2012), using household-level data, find that households which were highly leveraged cut back more on spending than less severely leveraged households during the GFC in the United States. Moreover, Intartaglia, Antoniades & Bhattacharyya (2017) employ a variety of econometric approaches to show that, although household debt can be expansionary in developing countries, it generally is contractionary in developed economies. Little to no research however has been performed on the negative impact of household debt on private investment in general and household investment in particular.

The research on whether elevated levels of public debt indeed lead to a decrease in private investment is rather limited. However, the empirical evidence does point in that direction. Chhibber, Van Wijnbergen & Mundial (1988) find that for Turkey high levels of debt slowed down private investment due to an increase in the real rate of interest, as large budget deficits were mainly financed by domestic borrowing. Similarly, Huang, Pagano & Panizza (2016) discover that local public debt issuance in China between 2006 and 2013 crowded out investment by private manufacturing firms through tightening their funding constraints. Follow up research by Huang, Panizza & Varghese (2018), using industry-level regressions, shows that there is a negative correlation between public debt and corporate investment, which is particularly strong for companies that need more external borrowing.

In summary, a large strand of the literature on private debt overhang looks at the impact of high corporate debt on the investment decisions of firms. We take a wider perspective and analyze how total debt levels in the public and the private sector (excluding financial institutions[96]) impact the propensity of households and firms to invest. To the best of our knowledge, no research has yet been performed on the potential detrimental effect of high levels of sovereign, household *and* corporate debt on total private investment. Moreover, we add to the scarce literature on the potential crowding out of private investment by high levels of public debt through studying whether the decline in private investment after the crisis might be caused by elevated levels of public debt rather than private debt.

4. Data description

As discussed above, the goal of this paper is to test the debt overhang hypothesis in which high public and/or private debt results in low private investment, using a dataset of 28 EU countries for the period 1995-2016. For private debt we focus

[96] Including the financial sector into this analysis would lead to double counting of several debt instruments as financial institutions often lend to each other and some debt is rebundled in financial assets (e.g. asset-backed securities are simply repackaged whole loans). For an overview of papers which do focus on excessive indebtedness in the financial sector, see e.g. Acharya, Drechsler & Schnabl (2012) and Philippon & Schnabl (2013).

on the private sector consolidated debt[97]-to-GDP ratio[98] whereas for public debt[99] we consider general government[100] consolidated gross debt[101] in percentage of GDP. Table 1 below provides a description of the variables in our dataset.

Table 1: Variables description

Variable name	Description
Private debt	Private debt, in percentage of GDP
Public debt	General consolidated government gross debt, in percentage of GDP
Private investment	Private gross fixed capital formation in percentage of GDP
Public investment	Government gross fixed capital formation in percentage of GDP
Borrowing rate (LT)	Sovereign long-term nominal interest rate
Business cycle	Deviation of the actual from the trend GDP growth rate
Trade openness	Summation of export and import divided by GDP

Our dependent variable is private investment[102] that is defined as gross fixed capital formation (GFCF) for the private sector at current prices. More specifically, we consider this variable in percentage of GDP in order to overcome differences deriving from countries' welfare level. We follow Eurostat and define private GFCF as "*resident producers' acquisitions, less disposals, of fixed assets during a given period plus certain additions to the value of non-produced assets realised by the productive activity of producer or institutional units*", as is standard in the

[97] According to Eurostat, it is defined as the stock of liabilities held by non-financial corporations, households and non-profit institutions serving households. The variables taken into account to define the private debt level are debt securities and loans and these are consolidated in the sense that transactions within the same sector are not taken into account.
[98] Both data are taken from Eurostat.
[99] Data come from AMECO.
[100] According to Eurostat, the general government sector includes the central government, state governments, local governments, and social security funds.
[101] It is defined in the Maastricht Treaty as the outstanding consolidated general government gross debt at nominal value at the end of the year. According to ESA2010, it is made up of the following categories of government liabilities: currency and deposits, debt securities and loans.
[102] Data come from AMECO.

literature (e.g. Cordella, Ricci & Ruiz-Arranz, 2004; Checherita-Westphal & Rother, 2012).

The decision to invest, both by firms and households, is of course influenced by the cost of funding this investment. To capture this effect, we take the sovereign long-term borrowing rate[103] which can also be considered as a proxy for the cost of funding for private companies. As the sovereign is perceived as the most creditworthy borrower in an economy, its bond yields act as a 'floor' below which private sector borrowing costs cannot fall. Consequently, higher borrowing rates for the sovereign also increase the cost of funding for private companies. Increased funding costs in turn result in a lower amount of investment that will be undertaken (e.g. Hambur & La Cava, 2018). Taking this variable into account also allows us to compare a debt overhang with a credit rationing effect (as in Picarelli, Vanlaer & Marneffe, 2018), i.e. it grants us the possibility to answer the question: does the stock of public and/or private debt matter most for private investment or does the cost of funding play a more important role? Put differently, it allows us to test whether high debt directly impacts private investment (i.e. through a debt overhang effect) or whether it does so indirectly, through in an increase in borrowing costs (i.e. through a credit rationing effect).

As explained in the introduction, public investment[104] might be another important determinant of private investment spending because of its potential complementarity or substitutability (Checherita-Whestphal & Rother, 2012). For example, public investment in infrastructure is widely believed to exert a positive impact on private investment, hence acting as compliment to private GFCF (Erden & Holcombe, 2005). However, public investment can also exert a negative impact in private investment when the private sector alters it investment plans in anticipation of higher taxes due to increased public expenditure or when

[103] It represents the central government long-term bond yield. Data come from AMECO.
[104] Public investment is defined as gross fixed capital formation for the general government at current prices divided by the GDP. Data comes from Eurostat, which defines GFCF as resident producers' investments, less disposals, of fixed assets plus the additions to the value of non-produced assets deriving from the productive activity of private producers. Fixed assets are considered as the produced assets used continuously in the production processes for more than one year. They do not include inventory investment (that might introduce a large degree of volatility), the ownership of companies and public-private partnerships projects (PPPs).

government spending drives up borrowing costs by competing for scarce funds with the private sector (Apergis, 2000).

Following Cordella et al. (2004), we consider trade openness as another potential determinant of private investment. It might indeed be the case that a country more open to international trade has a higher level of private investment. For example, through the implementation of free trade agreements a number of developing countries have been able to attract greater flows of foreign direct investment (Liargovas & Skandalis, 2012). Moreover, openness to trade might also stimulate investment by encouraging competition in domestic and international markets and generating higher returns on investment through economies of scale (Kim, Lin & Suen, 2013). We consider the summation of export and import[105] divided by GDP as a proxy for trade openness, as is standard in the literature (e.g. Checherita-Whestphal & Rother, 2012).

Finally, in order to take into account the business cycle, we compute the following proxy (Hallerberg & Strauch, 2002):

$$\Delta \log y_{it} - \Delta \log \bar{y}_{it}$$

where Δ represents the first difference operator, y_{it} and $\bar{y}_{it}$ represent respectively the real and the trend output[106]. Basically, this measure represents the deviation of the actual from the trend GDP growth rate. This variable might give some information about the pro-cyclicality of private investment. For example, in case of a negative relation between the business cycle and private investment, we might sustain the counter-cyclicality of private investment. However, we expect private investment to show a significant degree of pro-cyclicality; in the upswing of the business cycle, aggregate income increases and companies will see a higher demand for their product, which results in higher profit expectations and elevated levels of investment to meet the increase in demand for products that accompany higher incomes (Gordon, 1955).

Descriptive statistics for all variables for the period under consideration are displayed in Table 2. Appendix 4 shows the country-specific descriptive statistics for private debt, public debt and private investment over the period 1995-2016.

[105] Data for import and export come from AMECO.
[106] Data come from AMECO and they are computed taking 2010 reference levels.

We briefly discuss those variables which are most relevant for our analysis, i.e. debt and investment. Private GFCF averaged 18.64% over the period under consideration, but is subject to a substantial degree of variation. Private investment reached its zenith in Slovakia in 1998 at 32.29% whilst its nadir was 4.73% in Bulgaria in 1996. The variability in private debt is even more striking. Whereas private debt has an average of 125.39%, Bulgaria only had a private debt level of 10,00% in 1997 but Cyprus had private debt of over 352,50% in 2015. Public debt has a rather similar dispersion. It averages 55.20% in our sample but goes as low as 3.66% in Estonia in 2007 and as high as 180,85% in Greece in 2016.

Table 2: Descriptive statistics

Variable	No. Obs.	Mean	Std. Dev.	Min.	Max.
Private investment	610	18.64	3.70	4.73	32.29
Private debt	548	124.35	68.63	10.00	353.50
Public debt	575	54.47	31.90	3.66	178.96
Public investment	582	3.70	1.01	0.56	7.33
Borrowing rate (LT)	506	5.00	2.41	0.37	22.50
Business cycle	583	-0.013	2.81	-18.85	17.50
Trade openness	582	1.09	0.60	0.37	4.10

5. Econometric approach I: FE model

The equation that we want to estimate, builds on Checherita-Westphal & Rother (2012) and can be represented as follows:

$$Private\ investment_{it} = \beta Private\ debt_{it-1} + \theta Public\ \ debt_{it-1} + \sum_{c=1}^{3} \gamma_c\ (Controls)_{it-1}^{c}$$

$$+ \delta Business\ cycle_t + v_i + \varepsilon_{it} \qquad \text{(Eq. 1)}$$

for i = 1, ..., 28 EU countries and t = 1995, …, 2016. $Private\ investment$ is the private gross fixed capital formation-to-GDP ratio, $Private\ debt$ represents the private debt-to-GDP ratio, $Public\ debt$ is the public debt-to-GDP ratio, $Controls$ is

a set of control variables that includes the public investment-to-GDP ratio, the long-term nominal interest rate and the degree of trade openness. We also include a proxy for the business cycle. ε_{it} is the observation-specific error (i.e. the disturbance terms) and v_i the unobserved time invariant country-specific effect. More specifically, we use standard errors clustered at country level, asymptotically robust to both heteroscedasticity and autocorrelation. Then we augment this equation adding year dummies that control for year fixed effects and capture factors that vary over time but affect all countries (such as the effects of the Global Financial Crisis).

Following the literature (e.g. Checherita-Westphal & Rother, 2012; Picarelli, Vanlaer & Marneffe, 2018), most variables in this equation are taken into account with a lag as there is usually a delay between when an investment decision is approved and when it is actually implemented. Put differently, investment decisions in year t are generally based on information from year t-1. More specifically, we take 1-year lagged values for all explanatory variables, except for the variable that captures the business cycle. Summary statistics for the subsample used in these regressions are reported in Appendix 5[107].

5.1 Econometric approach I: FE results

As we can see from Table 4 below, we find evidence of a debt overhang for the EU countries. However, the debt overhang hypothesis works only through the *public* debt channel; private debt is never a significant determinant of private investment. The coefficient of this variable is indeed negative, quite large and always highly significant. According to these results, a 1 standard deviation increase in public debt produces an average reduction in private investment between 2.19 and 3.12 percentage points.

Moreover, we find that the long-term interest rate coefficient is always highly significant and negative. An increase in borrowing costs of 1 standard deviation brings about a reduction in private investment of between 0.54 and 0.99

[107] Descriptive statistics for the subsamples used in subsequent regressions do not alter materially. Hence, we do not report them.

percentage points. This might suggest an important role for the credit rationing effect, similarly to what was found in Picarelli, Vanlaer & Marneffe (2018).

Table 4: Baseline regression results for the EU countries: fixed effects

Explanatory variables	**(1)**	**(2)**	**(3)**
$Private\ debt_{t-1}$	-0.010	0.002	0.005
	(0.006)	(0.008)	(0.009)
$Public\ debt_{t-1}$	-0.103***	-0.085***	-0.068***
	(0.013)	(0.013)	(0.014)
$Public\ investment_{t-1}$	-0.524**	-0.527**	-0.383
	(0.233)	(0.234)	(0.236)
$Borrwing\ rate\ (LT)_{t-1}$	-0.228***	-0.420***	-0.382***
	(0.073)	(0.104)	(0.092)
$Business\ cycle_t$	0.254***	0.220***	0.273***
	(0.035)	(0.037)	(0.050)
$Trade\ openness_{t-1}$	-1.739*	-0.970	-2.061*
	(0.980)	(0.896)	(1.019)
$Trend$	-	-0.177**	-
		(0.065)	
$Constant$	30.767***	30.515***	29.229***
	(1.507)	(1.431)	(1.642)
N	484	484	484
Time FE	NO	NO	YES
Country FE	YES	YES	YES
R^2	0.51	0.53	0.61

Dependent variable: Private investment. Heteroscedasticity–robust standard errors clustered at country level are in parentheses. *, **, and *** indicate significance at the 10%, 5%, and 1% level respectively. Year FE are negative and significant in 1997, from 2003 to 2005, from 2010 to 2016.

Also the proxy for the cycle has a highly significant coefficient with a positive sign. This suggests that private investment can be considered as a pro-cyclical variable that increases during periods of boom and decreases during periods of busts. In addition, our results indicate that public investment acts as a substitute to private investment; a 1 standard deviation increase in public investment is associated with a decrease in private investment of 0.465 to 0.558 percentage points. Furthermore, a high level of trade openness is associated with lower levels of private investment, which is in line with the findings of Checherita et al. (2012)

and Lim (2013). More specifically, if the sum of exports and imports (measured as a percentage of GDP) increases by 1 standard deviation, private investment decreases by 0.61 to 1.30 percentage points.

6. Econometric Approach II: GMM

Given the strong persistence of the private investment series, we include the lagged value of the dependent variable, i.e. private investment, in our specification. Moreover, to tackle the potential reverse causality due to the simultaneous determination of the dependent variable and several explanatory variables, which is not addressed by taking lagged values of these variables, we exploit the instrumental variable approach based on the linear GMM estimator of Arellano & Bond (1991).

The Arellano-Bond estimator is based on a difference-GMM approach that first transforms all the regressors taking their first differences[108] and then applies a Generalized Method of Moments (see Roodman, 2009). More specifically, we will use the Arellano-Bond estimator with robust standard errors. Moreover, given the large number of **instruments** produced by the difference-GMM approach, we follow Roodman (2009) and use a collapsed set of instruments, which strengthens the results of the endogeneity's test of the instruments[109][110].

6.1 Econometric approach II: GMM results

Results for the GMM approach are reported in Table 5 below. It shows that the lagged value of private investment is positive and highly significant, which indicates a significant degree of persistence in private investment. In other words,

[108] Hence removing all the fixed effects.
[109] In all the specifications that follow, all control variables except for $Trade\ opennes_{t-1}$ are considered to be endogenous.
[110] Confirmation for the validity of the GMM instruments results from (i) the difference-in-Sargan test, according to which we can assume that the instruments used in this specification are exogenous, and (ii) from the serial correlation tests: according to the Arellano-Bond test for autocorrelation, we can indeed reject at a 1% level of significance the null hypothesis of no autocorrelation of order 1 in first differenced-errors and we cannot reject the hypothesis of no autocorrelation of order 2.

the current level of private investment is to a significant extent determined by its past value. Hence, the dynamic model is the most appropriate model to analyze the evolution of private investment.

Table 5: Regression results for the EU countries: GMM

	(1)
$Private\ investment_{t-1}$	0.673***
	(0.072)
$Private\ debt_{t-1}$	-0.020
	(0.014)
$Public\ debt_{t-1}$	-0.123***
	(0.034)
$Public\ investment_{t-1}$	-1.022***
	(0.285)
$Borrowing\ rates\ (LT)_{t-1}$	-0.197
	(0.124)
$Business\ cycle_t$	0.354***
	(0.062)
$Trade\ openness_{t-1}$	-0.199
	(1.139)
N	456
Time FE	YES
Difference-in-Sargan	0.13

Dependent variable: Private investment. Heteroscedasticity–robust standard errors clustered at country level are in parentheses. *, **, and *** indicate significance at the 10%, 5%, and 1% level respectively. Year FE for are negative and significant from 2001 to 2002.

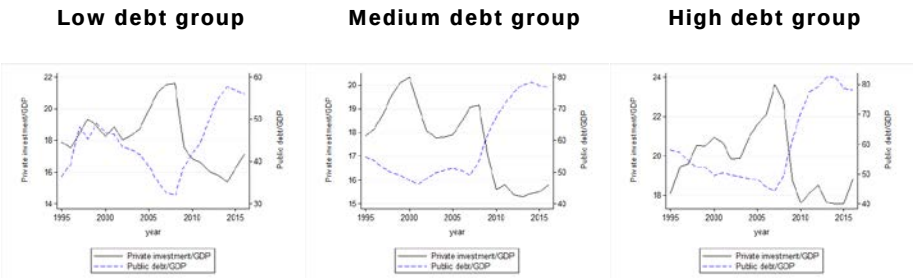
The other results from the GMM analysis are in line with what we found using a FE model. More specifically, we find evidence for a detrimental impact of public debt on private investment; private debt has no such effect. If public debt increases by 1 standard deviation, private investment decreases by 3.96 percentage point. Equivalently, if public debt in the EU would be 10 percentage points lower, private gross fixed capital formation would be €65 billion higher (given the levels of private investment prevalent in 2016). In addition, public investment can be regarded as a substitute to private investment; a 1 percentage point increase in public investment results in a decrease in private investment of 3.58 percentage points. Furthermore, private investment is rather pro-cyclical, as

a standard deviation increase in *Business cycle* is associated with a 1.04 percentage point decrease in private investment. Finally, the impact of trade openness and the cost of borrowing are both negative but never significant.

6.2 Extension: high vs. low public debt countries

In this section, we want to evaluate whether the link between debt and private investment changes when countries are grouped according to their level of public debt. In order to do that, we divide our sample in three groups (low, medium and high levels of public debt). We then split our sample using the 33th and the 66th percentiles of the public debt distribution and we use the dynamic approach described in the previous paragraph. The paths of public debt and private investment for the group of countries characterized respectively by low, medium and high level of public debt are represented in Figure 4 below. Results are reported in the first three columns of Appendix 6.

Figure 4: Private investment and public debt as a percentage of GDP for the EU28, 1995-2016



In countries characterized by low levels of public debt, private investment is mainly determined by past private investment, as well as where we are in the business cycle, with private investment being highly pro-cyclical. Thus, if debt is low, we do not find a negative impact of public debt on investment.

In countries with a medium level of public debt, private investment again is both highly persistent and pro-cyclical. Moreover, private debt also becomes a significant determinant of, and more specifically a drag on, private investment. Also for countries with medium levels of public debt, this is not a detriment to private investment.

For countries with high levels of public debt, all the variables included in our regression have a significant impact on private investment: (i) countries more open to trade have more private investment, (ii) higher borrowing costs result in less private investment, further providing evidence for a strong credit rationing effect, (iii) public investments act as a substitute for private investment, (iv) there is a positive relationship between private debt and private investment, and finally (v) higher public debt brings about lower private investment: a 1 standard deviation increase in public debt is associated with a 7.48 percentage points decrease in private investment.

Splitting our sample in three different groups and running a regression for each group limits the number of observations used for each subgroup analysis. Hence, to test the robustness of these findings, column 4 of Appendix 6 shows the results for an additional regression that includes the interaction terms between public debt and dummy variables for the different country groups: *Debt_low* for low debt countries (public debt below or equal to the 33rd percentile) and *Debt_high* for the high debt countries (public debt above the 66th percentile). The significant negative coefficient for the high debt group (i. $Public\ debt_{t-1} * Debt\_high$) indicates that the impact of public debt on private investment is indeed more pronounced in high debt countries. Moreover, a Wald test rejects the null hypothesis that the coefficients of the debt variables in the medium debt and the high debt group are equal.

6.3 Extension: the bailout effect

In this section, we want to study the effect of government bailouts of financial institutions in the European Union. Basically, the idea we want to test is whether, in case of a bailout of a bank, the provision of credit will be lower, which subsequently reduces private investment. To put it differently, the hypothesis we

test is that the higher the bailout, the more the banks will restrict credit to the economy.

Bailout data are taken from the European Commission and they refer to "*Capital injections recorded as deficit-increasing (capital transfer)"*. Since for some countries data are in local currency, we convert them using the exchange rates from AMECO. Moreover, in order to make the values comparable across countries, we divide the amount of the bailout by the GDP of each country.

As we can see from Appendix 7, the coefficient of the variable (lagged by one year) is non-significantly different from zero. Therefore, we can conclude that the bailouts implemented in Europe did not create a further drag on private investment, through the channel of restricting credit to the wider economy. Moreover, also this specification shows that private investment has a high degree of persistence and that it is quite pro-cyclical. In addition, the impact of public debt and public investment on private investment is negative and significant, confirming the previous results.

6.4 Extension: NPLs

Our previous analyses showed that credit rationing was a strong drag on private investment during the period under consideration. In this section, we test whether the credit rationing effect observed during the period of the analysis worked mainly through a price or a quantity channel. To do that, we compare the credit rationing effect as measured by the bond yield (i.e. price channel) with the same effect as measured by the amount of non-performing loans (NPLs) on banks' balance sheets. Data for NPL ratios (defined as NPLs to total loans) are downloaded from both the ECB and the IMF database[111]. We acknowledge the fact that the most homogeneous data come from the ECB. IMF data instead present longer time series but the definition used for NPLs and gross loans vary across countries[112].

[111] The dataset coming from the IMF is richer in term of countries included than the one provided by the ECB.
[112] After a preliminary analysis, we observed that, notwithstanding the heterogeneous definition used by the IMF in the collection of the NPL ratios, the path of IMF and ECB data

In Appendix 8, we report the results of the estimations using both IMF data (first column) and ECB data (second column). According to these results, the coefficient of the NPLs ratio in the first column is negative but not significantly different from zero whereas it is negative and significant in the second column (ECB data). Moreover, bond yields do not have significant impact on private investment. Since data from the ECB are more homogeneous than the data from the IMF, this provides suggestive evidence that the credit rationing effect in the EU mainly operated through a quantity channel. In particular, when the NPLs ratio increases by 1 standard deviation, private investment is reduced by 0.54 percentage points. In addition, both specifications conform that private investment is persistent as well as pro-cyclical. Moreover, in the second specification – which includes the NPL variable that has a significantly negative impact on private investment – the coefficient of public debt is no longer significant (although negative).

6.5 Extension: other controls

In this section we test whether our results are robust to the inclusion of additional controls. Although the extra control variables included in this extension are not traditionally suggested by the literature, from a theoretical point of view, they might still have an impact on private investment, as discussed below. Columns (1) – (8) in Appendix 9 include these additional control variables one by one.

Focusing on different aspects that might influence private investment, we control for: (i) variables related to a country's economic and/or financial condition, (ii) variables capturing a country's institutional quality, and (iii) demographic variables. In the first group we consider the market capitalization of listed domestic companies, the Economic Sentiment Indicator, total factor productivity and the number of patents, whereas the second group consists of two measures quantifying regulatory quality and corruption. Finally, we include population growth and the dependency ratio as demographic variables. The definition of each additional control variable as well as the rationale for including it in this robustness check is as follows:

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are very similar. The main difference is in the level of non-performing loans, not in the evolution of NPL's.

(1) **market capitalization** of listed domestic companies (computed in percentage of GDP)[113] can be considered as a proxy for financial development. Companies that operate in countries with very developed financial markets have more access to credit, which potentially facilitates finding funds to finance investments.

(2) **population growth**[114] is measured as the annual population growth rate. Economic theory suggests that countries with rapidly increasing population have a high need in investment, both public and private, for example due to an increased demand for housing.

(3) **total factor productivity**[115] represents the portion of output not explained by the amount of inputs (i.e. labour and capital) used in production. Strong productivity growth implies higher returns on invested capital. If companies can generate returns on the investments in excess of what they received before the improvement in productivity, they will invest more.

(4) **regulatory quality**[116] measures perceptions of the ability of the government to formulate and implement sound policies[117]. The quality of regulation can impact investment through a variety of channels, such as through the enforcement of property rights and the incentives to investment (e.g. a stable regulatory environment).

(5) the **Economic Sentiment Indicator**[118] (ESI) is a composite indicator made up of five sectoral confidence indicators, with each sector assigned a different weight. A positive economic outlook is likely to be associated with higher levels of investment.

(6) **corruption**[119] measures the extent to which the executive can be considered accountable for its use of funds[120]. If public sector corruption is high, private investment might be negatively impacted as this often

[113] Data come from the World Bank.
[114] Data come from the World Bank.
[115] Data come from AMECO.
[116] Data come from the World Bank.
[117] It is an index that can take on a value between -2.5 (= low quality) and 2.5 (= high quality).
[118] Data come from the European Commission.
[119] Data come from the World Bank.
[120] It is an index that can take on a value between -2.5 (= low corruption) and 2.5 (= high corruption).

entails lengthy procedures to get investment approved as well as 'grease payments' which increases the cost of investment.

(7) the **dependency ratio**[121] is measured as the ratio of dependents (people younger than 15 or older than 64) to the working-age population (those aged 15-64). In a world with perfect capital mobility, capital (and hence investment) should flow from ageing countries (e.g. Germany) to younger and growing countries with lots of investment opportunities, and thus higher investment returns (e.g. the USA).

(8) the **number of patents**[122] is measured as the sum of the number of patent applications of residents and non-residents. Since a patent provides exclusive rights for an invention[123] this can be seen as proxy for innovation: the larger the number of patent applications, the higher the degree of innovation in a specific country will be.

Table 6 provides full description of these additional control variables. Appendix 10 presents descriptive statistics.

Including additional control variables does not alter the results from our initial analysis substantially. Although the exact coefficients differ from specification to specification, they do not increase or decrease by an order of magnitude. Public debt has a negative impact on private investment, whereas private debt does not. In addition, public investment is a substitute for private investment and the impact of credit rationing is substantial. Finally, private investment is both persistent and pro-cyclical. However, the difference-in-Sargan test indicates that, for several specifications, there are problems with the exogeneity of the instruments used. Hence, we prefer not to add these variables in our baseline specification.

[121] Data come from the World Bank.
[122] Data come from the World Bank.
[123] The World Bank defines an invention as "*a product or process that provides a new way of doing something or offers a new technical solution to a problem*".

Table 6: Variables description (additional controls)

Variable name	Description
Market capitalization	Market capitalization of listed domestic companies, in percentage of GDP
Population growth	Annual population growth rate
TFP	Total factor productivity: total economy (2010 = 100)
Regulatory quality	Business regulatory environment rating (-2.5 = low to 2.5 = high)
ESI	Economic Sentiment Indicator, scaled to have a long-term mean of 100 and a standard deviation of 10, score ranging from 72.2 to 120.6
Corruption	Corruption in the public sector rating (-2.5 = low to 2.5 = high)
Age dependency ratio	Ratio of dependents (people younger than 15 or older than 64) to the working-age population (those aged 15-64)
Patents	Worldwide patent applications filed through the Patent Cooperation Treaty procedure or with a national patent office

7. Conclusions

There is a lot of discussion about a public debt overhang in the EU (e.g. Heinemann, 2006; Bacchiocchi et al., 2011): increased public debt since the crisis has resulted in lower economic growth and decreased public investment. However, private debt has increased more, and the drop in private investment was even sharper. We study whether this decline in private investment in Europe was indeed caused by an increase in debt, and if so whether public or private debt played the most important role.

The literature looking at the link between private debt and private investment generally focuses on corporate debt overhang (e.g. Gebauer, Setzer & Westphal, 2017) or household debt overhang (e.g. Mian & Sufi, 2015), mainly uses micro data and does not include the entire European Union. In addition, research on the negative link between public debt and private investment is scarce. However, cross-country studies on private investment are very relevant from the perspective of EU policymakers. If an increase in debt results in decreased private gross fixed capital formation, this has an impact on the long-term productive potential of the Union and consequently the living standards of its citizens. Thus,

if the EU wants to ensure a sustained increase in prosperity for its populace, acknowledging – and dealing with – this debt overhang effect is crucial. Hence, this paper adds to the literature by looking at the impact of both public and private debt on private investment, using aggregate data and employing a variety of econometric techniques (e.g. FE and GMM).

Contrary to our initial expectations, we find scant evidence for the private debt overhang hypothesis; our results do not indicate that an increase in private debt unambiguously results in lower private investment. However, we do find that an increase in *public* debt results in decreased private investment. In our sample of 28 EU countries covering the period 1995-2016, a rise in general government debt of 1 standard deviation brings about a reduction in private investment of 3.96 percentage points. Moreover, this effect is stronger in countries with high levels of public debt (which is defined as having public debt in the 66th percentile and higher): for this group of countries, private gross fixed capital formation is reduced by 7.48 percentage points with every standard deviation increase in public debt.

We identify three potential mechanisms through which this link between public debt and private investment might work. Firstly, if sovereign debt increases, corporations and households might expect future taxes to rise as well, and hence they cut back on investment now. Secondly, the private sector potentially views the level of public debt as an indicator of economic uncertainty; if public debt increases, the economic outlook is less benign. In an economic environment which is perceived as less favorable, the incentive to invest in an uncertain future is lower. Thirdly, higher levels of public debt will, ceteris paribus, be associated with higher borrowing costs of the sovereign, as default risk increases. This surge in borrowing costs feeds through to the private sector and hence crowds out private investment.

Our results provide evidence for this third effect. In countries with high levels of public debt, an increase in the long-term borrowing costs of 1 standard deviation results in a decrease in private gross fixed capital formation of 0.77 percentage points. This is in line with recent research from Huang et al. (2018) who find evidence of a causal link from sovereign debt to private investment, due to the presence of a credit rationing channel.

Building on these initial findings, we add several extensions to our analysis, focusing in particular on the role of credit supply for private investment. First off, we show that bailouts of financial institutions in the wake of the Global Financial Crisis have resulted in decreased private investment, which might suggest that banks which received a bailout restricted the availability of credit. Moreover, this credit rationing effect was complemented by a negative impact of high levels of non-performing loans (NPLs) on private investment. One explanation could be that banks that had high NPL ratios provided fewer credit to private firms, resulting in lower private gross fixed capital formation.

In our paper, we do not find robust evidence to suggest that a general increase in private debt results in less private investment. However, high levels of private debt of course might negatively impact the economy in various other ways. For example, Klein (2017) studied the role of private debt overhang in the context of fiscal consolidation. The author finds that fiscal austerity results in a severe contraction when it is implemented in an economy suffering from high debt levels. When private debt is low, in contrast, austerity does not impact economic growth. Similarly, Bernardini & Peersman (2018), looking at historical data for the United States, find that government spending multipliers are much larger than average in states characterized by high levels of private debt. In addition, recent research indicates that high levels of private debt might be one of the factors explaining the slowdown in productivity growth, *inter alia* due to the overcapacity resulting from abundant credit and misallocation of labor and capital in credit booms (e.g. Borio, Kharroubi, Upper & Zampolli, 2016; Borio, 2018). These three potentially negative consequences of private debt provide interesting avenues for further research.

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Appendices

Appendix 1: Illustration of the debt overhang concept

The private debt overhang concept can be explained using a simple example. Consider a firm with $80 of assets and $100 of debt that must be paid off entirely the next year.

Starting balance sheet	
Assets = $80	Liabilities = $100
	Equities = -$20

This means the company will default the coming year since it will not have sufficient resources to pay back its debt. This gap of $20 between assets on the one hand and liabilities on the other hand is defined as debt overhang in Lamont (1995).

Now assume an investment project that costs $5 today and will produce a return of $15 the next year (case 1). As the company is suffering from a debt overhang, no internal investors (such as the shareholders) will be willing to suffer the cost of $5 since the benefit will go only to the original creditors who will see an increase in the payoff of their original loan to the company from $80 to $95.

Balance sheet after the investment (case 1)	
Assets = $95	Liabilities = $100
	Equities = -$5

Even external creditors will not be interested in funding this investment project if the original creditors need to be repaid in full before subsequent creditors can lay claim to the assets of the company[124]. If the return on the new investment cannot at least cover the gap between assets and liabilities, the project will never be funded. If a company is suffering from a debt overhang, only very profitable

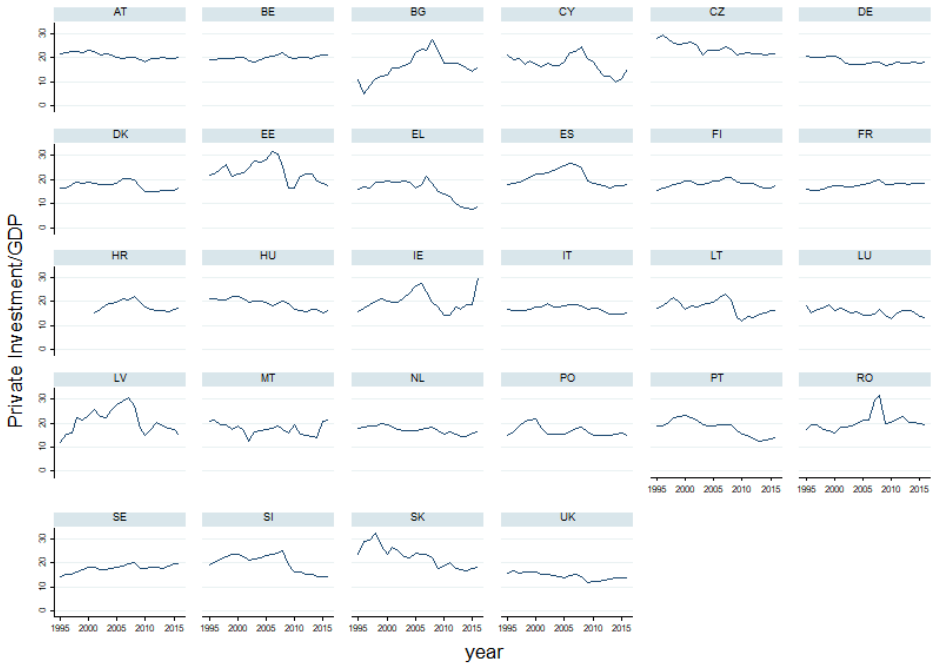
[124] This example might be related to the distinction between senior and junior creditors.

investments will be undertaken. Assuming for example a $25 return on a new investment then the profits will be shared between the original creditors and the investors in the project (internal or external) and then the investment will be undertaken (case 2). The large return would indeed enable the debt of the original creditor to be repaid. Furthermore the investors in the project would receive some of the benefits resulting from the investment.

Balance sheet after the investment (case 2)	
Assets = $105	Liabilities = $100
	Equities = $5

The example explained above illustrates how debt overhang deters investment at the company (i.e. micro) level but the same mechanism can be applied for the entire economy.

Appendix 2: Private investment-to-GDP ratios for EU28, 1995-2015



Source: AMECO

Appendix 3: Correlation table

Country	Private debt & Private investment	Public debt & Private investment	Public investment & Private investment
Austria (AT)	-0.72*	-0.74*	-0.86*
Belgium (BE)	0.57*	-0.42	0.50*
Bulgaria (BG)	0.61*	-0.78*	0.57*
Cyprus (CY)	-0.59*	-0.82*	0.26
Czechia (CZ)	-0.12	-0.90*	-0.84*
Germany (DE)	0.24	-0.70*	-0.36
Denmark (DK)	-0.32	-0.45	-0.55*
Estonia (EE)	-0.22	-0.66*	-0.23
Greece (EL)	-0.69*	-0.94*	0.46*
Spain (ES)	0.08	-0.84*	0.48*
Finland (FI)	-0.03	-0.85*	-0.02
France (FR)	0.73*	0.53*	0.84*
Croatia (HR)	-0.03	-0.59*	0.92*
Hungary (HU)	-0.70*	-0.61*	-0.75*
Ireland (IE)	-0.59*	-0.59*	0.39
Italy (IT)	-0.25	-0.95*	0.33
Lithuania (LT)	-0.30	-0.78*	-0.31
Luxembourg (LU)	-0.56*	-0.43*	-0.72*
Latvia (LV)	-0.37	-0.55*	0.12
Malta (MT)	-0.38	-0.64*	-0.15
Netherlands (NL)	-0.72*	-0.25	-0.67*
Poland (PL)	-0.50*	-0.80*	-0.46*
Portugal (PT)	-0.62*	-0.96*	0.43
Romania (RO)	0.40	-0.15	0.68*
Sweden (SE)	0.72*	-0.85*	0.63*
Slovenia (SI)	-0.42	-0.87*	-0.47*
Slovakia (SK)	-0.63*	-0.51*	-0.74*
United Kingdom (UK)	-0.83*	-0.72*	-0.81*
European Union (EU)	-0.49*	-0.90*	-0.30

* indicates significance at the 5% level

Appendix 4: Country-specific descriptive statistics for private debt, public debt and private investment, 1995-2016

Mean (standard deviation)

Country	Public debt	Private debt	Private investment
AT	72.01 (8.14)	121.45 (8.30)	20.70 (1.32)
BE	105.84 (11.37)	137.16 (32.55)	20.00 (0.86)
BG	37.35 (25.49)	78.69 (46.71)	16.42 (5.31)
CY	66.28 (20.54)	302.76 (31.90)	17.27 (3.69)
CZ	28.14 (10.87)	61.57 (8.85)	23.80 (2.52)
DE	66.34 (8.03)	111.36 (8.35)	18.50 (1.34)
DK	41.70 (6.62)	187.36 (31.89)	17.38 (1.76)
EE	6.74 (2.12)	92.60 (36.60)	23.15 (4.22)
EL	125.43 (32.60)	87.19 (36.80)	15.47 (4.30)
ES	63.19 (20.55)	142.94 (45.23)	20.72 (3.38)
FI	47.37 (8.95)	119.04 (25.66)	18.20 (1.37)
FR	71.97 (14.31)	115.60 (19.41)	17.60 (1.09)
HR	54.32 (19.84)	99.02 (23.89)	18.05 (2.10)
HU	67.58 (9.84)	76.59 (25.29)	18.96 (2.12)
IE	60.61 (32.05)	222.43 (60.04)	20.08 (4.05)
IT	112.67 (11.07)	97.20 (22.20)	16.83 (1.32)
LT	25.27 (10.52)	47.89 (20.13)	17.56 (3.02)
LU	12.57 (6.64)	243.93 (80.21)	15.57 (1.50)

Appendix 4 (cont.): Country-specific descriptive statistics for private debt, public debt and private investment, 1995-2016

Mean (standard deviation)

Country	Public debt	Private debt	Private investment
LV	22.58 (14.15)	99.03 (18.37)	20.86 (5.16)
MT	61.18 (10.22)	144.87 (13.86)	17.54 (2.46)
NL	58.11 (9.00)	211.73 (14.51)	17.14 (1.49)
PL	46.47 (5.82)	52.00 (20.54)	16.69 (2.22)
PT	80.41 (30.71)	161.88 (40.17)	18.10 (3.43)
RO	23.37 (10.30)	51.24 (17.91)	20.37 (3.75)
SE	49.41 (10.95)	160.71 (10.95)	17.76 (1.48)
SI	37.42 (21.34)	89.56 (20.77)	19.92 (3.67)
SK	40.84 (9.60)	64.25 (14.54)	22.61 (4.33)
UK	55.51 (21.23)	158.99 (25.30)	14.45 (1.40)
EU	55.12 (10.23)	123.41 (24.75)	18.64 (1.65)

Appendix 5: Descriptive statistics of variables used in baseline regressions

Variable	No. Obs.	Mean	Std. Dev.	Min.	Max.
Private investment	484	18.42	3.53	7.64	31.74
Private debt	484	135.26	66.44	29.70	353.50
Public debt	484	59.87	32.16	3.66	180.85
Public investment	484	3.73	1.06	1.64	7.26
Borrowing rate (LT)	484	4.58	2.36	0.09	22.50
Business cycle	484	-0.02	2.89	-18.85	17.50
Trade openness	484	1.10	0.63	0.37	4.10

Appendix 6: Regression results for the extension on high vs. low public debt countries: GMM

	Low Debt (1)	**Med. Debt (2)**	**High Debt (3)**	**Full sample (4)**
$Private\ investment_{t-1}$	0.722***	0.780***	0.347***	0.712***
	(0.106)	(0.066)	(0.125)	(0.061)
$Private\ debt_{t-1}$	0.001	-0.022**	0.037**	-0.010
	(0.015)	(0.010)	(0.017)	(0.012)
$Public\ debt_{t-1}$	-0.040	-0.019	-0.198***	-0.061**
	(0.043)	(0.018)	(0.044)	(0.026)
$Public\ investment_{t-1}$	-0.073	-0.072	-1.576***	-1.029***
	(0.322)	(0.155)	(0.451)	(0.240)
$Borrowing\ rates\ (LT)_{t-1}$	0.079	-0.029	-0.272**	-0.243**
	(0.331)	(0.089)	(0.121)	(0.114)
$Business\ cycle_t$	0.524***	0.203**	0.120*	0.312***
	(0.140)	(0.080)	(0.073)	(0.059)
$Trade\ openness_{t-1}$	2.093	2.025	4.764*	-0.625
	(1.497)	(1.596)	(2.873)	(1.075)
$Public\ debt_{t-1} * Debt\_low$				0.023
				(0.031)
$Public\ debt_{t-1} * Debt\_high$				-0.039*
				(0.023)
N	139	160	137	456
Time FE	YES	YES	YES	YES
Difference-in-Sargan	0.11	0.57	0.72	0.18

Dependent variable: Private investment. Heteroscedasticity–robust standard errors clustered at country level are in parentheses. *, **, and *** indicate significance at the 10%, 5%, and 1% level respectively. The low debt group of countries includes: BG, CY, LT, LU, MT, SK, ES, SE. The medium debt group includes: DK, FR, DE, HU, NL, PL, PT, SI, UK. The high debt group includes: AT, BE, HR,CZ, FI, EL, IE, LV, RO. Year FE for the first column are never significant; for the second column they are negative and significant in 2001; for the third column they are negative and significant from 1999 to 2011 and from 2013 to 2016; for the fourth column they are negative and significant in 2009, 2010, 2014 and 2015.

Appendix 7: Regression results for the extension on bailouts: GMM

	(1)
$Private\ investment_{t-1}$	0.609***
	(0.078)
$Private\ debt_{t-1}$	0.012
	(0.013)
$Public\ debt_{t-1}$	-0.042**
	(0.018)
$Public\ investment_{t-1}$	-0.644**
	(0.278)
$Borrowing\ rates\ (LT)_{t-1}$	-0.257***
	(0.099)
$Business\ cycle_t$	0.156***
	(0.049)
$Trade\ openness_{t-1}$	1.172
	(1.529)
$Bailouts_{t-1}$	0.057
	(0.129)
N	184
Time FE	YES
Hansen J (p-value)	0.29

Dependent variable: Private investment. Heteroscedasticity–robust standard errors clustered at country level are in parentheses. *, **, and *** indicate significance at the 10%, 5%, and 1% level respectively. Year FE are negative and significant in 2009, 2010 and from 2013 to 2015.

Appendix 8: Regression results for the extension on non-performing loans: GMM

	(1)	(2)
$Private\ investment_{t-1}$	0.627***	0.281***
	(0.093)	(0.082)
$Private\ debt_{t-1}$	0.031	-0.032
	(0.020)	(0.025)
$Public\ debt_{t-1}$	-0.078***	-0.009
	(0.030)	(0.025)
$Public\ investment_{t-1}$	-0.594**	-0.351
	(0.279)	(0.261)
$Borrowing\ rates\ (LT)_{t-1}$	-0.151	-0.141
	(0.112)	(0.087)
$Business\ cycle_t$	0.289***	0.269***
	(0.066)	(0.053)
$Trade\ openness_{t-1}$	1.435	-1.501
	(1.578)	(1.803)
$NPLs_{t-1}$	-0.0434	-0.064*
	(-0.044)	(0.034)
N	206	149
Time FE	YES	YES
Difference-in-Sargan	0.19	0.52

Dependent variable: Private investment. Heteroscedasticity–robust standard errors clustered at country level are in parentheses. *, **, and *** indicate significance at the 10%, 5%, and 1% level respectively. Year FE for the first column are negative and significant in 2007, 2009, 2010; in the second column they are positive and significant in 2009.

Appendix 9: Regression results for the extension on other control variables: GMM

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
$Private\ investment_{t-1}$	0.407***	0.716***	0.671***	0.598***	0.698***	0.556***	0.685***	0.623***
	(0.091)	(0.065)	(0.072)	(0.063)	(0.061)	(0.061)	(0.071)	(0.083)
$Private\ debt_{t-1}$	-0.010	0.009	-0.015	0.000	-0.016	-0.002	-0.015	-0.022
	(0.012)	(0.010)	(0.016)	(0.013)	(0.011)	(0.012)	(0.015)	(0.017)
$Public\ debt_{t-1}$	-0.076**	-0.076**	-0.124***	-0.099***	-0.075**	-0.092***	-0.114***	-0.192***
	(0.029)	(0.030)	(0.035)	(0.029)	(0.033)	(0.027)	(0.033)	(0.049)
$Public\ investment_{t-1}$	-0.230	-0.745***	-1.136***	-0.900***	-0.666**	-0.665***	-0.944***	-1.324***
	(0.326)	(0.252)	(0.276)	(0.254)	(0.260)	(0.213)	(0.281)	(0.379)
$Borrowing\ rates\ (LT)_{t-1}$	-0.180	-0.237**	-0.240*	-0.287**	-0.186*	-0.272**	-0.214*	-0.216
	(0.133)	(0.119)	(0.132)	(0.126)	(0.106)	(0.117)	(0.123)	(0.138)
$Business\ cycle_t$	0.315***	0.327***	0.350***	0.361***	0.248***	0.359***	0.348***	0.284***
	(0.087)	(0.062)	(0.067)	(0.055)	(0.083)	(0.052)	(0.061)	(0.068)
$Trade\_openness_{t-1}$	0.614	-0.298	-1.077	-0.512	0.165	0.295	-0.213	0.939
	(1.218)	(1.107)	(1.224)	(1.173)	(1.023)	(1.071)	(1.134)	(1.404)
$Market\ capitalization_{t-1}$	-0.024***							
	(0.008)							
$Population\ growth_{t-1}$		-0.810						
		(0.566)						
TFP_{t-1}			-0.006					
			(0.037)					
$Regulatory\ quality_{t-1}$				-2.215				
				(1.920)				
ESI_t					0.084**			
					(0.039)			
$Corruption_{t-1}$						-3.303**		
						(1.491)		
$Dependency\ ratio_{t-1}$							0.143*	
							(0.084)	
$Patents_{t-1}$								-0.000**
								(0.000)
N	332	454	456	347	438	347	456	425
Time FE	YES	YES	YES	YES	YES	YES	YES	YES
Difference-in-Sargan	0.45	0.131	0.01	0.022	0.079	0.05	0.07	0.174

Dependent variable: Private investment. Heteroscedasticity–robust standard errors clustered at country level are in parentheses. *, **, and *** indicate significance at the 10%, 5%, and 1% level respectively.

Appendix 10: Descriptive statistics (additional controls)

Variable	No. Obs.	Mean	Std. Dev.	Min.	Max.
Market capitalization	332	44.14	1.19	326.36	56.60
Population growth	454	0.22	0.76	-2.26	2.89
TFP	456	100.67	5.61	78.29	136.73
Regulatory quality	347	1.19	0.44	-0.18	2.10
ESI	438	100.67	9.84	72.20	118.40
Corruption	347	1.05	0.79	-0.61	2.47
Dependency ratio	456	48.57	3.84	38.10	60.27
Patents	425	5331.08	12282.91	3	66893

CHAPTER 5

Debt dynamics in the EU: towards Maastricht convergence?

Policy lessons for Greece from the Belgian experience

This chapter is under review as:

Vanlaer, W., Marneffe, W., & Van Overtveldt, J. (XXXX). Debt dynamics in the EU: Towards Maastricht Convergence?. Journal of European Integration.

ABSTRACT

This paper introduces an accounting framework to study the evolution of public debt. Subsequently, this framework is applied to analyze the main determinants of the debt-to-GDP ratio of Belgium for the period 1995-2014. The framework underscores the importance of the debt composition, the exchange rate and the fiscal stance for debt dynamics, all impacting fiscal vulnerability. The results show that: (i) Belgium succeeded in quite drastically reducing its public debt in the run-up to joining the Eurozone, and was able to continue doing so up until the Global Financial Crisis (GFC) hit in 2007-2008. This was chiefly accomplished by running large primary surpluses; (ii) the bailout of the financial sector in 2008 caused public debt to soar. Subsequently, anemic growth in combination with the cost of servicing an already high stock of debt, resulted in a steadily rising debt-to-GDP ratio. Next, this paper looks at what, if any, lessons can be learned from the Belgium experience that can also be applied to Greece. Even if no direct parallels can be drawn, the attitudes of European creditors on what can 'reasonably' be demanded of the Greek government is considerably influenced by the achievements of other countries in the past.

Keywords

Public Debt, Government Debt, Debt Accounting, Growth, Fiscal Policy.

1. Introduction

From the mid-1980s to the mid-2000s, the US and Europe were characterized by a substantial decline in macroeconomic volatility, which is often referred to as the Great Moderation (e.g. Bernanke, 2004; Gali & Gambetti, 2008). In an environment of strong growth and low inflation, topics such as fiscal sustainability and debt management reduced in importance to policymakers. This altered when the Global Financial Crisis (GFC) struck in 2007-2008. It became clear that the pattern of taxing and spending in several countries (e.g. Greece) could not be pursued indefinitely. Hence, the GFC, which originated in the US and was caused by a pernicious combination of dubious lending practices and highly complex and opaque financial products, morphed into a full blown sovereign debt crisis in Europa (e.g. Ureche-Rangau & Burietz, 2013).

Notwithstanding the fact that there is considerable consensus that excessive debt, both public and private, has played an important role in the recent Global Financial Crisis (e.g. Baldwin & Giavazzi, 2015), debt continues to grow. Between 2007 and 2014, global debt has increased by $57 trillion, with advanced economies accounting for around half of this growth (Dobbs, Lund, Woetzel & Mutafchieva, 2015). Hence, the question of how to lower government debt levels to a more manageable level has come to take center stage (e.g. Aizenman & Marion, 2014; Mauro, 2011). The Fiscal Compact, which came into force in 2013, requires EU countries with public debt of over 60% relative to GDP, to reduce the debt in excess of this reference level at an average rate of 5% per annum (Council of the European Union, 2012). In a subsequent edition of its Fiscal Monitor (2013), the IMF projected the required pace of consolidation for several highly indebted European countries. A country like Greece, for example, would require an average primary surplus of 7.2% in the decade 2020-2030 for its obligations to first stabilize and then evolve to the 60% target, an objective several prominent scholars deem very unlikely (e.g. Eichengreen & Panizza, 2016).

However, some countries did manage to produce such a drastic reduction in their debt ratio. Belgium, for example, succeeded in lowering its public debt-to-GDP ratio from a high of 130.7% in 1995 to 86.9% in 2007. In this paper, we take an in-depth look into this particular case. The reason for focusing on the Belgium

experience is threefold. Firstly, the country managed to complete one of the largest reductions in public debt in Europe since 1985; only Denmark and Ireland had a larger reduction in their public debt ratios[125]. Moreover, it did so while gradually reducing government spending. As can be seen from Appendix 1, general government spending dropped from more than 52% of GDP in 1995 to close to 48% in 2007. In addition, this episode is often referred to as a "textbook example of debt reduction" (e.g. Fabrizio, 2008, IMF, 2012; Nickel, Rother & Zimmermann, 2010).

Through a debt accounting framework, we assess the factors underlying changes in the debt-to-GDP ratio of Belgium for the period 1995-2014. More specifically, this study focuses on three distinct periods: (i) the years prior to entering the monetary union, starting from 1995, (ii) the ensuing years up to 2007 when the Global Financial Crisis broke out, and (iii) the period from 2008-2014. We adopt the framework introduced by Budina & Fiess (2005), but use multilateral exchange rates instead of bilateral exchange rates to calculate the impact of currency fluctuations on the evolution of debt, as suggested by Burnside (2005). Performing such an ex-post analysis of the main determinants of the evolution in public debt by means of the aforementioned framework can aid in formulating ex-ante policy advice on how to reduce sovereign debt in the period ahead. This is precisely what we attempt to do in the final section of our paper, where we draw policy lessons for a heavily indebted country which might benefit from a similar evolution in its public debt-to-GDP ratio as Belgium did over the period under consideration: Greece.

The rest of the paper is organized as follows. In Section 2, we review the literature on debt dynamics. Section 3 introduces the framework we constructed to study debt dynamics, and describes the data used in our analysis. Section 4 provides background information in the Belgian experience. In Section 5, we apply this framework to Belgium for the period 1995-2014. Section 6 looks at what Greece can learn from the Belgian experience. Finally, Section 7 presents the conclusions.

[125] Only Denmark and Ireland had a larger reduction in their public debt ratios. Denmark managed to decrease its debt ratio from 80.1% in 1994 to 26.8% in 2007, a reduction of 53.2%. Ireland realized an impressive 69.2 percentage points reduction, from 94.1% in 1994 to 24.9% in 2006 (Nickel, Rother & Zimmermann, 2010).

2. Review of literature

There is no conclusive evidence that high public debt automatically results into lower growth (e.g. Panizza & Presbitero, 2014), nor that there is critical debt-to-GDP ratio after which medium-term economic performance significantly worsens (e.g. Vanlaer, Marneffe, Vereeck & Van Overtveldt, 2015). Nevertheless, elevated levels of public debt have the potential to destabilize an economy. When the private sector starts questioning the fiscal sustainability of a country's macroeconomic policy, it might reassess its spending decisions, pulling back on investment and consumption, as it expects a higher level of taxation in the future (Barro, 1996). This drop in private sector expenditure further reduces growth and consequently increases default risk. As a result, higher bond yields raise debt servicing cost, potentially to an unsustainable level.

Higher interest rates on government borrowing can also spill over to the private sector, resulting in a crowding out effect (Elmendorf & Mankiw, 1999). This mechanism works as follows. Increasing debt is the result of ongoing deficits, which is tantamount to reduced public saving. When this reduction is not offset by increased private saving and/or capital inflows, the funds available for investment become scarcer, inducing higher interest rates for the whole economy. It follows that private investment is crowded out, and the capital stock and economic output decline (Traum & Yang, 2015).

Even if the possibility of crowding out is low, for example due to interest rates being stuck at the Effective Lower Bound (ELB), it might be prudent not to let public debt spiral out of control. Governments in the developed world are confronted with a rapidly aging population and the associated surge in entitlement spending. Sound public finances are essential in dealing with the challenges this entails (e.g. Ihori, Kato, Kawade & Bessho, 2006).

Low to moderate levels of public debt are also sensible from a precautionary motive. As the recent GFC has shown, a severe crisis almost mechanically increases the debt-to-GDP ratio, due to its impact on economic output. If debt levels are already elevated going into the crisis, fiscal space to counter the negative effects of a recession is limited, potentially resulting in years of sub-par

growth. Countercyclical fiscal policy requires some budgetary leeway (e.g. Lane, 2012).

Only a limited number of papers focus specifically on the drivers of the evolution of public debt-to-GDP through a formal debt accounting framework. In addition to this, there are different strands of literature which touch upon specific elements of debt dynamics. In our analysis, we draw from both the former, more comprehensive view, as well as from the latter, more focused perspective. The literature devoted to distinct elements of debt dynamics can be grouped into two broad categories. The first group looks at the effect of one specific macro-economic factor (e.g. fiscal consolidation or interest rate developments) on the evolution of the public debt-to-GDP ratio. The second category studies the impact of institutional determinants (e.g. ideology of the ruling party) of public debt.

We first discuss nine papers which do utilize a formal framework to assess public debt dynamics. Budina & Fiess (2005) analyze 31 market access countries (MACs) to gain a better understanding of public debt dynamics in these countries over the period 1990-2002. They establish an accounting framework that deconstructs evolutions in the ratio of public debt-to-GDP into changes in the primary balance, GDP growth, interest rates, foreign currency movements impacting debt issued in these currencies and one-off events such as bank bailouts or privatizations. Their findings suggest that in episodes of large reductions in debt-to-GDP, fiscal consolidation was a key component of credible debt reduction. They also find that declines in public debt ratios were determined by growth and appreciation effects.

Likewise, Burnside (2005) introduces an accounting framework to analyze debt dynamics, highlighting its usefulness in describing how public debt levels have evolved over our time as well as in illustrating sources of risk in government finances. The Burnside framework includes the same determinants of the evolution in public debt as the Budina & Fiess framework. However, the growth effect depends not only on the real growth rate but also on the rate of inflation, as it is not possible to perfectly decompose the inflation and growth effect because they interact with one another. Moreover, the revaluation effect takes into account end-of-period multilateral exchange rates rather than bilateral exchange rates. Subsequently, this framework is applied to study the debt dynamics of several countries. The lessons that can be learned for Turkey for the period 1994-2002

for example, is that debt levels can fluctuate wildly depending on the value of the real exchange rate if a country has significant amounts of external or foreign currency-denominated debt and that financial crises can have a dramatic impact on the government's finances.

Anaya & Pienkowski (2015) construct a single unified framework to explore how the main drivers of sovereign debt dynamics, i.e. the primary balance, the interest rate, growth and inflation, interact with each other. They conclude from their research that some interactions, such as an interest rate shock – especially in a country with unconstrained monetary policy, act as a stabilizer of debt dynamics, whilst others (e.g. a growth shock), intensify the effect of debt accumulation.

Cherif & Hasanov (2018) provide an empirical framework to study debt dynamics in the United States, focusing on the impact of improving the primary balance, i.e. austerity, inflation and growth shocks on public debt. They find that a positive growth shock reduces the public debt-to-GDP ratio categorically; an inflation shock only does so for a few quarters and an austerity shock does not have a statistically significant impact.

Casadio, Paradiso & Rao (2012) analyze the public debt dynamics for Italy. The authors apply different scenarios for both endogenous variables, e.g. Italian real GDP growth and the primary balance, and exogenous variables, e.g. the US growth rate and evolutions in the oil price. More specifically, they define a baseline scenario, as well as an upward/optimistic and a downward/pessimistic scenario for the evolution of these variables. The authors predict that a reduction of the debt ratio to 100% of GDP over a 10-year horizon is feasible.

Abbas, Akitoby, Andritzky, Berger, Komatsuzaki & Tyson (2014) study 26 large debt-reduction episodes in 20 advanced economies over the period 1980 to 2013. Strong growth and fiscal consolidation were the main drivers behind these debt reduction efforts. As fiscal policy tightened, strong external demand and loose monetary policy supported output growth.

A large body of literature is devoted to one specific factor impacting the evolution of public debt. The role of the fiscal multiplier, especially in crisis times, has received special attention, following a recent analysis from Blanchard & Leigh (2013). They find that during the GFC, stronger fiscal consolidation is correlated

with lower growth than expected and thus higher debt levels relative to GDP than first anticipated. This is corroborated by Corsetti, Meier & Müller (2012), which finds that output and consumption multipliers are very high during a financial crisis. Auerbach & Gorodnichenko (2012) also show that multipliers of government purchases are larger in a recession. In addition, Broner, Clancy, Erce & Martin (2018) conclude that fiscal multipliers are larger when debt is held by foreign rather than domestic bondholders.

Denes, Eggertsson & Gilbukh (2013) analyze debt dynamics in an idiosyncratic environment, which is nevertheless very relevant today, i.e. when short-term nominal interest rates approach zero. Their main finding is that, when interest rates are at, or close to, the Zero Lower Bound (ZLB) improving the primary balance, by raising taxes or cutting spending, counterintuitively *increases* the budget deficit, rather than reduces it and thus raises the debt burden. The reduction in spending or the increase in taxes, slashes output and hence cuts growth by more than the savings caused by the tax increase or spending cut.

Escolano, Kolerus & Ngouana (2014) focus specifically on emerging markets (EMs). They find that an increase in US bond yields causes public debt in EMs to rise by around 4.5% points, relative to GDP. Tighter financial conditions globally impact these countries negatively due to an increasing interest rate-growth differential.

A number of papers explore the determinants of debt from an institutional or a politico-economic perspective. A seminal paper by Roubini & Sachs (1989) suggests that countries defined by a short government tenure and a dispersed governing coalition, on average, run larger fiscal deficits and hence accumulate debt more rapidly. Looking at 298 Flemish municipalities, Ashworth, Geys & Heyndels (2005) show that the number of parties in a coalition positively impacts debt levels. Neck & Getzner (2001) find little empirical evidence to support the claim that the ideology of the ruling party, the form of government or the political business cycle are important drivers of the growth of public debt in Austria over the period 1960 to 1999. Roubini (1991) concludes that increasing political instability in developing countries leads to larger budget deficits and increasing debt. Woo (2003) finds that, both for developed and developing countries,

financial depth, income inequality and cabinet size are statistically significant determinants of public deficits.

Our study attempts to further the literature by formalizing an accounting framework to study public debt dynamics. As detailed in the section below, we use the framework presented by Budina & Fiess (2005), but follow Burnside (2005) in adapting it to include multilateral exchange rates to analyze the effect of changes in the exchanges rate on debt dynamics. Next, we apply this framework to a specific country, i.e. Belgium. Out of all EU countries, Belgium has achieved the third largest reduction in sovereign debt since the 1980's. Hence, it constitutes an interesting case study on the main drivers of this impressive debt reduction episode. Subsequently, we draw policy lessons for countries which are currently in a similar situation as Belgium was in the mid-1990s (e.g. Greece).

3. Methodology and data

The following section provides the description of the methodology for decomposing the debt dynamics and determinants. We follow Budina & Fiess' (2005) approach for accounting for the decomposition of debt dynamics, but adjust it to incorporate end-of-period multilateral exchange rates instead of bilateral exchange rates to calculate the revaluation effect, as suggested by Burnside (2005). The reason for this is straightforward. When working only with bilateral exchange rates, the value of all foreign currency denominated debt is recorded in one currency (often the US dollar). Hence, the only revaluation effect taken into account will be an appreciation or deprecation vis-à-vis the US dollar. Incorporating multilateral exchange rates in the debt accounting framework also allows for revaluation effects for each currency in which foreign currency debt is denominated.

This debt accounting framework breaks down the changes in the public debt-to-GDP ratio into components such as the real growth rate, primary fiscal deficits, inflation, the real growth rate and appreciation or depreciation effects on foreign currency denominated debt. Other factors that could affect changes in the debt ratio, such as privatization revenues and financial sector bailouts, are included in

the residual term. We aim to link the changes in debt-to-GDP ratios in Belgium with policy, structural factors and the macroeconomic context.

The underlying equation for the evolution of public debt is, in line with Escolano (2010), as follows:

$$D_t = (PD_t - NDFS_t) + D_{d,t-1}(1 + i_d) + e_t D_{f,t-1}(1 + i_f)$$

where D_t is the total stock of debt at time t. The increase in the stock of government debt is determined by the interest rate on the accumulated debt (D_{t-1}), and on the difference between the primary deficit (PD_t) and non-debt financing sources ($NDFS_t$). The debt stock is composed of debt denominated in both domestic as well as foreign currencies. Domestic-currency debt ($D_{d,t-1}$) evolves according to the interest rate in the market (i_d), while the evolution of the foreign-currency debt ($D_{f,t-1}$)[126], expressed in domestic currency, is affected not just by the weighted average foreign interest rate (i_f) but also by changes in the weighted average exchange rate (e_t).

Dividing both sides by $GDP_t = GDP_{t-1}(1 + g)(1 + \pi)$, with the lower-case variables expressed in upper-case variables as a proportion of GDP,

$$d_t = (pd_t - ndfs_t) + \frac{D_{d,t-1}(1+ i_d)}{GDP_{t-1}(1+ g)(1+ \pi)} + \frac{D_{f,t-1}e_{t-1}(1+ i_f)e_t}{GDP_{t-1}(1+ g)(1+ \pi)e_{t-1}} \quad (1)$$

or,

$$d_t = (pd_t - ndfs_t) + d_{d,t-1}\frac{(1+ i_d)}{(1+ g)(1+ \pi)} + d_{f,t-1}\frac{(1+ i_f)(1+ s_t)}{(1+ g)(1+ \pi)} \quad (2)$$

where

$d_{d,t-1}$ = domestic public debt ratio in period t-1, defined as $D_{d,t-1}/GDP_{t-1}$

$d_{f,t-1}$ = foreign public debt ratio in period t-1, defined as $e_{t-1}D_{f,t-1}/GDP_{t-1}$

[126] It is impossible for the National Bank of Belgium to split up the holdings of government debt per holder (i.e. domestic vs. external) AND subsequently per currency. It is only possible per holder OR per currency. Hence, we have made the following assumptions: i) all foreign currency debt is external debt (which is defined as debt held by foreign holders), i.e. external debt could be issued in euro and in foreign currency; and ii) all domestic debt is issued in euro. This does not impact the estimation of the other debt determinants.

s_t = change in the nominal exchange rate: $(1 + s_t) = \frac{e_t}{e_{t-1,}}$

or,

$$d_t = (pd_t - ndfs_t) + (1-\alpha)\, d_{t-1} \frac{(1+ i_d)}{(1+ g)(1+ \pi)} + \alpha d_{t-1} \frac{(1+ i_f)(1+ s_t)}{(1+ g)(1+ \pi)}$$

where α is the share of foreign currency denominated debt in total public debt[127]

$$d_t = (pd_t - ndfs_t) + \frac{d_{t-1}}{(1+ g)(1+ \pi)}[(1-\alpha)(1+ i_d) + \alpha\,(1+ i_f)(1+ s_t)] \quad (3)$$

Define $\hat{\imath} = (1-\alpha) i_d + \alpha i_f (1+ s_t)$ as the average nominal interest rate on public debt, and equation (3) can be rewritten as

$$d_t = (pd_t - ndfs_t) + \frac{d_{t-1}}{(1+ g)(1+ \pi)}[\hat{\imath} + 1 + \alpha s_t], \quad (4)$$

The average nominal interest rate $\hat{\imath}$ is calculated as the ratio of interest payments on debt divided by the previous period stock of public debt.

Subtracting d_{t-1} from both sides of equation (4) yields

$$\Delta d_t = (pd_t - ndfs_t) + \frac{\hat{\imath}}{(1+ g)(1+ \pi)} d_{t-1} - \frac{g}{(1+ g)} d_{t-1} + \frac{\alpha s_t - \pi}{(1+ g)(1+ \pi)} d_{t-1} \quad (5)$$

After some algebra, it is possible to show that the last term can be rewritten as

$$-\sum_{i=1}^{N} \theta_{it} \left(\frac{S_{it} - S_{\bar{it}}}{S_{it}}\right) d_{ft} + \left(\sum_{i=1}^{N} \theta_{it-1} \left(\frac{S_{\bar{it}} - S_{it-1}}{S_{it-1}}\right) \frac{1}{1+ g_t} - \frac{\pi_t}{1+ \pi_t} \right) d_{f,t-1} \quad (6)$$

where the revaluation effect is estimated using the end-of-period t exchange rate measured in local currency units per foreign currency *i* (S_{it}), and the equivalent period average exchange rate in local currency units per foreign currency *i* ($S_{\bar{it}}$), and where θ_{it} represents the share of currency i in a country's foreign public debt.

Substituting (6) into (5) gives the basic accounting framework for public debt decomposition as below:

[127] $\alpha = \frac{d_{f,t-1}}{d_{t-1}}$

$$\Delta d_t = (pd_t - ndfs_t) - \frac{g}{(1+g)} d_{t-1} + \frac{d_{t-1}}{(1+g)}\left[\frac{\hat{i}}{1+\pi} - \frac{\pi}{1+\pi}\right] +$$

$$\sum_{i=1}^{N} \theta_{it}\left(\frac{S_{it} - S_{\bar{it}}}{S_{it}}\right) d_{ft} + \left(\sum_{i=1}^{N} \theta_{it-1}\left(\frac{S_{\bar{it}} - S_{it-1}}{S_{it-1}}\right)\frac{1}{1+g_t} - \frac{\pi_t}{1+\pi_t}\right) d_{f,t-1} \quad (7)$$

where,

D_t – total public debt, $d_t = D_t/GDP_t$

D_{dt} – domestic public debt, $d_{dt} = D_{dt}/GDP_t$

D_{ft} – foreign public debt, $d_{ft} = e_t D_{ft}/GDP_t$

PD_t – primary deficit, $pd_t = PD_t/GDP_t$

$NDFS_t$ – non-debt financing sources, $ndfs_t = NDFS_t/GDP_t$

e_t – weighted average nominal exchange rate

s_t – changes in the nominal exchange rate: $(1 + s_t) = \frac{e_t}{e_{t-1,}}$, with s_t > 0 indicating *nominal* depreciation of the local currency

S_t - end-of-period t exchange rate (domestic currency/foreign currency), and

$S_{\bar{t}}$ - the average exchange rate

g – real GDP growth rate

π – domestic inflation (change in the domestic GDP deflator)

i_d – nominal interest rate on domestic debt

i_f – weighted average nominal interest rate on foreign debt

α – the share of foreign currency denominated debt in total public debt ($\alpha = \frac{d_{f,t-1}}{d_{t-1}}$)

3.1 Data

All data have been gathered from the National Bank of Belgium (NBB). This accounting exercise can be useful in describing how the debt levels evolved in Belgium during the period 1995-2014.

Appendix 2 provides the summary statistics for total debt, interest payments, the primary balance and real GDP growth. In our sample, the average debt-to-GDP ratio is 105.74%, starting from a high of 130.75% in 1995 and reaching a low of 86.84% in 2007. Interest payments, expressed as a percentage of GDP, averaged 5.31% and declined unabatedly from 8.96% at the start of our sample to 3.13% in 2014[128]. In addition, the primary balance has an average of 3.28%. This masks vast differences between the period before and the period after the GFC; until 2007, the primary balance averaged 5.02%, whilst from 2008 onwards it was 0.04%. The same discrepancy is observed when looking at real GDP growth, which averaged 1.76% over the entire sample, but was around 2.41% over the period 1995-2007 but dropped to 0.56% thereafter.

Appendix 3 brakes down the total stock of debt, in percentage of GDP, into domestic borrowing and external borrowing, where the latter is further divided into foreign currency debt and domestic currency debt. It shows that Belgium steadily increased its reliance on external borrowing, but simultaneously reduced its foreign currency lending, which was already rather limited at the start of our sample. Whereas less than a quarter of its public debt was financed by foreign borrowing in 1995, in 2014 external debt accounted from over 50% of the total stock of debt, but was chiefly denominated in euro.

We have included the revaluation effect in the debt dynamics, even though in the case of Belgium, the share of foreign currency denominated debt was low since the beginning of the period of study (1995), declining and approaching zero by 2014. Consequently, throughout the period of analysis, Belgium had a very low foreign currency risk exposure, leading to a very low and further declining revaluation effect. Seigniorage averaged 0.12% of GDP from 1995-2014, but was

[128] As noted above, the average nominal interest rate is calculated as the ratio of interest payments on debt divided by the previous period stock of public. This ratio of annual debt servicing costs divided by the outstanding stock of debt is sometimes also referred to as the implicit interest rate on government debt (e.g. de Callatay & Thys-Clément, 2013).

lower in 1995-2000 at about 0.10% of GDP, and increased in the period from 2009-2014 to a still very low 0.16%.

4. Prelude on the Belgian experience

Like most advanced economies, Belgium reacted to the oil crises of the 1970s by pursuing an expansionary fiscal policy. As a result, Gross Financing Needs rose to 13% of GDP and the public debt-to-GDP ratio increased to over 90%. A combination of low nominal growth and an insufficient primary balance, resulted in a 'snowball effect' of ever increasing debt: in 1988 the debt-to-GDP ratio was close to 130%. By this time, the primary surplus reached 4% which, in combination with strong growth, was sufficient to stabilize the debt ratio. The unexpected recession of 1993 caused public debt to rise further, to over 138%. Appendix 4 shows the evolution of government debt for Belgian and several other core European countries from 1980 to 1995. Each country in this sample experiences a rise in public debt. However, Belgium started from a higher level than every other country.

Belgium was clearly in a predicament and the federal government undertook several policy measures to tackle this unsustainable situation. One of these measures was the so-called "Global plan for employment, competitiveness and social security" of 1993, which focused on moderating labor costs and relaxing regulation for companies that want to hire additional personnel (NBB, 1995). Other measures aimed at boosting employment were the "jobs-for-young-people plan", which was focused on stimulating the recruitment of young workers, and the "plus-one plan", which allowed exemptions on social security payments for companies that hire, as their first employee, someone who was previously unemployed.

In addition, real wages were frozen in 1995 and 1996. As Belgium was, and still is, a very open economy - exports-to-GDP started from an already significant 60% in 1990 to over 80% in 1995 - it is important that Belgian companies can maintain competitive. Thus, wage moderation is crucial. To this end, the Belgian government passed the "1996 law on competitiveness". This law establishes a

biannual wage norm with the aim of keeping the development of wages in line with those of its neighboring countries (IMF, 2017).

Besides taking actions to boost growth, the Belgian government also implemented important measures to regain fiscal sustainability. As soon as a new government was formed in 1992, it gave high priority to fiscal consolidation. Hence, it established a 'convergence plan' that had three aims: (i) fulfilling the criteria as stipulated in the Maastricht Treaty by 1996, (ii) reversing the snowball effect of interest on the debt burden, and (iii) creating fiscal space to deal with the new challenges brought about by an aging population (NBB, 1994).

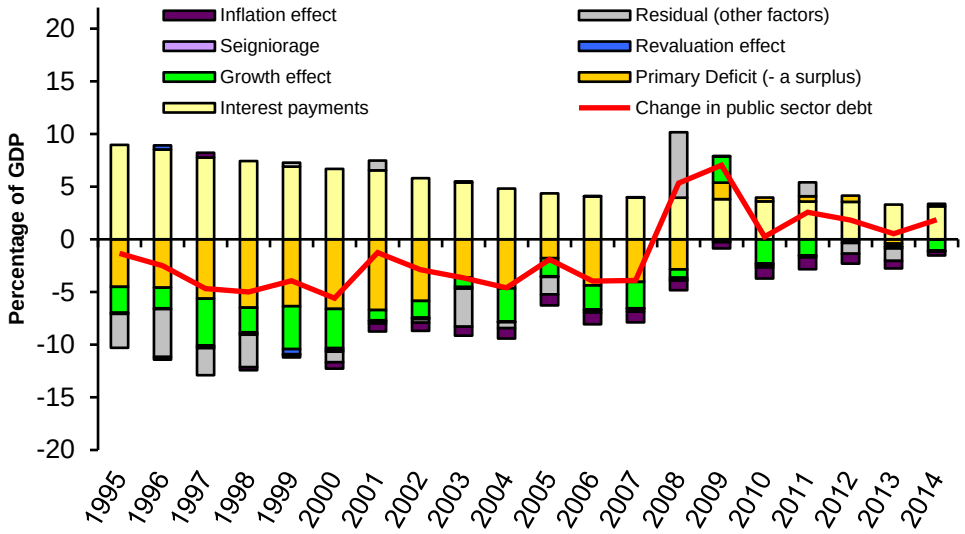
Appendix 5 gives an overview of the primary balance of Belgium and its three neighboring countries (excl. Luxembourg) for the period 1985-2010. The commitment to fiscal consolidation clearly had an impact, as Belgium more than doubled its primary balance from less than 2% to over 4%.

5. Results

As discussed in Section 3.2, Belgium managed to reduce public debt-to-GDP from 130.7% to 86.9% over the period 1995-2007. Then the GFC hit, which resulted in a rising debt ratio; at the end of 2014, sovereign debt reached 106.9% of GDP. In this section, we take a closer look at the primary drivers of the evolution of public debt. We divide our analysis in three parts: i) the years before the introduction of a single currency in the Eurozone, starting from 1995, ii) the subsequent years, up to 2007 when the Global Financial Crisis broke out, and iii) the period from 2008 to 2014. Breaking up the entire period under consideration into these specific episodes allows for studying whether entering a monetary union has had an impact on debt dynamics and how the GFC affected the evolution of public debt.

Figure 1 provides an overview of the evolution of public debt dynamics in Belgium for the period 1995-2015. It tries to link changes in debt-to-GDP ratios to episodes of marked policy change and substantial macroeconomic developments. Appendix 6 shows the same results, but in tabular form.

Figure 1: Belgium, debt dynamics, 1995-2014



Note: The interpretation of this chart is as follows. The colored segments of each column represent the contribution of each factor in our debt decomposition to the year-on-year change in the debt-to-GDP ratio. Items above the zero line contributed to an increase in the debt-to-GDP ratio, while items below the zero line contribute to a reduction in the debt-to-GDP ratio. As an example, a negative sign for the contribution from real GDP growth in a given year indicates that positive real GDP growth during that year contributed to a reduction in the debt-to-GDP ratio.

We find that, in the run-up to joining the Eurozone, Belgium succeeded in carrying out a considerable fiscal consolidation; it had primary surpluses of 4.5 to 6.5% of GDP. In addition, relatively strong growth helped pushed down debt further. This ensured that the public debt-to-GDP ratio was found to have "*sufficiently diminished and* […] *approaching the reference value at a satisfactory pace*" as was required by the euro convergence criteria (EMI, 1995).

After entering the monetary union, Belgium continued on its path of fiscal frugality; the primary balance dipped below 4% in just two years: 2003 (only marginally so) and 2005. Quite high real GDP growth, in combination with modest inflation also helped erode some of the debt. The austerity policy, which was put

in place in order to be able to join the Eurozone, was essentially maintained unaltered after joining the single currency. Moreover, the macroeconomic environment remained quite similar. Belgium was well on its way to reach the public debt-to-GDP target enshrined in the EU treaties.

Then the GFC hit, causing the uninterrupted series of primary surpluses to turn into, albeit small, primary deficits. It is interesting to note that Belgium never had a primary deficit larger than 1% of GDP, except in one year; at the height of the crisis in 2009, when the economy contracted by 2.6% in real terms, Belgium's primary deficit was 1.6%. This is remarkable, given the severity of the Global Financial Crisis and even more so when one compares it to the large primary surpluses which were being realized in the preceding periods.

Moreover, despite the unfavorable global economic conditions, Belgium did not really experience considerable negative growth. As mentioned above, only in 2009 real GDP growth dipped into negative territory, which is in line with the experience of other core Eurozone countries, such as Germany and the Netherlands, where growth - and the primary balance - only in 2009 went sharply negative, after which growth returned, albeit to lackluster levels, and the primary balance again moved to a surplus. This stands in sharp contrast to periphery countries, such as Portugal and Spain, and of course Greece, where the plunge in GDP was significantly more pronounced and primary surpluses were only reached in 2013-2014, if at all.

Table 1 further summarizes the cumulative public debt decomposition. The main drivers of debt dynamics are aggregated for the three periods under consideration.

Table 1: Cumulative public debt composition (in percentage of GDP)

	1995-1998	1999-2007	2008-2014
Interest payments	32.7	48.6	24.9
Primary Deficit (- a surplus)	-21.2	-44.0	-0.3
Growth effect	-11.2	-21.0	-3.6
Inflation effect	-0.1	-7.4	-5.7
Revaluation effect	0.1	-0.7	-0.2
Seigniorage	-0.4	-0.8	-1.1
Residual (other factors)	-13.4	-6.3	5.3
Change in public sector debt	-13.5	-31.7	19.4

During the period 1995-1998, Belgium's public sector debt-to-GDP ratio declined by 13.5% percentage points. The main factors behind this decline were a combination of primary fiscal surpluses and quite strong growth. Both factors combined to push down debt by 32.4% of GDP over this period. Unaccounted factors also played a substantial role in reducing public debt. These can mainly be attributed to the partial or full privatization of several state-owned companies, such as the public credit institutions and Belgacom. Moreover, significant gains were realized on the sale of the National Bank of Belgium's gold reserves (Bisciari et al., 2015). As Belgium had an average public debt level of over 125% of GDP over this period, interest payments were large. This was the only factor driving the debt ratio up.

After entering the monetary union in 1999, the same debt dynamics which were in play the previous period helped push down debt further; large fiscal surpluses and high real GDP growth helped scale down public debt from 114.6% of GDP in 1999 to 86.8% of GDP in 2007[129]. Inflation also had a sizeable effect on this reduction. It is noteworthy that the fit of the model improves, as the residual is

[129] As the number shown in the table is composed of the sum of the in- or decrease in the debt ratio of each individual year, it does not precisely match the difference between the debt ratio at the end of the period and the debt ratio at the start of the period.

significantly smaller[130]. Again, interest payments were the main factor boosting the ratio of public debt-to-GDP by 48.6% of GDP over the selected period.

The Global Financial Crisis completely halted the gradual decline in the public debt-to-GDP ratio and even sent it on an upward spiral. While it stood at 86.8% in 2007, it increased to 106.2% seven years later in 2014. One of the primary factors pushing down debt over the previous periods, i.e. a long series of primary surpluses, dissipated and turned into primary deficits in 2009-2011, resulting in a quasi-balanced - primary - budget over the period under consideration. Real GDP growth and inflation were to some extent factors that helped in reducing the level of debt-to-GDP, but overall the cost of servicing an already high stock of debt caused the public debt level to increase considerably. Again, the residual is lower (in absolute terms)[131] compared to the first period.

In summary, due to its historically high debt burden, Belgium continually needed to achieve a large primary surplus, as not to let debt spiral too much out of control. Once interest rates started to decline, due to a decrease in the risk premium required by bond investors once Belgium entered the EMU, and international growth picked up, the 'stars aligned' for an impressive episode of debt reduction.

Although Belgium did take measures to establish relatively high primary surpluses, these were not substantially higher than those it historically realized; for the period 1985-1995 the average primary surplus was 2.8%. In comparison, the Netherlands only had a primary surplus of 0.5%, while France had a primary deficit of 1.1%[132]. Of course, maintaining a primary surplus also requires taking difficult, and often unpopular, measures, but Belgium had ample experience in doing so. Moreover, the Belgian government's efforts to boost growth certainly had an impact, but this can be seen more as being able to *maintain* its growth

[130] In 2003, Belgacom, a Belgian telecommunications company of which the Belgian state was and still is a large shareholder, paid €5 billion to the Belgian government for it to take over its pension obligations. If we exclude this one-off effect, the residual over the entire period 1999-2007 is only 4.5%.
[131] The fiscal cost of bailing out banks is estimated at around €15-€20 billion (see e.g. Maurer & Grussenmeyer, 2015). This almost fully accounts for the unexplained factor in the debt dynamics over this period.
[132] Due to the reunification of East and West Germany in 1990, there are no comparable data for Germany over this period.

rate than to significantly *increase* it. Real GDP growth over the period 1995-2004 was not materially higher than in the period 1985-1994: 2.4% vs. 2.3%.

6. Policy lessons for Greece

In the previous section, we took an in-depth look at Belgium's debt dynamics over the period and identified the main drivers of the reduction in its public debt-to-GDP ratio from 130.7% in 1995 to 86.9% in 2007, which was one of the largest debt reduction episodes in Europe since 1985. In this section, we try to draw policy lessons for a country which could certainly benefit from a comparable, or preferably even larger, decrease in public debt: Greece. Its debt-to-GDP ratio ballooned from an already sizeable 103.5% in 2006 to 178.6% in 2014[133]. Here, we take a look at what, if any, lessons can be learned from the Belgium experience that can also be applied to Greece. Even if no direct parallels can be drawn, the attitudes of European creditors on what can 'reasonably' be demanded of the Greek government is considerably influenced by the achievements of other countries in the past. Thus, as a recent report by the Peterson Institute for International Economics (Zettelmeyer, Kreplin & Panizza, 2017) puts it: "*Hence, even if the behavior of other countries were irrelevant in a predictive sense (because Greece turns out to be structurally highly atypical), it could be important in a normative sense, from the vantage point of creditors*."

Therefore, we not so much aim to argue that Greece and Belgium are identical; the two countries have a very similar population size of approximately 11 million people and also maintain a public sector of significant size[134], but differ quite substantially with regards to economic output[135]. Rather, we seek to both identify the parallels as well as highlight the differences in order for these to be managed conscientiously. Introducing this combination of a political science perspective and

[133] Source: Eurostat.
[134] Total general government expenditure amounts to around 50% of GDP in both countries (source: Eurostat).
[135] In 2014, Belgium's GDP per capita (in PPS) was €34,700 while that of Greece was just €21,200, which makes Belgian citizens around 40% richer than their Greek counterparts (source: Eurostat).

an economic viewpoint is crucial to being able to properly recommend the right set of policies to deal with the Greek crisis, as argued by Featherstone (2011).

Belgium has been able to significantly lower its debt level so it could comply with the convergence criteria for the Maastricht treaty[136]. If it did not adhere to these, Belgium might not have been able to join the single currency, something which would have been unthinkable for one of the founding members of the European Community. Hence, there was ample political will and public willingness to make hard sacrifices. Similarly, during the stand-off between Greece and its creditors in the summer of 2015, it has become abundantly clear that 'Grexit' is a real political option for European leaders, one that cannot be ruled out anymore[137]. At the same time however, the people of Greece have shown their unequivocal desire to remain a member of the Eurozone, even if this requires harsh austerity[138]. One could argue that the credible threat of throwing Greece out is similar to the threat of not becoming a member in the first place. Hence, as staying part of the Eurozone is as important to the Greek people as entering it was for the Belgian people, they will be willing to make considerable sacrifices to this end.

Part of these sacrifices are realizing sustained primary surpluses. As we have shown above, this was the most important factor in driving down public debt in Belgium. Greece has already demonstrated that it is able to pursue significant fiscal tightening. According to Gechert & Rannenberg (2015), Greece's fiscal consolidation effort over the period 2010-2014 amounted to 24.9% of GDP, the largest of the entire Eurozone. To keep debt on a sustainable path, the IMF's 2015 Debt Sustainability Analysis on Greece (2015) estimates that permanent primary surpluses of 3-4% of GDP are required[139]. Whether or not this is feasible will, to a large extent, depend on the willingness of the Greek people to continue enduring

[136] For a detailed assessment of the Maastricht Treaty, see Christiansen, Duke & Kirchner (2012).
[137] See for example the 'non-paper' which was drafted by German Finance Minister Wolfgang Schäuble proposing a temporary 5-year Greek exit from the Eurozone on July 15th, 2015.
[138] During the summer of 2015, in the midst of heated negotiations between Greece and its creditors, opinion polls conducted by GPO showed that more than 70% of Greeks wanted their country to remain part of the Eurozone.
[139] The IMF acknowledged as much in its subsequent DSA (2016): "*Even if Greece through a heroic effort could temporarily reach a surplus close to 3½ percent of GDP, few countries have managed to reach and sustain such high levels of primary balances for a decade or more, and it is highly unlikely that Greece can do so considering its still weak policy making institutions and projections suggesting that unemployment will remain at double digits for several decades*."

the hardship they have faced over the last 7 years. Several factors play into this, such as who holds the sovereign debt and the overall economic climate.

Whereas only around a quarter of Belgium's stock of public debt was held by non-residents in the years prior to joining the Eurozone[140], at the end of 2014 around 83% of Greece's debt was owed to official - foreign - creditors[141]. Hence, realizing continued primary surpluses to pay down debt in Greece amounts to a massive transfer of Greek wealth abroad. This is politically a lot more sensitive than in Belgium, where most debt was held by residents. If Greek society considers this unequitable and views these payments as future generations having to pay for mistakes made by previous governments, their willingness to make hard sacrifices might be jeopardized. Hence, this political reality has to be first acknowledged and subsequently managed carefully in order for this perception not to be tilted towards hostility against foreign creditors on the part of Greek society.

Not only do prolonged primary surpluses constitute a transfer of wealth to foreign creditors, it also saps productive resources out of the economy. Indeed, the higher taxes or lower spending that are required to establish a primary surplus, vis-à-vis a balanced budget for example, act as a drag on growth and all the more so in a depressed economy such as that of Greece. Thus, the right pace of fiscal consolidation as not to undermine growth, is essential. As we have seen in the Belgian case, next to primary surpluses, solid growth is required to go down a sustainable and credible path of debt reduction, which is in line with the findings of Nickel, Rother & Zimmermann (2010), who study large debt reduction episodes over the period 1985-2009. Hence, putting in place and following through on growth-enhancing reforms will be crucial, not only for Greece, whose GDP fell by more than a quarter over the period 2008-2014, but also for foreign creditors who wish to recover some of the funds they have lent to Greece. A country that does not grow cannot repay its debt. The point we try to make is not so much that primary surpluses are undesirable, but that a fine balance has to be struck between what is politically feasible and economically sensible.

[140] Source: National Bank of Belgium.
[141] Source: The draft budget for 2015 submitted by the Greek government to parliament in October 2014.

Over the period 1995-2007, the sole factor driving up the debt ratio in Belgium were interest payments, starting from around 9% of GDP and falling steadily over the entire period to just under 4% of GDP. In anticipation of the single currency, interest rates in the Eurozone converged to the German rate, which itself declined substantially, as Appendix 7 shows. Risk premiums, defined as the spread between a country's 10-year bond yield over that of Germany's, went down across the entire Eurozone as the sovereign debt of Spain was considered as safe as that of Germany. Belgium also benefited from this, as its interest expenses declined markedly.

Notwithstanding Greece's far larger stock of debt, total interest expenditures for Greece will not exceed 4.3% of GDP for the period 2015-2020 due to the concessional nature of the loans granted by its creditors[142]. It is highly unlikely that, after this period, private investors will be eager to start borrowing to Greece at these very low rates[143]. Hence concessional loans by official creditors might be the only alternative to ensure Greece's debt servicing costs remain manageable. As the IMF (2015) puts it in of its latest Country Reports on Greece: "*Greece cannot return to markets anytime soon at interest rates that it can afford from a medium-term perspective.*" From a debt accounting point of view, the underlying factor driving down debt servicing costs are irrelevant[144]; it does not matter whether it is the result of a reduction in risk premium or very cheap loans from official creditors. The impact on the evolution of debt is the same.

However, Belgium is a very open economy that benefited from solid growth in its neighboring countries. In contrast, Greece is a relatively closed economy, with growth in its main trading partners projected to be relatively weak. Moreover, Belgium already had a lot of experience in fiscal consolidation, as this was required in the 1980s to keep debt from spiraling out of control. Hence, the policy measures undertaken by the Belgium government came quite naturally to them. This stands in stark contrast with Greece, which primary deficit 'exploded' once it entered the

[142] Source: Eurostat.
[143] However, under certain conditions official lending might spur the private sector into rolling over short term loans, thus alleviating the funding problems of the indebted country (e.g. Morris & Shin, 2006).
[144] Of course, the main reason why official creditors grant these concessional loans is because the other factors of its debt dynamics are not that favorable, such as the gargantuan stock of debt in a low-growth environment.

EMU: in 2009 Greece's primary deficit stood at an unsustainable 12.2%, as can be seen in Appendix 8. Finally, Belgium benefited from a vast decrease in its borrowing cost: the yield on 10-year government bonds stood at 8% in 1992 and declined to below 2% in 1994. In contrast, Greece's debt is to a large extent in the hands of official creditors, which are already lending at concessionary rates. Hence, a further reduction in borrowing costs is rather unlikely.

As we have tried to illustrate in the discussion above, whether or not Greece can achieve a similar reduction in its public debt-to-GDP ratio as Belgium did cannot be thought off in black and white terms. There are several elements speaking in its favor (e.g. a dedication to remaining part of the single currency union) and others which do not (e.g. experience in fiscal consolidation). Nevertheless, clearly highlighting the similarities and the differences between the Belgian experience and the prospects for Greece constitutes an important step in designing a credible debt reduction plan for Greece, which is in the interest both of the Greek people and its European creditors.

7. Conclusions

In summary, this paper has three main contributions. First, we introduce a formal framework to study debt dynamics. Subsequently, this framework is applied to analyze the main determinants of the debt-to-GDP ratio of Belgium for the period 1995-2014. Finally, we draw policy lessons from this particular case study for Greece, which might benefit from similar debt dynamics as Belgium has experienced.

We find that Belgium managed to significantly reduce its public debt-to-GDP ratio in the run-up to joining the Eurozone and continued to do so until the GFC broke out in 2008. The primary driver of this debt reduction effort were large primary surpluses. Quite strong economic growth further helped drive debt down further. Bailing out the financial sector in 2008 resulted in significant increase of public debt. Next, tepid growth in combination with the cost of servicing a large stock of debt, caused the public debt-to-GDP ratio to increase further. Although the Global Financial Crisis is considered to be the worst economic downturn since the Great

Depression, primary deficits, for example to counter the negative effects of the recession, only played a minor role in the surge in debt.

Next, this paper tries to draw policy lessons from this case study of Belgium for a country which is, compared with its peers, as heavily-indebted as Belgium was at the start of the period under investigation. We do not claim that Greece and Belgium are identical, nor that Greece can simply copy Belgium's policy. We merely highlight some lessons than can be learned from the experience of Belgium. As the great American novelist Mark Twain once wrote: "*History doesn't repeat itself, but it does rhyme.*" Greece is well-served to review the history of Belgium. We consciously do not take a position on whether Greece's debt is sustainable or not and hence whether or not it needs debt relief. It is clear that its partners require Greece to independently manufacture a significant reduction in its debt-to-GDP ratio. Debt relief will only influence the magnitude of this effort.

We see three main areas for further research. Firstly, the period under consideration starts in 1995 as the National Bank of Belgium only has detailed data on the characteristics of Belgium's sovereign debt as of then. When more data become available, it might be useful to broaden the period which is analyzed. Secondly, the framework introduced in this paper can be applied to a larger pool of countries. This way, common factors in episodes of large debt reductions and increases can be identified. Finally, whereas this paper relies on a debt accounting framework to assess public debt dynamics, the analysis might be extended with a vector autoregression framework, in line with Ryan & Maani (2015).

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Appendices

Appendix 1: General government spending (as percentage of GDP)

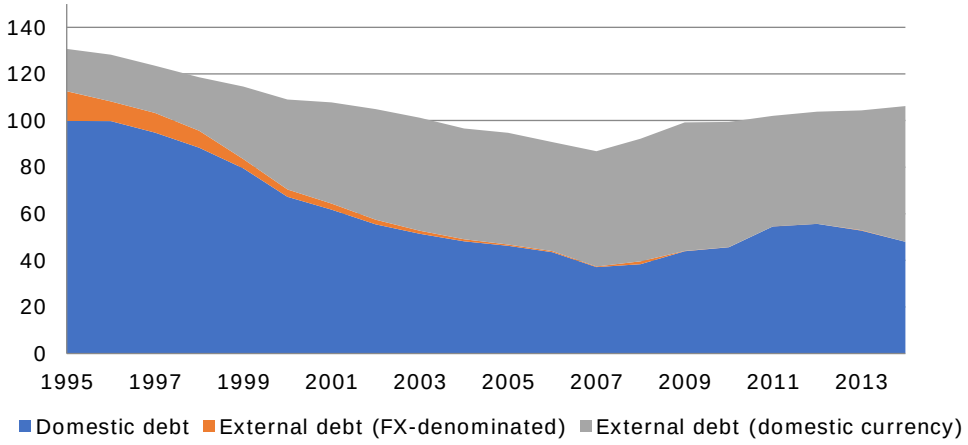
Year	Belgium
1995	52.39
1996	52.67
1997	51.24
1998	50.56
1999	50.07
2000	49.05
2001	49.19
2002	49.51
2003	50.71
2004	48.93
2005	51.43
2006	48.44
2007	48.24

Source: OECD – Economic Outlook (2017).

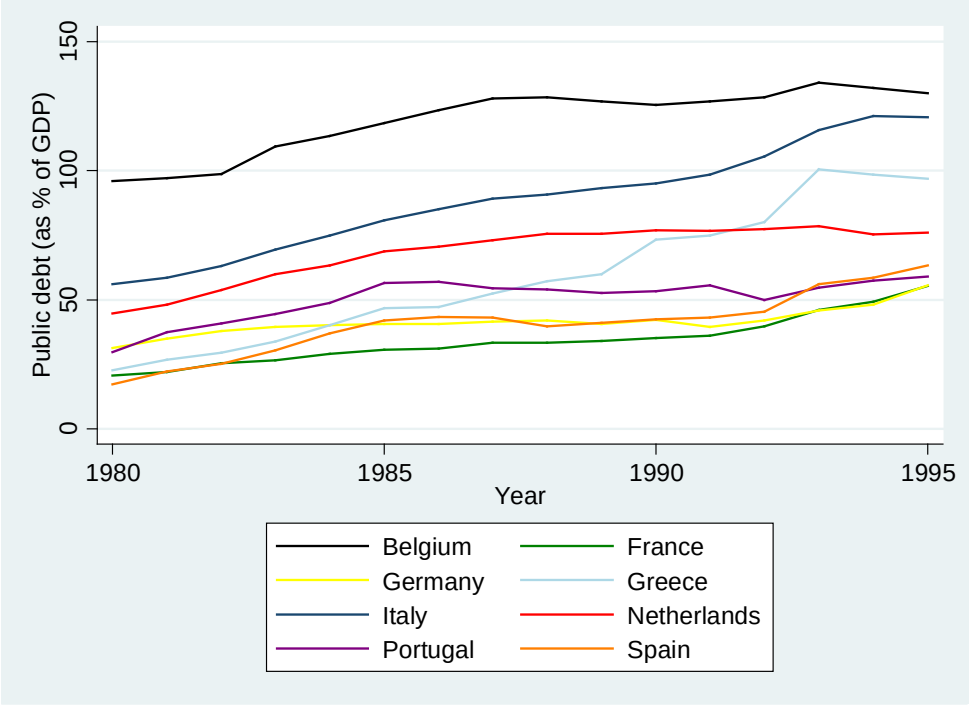
Appendix 2: Descriptive statistics

Year	Public debt (% GDP)	Interest payments (% GDP)	Primary balance (% GDP)	Real GDP growth (in %)
1995	130.75	8.96	4.51	2.38
1996	128.23	8.52	4.59	1.55
1997	123.55	7.77	5.64	3.74
1998	118.55	7.43	6.48	2.01
1999	114.62	6.90	6.34	3.72
2000	109.03	6.68	6.61	3.55
2001	107.76	6.55	6.72	0.92
2002	104.88	5.81	5.86	1.56
2003	101.22	5.40	3.63	0.89
2004	96.62	4.81	4.65	3.43
2005	94.71	4.36	1.79	1.89
2006	90.74	4.08	4.38	2.63
2007	86.84	3.98	4.04	3.00
2008	92.17	3.95	2.86	0.95
2009	99.20	3.81	-1.56	-2.62
2010	99.44	3.60	-0.36	2.50
2011	102.01	3.59	-0.50	1.64
2012	103.84	3.56	-0.58	0.09
2013	104.38	3.30	0.41	0.27
2014	106.22	3.13	0.03	1.04
Average	**105.74**	**5.31**	**3.28**	**1.76**

Appendix 3: External and domestic debt



Appendix 4: Evolution of public debt, 1980-1995



Source: OECD – Economic Outlook (2017).

Appendix 5: Underlying government primary balance (as percentage of potential GDP)

Year	Belgium	France	Germany*	Netherlands
1985	1.44	-0.37	.	0.97
1986	1.67	-0.51	.	0.33
1987	3.15	0.34	.	0.50
1988	1.89	-0.99	.	0.70
1989	2.16	-0.98	.	-1.33
1990	3.04	-1.12	.	-2.30
1991	2.38	-1.32	-2.71	0.78
1992	1.95	-2.29	-1.60	0.22
1993	4.44	-2.16	-0.49	2.61
1994	4.47	-1.61	-0.22	1.69
1995	4.28	-0.99	-0.35	1.50
1996	4.87	0.16	-0.29	2.83
1997	5.31	0.34	0.21	2.86
1998	6.53	0.71	0.97	2.37
1999	5.54	0.91	1.55	2.51
2000	5.27	-0.06	1.35	2.35
2001	5.98	0.28	-0.33	1.01
2002	5.31	-0.84	-0.78	-0.05
2003	4.37	-1.42	-0.35	-0.27
2004	3.73	-1.52	-0.19	0.68
2005	3.09	-1.31	0.10	1.60
2006	3.05	-0.95	0.36	0.69
2007	2.12	-1.54	1.35	-0.24
2008	1.54	-1.03	1.57	-0.22
2009	-0.21	-3.1	1.48	-2.66
2010	-0.04	-3.4	-0.18	-2.72

**No data were available for Germany for the period 1985-1990*

Source: OECD – Economic Outlook (2017).

Appendix 6: Belgium, public debt dynamics, 1995-2014 (in percentage of GDP)

	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Interest payments	8.96	8.52	7.77	7.43	6.90	6.68	6.55	5.81	5.40	4.81
Primary deficit (- a surplus)	-4.51	-4.59	-5.64	-6.48	-6.34	-6.61	-6.72	-5.86	-3.63	-4.65
Growth effect	-2.46	-1.96	-4.43	-2.34	-4.07	-3.72	-0.97	-1.60	-0.90	-3.18
Inflation effect	-*	-0.27	0.45	-0.29	-0.26	-0.60	-0.75	-0.78	-0.86	-0.99
Revaluation effect	-*	0.40	-0.14	-0.12	-0.49	-0.19	-0.09	-0.01	0.10	-0.03
Seigniorage	-0.10	-0.08	-0.13	-0.11	-0.05	-0.15	-0.22	-0.12	-0.14	-0.02
Residual (other factors)	-3.23	-4.54	-2.56	-3.09	0.39	-1.01	0.93	-0.33	-3.62	-0.56
Change in public sector debt	-1.34	-2.51	-4.68	-5.00	-3.93	-5.59	-1.27	-2.88	-3.65	-4.61

**As the inflation effect and the revaluation effect are calculated vis-à-vis the previous year, the required information was not available for 1994 at the NBB*

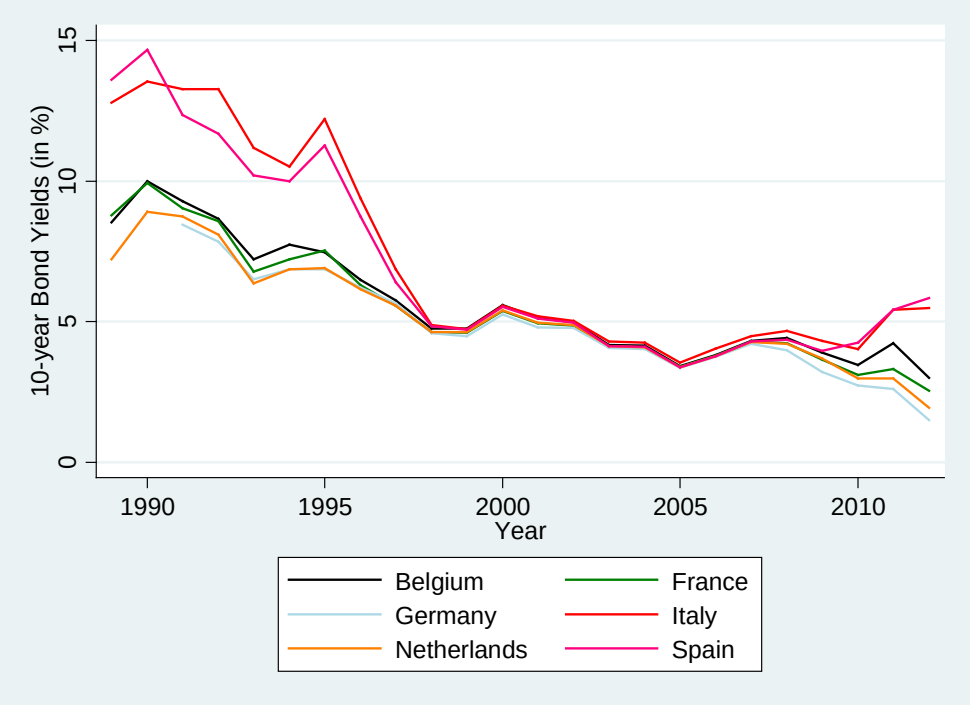
Source: Authors' calculations

Appendix 6 (cont.): Belgium, public debt dynamics, 1995-2014 (in percentage of GDP)

	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Interest payments	4.36	4.08	3.98	3.95	3.81	3.60	3.59	3.56	3.30	3.13
Primary deficit (- a surplus)	-1.79	-4.38	-4.04	-2.86	1.56	0.36	0.50	0.58	-0.41	-0.03
Growth effect	-1.72	-2.31	-2.51	-0.80	2.52	-2.31	-1.54	-0.09	-0.28	-1.06
Inflation effect	-1.05	-1.12	-1.01	-0.91	-0.60	-1.05	-1.12	-0.95	-0.71	-0.36
Revaluation effect	-0.02	0.02	0.00	-0.15	0.01	-0.02	-0.00	-	-0.00	-0.00
Seigniorage	-0.05	-0.02	-0.07	-0.12	-0.19	-0.16	-0.17	-0.25	-0.17	-0.08
Residual (other factors)	-1.65	-0.25	-0.26	6.21	-0.08	-0.18	1.31	-1.02	-1.19	0.25
Change in public sector debt	-1.91	-3.97	-3.90	5.33	7.03	0.24	2.57	1.83	0.54	1.85

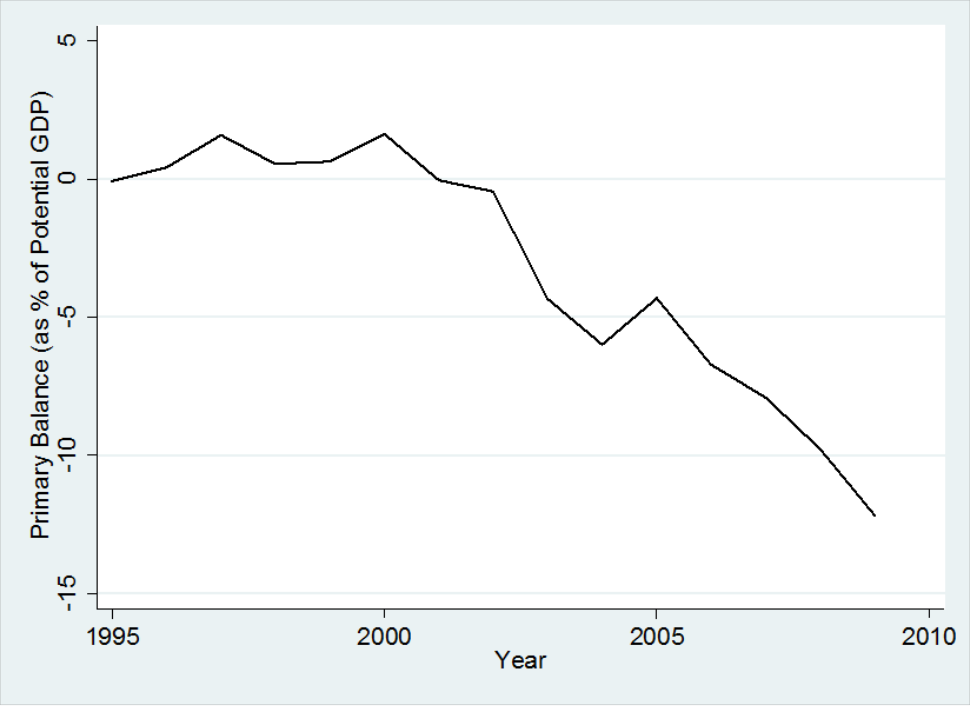
Source: Authors' calculations

Appendix 7: Evolution of long-term yields in Eurozone, 1989-2012



Source: OECD.

Appendix 8: Evolution of Greece's primary balance for the period 1995-2009



Source: OECD – Economic Outlook (2017).

CHAPTER 6

Consumer confidence and household saving behavior

A cross-country empirical analysis

This chapter is under review as:

Vanlaer, W., Bielen, S., & Marneffe, W. (XXXX). Economic uncertainty and household saving behavior – a cross-country empirical analysis. Social Indicators Research.

ABSTRACT

The Global Financial Crisis wreaked havoc on the European economy and dented consumer confidence. This paper exploits a panel dataset of 18 EU countries over the period 2001-2014 to examine whether this decrease in consumer confidence has had an impact on the saving behavior of households and if so, which specific sub-indicators of consumer sentiment have played the most significant role. To tackle the issue of potential endogeneity between the household saving rate and consumer confidence, we use an instrumental variable approach. Our results suggest that confidence in the financial situation of households has a substantially larger effect on household saving than confidence in the general economic situation. Moreover, we find that the impact of consumer confidence on household saving has increased after the crisis, potentially due to a threshold effect.

Keywords

Precautionary Saving, Consumer Confidence, Household Saving Behavior

1. Introduction

Recent years have been characterized by marked changes in the macroeconomic environment. Notwithstanding the recent uptick in growth, as well as upward revisions in growth forecasts (IMF, 2018), the recovery from the Global Financial Crisis (GFC) has been rather timid (Taylor, 2014), exemplified by a combination of meagre growth and low, and especially below-target, inflation[145]. In the wake of the crisis, central banks cut interest rates to nearly zero. The Federal Reserve, for example, introduced its Zero Interest Rate Policy (ZIRP) already in 2008. This policy measure proved to be insufficient to spur growth and the economic recovery remained tepid (Pollin, 2012). Central banks in developed countries, and increasingly so in the developing ones, reacted by further loosening monetary policy and, since policy rates were close to the Effective Lower Bound (ELB), by more unconventional monetary policy measures. Quantitative Easing (QE), forward guidance and Negative Interest Rate Policy (NIRP), which were regarded only a decade ago as nearly inconceivable, have now become commonplace. Even the prospect of Helicopter Money was openly being touted by senior members of the Executive Board of the ECB[146]. Its results can at best be described as moderately positive (Gambacorta, Hofmann & Peersman, 2014) and an increasing number of scholars and policymakers have expressed concerns that these measures are feeding into financial instability (Adrian & Liang, 2014; Borio, 2014; Lambert, 2015).

Although the GFC originated in the United States, Europe was not spared. After developing from a US subprime crisis into a full blown financial crisis, it subsequently evolved into a European sovereign debt crisis. Government debt in the EU, expressed as a percentage of GDP, skyrocketed from 57.5% in 2007 to 84.5% in 2015[147]. Almost every European country, albeit to varying degrees,

[145] For example, the European Central Bank (ECB) has missed its policy target, a headline rate of inflation at close to but below two percent — for over five years (ECB, 2017).
[146] Peter Praet, Chief Economist and member of the Executive Board of the ECB, said as much in a recent interview with La Repubblica when he stated "*Yes, all central banks can do it. You can issue currency and you distribute it to people. That's helicopter money. Helicopter money is giving to the people part of the net present value of your future seigniorage, the profit you make on the future banknotes*." (Praet, 2016)
[147] Source: Eurostat (2017).

experienced a significant increase in sovereign debt[148]. The increase in government debt was most distinct in the countries of Europe's southern periphery: both Spain and Portugal saw their debt-to-GDP levels increase by 60 percentage points; Greece even by a gargantuan 74 percentage points. This forced many governments to push through stringent austerity measures, which included both a trimming down of the public administration and cuts in social security spending in order for public finances to remain sustainable in the long run. As a result, citizens are to a larger extent expected to provide for their own pensions and health care.

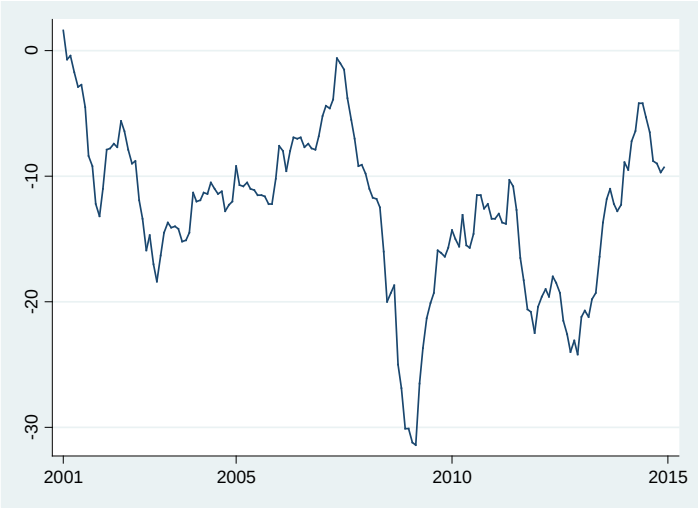
In addition, there is an increasing body of evidence suggesting the Global Financial Crisis has permanently scarred the economy (Ball, 2014; Fatas & Summers, 2018). Standard macroeconomic theory dictates that a recession, i.e. a period during which output drops below potential, is succeeded by a recovery period in which economic output returns to potential. Crucially, potential output is not significantly affected by a crisis. However, a growing literature indicates that cyclical shocks can have a permanent impact through hysteresis effects[149]. For example, Reinhart & Rogoff (2009) find that deep recessions have highly persistent effects on output. Similarly, Blanchard, Cerutti & Summers (2015) show that over the past 40 years, recessions in advanced countries have been associated surprisingly often with lower growth following the recession. Furthermore, Reifschneider, Wascher & Wilcox (2015) demonstrate that recessions damage an economy's labor force and productivity, reducing its potential output. Consequently, an economy's potential growth rate will be lower and wages will rise at a slower pace, as both ultimately depend on productivity growth.

These shifts in economic circumstances have brought about increasing uncertainty for households. People are less sure whether they will be able to keep their job, how much their wages will increase in future, what the return will be on their savings over the foreseeable horizon and to which extent they will have to finance their healthcare costs once they are retired and on what pension. Moreover,

[148] Only Malta managed to reduce its ratio of public debt-to-GDP, from 62.3% in 2007 to 60.3% in 2015.
[149] The presence of hysteresis was originally discussed in the context of labor markets in Blanchard & Summers (1986).

consumer confidence has been severely dented by the GFC and its fallout. Figure 1 shows the monthly evolution of an aggregated consumer confidence indicator[150] over the period 2001-2014 for the entire EU. This graph shows a clear drop in consumer confidence during the Global Financial Crisis as well as during the 'double dip' recession Europe experienced in 2012-2013.

Figure 1: Evolution of consumer confidence in the EU, 2001-2014



Source: European Commission (2017)

This paper studies whether the decrease in consumer confidence has had an impact on the saving behavior of households. More specifically, we research the effect of consumer confidence, as captured by 13 consumer confidence indicators from the Joint Harmonised EU Consumer Survey, on the saving rate of households. In other words, we study whether consumer confidence has any power in explaining household saving and if so, which specific sub-indicators of consumer sentiment (e.g. confidence in their own financial situation or confidence in the general economic situation) play the most important role. For this purpose we exploit a panel data set of 18 EU countries over the period 2001-2014. To tackle

[150] For a detailed explanation on how this indicator is calculated, see https://ec.europa.eu/info/files/user-guide-joint-harmonised-eu-programme-business-and-consumer-surveys_en.

the issue of potential endogeneity between the household saving rate and consumer confidence, we use an instrumental variable approach.

Notwithstanding the vast amount of literature on the role of both uncertainty and consumer confidence in explaining saving behavior, the impact of these specific consumer confidence indicators, i.e. the 13 consumer confidence indicators from the Joint Harmonised EU Consumer Survey, on household saving has hardly been studied[151], with Klopocka (2017) being a rare exception. Furthermore, cross-country saving behavior studies remain scarce despite their importance from a European policy perspective. If a decrease in consumer confidence results in more saving (and hence less consumption), this aggravates an economic downturn. Hence, if EU policymakers want to aid the recovery, they need to tackle a drop in consumer confidence on an EU wide level. Indeed, EU policymakers are mainly interested in the *average* impact of consumer confidence on household saving in EU-countries, less in the specific impact in single member states. A clear appreciation of how consumer confidence impacts household saving is a prerequisite for reasoned and evidence-based action.

The remainder of this paper is organized as follows. In Section 2, we discuss the theoretical framework that has been used to explain saving behavior. Section 3 reviews the empirical literature on saving behavior and more specifically on the importance of precautionary motives in explaining household saving behavior. In Section 4, we describe our variables and data. Section 5 presents the empirical strategy. In Section 6, we show our empirical results and finally, Section 7 concludes.

2. Theoretical framework

Different theories have been put forward to explain the extent to which the changing economic environment influences saving behavior. Two well-known neoclassical theories are linked to the economists Ricardo (1951) and Ando &

[151] The results of the survey used to construct the indicators have been discussed to explain evolutions in households' spending decisions (e.g. ECB, 2011), but these confidence indicators have not yet been introduced in a cross-country analysis of the savings behavior of households.

Modigliani (1963). The Ricardian equivalence theorem (Barro, 1996) posits that consumers are fully aware and knowledgeable of the government's budget restrictions. If households perceive government debt to be rising to unsustainable levels, they will expect taxes to rise in the future. Subsequently, they adapt their consumption pattern by spending less and saving more now, in anticipation of a higher future tax bill.

According to the life cycle hypothesis (Ando & Modigliani, 1963), individuals attempt to level out their consumption and savings across their entire life, keeping consumption relatively constant over different periods. Consequently, a sudden drop in income, for example due to a job loss resulting from a recession, would not have a sizeable impact on consumption and would largely be absorbed by dissaving, conditional on the fact that the shock in income is not perceived as permanent.

Another theory is based on the downpayment motive (Browning & Lusardi, 1996) and presumes that households save to meet certain needs, such as consumption after retirement, the purchase of durable goods, insurance against income volatility and fluctuations in health. Hence, households have a particular target of savings in mind to accommodate these requirements (Nabar, 2011). If the return on saving drops, households will save a larger portion of their monthly income to accommodate this target.

Following these theoretical frameworks, we expect that the economic evolutions we have witnessed during and after the crisis have had an impact on the saving behavior of households, each through a different channel. Ricardian equivalence would suggest that increased government debt and deficits after the GFC, lead to an increase in saving due to an expectation of higher taxes in the future. Moreover, the downpayment motive posits that the lower return on saving, for example due to decline in interest rates, increases saving in order for households to reach the target amount of savings they strive to reach[152]. In contrast, the life cycle hypothesis implies that, as long as the drop in income during or after a recession is perceived as temporary, households reduce saving to maintain a similar level of consumption. Hence, the classical theories pertaining to saving

[152] However, there might also be a substitution effect: when interest rates fall, this decreases the reward for saving, making it more attractive to spend rather than to save.

behavior of households do not allow to predict a priori which effect is dominant and thus it remains unclear if the effect of the changing macroeconomic environment is to increase the saving rate or to push it down.

One could also argue that these economic evolutions have had a substantial impact on consumer confidence and that these changing economic circumstances influence household saving through the channel of fluctuating consumer sentiment[153]. Indeed, it has been documented extensively that precautionary motives are an important driver of the saving decisions of households. This mechanism works as follows (Ludvigson, 2004). Households attempt to level out their consumption throughout their lifetime. However, households do not know their exact income over their entire lifecycle, and hence need to make certain assumptions. The uncertainty which surrounds these assumptions leads to precautionary saving. In turn, increased uncertainty about the future is reflected in lower consumer confidence levels. Moreover, consumer confidence surveys capture household expectations about future income and wealth. Pessimistic beliefs about the future result in lower levels of consumer confidence and increased household saving. In our paper, we try to determine to what extent precautionary motives, as measured by a decrease in consumer confidence, impact household saving.

3. Review of literature

The research on the role of the precautionary saving motive was pioneered by Skinner (1988), who studied the effect of uncertainty regarding interest rates and income on consumption throughout the lifecycle in the United States and found that precautionary saving accounts for over half of total saving. Similarly, Cagetti (2003) constructed and simulated a life cycle model of wealth accumulation for the US. His results suggest that the accumulation of wealth is primarily driven by

[153] This argument was first advanced by Keynes (1936) who argued that economic fluctuations are largely driven by 'animal spirits'; low confidence makes consumers spend less and save more, and makes firms reluctant to invest and hire. The resulting decline in incomes undermines consumer and producer confidence even more.

precautionary saving at the start of the life cycle and that saving for retirement only gains in importance as retirement approaches.

Whereas the previous two scholars look at what part of lifetime savings or accumulation of wealth over an entire lifespan can be attributed to precautionary motives, a different, but nevertheless very much related, strand of literature examines the extent to which increases (or decreases) in uncertainty *over a specific timespan* influence household behavior with regards to saving.

Most research in this area focuses on a single country, employing a wide range of self-reported measures of uncertainty, including the probability of primary job loss of household heads (Guariglia & Kim, 2004; Lusardi, 2000), earnings or income uncertainty (Guiso, Jappelli & Terlizzese, 1992; Murata, 2003; Kazarosian, 1997; Bartzsch, 2008; Lusardi, 2000), the Consumer Confidence Index (Klopocka, 2017) and the probability that health will affect work activity in the future (Lusardi, 1997). This strand of literature provides overwhelming support for the hypothesis that an increase in uncertainty leads to an increase in saving. Nevertheless, Guiso, Jappelli & Terlizzese (1992) find that uncertainty only explains a small fraction of the saving behavior of households. Furthermore, Basselier & Langenus (2014) emphasize that the indicator used to define uncertainty matters. In their analysis, self-reported uncertainty concerning the financial situation has significant explanatory power on the saving rate, whereas variance between professional economic forecasts – which is used as a proxy for economic uncertainty – does not.

A related part of the literature focuses on the impact of uncertainty and consumer confidence on household consumption, rather than on saving. De Bondt, Gieseck & Zekaite (2018) find that, in the Eurozone, macroeconomic uncertainty leads to lower consumption growth as a result of precautionary saving. Dees & Brinca (2013) show that, in the United States and the Eurozone, confidence indicators are good predictors of household consumption, especially when household survey indicators display large changes. This is in line with Estrada, Garrote, Valdeolivas & Vallés (2015), who find that, for a panel of OECD countries, uncertainty is crucial in explaining the per capita consumption growth, especially at the height of the Global Financial Crisis (2007-2009). Similarly, Lahiri, Monokroussos & Zhao (2016) study the role of consumer confidence in forecasting real personal

consumption expenditure and find that during the recession of 2007–2009, sentiment is found to have a more pervasive effect on all components of aggregate consumption in the United States.

The importance of the precautionary motive in determining household saving has been studied in many countries, such as the United States (Kazarosian, 1997; Lusardi, 1997; Lusardi, 2000; Chakrabarti, Van der Klaauw & Zafar, 2011), Belgium (Basselier & Langenus, 2014), Italy (Guiso, Jappelli & Terlizzese, 1992), Germany (Bartzsch, 2008), Russia (Guariglia & Kim, 2004), Poland (Klopocka, 2017), Japan (Murata, 2003) and China (Chamon & Prasad, 2010). Nevertheless, only a limited number of papers perform a cross-country analysis on the extent to which precautionary motives explain household saving.

Mody, Ohnsorge & Sandri (2012) are among the few authors that perform such a cross-country study. They analyze the precautionary motive in household saving behavior for a panel of 27 advanced economies. The authors use three measures to proxy uncertainty: (i) the unemployment rate as a proxy for labor income uncertainty, (ii) a direct measure of the forecast uncertainty of per capita real GDP growth, and (iii) a measure of the stock market volatility to focus on investment risk. They find that increased uncertainty following the Great Recession has substantially increased the saving rate, resulting in decreased consumption and consequently, lower economic growth.

In a recent ECB paper, Rodriguez-Palenzuela & Dées (2016) studied whether the saving behavior of Eurozone households has changed post crisis. They find that after the Global Financial Crisis, precautionary saving has increased substantially in the face of increased macroeconomic uncertainty, which is calculated via a set of diverse sources, such as (i) measures of economic agents' perceived uncertainty about the future economic situation based on surveys, (ii) measures of uncertainty or of risk aversion based on financial market indicators and (iii) measures of economic policy uncertainty.

In sum, the existing literature on precautionary saving suffers from two major limitations. Firstly, most studies are single-country studies. There are hardly any studies performing a rigorous cross-country analysis on the role of precautionary motives in determining household saving behavior. Whereas the advantage of

single-country studies is that these often employ household-level data and they yield insights for the national policymakers of the countries concerned, gaining a clear understanding of the drivers of household saving across EU countries is important from an EU policy perspective. Indeed, a single-country study can determine whether consumer confidence has an impact on household saving in that specific country, but for European policymakers it is important to have knowledge on the average impact of consumer confidence on household saving across the entire EU. Hence, if EU policymakers wish to counter a drop in consumer confidence, and the consequent increase in saving and decrease in consumption, a first requirement for EU action[154] is of course acquiring a clear understanding of the extent to which a drop in consumer confidence influences the saving decisions of households in Europe.

Secondly, the limited number of studies which do perform a cross-country analysis, generally do not deal with the issue of endogeneity in a satisfactory fashion. For example, Mody et al. (2012) simply state that their results need to be interpreted with caution as there might be some reverse causality from saving decisions to unemployment, which they take as a proxy for uncertainty due to the fact that an exogenous rise in the saving rate will reduce aggregate demand and hence also demand for labor. They do not present an econometric strategy to tackle this problem.

Hence, our paper attempts to further the literature on the role of precautionary saving in the period before, during and after the Global Financial Crisis by focusing on a sample of 18 EU countries, addressing the issue of endogeneity between saving decisions and consumer confidence by exploiting an instrumental variable approach. More specifically, we study whether consumer confidence, as measured by the confidence indicators of the Joint Harmonised EU Consumer Survey, influences the saving behavior of households.

[154] As expansionary fiscal policy improves consumer and business confidence (e.g. Konstantinou & Tagkalakis (2011)), an example of such EU-wide policy would be the announcement of a concerted fiscal stimulus in response to an economic downturn, similar to what was presented at the 2009 G20 summit in London, where global leaders agreed to inject $1.1 trillion in the world economy.

4. Data and variables

4.1 Data

As discussed above, the central aim of this paper is to test whether consumer confidence has an impact on household saving behaviour. Using a data set of 18 EU countries[155] for the years 2001-2014, we study whether lower consumer confidence results in higher household saving and if so, which specific sub-indicators of consumer sentiment play the most important role.

We follow the literature and take the consumer confidence indicators produced by the European Commission's Directorate-General for Economic and Financial Affairs (DG ECFIN) (e.g. Taylor & McNabb, 2007; Carriero & Marcellino, 2011; Dreger & Kholodilin, 2013). Data for these confidence variables is derived from consumer surveys conducted on a monthly basis by national institutes in all 28 Member States and 5 candidate countries[156]. Data for our control variables and our dependent variable come from AMECO, the World Bank and Eurostat[157]. Finally, data for our instrumental variable are extracted from the Global Terrorism Database (GTD).

The consumer survey serves two main aims (DG ECFIN, 2016): (i) collecting information on the spending and saving decisions intentions of households; and (ii) assessing households' perception of the factors which influence their decisions on saving decisions and spending. To fulfil these aims, the questions are grouped around four topics: (i) the households' financial situation, (ii) the general economic situation, (iii) saving intensions, and (iv) intentions regarding major purchases. As it is crucial to have comparable data for each country, harmonization is ensured by using a single questionnaire for all national institutions and by scheduling the national surveys and the subsequent reporting of results according to a fixed timetable.

[155] Due to data limitations, an analysis of all EU countries was not feasible. The countries retained in our analysis are: Austria, Belgium, Bulgaria, Cyprus, Czech Republic, Denmark, Finland, France, Germany, Hungary, Ireland, Italy, Netherlands, Portugal, Slovakia, Slovenia, Spain, United Kingdom.
[156] These five candidate countries are Albania, Montenegro, The Former Yugoslav Republic of Macedonia, Turkey and Serbia.
[157] The specific data source for each variable is mentioned in footnote when discussing the variable.

The national institutes which conduct the survey are responsible for ensuring that each survey is representative of the target group. As large countries generally have more structural heterogeneity than small countries, the sample size is positively correlated with the size of the economy. In total, 40,000 consumers are surveyed on a monthly basis across the entire EU, resulting in approximately 34,000 filled-in questionnaires.

4.2 Variables

Our dependent variable is gross saving[158] of households and non-profit institutions serving households (NPISHs), expressed as a percentage of gross disposable income[159]. Hence, this variable measures the proportion of disposable income that is not used for final consumption expenditure and includes adjustments for the change in net equity of households in pension funds reserves.

Table 1 provides a description of the variables in our dataset. Summary statistics for all variables are displayed in Table 2. The table shows that the average household saving rate over the period under consideration is 10.72%, but is subject to a substantial degree of variation. In 2007, just before the Global Financial Crisis, Bulgarian households were dissaving[160] 20.8% of their disposable income; in other words Bulgarians were, on average, spending 20.8% more than they were receiving in income. In contrast, at the height of the GFC in 2009, Belgian households were saving 17.8% of their disposable income.

[158] Measured as savings without deducting consumption of fixed capital.
[159] Data are taken from AMECO.
[160] Households dissave when spending exceeds income.

Table 1: Variable description

Variable name	Description	Data source
Saving rate	Gross saving decisions of households and non-profit institutions serving households (NPISHs) as a percentage of gross disposable income	AMECO
Growth	Growth in real GDP	AMECO
Inequality	Gini coefficient of equalized disposable income	Eurostat
Age dependency	Ratio of population aged 0-19 and ≥ 60 to population aged 20-59	Eurostat
Gov. bond yield	Nominal yield on 10 year government bonds	Eurostat
Gov. deficit	Government deficit (-)/surplus (+), in percentage of GDP	Eurostat
Gov. debt	General consolidated government gross debt, in percentage of GDP	Eurostat
Social protection	Total government expenditure on social protection, in percentage of GDP	Eurostat
Pension expenditure	Total government expenditure on pensions, in percentage of GDP	Eurostat
Market capitalization	Market capitalization of listed domestic companies, in percentage of GDP	World Bank
Unemployment rate	The number of people unemployed as a percentage of the labor force	Eurostat
Inflation	The annual average rate of change in the Harmonized Indices of Consumer Prices	Eurostat
Household debt	Gross debt-to-income ratio of households	Eurostat
Household income	Median equivalised net household income (in Purchasing Power Standards)	Eurostat
Financial wealth	Household net financial assets ratio	Eurostat
Property income	Net property income per capita (in current prices)	Eurostat
FDI	Net inflow of foreign direct investment	World Bank
Interest rate	The 3-month interbank interest rate	AMECO
Financial situation (past)	Financial situation over last 12 months, score ranging from -100 to 100	EC
Financial situation (future)	Financial situation over next 12 months, score ranging from -100 to 100	EC

Table 1 (cont.): Variable description

Variable name	Description	Data source
Economic situation (past)	General economic situation over last 12 months, score ranging from -100 to 100	EC
Economic situation (future)	General economic situation over next 12 months, score ranging from -100 to 100	EC
Consumer prices (past)	Evolution consumer prices over last 12 months, score ranging from -100 to 100	EC
Consumer prices (future)	Evolution consumer prices over next 12 months, score ranging from -100 to 100	EC
Unemployment expectations	Unemployment expectations over next 12 months, score ranging from -100 to 100	EC
Major purchases (timing)	Timing of major purchases, score ranging from -100 to 100	EC
Major purchases (spending)	Spending on major purchases over next 12 months, score ranging from -100 to 100	EC
Saving (timing)	Timing of saving, score ranging from -100 to 100	EC
Saving (likeliness)	Likeliness of saving over next 12 months, score ranging from -100 to 100	EC
Financial situation (current)	Current financial situation, score ranging from -100 to 100	EC
Consumer confidence (aggregated)	Aggregated consumer confidence indicator, score ranging from -100 to 100	EC
Terrorst incidents	Number of terrorist incidents (per million inhabitants)	GTD

The figure in Appendix 1 shows the evolution of the household saving rate for the period 2001 – 2014 for each country in our sample. It reveals that there is both substantial variation in household saving between countries as well as over time. In addition, this figure illustrates that a significant number of countries experienced a peak in saving in 2009, when consumer confidence in the EU was at its lowest, as was illustrated in Figure 1.

Table 2: Descriptive statistics

Variable	No. Obs.	Mean	Std. Dev.	Min.	Max.
Dependent Variable					
Saving rate	156[161]	10.72	5.74	-20.80	17.80
Confidence Measures					
Financial situation (past)	156	-19.36	14.16	-52.90	13.50
Financial situation (future)	156	-10.32	13.00	-49.80	15.50
Economic situation (past)	156	-37.18	24.35	-83.20	20.40
Economic situation (future)	156	-19.52	17.45	-71.20	20.10
Consumer prices (past)	156	27.35	24.40	-59.70	80.20
Consumer prices (future)	156	21.23	20.05	-38.20	74.30
Unemployment expectations	156	-33.34	21.86	-81.40	18.80
Major purchases (timing)	156	-20.08	25.73	-84.70	25.40
Major purchases (spending)	156	-23.17	14.88	-69.40	18.50
Saving (timing)	156	1.56	42.16	-74.60	79.40
Saving (likeliness)	156	-12.10	29.60	-74.30	51.10
Financial situation (current)	156	11.94	12.42	-15.90	35.10
Consumer confidence (agg.)	156	-19.35	16.51	-64.80	15.70
Control Variables					
Interest rate	156	3.90	3.88	-0.02	24.27
Growth	156	1.35	2.97	-7.94	10.49
Inequality	156	28.99	3.62	22.70	38.10
Age dependency	156	78.71	5.86	66.40	95.20
Gov. bond yield	156	4.36	1.55	1.16	10.55
Gov. deficit	156	-3.58	3.98	-32.10	5.00
Gov. debt	156	68.69	28.78	13.00	132.50
Social protection	156	16.31	4.50	8.00	25.10
Pension expenditure	156	11.09	2.86	3.60	16.50
Market capitalization	156	47.72	30.95	3.92	147.35
Unemployment rate	156	8.78	4.15	3.10	26.10
Inflation	156	2.31	1.75	-1.70	12.00
Household debt	156	98.83	55.60	20.25	232.02
Household income	156	14,515.77	4,388.57	3,296.00	21,981.00
Financial wealth	156	185.90	83.56	50.33	408.62
Property income	156	1,661.29	1,389.03	1.89	4,576.37
FDI	156	7.95	12.54	-16.07	87.44
Instrument					
Terrorist incidents	156	0.27	1.09	0.00	10.39

[161] Due to the fact that the dataset is an unbalanced panel, the total number of observations does not equal 252 (18 countries * 14 years).

4.2.1 Confidence measures

With regards to the consumer confidence indicators, we use data gathered from the Joint Harmonised EU Consumer Survey, managed by DG ECFIN. The answers retrieved from the consumer surveys are aggregated in the form of 'balances', which are composed as the difference between the percentages of those surveyed giving positive and negative responses. Moreover, the national results are seasonally adjusted[162]. The aim of the survey is both to amass information on the spending and saving decisions intentions of households and to gauge their view on factors impacting these decisions. We consider the following 13 confidence indicators:

1. **Own financial situation over last 12 months**: *"How has the financial situation of your household changed over the last 12 months?"*
2. **Own financial situation over next 12 months**: *"How do you expect the financial position of your household to change over the next 12 months?"*
3. **Country's general economic situation over last 12 months**: *"How do you think the general economic situation in your country has changed over the past 12 months?"*
4. **Country's general economic situation over next 12 months**: "*How do you expect the general economic situation in this country to develop over the next 12 months?*"
5. **Evolution of country's consumer prices over last 12 months**: *"How do you think that consumer prices have developed over the last 12 months?"*
6. **Evolution of country's consumer prices over next 12 months**: *"By comparison with the past 12 months, how do you expect that consumer prices will develop in the next 12 months?"*
7. **Expectations on country's unemployment rate over next 12 months**: *"How do you expect the number of people unemployed in this country to change over the next 12 months?"*
8. **Right moment for major purchases**: *"In view of the general economic situation, do you think that now is the right moment for people to make major purchases such as furniture, electrical/electronic devices, etc.?"*

[162] For further methodological guidance, see DG ECFIN (2016).

9. **Spending on major purchases over next 12 months**: *"Compared to the past 12 months, do you expect to spend more or less money on major purchases (furniture, electrical/electronic devices, etc.) over the next 12 months?"*
10. **Good moment for saving:** *"In view of the general economic situation, do you think that now is good moment to save?"*
11. **Likeliness of saving**: "*Over the next 12 months, how likely is it that you save any money?"*
12. **Current financial situation**: *"Which of these statements best describes the current financial situation of your household?: (a) we are saving a lot, (b) we are saving a little, (c) we are just managing to make ends meet on our income, (d) we are having to draw on our savings, (e) we are running into debt, (f) don't know."*
13. **Consumer confidence (aggregated):** The arithmetic average of the balances (in percentage points) of the answers to the questions on the financial situation of households, the general economic situation, unemployment expectations (with inverted sign) and savings, all over the next 12 months.

The framing of the question on which confidence indicator 7 is based, is such that a positive value corresponds to a worsening of the economic environment. For that reason, we transformed the indicator so that a positive (negative) value corresponds to an improving (worsening) of the economic environment, consistent with the coding of our other confidence indicators.

The answer possibilities for each question can be found in Appendix 2. The answers to the questions are converted into a numerical value as follows (DG ECFIN, 2016). For each question, aggregate balances are calculated on the basis of the distribution of the answers to the questions. More specifically, these balances are the difference between positive and negative answering options, measured as percentage points of total answers. Hence, the balance values range from –100, when all respondents choose the most negative option, to +100, when all respondents choose the most positive option.

Appendix 3 shows the correlation matrix of the 13 confidence indicators included in our analysis. Nearly all correlations are significant at the 0.05% level. As one

would expect, the correlation between indicators that measure similar factors, but differ with regards to being backward or forward looking, are especially high. For example, the correlation between *Financial situation* (past) and *Financial situation (future)* is 0.85. Similarly, *Economic situation (past)* and *Economic situation (future)* have a correlation of 0.75. Despite these confidence indicators exhibiting a significant degree of correlation, they nevertheless capture distinct aspects of overall consumer confidence. In our subsequent analysis, we study which sub-indicators of consumer confidence have the most power in explaining the variation in household saving behaviour.

4.2.2 Control variables

We categorize our control variables into three groups: (i) variables related to the government's balance sheet, (ii) variables explaining a country's socio-economic characteristics, and (iii) financial measures. In the first group we consider government bond yields, the government deficit, government debt and social protection and pension expenditures. Control variables related to a country's socio-economic characteristics include age dependency, the unemployment rate, inflation, GDP growth and inequality. In the third and final group, we include financial measures: household debt, household income, property income, financial wealth, the market capitalization of all listed domestic companies, foreign direct investment (FDI) and the nominal short-term interest rate.

We follow Rocher & Stierle (2015) and include the long-term interest rate in our analysis of household saving behavior, which we define as the yield on 10-year government bonds[163]. Investing in government bonds can be viewed as an alternative to putting money in a saving account, as these bonds – especially those of highly rated countries – possess the three characteristics households look for in a saving vehicle. Firstly, the market of government bonds is highly liquid, which means they can be sold easily, without impacting their price (Pagano & Von Thadden, 2004). Secondly, these bonds, and particularly those of advanced economies, are very safe, with the odds of governments defaulting on them being

[163] Data are taken from Eurostat.

extremely marginal (Tomz & Wright, 2013). Finally, similar to a saving accounts, government bonds offer a steady return by way of yearly coupon payments.

In order to stimulate the economy, governments can cut taxes or increase spending, resulting in a larger budget deficit. However, Ricardian equivalence suggests that if households expect that taxes will have to rise in the future to finance the growth in government debt, they will increase their saving, offsetting the initial boost to aggregate demand of active fiscal policy. Hence, higher public debt, which is measured by general government gross debt as a percentage of GDP, and a larger government deficit (also expressed as percentage of GDP) would be associated with an increase in household saving[164]. We control for both public debt and government deficit.

If households believe they are to a large extent dependent on themselves to finance health care expenses or to bridge spells of unemployment, they are expected to save more. To capture this effect, we include total government expenditure on social protection (as a percentage of GDP) as a control variable[165]. Similarly, if the pensions a government provides for its citizens are insufficient to maintain an adequate lifestyle, households will increase saving during their professional career, which will allow them to dissave after retirement. We therefore take into account total government expenditure on pensions (as a percentage of GDP)[166].

According to the life cycle hypothesis, young people save little, middle aged people save a lot and the elderly draw down their savings, as this allows individuals to smooth out consumption throughout their life. Thus, economies with comparatively few middle aged people, i.e. the group of people which is most likely to accumulate savings, tend to have a lower saving rate (Edwards, 1995; Callen & Thimann, 1997). However, an opposite effect might also be in play: as older workers get closer to their retirement age, they tend to increase their saving decisions through increased contributions to pension plans and healthcare insurance. If younger workers simultaneously start anticipating this mass exodus of baby boomers from the labor market, and the accompanying pressure on

[164] Both data are taken from Eurostat.
[165] Data are taken from Eurostat.
[166] Data are taken from Eurostat

government budgets, they could start saving more for the future, for example by postponing consumption decisions and investing more in private pension plans (Santacreu, 2016). We include the age dependency ratio to capture this effect[167].

When households experience an increase in unemployment risk, they respond by postponing the purchase of durable goods and by reducing spending on nondurable goods, in effect increasing their saving decisions (Dunn, 1998). In other words, uncertainty about earnings in the future, will result in households decreasing their consumption today. As a proxy for unemployment risk, we use the unemployment rate[168].

A high rate of inflation erodes the purchasing power of saving. Households are better off to spend their money today, as their savings will be worth less in the future. Hence, ceteris paribus, we expect high inflation to be linked with lower saving decisions. Moreover, if we assume nominal interest rates are constant, a higher rate of inflation lowers the real cost of borrowing and thus has a stimulative effect on household consumption and an opposing effect on household saving (Muradoglu & Taskin, 1996). We measure consumer price inflation by inflation of the Harmonised Index of Consumer Prices (HICP)[169].

Both the level of income and the rate of economic growth are expected to have a positive and significant impact on the saving rate (e.g. Rossi, 1988). Low income households spend a substantial amount of their income on necessities, such as food and housing. Hence, there is simply not much left for saving. Put differently, their propensity to consume is high. Correspondingly, as a household's disposable income increases, they will be able to save more and the increase in saving decisions is proportionally larger than their increase in income (Keynes, 1936)[170]. We use median household income as an indicator for income[171] and the growth rate of real GDP as an indicator for economic growth[172]. In addition, recent research has shown that the decomposition of income has a significant impact on

[167] Data are taken from Eurostat.
[168] Data are taken from Eurostat.
[169] Data are taken from Eurostat.
[170] In a standard Keynesian framework, consumption and saving mainly depend on current income. However, Ando & Modigliani (1963) and Friedman (1957) argue that consumption and saving decisions are not only driven by current income which but also by the income individuals expect to receive in the future.
[171] Data are taken from AMECO.
[172] Data are taken from AMECO

household consumption and saving (e.g. de Bondt, Gieseck & Zekaite, 2018). To control for this effect, we include property income in our model[173].

The impact of inequality on saving is ambiguous. On the one hand, households with higher income tend to save more than lower income households. Hence, a society characterized by a large degree of inequality, i.e. one where the income distribution has fat tails, has a high degree of saving (e.g. Dynan, Skinner & Zeldes, 2004). Put differently, if a larger share of GNI flows to a small group of very wealthy people, who have a low propensity to consume, the overall saving rate rises. In contrast, there is tentative evidence that low income households try to emulate the consumption pattern of their richer peers, and they do so by lowering their saving rate and taking on more debt (Bertrand & Morse, 2016). We control for the Gini coefficient as a proxy for inequality[174].

If households have high levels of debt, this reduces their consumption as well as their saving, as debt servicing costs take up a significant part of disposable income. This is simply true by way of accounting. Hence, a negative link between household debt and household saving is to be expected. We use the gross debt-to-income ratio of households (households and NPISH) as a proxy for household debt[175]. Next to debt, assets also play an important role in determining household saving behavior as the rate of saving is influenced by households' net worth through the wealth effect: increases in (financial) wealth cause households to increase consumption and decrease saving (e.g. Juster, Lupton, Smith & Stafford, 2006). To account for financial wealth, we include the household net financial assets-to-income ratio[176].

Deeper financial markets allow for easier access to credit and relax credit constraints, resulting in more smoothing of consumption over the lifecycle. Hence, a high degree of financial market sophistication results in more borrowing and consequently a lower saving rate. We use the market capitalization of listed domestic companies (as a percentage of GDP) as a proxy for financial market sophistication[177]. Similarly, increased international financial integration improves

[173] Data are taken from Eurostat.
[174] Data are taken from Eurostat.
[175] Data are taken from Eurostat.
[176] Data are taken from Eurostat.
[177] Data are taken from the World Bank.

access to foreign credit, stimulating borrowing and reducing household saving. Therefore, we take into account net inflow of foreign direct investment (FDI) to proxy international financial integration[178].

Finally, we control for the 3-month interbank interest rate[179] as a proxy for the nominal short-term interest rate. An increase in the interest rate can have both a positive and a negative impact on the saving rate. At first, we might expect that a higher return on saving will induce households to save a larger portion of their disposable income each month, as patience and frugality now bring about a larger reward in the future, in the form of more expected consumption (Boskin, 1983; Gross & Souleles, 2001). However, if households primarily target a specific level of saving, i.e. a nominal amount, an increase in the interest rate will result in a lower saving rate (e.g. Chamon & Prasad, 2013).

5. Empirical strategy

5.1 Fixed effects estimation

To test the effect of consumer confidence on household saving, we posit the following fixed effects model:

$$HS_{rate_{it}} = \sum_{c=1}^{17} \beta_c \, (Controls)_{it}^{c} + \beta_j Confidence_{jit} + v_i + \gamma_t + \varepsilon_{it} \qquad \text{(Eq. 1)}$$

for i = 1, ..., 18 EU countries and t = 2001, …, 2014. HS_rate_{it} is the gross household saving rate in country *i* in year t.

$Controls$ is a set of control variables that is expected to affect the household saving rate and includes: real GDP growth, inequality, age dependency, the 10-year government bond yield, the government deficit, government debt, total government expenditure on social protection, total government expenditure on pension expenditure, the market capitalization of listed domestic companies, the

[178] Data are taken from the World Bank
[179] Data are taken from AMECO.

unemployment rate, inflation, household debt, household income, property income, financial wealth, FDI and the 3-month interbank interest rate.

$Confidence_j$ is our key variable of interest and represents a particular indicator of consumer confidence: Financial situation (past), Financial situation (future), Economic situation (past) Economic situation (future), Consumer prices (past), Consumer prices (future), Unemployment expectations, Major purchases (timing), Major purchases (spending), Saving (timing), Saving (likeliness), Financial situation (current) and Consumer confidence (aggregated).

v_i is the country fixed effect and is included to account for the existence of unobserved social and economic characteristics that are specific to each country in the sample but that stay broadly constant over time. γ_t is the year fixed effect and captures factors that vary over time but affect all countries (e.g. the effects of the Global Financial Crisis). ε_{it} represents the observation-specific errors (i.e. the disturbance terms).

Standard errors are always heteroscedasticity-robust (White, 1980) and clustered at the country level to correct for a possible correlation of error terms over time for all countries (Newey & West, 1987).

5.2 Instrumental variable estimation

Although our fixed effects model addresses the possible endogeneity problem arising from omitted variables, it does not tackle the potential endogeneity in case of reverse causality between saving decisions and consumer confidence. It is conceivable that consumer confidence not only impacts households' saving decisions, but that household saving in itself is a determinant of consumer confidence. However, the impact of household saving on consumer sentiment is ambiguous. One the one hand, high household saving can lead to low consumer confidence. If households start to save more, for example due to a decrease in the interest rate they receive on deposits, this will, ceteris paribus, result in lower consumption. Because household consumption is a large share of Gross Domestic Product (GDP), economic growth will slow down. Subsequently, as the economy loses momentum - your spending is my income - this will in turn result in a

decrease in consumer confidence. It is easy to see how, through this mechanism, a decrease in consumer confidence can be a self-fulfilling prophecy. In contrast, if households are able to save less, for example due to temporary tax increases or the (partial) loss of household income, this might negatively impact the perception of their economic and financial situation, resulting in deteriorating consumer sentiment. In that case, low household saving brings about low consumer confidence.

To address this issue, we apply an instrumental variable approach and estimate our model with 2SLS. We follow Baker & Bloom (2013) and use terrorist attacks as an instrument for the endogenous covariates that measure consumer confidence. More specifically, we use the number of terrorist incidents in country *i* in year *t-1* and divide it by the number of inhabitants to account for population size.

Two factors determine whether the number of terrorist attacks are a good instrument. Firstly, the instrument needs to be relevant, that is the number of terrorist incidents need to be correlated with our variable of interest, i.e. the confidence indicator. There is ample evidence that terrorist attacks have a statistically significant effect on consumer sentiment (McKercher & Hui, 2004; Drakos & Kallandranis, 2015; Brodeur, 2018). Secondly, our instrument needs to be exogenous. It seems legitimate to assume that terrorist attacks are indeed exogenous to the household saving rate. Put differently, it is to be expected that terrorist incidents do not impact the saving decisions of households, other than through their effect on consumer sentiment.

Data on terrorist incidents are taken from the Global Terrorism Database (GTD), which defines a terrorist attack as "*The threatened or actual use of illegal force and violence by a non-state actor to attain a political, economic, religious, or social goal through fear, coercion, or intimidation.*"

Hence, in order to be considered for inclusion in the Global Terrorism Database, an incidents needs to possess all three of the following attributes:

(1) *"The incident must be intentional: the result of a conscious calculation on the part of a perpetrator.*

(2) *The incident must entail some level of violence or immediate threat of violence: including property violence, as well as violence against people.*

(3) *The perpetrators of the incidents must be sub-national actors: the database does not include acts of state terrorism."*

Moreover, at least two of the following three criteria must be met for a terrorist attack to be included in the GTD:

- *"Criterion 1: The act must be aimed at attaining a political, economic, religious, or social goal. In terms of economic goals, the exclusive pursuit of profit does not satisfy this criterion. It must involve the pursuit of more profound, systemic economic change.*
- *Criterion 2: There must be evidence of an intention to coerce, intimidate, or convey some other message to a larger audience (or audiences) than the immediate victims. It is the act taken as a totality that is considered, irrespective if every individual involved in carrying out the act was aware of this intention. As long as any of the planners or decision-makers behind the attack intended to coerce, intimidate or publicize, the intentionality criterion is met.*
- *Criterion 3: The action must be outside the context of legitimate warfare activities. That is, the act must be outside the parameters permitted by international humanitarian law (particularly the prohibition against deliberately targeting civilians or non-combatants)."*

6. Empirical results

The following section presents our main empirical findings. We use different empirical strategies to assess the impact of the sub-indicators of consumer sentiment on the household saving rate.

6.1 Fixed effects estimation

The fixed effects estimation results are presented in Table 3a and Table 3b. Columns (1) to (13) include our confidence indicators one by one. The results show that households' own financial situation, both past and future, significantly impacts household saving. If the confidence indicator which measures the perception of the past and future financial situation decreases by 1 standard deviation, the household saving rate increases by 1.02 (future situation) to 1.11 (past situation) percentage points, all else equal. Given that the average saving rate in our sample is 10.72%, this increase is quite substantial. Moreover, a one standard deviation decrease in *Economic situation (future)* is associated with a 0.64 percentage points increase in household saving. Furthermore, if unemployment expectations increase, households tend to save more; a 1 standard deviation decrease in *Unemployment expectations* is linked with a rise in saving of 0.67 percentage points. In addition, if households indicate they intend to spend less on major purchases over the coming year, they save more in the current year; if the indicator which measures spending on major purchases decreases by a 1 standard deviation, households increase saving by 0.65 percentage points. Finally, also the aggregated consumer confidence indicator has predictive power in explaining the saving rate of households. If this indicator decreases by 1 standard deviation, household saving goes up by 0.99 percentage points. The coefficients for the other confidence indicators are not statistically significantly different from zero.

In addition, increases in the unemployment rate and in inflation, which both can be seen as proxies for economic uncertainty, are associated with higher saving. We also find tentative evidence to support Ricardian equivalence; as the government increases its deficit, households will save more, possibly in anticipation of higher taxes in the future. Moreover, if inequality increases, households will save less. This is in line with several recent micro-econometric studies which find that middle- and low-income earners decrease saving in response to rising incomes at the top (Drechsel-Grau & Schmid, 2014). Unsurprisingly, richer households tend to save more whereas indebted households save less.

Table 3a: FE results

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Growth	0.2162	0.1339	0.2014	0.1274	0.0839	0.0868	0.1547
	(0.1750)	(0.1572)	(0.2002)	(0.1738)	(0.1601)	(0.1587)	(0.1720)
Inequality	-0.2465*	-0.2639*	-0.2682*	-0.2666*	-0.2859*	-0.2869*	-0.2883*
	(0.1218)	(0.1284)	(0.1385)	(0.1425)	(0.1601)	(0.1595)	(0.1486)
Age dependency	0.0096	0.0074	0.0099	0.0306	0.0255	0.0266	-0.0027
	(0.1047)	(0.1021)	(0.1063)	(0.1066)	(0.1108)	(0.1072)	(0.1138)
Gov. bond yield	0.0340	-0.0207	0.0906	0.0005	0.1082	0.1162	0.0423
	(0.2197)	(0.2056)	(0.2244)	(0.2452)	(0.1986)	(0.2086)	(0.2116)
Gov. deficit	-0.1009	-0.0703	-0.0910*	-0.0981	-0.1463**	-0.1435**	-0.1037**
	(0.0697)	(0.0687)	(0.0520)	(0.0570)	(0.0691)	(0.0662)	(0.0481)
Gov. debt	-0.0413	-0.0500	-0.0337	-0.0353	-0.0404	-0.0405	-0.0311
	(0.0345)	(0.0351)	(0.0401)	(0.0387)	(0.0353)	(0.0364)	(0.0343)
Social protection	0.0451	0.0685	0.0808	0.1015	0.0851	0.0910	0.0651
	(0.1370)	(0.1345)	(0.1342)	(0.1496)	(0.1448)	(0.1525)	(0.1369)
Pension expenditure	-0.7595	-0.7326	-0.7563	-0.7725	-0.7848	-0.7817	-0.8692
	(0.6012)	(0.5793)	(0.5863)	(0.5846)	(0.6299)	(0.6276)	(0.5741)
Market capitalization	-0.0074	0.0025	0.0050	0.0060	-0.0003	0.0004	0.0062
	(0.0219)	(0.0211)	(0.0211)	(0.0221)	(0.0225)	(0.0221)	(0.0237)
Unemployment rate	0.3138***	0.4107***	0.3821***	0.4140***	0.4108***	0.4061***	0.4432***
	(0.0915)	(0.0914)	(0.1100)	(0.1014)	(0.1192)	(0.1232)	(0.1164)
Inflation	-0.4905*	-0.5235**	-0.5061**	-0.4889*	-0.4448*	-0.4362*	-0.5337**
	(0.2436)	(0.2389)	(0.2145)	(0.2322)	(0.2310)	(0.2237)	(0.1962)
Household debt	-0.0651*	-0.0664**	-0.0515*	-0.0525*	-0.0493*	-0.0498*	-0.0545*
	(0.0311)	(0.0280)	(0.0277)	(0.0283)	(0.0264)	(0.0279)	(0.0278)
FDI	-0.0243	-0.0251	-0.0161	-0.0197	-0.0165	-0.0165	-0.0154
	(0.0205)	(0.0200)	(0.0203)	(0.0192)	(0.0202)	(0.0207)	(0.0197)
Interest rate	-0.0244	-0.0082	-0.0097	-0.0086	-0.0160	-0.0151	-0.0051
	(0.0310)	(0.0290)	(0.0299)	(0.0319)	(0.0297)	(0.0295)	(0.0313)
Household income	0.0012***	0.0011***	0.0012***	0.0011**	0.0013**	0.0013***	0.0011**
	(0.0004)	(0.0004)	(0.0004)	(0.0004)	(0.0004)	(0.0004)	(0.0004)
Financial wealth	-0.0196	-0.0261	-0.0191	-0.0242	-0.0180	-0.0178	-0.0220
	(0.0200)	(0.0200)	(0.0203)	(0.0197)	(0.0203)	(0.0203)	(0.0200)
Property income	0.0030**	0.0033***	0.0033***	0.0034***	0.0030**	0.0030**	0.0032***
	(0.0010)	(0.0010)	(0.0011)	(0.0011)	(0.0011)	(0.0011)	(0.0011)
Fin. situation (past)	-0.0786*						
	(0.0379)						
Fin. situation (future)		-0.0786***					
		(0.0260)					
Econ. situation (past)			-0.0259				
			(0.0206)				
Econ. situation (future)				-0.0367**			
				(0.0171)			
Cons. prices (past)					0.0025		
					(0.0146)		
Cons. prices (future)						-0.0017	
						(0.0123)	
U. expectations							-0.0311**
							(0.0140)
Observations	156	156	156	156	156	156	156
R-squared	0.6302	0.6451	0.6230	0.6285	0.6124	0.6124	0.6300
Country FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Dependent variable: Saving rate. Heteroscedasticity–robust standard errors clustered at country level are in parentheses. *, **, and *** indicate significance at the 10%, 5%, and 1% level respectively.

Table 3b: FE results

	(8)	(9)	(10)	(11)	(12)	(13)
Growth	0.0727	0.1043	0.0956	0.0794	0.0892	0.1504
	(0.1577)	(0.1689)	(0.1487)	(0.1638)	(0.1669)	(0.1719)
Inequality	-0.2927*	-0.2583*	-0.2706*	-0.2913*	-0.2859*	-0.2620*
	(0.1620)	(0.1283)	(0.1506)	(0.1596)	(0.1587)	(0.1368)
Age dependency	0.0380	0.0589	0.0756	0.0214	0.0216	0.0195
	(0.1104)	(0.1159)	(0.1353)	(0.1080)	(0.1166)	(0.1115)
Gov. bond yield	0.1280	0.0329	0.1559	0.1137	0.1161	-0.0053
	(0.2034)	(0.2292)	(0.2251)	(0.2002)	(0.2057)	(0.2389)
Gov. deficit	-0.1476**	-0.1232**	-0.1204*	-0.1468**	-0.1438**	-0.0782
	(0.0608)	(0.0559)	(0.0677)	(0.0649)	(0.0652)	(0.0531)
Gov. debt	-0.0460	-0.0319	-0.0548	-0.0407	-0.0407	-0.0331
	(0.0384)	(0.0364)	(0.0440)	(0.0362)	(0.0360)	(0.0360)
Social protection	0.0836	0.0898	0.0719	0.0817	0.0849	0.0904
	(0.1414)	(0.1477)	(0.1511)	(0.1436)	(0.1332)	(0.1408)
Pension expenditure	-0.7470	-0.8288	-0.6139	-0.8018	-0.7789	-0.7805
	(0.6627)	(0.6086)	(0.6783)	(0.6313)	(0.6111)	(0.5675)
Market capitalization	-0.0001	0.0002	0.0013	-0.0001	-0.0001	0.0078
	(0.0223)	(0.0214)	(0.0214)	(0.0221)	(0.0233)	(0.0229)
Unemployment rate	0.4108***	0.3645***	0.4156***	0.4187***	0.4007***	0.4079***
	(0.1283)	(0.0947)	(0.1218)	(0.1158)	(0.1281)	(0.0984)
Inflation	-0.4310*	-0.4600**	-0.4805**	-0.4262*	-0.4406*	-0.5449**
	(0.2227)	(0.2081)	(0.2270)	(0.2259)	(0.2263)	(0.2166)
Household debt	-0.0442	-0.0562*	-0.0504*	-0.0494*	-0.0499*	-0.0564*
	(0.0306)	(0.0294)	(0.0274)	(0.0279)	(0.0281)	(0.0287)
FDI	-0.0185	-0.0207	-0.0180	-0.0168	-0.0169	-0.0186
	(0.0216)	(0.0193)	(0.0210)	(0.0203)	(0.0195)	(0.0195)
Interest rate	-0.0083	-0.0096	-0.0130	-0.0140	-0.0157	-0.0081
	(0.0306)	(0.0318)	(0.0318)	(0.0269)	(0.0317)	(0.0317)
Household income	0.0012**	0.0014***	0.0012***	0.0013***	0.0013***	0.0011**
	(0.0005)	(0.0005)	(0.0004)	(0.0004)	(0.0004)	(0.0004)
Financial wealth	-0.0184	-0.0169	-0.0216	-0.0174	-0.0179	-0.0252
	(0.0205)	(0.0209)	(0.0222)	(0.0202)	(0.0202)	(0.0199)
Property income	0.0031**	0.0032***	0.0033**	0.0030**	0.0031***	0.0034***
	(0.0012)	(0.0011)	(0.0012)	(0.0011)	(0.0010)	(0.0011)
Major purchases (timing)	0.0167					
	(0.0232)					
Major purchases (spending)		-0.0438*				
		(0.0209)				
Saving (timing)			-0.0227			
			(0.0222)			
Saving (likeliness)				0.0085		
				(0.0162)		
Financial situation (current)					-0.0073	
					(0.0435)	
Consumer confidence (agg.)						-0.0600**
						(0.0234)
Observations	156	156	156	156	156	156
R-squared	0.6151	0.6231	0.6191	0.6127	0.6124	0.6335
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Country FE	Yes	Yes	Yes	Yes	Yes	Yes

Dependent variable: Saving rate. Heteroscedasticity–robust standard errors clustered at country level are in parentheses. *, **, and *** indicate significance at the 10%, 5%, and 1% level respectively.

6.2 Pre vs. post crisis

In this section, we want to test whether the sovereign debt crisis has had an impact on how consumer confidence influences household saving. As shown in Figure 1, consumer confidence went through an exceptionally steep decline in the aftermath of the Global Financial Crisis. In order to study whether the impact of consumer confidence on saving is more pronounced after the GFC, we split up our sample into two periods: 2001-2008 and 2009-2014 and re-estimate our FE model on both subsamples. Tables 4a and 4b show the pre-crisis results, Tables 5a and 5b present the post crisis results.

As expected, the effect of consumer confidence on household saving is indeed markedly different pre and post crisis. Before the GFC, not a single indicator of consumer sentiment impacts the saving decisions of households. After the crisis, every indicator which was found to have a statistically significant impact on household saving decisions in the full sample, also significantly impacts the saving rate of household after the crisis, except for *Unemployment expectations*. Confidence in households' financial situation (past and future), confidence in the general economic situation (past), the spending on major purchases and the aggregated consumer confidence indicator all have a statistically significant effect on the saving decisions of households.

Moreover, the effect of consumer confidence becomes much stronger after the crisis: whereas the increase in the household saving rate ranges from 0.44-0.73 percentage points before the GFC, given a 1 standard deviation decrease in the perception of households' past or future financial situation, it ranges from 0.87-1.28 percentage points after the GFC. This effect is even stronger for *Major purchases (spending)*: if this indicator decreases by 1 standard deviation, household saving increases by 1.37 percentage points after the GFC, which is triple the pre-crisis effect of 0.46 percentage points.

Table 4a: FE results pre crisis

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Growth	0.2762	0.3767	0.2148	0.2586	0.2394	0.2228	0.2235
	(0.3214)	(0.3485)	(0.2907)	(0.3244)	(0.3243)	(0.2978)	(0.3093)
Inequality	-0.0602	-0.1183	-0.0299	-0.0536	-0.0414	-0.0138	-0.0408
	(0.1764)	(0.1967)	(0.1658)	(0.1784)	(0.1696)	(0.1435)	(0.1718)
Age dependency	-0.0599	-0.0570	-0.0330	-0.0333	-0.0498	-0.0351	-0.0518
	(0.1423)	(0.1405)	(0.1579)	(0.1407)	(0.1403)	(0.1495)	(0.1365)
Gov. bond yield	0.2316	-0.0050	0.2233	0.2772	0.2727	0.1900	0.2777
	(1.0181)	(0.8644)	(1.0547)	(1.0550)	(1.0311)	(0.9092)	(1.0550)
Gov. deficit	-0.0254	-0.0226	-0.0563	-0.0397	-0.0382	-0.0388	-0.0426
	(0.2011)	(0.1938)	(0.1797)	(0.1965)	(0.1996)	(0.1908)	(0.1976)
Gov. debt	0.1003	0.0822	0.0886	0.0860	0.0875	0.0718	0.0935
	(0.1028)	(0.1012)	(0.1017)	(0.1003)	(0.0950)	(0.1014)	(0.1042)
Social protection	0.2176	0.2884	0.3053	0.2685	0.2891	0.2491	0.2858
	(0.2756)	(0.2437)	(0.2834)	(0.2731)	(0.3396)	(0.2287)	(0.2709)
Pension expenditure	-0.7258	-0.6836	-0.6469	-0.6880	-0.7089	-0.8065	-0.7172
	(1.0186)	(0.9383)	(0.9845)	(0.9481)	(0.9903)	(0.7567)	(0.9557)
Market capitalization	0.0092	0.0118	0.0124	0.0132	0.0131	0.0059	0.0127
	(0.0153)	(0.0163)	(0.0165)	(0.0159)	(0.0185)	(0.0167)	(0.0163)
Unemployment rate	-0.4663*	-0.4478*	-0.4010*	-0.4042*	-0.3987	-0.3753	-0.4065
	(0.2572)	(0.2321)	(0.2159)	(0.2311)	(0.2304)	(0.2210)	(0.2353)
Inflation	0.2604	0.3103	0.2567	0.2486	0.2411	0.3165	0.2456
	(0.3828)	(0.3824)	(0.3917)	(0.3949)	(0.3890)	(0.3578)	(0.3879)
Household debt	-0.0515	-0.0545	-0.0515	-0.0471	-0.0504	-0.0469	-0.0506
	(0.0431)	(0.0424)	(0.0424)	(0.0386)	(0.0420)	(0.0405)	(0.0419)
FDI	-0.0377	-0.0368	-0.0379	-0.0362	-0.0357	-0.0385	-0.0363
	(0.0278)	(0.0250)	(0.0289)	(0.0267)	(0.0268)	(0.0250)	(0.0268)
Interest rate	-0.0013	-0.0237	0.0252	0.0214	0.0229	0.0259	0.0223
	(0.0492)	(0.0493)	(0.0499)	(0.0467)	(0.0534)	(0.0400)	(0.0486)
Household income	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002
	(0.0005)	(0.0005)	(0.0004)	(0.0005)	(0.0005)	(0.0005)	(0.0004)
Financial wealth	-0.0752*	-0.0757*	-0.0774*	-0.0767*	-0.0765*	-0.0716*	-0.0769*
	(0.0404)	(0.0383)	(0.0416)	(0.0407)	(0.0416)	(0.0382)	(0.0412)
Property income	0.0013	0.0012	0.0009	0.0014	0.0011	0.0011	0.0011
	(0.0012)	(0.0011)	(0.0013)	(0.0010)	(0.0013)	(0.0012)	(0.0012)
Fin. situation (past)	-0.0374						
	(0.0363)						
Fin. situation (future)		-0.0590					
		(0.0341)					
Econ. situation (past)			0.0116				
			(0.0217)				
Econ. situation (future)				-0.0140			
				(0.0271)			
Cons. prices (past)					-0.0013		
					(0.0192)		
Cons. prices (future)						0.0347	
						(0.0228)	
U. expectations							0.0034
							(0.0150)
Observations	78	78	78	78	78	78	78
R-squared	0.5256	0.5559	0.5219	0.5214	0.5176	0.5572	0.5180
Country FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Dependent variable: Saving rate. Heteroscedasticity–robust standard errors clustered at country level are in parentheses. *, **, and *** indicate significance at the 10%, 5%, and 1% level respectively.

Table 4b: FE results pre crisis

	(8)	(9)	(10)	(11)	(12)	(13)
Growth	0.2141	0.2125	0.2349	0.3309	0.3260	0.2836
	(0.3130)	(0.3013)	(0.3201)	(0.3922)	(0.3436)	(0.3426)
Inequality	-0.0217	-0.0169	-0.0365	-0.0609	-0.0651	-0.0538
	(0.1662)	(0.1827)	(0.1905)	(0.1782)	(0.1747)	(0.1775)
Age dependency	-0.0360	-0.1239	-0.0524	-0.0645	-0.1042	-0.0420
	(0.1462)	(0.1523)	(0.1380)	(0.1479)	(0.1546)	(0.1457)
Gov. bond yield	0.2572	0.3259	0.2755	0.1189	0.0629	0.2250
	(1.0630)	(1.0883)	(1.0835)	(1.0687)	(1.0684)	(1.0435)
Gov. deficit	-0.0371	-0.0709	-0.0391	-0.0550	-0.0074	-0.0318
	(0.2008)	(0.2077)	(0.2021)	(0.1914)	(0.2061)	(0.2004)
Gov. debt	0.0649	0.0702	0.0920	0.1017	0.1022	0.0813
	(0.0884)	(0.0850)	(0.1033)	(0.1054)	(0.1007)	(0.1009)
Social protection	0.2981	0.2125	0.2781	0.2539	0.1020	0.2671
	(0.2716)	(0.2411)	(0.2734)	(0.2771)	(0.2818)	(0.2766)
Pension expenditure	-0.6413	-0.4732	-0.6917	-0.6406	-0.5874	-0.6411
	(0.8094)	(0.8417)	(1.0058)	(0.9653)	(0.9072)	(0.9619)
Market capitalization	0.0111	0.0095	0.0130	0.0133	0.0103	0.0131
	(0.0153)	(0.0158)	(0.0166)	(0.0159)	(0.0154)	(0.0161)
Unemployment rate	-0.3108	-0.2793	-0.3964*	-0.4462*	-0.4081*	-0.4011
	(0.2042)	(0.2329)	(0.2251)	(0.2385)	(0.2227)	(0.2331)
Inflation	0.2667	0.2696	0.2432	0.2832	0.3291	0.2448
	(0.3650)	(0.3678)	(0.3863)	(0.4185)	(0.3845)	(0.3930)
Household debt	-0.0443	-0.0487	-0.0505	-0.0455	-0.0511	-0.0480
	(0.0402)	(0.0425)	(0.0417)	(0.0386)	(0.0431)	(0.0393)
FDI	-0.0385	-0.0318	-0.0354	-0.0382	-0.0413	-0.0359
	(0.0274)	(0.0268)	(0.0274)	(0.0278)	(0.0277)	(0.0266)
Interest rate	0.0369	0.0110	0.0239	-0.0071	-0.0103	0.0139
	(0.0513)	(0.0535)	(0.0465)	(0.0622)	(0.0472)	(0.0486)
Household income	0.0001	0.0001	0.0002	0.0002	0.0002	0.0002
	(0.0004)	(0.0004)	(0.0005)	(0.0005)	(0.0005)	(0.0004)
Financial wealth	-0.0744*	-0.0704	-0.0766*	-0.0731*	-0.0737*	-0.0752*
	(0.0401)	(0.0410)	(0.0410)	(0.0391)	(0.0411)	(0.0399)
Property income	0.0011	0.0013	0.0011	0.0012	0.0014	0.0013
	(0.0011)	(0.0011)	(0.0011)	(0.0012)	(0.0011)	(0.0011)
Major purchases (timing)	0.0254					
	(0.0249)					
Major purchases (spending)		0.0405				
		(0.0417)				
Saving (timing)			0.0030			
			(0.0250)			
Saving (likeliness)				-0.0313		
				(0.0440)		
Financial situation (current)					-0.0703	
					(0.0628)	
Consumer confidence (agg.)						-0.0187
						(0.0350)
Observations	78	78	78	78	78	78
R-squared	0.5325	0.5311	0.5178	0.5237	0.5294	0.5216
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Country FE	Yes	Yes	Yes	Yes	Yes	Yes

Dependent variable: Saving rate. Heteroscedasticity–robust standard errors clustered at country level are in parentheses. *, **, and *** indicate significance at the 10%, 5%, and 1% level respectively.

Table 5a: FE results post crisis

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Growth	0.4123*	0.3513	0.3025	0.2546	0.2618	0.2598	0.2604
	(0.2276)	(0.2044)	(0.2283)	(0.2172)	(0.1904)	(0.1915)	(0.2065)
Inequality	-0.7725**	-0.7792**	-0.7092**	-0.7845**	-0.8633**	-0.8616**	-0.7997**
	(0.2985)	(0.2838)	(0.2394)	(0.2826)	(0.3210)	(0.3212)	(0.2920)
Age dependency	0.2374	0.3303	0.2709	0.2818	0.2835	0.2776	0.2866
	(0.1912)	(0.2114)	(0.2623)	(0.2539)	(0.2313)	(0.2523)	(0.2598)
Gov. bond yield	0.1769	0.1222	0.1418	0.1445	0.2101	0.2043	0.1569
	(0.2942)	(0.2745)	(0.2888)	(0.2923)	(0.2819)	(0.2876)	(0.2865)
Gov. deficit	-0.0603	-0.0495	-0.0582	-0.0751*	-	-0.1053**	-0.0831*
	(0.0407)	(0.0418)	(0.0407)	(0.0416)	(0.0353)	(0.0356)	(0.0388)
Gov. debt	-0.0376	-0.0622	-0.0368	-0.0553	-0.0587	-0.0595	-0.0506
	(0.0425)	(0.0396)	(0.0430)	(0.0403)	(0.0413)	(0.0398)	(0.0423)
Social protection	-0.1309	-0.0890	-0.0850	-0.0549	-0.0534	-0.0660	-0.0546
	(0.1780)	(0.1951)	(0.1967)	(0.1899)	(0.1899)	(0.1829)	(0.1893)
Pension expenditure	-1.3511	-1.1274	-1.3171	-1.3051	-1.4567	-1.4355	-1.3843*
	(0.9017)	(0.7907)	(0.7903)	(0.7795)	(0.8636)	(0.8375)	(0.7722)
Market capitalization	-0.0547**	-0.0410	-0.0339	-0.0322	-0.0416	-0.0422	-0.0398
	(0.0248)	(0.0264)	(0.0262)	(0.0273)	(0.0290)	(0.0299)	(0.0277)
Unemployment rate	0.3847	0.5659**	0.6239**	0.7075**	0.7479**	0.7514**	0.7022**
	(0.2945)	(0.2371)	(0.2256)	(0.2397)	(0.2583)	(0.2588)	(0.2493)
Inflation	-0.6871**	-0.6227**	-0.5650**	-0.5460**	-0.5204*	-0.5351*	-0.5799**
	(0.2715)	(0.2630)	(0.2199)	(0.2526)	(0.2750)	(0.2641)	(0.2324)
Household debt	-0.0313	-0.0359	-0.0522	-0.0533	-0.0395	-0.0376	-0.0428
	(0.0318)	(0.0335)	(0.0343)	(0.0334)	(0.0392)	(0.0381)	(0.0363)
FDI	0.0172	0.0137	0.0200	0.0209	0.0325	0.0328	0.0270
	(0.0334)	(0.0319)	(0.0298)	(0.0295)	(0.0301)	(0.0308)	(0.0291)
Interest rate	-0.0391	-0.0224	-0.0353	-0.0367	-0.0461	-0.0431	-0.0378
	(0.0469)	(0.0495)	(0.0524)	(0.0542)	(0.0498)	(0.0520)	(0.0521)
Household income	0.0015***	0.0014***	0.0017***	0.0015***	0.0017***	0.0017***	0.0016***
	(0.0005)	(0.0004)	(0.0004)	(0.0004)	(0.0004)	(0.0004)	(0.0004)
Financial wealth	-0.0047	-0.0114	-0.0047	-0.0105	-0.0040	-0.0044	-0.0050
	(0.0120)	(0.0133)	(0.0133)	(0.0148)	(0.0143)	(0.0138)	(0.0129)
Property income	0.0024	0.0027	0.0023	0.0023	0.0019	0.0020	0.0021
	(0.0018)	(0.0018)	(0.0017)	(0.0019)	(0.0019)	(0.0019)	(0.0019)
Fin. situation (past)	-0.0904*						
	(0.0505)						
Fin. situation (future)		-0.0681**					
		(0.0298)					
Econ. situation (past)			-0.0309**				
			(0.0139)				
Econ. situation (future)				-0.0240			
				(0.0157)			
Cons. prices (past)					-0.0008		
					(0.0110)		
Cons. prices (future)						0.0033	
						(0.0124)	
U. expectations							-0.0188
							(0.0153)
Observations	78	78	78	78	78	78	78
R-squared	0.8745	0.8769	0.8730	0.8678	0.8616	0.8617	0.8670
Country FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Dependent variable: Saving rate. Heteroscedasticity–robust standard errors clustered at country level are in parentheses. *, **, and *** indicate significance at the 10%, 5%, and 1% level respectively.

Table 5b: FE results post crisis

	(8)	(9)	(10)	(11)	(12)	(13)
Growth	0.2250	0.3823*	0.2604	0.2550	0.2710	0.2640
	(0.2176)	(0.2057)	(0.1895)	(0.1992)	(0.1974)	(0.2099)
Inequality	-0.8223**	-0.5698*	-0.8618**	-0.8581**	-0.8729**	-0.7585**
	(0.2933)	(0.3162)	(0.3248)	(0.3191)	(0.3157)	(0.2774)
Age dependency	0.2654	0.3283*	0.2588	0.2925	0.2859	0.3092
	(0.2421)	(0.1775)	(0.2415)	(0.2351)	(0.2341)	(0.2526)
Gov. bond yield	0.2207	0.2621	0.2080	0.1942	0.2233	0.1062
	(0.2899)	(0.2725)	(0.2818)	(0.3048)	(0.2979)	(0.2891)
Gov. deficit	-0.0771*	-0.0662	-0.1123**	-0.1039**	-0.1035**	-0.0586
	(0.0382)	(0.0431)	(0.0458)	(0.0375)	(0.0361)	(0.0459)
Gov. debt	-0.0499	-0.0453	-0.0565	-0.0578	-0.0555	-0.0500
	(0.0389)	(0.0397)	(0.0417)	(0.0421)	(0.0416)	(0.0385)
Social protection	-0.0534	-0.1526	-0.0539	-0.0340	-0.0273	-0.0385
	(0.1983)	(0.1721)	(0.1902)	(0.2078)	(0.1990)	(0.1886)
Pension expenditure	-1.5587*	-0.8923	-1.4865	-1.4968	-1.5853	-1.3275*
	(0.8377)	(0.8639)	(0.8716)	(0.9348)	(0.9080)	(0.7472)
Market capitalization	-0.0395	-0.0400	-0.0394	-0.0426	-0.0491	-0.0354
	(0.0251)	(0.0255)	(0.0328)	(0.0299)	(0.0299)	(0.0260)
Unemployment rate	0.7078**	0.3278	0.7597**	0.7414**	0.5974**	0.6515**
	(0.2594)	(0.2997)	(0.2672)	(0.2571)	(0.2291)	(0.2391)
Inflation	-0.6295**	-0.5768**	-0.5008	-0.5381*	-0.5522*	-0.5823**
	(0.2763)	(0.2191)	(0.2970)	(0.2644)	(0.2591)	(0.2421)
Household debt	-0.0460	-0.0301	-0.0413	-0.0390	-0.0274	-0.0493
	(0.0302)	(0.0319)	(0.0371)	(0.0358)	(0.0343)	(0.0336)
FDI	0.0320	0.0078	0.0324	0.0334	0.0345	0.0212
	(0.0282)	(0.0327)	(0.0303)	(0.0305)	(0.0294)	(0.0302)
Interest rate	-0.0360	-0.0293	-0.0457	-0.0481	-0.0593	-0.0370
	(0.0490)	(0.0572)	(0.0466)	(0.0510)	(0.0593)	(0.0543)
Household income	0.0017***	0.0016***	0.0017***	0.0017***	0.0016***	0.0015***
	(0.0004)	(0.0005)	(0.0004)	(0.0004)	(0.0004)	(0.0004)
Financial wealth	-0.0100	-0.0049	-0.0037	-0.0038	-0.0035	-0.0085
	(0.0151)	(0.0118)	(0.0143)	(0.0136)	(0.0134)	(0.0136)
Property income	0.0023	0.0035*	0.0019	0.0019	0.0023	0.0022
	(0.0018)	(0.0018)	(0.0019)	(0.0019)	(0.0017)	(0.0019)
Major purchases (timing)	-0.0458					
	(0.0301)					
Major purchases (spending)		-0.0900**				
		(0.0396)				
Saving (timing)			0.0058			
			(0.0182)			
Saving (likeliness)				-0.0110		
				(0.0334)		
Financial situation (current)					-0.0899	
					(0.0726)	
Consumer confidence (agg.)						-0.0464*
						(0.0255)
Observations	78	78	78	78	78	78
R-squared	0.8683	0.8843	0.8618	0.8620	0.8667	0.8729
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Country FE	Yes	Yes	Yes	Yes	Yes	Yes

Dependent variable: Saving rate. Heteroscedasticity–robust standard errors clustered at country level are in parentheses. *, **, and *** indicate significance at the 10%, 5%, and 1% level respectively.

Further research is needed into the specific channels through which the GFC has changed how consumer confidence influences households' saving decisions. One possible explanation could be that consumer confidence after the crisis simply reached lows which it had not reached before. When consumer confidence is above this threshold, households hardly incorporate confidence in their own financial situation or in the general economic situation in their saving decisions; what portion of their disposable income they save is largely determined by other factors than consumer confidence. After the threshold is crossed, consumer confidence is factored in to household saving decisions to a far greater extent and a broader range of confidence indicators have an impact on household saving.

6.3 2SLS results

As already discussed extensively in Section 5.2, this fixed effect estimation does take into account time-invariant unobserved country-specific heterogeneity, but does not deal with the potential reverse causality between consumer confidence and household saving, in which case the initial results merely identify a statistically significant correlation between several sub-indicators of consumer sentiment rather than determine a causal effect of consumer confidence on household saving. To study the latter, we proceed with the instrumental variable approach.

As has been explained at length in the literature (e.g. Staiger & Stock, 1997; Stock & Yogo, 2005), instruments are weak when they are sufficiently exogenous but only weakly correlated with the endogenous covariate. As Bound, Jaeger & Baker (1993) argue, "the cure can be worse than the disease" in that case. Hence, we start by evaluating the goodness-of-fit of the first stage results to test whether the excluded instrument is satisfactorily correlated with the included endogenous regressors, i.e. the different sub-indicators of consumer confidence. As stated in Staiger & Stock (1994), an instrument is considered to be weak if the F statistic in the first stage of the two-stage procedure is less than 10. However, in case of a just-identified model with one endogenous variable and one instrument, as in ours, smaller F values are acceptable because in these models 2SLS is median-unbiased (Angrist & Pischke, 2009; Cannonier & Mocan, 2018). With F-values greater than 4 for every sub-indicator which has a statistically significant impact

on household saving, we can reject the hypothesis that our instrument is weak. For completeness, Appendix 4 sets out the form of first-stage regression equations implicit in our instrumented equations[180].

The 2SLS results, shown in Tables 6a and 6b below, indicate that nearly every sub-indicator of consumer confidence is a significant driver of the saving decisions of households. Only the perception of price evolutions (past and present) and the timing and likeliness of saving do not have a statistically significant impact on the household saving rate. Confidence in their own financial situation is still a more important determinant of household saving than confidence in the general economic situation is. However, in the 2SLS estimation, confidence in the current financial situation has a larger impact on the saving rate than the perception of the past or future financial situation has. If *Financial situation (current)* decreases by 1 standard deviation, household saving increases by 12.43 percentage points, compared with a 7.62 (past) and 4.04 (future) percentage points increase, given a 1 standard deviation decrease in both indicators. As the household saving rate averages 10.72% in our sample, this effect is very sizeable.

Moreover, in the 2SLS estimation, the impact of confidence in the general economic situation is also statistically significant, but the magnitude of the effect is more moderate than the impact of *Financial situation*; all else equal, a 1 standard deviation increase in the confidence indicator which measures the perception of the general economic situation yields on average a 3.81 (past economic situation) to 2.82 (future economic situation) percentage points increase in household saving.

[180] Surprisingly, these first-stage results indicate there is a positive relationship between terrorist incidents in year t-1 and consumer confidence in year t. This might suggest that consumer confidence is surprisingly resilient to the occurrence of terrorist incidents and bounces back rapidly, which is line with Garner (2002). This can potentially be explained by an increase in patriotism following terrorist attacks (Sandler & Enders, 2008).

Table 6a: 2SLS results

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Growth	0.9885***	0.2805*	0.7904***	0.2745	0.4517	20.6847	0.5598***
	(0.3772)	(0.1696)	(0.2884)	(0.2035)	(2.3593)	(271.3151)	(0.1925)
Inequality	-0.0152	-0.1985	-0.1787	-0.2005	-0.4837	-7.2365	-0.3010*
	(0.2772)	(0.2501)	(0.1254)	(0.1304)	(1.5758)	(87.9459)	(0.1822)
Age dependency	-0.0825	-0.0458	-0.0680	0.0483	-0.0963	9.2289	-0.1643
	(0.1229)	(0.0993)	(0.0906)	(0.1049)	(2.9293)	(121.1863)	(0.1623)
Gov. bond yield	-0.4326	-0.4172	-0.0258	-0.3848	7.6331	19.8775	-0.3677
	(0.5158)	(0.3159)	(0.2981)	(0.3230)	(35.2756)	(264.3118)	(0.3652)
Gov. deficit	0.1514	0.1472	0.1756**	0.0582	2.9258	3.9567	0.1284
	(0.1240)	(0.0932)	(0.0756)	(0.0600)	(14.3528)	(55.5235)	(0.1058)
Gov. debt	-0.0449	-0.0773**	0.0016	-0.0169	-0.5318	1.6833	0.0243
	(0.0372)	(0.0309)	(0.0444)	(0.0433)	(2.0378)	(23.1818)	(0.0453)
Social protection	-0.2120	0.0079	0.0395	0.1439	5.5428	15.0300	-0.0727
	(0.2735)	(0.1469)	(0.1539)	(0.2085)	(26.2292)	(197.9455)	(0.1915)
Pension expenditure	-0.6111	-0.5784	-0.6130	-0.7305	-0.9375	24.0353	-1.3533***
	(0.6328)	(0.4547)	(0.4876)	(0.4468)	(7.1311)	(336.3766)	(0.4977)
Market capitalization	-0.0517*	0.0092	0.0291	0.0258	0.6886	1.0546	0.0404
	(0.0271)	(0.0228)	(0.0247)	(0.0225)	(3.1744)	(13.7870)	(0.0344)
Unemployment rate	-0.2400	0.4169***	0.2490**	0.4327***	-2.6696	-18.7293	0.6421***
	(0.3117)	(0.1269)	(0.1199)	(0.1061)	(15.6266)	(256.6705)	(0.1160)
Inflation	-0.7930***	-0.7734***	-0.8441***	-0.6591***	7.5667	20.3454	-1.0782***
	(0.2536)	(0.2026)	(0.2466)	(0.2424)	(37.4994)	(267.8603)	(0.3134)
Household debt	-0.1546***	-0.1155***	-0.0601**	-0.0616**	-0.6581	-0.4994	-0.0814***
	(0.0321)	(0.0234)	(0.0245)	(0.0262)	(2.9834)	(6.0495)	(0.0228)
FDI	-0.0687**	-0.0500**	-0.0130	-0.0301	-0.2995	1.1662	-0.0083
	(0.0318)	(0.0201)	(0.0250)	(0.0183)	(1.4647)	(16.3018)	(0.0309)
Interest rate	-0.0811	0.0107	0.0154	0.0119	1.7223	-3.3724	0.0496
	(0.0622)	(0.0359)	(0.0457)	(0.0428)	(8.3347)	(45.3243)	(0.0471)
Household income	0.0009**	0.0007**	0.0010***	0.0006*	0.0030	0.0419	0.0004
	(0.0004)	(0.0003)	(0.0003)	(0.0003)	(0.0100)	(0.5376)	(0.0004)
Financial wealth	-0.0296	-0.0505***	-0.0253	-0.0460**	0.1398	0.5460	-0.0459*
	(0.0196)	(0.0183)	(0.0205)	(0.0187)	(0.7143)	(7.5039)	(0.0240)
Property income	0.0028***	0.0042***	0.0043***	0.0045***	0.0077	-0.0863	0.0038***
	(0.0010)	(0.0008)	(0.0009)	(0.0010)	(0.0284)	(1.1639)	(0.0013)
Fin. situation (past)	-0.5382***						
	(0.1610)						
Fin. situation (future)		-0.3107***					
		(0.0696)					
Econ. situation (past)			-0.1563***				
			(0.0420)				
Econ. situation (future)				-0.1615***			
				(0.0408)			
Cons. prices (past)					-3.3948		
					(15.7559)		
Cons. prices (future)						-13.2383	
						(174.9486)	
U. expectations							-0.2094***
							(0.0580)
Observations	156	156	156	156	156	156	156
Country FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
First stage (F-stat.)	5.02	7.83	38.52	34.32	0.06	0.01	6.93

Dependent variable: Saving rate. Heteroscedasticity–robust standard errors clustered at country level are in parentheses. *, **, and *** indicate significance at the 10%, 5%, and 1% level respectively.

Table 6b: 2SLS results

	(8)	(9)	(10)	(11)	(12)	(13)
Growth	0.4016	0.2295	-2.4666	1.1986	0.7692	0.3501*
	(0.3032)	(0.2655)	(17.5376)	(1.8156)	(0.5443)	(0.1873)
Inequality	-0.1027	-0.0855	-3.7389	0.9286	-0.2618	-0.1896
	(0.2541)	(0.2009)	(24.1260)	(1.8535)	(0.2457)	(0.1522)
Age dependency	-0.3238	0.2683*	-11.2193	0.9561	-0.4962	0.0016
	(0.2929)	(0.1549)	(75.1947)	(1.5288)	(0.3761)	(0.1129)
Gov. bond yield	-0.2816	-0.4717	-9.3309	0.1241	0.4372	-0.3646
	(0.4935)	(0.4470)	(63.4012)	(2.1405)	(0.6161)	(0.3222)
Gov. deficit	-0.0458	0.0072	-5.4456	0.4837	-0.1117	0.1205*
	(0.1771)	(0.0980)	(36.7331)	(0.9652)	(0.0899)	(0.0677)
Gov. debt	0.1039	0.0231	3.1044	-0.0388	-0.0416	-0.0102
	(0.0994)	(0.0410)	(21.3797)	(0.1476)	(0.0554)	(0.0361)
Social protection	0.2395	0.0941	3.9317	1.7909	-0.4796	0.0945
	(0.4984)	(0.2267)	(26.6940)	(3.4019)	(0.5076)	(0.1456)
Pension expenditure	-1.8327	-1.1033**	-39.0652	3.1329	0.0358	-0.7675*
	(1.4511)	(0.5587)	(262.6848)	(4.9391)	(0.9370)	(0.4084)
Market capitalization	0.0093	0.0000	-0.2439	0.0808	-0.0488	0.0308
	(0.0345)	(0.0302)	(1.6587)	(0.1661)	(0.0421)	(0.0238)
Unemployment rate	0.3458	0.0897	-1.1774	-1.9581	-0.6596	0.4058***
	(0.3290)	(0.1539)	(11.7182)	(3.1262)	(0.5478)	(0.1011)
Inflation	-0.6563	-0.5919***	8.8912	-3.3623	-0.6742	-0.8651***
	(0.4857)	(0.1980)	(65.4593)	(4.4871)	(0.4816)	(0.2013)
Household debt	-0.2033**	-0.0961***	0.0921	-0.1457	-0.0650	-0.0764***
	(0.0793)	(0.0258)	(1.2463)	(0.1705)	(0.0567)	(0.0268)
FDI	0.0343	-0.0460**	0.2843	0.0115	-0.0422	-0.0244
	(0.0475)	(0.0226)	(2.2243)	(0.1226)	(0.0304)	(0.0198)
Interest rate	-0.1903	0.0223	-0.3889	-0.1666	-0.1620	0.0116
	(0.1429)	(0.0577)	(2.8559)	(0.3596)	(0.1186)	(0.0382)
Household income	0.0026***	0.0021***	0.0050	0.0006	0.0008	0.0006**
	(0.0007)	(0.0004)	(0.0286)	(0.0022)	(0.0008)	(0.0003)
Financial wealth	-0.0026	-0.0109	0.8248	-0.1173	-0.0223	-0.0473**
	(0.0416)	(0.0235)	(5.7835)	(0.1360)	(0.0316)	(0.0185)
Property income	0.0005	0.0044***	-0.0472	0.0114	0.0090***	0.0044***
	(0.0022)	(0.0017)	(0.3416)	(0.0113)	(0.0023)	(0.0008)
Major purchases (timing)	-0.4632*					
	(0.2406)					
Major purchases (spending)		-0.3169***				
		(0.1166)				
Saving (timing)			5.0824			
			(34.6493)			
Saving (likeliness)				-1.9769		
				(2.6719)		
Financial situation (current)					-1.0006**	
					(0.4451)	
Consumer confidence (agg.)						-0.2411***
						(0.0592)
Observations	156	156	156	156	156	156
Country FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
First stage (F-stat.)	4.04	5.13	0.02	0.47	9.66	30.68

Dependent variable: Saving rate. Heteroscedasticity–robust standard errors clustered at country level are in parentheses. *, **, and *** indicate significance at the 10%, 5%, and 1% level respectively.

Also unemployment expectations drive the household saving rate; a 1 standard deviation decrease in *Unemployment Expectations* lowers saving by 4.58 percentage points. In addition, if households declare that now is not the right moment for major purchases or that they expect to spend less on big ticket items, they save more in the current year; if *Major purchases* declines by 1 standard deviation, household increase saving decisions by 11.92 (timing) and 4.72 (spending) percentage points. Finally, the aggregated consumer confidence indicator is also a significant determinant of household saving decisions; a 1 standard deviation increase in *Consumer confidence (aggregated)* results in a 3.98 percentage points rise in the saving rate of households. The results for the control variables are in line with our previous analyses.

7. Conclusions

The saving behaviour of households has been the subject of a vast amount of studies, focusing both on individual drivers of saving (e.g. the interest rate or the rate of unemployment) and more comprehensive explanations of what drives saving decisions (e.g. the life cycle hypothesis). Little research however has been performed on the impact of the recent decrease in consumer confidence due to the Global Financial Crisis on household saving behaviour, nor on which sub-indicators of consumer sentiment play the most important role. In our paper, we attempt to fill this gap by exploring whether consumer confidence, as measured by 13 consumer confidence indicators from the Joint Harmonised EU Consumer Survey, indeed effects saving decisions behaviour.

We find that confidence in the financial situation of households has a substantially larger effect on household saving than confidence in the general economic situation. Basselier & Langenus (2014), which assesses recent changes in the saving decisions behaviour of Belgian households, has similar findings. Heightened uncertainty and decreased consumer confidence raises saving, but the specific measure of uncertainty matters: self-reported uncertainty relating to the financial situation of households boosts saving the most. Likewise, Klopocka (2017) aims to gauge the extent to which various confidence indicators have predictive power in explaining aggregate household propensity to save and finds a statistically

significant raise of forecast accuracy compared to the baseline equation from adding lagged changes of the consumer confidence indicator which assesses the expected financial situation of households.

Moreover, although the impact of different components of consumer confidence on household saving has hardly been studied, the differential effects of various sub-indicators of consumer sentiment on household expenditure has been analyzed. The results of most studies are in line with our findings. Dreger & Kholodilin (2013) study the forecasting power of various aspects of consumer confidence for predicting the future path of consumption and find that forecasting accuracy improves considerably if the expected change in households' financial situation is incorporated in the benchmark model. Similarly, Berg & Reinhold (1996) demonstrate that the indicator regarding the personal financial situation is found to be more closely related to changes in consumption than the indicator regarding the general economic situation. In addition, Easaw & Heravi (2004) show that the confidence indicator capturing the expectations about households' financial situation is a useful predictor for the growth of durable, motor vehicles and service goods consumption. In contrast, Cotsomitis & Kwan (2006) find that the forecasting ability of the various consumer confidence indicators is rather weak and that the indicator on financial position expectations is a reliable predictor of Personal Consumption Expenditures in only a limited number of countries. Moreover, studying the relationship between consumer confidence and stock market developments - rather than saving - Jansen & Nahuis (2003) show that the stock market–confidence relationship is driven more by expectations about economy-wide conditions than by beliefs about the evolution of personal finances.

Hence our findings fit well into the literature on precautionary saving as we show that decreased consumer confidence results in increased saving. However, it also furthers the literature as it narrows down which component of consumer confidence is the dominant driver in this process, that is confidence in households' own financial situation. Hence, households are hence more concerned with how their personal financial situation develops than with the state of the general economy. Indeed, it is the evolution of a household finances over the past year, and their outlook for the coming year, which ultimately drives their spending decisions. If they experience a deterioration in their financial situation, and/or

expect it to deter further, they will postpone the consumption of durable consumer goods[181], such as a car, to a time when their finances, or at least their perception of them, have improved.

Moreover, our results suggest the impact of consumer confidence on household saving has increased after the Global Financial Crisis. More research is needed to establish the mechanisms behind this. We posit that a threshold effect might be in place: after the GFC, consumer confidence dropped to such a low level, that it altered the way households incorporate consumer sentiment in their saving decisions: consumer confidence plays a larger role and households incorporate a broader array of confidence indicators to determine their economic or financial situation.

As noted, consumer confidence deteriorated almost unabatedly over the period under consideration. However, households might react differently to a positive shock to consumer confidence than to a negative shock. When the recovery from the GFC gains momentum, and households experience a prolonged period of increasing consumer confidence, an interesting avenue for research would be to study whether households indeed alter their saving behaviour in a different way when exposed to a positive shock to consumer confidence. Moreover, aggregated data only go so far in helping to identify the relationship between consumer confidence and household saving. Collecting household-level microdata on the saving rate as well as the different determinants of saving would allow for testing the robustness of our results and for studying the extent to which the impact varies from country to country. Finally, our research uses annual data as quarterly data on most of our control variables are not available on an EU-wide scale. However, specific shocks in consumer sentiment are presumably more visible in quarterly data. Hence, as the set of economic indicators for which quarterly data is available expands, follow-up research could replicate our analysis using quarterly data to test the robustness of our results.

[181] This mechanism is not confined to the postponement of purchasing durable consumer goods. When households have low confidence in the evolution of their personal financial situation, they will be less inclined to spend a significant amount of their disposable income on going on a holiday, as this is considered to be a luxury expense which can easily be forgone for a while.

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Appendices

Appendix 1: Evolution of the household saving rate, 2001-2014

Source: European Commission (2017)

Appendix 2: Joint Harmonised EU Consumer Survey Questions concerning consumer confidence

Q1 How has the financial situation of your household changed over the last 12 months? It has...

+ + got a lot better

+ got a little better

= stayed the same

– got a little worse

– – got a lot worse

N don't know.

Q2 How do you expect the financial position of your household to change over the next 12 months? It will...

+ + get a lot better

+ get a little better

= stay the same

– get a little worse

– – get a lot worse

N don't know.

Q3 How do you think the general economic situation in your country has changed over the past 12 months? It has...

+ + got a lot better

+ got a little better

= stayed the same

– got a little worse

– – got a lot worse

N don't know.

Q4 How do you expect the general economic situation in this country to develop over the next 12 months? It will...

+ + get a lot better

+ get a little better

= stay the same

– get a little worse

– – get a lot worse

N don't know.

Q5 How do you think that consumer prices have developed over the last 12 months?

They have..

+ + risen a lot

+ risen moderately

= risen slightly

- stayed about the same

-- fallen

N don’t know

Q6 By comparison with the past 12 months, how do you expect that consumer prices will develop in the next 12 months? They will..

+ + increase more rapidly

+ increase at the same rate

= increase at a slower rate

- stay about the same

-- fall

N don’t know

Q7 How do you expect the number of people unemployed in this country to change over the next 12 months? The number will...

+ + increase sharply

+ increase slightly

= remain the same

– fall slightly

– – fall sharply

N don't know.

Q8 In view of the general economic situation, do you think that now is the right moment for people to make major purchases such as furniture, electrical/electronic devices, etc.?

++ yes, it is the right moment now

= it is neither the right moment nor the wrong moment

- no, it is not the right moment now

N don't know.

Q9 Compared to the past 12 months, do you expect to spend more or less money on major purchases (furniture, electrical/electronic devices, etc.) over the next 12 months? I will spend

++ much more

+ a little more

= about the same

- a little less

-- much less

N don't know.

Q10 In view of the general economic situation, do you think that now is..?

++ a very good moment to save

+ a fairly good moment to save

- not a good moment to save

-- a very bad moment to save

N don't know.

Q11 Over the next 12 months, how likely is it that you save any money?

+ + very likely

+ fairly likely

– not likely

– – not at all likely

N don't know.

Q12 Which of these statements best describes the current financial situation of your household?

+ + we are saving a lot

+ we are saving a little

= we are just managing to make ends meet on our income

- we are having to draw on our savings

-- we are running into debt

N don't know.

COF = (Q2 + Q4 + Q7 + Q11)/4

Appendix 3: Correlation matrix of confidence indicators

	Financial situation (past)	Financial situation (future)	Economic situation (past)	Economic situation (future)	Consumer prices (past)	Consumer prices (future)	Unemployment expectations	Major purchases (timing)	Major purchases (spending)	Saving (timing)	Saving (likeliness)	Financial situation (current)	Consumer confidence (agg.)
Financial situation (past)	1												
Financial situation (future)	0.85*	1											
Economic situation (past)	0.73*	0.61*	1										
Economic situation (future)	0.55*	0.72*	0.75*	1									
Consumer prices (past)	-0.07	-0.09	-0.05	-0.20*	1								
Consumer prices (future)	0.02	-0.26*	0.21*	-0.18*	0.49*	1							
Unemployment expectations	0.41*	0.46*	0.74*	0.77*	-0.13	0.04	1						
Major purchases (timing)	0.66*	0.50*	0.65*	0.54*	-0.14	0.08	0.48*	1					
Major purchases (spending)	0.69*	0.63*	0.56*	0.52*	0.14	0.07	0.40*	0.55*	1				
Saving (timing)	0.46*	0.50*	0.27*	0.32*	-0.19*	-0.29*	0.22*	0.32*	0.40*	1			
Saving (likeliness)	0.70*	0.62*	0.49*	0.47*	-0.20*	-0.11	0.30*	0.71*	0.55*	0.65*	1		
Financial situation (current)	0.69*	0.55*	0.55*	0.43*	-0.13	-0.03	0.28*	0.72*	0.50*	0.51*	0.90*	1	
Consumer confidence (agg.)	0.77*	0.84*	0.77*	0.88*	-0.18*	-0.12	0.75*	0.69*	0.64*	0.54*	0.77*	0.70*	1

* indicates significance at the 5% level

Appendix 4a: First-stage results

	(CI1)	(CI2)	(CI3)	(CI4)	(CI5)	(CI6)	(CI7)
Growth	1.873***	0.967	5.185***	1.822	0.139	1.564	2.768**
	(4.38)	(1.67)	(6.63)	(1.99)	(0.12)	(1.83)	(3.36)
Inequality	0.270	-0.122	-0.116	-0.247	-0.095	-0.535	-0.671
	(0.44)	(-0.11)	(-0.11)	(-0.28)	(-0.16)	(-0.59)	(-0.58)
Age dependency	-0.207	-0.240	-0.620	0.121	-0.0370	0.695	-0.922
	(-0.84)	(-0.72)	(-1.01)	(0.26)	(-0.04)	(1.34)	(-1.64)
Gov. bond yield	-0.717	-1.193	0.133	-2.095	2.262	1.505	-1.534
	(-1.05)	(-1.29)	(0.12)	(-1.50)	(1.73)	(1.36)	(-1.05)
Gov. deficit	0.465***	0.792***	1.756***	0.972**	0.891	0.306	1.085*
	(4.67)	(5.37)	(6.52)	(3.37)	(1.93)	(0.95)	(2.53)
Gov. debt	-0.057	-0.203*	0.102	-0.016	-0.152	0.128	0.185
	(-0.74)	(-2.60)	(0.92)	(-0.14)	(-1.04)	(1.12)	(1.21)
Social protection	-0.459	-0.087	0.029	0.675	1.622	1.133	-0.514
	(-0.95)	(-0.18)	(0.03)	(0.62)	(1.10)	(1.12)	(-0.52)
Pension expenditure	0.271	0.575	0.922	0.165	-0.053	1.873	-2.847
	(0.26)	(0.52)	(0.33)	(0.08)	(-0.02)	(0.88)	(-0.77)
Market capitalization	-0.136**	-0.040	0.049	0.027	0.197	0.078	0.090
	(-2.99)	(-0.71)	(0.40)	(0.33)	(1.42)	(0.67)	(0.74)
Unemployment rate	-1.075	0.252	-0.574	0.582	-0.886	-1.440	1.449
	(-1.78)	(0.42)	(-0.68)	(0.63)	(-0.88)	(-1.90)	(1.52)
Inflation	-0.599	-0.975*	-2.390*	-1.167	2.368*	1.572	-2.902
	(-1.69)	(-2.80)	(-2.79)	(-1.70)	(2.50)	(1.50)	(-2.08)
Household debt	-0.232***	-0.276***	-0.195	-0.198*	-0.185	-0.036	-0.247*
	(-5.19)	(-6.12)	(-1.95)	(-2.67)	(-1.50)	(-0.53)	(-2.80)
FDI	-0.103*	-0.119	0.001	-0.105	-0.084	0.089	0.023
	(-2.13)	(-1.48)	(0.00)	(-1.26)	(-0.97)	(0.71)	(0.15)
Interest rate	-0.075	0.166	0.359	0.327	0.519	-0.252	0.432
	(-0.64)	(1.32)	(1.50)	(1.56)	(1.21)	(-0.94)	(1.73)
Household income	-0.000	-0.000	0.000	-0.002	0.001	0.003*	-0.003
	(-0.16)	(-0.86)	(0.17)	(-1.86)	(0.32)	(2.35)	(-1.64)
Financial wealth	-0.013	-0.089	-0.016	-0.144*	0.048	0.043	-0.110
	(-0.48)	(-1.65)	(-0.36)	(-2.55)	(0.53)	(0.48)	(-1.27)
Property income	-0.001	0.003	0.007	0.008*	0.001	-0.007	0.003
	(-0.31)	(1.61)	(1.79)	(2.86)	(0.29)	(-1.72)	(0.50)
Terrorist incidents	1.274*	2.207*	4.389***	4.246***	0.202	0.052	3.275*
	(2.24)	(2.81)	(6.27)	(5.88)	(0.18)	(0.07)	(2.62)
Observations	156	156	156	156	156	156	156
Country FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Dependent variable: the different sub-indicators of consumer confidence. Heteroscedasticity–robust standard errors clustered at country level are in parentheses. *, **, and *** indicate significance at the 10%, 5%, and 1% level respectively.

Appendix 4b: First-stage results

	(CI8)	(CI9)	(CI10)	(CI11)	(CI12)	(COF)
Growth	0.910	0.787	0.789*	0.481	0.616	1.534**
	(1.38)	(1.29)	(2.72)	(0.52)	(1.76)	(3.16)
Inequality	0.125	0.237	-0.101	0.704	0.551	-0.121
	(0.21)	(0.29)	(-0.32)	(1.09)	(1.16)	(-0.15)
Age dependency	-0.761	0.756	-0.525	2.213*	0.469	-0.113
	(-1.09)	(1.87)	(-1.90)	(2.55)	(1.00)	(-0.37)
Gov. bond yield	-0.508	-1.342	0.483	1.827	0.086	-1.320
	(-0.58)	(-1.87)	(0.95)	(1.52)	(0.08)	(-1.60)
Gov. deficit	0.114	0.334	-0.013	1.052***	0.295	0.909***
	(0.28)	(1.58)	(-0.16)	(5.40)	(1.78)	(5.01)
Gov. debt	0.255*	0.118	-0.027	-0.614*	-0.012	0.017
	(2.34)	(1.62)	(-0.51)	(-2.60)	(-0.13)	(0.31)
Social protection	0.442	0.187	-0.514	-0.767	0.888	0.247
	(0.49)	(0.25)	(-0.87)	(-0.88)	(1.07)	(0.57)
Pension expenditure	-2.322	-1.092	0.792	7.537*	1.968	-0.043
	(-0.97)	(-0.70)	(0.88)	(2.31)	(1.56)	(-0.03)
Market capitalization	-0.026	-0.068	-0.070	0.052	0.030	0.039
	(-0.33)	(-0.92)	(-1.78)	(0.33)	(0.49)	(0.64)
Unemployment rate	0.016	-0.785	-0.998***	0.298	-1.162*	0.279
	(0.02)	(-1.35)	(-4.52)	(0.30)	(-2.61)	(0.45)
Inflation	-0.401	-0.383	-0.203	-1.842	-1.463*	-1.636**
	(-0.40)	(-0.48)	(-0.49)	(-1.09)	(-2.52)	(-2.98)
Household debt	-0.375*	-0.210*	-0.035	-0.024	-0.059	-0.194**
	(-2.85)	(-2.85)	(-0.63)	(-0.15)	(-0.75)	(-3.71)
FDI	0.102*	-0.104	-0.029	-0.059	0.013	-0.047
	(2.28)	(-1.46)	(-1.12)	(-0.66)	(0.20)	(-0.65)
Interest rate	-0.323	0.199	-0.121	0.069	-0.064	0.218
	(-1.43)	(1.15)	(-1.31)	(0.26)	(-0.39)	(1.83)
Household income	0.003**	0.003**	-0.000	-0.001	-0.000	-0.001
	(3.04)	(3.07)	(-0.13)	(-0.28)	(-0.13)	(-1.66)
Financial wealth	0.044	0.038	0.000	-0.167	-0.048	-0.102*
	(0.52)	(0.88)	(0.02)	(-2.10)	(-0.94)	(-2.13)
Property income	-0.006	0.004	0.006*	0.010	0.004	0.005*
	(-1.55)	(0.83)	(2.71)	(1.31)	(1.32)	(2.12)
Terrorist incidents	1.480	2.164*	0.685**	-0.135	0.347	2.845***
	(2.06)	(2.26)	(2.98)	(-0.13)	(0.69)	(5.54)
Observations	156	156	156	156	156	156
Country FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes

Dependent variable: the different sub-indicators of consumer confidence. Heteroscedasticity–robust standard errors clustered at country level are in parentheses. *, **, and *** indicate significance at the 10%, 5%, and 1% level respectively.

CHAPTER 7

Conclusions

1. General conclusions

After the Global Financial Crisis (GFC), government indebtedness (re)gained center stage in the economic policy debate. However, scholars have struggled to specify at what point public debt becomes a drag on growth. In 2010, Carmen Reinhart & Kenneth Rogoff published a, by now infamous, paper which appeared to provide an answer to this pressing question (Reinhart & Rogoff, 2010). The authors claimed that real GDP growth significantly decelerates when the ratio of sovereign debt to GDP crosses the 90% mark. This threshold swiftly became ammunition in political debates on austerity, on both sides of the Atlantic. For a relatively extended period, the assertion that debt levels in excess of 90% of GDP bring about economic mayhem and hence need to be avoided by all means, was treated as received wisdom. Our first research question further investigates this claim:

RQ1: Is there a debt threshold after which growth declines significantly?

We extend the original study by Reinhart & Rogoff twofold. Firstly, we do not limit our analysis to public debt, but also add private debt as both are not only intimately interlinked (e.g. when the government bails out the private sector) but are also interchangeable (e.g. students take on loans to pay full cost fees at universities and colleges vs. increased government indebtedness to finance higher education). Thus, public and private debt need to be aggregated to be able to fully appreciate the extent to which debt impacts an economy. Secondly, to mitigate the potential reverse causality between debt and growth we extend the horizon of our analysis and also study the evolution of economic growth 5, 10 and 15 years after a certain threshold is crossed, not merely after one year.

We use annual data of 26 developed economies, spanning the period 1961-2012 to study whether it is possible to predict the future level of growth, solely by considering the level of total debt in an economy, or changes in that level. Data on private debt comes from a recent BIS database[182] on credit to the private non-financial sector. Data on public debt levels are gathered from a comprehensive

[182] See Dembiermont, Drehmann & Muksakunratana (2013) for a detailed description of the database: http://www.bis.org/statistics/credtopriv.htm.

database on gross government debt, which is compiled by the IMF Fiscal Affairs Department[183]. We find little evidence to support the hypothesis that a critical debt threshold exists after which economic output is drastically reduced. Instead, our research shows growth performance deteriorates progressively as the level of total debt-to-GDP increases. Moreover, this relationship is stronger for short-term growth than for medium- to long-term growth, which suggests the causality most likely runs from low growth to high debt, rather than vice versa.

We submit two other interpretations of our results. Firstly, our research suggests that historically, on average, sovereign debt and private credit have generally been used in such a way that is conducive to economic growth. Put differently, the return on investments which are financed by issuing debt, has on average compensated the costs of incurring that debt. Consider the following example. A company takes on additional debt to improve its equipment. In the short run, this results in an increase of its debt level. In the longer run however, the upgraded machinery brings about higher productivity and consequently higher profits. The increase in productivity leads to more profits, which offsets the elevated debt servicing costs. Similarly, increased government borrowing to finance public investments increases the stock of public debt in the short run, but boosts the long-term productive potential of an economy. Secondly, our results indicate that looking solely at the level of public debt does not yield much useful information to predict future GDP growth. It can be argued that the cost of servicing that debt has a more substantial impact on the evolution of economic growth. Higher interest rates harm public finances, as the servicing of debt becomes more onerous. Similarly, certain investment projects will cease to be profitable due to the higher cost of financing them, thus resulting in lower growth. Notwithstanding the feedback loop between the level of debt and the interest paid on that debt, ceteris paribus, higher bond yields have a negative impact on the number of investment projects being undertaken, and hence on economic growth.

Finally, we analyzed the impact of the pace of debt accumulation on GDP growth. Our results show that rapid debt accumulation is negatively correlated with short run economic growth, but that this effect is less pronounced over the medium

[183] See Horton et al. (2010) for a complete description of the database, which can be found online on www.imf.org/external/datamapper/index.php?db=DEBT.

term and non-existent over the long run. This suggests that rapid debt accumulation in most instances is the result of a negative exogenous shock, which results in low growth and high debt in the short run, but does not significantly alter the long-term economic fundamentals of a country.

In conclusion, our results provide no evidence for the premise that there is one common debt threshold, for all periods and for all countries, after which an economic pandemonium ensues. Should such a threshold exist, it most likely varies from country to country, across time and depends on a plethora of different factors (e.g. a country's potential growth rate, debt servicing costs, institutional capabilities and the willingness and ability of the private sector to save). However, high debt levels might still negatively impact an economy in myriad other ways. Hence, we put forward the second research question of this doctoral dissertation:

RQ2: To what extent does higher public debt result in lower public investment?

The Sovereign Debt Crisis brought about rapidly increasing public debt levels. Compared to the debt levels prevalent in 2007, the public-debt-to-GDP ratio increased by 66.66% in the EU, by 70.23% in the Eurozone and even by a staggering 86.52% in the so-called PIIGS countries (Portugal, Italy, Ireland, Greece and Spain). Concurrently with public debt levels in Europe surging, public investment plummeted. From 2007 to 2015, public gross fixed capital formation (GFCF) decreased by 6.32% in the EU, by 11.08% in the Eurozone and by 37.87% in the PIIGS.

We study whether the rise in public debt has caused the fall in public investment, which is often referred to as the 'debt overhang' hypothesis. The current literature on this has three gaps. Firstly, most research on the impact of debt on investment is concentrated on developing economies, and the small number of papers that do focus on advanced economies, only include a limited number of countries in their analysis. Secondly, the potential endogeneity between debt and investment is not dealt with in a satisfactory manner; a rudimentary (P)OLS or FE model does not suffice to tackle the simultaneity bias between public investment (i.e. the dependent variable) and public debt. Thirdly, despite the clear downward trend in public investment in the EU over the previous decade, there is very limited

research on the determinants of public investment, especially in advanced economies, and most analyses are centered on just one country. Hence, we add to the existing literature by taking into account a richer set of explanatory variables to determine public investment, using a panel dataset of 26 EU countries between 1995 and 2015 to examine the extent to which increased debt levels have contributed to decreased public investments. We address the problem of endogeneity by using a Generalized Method of Moments (GMM) model which exploits the instrumental variable approach (IV) based on the linear GMM estimator of Arellano & Bond.

We find a significantly negative impact of sovereign debt on public investment. The most conservative estimate of the dynamic GMM specification indicates that a 1 percentage point increase in public debt lowers public investment in the EU by around €1.85 billion (given the level of public investment in 2015). This suggests that, when sovereign debt rises, public investment is crowded out by the increase in debt servicing costs. When faced with the need to curtail spending, governments have a bias for reducing investment spending rather than current spending, as the political cost of deferring investment projects is generally lower than the political cost of trimming current expenditure since the latter often benefits politically influential interest groups (e.g. civil servants). As a result, highly indebted governments spend less on public capital. Hence, from an economic policy perspective, fiscal consolidation measures might be justified, if the aim is to boost public investment[184].

Moreover, the results of our empirical analysis show that this debt overhang effect is only prevalent in high debt countries. For an average country in the high debt group, a 1 percentage point decrease in public debt would increase public investment by €286 million. This provides further credence to the claim that excessive debt levels should be avoided and, if necessary, need to be addressed by taking austerity measures. In addition, our results show that the negative link between debt and investment is somewhat smaller in the Eurozone than in the entire EU, which implies that the institutional framework of the Eurozone does *not* act as 'straightjacket' for countries that are characterized by high levels of public

[184] Of course, many more factors need to be considered when contemplating whether austerity measures are appropriate, such as the potential negative effect on economic growth in the short run.

debt[185]. Finally, we find that the negative effect of *changes* in the debt level is stronger than the negative impact of the debt level per se. This illustrates that both the stock and flow of debt have played a role in reducing public investment, and that the latter's impact was more profound.

As already extensively illustrated, public gross fixed capital formation declined substantially in the aftermath of the Global Financial Crisis. This has been recognized by scholars and policymakers alike and considerable effort has been exerted to bridge the investment gap that has materialized over the past decade. The substantial drop in *private* gross fixed capital formation however, has been less well acknowledged, and studied. Moreover, the decline in private investment has been matched by an increase in debt, both public and private. Thus, we address the following research question:

RQ3: To what extent does higher debt result in lower private investment?

Private investment has been quite cyclical over the past two decades: in 1995 private gross fixed capital formation stood at roughly 18% of GDP, followed by a peak during the dot.com bubble, after which it fell back to the 1995 level. Subsequently, private investment boomed again, reaching a high point of 20% of GDP in 2007. This was again succeeded by a significant drop, as the GFC caused the ratio of private investment to GDP to drop to 17%. However, this masks vast differences between (groups of) countries. Whereas, private gross fixed capital formation only declined marginally in Northern countries, such as Germany, Austria and Belgium, it plunged in the PIIIGS. Between 2006 and 2013: private investment decreased by 20% in Italy, by 34% in Portugal, by 38% in Spain, by 39% in Ireland and by a staggering 51% in Greece.

We aim to further the literature on what has driven the collapse in private investment, particularly focusing on the potential detrimental impact of debt, both private and public, on investment. To investigate whether the EU suffers from a

[185] For example, Eurozone countries have forfeited their ability to devalue their currency with the goal of boosting exports to offset the negative impact fiscal consolidations can have on an economy. This was often advanced as an argument why, during and after the sovereign debt crisis, countries in the euro area periphery performed badly (e.g. Lauren, 2016).

debt overhang, in which high debt results in low private investment, we exploit a panel dataset of 28 EU countries over the period 1995-2016. All data are extracted from AMECO, Eurostat or the World Bank. We use different econometric techniques to test our hypothesis, such as a FE model and an instrumental variable approach (GMM); the latter helps in dealing with the potential endogeneity between private investment and private debt.

Most literature on the private debt overhang hypothesis analyzes how elevated levels of corporate debt influence the way firms decide to invest. Our research tries to extend this perspective, looking at how *total*, i.e. public plus private, debt levels (excluding financial institutions) have an impact on the investment decisions of firms and households. We are not aware of any research which focuses on the potential detrimental effect of excessive levels of sovereign, household *and* corporate debt on total private gross fixed capital formation.

We find scant evidence to support the hypothesis that high private debt leads to low private investment. However, we do find that inflated levels of *public* debt result in diminished private investment. In our sample of 28 European countries over the period 1995-2016, a rise in sovereign debt of 1 standard deviation generates a decline in private investment of 3.96 percentage points.[186] Equivalently, if public debt in the EU would be 10 percentage points lower, private gross fixed capital formation would increase by €65 billion. In addition, this debt overhang effect is stronger in countries characterized by high levels of public debt (defined as public debt levels in the 66th percentile and higher). For these countries, private investment is lowered by 7.48 percentage points for every 1 standard deviation increase in general government debt.

We identify three potential channels through which higher public debt can result in lower private investment. Firstly, as government debt rises, companies and households expect future taxes to increase as well and decide to reduce investment spending now. Secondly, the private sector considers public debt to be an indicator of economic uncertainty: if sovereign debt goes up, economic prospects are dismal. In a future mired in economic uncertainty, the incentive to

[186] In comparison, the results emanating from our second research question showed that a 1 standard deviation increase in public debt results in a decrease in public investment of 0.92 percentage points.

invest will be lower. Thirdly, higher levels of public debt will, ceteris paribus, bring about higher borrowing costs for the sovereign, as this implies a higher risk of default. This increase in borrowing costs feeds through to the private sector and crowds out private investment.

Our results provide evidence for this third effect. In countries with high levels of public debt, an increase in the long-term borrowing costs of 1 standard deviation results in a decrease in private gross fixed capital formation of 0.77 percentage points. Moreover, this credit rationing effect was complemented by a negative impact of high levels of non-performing loans (NPLs) on private investment. One explanation could be that banks with high NPL ratios provided fewer credit to private firms, resulting in lower private gross fixed capital formation. Finally, our research shows that bailing out financial institutions that were severely battered by the GFC, resulted into lower private investment, which might suggest that banks which received a bailout restricted the availability of credit.

The first part of this dissertation focused on how debt impacts growth and investment. For the fourth research question, we explore how public debt has evolved over the past two decades, what were the main drivers of these debt dynamics and what policy lessons can be drawn from studying the evolution of public debt. We carry out a case study on a country which has historically struggled with high debt levels to answer the following research question:

RQ4: What were the main drivers of Belgium's debt dynamics between 1995 and 2014?

Due to the substantial decline in macroeconomic volatility that characterized the US and the EU from the mid-1980s until the mid-2000s, fiscal sustainability and debt management receded to the background of economic policy discussions. The GFC showed, however, that the pattern of taxing and spending in a number of countries was unsustainable. To ward off another Great Depression, governments adopted budgetary stimulus measures. Moreover, automatic stabilizers kicked in to counteract decreases in aggregate demand. The combination of discretionary fiscal stimuli, decreased government revenues and increased government spending, caused debt levels to surge. Between 2007 and 2014, global debt increased by $57 trillion, with advanced economies accounting for about half of

this growth[187]. As a result, the thorny question of how a country can reduce its government debt to a more manageable level, has regained prominence.

Belgium's experience in bringing sovereign debt down is often referred to as a textbook example of a successful debt reduction episode; Belgium managed to lower its public debt-to-GDP ratio from 130.7% in 1995 to 86.9% in 2007. Hence, we take an in-depth look into this particular case. More specifically, we formalize a debt accounting framework to assess the determinants of changes in the ratio of public debt-to-GDP of Belgium for the period 1995-2014, focusing on three distinct periods: (i) the years leading up to the adoption of the euro, starting from 1995; (ii) the following years until 2007, when the GFC erupted; and (iii) the period from 2008 to 2014. This debt accounting framework breaks down the changes in the public debt-to-GDP ratio into components such as the real growth rate, primary fiscal deficits, inflation, the real growth rate and appreciation or depreciation effects on foreign currency denominated debt.

Subsequently, we take a look at what, if any, lessons can be learned from the Belgium experience and applied to Greece, a country which would certainly benefit from a comparable, or preferably even larger, reduction in sovereign debt; its ratio of public debt-to-GDP inflated from an already substantial 103.5% in 2006 to 187.6% in 2014[188]. Our aim is not to demonstrate that Belgium and Greece are identical. Rather, we endeavor to establish the similarities between the two countries as well as accentuate the differences, resulting in both to be acknowledged and managed conscientiously. Even if there would not be any economic rationale for making direct comparisons, the attitudes of European creditors (personified by the Eurozone Finance Ministers) is to a significant extent determined by the past achievements of other countries. As Zettelmeyer, Kreplin & Panizza (2017) state: "*Hence, even if the behavior of other countries were irrelevant in a predictive sense (because Greece turns out to be structurally highly atypical), it could be important in a normative sense, from the vantage point of creditors*."

We find that Belgium, driven by a combination of large primary surpluses and strong economic growth, succeeded in considerably reducing its public debt level

[187] Source: McKinsey Global Institute, 2015.
[188] Source: Eurostat, 2015.

in the run-up to joining the Economic and Monetary Union (EMU) and continued this impressive feat, until the Global Financial Crisis erupted. In 2008, the federal government had to bail out large parts of the financial sector, causing a sizeable increase in the public debt-to-GDP ratio. Moreover, anemic growth combined with the cost of servicing a large stock of legacy debt, resulted in public debt to rise even further.

Belgium had ample experience in running primary surpluses. As a result of its historically high debt burden, the Belgium government already had to realize substantial primary surpluses during the 1980s, as to avoid debt snowballing out of control. When Belgium decided to enter the EMU, the risk premium on Belgian bonds decreased and interest rates on government bonds started to fall substantially. Both elements combined with an uptick in international growth and the 'stars aligned' for an impressive debt reduction episode. We do not claim the Belgium government refrained from implementing important reforms to establish these relatively high primary surpluses. However, the latter were not significantly larger than the surpluses it had historically realized; for the period 1985-1999 the average primary surplus was 3.5%, which is only slightly lower than the 3.8% Belgium averaged over the period 2000-2008. Of course, maintaining a primary surplus also requires taking difficult, and often unpopular, measures, but Belgium had extensive experience in doing so.

Whether Greece can achieve a similar reduction in its public debt ratio is not clear-cut. Certain factors speak in favor of Greece emanating the Belgium experience; others do not. For example, there was a large public willingness in Belgium to make hard sacrifices in order to comply with the Maastricht treaty (see e.g. Maes & Verdun, 2005). Similarly, even at the heights of the GFC, the Greek people showed an unequivocal desire to remain part of the common currency block, even if this meant stringent austerity measures. As staying part of the Eurozone seems as important to the Greek people as entering it was for the Belgian people, they are likely willing to make considerable sacrifices to this end. In contrast, whereas only around a quarter of Belgium's stock of sovereign debt was held by non-residents when it entered the Eurozone[189], approximately 83% of Greece's debt was owed to official, foreign creditors at the end of 2014. Running continued

[189] Source: National Bank of Belgium, 2015.

primary surpluses to pay down debt constitutes a massive transfer of Greek wealth to other counties, which is of course a lot more sensitive than the situation Belgium was in at the end of the 1990s, when most sovereign debt was held by residents. If Greek citizens take the view that these transfers are unfair, as future generations will have to continue to "pay for mistakes made by previous governments", this will significantly hamper their willingness to tolerate painful austerity measures.

For the fifth and final research question, we study the impact of the Global Financial Crisis on consumer confidence and household savings. As noted, the GFC had a major impact on the European economy, causing, amongst other things, low growth and low investment. In the fifth research question, we study the influence of the GFC on consumer confidence and how changes in consumer confidence influenced household savings:

RQ5: To what extent does consumer confidence explain household saving and if so, which specific sub-indicators of consumer sentiment are most significant?

The marked increase in sovereign debt resulting from the GFC forced most governments to push through stringent austerity measures, including cuts in social security spending and laying off civil servants. Moreover, monetary policy reacted by implementing a host of conventional and unconventional policy measures to contain the fall-out of the crisis. These shifts in economic circumstances have culminated in increasing uncertainty for households. People experience a higher degree of uncertainty on whether they will be able to keep their job, what return they can expect on their savings, at what age they can retire and how large their pension will be. Moreover, consumer confidence has been severely dented by the GFC and its repercussions.

Our research focuses on whether the decrease in consumer confidence has had an impact on the saving behavior of households. More specifically, we study the effect of consumer confidence, as captured by 13 consumer confidence indicators from the Joint Harmonised EU Consumer Survey, on the household saving rate. In other words, we analyze whether consumer confidence has any power in explaining household saving and if so, which specific sub-indicators of consumer

sentiment (e.g. confidence in their own financial situation or confidence in the general economic situation) plays the most important role. For this purpose we exploit a panel data set of 18 EU countries over the period 2001-2014. To tackle the issue of potential endogeneity between the household saving rate and consumer confidence, we use an instrumental variable approach.

Our results indicate that confidence in the financial situation of households has a considerably larger impact on the saving behavior of households than confidence in the general economic situation. In the 2SLS estimation, a 1 standard deviation decrease in the indicator measuring the perception of the current financial situation, the household saving rate increases by 12.43 percentage points, all else equal. A 1 standard deviation decrease in the indicator measuring the perception of the general economic situation, however, only yields a 2.82 (future economic situation) to 3.81 (past economic situation) percentage points increase in household saving.

We also find that the impact of consumer confidence on the household saving rate substantially differs before (2001-2008) and after the crisis (2009-2014). Before the eruption of the GFC, not a single indicator of consumer sentiment impacts the saving decisions of households. After the crisis, five sub-indicators of consumer sentiment have a statistically significant impact on household saving: confidence in households' financial situation (past and future), confidence in the general economic situation (past), the spending on major purchases and the aggregated consumer confidence indicator.

In addition, the impact of consumer confidence becomes stronger after the crisis: whereas the increase in the household saving rate ranges from 0.44 to 0.73 percentage points before the GFC, given a 1 standard deviation decrease in the perception of households' past or future financial situation, it ranges from 0.87 to 1.28 percentage points after the GFC. This effect is even stronger for *Major purchases (spending)*: if this indicator decreases by 1 standard deviation, household saving increases by 1.37 percentage points after the GFC, which is triple the pre-crisis effect of 0.46 percentage points.

2. Suggestions for further research

The first research question focused on the existence of a debt threshold after which growth slows down significantly. More specifically, we studied whether the total level of debt in an economy is a good predictor of future GDP growth. As the research done by Reinhart & Rogoff (2010) was highly influential in policy circles and inspired a vast amount of new studies on this subject[190], we intended to follow their methodology as much as possible. Hence, our paper suffers from the same methodological limitations[191]. We applied a non-parametric method to explain the correlation between debt and growth. The appeal of this method is that the results can be interpreted rather intuitively. However, this also implies that our work is simply descriptive in nature. Hence, we do not formally consider the causality in the relationship between debt and growth. Further research is warranted to identify the complex structural relationship between the level of total debt in an economy and GDP growth, for example by formalizing a structural econometric model that is firmly rooted in economic theory. Moreover, as already discussed, a potential debt threshold will most likely depend on a multitude of factors (e.g. the neutral rate of interest, the monetary policy framework or the level of competitiveness of an economy), and be country-specific and time-dependent. Identifying these potential determinants and including them in a formal model, incorporating this country-specific heterogeneity and allowing for time-dependent variability, can provide insights into the mechanisms through which debt influences economic growth. An additional avenue for further research is to break down the total level of debt in its disparate parts - public debt can be disaggregated into internal and external debt, private debt into mortgage debt, credit card debt and others, and so forth - to establish what type of debt significantly impacts GDP growth. This will allow policymakers to focus on preventing the build-up of excessive debt levels in those areas most likely to cause economic harm (e.g. high-yielding corporate debt) and to be less preoccupied with

[190] At the time of writing, Google Scholar indicates that the original Reinhart & Rogoff paper 'Growth in a Time of Debt' has been cited 2.911 times.
[191] More specifically, we further develop the methodology by Reinhart & Rogoff (2010) by (i) incorporating total levels of debt rather than solely public debt, and (ii) expanding the time-horizon of growth performance.

types of debt that appear to be less harmful to GDP growth (e.g. long-dated public debt that is issued by a sovereign perceived as highly trustworthy).

In our second research question, we studied to what extent higher public debt results in lower public investment. We found evidence for a debt overhang effect, but only so in high debt countries. An interesting avenue for further research is to study *why* public debt negatively affects public investment, particularly in countries characterized by high levels of sovereign debt. Does a specific mechanism exist that impedes public investment but is only triggered when debt is excessively high? Or do these high debt countries possess a common component/trait causing both debt to be high and investment to be low? In addition, as the negative effect of high public debt on growth and investment is generally studied in the context of emerging markets (EMs), a logical extension of our analysis would be to test the model we formulated for advanced economies using data for EMs, in effect comparing the debt overhang effect in both groups of countries. Moreover, we posit that a potential reason why public investment is low in high debt countries, is that it is less politically painful to cut capital expenditure than current expenditure when fiscal austerity measures have to be implemented as a result of an excessive debt load. Hence, follow-up research could look at different episodes of austerity and formally test whether public investment is indeed the first component of the government budget that is axed when austerity is introduced. Finally, we use a GMM model, exploiting the IV approach based on the linear GMM estimator of Arellano & Bond (1991). Different econometric techniques could be employed to validate our findings, such as an autoregressive distributed lag (ARDL) model, a method to test for the presence of long-run relationships between economic time-series, similar to Ncanywa & Masoga (2018).

In our third research question, we studied the extent to which higher public and private debt result in lower private investment. Although we do find that public debt negative influences private investment, we do not find robust evidence that higher private debt levels result in lower private investment. Of course, excessive levels of private investment might have a negative economic impact in myriad other ways. For example, recent research (e.g. Klein, 2017; Bernardini & Peersman, 2018) shows that fiscal multipliers are much larger when private debt

is high. This implies that, when debt levels in the private sector are elevated, austerity measures will result in a more severe economic contraction. In addition, Klein & Winkler (2018) find that austerity leads to a strong and persistent increase in income inequality during periods of private debt overhang. Further research could look at other economic indicators (next to fiscal multipliers and income inequality) which are impacted by austerity when private debt levels are high. Over the past years, the Bank for International Settlements (BIS) published various studies indicating that excessive levels of private debt are an important factor in explaining the slowdown in productivity growth that has occurred over the past two decades (Borio, Kharroubi, Upper & Zampolli, 2016; Borio, 2018), *inter alia* due to the misallocation of labor and capital during and after credit booms. For example, households with mortgage debt exceeding the value of their home will find it more difficult to relocate and take advantage of job opportunities in other cities, states or even countries. In addition, highly leveraged banks, especially those with a significant stock of non-performing loans (NPLs), have a strong incentive not to recognize losses on those loans. Even more, they have a tendency to keep credit to these companies flowing, as to avoid their going bankrupt, and reduce the availability of credit for healthy companies. Keeping these zombie companies alive by misallocating credit will result in lower overall productivity (growth). One avenue for further research could be to study whether companies mainly relying on bank loans indeed invest less when their creditors have high NPL levels.

In our fourth research question, we studied the main drivers of Belgium's debt dynamic over the period 1995 to 2014 and tried to draw policy lessons for Greece. We see three main areas for further research. Firstly, our analysis starts in 1995, as that is the first year for which the National Bank of Belgium has detailed data on the characteristics of Belgium's sovereign debt (e.g. currency denomination, maturity, domestic vs. external public debt). As new debt databases are constructed (such as the IMF's Global Debt Database that was launched in 2018 (Mbaye, Badia & Chae, 2018)), our research can be replicated over an extended horizon. Secondly, our current analysis relies on a debt accounting framework to study the debt dynamics of Belgium. Follow-up research could estimate a recursive vector autoregression (VAR) based on the different macroeconomic indicators we incorporate in our model (e.g. the primary balance, the real GDP

growth rate, exchange rate fluctuations) and analyze the impulse response functions, as in Ryan and Maana (2015). Thirdly, the debt accounting framework we introduced in this paper is only applied to Belgium. An interesting avenue for further research might be to apply this framework to a larger set of countries, such as the entire EU or Eurozone. This will allow for identifying common factors in large debt reduction episodes. A final avenue for further research is to compare the policy implications we draw for Greece with Greece's Debt Sustainability Analysis, as performed by the IMF, and scrutinize whether their assumptions (regarding expected primary balance, real GDP growth, inflation, etc.) are realistic, given the lessons that can be learned from a country which was in a similar predicament as Greece was.

In our fifth and final research question, we analyzed the extent to which consumer confidence explains household saving and if it does so, which specific sub-indicators of consumer sentiment play the most important role. As our analysis is based on aggregate data, a topic for further research is to analyze the impact of consumer confidence on saving using household-level data. This will allow for testing heterogeneity in households' sensitivity to changes in consumer confidence. For example, the effect of decreases in consumer confidence on saving decisions might be more pronounced for highly indebted households, for low-income individuals or for the elderly. In addition, further research is warranted to establish through which channel the increase in household saving rate is achieved (e.g. via lower spending on durable goods or spending less on leisurely activities such as travel or restaurant visits). Whereas this paper looks at the impact of different components of consumer confidence on household saving, follow-up research could study the differential effects of sub-indicators of consumer sentiment on the decomposition of household consumption. Finally, our analysis was centered on how households react to changes in consumer confidence. An interesting avenue for further research is to study the effect of business sentiment on corporate behavior. Companies that perceive the future to be permeated by ambivalence might choose to invest less or retain a larger share of their earnings.

3. Policy implications

This doctoral dissertation has a strong policy focus, with the intention to aid public officials in evidence-based decision making. Hence, in the final section of this doctoral dissertation, we elaborate on four policy implications that follow from our research. Although the results of our analyses can serve to inspire a myriad of policy lessons, ranging from preventing the accumulation of excessive debt to creating incentives to promote public and private investment, we focus specifically on these four policy implications as they are, in our opinion, most topical and can have the most substantial impact.

Our research showed that debt *per se* is not a good predictor of future GDP growth, but that it does have a negative impact on a variety of macroeconomic indicators, such as public and private investment. Hence, we advocate a more comprehensive view of fiscal sustainability and public wealth, which goes beyond debt and deficits and takes into account the entire public sector balance sheet, as suggested in the IMF's latest Fiscal Monitor (IMF, 2018). Thus, our first policy implication is:

PI1: Apply a public sector balance sheet approach to assess fiscal sustainability and public wealth.

If governments assess the entirety of their balance sheet in a systemic way, this increases both transparency and accountability as it forces governments to delineate all its assets and liabilities, scrutinize how both evolve over time and contemplate how they are handled. Most governments do a poor job in managing their assets. Consequently, there is considerable potential to improve the returns on these assets. The IMF estimates that the overall revenue gains of improved asset management, defined as moving from the 25th percentile to the 75th percentile of the cross-country distribution, would equal 3% of GDP per year. This is equivalent to annual corporate tax collections in advanced economies. Attending to a country's complete balance, rather than focusing solely on debts and deficits, provides more valuable information in explaining macroeconomic outcomes. Most assessments of the sustainability of public finances are centered on rudimentary fiscal parameters, like (the evolution of) government revenues and expenditures, the budget deficit and particularly gross debt. Consequently, many valuable elements of government activity are overlooked, resulting in an incomplete picture

of actual public sector wealth. Shifting the attention from one component of a public sector's balance sheet, i.e. debt, to the entirety of government assets and liabilities will yield a more accurate account of the health and sustainability of public finances, is likely to lead to better management of state assets and will draw attention to nondebt liabilities (e.g. unfunded pension obligations) that are often neglected in standard fiscal analyses.

As indicated throughout this doctoral dissertation, most research on whether or not debt is sustainable attempts to establish a specific debt threshold after which economic growth suffers, public or private investment collapses or inflation soars. We promote a broader, more extensive approach to assess the potential negative impact of debt on an economy, in line with the IMF's Debt Sustainability Analysis (DSA). Thus, our second policy implication is:

PI2: Perform a comprehensive Debt Sustainability Analysis to assess whether fiscal policy is sustainable.

The DSA framework considers a fiscal policy stance to be sustainable if the government is able to service its debt in the indefinite future without (i) default, (ii) renegotiation, and (iii) unrealistically large policy adjustments (Cottarelli & Moghadam, 2011) and is used as a tool to detect, prevent and resolve potential crises. We refer to IMF (2013) for a detailed explanation of the full DSA framework, but highlight several noteworthy elements. The DSA starts by assessing the current debt structure (e.g. the maturity structure, fixed vs. floating rates, domestic vs. external debt). Next, vulnerabilities in this structure are identified, preferably far enough in advance to correct policy before difficulties in debt servicing arise. Finally, if such vulnerabilities are diagnosed, the impact of alternative debt-stabilizing policy paths are studied. More specifically, a baseline scenario is constructed, containing the macroeconomic projections that underpin the policies the government has articulated, including the main assumptions which support it. Subsequently, a series of sensitivity tests to this baseline scenario are simulated in which the different policy variables are adjusted to reflect adverse macroeconomic developments which put pressure on a government's financing costs. The vulnerability of a country's debt structure, which can be viewed as a measure of its debt sustainability, is determined by how public debt evolves under these 'stress tests'.

We showed that countries characterized by high levels of public debt tend to devote less resources to public investment. Decreased investment, for example in education and roads, hurts the long-term productive potential of a country and has obvious negative implications for the private sector. When the latter is confronted with, for example, a less educated workforce or crumbling infrastructure, it responds by investing less as well, further reducing the country's growth prospects. Hence, low public gross fixed capital formation can lead to low private GFCF. Thus, countries, especially highly indebted ones, should be incentivized to allocate sufficient resources towards public investments. Therefore, our third policy implication is:

PI3: Introduce a 'golden rule', allowing public investments to be financed by budget deficits.

More specifically, we propose the introduction of a 'golden rule' at the European level, which would allow the government to borrow with the purpose of financing public investment but would require current spending to be covered by current revenues, along the lines of Blanchard & Giavazzi (2004). The authors suggest to rewrite the Stability and Growth Pact (SGP) by exempting spending on public GFCF from the deficit rule[192]. As governments are only allowed to borrow in order to finance net public investment (i.e. gross GFCF minus capital depreciation), an additional benefit following from the introduction of such a golden rule is that all public debt would, over time, be fully backed by public capital. This is consistent with our previous recommendation to replace standard fiscal analyses by a more comprehensive approach that takes into account the entire public sector balance sheet. The rationale for implementing such a golden rule, and hence treating capital spending different from current spending is twofold (Perée & Välilä, 2005). Firstly, as mentioned before, public investment boosts a country's potential output by expanding its capital stock. All investments for which the social rate of return exceeds the government's 'cost of capital' should be undertaken to reach a country's full economic potential. If the government's ability to finance these investments is hampered due to binding fiscal rules, these will lead to suboptimal

[192] Although the SGP has been modified several times since 2004, *inter alia* to allow for more flexibility in determining when a deficit is deemed to be excessive, these changes did not address the central problem we touch on here, namely that deficit rules have a built-in bias toward spending on public investment.

economic development, all the more so of public investment crowds in private investment. Secondly, governments should be allowed to spread the costs of public investment projects over the entire lifecycle of the investment, akin to what is common in the private sector where companies do not have to attribute the full cost of an investment to a single year's account. Moreover, current fiscal rules and public sector accounting standards impose the costs of public investment completely on the current generation, while future generations will also benefit from them, violating intergenerational equity. Hence, the costs of a public investment project should be distributed over all generations that benefit from it. Financing public investments by government borrowing rather than from current tax revenues, i.e. the golden rule, achieves this goal.

In our fifth and final research question, we studied the link between consumer confidence and household saving. If households are very pessimistic about their economic and financial situation, they might fear losing their job, the financial sector collapsing or inflation spiraling out of control. As a result, household spending on durables is postponed and companies defer investment decisions as it is unclear whether they will able to sell their products in the future. Hence, decreased consumer confidence brings about higher household saving and consequently less consumption. This drop in consumer confidence results in what Mark Carney, Governor of the Bank of England, calls "economic post-traumatic stress disorder" (Carney, 2016). Households and businesses display a heightened sensitivity to downside tail risk and are more cautious about the future. When consumer confidence is low, policymakers need to have three objectives. Firstly, perform an objective assessment of the economic outlook and highlight the most significant risks to it. Secondly, develop a plan to reduce those risks and communicate these plans to the broader public. Thirdly, do no aggravate the economic downturn. Policymakers should be very careful not to implement measures which are intended to counteract this fall in consumer confidence but in reality prove to worsen a dire economic situation. Although all three objectives are equally important, our fourth and final policy implication specifically focuses on the third goal:

PI4: Avoid the introduction of policy measures which further reduce consumer sentiment in an economic downturn.

With regards to fiscal policy, governments need to show a clear commitment to long-run debt sustainability. If governments proceed with a budgetary stimulus to counter a recession that is regarded by citizens as being excessive and jeopardizing the long-term health of public finances, households might respond more sluggishly to this demand stimulus. With regards to monetary policy, central banks need to tread carefully as to not *worsen* consumer sentiment. Highly accommodative monetary policy, especially unconventional policy measures, might be viewed by the public as an indicator that the economic future looks very bleak. The introduction of negative interest rates, monthly purchases of governments bonds to the tune of €80 billion and commitments to keep interest rates extremely low for the indefinite future can give the impression that the economy is in dire straits and is expected to be so for the foreseeable future, in the process negatively affecting household expectations about the economic outlook.

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