Essays on the Political Economy of the Eurozone and Greek Crises

Simon Ganem

London School of Economics and Political Science

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Statement of Originality

I certify that the thesis I have presented for examination for the PhD degree of the London School of Economics and Political Science is solely my own work.

I declare that my thesis consists of 33,455 words.

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Abstract

This dissertation is about the Eurozone and Greek crises of the 2010s, comprising of three papers, an introduction and a conclusion. The three papers respectively analyse the political, financial and economic dimensions of the crises. Paper 1 shows that double-sided incomplete information is a necessary condition for explaining the bargaining dynamics and outcome of the third Greek bailout negotiations. Our model also demonstrates that the outcome of the negotiations was not that predictable. Finally, the Greek policy-makers could have been more aggressive to increase their chance of obtaining a better deal. Paper 2 then investigates the effect of political uncertainty on Greek sovereign spreads between October 2009 and July 2012. We thus create a dataset comprising of more than 5800 news items covering most policy debates prevailing at that time and that are manually coded along several dimensions, in particular as expected or unexpected policy developments. The results using an EGARCH(1,1) specification suggest that financial markets reacted strongly to unexpected positive policy developments but remained, on the whole, more sensitive to negative developments in line with existing findings. Finally, paper 3 studies the role played by uncertainty in the protracted slump of investment following the Great Recession and Eurozone crisis. Since existing volatility-based proxies for uncertainty may discount uncertainty shocks coming from the left tail, we create a proxy for disaster risk building on the Growth-at-Risk approach. Using Bayesian VAR models on a panel of 12 advanced economies from 1997Q1 to 2019Q3, we find no conclusive effect of disaster risk shocks on investment.

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Introduction

1. Motivation and objective

This dissertation is about the Eurozone crisis of the 2010s, with a particular focus on the Greek specific developments. By all standards, the Eurozone crisis was an exceptional crisis. It has shaken the single currency and the wider European project to its very core. What was at stake was the very existence of the single currency. The Eurozone crisis was not only a political crisis though, it was also a financial and an economic crisis. The Eurozone has indeed been subject to major financial instability with some sovereign bonds losing most of their value and strong contagion across countries. The Eurozone even experienced a double-dip recession after the first shock of the Global Financial Crisis. The Eurozone crisis has therefore attracted the interest of a very important number of scholars, from both political science and economics.

It is beyond this dissertation to map the full debates that took place within those specific disciplines over the causes, consequences and implications of the Eurozone crisis. Nevertheless, economists have generally focused on the causes of the crisis (see Baldwin and Giavazzi 2015) and on the predicament to make the EMU viable in the long-run (see Baldwin et al 2017, Pisani-Ferry and Zettelmeyer 2019). Doing so, they have hardly taken into account the political constraints that caused what they have judged to be a suboptimal collective management of the crisis (Matthijs and Blyth 2015). In the meantime, political scientists have studied the domestic and international political consequences and implications of the crisis. But, mirroring economists, they have equally discounted economic constraints in their analyses (Copelovtich Frieden and Walter 2016).

In hindsight, it is striking to see that the multi-faceted nature of the Eurozone crisis has sparked so few exchanges and dialogue across disciplines. This has resulted into fragmented understandings of the crisis where political and economic analyses have evolved in parallel within their own discipline boundaries. As such, they might have failed to grasp the multiple dimensions of the crisis and the feedbacks loops among them. One should mention exceptions though such as the special issues edited by Jones and Torres in 2015 and by Copelovitch, Frieden and Walter in 2016. This dissertation thus aims at filling this gap by developing a comprehensive understanding of the Eurozone crisis through the analysis of its political, financial and economic dimensions.

2. A brief description of the drivers of the Eurozone and Greek crises

While this dissertation is not about the root causes of the Eurozone crisis, it is necessary to go back to the first ten years of the EMU to understand why the crisis was ever possible. By 1999, the time of the launch of the euro, there had been a quasi-full convergence of interest rates of peripheral countries to the levels of core Eurozone countries. Those very same countries that had prior expensive access to credit had now access to mature and large financial markets at very low prices. This encouraged widespread borrowing in those peripheral countries. And since the Northern Eurozone countries experienced low growth during those years, capital flows from the slow-growing core countries flooded peripheral fast-growing economies. But instead of financing real convergence as it was expected, capital flows financed non-tradable sectors such as the housing market and construction industries. Alternatively, in Greece (and to some extent in Portugal), such abundance of cheap credit allowed states to finance almost freely their public deficits.

What is more, this process was self-reinforcing: the more peripheral countries grew, the more capital flowed in eventually reinforcing economic activity. In the meantime, the boom increased price and wage inflation, weakening competitiveness of the export sectors in those countries. This eventually created large intra-Eurozone macroeconomic imbalances as reflected by the divergence in current accounts between peripheral and core countries. At some point, the credit bubble became unsustainable and caused sudden stops, as in standard Balance-of-Payment (BOP) crises (see Merler and Pisani-Ferry 2012). Accumulated debts had to swallowed in one way or another since the private sector was not willing anymore to finance them. Without European-wide mechanism, states quickly took on the respective claims and debts of the private sector, as in Ireland or Spain, to prevent a complete breakdown of the economy. This resulted into a massive increase of the public debt of member states.

This was precisely the time where the deficiencies of the institutional setup inherited from the Maastricht compromise resurfaced. Indeed, the prevailing architecture of the euro did not solve what Pisani-Ferry (2012) deemed to be a new impossible trinity. In this trilemma, one cannot have simultaneously strict no-monetary financing, sovereign-bank interconnectedness, no co-responsibility for public debt. Obviously, there was no monetary financing of public debt in the Eurozone as the Treaties, or at least their then prevailing interpretation, did not allow the ECB to act as the lender of last resort for sovereigns. Still, financial systems, in particular banking systems, remained extremely fragmented. Member states were responsible for their banks (supervising and rescuing) while the same banks held a disproportionate amount of debt

securities from their own country, creating the risks of doom-loops. And finally, countries were only liable for their own debts because of the no-bailout clause in the Treaties. As a consequence, the economic and monetary union was extremely fragile and vulnerable to self-fulfilling solvency crises (de Grauwe 2011). Prior to the crisis, financial markets expected that financial distress in one member state would force other countries to bail it out, therefore solving the trilemma in place of the policy-makers. Once Eurozone policy-makers from the creditor countries signalled their reservations to rescue distressed peripheral countries, the trilemma came back with a revenge: policy-makers had to find a way to solve the trilemma themselves.

3. A comprehensive approach to the Eurozone crisis

This dissertation precisely explores how such a common balance-of-payment crisis that was never supposed to happen in a monetary union (see Ingram 1973) became a major political crisis that had existential implications for the governance of the Economic and Monetary Union (EMU). It also studies the other side of the coin, namely how this political crisis quickly mutated into a financial crisis and eventually turned into a lasting economic crisis. To put it simply, we try to connect the dots between the three dimensions of the Eurozone crisis. This dissertation has therefore an interdisciplinary scope. We not only analyse the political consequences of the balance-of-payment crisis in a monetary union but we also investigate the economic and financial consequences of the political crisis.

3.1. The conceptual framework

Our first premise in this dissertation is that the political conflict over the adjustment process is at the center of the Eurozone crisis. There were obviously economic and financial vulnerabilities in the Eurozone that we have mentioned above and that were necessary for the crisis to occur. However, they were not sufficient to trigger the Eurozone crisis. Those vulnerabilities did not appear in one day but pretty close to no one cared for years. Financial markets started to panic only once they realised that there was some doubt about political solidarity in the Eurozone after the Greek budget revelations. As Corsetti (2015) puts it, it is the policy conflict on adjustment that let the "'risk premia genie' out of the bottle" because it fed doubts about the stability of the euro itself. And without the genie out of the bottle, the deleveraging process that started since the Global Financial Crisis would have likely continued

without a double-dip recession, much like for other European countries outside of the Eurozone (de Grauwe 2015).

Second, as we are trying to connect the different dimensions of the Eurozone crisis, we assume that there must be at least one factor that binds them together. From the existing literature, we can identify two potential channels of transmission, that are not mutually exclusive and that may even be somewhat related. The first theoretical channel of transmission is the *fragility channel*. Because of the fragility of the Eurozone, peripheral countries had to engage into pro-cyclical fiscal policy tightening once financial markets lost confidence in those countries (de Grauwe and Ji 2013). But because of very high multipliers, this process turned out to be self-defeating (Blanchard and Leigh 2013). Instead of reducing debt levels, austerity contributed to increase them: the fall in activity was so critical that it more than compensated the fiscal consolidation effort. Concerns about fiscal solvency thus further raised risk premia, exacerbating the need for further fiscal adjustment. This process was itself reinforced by doom loops between banks and sovereigns. The *fragility channel* explains the markets' loss of confidence as the result of collective movements of fear and panic though. As a consequence, the role of the political crisis is only secondary: the financial crisis came first and the management of the crisis simply worsened the situation.

There is however an alternative channel of transmission, the *uncertainty channel*, that allows for a much more active role for the political crisis in the evolution of the Eurozone crisis into both a financial and an economic crises. Contrary to the *fragility channel*, it is primarily the crisis management that affects the financial markets and in turn the real economy. Actually, in recent years, theoretical (as well as empirical) work have investigated both the financial and macroeconomic effects of political uncertainty. On the effect of political uncertainty on financial markets, one can cite the work of Pastor and Veronesi (2011). They develop a theoretical model linking political uncertainty to asset prices. They show that political uncertainty commands a risk premium whose magnitude is larger in weaker economic conditions. The work of Collignon et al (2013) is also insightful. The authors model the interaction between financial markets and political communication where markets do not know the real rate of return of Greek assets and must infer it from the signals emitted by informed European governments.

The theoretical effects of uncertainty on investment have been studied for a long time. Actually, several theoretical mechanisms have been identified. First, according to Bernanke (1983), the presence of uncertainty creates an option value for deferring investment projects and adopt a wait-and-see strategy (see also Dixit and Pindyck 1994 and Pyndick 1990). Second,

financial constraints can also propagate uncertainty shocks to the economy (Arellano et al 2012, Christiano et al 2014, Gilchrist et al 2014). When uncertainty increases, the cost of external finance increases as well for firms that hit their financial constraints. This in turn impacts economic activity because firms are less willing to invest out of fear of having to bear the risk of default (Arellano et al 2012). Third, uncertainty can also affect consumers through risk-aversion and precautionary savings (Romer 1990, Carroll 1997, Fernández-Villaverde et al 2016, Caballero 1990). The fall in consumption will then negatively affect economic activity. Finally, uncertainty can affect economic activity through a change in the probability of disaster (Gourio 2012 and 2013). Gourio (2012 and 2013) show that an exogenous increase in the probability of disaster leads to recessions driven by a reduction of investment and employment as uncertainty leads agents to save less in risky capital.

3.2. Operationalisation

We operationalise our conceptual framework through three distinct papers. We briefly outline the motivation, research question, research design and the main findings of each paper. In Paper 1, we study the political conflict at the heart of the crisis, defined as a distributive conflict between debtor and creditor countries (see Frieden and Walter 2015). Indeed, the intra-Eurozone imbalances *de facto* divided the Eurozone into creditor and debtor countries with contradictory interests, thus setting the very terms of the dispute. Since the political crisis had so many dimensions (see Brunnermeier James and Landau 2016 for a review of all the dimensions, see the special issue by Wasserfallen et al 2019), we focus on the Greek crisis and in particular on the negotiations over the third Greek bailout. As such, our goal in the paper is more specific than answering a general question about the political dimensions of the Eurozone crisis. But while the Greek case has its own specificities, it remains illustrative of the wider conflict over the distribution of the adjustment costs that has been present in each and every policy debate that arisen during the Eurozone crisis. What is more, we focus on this episode of the crisis because we believe that existing analyses fail to account for the outcome as well as the bargaining dynamics. We therefore aim at answering the following two specific research questions: why has Greece failed to obtain a debt relief? Why have the negotiations lasted for months? To answer these questions, we develop a game-theoretical model that integrate the main features of the negotiations. We thus demonstrate that double-sided incomplete information is a necessary condition for explaining the bargaining dynamics and outcome of the third Greek bailout's negotiations. We further argue that the outcome of the negotiations

was not as predictable as it has often been perceived. Finally, the Greek policy-makers could have been more aggressive in order to increase their chance of obtaining a better deal.

In the following two papers, we aim at testing whether there had been feedback loops between the different dimensions of the crisis. To do so, we follow the *uncertainty channel* path rather than the *fragility channel* because we want to insist on the centrality of the political dimension of the Eurozone crisis. In Paper 2, we study the interaction between political uncertainty prior to the Draghi's "whatever it takes" speech and financial markets. In this paper, we try to determine whether political uncertainty, defined as the uncertainty over future policy choices, has affected financial markets. More specifically, we assess the effect of the uncertainty surrounding the crisis management on Greek sovereign spreads by focusing on policy-oriented news. We thus construct a dataset of more than 5800 manually coded news items. The dataset provides an encompassing picture of the crisis management as we included most, if not all, Greek-specific and Eurozone-wide policy debates (the design of the Greek bailouts, the crisis resolution mechanisms, debt restructuring, fiscal rules, Grexit, Eurobonds, the role of the ECB, etc). We classify the news items along several dimensions to have a precise picture of the effect of different types of news on financial markets. In particular, we differentiate between expected and unexpected decisions to have a finer sense of how markets responded to policy developments. We then use the information included into our dataset to answer several questions: what was the effect of news on Greek spreads during the crisis? Which types of news were more relevant than others? How have news affected volatility in Greek spreads? Our results based on EGARCH models show that news have had an effect on Greek sovereign spreads from October 2009 to mid-2012, corresponding to the heightened period of the Greek and Eurozone crises. The results using an EGARCH(1,1) specification suggest that financial markets reacted strongly to unexpected positive policy developments but remained, on the whole, more sensitive to negative developments in line with existing findings.

In Paper 3, we focus on the macroeconomic effects of uncertainty in order to determine whether uncertainty can explain the protracted slump in investment in the Eurozone (and beyond). We focus on disaster risk in contrast to existing papers using volatility-based proxies for uncertainty. The motivation for this paper is based on the fact that existing volatility-based proxies for uncertainty may discount shocks coming from left tail risk. Indeed, volatility is appropriate to describe a distribution only if it is normally distributed. Building on the recent work of Adrian et al (2019) on downside risks to growth, we construct a proxy for disaster risk defined as the conditional probability of occurrence of extreme left tail events. Using Bayesian

panel VAR models for 12 advanced economies from 1997Q1 to 2019Q3, we find no conclusive evidence on the effect of disaster risk shocks on investment.

4. Discussion and contribution of this dissertation

In the first paper, we try to figure out whether it was pointless for Greece to challenge the status quo in 2015. By doing so, we therefore take the footsteps of many scholars who have studied interstate bargaining in the Eurozone and the European Union. However, we demonstrate that the standard power-based understanding of the negotiations over the third Greek bailout is too restrictive. Contrary to the assumption of complete information generally made in EU studies, information asymmetry can play a very important role. What is more, our findings have implications beyond the Greek case. As integration reaches core state power, distributive conflicts become all the more likely and acute. And precisely in those types of conflicts, stakeholders have an interest in misrepresenting their true preferences in order to obtain a greater share of the cooperation gains.

The starting point of the second paper was to remedy one of the limitations we found in the existing literature, namely that news dataset can be black boxes, undermining confidence in the results. The paper thus contributes to the literature on the effect of news on financial markets in methodological terms. Not only though. We indeed try to very meticulously build in a very transparent way a consistent and comprehensive news dataset. In particular, we try to deal with three common problems in the existing literature, namely the problem of endogeneity, of credibility and of expectations. Still, with our novel dataset, we obtain results that somewhat contradict the findings in the existing literature on the effect of news on financial markets during the Eurozone crisis. We find financial markets reacted strongly to unexpected positive policy developments but remained, on the whole, more sensitive to negative developments in line with existing findings.

In the third paper, in line with an expanding literature, we construct an alternative proxy for uncertainty for advanced economies based on disaster risk. We then estimate the effect of disaster risk shocks on investment in those economies.

From this dissertation, we also draw two general policy lessons. The first lesson is that, in spite of the destabilizing effect of politics on financial markets and the economy, it would be counter-productive to limit policy-makers' room of manoeuvre with more rules because distributive conflicts can only be settled through politics and policy-makers' discretion, thereby assuring the sustainability of the economic system. The second lesson is that systematically

minimising uncertainty may not always be an optimal policy. It may be beneficial for the economy as a whole to allow some degree of uncertainty or disorder as stressors of rather moderate levels may improve the capacity of the economy to resist to stronger shocks or tail events that will necessarily occur.

Paper 1. Negotiating the Third Greek Bailout: A Signalling Game with Double-Sided Incomplete Information

Abstract

Using a game-theoretical framework, we show that double-sided incomplete information is a necessary condition for explaining the bargaining dynamics and outcome of the third Greek bailout's negotiations. Our model also demonstrates that the outcome of the negotiations was not that predictable. Finally, the Greek policy-makers could have been more aggressive to increase their chance of obtaining a better deal.

1. Introduction

For many commentators, Alexis Tsipras, the then newly-elected Greek Prime Minister, deluded himself and cost his country years of additional and unnecessary pain when he decided to play hardball with the creditors after winning the snap elections in January 2015. He simply entered a game he was doomed to fail from the very beginning because he had no leverage on Greece's creditors. After all, Tsipras' *kolotumba* and complete surrender to the Europeans' terms in July 2015 was no surprise. Adopting a power-based analysis of bargaining, some scholars have indeed demonstrated that the outcome of the negotiations was rather predictable because the costs of non-cooperation would have primarily fallen on Greece (Lim et al 2018, Schimmelfennig 2015).

On the contrary, we argue that Greece did come to the negotiations' table with substantial leverage (see *inter alia* Pitsoulis and Schwuchow 2017, Legrain 2015, Varoufakis 2017 and Coppola 2015). By early 2014, Greece had reached a primary surplus, meaning that Greece could rationally decide to default on its loans for the first time since the beginning of the crisis. While a default would not have led automatically to an exit from the Eurozone (and/or the European Union), it *might* or *might have not* set in motion a chain reaction eventually leading to a Graccident. One may argue that Grexit or a Graccident had become a rather minor economic problem for the Europeans since Mario Draghi had decided to turn the ECB into a lender of last resort for sovereigns in 2012. Nevertheless, it remained a major political issue for the Europeans. A Graccident (or simply a default) would have entailed heavy symbolic costs as well as political costs because policy-makers in (Northern) European countries had invested a tremendous amount of political capital since 2010 by pledging repeatedly to their citizens, and as a condition for bailing Greece out in the first place, that every euro lent to Greece would be fully repaid.

Having the possibility to default does not equate with the willingness to do it. The Samaras government, precisely the one that created the surplus, had the opportunity to default, but it never came even close from threatening the Europeans directly with it. SYRIZA's win did not change the underlying preferences of Greece of obtaining a (substantial) debt relief while staying in the Eurozone. Still, it created, for the first time, uncertainty over how far Greek policy-makers would go to secure a debt relief.

Indeed, we argue that information asymmetry is necessary to understand the negotiations over the third Greek bailout. More specifically, we contend that the strategic use and manipulation of information through costly signals was a central part of the bargaining

process. In that sense, our argument is related to Hennessy's (2017) signalling game. In addition, those few papers that have attempted to formalise the effect of incomplete information on the bargaining process (see Hennessy 2017 and Pitsoulis and Schwuchow 2017, see also Schneider and Cederman 1994) have relied on the restrictive assumption of one-sided incomplete information. To some extent, this results into a partial analysis of the bargaining process where the behaviour of one stakeholder is passive. And as Powell (1988) shows, the incorporation of double-sided incomplete information is not a useless elaboration as it significantly changes the dynamics of negotiations, especially under the shadow of a risk of mutual assured destruction, here a Graccident.

To analyse the negotiations over the third Greek bailout, we model a game where both sides possess incomplete information about their counterpart's true preferences. We show that the presence of double-sided incomplete information made the negotiations much less predictable than generally acknowledged. In addition, the presence of incomplete information is necessary to explain the length of the negotiations. Finally, we argue that the Geek policy-makers could have been more aggressive to increase their chance of getting a better deal.

This paper makes at least three contributions. First, it offers a new narrative of the third Greek bailout's negotiations where the bargaining outcome is not that predictable. Second, it contributes to the wider literature on the political economy of the eurozone crisis by offering a formal model for debt negotiations between debtor and creditor countries within a monetary union. Third, it contributes to the literature on interstate bargaining in the EU by showing that information asymmetries are an important determinant of bargaining power.

Before proceeding, some clarifications are in order as to the scope of the analysis. This paper, while focusing on the international negotiations between Greece and its creditors, will not study the underlying factors shaping Greece and its creditors' preferences (we will be using "creditors" and "the Europeans" interchangeably throughout the paper). We will simply make plausible assumptions about the players' preferences ordering without elaborating at length about the determinants of the players' preferences.

In section 2, we review the existing literature on the Greek bailouts' negotiations and explain why focusing on incomplete information can be insightful for the analysis of the negotiations over the third Greek bailout compared to other sources of bargaining power such as outside options, domestic constraints or formal voting rules. In section 3, we describe the main features of the negotiations that we later include in the formal game in section 4. In section 5, we develop a narrative of the negotiations using some insights from the game. In section 6, we draw some concluding remarks.

2. Bargaining power and the Greek bailout negotiations

Bargaining power is a central element of negotiations[1] and comes from different sources according to a well-established literature. First, bargaining power depends on a state's best alternative to a negotiated agreement, i.e. its outside option. This is a standard and central prediction in International Relations and Liberal Intergovernmentalism that the state who has more to lose from non-cooperation has less bargaining power (Keohane and Nye 1977, Putnam 1988, Moravcsik 1998). Similarly, the most impatient player in negotiations has to make the most concessions (Rubinstein 1982). Specifically on the Eurozone and Greek crises, Schimmelfennig (2015) argues that the negotiations exhibited elements of a chicken game with hard bargaining and brinkmanship because the failure to reach an agreement would bring "mutual assured destruction" (at least before mid-2012). But since Greece had more to lose from non-cooperation, most of the burden of adjustment fell on Greece. Lim et al (2018) show that the negotiated outcomes were closer to the creditors' ideal-points precisely, largely in part due to the presence of asymmetric outside options. While their work is not specifically focusing on the Greek bailouts, Finke and Bailer (2018) lend support to the idea that debtor countries had reduced bargaining power, at least in the heightened period of the Eurozone crisis precisely because they had limited capacity to withhold the consequences of a non-agreement.

This reading of the negotiations is highly dependent on the way outside options are defined though. When defined in economic terms as in Schimmelfennig (2015) and Lim et al (2018), obviously Greece would have had a worse outside option compared to the Europeans, in particular during the negotiations over the third Greek bailout. However, when defined in political terms, the asymmetry somewhat fades away. Indeed, while the Europeans would have had the economic capacity to bear the costs of Grexit, they may not have had the political willingness to take responsibility for the disintegration of Europe. In addition, there would have been immediate political costs associated with Grexit or even simply a default. Take for instance the case of Germany. Without a deal, all the political capital invested by German policy-makers in repeating again and again that every euro lent to Greece would be repaid would have simply been lost.

[1] It is interesting to notice that in existing studies (not specifically focusing on the Greek bailouts though), preferences were found to be generally derived from national considerations, were they economic (see Schimmelfennig 2015, Tarlea et al 2019), political (see Hagemann et al 2017, Moschella 2017, Ardagna and Caselli 2014, Schneider and Slantchev 2018, see Rothacher 2015 for a synthesis between economic and political considerations) or even ideational (see Brunnermeier, Landau and James 2016, Bulmer 2014, Schäfer 2016, Blyth 2013, Zahariadis 2016a).

Second, as theorised by Putnam (1988), domestic politics or domestic constraints should affect bargaining power in the context of two-level games where international agreements need to be ratified at home, which was definitely the case in the negotiations over the Greek bailouts. Paradoxically, this theory also predicts that the more a negotiator is constrained at home, the greater bargaining power she will enjoy, i.e. the so-called Schelling Conjecture. But in spite of the popularity of this theory, very few empirical tests have been made in European studies. Slapin (2006) and Hug and König (2002) have tested the predictions of two-level games on the Amsterdam treaty reform and found that domestic constraints did influence the final bargaining outcome. More recently though, Lundgren et al (2018) econometric results suggest that domestic constraints did not systemically affect bargaining success in the Eurozone reform negotiations.

The specific evidence on domestic constraints as a source of bargaining power during the Greek bailout negotiations is also mixed. Resorting to Putnam's two level game theory, Zahariadis (2016b) shows that governments with fewer power resources, worse best alternative to negotiated agreement and fewer domestic constraints are more likely to follow soft rather than hard bargaining strategies[2]. Moschella (2017) also argues that Merkel's bargaining position was strongly influenced by the progressive empowerment of the Bundestag. For Lim et al (2018) though, domestic constraints certainly played a role but not the one expected. Greece obtained concessions from its creditors as expected by the Schelling Conjecture but less because of domestic politics than by the technocratic assessments of third parties like the IMF and international credit-rating agencies that credibly signalled that Greece could not achieve full adjustment solely through internal devaluation[3]. In addition, Frieden and Walter (2018) make the interesting case that domestic constraints and outside options generally interact with each other in determining bargaining strength. Domestic constraints will more acutely bite when influential domestic actors prefer the outside option to a compromise. In our case, this argument would have been particularly powerful in undermining the role of domestic constraints. During the Greek bailout's negotiations, the alternative was not between the status

[2] See also Zahariadis (2016a) who explains how ideology induced the Greek government to follow the hard bargaining strategy observed during the negotiations and how it acted as a barrier to compromise.

[3] The evidence on the political economy of IMF lending can be also insightful for our case study as IMF lending negotiations are maybe closer in their logic to negotiations over the Greek bailouts than negotiations over treaty changes. But there again, the evidence is still inconclusive. Rickard and Caraway (2014) econometric results show that elections gave leverage to governments in international negotiations with the IMF while Stone (2008) and Dreher and Jensen (2007) do not find such effects. Testing a more political economic hypothesis, Caraway et al (2012) show that governments are able to leverage powerful domestic labour movements in their negotiations with the IMF. The paper by Lehman and McCoy (1988) on the 1988 Brazilian debt negotiations between Brazil and the international bank advisory committee is also interesting.

quo and a new deal as in most EU negotiations but between a potential political disaster and a new deal. In all likelihood, domestic constraints would not have carried much weight in the face of a probable major political (and financial) crisis (see Schneider and Slantchev 2018).

Third, bargaining power comes from formal voting rules as predicted by rational choice institutionalism (Shepsle 2006). Very much like in the standard median voter model, formal voting rules determine the "pivotal voter" (see Krehbiel 1998 and 2008). Tsebelis (2016) argues that the unanimity rule reinforced the creditors' bargaining power by making the status quo extremely sticky to any challenge. Under unanimity, each state has indeed a veto power: decisions need to be made at the lowest common denominator. In such settings, the state with the most extreme preferences is generally the pivotal voter and thus enjoys the most bargaining power. Finke and Bailer (2018) and Lundgren et al (2018) also find that voting rules did matter for explaining bargaining success throughout the Eurozone crisis.

On the specific case of the third Greek bailout negotiations, we believe that Tsebelis (2016) overstates the relevance of the unanimity rule. He indeed focuses on the apparent unanimity within the Eurogroup against Greece, but the Eurogroup was actually not the forum where the real decisions were made. Nor did the (plenary) European Council by the same occasion. As we will later show, the relevant decisions were taken by a very few number of participants, above all Chancellor Merkel, President Hollande and Prime Minister Tsipras.

Even if we exaggerate the inability of those three sources of bargaining power to explain the outcome of the third Greek bailout negotiations, they still cannot explain why the negotiations dragged for months. Indeed, those determinants are silent over the time dimension of negotiations. For instance, if two stakeholders perfectly knew the value of their counterpart's outside option or win-set in the context of a two-level game, the optimal bargaining outcome would be reached quite rapidly. Otherwise, there would be inefficiency loss attached with longer negotiations.

That is why it may be necessary to resort to incomplete information. This concept is central in crisis bargaining, in particular in the field of International Relations. Take for instance Fearon's (1995) canonical model of war. In his model, confrontation is costly for both sides, therefore states have incentives to reveal their preferences but, in the meantime, they also have incentives to misrepresent their true preferences, especially the value of their outside option, in order to receive a better settlement. Incomplete information is also present in Putnam's work as it can play a role at the international level of negotiations. Incomplete information is also a necessary condition for nuclear crisis bargaining, whose process resembles the dynamics observed during the third Greek bailout's negotiations, to occur (see Powell 1987 and 1988).

When the respective level of resolve is common information[4], the state with the greater resolve would never face resistance to its initial challenge as the less-resolved state would concede the issue and there would be no nuclear crisis. But in presence of incomplete information, it is not always the state with the greatest resolve that prevail: bluffing sometimes succeeds. An increase in an adversary's resolve may even make a state more, not less, likely to escalate (Powell 1987 and 1988).

Some authors have delved into such informational problems even though they are generally assumed to play a minor role in EU negotiations (see *inter alia* Moravcsik 1998, Bailer 2004 and 2011, Thomson et al 2006). In EU studies, and prior to the crisis, the work of Schneider and Cederman (1994) is maybe the one that has taken information asymmetries the most seriously. The authors show that incomplete information is an important source of bargaining power and that European policy-makers have not shied away for misrepresenting their true preferences in order to obtain a better deal. Specifically on the Eurozone crisis, Tsebelis (2016) touches upon the notion of incomplete information as a factor behind the length of the negotiations. He argues that Greek policy-makers took time to understand that the unanimity rule structurally weakened their hand. In line with Schneider and Cederman (1994), some scholars have also formalised the effect of informational asymmetries during the Greek bailouts' negotiations by resorting to game theory. Pitsoulis and Schwuchow (2017) use incomplete information to explain the strategy followed by Greek policy-makers in the run-up to the third Greek bailout. According to the authors, Greek policy-makers, far from being erratic and irrational, decided to hold out by betting on the costs of reforms, through a referendum, after they realised that the Europeans would not offer early concessions. As the costs of holding out increased, so should have the risk of a Graccident to occur. However, incomplete information about Greece's commitment to brinkmanship seems to be a secondary and somewhat redundant element in the game. There is no manipulation of information or exchange of signals between the players. Domestic constraints rather appear as the main element explaining the length and brinkmanship pattern followed by the negotiations. The two players simply bet on the results of a referendum, i.e. that domestic constraints will either be high or low, while there is no explicit link with Greece's commitment to brinkmanship.

Hennessy (2017) analyses the role of costly signalling during crisis bargaining over the three Greek bailouts. She assumes that Greece had only incomplete information about the Europeans' commitment to support it financially. Accordingly, she builds a formal model

[4] Brinkmanship is generally seen as a "competition of risk-taking" where the state with the greater resolve should prevail (see Jervis 1979, Schelling 1966).

where a debtor's (here Greece) actions depend on its beliefs over the type of creditor (here the Europeans) it is facing, i.e. whether the creditor is ready to pull the plug or not if the debtor does not comply with the terms of the bailout. She argues that, since the Europeans could not issue credible signals from 2010 to 2012 because of the systemic risk attached to Grexit or a Greek default, Greece could shirk major adjustment without punishment[5]. After 2012 though, she argues that the exchange of credible and costly signals induced Greece to comply with conditionality. For the specific case of the third Greek bailout's negotiations, she argues that Greece wrongly took a EU hardliner for a EU unifier. Hennessy (2017) takes the creditors' push for Grexit in the immediate aftermath of the Greek referendum as such a proof. All in all, and much like Tsebelis (2016), the length of the negotiations were simply the learning process through which Greece understood this stark reality.

While we have sympathy for Hennessy's (2017) approach, she relies on the restrictive assumption of one-sided incomplete information. To some extent, this results into a partial analysis of the bargaining process where the behaviour of one stakeholder is somewhat passive (see also Schneider and Cederman 1994). For instance, in Hennessy (2017), there could not have been a situation where both players could have bluffed and/or mutually affected their opponent's perceptions of their preferences. Only the Europeans could have done such things. Incorporating double-sided incomplete information thus offers a richer understanding of bargaining dynamics (see Powell 1988).

3. A signalling game with double-sided incomplete information

In this section, we develop a formal game that models (and thus greatly simplifies) the debt negotiations between Greece and its official creditors in the run-up to the third Greek bailout. To construct the game, we integrate the main features of the observed negotiations and in particular double-sided incomplete information.

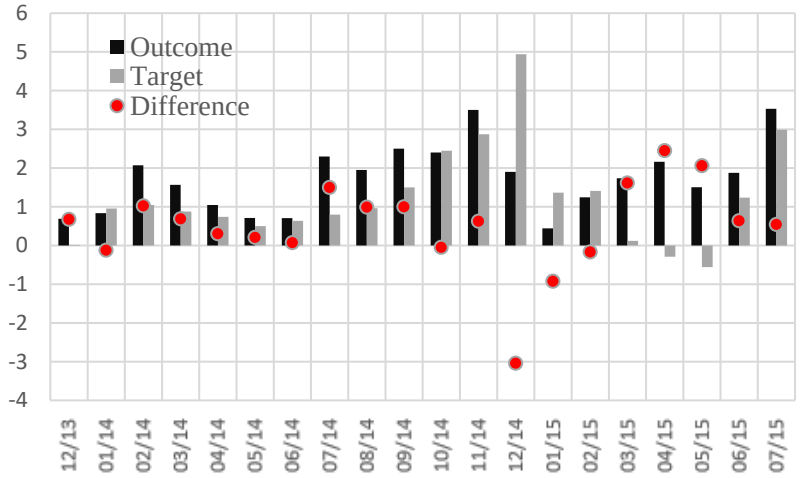
3.1. Negotiations in the shadow of default (and Grexit)

During the negotiations, the Greeks threatened on several occasions to default on their official loans were the Europeans to refuse to grant them a debt relief. Indeed, Greece had reached a primary surplus in 2013 for the first time since the beginning of the crisis (see figure 1). This

[5] This point is debatable as Greece was very likely insolvent by that time (see IMF 2013). Even with all the goodwill in the world, swimming against the (debt) tide is never an easy task.

made a huge difference in the negotiations because Greece was theoretically no more dependent on external financing and could have rationally decided to default on its debt (notice that Greece had a primary surplus throughout the negotiations)[6]. In response, the Europeans assured that either the attempt to renegotiate the deal or a default would lead to the end of financial help.

Figure 1. Greek primary surplus (in billion euros)



Source: Greek Ministry of Finance

Notes: "Outcome" refers to the actual realized primary fiscal balance; "Target" refers to the targeted primary balance in the second Greek memorandum.

A default could have had disastrous and somewhat unpredictable consequences for both Greece and the Europeans even though a country's belonging to the EMU is not dependent on it defaulting, as the 2012 PSI and the Cypriot experience have demonstrated. In addition, the European Council, short of Greece that is, cannot legally decide to unilaterally exclude Greece from the Eurozone if Greece were to default as there is no provision in the Treaties for doing so[7]. Even the ECB cannot cause an immediate Grexit by cutting off liquidity to the Greek banking system. However, in the specific context of the Greek crisis, a default *may* or *may not* unleash an uncontrollable chain reaction leading to a Graccident: default *may* or *may not* lead to capital controls, capital controls *may* or *may not* lead to a banking crisis, a banking crisis *may* or *may not* lead to a parallel currency, a parallel currency *may* or *may not* lead to Grexit[8]. By having a primary surplus, Greece has therefore the possibility to trigger such a chain reaction

[6] Obviously, a default would not have been a panacea and would have had numerous and important risks. The uncertainty caused by a default may deteriorates already poor tax collection, cause a banking crisis, etc. Notice that by the time of the negotiations, most Greek debt was held by European and international official creditors.
[7] The action closest to expelling a country would be the suspension of its voting rights for serious breach of EU values, decided unanimously (excluding the state concerned) by the European Council (art. 7 of TEU).
[8] Dabrowski (2015) has outlined how a default might cause in the space of weeks or months a Graccident.

that may end up or not with a Graccident. Since it is difficult to know with certainty the consequences of a default and how the stakeholders would have reacted, we will assume that default can lead to a Graccident with a probability h in the game.

3.2. The presence of double-sided incomplete information

If both the Greeks and the Europeans perfectly knew in advance the preferences of their opponent, the negotiations would have ended up much more rapidly than we have actually witnessed. The player with the worst outside option would have simply bowed to its opponent. However, the specific context of the negotiations over the third Greek bailout made the strategic manipulation of information over the true preferences of the stakeholders possible and even rational so as to turn the negotiations to one's own favour.

On the one hand, the Europeans were uncertain about Tsipras' preferences and how far he would have gone to secure a debt relief. They knew that Tsipras was aiming at obtaining a major debt relief while staying in the Eurozone as he repeatedly claimed since the 2012 and each and every later election campaigns, not least the 2015 campaign. Still, Tsipras and SYRIZA had no record in power and SYRIZA, as a constellation of fringe radical left parties, had no links with the centre-left and right European political parties ruling all over the Eurozone. Tsipras and SYRIZA as such were not connected to those networks: new members of the Greek cabinet and parliament were outsiders. The Europeans had thus only fragmentary knowledge about Tsipras' personality: was he serious about his pledges or was it simply electoral posturing? What is more, and unlike mainstream Greek political parties, there was an important internal divide within the party's central committee on the question of Grexit. An important minority within the party was in favour of Grexit (see Tsebelis 2016, Galbraith 2016). How this balance would evolve over the course of the negotiations was unclear. It was also unclear whether the Greek public would support its government if negotiations turned nasty (Galbraith 2016), in particular if the Greek government were to default on its loans. For instance, Greece had important repayments to the IMF to honour in March and June 2015. Would have it been that unpopular to "postpone" those repayments?

Anyway, it appears from several memoirs and historical accounts that European leaders held only incomplete information about the newly-elected Greek government' preferences. In their account of the events, Dendrinou and Varvitsioti (2019) report that European officials, Juncker above all, were not aware what Tsipras would have broughtg to the table as they refused to interact with him prior to his election. Only Rehn had met Tsipras in December 2013 for a

brief but very tense exchange. About his first trip to Athens in January 2015, Jeroen Dijsselbloem, in his memoirs (2018), writes the following:

> "Martin Schulz, president of the European Parliament, had got there before me. I rang him on the way to hear his impressions. He confessed to being greatly worried. The new government was reckless […]."

French President Hollande, in his memoirs (2018), also conveys a sense of uncertainty about Tsipras' intentions, and claims to have invited Merkel to wait and judge Tsipras on his acts.

On the other, it was also unclear to Greek policy-makers what the Europeans' preferences were. For instance, Germany, a major stakeholder in the negotiations, had uncertain preferences on Grexit. Schäuble was clearly in favour of Grexit and was ready to significantly help Greece to sail through the transition period (see Varoufakis 2017). For Merkel, there might have had room for much more ambiguity. She indeed held Greece back in 2012 after considering letting Greece go (Spiegel 2014). But at that time Greece represented a systemic risk to the Eurozone. This was no more the case in 2015, at least financially. Still, Grexit (or at least a hard default) in 2012 or 2015 would have been equally loaded politically and symbolically for her. Germany and other Northern countries might have also been willing to make an example of Greece and build a reputation for toughness to educate systemic countries such as Spain, Italy or even France (Varoufakis 2017 hints at this possibility, arguing that Greece could have simply been a pretext for a larger, much more significant battle, see also Giugliano 2015).

We thus take into account the presence of incomplete information by assuming that each player can be of two types, either compromise-averse or Grexit-averse, i.e. ready or not to take/accept the risk of a Graccident. Each player's type is assumed to be private information (see section 3.5 for how different player's types affect their payoffs ordering).

3.3. Exchanging costly signals with a time limit

Throughout the negotiations, both sides exchanged threats, counter-offers, concessions etc. In the presence of incomplete information, such signals are instrumental for the strategic manipulation of information over the true preferences of the stakeholders. For a signal may either reveal genuine aversion to compromise or exploitation by a negotiator pretending to be compromise-averse. For instance, a concession signals that a player is not ready to do whatever

it takes, including risk Greece's belonging to the Eurozone, to shift the burden of the adjustment onto her opponent. It may also enable a player to test the credibility of one's opponent threat and determine the limits one's compromise-averse opponent might not tolerate.

However, sending signals induces delays in reaching an agreement and delays come with costs for both the Greeks and the Europeans. A deal reached after a lengthy showdown increases the kind of fiscal adjustment/debt relief needed because of the economic deterioration that political uncertainty would have caused. The necessity to implement additional reforms may thus prove to entail political cost as well (see Pitsoulis and Schwuchow 2017 for a similar argument, namely that holding out is costly). Delays are also costly even when a player has obtained a good deal from her own perspective. From the Europeans' perspective, economic deterioration in Greece caused by the delay would necessitate greater European financing. From the Greek perspective, the loss of economic activity and jobs would by itself be costly, in economic and/or in political terms.

Signals are also costly to break because a public commitment entails audience costs for policy-makers. All along the Greek crisis, there has been daily and intense media reporting: each and every development of the negotiations was therefore under the scrutiny of national audiences. For Greek policy-makers, signals create potential audience costs by raising the expectations of the voters but not delivering at the end of the day. For Europeans, accepting a fair deal for the Greeks after a showdown is also costly politically because of those same audience costs. We will thus assume that signalling creates disutility for the players.

This exchange of signals had a time limit though. As argued previously, the debt negotiations took place under the shadow of a default, voluntary or unvoluntary for that matter. However, as Greece had some fiscal surplus at the beginning of the showdown, there was some time before Greek policy-makers had to make a hard and final decision on a default. The signals were precisely about informing or manipulating information over what the stakeholders would do once Greek fiscal reserves are exhausted: escalate or back down. In order to model the mutual exchange of signals as well as the time dimension of the negotiations, we will assume that each player can play twice to allow for (Bayesian) belief updating to take place. We restrict ourselves to two moves for each player mainly for the sake of simplicity as adding more moves only creates unnecessary complexity without substantially changing the logic of the game.

4. The formal game

4.1. Description of the game

Let us assume that there are two players, G (for Greece) and E (for the Europeans). Voluntarily abstaining from describing the complexity of group dynamics that would have taken place within the group of European creditors made up of sovereign states and international and regional and international organisations (this could be an interesting topic for future research, see Henning 2017), let us assume that the Europeans can be modelled as a unitary actor, which is in line with the approach taken by several other papers dealing with the Greek bailouts' negotiations (see Lim et al 2018, Pitsoulis and Schwuchow 2017, Hennessy 2017). Again, in line with existing papers, let us assume that the preferences of the Europeans are typical of a creditor country (we develop this point further below).

The game goes as follows. E decides to *grant* a debt relief to G *or not*. If E *grants debt relief* to G, the game ends with a fair deal for Greece. On the contrary, if E *does not grant debt relief* to G, then G decides to *challenge* the status quo in order to obtain a debt relief or *resign* to implement the memorandum without a debt relief. If G *resigns*, the game ends with G continuing to apply the existing memorandum. If G *challenges* the status quo, E has to decide whether to *reject* or *accept* debt relief after a challenge. If E *accepts*, the game ends with G obtaining a debt relief. On the contrary, if E *rejects* the challenge, G must decide whether to *back down* or *defaults*. If G *backs down*, the game ends with G continuing to adjust without a debt relief. If G *defaults*, the game continues. Nature (N) then decides whether a default leads involuntary Grexit with probability h and to a new deal with probability $1-h$. In case Grexit happens by accident, both players bear the costs[9] of a Graccident and the game ends (see figure 2). Otherwise, a Graccident does not happen and the game ends[10].

There are 6 possible outcomes in this game that very plausibly cover the whole range of possible outcomes. The *first outcome* is a quick fair deal if Europe accepts to grant debt relief to Greece (under Samaras). The *second outcome* is a quick asymmetric deal with Greece if Tsipras, after being elected, decides after all to implement the second bailout without further due. The *third outcome* is a delayed fair deal with Greece if Tsipras decides to ask for new

[9] We assume that the costs of a Graccident that matter for the players, i.e. policy-makers, are political costs but there can also be economic and financial costs attached to a Graccident.

[10] Like we cannot perfectly describe how a Graccident would occur, we willingly remain vague here and do not describe what kind of deal would materialise were a Graccident no to occur as this would go beyond prediction. It may be that a fair or an asymmetric deal may occur.

terms and Europe accepts. The *fourth outcome* is a delayed asymmetric deal with Greece if Tsipras, after being refused new terms by Europe decides, not to default and yield to Europe's conditions. The *fifth outcome* is Grexit if Greece decides to default on its loans after being refused a debt relief and such a default leads accidentally to Grexit. The *sixth outcome* is no Graccident.

4.2. Payoffs

First, payoffs are assumed to reflect the conflict between debtors and creditors during a standard debt crisis (see Frieden 2015 on the political economy of adjustment and rebalancing, Copelovitch Frieden and Walter 2016). At the core of any debt crisis lies a distributive issue: who will bear the adjustment costs? Indeed, debt crises generate losses that need to be swallowed through adjustment. And adjusting to a debt crisis, at least in the Eurozone, can be achieved either through the sole debtor's fiscal adjustment or through the creditors' debt relief or through a mix of the two solutions (outside of the Eurozone, external adjustment through the exchange rate and monetary financing are two obvious potential solutions). Intuitively, creditor countries prefer adjustment to be fully borne by the debtor country, i.e. adjustment through fiscal adjustment. On the contrary, debtor countries prefer adjustment through debt relief. Henceforth, a player will obtain a higher payoff if it is able to shift the burden of adjustment onto its opponent[11]. In other words, payoffs reflect the respective balance in terms of the distribution of the adjustment costs. Deals with (no) debt relief are assumed to impose most of the adjustment costs on the creditors (Greece). Still, we remain silent over the precise distribution of a deal. Concessions are therefore possible at the margin if they do not affect the overall balance of a deal.

Second, in order to operationalise incomplete information in the negotiations, we assume that each player can be of two types, depending on the desirability of one's own outside option, i.e. the desirability of running the risks of a Graccident. Each player can either be *compromise-averse* or *Grexit-averse*, depending on a player's preferences ordering, in particular with regard to running the risk of a Graccident compared to the other options available. Again, we restrict ourselves to these two possibilities as they cover the range of plausible preferences ordering.

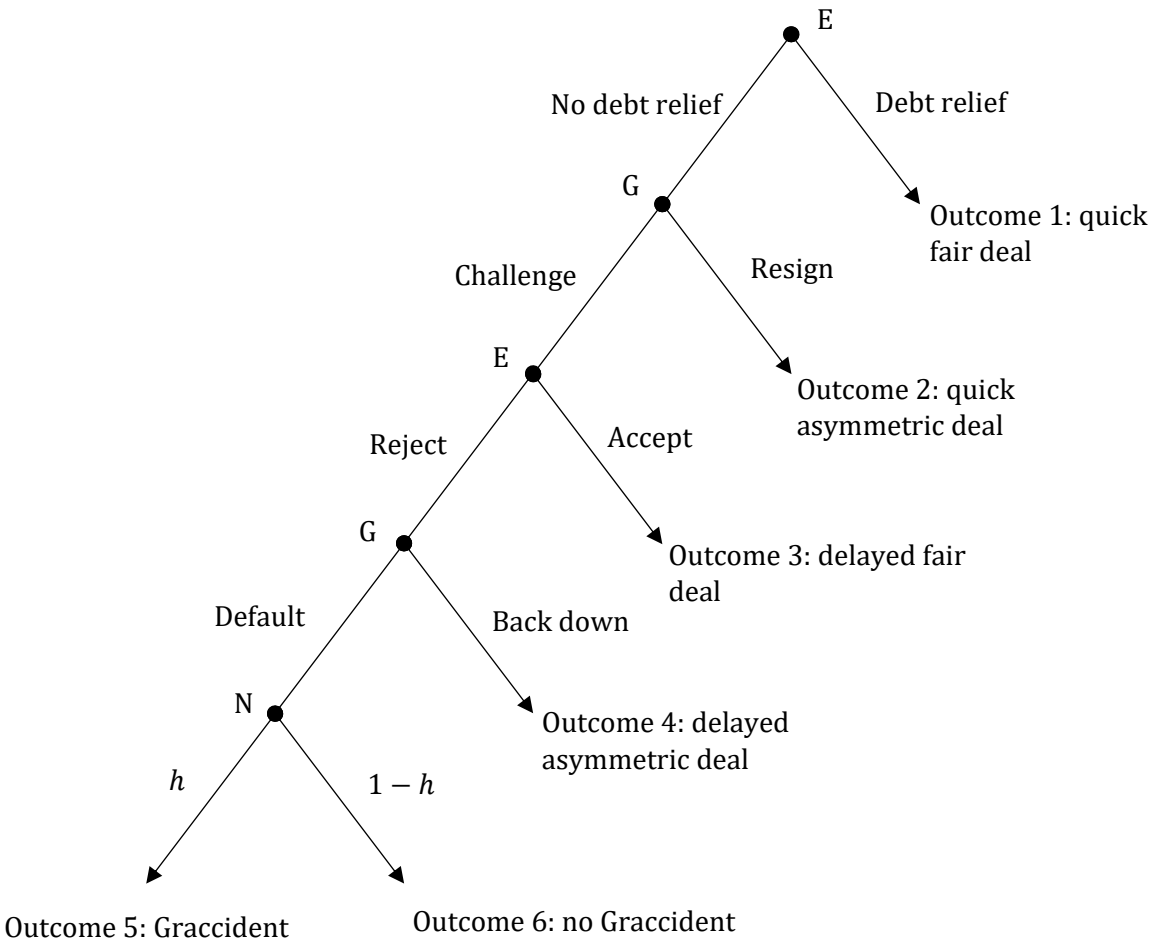
[11] The logic is that of a zero-sum game even though the payoffs are not set formally as in zero-sum game.

Third, we assume that signalling is not simply cheap talk but is costly for the players. Payoffs are made up of two elements. The first element would represent the utility derived from reaching a compromise however bad or good this may be from a player's perspective, i.e. the cooperation gains from not suffering the costs of a default. The second element of an outcome's payoff would represent the disutility caused by costs associated with a delayed compromise. For instance, part of the wedge between outcomes 1 and 4 for the Europeans comes from the kind of higher financial support required to bailout Greece. Signals are also costly to break because a public commitment entails audience costs for policy-makers. For instance, for a Greek player, what (partially) drives the wedge between the payoff of a quick asymmetric deal (outcome 2) and that of a delayed asymmetric deal (outcome 4) is precisely the existence of audience costs from raising the expectations of the voters but not delivering at the end of the day.

Based on the above considerations, we obtain the following preferences' orderings. Greece always prefers a fair deal (outcome 1 or 3), defined here as a deal with a significant debt relief, to an asymmetric deal (outcomes 2 or 4), defined as a deal without debt relief. In addition, Greece always strictly prefers a quick asymmetric deal (outcome 2) to a delayed one (outcome 4) because of the higher costs associated with a delayed deal. Greece's type will thus depend on whether running the risks of a Graccident is preferred to an asymmetric deal or not. If Greece is Grexit-averse, Greece prefers a new asymmetric deal (outcomes 2 or 4) to running the risks of a Graccident (outcome X). On the contrary, if Grexit is compromise-averse, Greece prefers running the risk of a Graccident to back down[12].

[12] For the sake of simplicity and clarity of the argument, we assume that a compromise-averse Greek player would always choose to default and take the risk of a Graccident, namely that $h \geq \bar{h}$. Indeed, when $h < \bar{h} = (\pi_G^4 - \pi_G^6)/(\pi_G^5 - \pi_G^6)$, a compromise-averse Greek player would prefer to back down (outcome 4).

Figure 2. The game with complete information



Similarly to Greece, Europe always prefers a quick deal to a delayed one as implementation delays and macroeconomic deterioration in the debtor country imply more financial support for the creditors. Unlike Greece, Europe does not always prefer an asymmetric to a fair deal to Greece though. On the contrary, Europe prefers a fair deal with Samaras (outcome 1) compared to a delayed asymmetric deal with Tsipras (outcome 4). A deal with Tsipras even without a debt relief would still require appropriate financing from the creditors. And granting financial support after a showdown could be extremely badly perceived by enraged public opinions in Northern European countries, even if most of the adjustment remains with Greece (see our argument about audience costs). On the contrary, a quiet debt relief granted to Samaras would go somewhat unnoticed and as such would entail fewer audience

costs. When compromise-averse, Europe prefers running the risks of a Graccident (outcome X) to any other option short of a quick asymmetric deal (outcome 2). When Europe is Grexit-averse, it prefers any option to running the risks of a Graccident, even a fair deal with Tsipras (outcome 3). The resulting preference orders are summarized in the following four assumptions:

Assumption 1. *When Europe is Grexit-averse,* $\pi_2^E > \pi_1^E > \pi_4^E > \pi_3^E > \pi_X^E$
Assumption 2. *When Europe is compromise-averse,* $\pi_2^E > \pi_X^E > \pi_1^E > \pi_4^E > \pi_3^E$
Assumption 3. *When Greece is Grexit-averse,* $\pi_1^G > \pi_3^G > \pi_2^G > \pi_4^G > \pi_X^G$
Assumption 4. *When Greece is compromise-averse,* $\pi_1^G > \pi_3^G > \pi_X^G > \pi_2^G > \pi_4^G$

4.3. Solving the game with complete information

Under complete information, Grexit-averse players never attempt to bluff and the two sides always reach a solution, cooperative or not for that matter, immediately. Otherwise, there would be inefficiency loss attached with longer negotiations. However, such a finding contradicts what happened during the negotiations over the third Greek bailout as the crisis lasted for months before a deal was eventually found. Proposition 1 summarizes this case more formally.

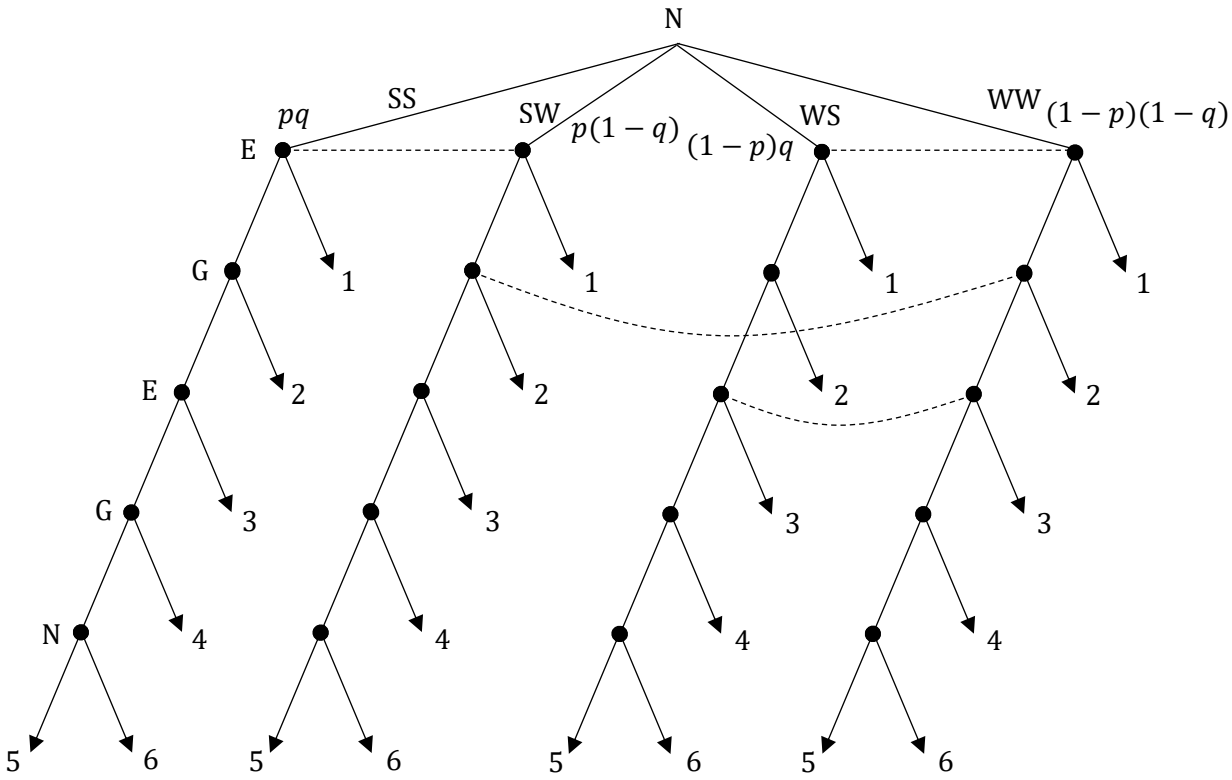
Proposition 1. *Under complete information, the game has three equilibria. Equilibrium 1: if Europe is Grexit-averse and Greece is compromise-averse, the negotiations result in a quick fair deal for Greece. Equilibrium 2: if Europe is compromise-averse or Grexit-averse and Greece is Grexit-averse, the negotiations result in a quick asymmetric deal for Greece. Equilibrium 3: if Europe and Greece are compromise-averse, the negotiations result in a default and a Graccident happens with probability h.*

4.4. The game with double-sided incomplete information

To the game with complete information, we now add double-sided incomplete information: each player only privately observes its own type but is uncertain of its opponent's type. What is more, Nature determines whether a player is compromise-averse (S(trong)) or Grexit-averse (W(eak)). We assume that q is the probability that Greece is compromise-averse and p is the probability that Europe is compromise-averse. These probabilities are assumed to be common knowledge.

All in all, the sequential bargaining game thus turns into a signalling game with double-sided incomplete information (see figure 3). When bargaining, a Grexit-averse Greece (Europe) is therefore unsure whether it faces a Grexit- or a compromise-averse Europe (Greece) and must take into account the signals sent by Europe (Greece) when following a particular strategy.

Figure 3. The game with incomplete information

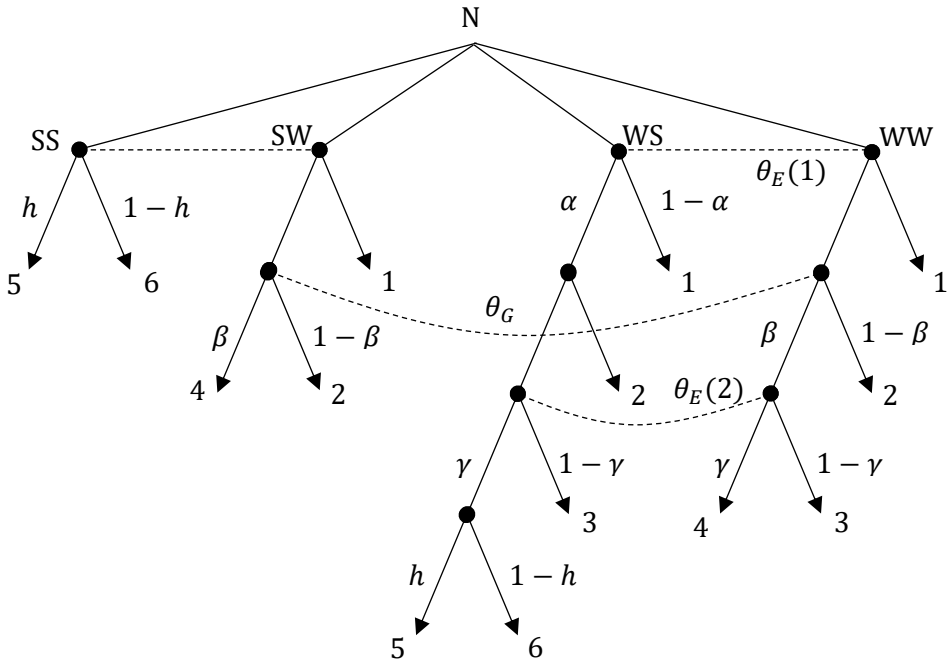


Note: the number at the end of each branch denotes the outcome reached (see above)

In light of the above preferences (see table 1), the game simplifies in the following way thanks to backward induction (see figure 4). For a summary and description of the different parameters of the game, see table 2.

From our assumptions, playing (Challenge, Default) is a strictly dominant strategy for a compromise-averse G (SS and WS nodes), irrespective of the strategy E selects (cf. our assumptions on a player's preferences). Similarly, (No Debt Relief, Reject) is a strictly dominant strategy for a compromise-averse E (SS and SW nodes), irrespective of the strategy G selects. When both players are compromise-averse (SS node), Graccident (outcome 5) happens with probability h and no Graccident (outcome 6) happens with probability $1-h$.

Figure 4. Simplified game with incomplete information



Proposition 2. *Under double-sided incomplete information, the game has 4 sequential crisis equilibria and depends on the values of p and q.*

Equilibrium 1 exists only when $0 < q \leq \bar{q}$ *and* $0 < p \leq \bar{p}$. *Grexit-averse and compromise-averse Europe never grants a debt relief at the beginning of the negotiations. Compromise-averse Greece always challenge the status quo. Grexit-averse Greece randomizes its strategy between challenging the status quo and resign. In the latter case, a quick asymmetric deal occurs. In the former case, Grexit-averse Europe randomizes its strategy between rejecting and accepting a Greek offer. If Greece is compromise-averse, Greece defaults and a Graccident occurs with probability h. If Greece is Grexit-averse, a delayed asymmetric deal occurs.*

Equilibrium 2 exists only when $0 < q \leq \bar{q}$ *and* $\bar{p} < p < 1$. *Grexit-averse and compromise-averse Europe never grants a debt relief at the beginning of the negotiations. Compromise-averse Greece always challenge the status quo. Grexit-averse Greece resigns and a quick asymmetric deal occurs. Compromise-averse Greece challenges the status quo. Grexit-averse Europe randomizes its strategy between rejecting and accepting a Greek offer. Compromise-averse Greece defaults and a Graccident occurs with probability h.*

Equilibrium 3 exists only when $\bar{q} < q < 1$ *and* $0 < p \leq \bar{p}$. *Grexit-averse and compromise-averse Europe never grants a debt relief at the beginning of the negotiations. Compromise-averse Greece always challenge the status quo. Grexit-averse Greece randomizes its strategy*

between challenging the status quo and resign. In the latter case, a quick asymmetric deal occurs. In the former case, Grexit-averse Europe accepts the Greek offer and a delayed fair deal occurs. Compromise-averse Europe rejects the Greek offer. If Greece is compromise-averse, Greece defaults and a Graccident occurs with probability h. If Greece is Grexit-averse, a delayed asymmetric deal occurs.

Equilibrium 4 exists only when $\bar{q} < q < 1$ *and* $\bar{p} < p < 1$. *Grexit-averse and compromise-averse Europe never grants a debt relief at the beginning of the negotiations. Compromise-averse Greece always challenge the status quo. Grexit-averse Greece resigns and a quick asymmetric deal occurs. Compromise-averse Greece challenges the status quo. Grexit-averse Europe accepts the Greek offer and a delayed fair deal occurs. Compromise-averse Europe rejects the Greek offer. If Greece is compromise-averse, Greece defaults and a Graccident occurs with probability h.*

We can draw several insights from Proposition 2. First, adding double-sided incomplete information to our bargaining game creates a theoretical world where the bargaining outcome is not that predictable and depends on the players' mixing strategies, especially when at least one of players is Grexit-averse. In the theoretical world where both players are Grexit-averse and the probability of one's opponent being compromise-averse is low enough, three outcomes are thus possible: (i) a quick asymmetric deal, (ii) a delayed fair deal and (iii) a delayed asymmetric deal. The last case is the actual outcome of the negotiations.

Second, when a player is Grexit-averse and the probability of one's opponent being compromise-averse is low enough, she has an incentive to conceal its true type. Grexit-averse Greece will thus have incentives to bluff in order obtain a better deal, typically outcomes 1 or 3. The risk for a Grexit-averse Greek player is for her bluff to be called since she will eventually back down if pushed to and experience audience costs. Similarly, Grexit-averse Europe will have incentives to bluff in order to reach outcome 2 or at least outcome 4. The risk of a bluff for Grexit-averse Europeans is that Greece turns out to be compromise-averse and defaults on its loans, leading up to a Graccident or not. When the probability of one's opponent being compromise-averse is too high, a Grexit-averse player will prefer to quickly back down rather than back down later on and experience lower utility.

Third, there can thus be long negotiations between Greece and the Europeans, even when both players are compromise-averse.

Fourth, since Grexit-averse and compromise-averse Europeans follow the same strategy by not granting a debt relief, Grexit-averse Greece learns nothing about its adversary's type

from the Europeans' first move. Not granting a debt relief reveals no information about the Europeans' type. Grexit-averse Greece can only rely on what she knows of the prior distribution p of the Europeans' types.

Fifth, the probability that Grexit-averse Europeans reject the Greek offer γ^* is increasing with π_G^4 *ceteris paribus.* Similarly, the probability that Grexit-averse Europeans reject the Greek offer β^* is increasing with π_E^3 *ceteris paribus.* In other words, the greater the audience costs of backing down, the lower the probability of one's opponent from escalating (see Appendix B).

Table 1. Parameters of the game

Variables	**Description**
π_i^1	Payoff of outcome 1 (quick fair deal) for player i
π_i^2	Payoff of outcome 2 (quick asymmetric deal) for player i
π_i^3	Payoff of outcome 3 (delayed fair deal) for player i
π_i^4	Payoff of outcome 4 (delayed asymmetric deal) for player i
π_i^X	Expected payoff of Greece playing default for player i
p	Probability that Europe is compromise-averse
q	Probability that Greece is compromise-averse
h	Probability of a Graccident
α	Probability that Europe plays No debt relief when Grexit-averse
γ	Probability that Europe plays Reject when Grexit-averse
β	Probability that Greece plays Challenge when Grexit-averse
μ_E	E's belief that G is compromise-averse after observing a "Challenge"
μ_G	G's belief that E is compromise-averse after observing "No debt relief"
$\theta_i(k)$	k^{th} information set of player i

Note: π_i^X is defined as $\pi_i^X = h\pi_i^5 + (1-h)\pi_i^6$

5. How could have Greece increased its chance of obtaining a better deal?

While the game is a very stylised representation of the negotiations, it remains insightful to understand why Greece failed to secure a debt relief. In addition, if we follow the logic of our game, Greece could have increased its chance of obtaining a fair deal by reducing the utility she would have obtained from a delayed asymmetric deal. In the game, the payoffs are fixed. But in the actual negotiations, it is sensible to assume that the payoffs' value would have been set in a much more dynamic way, depending on the specific offers, statements, moves made by the two sides. Indeed, Greece could have manipulated the audience costs from backing down to reduce the payoff from a delayed asymmetric deal π_G^4 in order to reduce the value of γ^*.

While a risky strategy, the Greeks could have been more aggressive by increasing the audience costs from backing down. Among other options, a referendum could have possibly played this role. The Greek Prime Minister did call a referendum. However, it should have been called sooner in the negotiations than what actually happened in order to have had an effect on the Europeans' belief over Greece's type, in particular before the Greeks started to send contradictory signals (see Appendix A). The "No" could have thus rallied much more support than it did in July in the midst of chaos. As such, it could have created an extremely important sense of unity and legitimacy around the Greek government, making more credible the Greek position of no-compromise and more credibly tying the hands of the Greek government. In comparison, in July, after the second program ended and capital controls had been installed, there was no time left for further negotiations in spite of the clear "No" victory.

In addition, and to support such an aggressive stance in the negotiations, the Greeks could have conveyed privately to the Europeans in a clear and unambiguous manner how Greece would deal with the consequences of a Graccident or with an end of official funding. For instance, they could have told their European counterparts that Greece would be ready to introduce a parallel currency or that Greece was ready to default on the remaining SMP bonds that Greece still owed to the ECB in case the ECB were to stop providing ELA to Greek banks (see Varoufakis 2017).

6. Concluding remarks

With the help of a game-theoretical model, we have demonstrated that incomplete information is a necessary condition to explain the outcome and dynamic of the negotiations over the third Greek bailout. In particular, incomplete information is a necessary condition for explaining why

a bargaining outcome had been delayed for months. What is more, our main result is that the third Greek bailout negotiations were much less predictable than generally acknowledged. Contrary to the mainstream understanding of the negotiations that Greece had no leverage in the negotiations, we argue that it was neither unpreparedness nor pure folly for Greek policy-makers to engage into a showdown in order to obtain a better deal for Greece, even if this meant full surrender at the end of the day. On the contrary, we show that the Greeks could have been more aggressive to increase their chance of obtaining a better deal.

As the Greek negotiations over the third Greek bailout were exceptional by all standards, the game theoretical model may not be fully replicable to other, more regular, bargaining situations. Still, the focus on the strategic manipulation of information when this information is unevenly distributed among actors may be insightful for the study of interstate bargaining in the EU and beyond (see Moravcsik 1998). Informational problems may indeed be particularly relevant for analysing bargaining over the integration of core state powers or the design of burden and risk sharing mechanisms in the EU and the Eurozone (Genschel and Jachtenfuchs 2013, Schelkle 2017). Those negotiations have by essence distributional consequences and while member states may have an interest in preserving the joint gains from integration, they may differ on the way to preserve it. As a result, stakeholders may have incentives to manipulate information about outside option or about the ratification process through threats and signals in order to obtain concessions. In addition, by applying double-sided incomplete information, our model provides a realistic setting in which each side can use information strategically. As such, it extends the model of Schneider and Cederman (1994) that uses one-sided incomplete information.

Paper 2. Financial markets' reactions to policy developments during the Greek and Eurozone crises

Abstract

In this paper, we study the interaction between policy uncertainty prior to the Draghi's "whatever it takes" speech and financial markets. More specifically, we assess the effect of policy-oriented news on Greek sovereign spreads. We do so by constructing a novel dataset of more than 5800 manually coded news items. The dataset provides an encompassing picture of the crisis management as we included most, if not all, prevailing policy debates (the design of bailouts, the crisis resolution mechanisms, debt restructuring, fiscal rules, Grexit, Eurobonds, the role of the ECB, etc). We classify the news items along several dimensions to have a precise picture of the effect of different types of news on financial markets. In particular, we differentiate between expected and unexpected decisions to have a finer sense of how markets responded to policy developments. Our results based on EGARCH models suggest that news have had an effect on Greek sovereign spreads from October 2009 to mid-2012, corresponding to the heightened period of the Greek and Eurozone crises. We find that financial markets did react extremely strongly to unexpected positive decisions and events. Our results are also consistent with the asymmetric effect of news commonly reported in the existing literature as financial markets were sensitive to negative news as a whole (decisions, events and political communication).

1. Introduction

In October 2009, the then Greek Prime Minister George Papandreou revealed that his country's budget deficit had been significantly understated. In hindsight, this was the starting point of the so-called Eurozone sovereign debt crisis. Since the Eurozone was not equipped to deal with the sort of problems caused by macroeconomic imbalances, financial sudden stops and sovereign insolvency, the eurozone policy-makers had to simultaneously engage with firefighting and institution-building. A long-delayed joint EU-IMF bailout was finally granted to Greece in May 2010. Few days later, European leaders decided to create an instrument, the European Financial Stability Facility (EFSF), able to provide financial assistance to troubled Eurozone members. In December 2010, the same European leaders went a step further and decided to equip the eurozone with a permanent bailout fund, the European Stability Mechanism (ESM). As the crisis worsened, the new crisis instruments got gradually upgraded while Greece (and other peripheral countries) asked for more financial support.

In the meantime, the European Central Bank (ECB) took steps to contain the crisis, at first reluctantly though, by buying sovereign bonds on the secondary markets and by easing its collateral policy in order to continue accepting heavily downgraded Greek bonds. After the nomination of Mario Draghi in late 2011, the ECB became much more pro-active. In December 2011 and February 2012, the ECB announced the Long Term Refinancing Operation (LTRO), a fixed rate full allotment program of lending to banks. And in July 2012, the ECB decided to make use of its unlimited firepower and endorsed its role as a lender of last resort for sovereigns with Draghi's famous "whatever it takes" speech

During those years, European policy-makers struggled to offer a consistent response to the Greek solvency problems as well as to the other systemic fault lines uncovered by the specific Greek situation. The process of crisis decision-making was indeed all but linear and clear, fraught with enormous difficulties and uncertainties. Political deals were generally reached at the eleventh hour during what became ordinary "last chance summits" after weeks, if not months of hard bargaining. And on many occasions, those hard-fought compromises were obsolete as soon as few hours after they were achieved, either because of rapidly changing conditions or because they were not ambitious enough or even because political leaders undermined the deals for domestic political reasons.

As a matter of fact, the public positions of the many different stakeholders involved in the crisis-management process were often contradictory on the many dimensions of the crises (see Brunnermeier, James and Landau 2016 for a review of the main debates that had to be

solved by European policy-makers). In a context of asymmetric information, the signals sent by European policy-makers over future policies were at best inconsistent, intentionally – as policy-makers debated in public – or not for that matter. In addition, the Eurozone and Greek crises attracted a lot of attention from the media that reported on a daily basis over the very latest policy developments and political comments, with its inevitable share of rumours and denials.

As figure 1 (left panel) shows, none of the policy steps created the sufficient shock and awe on Greek sovereign spreads until Draghi's intervention in July 2012. In addition to the upward trend observed in the left panel of figure 1, Greek sovereign spreads exhibited varying degrees of volatility (see figure 1, right panel). Volatility increased around the first Greek bailout in May 2010. This was followed by a relatively long period of calm as Greece seemed to be on track with its programme. Financial stress resumed with greater intensity from May 2011 up to Draghi's intervention in July 2012 once it became clear Greece would not succeed in adjusting without a debt restructuring.

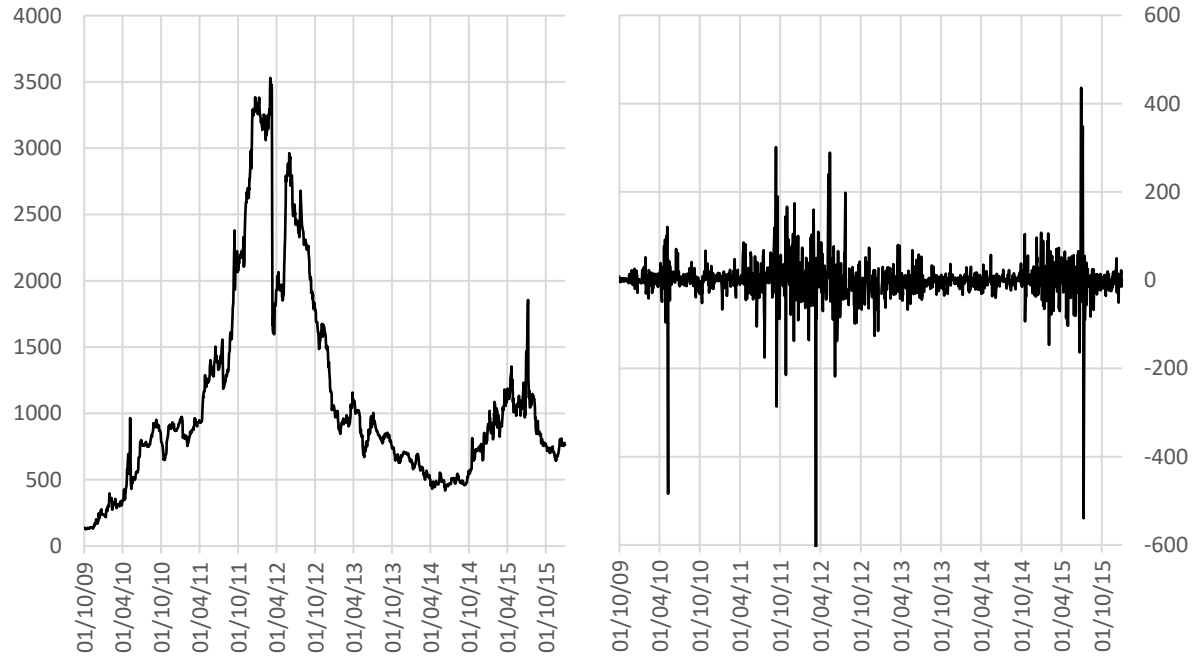
In this paper, we precisely assess how political uncertainty, defined as the uncertainty over future policy choices, affected financial markets during the Greek and Eurozone crises. We focus on the Greek sovereign spreads for two reasons. First, because Greece was obviously the starting point of the wider Eurozone crisis. Second, because policy developments in response to the Eurozone crisis had, in most cases, repercussions for Greece since the Greek crisis lasted even after the heightened of the Eurozone crisis.

To perform our analysis, we have created a novel dataset of more than 5800 manually coded single policy-oriented news items covering the period from October 1, 2009 to July 25, 2012 on the eve of Draghi's "whatever it takes" speech[13]. The dataset provides an encompassing picture of the crisis and its management as we included most, if not all, policy debates during the Greek and Eurozone crises over the design of bailouts, the crisis resolution mechanisms, debt restructuring, fiscal rules, Grexit, Eurobonds, the role of the ECB, etc. We classified the news items along several dimensions to estimate the respective effect of different types of news. Accordingly, we differentiated between positive and negative news, between political communication, media reports and actual decisions, and between Greek-specific and Eurozone-wide news. As a further refinement, we differentiated between expected and unexpected

[13] Manually coding the news represents both a liability and an asset. It is a liability insofar as it involves a substantial degree of subjectivity in judging the positive or negative tone of news items. In the meantime, it allows for a much more flexible and context-specific coding of news by taking into account the evolution of the positions of the different stakeholders.

decisions to have an even more precise sense of how markets responded to policy developments. This differentiation between expected and unexpected news as well as the comprehensive nature of our dataset dealing simultaneously with decisions, media reports and political communication represent insightful contributions to the existing literature on the effect of news on financial markets during the Eurozone and Greek crises.

Figure 1. Daily Greek 10-year sovereign bid spreads (basis points)



Notes: The left panel plots the Greek 10-year sovereign bid spread vis-à-vis the German Bund (basis points); The right panel plots the daily changes in the Greek 10-year sovereign bid spread.
Source: Bloomberg

The research design of this paper is mainly exploratory as we do not test directly the predictions of theories with regard to the effect of news on financial markets (see Collignon et al 2013 for an interesting formal model of financial markets' reacting to political signals in the presence of asymmetric information or Pastor and Veronesi 2011). We rather build on the information contained in our dataset to answer various questions about the market behaviour during the Greek and Eurozone crises: what was the effect of news on Greek spreads during the crisis? Which types of news were more relevant than others? How have news affected volatility in Greek spreads?

Our results based on EGARCH (1,1) models suggest that news have had an effect on 10-year Greek sovereign spreads from October 2009 to July 2012. Our main result is that

financial markets did react extremely strongly to unexpected positive decisions and events. Unexpected positive news have more impact in absolute terms than unexpected negative news. Our results are also consistent with the asymmetric effect of news commonly reported in the existing literature as financial markets were sensitive to negative news as a whole (decisions, events and political communication). The daily number of Greek-specific negative developments (excluding decisions and events) has widened Greek spreads as well while we find no such effect for positive developments.

Our findings offer a new interpretation of the Eurozone and Greek crises management. Indeed, in other studies analysing the effect of news on financial markets, the asymmetric effect of news somewhat disempowers policy-makers: no matter what they did, no matter how hard they fought to solve the crisis, financial markets did not take policy-makers' (positive) steps into account. This result can feed a narrative where all the blame is on financial markets' irrationality. On the contrary, our results rather point to the other direction: financial markets did acknowledge the policy efforts. Policy-makers could thus put an end to a financial turmoil they contributed to create with a more appropriate crisis management. What was maybe missing from European policy-makers was the decisive proof that they were actually ready to walk the walk after talking the talk. Arguably, the much-awaited decisive action occurred on July 26, 2012.

Before laying out our methodological approach that we have used to construct our news dataset (in sections 3 and 4) and present our econometric results (section 5), we first critically overview the existing literature (section 2). In section 6, we draw some concluding remarks.

2. News and Financial Markets

This paper is closely related to the existing literature on the effects of news and statements by politicians during the Eurozone sovereign debt crisis[14]. In this literature, most scholars find a link between news and different financial assets such as sovereign bonds, the euro exchange rate, stock returns, etc. What is more, when differentiating between good and bad news, most studies find a more significant effect for the latter (see Büchel 2013, Haupenthal and Neuenkirch 2017, Bird Du and Willett 2017, Conrad and Zumbach 2016) with the notable exception of Mink and de Haan (2013) who find no asymmetric effect. Some studies also

[14] As such, this paper is also related to the literature on the effects of political communication on financial markets (see Blinder et al 2008). See Kaminsky and Schmukler (1999) on news' effect during the Asian crisis and Hayo and Kutan (2005) on the effects of IMF-related news on emerging markets for interesting papers prior to the crisis.

suggest that there is a "credibility" effect of news on financial markets: news emanating from less credible policy-makers tend to be discounted altogether by the markets (Büchel 2013, Mohl and Sondermann 2013, Bolstad and Elhardt 2015). Finally, this credibility effect seems to be complemented by an "additive" effect when several politicians from AAA-rated countries speak on the same day (see Mohl and Sondermann 2013 and Ehrmann et al 2014).

Nevertheless, the results differ from one paper to the other for the simple reason that scholars use different econometric models, different data sources and different ways of measuring what a "news" is. Starting with what had been included in the "news" variable, several scholars only estimate the impact of political communication on financial markets. Büchel (2013) studies the impact of hawkish and dovish political statements – statements expressing respectively low and high commitment to shield private creditors – on the GIIPS' CDS and bond yield spreads during Europe's sovereign debt crisis thanks to the Factiva database (see also Petrakis et al 2012). Unlike Büchel (2013), Mohl and Sondermann (2013) investigate the effect of political communication without differentiating the positive or negative content of the 15 000 news agencies reports from May 2010 to June 2011 included in their dataset. Conrad and Zumbach (2016) also compile the statements emanating from the main European policy-makers from August 2011 to December 2011 and classified those statements into two categories: positive/negative statements that refer to the economic situation or austerity measures in the peripheral countries and positive/negative statements that refer to the Eurozone as a whole. Some papers study the role of a single type of political communication: Haupenthal and Neuenkirch (2017, see also Gregori and Sacchi 2017 for a similar attempt at the daily frequency level) investigated the effect of positive and negative statements about Grexit on intraday stock returns in Germany, Greece, and the euro area during the period from 1 January 2015 to 19 August 2015 while Gade et al (2013) examine to what extent political communication on fiscal policy and public finances had an effect on sovereign bond spreads (Falagiarda and Gregori 2015 took the same approach but restrict themselves to the Italian case, see also de Jong 2018 on the effect of Dutch fiscal announcements on Dutch sovereign spreads).

The literature focusing on the Eurozone crisis is not restricted to political communication though. For instance, Ehrmann et al (2014) assess the impact of a wider range of news – i.e. macroeconomic fundamentals, policy actions and the public debate among policy makers – on the euro exchange rate. Alternatively, Beetsma et al (2013) rely on Eurointelligence daily reports to construct their news variable which is set up so as to measure the intensity of the news by the number of words on the news item as well as by the number of times certain words are mentioned. Their dataset is pretty eclectic: they include for instance news indicating

relaxed commitment to budgetary targets, disagreements over economic policy and information on rising poverty levels (Bolstad and Elhardt 2015 also compiled statements and decisions from 2009 to 2012 through Eurointelligence reports and complemented them with other news sources). Going further, several scholars only focus their analysis on policy decisions. Kilponen et al. (2012) only study policy decisions by identifying more than 50 important policy decisions from 2007 to 2012. In a similar vein, Smeets and Zimmermann (2013) examine whether Euro summits, as well as their agreed and communicated results, had a significant impact on Europe's financial markets.

When differentiating between good and bad news, most scholars classify the content of news manually (for instance Büchel 2013, Beetsma et al 2013, Bolstad and Elhardt 2015) with or without the help of content analysis (see Haupenthal and Neuenkirch 2017, Büchel 2013, Conrad and Zumbach 2016 for applications of content analysis). Gade et al (2013), for their part, classify over 25,000 news reports from 2009 to 2011 using an algorithm searching for the name of policy-makers and then for predetermined words that are expected to have either a positive or a negative connotation in relation to fiscal policy or public finance[15].

Turning to estimation techniques, a variety of econometric models are used to study the impact of news. While some studies rely on ordinary or pooled least squares (Falagiarda and Gregori 2015, Beetsma et al 2013, Gade et al 2013), many studies use GARCH models in order to take into account the kind of volatility clustering observed in financial time series (see *inter alia* Büchel 2013, Ehrmann et al 2014, Mohl and Sondermann 2013, Haupenthal and Neuenkirch 2017). In addition, a third technique can be found in the literature, namely the so-called event-study approach[16]. For instance, Mink and de Haan (2013) first identify the twenty days with extreme returns of Greek sovereign bonds, link them to news using Reuters data source, and then categorise the news events during those days into news about Greece and news about the prospects of a Greek bailout. Smeets and Zimmermann (2013) define the events of interest as the meetings of the heads of state and government while Bird, Du and Willett (2017) take announcements made independently by selected national governments, the IMF, the ECB and the EC, as well as jointly by the Troika (see also Bolstad and Elhardt 2015).

[15] See also Choularias (2015) for textual sentiment analysis, i.e. pessimism vs optimism, of reports during the European crisis. "Word count" methods or computer linguistics may miss the context of a news report and thus fail to get the content right. In addition, relevant reports may be filtered out if the wording of a report is different from the words chosen in the search string (see Wolflinger et al 2018).

[16] Event studies consist in finding the abnormal return attributable to a particular event by comparing the pattern of financial market movements during a pre- and post-event period (see MacKinlay 1997).

In spite of their diversity, these studies share several common methodological shortcomings. Many studies in the existing literature may indeed suffer from an endogeneity problem for at least two reasons. First, when there is high volatility in the markets, the number of press reports tend to increase as analysts search for stories that could explain such market swings, ending up creating "news." For instance, Beetsma et al (2013) measure the "intensity" of the news by the length (number of words) of the news items as well as by the number of times a particular word and country is mentioned on each given day. And they indeed find that more intensity raises the domestic interest spread of GIIPS countries. Moreover, their data source is Eurointelligence, which apart from reporting major news of the previous day, also includes selected summaries of op-eds produced by influential columnists. However, such articles are not precisely what one may call "news" but are rather reactions to other news, events or simply to market developments. Arguably, the length of such morning briefings may increase following days of high market volatility (see also Bolstad and Elhardt 2015, Bouzgarrou and Chebbi 2015 for papers using Eurointelligence reports).

Second, policy-makers may decide to communicate precisely in reaction to high volatility in the markets. This creates a reverse causality problem. Nevertheless, Büchel (2013) argues that news are contemporaneously exogenous because (i) financial markets are assumed to react immediately to a statement (within the same trading day), in line with Efficient Market Hypothesis and (ii) events can be determined with precision on a daily basis (see *inter alia* Falagiarda and Gregori 2015, Gade et al 2013 or Bird Du and Willett 2017 for a similar assumption). All in all, since the data on yield spreads is collected as of end-of-day, while the construction of the communication variable is on the basis of news releases during the day, the issue of endogeneity would be contained. However, the two premises on which the assumption of weak exogeneity rests may be misleading. First, it may be possible that a piece of news does affect financial markets for a longer period of time and/or that financial markets may need more than one day to price in a news correctly (Wolflinger et al 2018). Second, there may be more than one relevant piece of news per day, in particular when one is not only looking at statements. One may thus end up finding a fallacious relationship between political communication and financial markets. For their part, Gade et al. (2013) run Granger causality tests to determine any reversed causality problem both in the short term and over a reasonable longer period, through the inclusion of lagged variables, but they find inconclusive results (see also Collignon et al 2013)[17].

[17] Notice that some scholars have also relied on high-frequency data, namely intraday data, to overcome the endogeneity problem (see Conrad and Zumbach 2016, Haupenthal and Neuenkirch 2017, Bahaj 2018).

The second problem has to do with how existing papers have dealt with markets' anticipations. As far as macroeconomic news are concerned, it is relatively easy to differentiate between expected and unexpected news when consensus surveys are available. For instance, Caporale et al (2014) define the surprise component as the standardised difference between the consensus prediction and the actual data. Unfortunately, this is much more difficult to operationalise for policy-oriented type of news. As noted by Bird, Du and Willett (2017: 279), "studies generally note these problems but, because of their difficulty, efforts to deal with them have been fairly limited." To the best of our knowledge, only Kim and Willett (2014), in a study about the Korean stock market during the global financial crisis, apply a strategy to differentiate between expected and unexpected policy news (see below).

Notice that relying on the event-study approach may somewhat circumvent this problem by simplifying the identification of relevant news. It is indeed easier to identify specific events instead of recording all news items over a lengthy period of time (Bird Du Willett 2017). It may allow to identify the news (or the absence of news) that eventually were considered the main events in the Greek crisis by the markets, instead of treating all news items as relevant data. However, scholars might arbitrarily exclude events that were relevant and/or include irrelevant ones (see Smeets and Zimmermann 2013 for instance). In addition, this approach, taken in its purest form, has a major shortcoming as it requires the estimation of "normal" returns several days prior to the event, on the day of the event, and several days after the event (see MacKinlay 1997).

3. Defining and Measuring News

Before trying to deal with the aforementioned issues, the preliminary question that we should answer is the following: what do we mean by news? In this paper, we assume that news can take many forms, from verbal political statements, to written political statements, decisions, media reports, rumours, etc. On the contrary, we do not consider analyses or explanatory articles to be news since by definition they interpret the meaning of other news such as events and/or decisions. Having set the limits of our dataset, we now turn to the three main measurement issues identified in the literature and on potential ways to deal with them.

3.1. Can we distinguish between endogenous and exogenous statements?

The problem of news endogeneity mainly concerns political statements since we do not include any analytical or explanatory reports in our dataset. A first solution is to run Granger causality test as it has already been done in several papers in order to exclude specific vectors of news items. However, it may be more insightful to treat the problem of endogeneity right from the very beginning by excluding potentially endogenous single news items. In conceptual terms, part of the endogeneity problem may indeed come down to an informational problem. If a statement has sufficient informational content, it does not really matter whether it came as a reaction to market developments or not because it will affect markets anyway. So which statements could have such informational content? Arguably, statements that are unlikely to be endogenous are statements that inform financial markets about future policy choice. Consequently, relevant statements should clearly advocate or refute a particular policy option. In addition, the number of statements on particular policy options should increase as policy-makers engage with each other. Actually, we observe such "bursts" in the dataset where an initial proposal causes the many stakeholders to react to it and feed a discussion among policy-makers through the media (see figure 19 in Appendix A).

On the contrary, an important share of reassurances or statements such as "Greece will not default," "Greece does not need a bailout," "Greece will not leave the eurozone," etc. that were very likely made in reaction to large swings in the markets plausibly convey very little information for financial markets. More generally statements expressing confidence or trust that a positive outcome will occur may be particularly endogenous as they are precisely made to reassure markets. Those statements will therefore be excluded from our dataset.

3.2. Can we determine the importance of a piece of news?

Intuitively, policy decisions or data releases should be more important than rumours, statements issued by single policy-makers or discussions over future decisions. But that is debatable. Another way to express this problem would be think of importance as credibility, in particular for political communication. The credibility issue may come from the identity of the issuer as it has already been documented in the literature (see above). It may also come from the content of message: policy-makers' reassurances may have very low informational content and may

therefore be irrelevant for the markets[18]. Since such assurances were plentiful during the crisis, this feature may explain the asymmetric effect of news found in papers including those assurances: they might have simply diluted the effect of positive news altogether.

3.3. Can we disentangle between anticipated and unanticipated news?

Most of the time, scholars have not attempted to do it. Indeed, it can be very challenging to determine which news was anticipated and which news was not without perfectly knowing investors' expectations in real-time. However, by closely following policy debates and developments, we may be able to identify decisions and events that were foreseen by previous news reports and therefore already priced in by the markets.

In order to deal with this problem (as well as for the importance/credibility of news), we will follow Kim and Willett's (2014) approach by differentiating between hard (policy decisions or sometimes lack of decisions, important events, European collective or Franco-German statements or economic news releases) and soft news (statements issued by single policy-makers, media reports, policy discussions or rumours). If soft news related to a particular policy action, event or data release were released few days before the hard news eventually occurred, then the hard news can be coded as "expected hard news." On the contrary, if there were no soft news released before the hard news or the hard news contradicts the previously released soft news, then the hard news will be coded as "unexpected hard news.

4. A Novel News Dataset

4.1. Collecting the data

We took a two-step approach to collect our data. First, we have extracted relevant news from Reuters' *GREECE - Factors to Watch* and *Eurointelligence* daily morning summaries. We used these reports to have a first idea of the most important news about the Greek and Eurozone crises. Second, we fleshed out our dataset with news releases from the major news agencies (Reuters, Dow Jones Newswires, Agence France Presse, Associated Press Newswires, and

[18] For instance, Beetsma et al (2013) argue that they cannot objectively distinguish between reliable and unreliable assurances and, therefore count all assurances as good news. In this paper, we will adopt the very opposite strategy by not including them in the dataset in order to reduce the prevalence of non-credible statements.

Market News International) and the Greek news agency (Athens News Agency) through Dow Jones' Factiva database. We relied on simple keywords search for retrieving data. We have generally focused on headlines and an article's first paragraph since, in the massive amount of news released each day, financial actors usually only look at headlines (see Haupenthal and Neuenkirch 2017 and Büchel 2013 for a similar approach of collecting news based on headlines). Each time a news was to be included into the dataset, we checked for its first occurrence and took great care in not including later duplications. News that were released after 18:00 CET or at weekends, were assumed to affect financial markets on the following trading day. We have collected news from October 1, 2009 to July 25, 2012, i.e. on the eve of Draghi's "whatever it takes" speech, to cover the entire stress period of the Eurozone and Greek crises.

4.2. Cleaning the data

In a second phase, we have applied the strategies for dealing with the endogeneity and credibility issues we have described in the previous section. More specifically on the credibility problem, we have not included statements made by Greek policy-makers, except if they were "surprising" or relevant. Arguably, a large part of Greek policy-makers statements were endogenous as they were made to reassure markets. Statements from Greek policy-makers were also excluded in order to minimise a credibility issue which may blur our interpretation of the results. When PM Papandreou, at the beginning of the crisis, is saying that his country will not default or will stick to the agreed fiscal targets, the informational content is very likely to be low as this is likely cheap talk. On the contrary, when a Greek official says that Greece will default on its debt, her statement should be included in the dataset because it goes contrary to what markets may expect from the "dull" Greek official line. We have also decided to exclude European policy-makers' positive reassurances or official denials over negative news. On the contrary, we have kept official denials of positive news in the dataset. Following Collignon et al (2013) and Gade et al (2013), and as a further check to the reverse causality problem, we have run Granger causality and predderminedness tests on the different news variables (see table 12A to 12C in Appendix A).

4.3. Classifying the data

After the collection and cleaning phases were completed, we have classified news into 9 main categories (level I, see Tables 1A and 1B) in order to facilitate the coding of news. This

classification is only illustrative though. Indeed, the different dimensions of the Greek crisis were closely intertwined. Consequently, a same news could be included into different news categories. For instance, a statement saying that Greece had to be more committed to reforms or quit the eurozone could be related to both "Grexit" and "Financial Support" (see figure 19 in Appendix A)

4.4. Coding the data

We have coded news along five different dimensions: positive vs. negative, soft vs. hard, expected vs. unexpected (only for hard news), Greek-specific vs. Eurozone-wide, political statements vs. media reports (only for soft news). A piece of news was coded as positive (negative) when it was expected to reduce (widen) spreads (see tables 1A to 1C). In addition, a piece of news can be part of these different categories at the same time. For instance, a piece of news can be a positive Greek-specific expected hard news.

Statements issued by single policy-makers or media reports were coded as soft news. On the contrary, decisions (or sometimes lack of decisions), events or collective statements (as well as Franco-German statements) were coded as hard news. Note that decisions or events that were deemed relatively unimportant on their own were coded as soft news, in particular when other relatively important developments took place on the same day. For instance, on July 25, 2012, the news "Greece appoints new chief for privatisation agency" was coded as a soft news even though this was obviously a decision.

If soft news related to a particular policy decision, event or data release were released few days before the hard news eventually occurred, then the hard news was coded as "expected hard news." On the contrary, if there were no soft news released before the hard news or the hard news contradicted the previously released soft news, then the hard news was coded as "unexpected hard news." In order not to mix the effect of soft news with hard news, we have excluded soft news that took place on days with hard news.

A piece of news was coded as a political statement if it directly emanated from one of the key stakeholders (or from his/her respective spokesperson) of the Greek and Eurozone crisis (see table A in the Appendix for the list of the key Greek, European and international stakeholders). At this stage, we had two possibilities, either to code the content of the statement itself or code the degree of disagreement over policy options a piece of news would reveal. The assumption made in the former case is that markets would react positively to a positive statement and negatively to a negative news irrespective of the state of the debate on a particular

policy option at time t. On the contrary, in the latter case, the assumption is that markets would not to react simply to a single news at a time (as in the content coding) but to the overall message sent by policy-makers. The idea is that when at least two policy-makers speak on the same topic with two different messages, the message hence become unclear for the markets. Therefore this kind of inconsistency about future policy options may negatively affect markets, irrespective of the positive content of one (or more) of the statements.

We have opted for the "content coding" of news in our regressions, since different opinions are pieces of news after all. In addition, this coding is more convenient methodologically speaking compared to the disagreement coding. Indeed, contradictory statements on a particular policy could take place on the same day. In that case, coding disagreement can be quite straightforward. However, policy-makers could also express their disagreements over a specific subject on different days. In that setting, coding disagreement becomes much less intuitive. In addition, the "disagreement coding" would proxy "sentiment" rather than "news" and this would introduce a further layer of subjectivity to our coding procedure.

When a piece of news was explicitly referring the Greek developments, it was coded as a Greek-specific news, and as a Eurozone-wide news otherwise.

Finally, we have constructed two types of news variables. Dummy variables are equal to 1 on days with at least one piece of news of the respective type (see above) and 0 otherwise. Since on many occasions, there were more than one pieces of news of a particular type of news on a single day, we have also constructed "count variables." They would simply take the value of the number of pieces of news occurring on a particular day, for a particular type of news. We use these count variables for the study of soft news, as their frequency was extremely high: virtually every day, there was at least one soft news about the Greek and Eurozone crises (see tables 2A and 2B). The intuition behind the count variables is to measure the intensity of the debate over future policy decisions and hence the kind of uncertainty surrounding those decisions.

Finally, and to be as transparent as possible on the content of our dataset, we have compiled in Appendix B the full and almost exhaustive coding procedure for each news category. We have also provided examples of news coding for each news category (see tables B1, B2, C1, C2 in Appendix B).

Table 1A. Coding of news (1)

Level I	Level II	Description
GDP and fiscal data	Data releases (Eurostat/Finance Ministry)/official forecasts (Troika/BoG)	A news is positively (negatively) coded when it signals that Greece is hitting (missing) its fiscal targets, in particular in terms of revenues targets
		A news is positively (negatively) coded when it signals that Greece's macroeconomic situation is improving (deteriorating) compared to expectations
Financial Support	Bailout package (EZ and/or IMF participation, (dis)agreement, negotiations, ratification process, collateral, legal challenges, written commitment)/Loan Tranche(disbursement/delay)	A news is positively (negatively) coded if it signals the Europeans' (un)willingness to offer support or offer support without conditionality.
		A news is negatively coded when it signals that Greece needs more financial support
		A news is positively (negatively) coded when it signals the (un)willingness to disburse funds.
	Loan Reviews (negotiations, reports, implementation process, austerity packages)	A news is positively (negatively) coded when it signals that Greece is on (off) track with the program
		A news is positively (negatively) coded when it signals Greece's (un)willingness to adjust/reform/privatise
		A news is positively (negatively) coded when it signals a stronger (weaker) Greek banking system
	Official Sector Involvement (from member states and ECB)	A news is positively (negatively) coded when the EU/IMF signals its (un)willingness to lengthen the maturity and/or reduce the interest rate of Greek loans.
		A news is positively (negatively) coded when it signals that the ECB is (not) willing to participate in the OSI for the second Greek bailout

Table 1B. Coding of news (2)

Level I	Level II	Description
Restructuring	Disorderly Default	A news is negatively (positively) coded when it signals the (im)possibility/(in)desirability of a Greek default.
	Forced Orderly Restructuring	A news is positively (negatively) coded when it signals the (im)possibility/(in)desirability of a forced orderly Greek default
		A news is positively (negatively) coded when it signals support/opposition (opposition/support) for a buyback or rollover/swap of Greek bonds
		A news is negatively coded when it signals a disagreement between the ECB and the member states on selective default
	Voluntary Orderly Restructuring	A news is positively (negatively) coded when it signals progress (delay/breakdown) in negotiations on PSI
		A news is negatively coded when it signals support (opposition) for higher private losses on Greek bonds
Crisis Resolution Mechanisms (EFSF and ESM)	Size (ceiling, leveraging strategy, combination of ESM and EFSF, early start)	A news is positively (negatively) coded when it signals the (im)possibility/(in)desirability of an increase (limitation) in the bailout funds' firepower
	Flexibility (Bond-buying, bank recapitalisations, loan interest rate and maturity, parliamentary participation)	A news is positively (negatively) coded when it signals the (im)possibility/(in)desirability of greater bailout funds' flexibility
	PSI	A news is positively (negatively) coded when it signals the (in)desirability of PSI in the ESM (even after 2013)
	Conditions (SGP, policy coordination, Fiscal Pact, legal challenges)	A news is positively (negatively) coded when it (does not) signals a possible compromise on the conditions set for an increase in the firepower and/or flexibility of the bailout funds

Table 1C. Coding of news (3)

Level I	Level II	Description
ECB	Collateral framework	A news is positively (negatively) coded when it signals ECB's (un)willingness to ease (tighten) its collateral framework
	Bond-buying	A news is positively (negatively) coded when it signals the (in)desirability of the ECB's bond-buying program
	Lender of last resort	A news is positively (negatively) coded when it signals the (in)desirability for the ECB to act as a lender of last resort for sovereigns
	Liquidity provisison	A news is positively (negatively) coded when it signals the (in)desirability/(im)possibility of providing liquidity to the financial sector
Political environment	Elections, referendums, opposition support, majority unity, cabinet reshuffle, polls (after Nov 2011)	A news is positively (negatively) coded when it signals (a lack of) large political support for reforms.
		A news is positively (negatively) coded when it signals reduced (heightened) political uncertainty.
Grexit		A news is positively (negatively) coded when it signals Europeans' (un)willingness to preserve the integrity of the eurozone
Eurobonds		A news is positively (negatively) coded when it signals Europeans' (un)willingness to create a joint Eurobond
Banking Union		A news is positively (negatively) coded when it signals support for a far-reaching (no/modest) banking union

4.5. Describing the data

Our dataset is made of a bit more than 5800 observations, of which 54% of them are negative. Soft news compose the very bulk of the observations. For hard news, most of them were expected by markets (according to our definition) while most unexpected news were negative. Note that there were more hard positive news than hard negative news. On average, (at least) one hard news took place every 4 trading days (see table 2A and 2B). In addition, there was news coverage about the Greek and/or Eurozone crises virtually every day. These high numbers are due to our comprehensive coverage of the Eurozone *and* Greek crises. When we exclude soft news that occurred on days with hard news, the final dataset shrinks by more than the

double. Consequently, the relative proportion of hard news in the final dataset increases. We have also broken down the news variables by topic (see tables 13A to 14B in Appendix A, see also figures 2 to 19 in Appendix A to have an idea of the evolution of the different news variables over time).

Table 2A. Distribution of the news in the dataset

	Total	% of Total		% of Days with
Total	5808	100%		91.5%
Negative News NB	3260	56.2%	% of Neg	82.6%
Soft Negative NB	3001	51.7%	92.1%	81.1%
Political Statements Negative NB	1884	32.4%	57.8%	70.6%
Media Reports Negative NB	1117	19.2%	34.3%	61.8%
Hard Negative NB	259	4.5%	7.9%	26.0%
Hard Expected Negative NB	196	3.4%	6.0%	19.8%
Hard Unexpected Negative NB	63	1.1%	1.9%	8.2%
Positive News NB	2548	43.8%	% of Pos	81.3%
Soft Positive NB	2268	39.0%	89.0%	78.0%
Political Statements Positive NB	1189	20.5%	46.7%	60.3%
Media Reports Positive NB	1079	18.6%	42.3%	63.6%
Hard Positive NB	280	4.8%	11.0%	27.6%
Hard Expected Positive NB	249	4.3%	9.8%	25.6%
Hard Unexpected Positive NB	31	0.5%	1.2%	3.6%

Table 2B. Distribution of the news in the final dataset
(excluding soft news on days with hard news)

	Total	% of Total		% of Days with
Total	2710	100%		91.5%
Negative News NB	1456	53.7%	% of Neg	66.5%
Soft Negative NB	1197	44.2%	82.2%	40.5%
Political Statements Negative NB	735	27.1%	50.5%	34.2%
Media Reports Negative NB	462	17.0%	31.7%	28.6%
Hard Negative NB	259	9.6%	17.8%	26.0%
Hard Expected Negative NB	196	7.2%	13.5%	19.8%
Hard Unexpected Negative NB	63	2.3%	4.3%	8.2%
Positive News NB	1254	46.3%	% of Pos	66.3%
Soft Positive NB	974	35.9%	77.7%	38.7%
Political Statements Positive NB	540	19.9%	43.1%	29.4%
Media Reports Positive NB	434	16.0%	34.6%	29.8%
Hard Positive NB	280	10.3%	22.3%	27.6%
Hard Expected Positive NB	249	9.2%	19.9%	25.6%
Hard Unexpected Positive NB	31	1.1%	2.5%	3.6%

5. Econometric Methodology and Results

5.1. Econometric methodology

In order to test the effect of policy developments during the Greek and Eurozone crises on financial markets, we use an EGARCH (1,1) model as proposed by Nelson (1991). This approach has the advantage that it corrects for the serial correlation, skewness, and time-varying volatility of the Greek bond spreads. Indeed, we have found significant ARCH effects after

performing a standard Engle's LM ARCH test as well as serial correlation on OLS regressions with or without our news variables[19].

The augmented conditional mean equation of an AR(1)-EGARCH(1,1) model is the following

$$\Delta\text{Spread}_t = \alpha + \beta\Delta\text{Spread}_{t-1} + \sum_j \gamma^j_{\text{Pos}}\text{News}^j_{\text{Positive,t}} + \sum_j \gamma^j_{\text{Pos}}\text{News}^j_{\text{Negative,t}} + \theta X_t + (\log(\sigma_t^2)) + \varepsilon_t$$

Where $\Delta Spread_t$ is the daily change of Greece's 10-year sovereign bond spread (bid price[20]) with Germany at time t, $\Delta Spread_{t-1}$ is the lagged daily change of Greece's 10-year sovereign bond spread with Germany[21]. $\text{News}^j_{\text{Positive,t}}$ ($\text{News}^j_{\text{Negative,t}}$) is a news variable. We construct several types of news variables, whereby j indicates the type of the news considered (hard, soft, expected, unexpected, political statements, media reports, Greek-specific news, Eurozone-specific news) on day t. For the different types of hard news, we use dummy variables. For the different types of soft news, we rely only on count variables.

X_t is a vector of control variables. As control variables, we use the daily VIX index to take into account for global risk factors, the daily dollar-euro rate to take into account regional risk factors and the Euribor 3 month-OIS spread as a proxy for credit risk. In addition, we use a dummy variable equal to 1 on days with macroeconomic news releases (Unemployment, CPI, Industrial Production, PMI, Construction activity). Log (σ_t^2) is the logarithm of the conditional variance, i.e. the ARCH-in-mean term, as the risk factor may affect the conditional mean change in Greek spreads (see Collignon et al 2013). ε_t is the error term following a Student's t-distribution, with the number of degrees of freedom (i.e., the tails' width) to be estimated by the model[22].

The variance equation of the EGARCH is expressed as a function of a constant term, q lags of the dependent variable (the GARCH structure) and p lags of the residuals from the previous periods. The conditional variance equation of an EGARCH(1,1) model is therefore the following

[19] We first estimated the "right" model with the help of the Auto Regressive Distributed Lags methodology. Based on this model, we tested for serial correlation, heteroskedasticity and ARCH effects.
[20] Boffelli and Urga (2015: 150, see also Büchel 2013) consider that "bid, rather than mid, data as more representative of the spreads during crisis periods considering the widening of bid-ask spreads witnessed by bond markets."
[21] The inclusion of the lagged spread variable is be justified by the existence of serial correlation.
[22] The t-distribution approaches the normal as the degrees of freedom converge to infinity.

$$\log(\sigma_t^2) = \omega + \eta\left(\left|\frac{\varepsilon_{t-1}}{\sigma_{t-1}}\right| - \mathrm{E}\left|\frac{\varepsilon_{t-1}}{\sigma_{t-1}}\right|\right) + \phi\log(\sigma_{t-1}^2) + \rho\frac{\varepsilon_{t-1}}{\sigma_{t-1}} + \sum_j \gamma^j \mathrm{News}_t^j$$

We also include our news variables in the conditional variance equation in order to assess their effect on the Greek spread volatility. Following Erhmann et al (2013), we estimate the effect of news on the conditional variance in a slightly different way compared to the mean equation. We continue to use dummy variables for hard news and count variables for soft news but we do not disentangle anymore between positive and negative news.

All time series are stationary (table 11, see also tables 9 and 10 for the description of the variables and descriptive statistics in Appendix A). There was no more ARCH effect nor serial correlation after running GARCH regressions. While the R-squared is low in the benchmark models, incorporating news improved it up to 250 percent. Finally, the estimated degrees of freedom of the Student-t distribution of errors is always fluctuating around 2 and 3, indicating the presence of particularly fat tails, justifying the choice of the Student-t distribution to model errors.

5.2. Analysis of the results and robustness checks

Models A and B are the benchmark models to which we assess the value added of accounting for policy developments during the Eurozone and Greek crises (see table 3). In those benchmark models, we only include the control variables (model A) and the ARCH-in-mean term (model B). These two models suggest that there was some inertia in the markets while an appreciation of the euro-dollar exchange rate was correlated with spread tightening. Credit risk as well as global risk-aversion had no significant effect. Spread volatility also had a widening effect on the mean change in Greek spreads.

Our main result is that financial markets did react extremely strongly to unexpected positive decisions and events. Our results are also consistent with the asymmetric effect of news commonly reported in the existing literature as financial markets were sensitive to negative news as a whole (decisions, events and political communication). The daily number of Greek-specific negative developments (excluding decisions and events) has widened Greek spreads as well while we find no such effect for positive developments.

Let us now elaborate further on the results. We first estimate the effect of news at the most aggregated level and then gradually break down our different news variables. In models 1 to 10, we study the effect of news without differentiating between Greek-specific and Eurozone-wide developments (see tables 4A and 4B). Looking at the most aggregated level of

news (models 1 to 5), we find an asymmetric pattern in the reaction of financial markets to positive and negative news in the mean equation. Hard and soft negative news have a significant effect on spreads while hard and soft positive news have no effect. The coefficients have the expected sign when significant: negative news widen spreads while positive news tighten spreads. This result is in line with the main findings of the existing literature that negative news had an asymmetric effect on markets during the crisis[23].

Table 3. Benchmark Models – Mean Equation

ΔSpread	A	B
Log(GARCH)		0.871 [0.370]**
ΔSpread(-1)	0.152 [0.032]***	0.138 [0.031]***
C	1.713 [0.519]***	-6.826 [1.807]***
VIX	0.225 [0.328]	0.074 [0.309]
EUR-USD	-4.518 [0.868]***	-3.986 [0.836]***
Euribor-OIS Spread	18.864 [24.474]	5.426 [23.302]
Economic News	-0.065 [1.413]	-0.943 [1.385]
T-DIST. DOF	2.544 [0.292]***	2.003 [0.008]***
Adjusted R-squared	0.032	0.032
Obs	731	731

Notes: Standard errors in brackets; * significant at 10% level; **significant at 5% level; ***significant at 1% level.

When breaking down soft news into political communication and media reports, only the daily number of negative political statements significantly (at the 10% level) widened the mean change in spreads. However, this result should be taken cautiously as political communication and media reports are highly correlated. Actually, when we include only one

[23] For presentation purposes, we do not report the coefficients, standard errors and significance levels for the control variables in the regression tables. But notice that those elements do not change substantially compared to the benchmark models. Full regression results are available on demand.

of those types of news at a time, we find that negative political communication and media reports have significant effects with the expected sign.

Interestingly, when we differentiate between expected and unexpected hard news (models 6 to 10), the asymmetric effect of news somewhat fades away. On the one hand, we find that unexpected hard news are significant when both positive and negative and have the expected sign, with the former having a greater effect in absolute terms (more than 20 bps against 11-12 bps). On the other, financial markets have remained more sensitive to negative news in general as markets kept reacting to soft negative news.

With regard to the variance equation for models 1 to 10, our results suggest that news had a destabilizing effect on spreads (table 4C). Hard news as well as soft news increase volatility, with the former having a greater impact than the latter. When we delve into greater details, we find that unexpected news had a significant, strong and robust effect on volatility while expected news had no effect. Finally, it is difficult to conclude on the respective effect of media reports and political communication on variance because of the high correlation between the two variables.

In models 11 to 20, we estimate the effect of news when we differentiate between Greek-specific and Eurozone-wide developments (see tables 4C to 4E). We find some insightful and complementary results, in particular when put in perspective with models 1 to 10. First, the asymmetric pattern holds with both Greek-specific and Eurozone-wide hard news: hard negative news have a significant widening effect even though Eurozone-wide hard news are less significant. Still, this result tells us that policy decisions and events during the wider Eurozone crisis did matter in driving Greek spreads higher. Second, Greek-specific and Eurozone-wide unexpected positive as well as negative decisions and events affected the conditional mean change in Greek spreads. In particular, unexpected positive news had a huge tightening effect on Greek spreads (up to 30 bps), an effect greater in absolute value than for negative news (up to 17 bps). Again, notice that Eurozone-wide unexpected news are less significant than Greek-specific unexpected news, especially unexpected negative news. Nevertheless, their effect goes way beyond the effect of Greek-specific unexpected news. Third, models 11 to 20 suggest that, when taken as a whole, only Eurozone-wide soft negative news mattered for financial markets (significant at the 5% level). Moreover, from our regressions, it appears that markets did not react to Greek-specific or Eurozone-wide political communication. As for models 3 and 8, we also include political statements and media reports one at a time and we find that Greek-specific negative political statements and media reports are significant.

With regard to the effect of Greek-specific and Eurozone-wide news on variance, we find that Greek-specific hard news had a significant and robust destabilizing effect on spreads while Eurozone-wide hard news had no effect. Looking at expected and unexpected news offers a picture similar to that of models 1 to 10. The destabilizing effect only came from unexpected news, with Greek-specific news having an extremely significant and robust effect compared to Eurozone-wide news. With regard to soft news, we obtain comparable results as for models 1 to 10 for soft news. Nevertheless, both Greek-specific and Eurozone-wide soft news slightly but significantly destabilized markets.

When we add a ARCH-in-mean term in the mean equation (regressions 21 to 40, see tables 5A to 5E), the previous results for both the mean and variance equations continue to hold for hard news. For soft news, we also obtain a similar picture even though their levels of significance are reduced in the conditional mean equation. Also notice that soft positive news are significant. Anyway, those Mean-EGARCH regressions do not allow to conclude on the effect of the conditional variance on the conditional mean as the significance of the ARCH-in-mean is not always significant and not robust across specifications[24].

More generally, our main result with respect to the effect of news on the mean equation turns out to be robust to different model specifications. First, we add more lags of the dependent variable as our baseline specification may not fully account for the inertia in Greek spreads but we obtain similar results (see tables 6A to 6E in Appendix A). Second, we use the Greek sovereign yield instead of the spread as the spreads might have reacted to German-specific news. Again, the results offer a similar picture with regard to hard news (see tables 7A to 7E in Appendix A). It appears that Greek yields have reacted to Greek-specific negative but also to positive soft news. Third, we estimate Asymmetric Power ARCH (1,1) models in order to account for the common finding in the empirical financial literature of high serial correlation between the absolute asset returns and their power transformations (see tables 8A to 8E in Appendix A). The main difference here is that news have no more effect on the variance of Greek spreads while the news variables continue to affect the mean change in Greek spreads as in the EGARCH models. Finally, we also test alternative EGARCH structures with up to three lags in the ARCH and GARCH terms but our results remain robust to such specifications (for both the mean and variance equation) except for Eurozone-wide hard negative news.

[24] We have tested for alternative specifications of both the mean and variance equations – including only the daily number of soft news in the variance equation but not in the mean equation and including both hard and soft news in the mean equation but only soft news in the variance equation – and for alternative ARCH-in-mean term – instead of the logarithm of the conditional variance, we have simply used variance as well as the conditional standard deviation – but all these alternative still fail to offer a clear-cut picture.

Table 4A. AR(1) – EGARCH(1,1) with news – Mean Equation

ΔSpread	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Hard Positive	-1.068 [1.334]	-0.238 [1.330]	-0.136 [1.336]	-0.394 [1.318]	-0.324 [1.332]					
Hard Negative	4.915 [1.255]**	5.904 [1.271]**	5.919 [1.259]**	5.852 [1.266]**	5.602 [1.252]**					
Positive Expected						-0.081 [1.117]	0.701 [1.114]	0.687 [1.121]	0.542 [1.103]	0.552 [1.131]
Positive Unexpected						-21.363 [4.331]**	-19.219 [4.199]**	-18.894 [4.118]**	-20.167 [4.296]**	-19.467 [4.078]**
Negative Expected						1.621 [1.385]	2.586 [1.358]*	2.607 [1.353]*	2.424 [1.393]*	2.391 [1.345]*
Negative Unexpected						11.807 [2.815]**	12.372 [2.923]**	12.317 [2.879]**	12.357 [2.913]**	12.123 [2.834]**
Soft Positive NB		-0.579 [0.438]					-0.569 [0.409]			
Soft Negative NB		0.953 [0.378]**					0.903 [0.351]**			
Positive Political Statements NB			-0.484 [0.618]	-0.408 [0.613]				-0.330 [0.596]	-0.275 [0.587]	
Negative Political			0.924 [0.485]*	1.052 [0.487]**				0.769 [0.475]	0.913 [0.461]**	
Positive Media Reports NB			-0.715 [0.818]		-0.553 [0.779]			-0.905 [0.777]		-0.655 [0.736]
Negative Media Reports NB			1.001 [0.769]		1.320 [0.714]*			1.075 [0.718]		1.316 [0.673]*
T-DIST. DOF	2.503 [0.284]**	2.628 [0.310]**	2.692 [0.320]**	2.552 [0.298]**	2.672 [0.314]**	2.658 [0.319]**	2.816 [0.351]**	2.873 [0.363]**	2.736 [0.338]**	2.865 [0.359]**
Adj R-squared	0.044	0.049	0.046	0.048	0.043	0.074	0.076	0.072	0.076	0.071
Obs	731	731	731	731	731	731	731	731	731	731

Table 4B. AR(1) – EGARCH(1,1) with news – Variance Equation

Spread	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Hard News	0.113 [0.073]	0.238 [0.092]***	0.257 [0.091]***	0.192 [0.085]**	0.258 [0.092]***					
Expected News						-0.062 [0.079]	0.059 [0.098]	0.075 [0.097]	0.019 [0.093]	0.073 [0.095]
Unexpected News						0.701 [0.144]***	0.892 [0.161]***	0.871 [0.160]***	0.845 [0.156]***	0.852 [0.159]***
Soft News		0.033 [0.009]***					0.038 [0.010]***			
Political Communication			0.002 [0.018]	0.039 [0.013]***				0.017 [0.019]	0.049 [0.014]***	
Media Reports			0.089 [0.030]***		0.093 [0.022]***			0.072 [0.030]**		0.093 [0.022]***

Table 4C. AR(1) – EGARCH(1,1) with Greek-specific and Eurozone-wide news – Mean Equation (1)

ΔSpread	(11)	(12)	(13)	(14)	(15)
G Hard Positive	-0.713 [1.405]	-0.170 [1.400]	0.083 [1.406]	-0.268 [1.395]	0.083 [1.389]
G Hard Negative	4.903 [1.347]***	5.747 [1.341]***	5.962 [1.321]***	5.781 [1.347]***	5.610 [1.324]***
E Hard Positive	-0.099 [3.088]	0.867 [3.320]	1.304 [3.396]	0.664 [3.231]	1.058 [3.338]
E Hard Negative	4.192 [2.745]	5.625 [3.077]*	6.044 [3.142]*	5.737 [3.052]*	5.142 [3.001]*
G Soft Positive NB		-0.134 [0.758]			
G Soft Negative NB		0.662 [0.678]			
E Soft Positive NB		-0.795 [0.574]			
E Soft Negative NB		1.108 [0.470]**			
G Positive Political NB			-1.077 [0.821]	-0.726 [0.912]	
G Negative Political NB			0.907 [0.619]	1.154 [0.628]*	
E Positive Political NB			-0.231 [0.964]	-0.119 [0.934]	
E Negative Political NB			1.215 [0.873]	1.072 [0.840]	
G Positive Media Reports NB			-0.416 [0.868]		-0.451 [0.834]
G Negative Media Reports NB			1.388 [0.866]		1.604 [0.805]**
E Positive Media Reports NB			0.144 [1.561]		0.468 [1.570]
E Negative Media Reports NB			-0.133 [1.692]		0.413 [1.599]
T-DIST. DOF	2.530 [0.289]***	2.628 [0.312]***	2.732 [0.329]***	2.576 [0.304]***	2.705 [0.321]***
Adjusted R-squared	0.042	0.041	0.034	0.041	0.035
Obs	731	731	731	731	731

Table 4D. AR(1) – EGARCH(1,1) with Greek-specific and Eurozone-wide news – Mean Equation (2)

ΔSpread	(16)	(17)	(18)	(19)	(20)
G Positive Expected	0.931 [1.157]	1.183 [1.178]	1.397 [1.204]	1.108 [1.166]	1.659 [1.181]
G Positive Unexpected	-15.735 [4.279]***	-13.704 [4.064]***	-12.826 [4.050]***	-14.732 [4.130]***	-13.068 [4.002]***
G Negative Expected	1.661 [1.566]	2.574 [1.515]*	2.754 [1.488]*	2.516 [1.554]	2.450 [1.504]
G Negative Unexpected	11.113 [2.993]***	11.853 [3.030]***	11.940 [2.866]***	11.861 [3.010]***	11.683 [2.940]***
E Positive Expected	2.459 [2.668]	2.842 [2.759]	3.144 [2.844]	2.664 [2.699]	3.036 [2.799]
E Positive Unexpected	-30.267 [11.437]***	-29.130 [12.450]**	-29.731 [12.646]**	-29.320 [11.850]**	-29.547 [12.530]**
E Negative Expected	-0.504 [2.722]	0.565 [3.082]	0.903 [3.163]	0.856 [3.016]	0.100 [3.034]
E Negative Unexpected	15.199 [6.350]**	16.033 [6.586]**	16.690 [6.657]**	15.735 [6.468]**	16.950 [6.621]**
G Soft Positive NB		-0.093 [0.739]			
G Soft Negative NB		0.599 [0.639]			
E Soft Positive NB		-0.784 [0.546]			
E Soft Negative NB		1.063 [0.445]**			
G Positive Political NB			-0.914 [0.798]	-0.679 [0.892]	
G Negative Political NB			0.774 [0.610]	1.037 [0.611]*	
E Positive Political NB			-0.085 [0.951]	-0.060 [0.916]	
E Negative Political NB			1.113 [0.829]	0.968 [0.793]	
G Positive Media Reports NB			-0.477 [0.840]		-0.444 [0.785]
G Negative Media Reports NB			1.397 [0.831]*		1.626 [0.769]**
E Positive Media Reports NB			-0.553 [1.431]		-0.150 [1.455]
E Negative Media Reports NB			0.032 [1.632]		0.682 [1.502]
T-DIST. DOF	2.689 [0.324]***	2.852 [0.364]***	2.945 [0.385]***	2.787 [0.351]***	2.907 [0.376]***
Adjusted R-squared	0.079	0.077	0.071	0.078	0.073
Obs	731	731	731	731	731

Table 4E. AR(1) – EGARCH(1,1) with Greek-specific and Eurozone-wide news – Variance Equation

Spread	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)
G Hard News	0.154 [0.076]**	0.286 [0.099]***	0.321 [0.100]***	0.251 [0.093]***	0.303 [0.097]***					
E Hard News	-0.001 [0.094]	0.103 [0.115]	0.120 [0.114]	0.053 [0.108]	0.129 [0.115]					
G Expected News						0.022 [0.082]	0.142 [0.101]	0.176 [0.101]*	0.111 [0.098]	0.155 [0.098]
G Unexpected News						0.612 [0.168]***	0.777 [0.180]***	0.743 [0.178]***	0.735 [0.177]***	0.741 [0.177]***
E Expected News						-0.154 [0.129]	-0.111 [0.153]	-0.105 [0.152]	-0.134 [0.146]	-0.092 [0.151]
E Unexpected News						0.343 [0.265]	0.600 [0.294]**	0.595 [0.289]**	0.530 [0.285]*	0.568 [0.288]**
G Soft News		0.034 [0.012]***					0.034 [0.013]***			
E Soft News		0.039 [0.014]***					0.046 [0.015]***			
G Political Communication			-0.013 [0.024]	0.036 [0.018]**				-0.006 [0.025]	0.039 [0.019]**	
G Media Reports			0.116 [0.039]***		0.108 [0.029]***			0.103 [0.038]***		0.103 [0.029]***
E Political Communication			0.028 [0.027]	0.051 [0.020]**				0.031 [0.028]	0.059 [0.021]***	
E Media Reports			0.052 [0.047]		0.091 [0.036]**			0.061 [0.050]		0.100 [0.037]***

Table 5A. AR(1) – EGARCH(1,1) with news – Mean Equation (MGARCH specification)

ΔSpread	(21)	(22)	(23)	(24)	(25)	(26)	(27)	(28)	(29)	(30)
Log(GARCH)	0.752 [0.406]*	0.541 [0.079]***	0.599 [0.098]***	0.621 [0.069]***	0.586 [0.079]***	0.683 [0.200]***	0.863 [0.468]*	-0.112 [0.196]	0.662 [0.448]	1.034 [0.429]**
Hard Positive	-0.027 [1.076]	0.737 [1.008]	0.475 [1.006]				0.860 [0.926]	-0.052 [1.070]		
Hard Negative	4.321 [1.237]***	5.159 [1.230]***	5.053 [1.249]***				5.168 [1.262]***	4.562 [1.255]***		
Positive Expected				1.319 [0.839]	1.054 [0.972]	0.642 [1.066]			1.296 [0.897]	0.968 [0.934]
Positive Unexpected				-23.242 [4.261]***	-22.136 [4.580]***	-22.181 [4.192]***			-22.384 [4.329]***	-22.093 [4.066]***
Negative Expected				1.463 [1.299]	2.263 [1.336]*	2.065 [1.334]			2.143 [1.340]	1.864 [1.302]
Negative Unexpected				10.699 [2.818]***	11.117 [2.797]***	10.798 [2.909]***			11.199 [2.894]***	10.702 [2.863]***
Soft Positive NB		-0.656 [0.381]*			-0.653 [0.353]*					
Soft Negative NB		0.810 [0.338]**			0.747 [0.303]**					
Positive Political Statements NB			-0.377 [0.604]			-0.281 [0.580]	-0.431 [0.591]		-0.287 [0.558]	
Negative Political Statements NB			0.745 [0.472]			0.560 [0.454]	0.885 [0.480]*		0.683 [0.446]	
Positive Media Reports NB			-0.900 [0.799]			-1.040 [0.730]		-0.896 [0.769]		-0.930 [0.691]
Negative Media Reports NB			0.737 [0.711]			0.769 [0.635]		0.912 [0.679]		0.992 [0.589]*
T-DIST. DOF	2.002 [0.007]***	2.000 [0.000]***	2.001 [0.000]***	2.000 [0.000]***	2.000 [0.000]***	2.001 [0.003]***	2.000 [0.000]***	2.001 [0.004]***	2.000 [0.000]***	2.000 [0.000]***
Adjusted R-squared	0.041	0.042	0.041	0.074	0.077	0.074	0.043	0.040	0.076	0.073
Obs	731	731	731	731	731	731	731	731	731	731

Table 5B. AR(1) – EGARCH(1,1) with news – Variance Equation

Spread	(21)	(22)	(23)	(24)	(25)	(26)	(27)	(28)	(29)	(30)
Hard News	0.135 [0.081]*	0.406 [0.137]***	0.279 [0.103]***	0.227 [0.097]**	0.269 [0.101]***					
Expected News						-0.040 [0.093]	0.221 [0.142]	0.103 [0.115]	0.061 [0.110]	0.096 [0.112]
Unexpected News						0.744 [0.166]***	0.981 [0.193]***	0.928 [0.187]***	0.908 [0.182]***	0.891 [0.185]***
Soft News		0.396 [0.132]***					0.425 [0.141]***			
Political Communication			0.007 [0.020]	0.045 [0.015]***				0.027 [0.022]	0.057 [0.017]***	
Media Reports			0.087 [0.033]***		0.094 [0.024]***			0.065 [0.034]*		0.094 [0.025]***

Table 5C. AR(1) – EGARCH(1,1) with Greek-specific and Eurozone-wide news – Mean Equation (MGARCH specification) (1)

ΔSpread	(31)	(32)	(33)	(34)	(35)
Log(GARCH)	0.589 [0.075]***	0.583 [0.416]	0.690 [0.305]**	0.533 [0.082]***	0.781 [0.428]*
G Hard Positive	1.140 [1.069]	-0.384 [1.600]	0.057 [1.180]	1.118 [1.156]	-0.629 [1.619]
G Hard Negative	4.390 [1.311]***	4.970 [1.384]***	4.989 [1.311]***	5.114 [1.332]***	4.625 [1.351]***
E Hard Positive	-1.335 [2.892]	0.077 [3.308]	-0.217 [3.105]	-0.663 [2.962]	-0.012 [3.295]
E Hard Negative	3.607 [2.564]	4.675 [3.129]	5.305 [2.999]*	5.272 [2.866]*	4.020 [3.033]
G Soft Positive NB		-0.934 [0.577]			
G Soft Negative NB		1.014 [0.480]**			
E Soft Positive NB		-0.227 [0.761]			
E Soft Negative NB		0.510 [0.698]			
G Positive Political NB			-0.919 [0.811]	-0.711 [0.887]	
G Negative Political NB			0.842 [0.587]	1.089 [0.614]*	
E Positive Political NB			-0.199 [0.908]	-0.127 [0.879]	
E Negative Political NB			0.718 [0.821]	0.595 [0.793]	
G Positive Media Reports NB			-0.748 [0.876]		-0.872 [0.904]
G Negative Media Reports NB			1.112 [0.851]		1.221 [0.836]
E Positive Media Reports NB			-0.249 [1.456]		-0.229 [1.578]
E Negative Media Reports NB			-0.136 [1.599]		0.114 [1.599]
T-DIST. DOF	2.000 [0.000]***	2.565 [0.305]***	2.002 [0.004]***	2.000 [0.000]***	2.606 [0.306]***
Adjusted R-squared	0.037	0.040	0.033	0.038	0.036
Obs	731	731	731	731	731

Table 5D. AR(1) – EGARCH(1,1) with Greek-specific and Eurozone-wide news – Mean Equation (MGARCH specification) (2)

ΔSpread	(36)	(37)	(38)	(39)	(40)
G Positive Expected	1.594 [1.146]	0.803 [1.261]	0.507 [1.329]	1.420 [1.201]	0.461 [0.819]
G Positive Unexpected	-17.342 [4.161]***	-16.820 [4.052]***	-16.335 [4.135]***	-17.393 [4.097]***	-15.732 [4.040]***
G Negative Expected	1.655 [1.484]	2.117 [1.472]	2.125 [1.543]	2.198 [1.495]	1.913 [1.459]
G Negative Unexpected	10.387 [2.929]***	10.377 [3.045]***	10.292 [3.223]***	10.679 [2.993]***	10.373 [2.950]***
E Positive Expected	1.687 [2.493]	1.684 [2.558]	1.768 [2.661]	1.501 [2.482]	1.839 [2.616]
E Positive Unexpected	-30.227 [9.833]***	-29.145 [10.776]***	-29.756 [11.312]***	-28.876 [10.319]***	-29.700 [11.017]***
E Negative Expected	-0.241 [2.668]	0.169 [3.010]	0.255 [3.088]	0.496 [2.916]	-0.208 [2.942]
E Negative Unexpected	13.875 [5.963]**	14.044 [6.139]**	14.350 [6.285]**	14.248 [6.008]**	14.294 [6.140]**
G Soft Positive NB		-0.893 [0.507]*			
G Soft Negative NB		0.906 [0.408]**			
E Soft Positive NB		-0.088 [0.677]			
E Soft Negative NB		0.245 [0.607]			
G Positive Political NB			-0.890 [0.791]	-0.731 [0.844]	
G Negative Political NB			0.688 [0.579]	0.908 [0.583]	
E Positive Political NB			0.010 [0.905]	0.091 [0.851]	
E Negative Political NB			0.485 [0.788]	0.337 [0.742]	
G Positive Media Reports NB			-0.777 [0.863]		-0.863 [0.790]
G Negative Media Reports NB			1.064 [0.806]		1.099 [0.698]
E Positive Media Reports NB			-1.071 [1.374]		-0.833 [1.342]
E Negative Media Reports NB			-0.040 [1.521]		0.238 [1.410]
T-DIST. DOF	2.000 [0.000]***	2.001 [0.003]***	2.070 [0.078]***	2.000 [0.000]***	2.002 [0.005]***
Adjusted R-squared	0.081	0.079	0.075	0.079	0.077
Obs	731	731	731	731	731

Table 5E. AR(1) – EGARCH(1,1) with Greek-specific and Eurozone-wide news – Variance Equation

Spread	(31)	(32)	(33)	(34)	(35)	(36)	(37)	(38)	(39)	(40)
G Hard News	0.171 [0.086]**	0.282 [0.098]***	0.323 [0.111]***	0.273 [0.105]***	0.287 [0.094]***					
E Hard News	-0.001 [0.107]	0.103 [0.116]	0.133 [0.129]	0.066 [0.123]	0.123 [0.114]					
G Expected News						0.016 [0.096]	0.150 [0.118]	0.179 [0.117]	0.116 [0.114]	0.143 [0.110]
G Unexpected News						0.667 [0.193]***	0.830 [0.208]***	0.786 [0.206]***	0.796 [0.205]***	0.771 [0.204]***
E Expected News						-0.118 [0.149]	-0.067 [0.177]	-0.060 [0.174]	-0.095 [0.169]	-0.044 [0.172]
E Unexpected News						0.318 [0.316]	0.595 [0.349]*	0.620 [0.344]*	0.528 [0.339]	0.543 [0.338]
G Soft News		0.034 [0.012]***					0.036 [0.014]**			
E Soft News		0.039 [0.014]***					0.047 [0.017]***			
G Political Communication			-0.008 [0.027]	0.043 [0.020]**				0.003 [0.029]	0.045 [0.022]**	
G Media Reports			0.114 [0.042]***	0.054 [0.022]**				0.094 [0.042]**	0.063 [0.024]***	
E Political Communication			0.033 [0.030]		0.104 [0.029]***			0.037 [0.032]		0.102 [0.031]***
E Media Reports			0.044 [0.053]		0.088 [0.036]**			0.053 [0.057]		0.095 [0.043]**

6. Concluding remarks

In this paper, we have showed that financial markets did react to policy developments of the Greek and Eurozone crisis. We thus have constructed a novel dataset of 5800 single news items. Our contribution in this paper has to do precisely with the construction of the dataset and our coding approach. We have tried to be as transparent as possible about how we have built our dataset and coded news. And to the best of our knowledge, this is the only paper that has tried to differentiate between expected and unexpected news during the Greek and Eurozone crises.

Interestingly, this coding refinement is not neutral. Disentangling between expected and unexpected decisions and events indeed allow us to complement the common finding that financial markets have reacted asymmetrically to news during the Eurozone and Greek crises. Financial markets were indeed more sensitive to negative news as they reacted to both negative soft and hard news. Still, financial markets were also extremely responsive to clear, and unexpected for that matter, positive signals sent by policy-makers, even more so than for unexpected negative decisions and events. In addition, Greek spreads reacted more to unexpected Eurozone-wide developments than Greek-specific ones.

These two findings imply that financial markets were not entirely solely concerned about the Greek debt problems. They also appeared to be deeply worried by the broader sustainability of the Eurozone: financial markets were eager to receive a clear, unambiguous and non-contingent signal that policy-makers were actually ready to do whatever it took to save the euro and solve the Greek problem after repeatedly claiming to do so.

Finally, and contrary to the claims made by several European policy-makers that financial markets did not acknowledge the steps that were taken to upgrade the Eurozone governance and solve the Greek solvency problems, our results rather point to the other direction: financial markets did acknowledge the policy efforts. However, the inability of the European policy-makers to provide the markets with the decisive proof that the Eurozone was sustainable over the long-run allowed the development of a major financial crisis with deep economic consequences.

Paper 3. Disaster Risk and Investment in Advanced Economies

Abstract

Uncertainty has been identified as an important factor behind the protracted slump in advanced economies following the Great Recession and Eurozone crisis. However, an important number of proxies for uncertainty are volatility-based, implicitly assuming that the underlying distribution of shocks is normal. They may thus fail to account for an important source of uncertainty coming from disaster risk. We therefore build on the novel Growth-at-Risk approach to derive a proxy for disaster risk. We estimate the macroeconomic effect of disaster risk on a panel of twelve advanced economies from 1997Q1 to 2019Q3. Our findings suggest the impact of disaster risk shocks on investment is not conclusive.

1. Introduction

Following the Global Financial Crisis and the Eurozone crisis, investment has nose-dived in advanced economies. However, the recovery has been much more less staggering. Many scholars have resorted to uncertainty to explain (part of) the extraordinary investment fall as well as the subsequent weak economic recovery in advanced economies. This renewed interest in estimating the macroeconomic effects of uncertainty has fostered the development of numerous proxies for uncertainty (see *inter alia* Bloom 2009, Baker et al 2016, Jurado et al 2015, Rossi and Sekhposyan 2015, see Cascaldi-Garcia 2020 for a comprehensive review).

An important number of scholars have proxied uncertainty by relying on volatility-based indicators. In this paper, we argue that this understanding of uncertainty overlooks uncertainty that originates from disaster risk. Arguably, the 2008 global financial crisis and the Lehman bankruptcy have come as powerful wake-up calls towards the risk of extreme left tail events. The so-called Eurozone sovereign debt crisis that started in late 2009 also raised major questions about the survival of the single currency whose demise could have caused a major blaze. And the outburst of the Covid-19 pandemic has simply been the latest evidence that tail events, or black swans, are not simply theoretical possibilities but do exist.

Actually, the risk of tail events may affect agents' decisions because of the critical consequences those disasters may have. In a seminal paper, Rietz (1988) solves the so-called equity premium puzzle (Mehra and Prescott 1985) by including a low probability of an extreme left tail event. Rietz (1988: 118) shows that "risk-averse equity owners demand a high return to compensate for the extreme losses they may incur during an unlikely, but severe, market crash." Following the work of Rietz (1988), some authors have developed new theoretical frameworks to solve other existing financial puzzles (see *inter alia* Barro 2006, Wachter 2013, Gabaix 2012, Farhi and Gabaix 2016). Closer to our purpose, several authors have also applied Rietz (1988) approach to analyse the real effects of rare disasters risk. Barro (2009) shows that the welfare consequences from eliminating all uncertainty from rare disasters are large. Similarly, Gourio (2012) shows that an increase in disaster risk leads to recessions and particularly large decline of investment (see also Gourio 2013).

Using the so-called Growth-at-Risk (GaR) methodology developed by Adrian et al (2019) that allows to retrieve full conditional density functions from GDP growth time series, we therefore construct a proxy for the implied left tail risk of GDP growth at the one-quarter and four-quarter ahead horizon for twelve advanced economies. We define disaster risk as the implied probability of GDP growth to fall by more than 5 points of percentage. We describe in

depth how our tail risk proxy is defined constructed in section 3. For that matter, our disaster risk proxy identifies periods of acute uncertainty that are different from realized stock volatility.

We then estimate the macroeconomic effect of disaster risk shocks using structural panel Vector Autoregressive (VAR) models coupled with Bayesian techniques for our panel of 12 countries from 1997Q1 to 2019Q3. The effect of disaster risk shocks on investment is not conclusive even though one-year ahead disaster risk shocks tend to have more impact than one-quarter ahead disaster risk shocks.

Our paper is related to the literature on disaster risk following Barro (2006) as we compute time-varying country-specific disaster risk proxies. Our paper is also closely related to Adrian et al (2019) showing that changes in the left tail are largely driven by changes in financial conditions, the left tail increasing in periods of high financial stress[25]. But instead of simply estimating the expected distribution of GDP growth, we estimate the effects of tail risk shocks on investment. Another important related paper is Forni et al (2021) whose approach and objective is similar. Our paper differs as we apply our analysis on a panel of advanced economies and not simply on the US. In contrast to Forni et al (2021), we focus on disaster risk rather than downside and upside risk.

The remainder of the paper is organized as follows. Section 2 reviews the existing proxies of uncertainty. Section 3 presents our tail risk proxy. Section 4 describes our econometric strategy and discusses our results. Section 5 draws some concluding remarks.

2. Proxies for uncertainty

An important number of the proxies for uncertainty that have been developed in recent years are volatility-based[26]. Those volatility-based proxies can be grouped into five groups, depending on the way they are constructed or on the type of data they rely on. First, implied or realized stock market volatility (financial data more generally) has been the most commonly used proxy by scholars as financial markets are generally assumed to integrate expectations about future macroeconomic developments (see Bloom 2009). Still, those proxies are broadly imperfect as market volatility can be related to changes in risk-aversion or sentiments rather

[25] For a dissenting view, see Plagborg-Moller et al. (2020).

[26] Newspaper-based indices have also been constructed to proxy for uncertainty (Bloom 2019 and Baker et al 2013 and 2016 on economic policy uncertainty, see also the geopolitical risk index constructed by Caldara and Iacovello 2018). These indices are based on the frequency of articles referring to economic policy uncertainty or geopolitical risk.

than to changes in uncertainty. In addition, financial markets' perception of uncertainty may be different from that of businesses and consumers.

Second, uncertainty has also been proxied through the cross-sectional dispersion of micro-level data such as profits, returns or productivity across firms or industries (Bloom et al 2012). More micro-dispersion will reflect more uncertainty because firms with different forecasts will make different decisions which in turn will lead to different outcomes. Survey-derived cross-sectional businesses and consumers' expectations over the future is another similar uncertainty proxy (Bachmann et al 2013). The idea is that economic agents will have (dis)similar expectations in periods of low (high) uncertainty as future developments will be more (less) predictable. Heterogeneity is the main shortcoming of these proxies though: rising dispersion might reflect idiosyncratic firms' business activity or different prospects across the different sectors of the economy. Disagreement rather than uncertainty may also be an important factor in changes in survey-derived expectations' dispersion (see Girardi and Reuter 2017 for an attempt to disentangle between heterogeneity, disagreement and uncertainty using survey data dispersion).

Third, disagreement among professional forecasters as measured by the cross-sectional point forecasts' variance has been used another proxy for uncertainty (Abel et al 2016). Indeed, disagreement among forecasters would suggest that it is becoming more difficult to predict future economic developments because of the prevalent degree of uncertainty. However, disagreement may simply reflect differences in the underlying models used by the forecasters or different information sets and not heightened uncertainty for that matter.

Fourth, realized forecast errors have been used to proxy for uncertainty. Jurado et al (2015, JLN hereafter) compute the conditional volatility of the unforecastable component of the future value of a very large range of variables and aggregate those individual volatilities into a single index. They thus create "objective" or model-based forecasts using a very large factor model. However, this approach implies that economic agents know perfectly the distribution of future shocks. Jo and Sekkel (2019) somewhat lessen this problem by resorting to subjective forecasts from the Survey of Professional Forecasters (SPF). They define macroeconomic uncertainty as the conditional time-varying standard deviation of a factor that is common to the forecast errors for various macroeconomic indicators from the SPF[27].

[27] Alternatively, Scotti's (2016) uncertainty index is the weighted sum of the squared forecast errors, computed as the difference between the realized outcome and forecasts obtained from Bloomberg surveys.

Finally, several papers have relied on the density distribution of forecasts provided by the SPF to compute volatility-based proxies. Abel et al (2016) have constructed two proxies for *ex ante* uncertainty, namely the average variance and the median interquartile range of individual density forecasts. Rossi et al (2020) and Soupre (2018) show that *ex ante* uncertainty is a function of the variance of the aggregate forecast density distribution (which is the average of the individual forecast density distributions). However, their decomposition relies on the assumption of the normality of forecasts. More generally, there is another problem when using the SPF's forecast density distributions since the probability ranges defined in the SPF truncate extreme events and thus do not pay enough attention to tail risk. As a consequence, they reproduce very partial probability density functions.

While there are specific problems attached to each of these proxies, there is a more fundamental issue with volatility-based proxies. By relying on the standard-deviation of some exogenous aggregates or idiosyncratic variables, they discount the risks coming from the tails of the distribution, thus potentially missing an important driver of uncertainty. Standard deviation is indeed a relevant moment if the probability density function of shocks is Gaussian since 95% of the data would fall within two standard deviations around the mean. But looking at the standard deviation (and the mean) of a probability distribution provides very few information about the shape (and the tails) of the density distribution if this distribution is non-normal. In addition, volatility-based proxies are symmetric and an increase in uncertainty may thus only poorly inform about downside risk.

As a matter of fact, several scholars have used full density functions to proxy uncertainty. Following Adrian et al's (2019) work on expected distribution of GDP growth, Forni et al (2021) compute downside uncertainty as the difference between the median and the 10th percentile, upside uncertainty as the difference between the 90th percentile and the median, and total uncertainty as the sum of the two. Using forecast errors, Rossi and Sekhposyan (2015) have constructed a proxy that is the unconditional cumulative distribution function of observed forecast errors from the SPF. If an observed forecast error falls into an extreme percentile of the distribution, then uncertainty is deemed to be higher. They also distinguish between upside and downside uncertainty[28].

[28] See also Ferreira (2018) who proxies uncertainty as financial skewness by comparing the cross-sectional upside and downside risks of the distribution of stock market returns of financial firms; or Salgado et al (2019) who proxy uncertainty as the realized cross-sectional skewness of firm-level employment, sales and productivity.

Some other authors have focused on disaster risk, i.e. the risk of extreme left tail events. This risk is generally calibrated following Barro (2006) and Barro and Ursua (2008). In Barro (2006), the probability and size distribution of disaster events was gauged from time series on real per capita GDP for 35 countries for the full twentieth century and where a macroeconomic disaster is defined as a decline in real per capita GDP by at least 15 percent over consecutive years. Barro and Ursua (2008) update Barro's (2006) approach by correcting errors and filling in gaps in Maddison's GDP data, as well as construct an analogous data set of consumption declines for 21 countries for which they had consistent data. Two limitations of this approach are that it assumes that that the underlying probability distributions are reasonably similar across countries, as well as roughly stable over time (Barro 2009). In the next section, we will present the so-called Growth-at-Risk approach developed by Adrian et (2018) that allows to construct time-varying and country-specific disaster risk proxies in a rather parsimonious way.

3. Measuring disaster risk

3.1. Defining disaster risk

Before describing how we compute our disaster risk proxy, let us first define more formally what we mean by disaster risk. In line with Orlik and Veldkamp (2014), we define disaster risk as the probability of occurrence of an extreme left tail event. Disaster risk is the conditional probability of the annualized average growth rate of GDP between t and $t + h$, y_{t+h}, falling more than a certain threshold x_i

$$DisasterRisk_{t+h} = \Pr(y_{t+h} \leq x_i|\mathcal{L}_t) = F_{y_{t+h}}(x_i) = \int_{-\infty}^{x_i} f_{y_{t+h}}(x_i)dx_i$$

Following Orlik and Veldkamp (2014), we set $x_i = \mu_i - 4.2\sigma_i$ where μ_i and σ_i are respectively the realized mean and standard deviation of annualized quarterly GDP growth compute from 1972Q1 to 2019Q3 (1992Q1 to 2019Q3 for Germany). If the annualized average growth rate of GDP between t and $t + h$, y_{t+h}, were normally distributed, $\Pr(y_{t+h} \leq x_i|\mathcal{L}_t)$ would represent a 1-in-100 year event.

3.2. Computing a disaster risk proxy

To operationalise our disaster risk proxy, we rely on the Growth-at-Risk (GaR) methodology (see Adrian et al 2019) which is a relatively easy and parsimonious way to fit expected conditional density functions of future GDP growth. We focus on real GDP growth since changes in GDP are indicative of the state of the business cycle and as such inform macroeconomic uncertainty (Stock and Watson 1998, Soupre 2018, Rossi and Sekhposyan 2015).

The GaR approach has two steps. The first step is to estimate the quantile function of future GDP growth[29]. Quantile regressions are thus estimated across different quantiles of the distribution (every 5 quantiles from the 5th to 95th quantiles) and over two horizons h, respectively one-quarter and one-year ahead. The quantile regression takes the following specification

$$y_{\tau,t+h} = \alpha_\tau + \beta_{\tau,FCI} X_{FCI,t} + \beta_{\tau,G} X_{G,t} + \varepsilon_{t+h}$$

where y_{t+h} is the annualized average growth rate of GDP between t and $t + h$, $X_{FCI,t}$ and $X_{G,t}$, represent the financial conditions index (FCI), current quarterly annualised real GDP growth (as a control), respectively[30]. The estimated coefficients β_τ measure the respective effect of the different regressors at quantile τ and for the different forecasting horizons. The quantile function is defined as

$$\hat{Q}_{y_{t+h}|x_t}(\tau|x_t) = x_t \hat{\beta}_\tau$$

with x_t denoting the vector of conditioning variables and $\hat{\beta}_\tau$ the quantile τ specific matrix of estimated coefficients.

As a second step, the quantile function $\hat{Q}_{y_{t+h}|x_t}$ is smoothed to recover a full probability density function by fitting the skewed t-distribution developed by Azzalini and Capitanio (2003). The parameters – mean μ, volatility σ, skewness θ, and kurtosis ν – of the skewed t-distribution are chosen so that they minimize the squared loss between the estimated quantile function and the inverse of the cumulative distribution function of the skewed t-distribution for the 5th, 25th, 75th and 95th quantiles

[29] Adrian et al's (2019) replication code is available here https://www.openicpsr.org/openicpsr/project/113169/version/V1/view?path=/openicpsr/113169/fcr:versions/V1

[30] See Appendix A for a description of how FCIs are constructed.

$$\{\hat{\mu}_{t+h}, \hat{\sigma}_{t+h}, \hat{\theta}_{t+h}, \hat{\nu}_{t+h}\} = \underset{\mu,\sigma,\theta,\nu}{\operatorname{argmin}} \sum_{\tau} \left(\hat{Q}_{y_{t+h}|x_t,\tau} - F_{\tau}^{-1}(\mu, \sigma, \theta, \nu)\right)^2.$$

The conditional probability density function $\hat{f}_{t+h}$ is eventually recovered by shaping the probability density function of the skewed t-distribution, $t(.)$, by its cumulative distribution function, $T(.)$, and the skewness parameter, θ

$$\hat{f}_{t+h}(y;\ \hat{\mu}, \hat{\sigma}, \hat{\theta}, \hat{\nu}) = \frac{2}{\hat{\sigma}} t\left(\frac{y-\hat{\mu}}{\hat{\sigma}}; \nu\right) T\left(\hat{\theta}\frac{y-\hat{\mu}}{\hat{\sigma}}\sqrt{\frac{\hat{\nu}+1}{\hat{\nu}+\left(\frac{y-\hat{\mu}}{\hat{\sigma}}\right)^2}}; \nu+1\right).$$

Using this approach, we construct disaster risk proxies for 12 advanced economies at the one-quarter and one-year horizon from 1972Q1 to 2019Q3 (from 1992Q1 to 2019Q3 for Germany).

Figures 1a and 1b report the evolution of the one-quarter and one-year ahead country-specific disaster risk proxies. First, beyond the country-specific factors behind the fluctuations in disaster risk, we generally identify a peak around 2008, around the Lehman bankruptcy. For Eurozone countries, like Spain, France or Italy, we also identify another peak around the Eurozone crisis. Second, disaster risk at the one-year ahead horizon displays much more variability than disaster risk at the one-quarter ahead horizon. These spikes in disaster risk are the consequences of financial stress increasing by end-2008 as well as fall in output that enters the regression with a lag, thereby fanning out the expected conditional density distribution of GDP growth around that time.

In figure 2, we compare our disaster risk proxies with realized stock volatility, a commonly used proxy for uncertainty. For that matter, our disaster risk proxies identify periods of high uncertainty that are different from stock volatility. Notice that the uncertainty peak of 2008 is generally higher for our disaster risk proxy than for stock volatility.

Figure 1a. One-Quarter Ahead Disaster Risk (%)

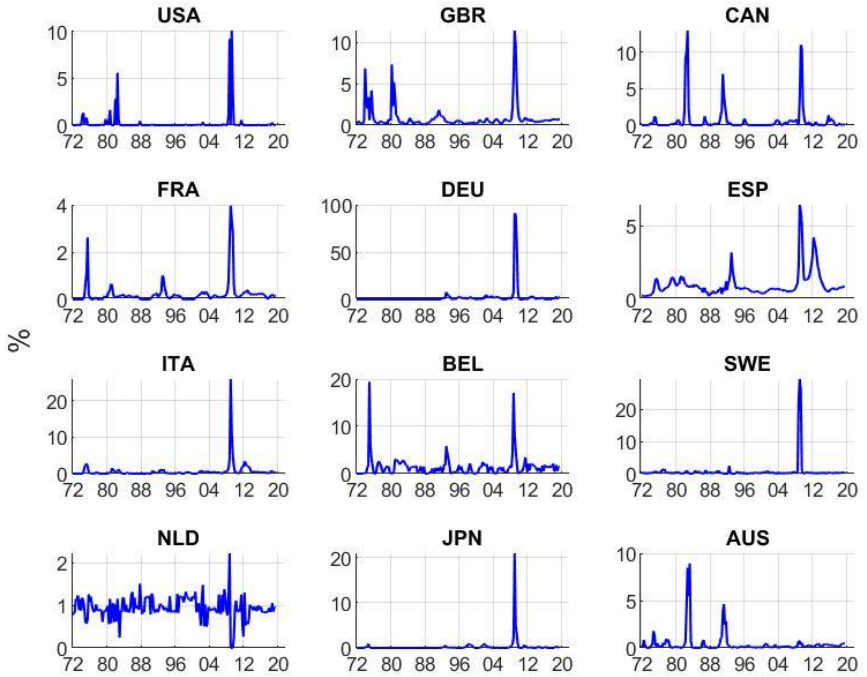


Figure 1b. One-Year Ahead Disaster Risk

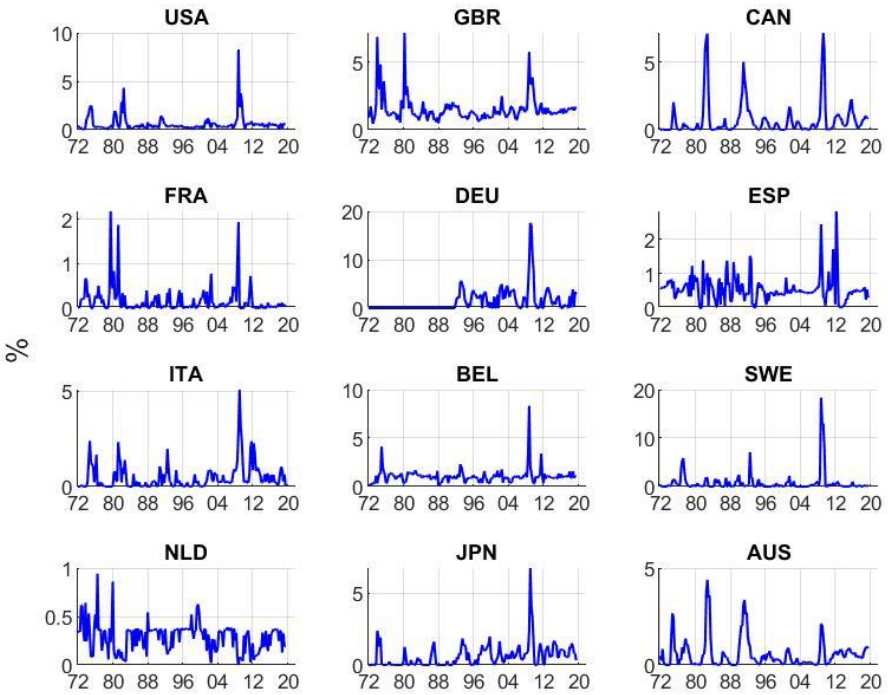
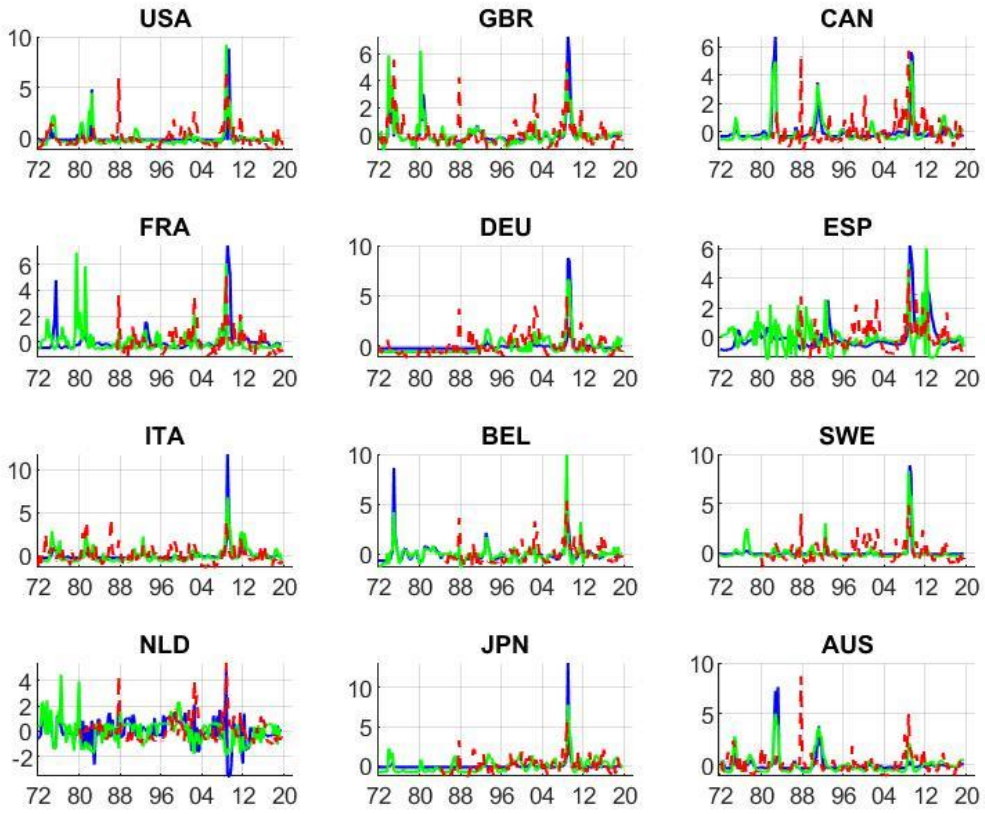


Figure 2. Disaster Risk and Realized Stock Volatility



Notes: The blue (green) solid line plots the one-quarter (one-year) ahead disaster risk proxy; the red dashed line plots realized stock volatility. Series are standardized.

Notice that our proxy is constructed in an *ex post* manner since we are using final data to construct them. We do so for a very practical reason, namely data availability. Proxying disaster risk in real time would require vintages for all the time series that are required to construct the proxies. This data may exist for some countries and/or for some time series but not for all. As a consequence, using real-time proxies for tail risk would restrict the scope of our analysis. Our proxy is also *objective* because we use actual GDP data and not forecast surveys or businesses and consumers' expectations surveys.

4. The Macroeconomic Effects of Disaster Risk Shocks

In this section, we estimate the macroeconomic effects of disaster risk shocks. We estimate a k-variate panel $VAR(p)$ model using quarterly data over the largest period for which there is available data for each proxy[31]. At time t, the estimator is the following pooled estimator for N countries

$$\begin{pmatrix} y_{1,t} \\ y_{2,t} \\ \vdots \\ y_{N,t} \end{pmatrix} = \begin{pmatrix} A^1 & 0 & \cdots & 0 \\ 0 & A^1 & \cdots & 0 \\ \vdots & \vdots & \ddots & \vdots \\ 0 & 0 & \cdots & A^1 \end{pmatrix} \begin{pmatrix} y_{1,t-1} \\ y_{2,t-1} \\ \vdots \\ y_{N,t-1} \end{pmatrix} + \cdots$$

$$+ \begin{pmatrix} A^p & 0 & \cdots & 0 \\ 0 & A^p & \cdots & 0 \\ \vdots & \vdots & \ddots & \vdots \\ 0 & 0 & \cdots & A^p \end{pmatrix} \begin{pmatrix} y_{1,t-p} \\ y_{2,t-p} \\ \vdots \\ y_{N,t-p} \end{pmatrix} + \begin{pmatrix} C \\ C \\ \vdots \\ C \end{pmatrix} x_t + \begin{pmatrix} \varepsilon_{1,t} \\ \varepsilon_{2,t} \\ \vdots \\ \varepsilon_{N,t} \end{pmatrix}$$

and the variance-covariance matrix is given by $\Sigma_t = \begin{pmatrix} \Sigma_c & 0 & \cdots & 0 \\ 0 & \Sigma_c & \cdots & 0 \\ \vdots & \vdots & \ddots & \vdots \\ 0 & 0 & \cdots & \Sigma_c \end{pmatrix} = \Sigma_c \otimes I_N$, Σ_c being time invariant and common to all units. Taking the transposes and stacking over the time T periods, we can rewrite the panel VAR in the following compact form

$$\begin{pmatrix} Y_1 \\ Y_2 \\ \vdots \\ Y_T \end{pmatrix} = \begin{pmatrix} X_1 \\ X_2 \\ \vdots \\ X_T \end{pmatrix} B + \begin{pmatrix} \mathcal{E}_1 \\ \mathcal{E}_2 \\ \vdots \\ \mathcal{E}_T \end{pmatrix}$$

with $Y_t = \begin{pmatrix} y'_{1,t} \\ y'_{2,t} \\ \vdots \\ y'_{N,t} \end{pmatrix}$ $X_t = \begin{pmatrix} y'_{1,t-1} & \cdots & y'_{1,t-p} & x'_t \\ y'_{2,t-1} & \cdots & y'_{2,t-p} & x'_t \\ \vdots & \ddots & \vdots & \vdots \\ y'_{N,t-1} & \cdots & y'_{N,t-p} & x'_t \end{pmatrix}$ $B = \begin{pmatrix} (A^1)' \\ \vdots \\ (A^p)' \\ C' \end{pmatrix}$ $\mathcal{E}_t = \begin{pmatrix} \varepsilon'_{1,t} \\ \varepsilon'_{2,t} \\ \vdots \\ \varepsilon'_{N,t} \end{pmatrix}$

and $\mathcal{E} \sim N(0, \bar{\Sigma})$ with $\bar{\Sigma} = \Sigma_c \otimes I_{NT}$.

We estimate this model for $N = 12$ countries, namely Australia, Belgium, Canada, France, Germany, Italy, Japan, the Netherlands, Spain, Sweden, the United Kingdom and the United States and from 1997Q1 to 2019Q3 because of data availability constraints. In the existing uncertainty literature, VAR models are generally performed at a monthly frequency and include 12 lags. Since we are using quarterly data, we have decided to use 4 lags. In addition, the panel VAR is estimated using Bayesian methods in order to avoid overfitting

[31] We use the BEAR toolbox developed by Legrand, Dieppe and van Roye (2018) to run our VAR models. For more information about the specific formulation of the VAR models, please refer to the BEAR's technical guide.

because of the rather short time series we use. Specifically, a traditional normal-Wishart identification strategy is adopted. The prior for β is assumed to be multivariate normal while Σ_c has an inverse Wishart distribution with scale S_0 and degrees of freedom α_0

$$\beta \sim \mathcal{N}(\beta_0, \Sigma_c \otimes \Phi_0)$$

$$\Sigma_c \sim IW(S_0, \alpha_0)$$

For β_0, a conventional Minnesota scheme is adopted, setting values around 1 for own first lag coefficients, and 0 for cross variable and exogenous coefficients. Φ_0 is a $(p \times p)$ diagonal matrix defined with two different types of variance terms on its main diagonal. For lag terms (both own and cross-lags), the variance is defined as

$$\sigma_{a_{ij}}^2 = \left(\frac{1}{\sigma_j^2}\right)\left(\frac{\lambda_1}{l^{\lambda_3}}\right)^2$$

where σ_j^2 is the unknown residual variance for variable j in the panel Bayesian VAR model. σ_j^2 is estimated by pooling the samples for variable j over units $1, 2, \ldots, N$ and then estimating an autoregressive model over this pooled series. For exogenous variables (the constants and trends), the variance is defined as

$$\sigma_c^2 = (\lambda_1 \lambda_4)^2$$

The value of the hyperparameters λ_1 to λ_4 are set in accordance with standard values commonly used in the literature[32]. Furthermore, a Gibbs sampling approach is employed to generate draws of β and Σ_c from their respective marginal posterior distribution. We collect 5000 draws by storing every 10th draw to avoid potential autocorrelation across draws, after discarding the first 10,000 draws of parameters[33].

In the existing literature on the macroeconomic effects of uncertainty, two Cholesky decompositions are generally used, that of Bloom (2009) and that of Jurado et al (2015). In Bloom (2009), stock prices are ordered first, followed by the proxy for uncertainty, then by prices (interest rates and consumer prices) and quantities (employment and investment). This decomposition gives some puzzling assumptions. For instance, inflation can react

[32] $\lambda_1 = 0.1$; $\lambda_2 = 0.5$; $\lambda_3 = 1$; $\lambda_4 = 100$

[33] For more information about the specifics of the Bayesian methods used in this paper, please refer to the BEAR's technical guide.

instantaneously to a rate hike, at a monthly frequency while stock prices cannot react instantaneously to any other shocks.

In Jurado et al (2015), investment is ordered first, followed by employment and consumption, then by prices, wages and interest rates, and finally by stocks, the growth rate of M2 and the proxy for uncertainty. Here, the structural identification goes from slow- to fast-moving variables with the assumption that slow-moving variables should not be responding contemporaneously to shocks on fast-moving variables. But as for Bloom's (2009) decomposition, there are some inconsistent theoretical assumptions here again. For instance, stock prices cannot react instantaneously to uncertainty shocks. Or inflation reacts instantaneously to an investment or an employment shock despite evidence that prices are sticky in practice. Again, this assumption is all the more puzzling since the decomposition is originally sets up with monthly data.

To take those limitations into account, we thus adopt the following two Cholesky decompositions

(VAR-8)
$$\begin{bmatrix} \text{CPI} \\ \text{DisasterRisk}_{t+h} \\ \text{Investment} \\ \text{Employment} \\ \text{Wage} \\ \text{Hours} \\ \text{SSR} \\ \text{Stocks} \end{bmatrix}$$

(Inverse VAR-8)
$$\begin{bmatrix} \text{CPI} \\ \text{Investment} \\ \text{Employment} \\ \text{Wage} \\ \text{Hours} \\ \text{SSR} \\ \text{DisasterRisk}_{t+h} \\ \text{Stocks} \end{bmatrix}$$

Where CPI is the log of the consumer price index, $DisasterRisk$ is our disaster risk proxy (see section 3), $Investment$ is the log of the gross fixed capital formation excluding construction, $Employment$ is the log of total employment, *Wage* is the log of total wage, *Hours*

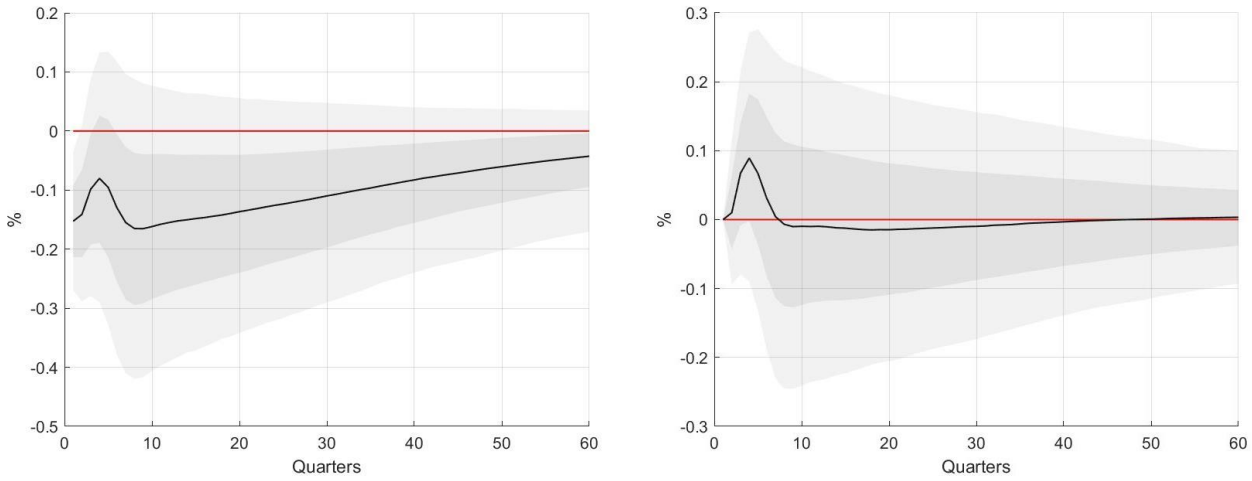
is the log of total hours worked per worker, SSR is the shadow short rate[34] and $Stocks$ is the log of stock prices, in addition to a deterministic trend and a constant.

Both specifications share three main assumptions. The first assumption is that macroeconomic variables should not react contemporaneously to monetary shocks in line with Christiano, Eichenbaum and Evans (2005). The second assumption is that inflation should never react contemporaneously to a shock, because of the common empirical evidence of nominal rigidities. The third assumption is that stock prices should always react contemporaneously to a shock. But the two decompositions differ with regard to the ordering of the disaster risk proxies. At a quarterly frequency, it is plausible that macroeconomic variables may not contemporaneously to uncertainty shocks. In the baseline specification, the VAR-8 model, we assume that uncertainty shocks affect instantaneously macroeconomic variables (except inflation) and policy variables. Still, ordering the proxy for uncertainty in the second place implies that uncertainty reacts instantaneously to an inflation shock but reacts only with a lag to other macroeconomic variables. This is a debatable assumption that we therefore release in the inverse VAR-8 specification by placing the proxy for uncertainty just before stock prices.

Figures 4a and 4b show the dynamic responses of investment to disaster risk shocks in respectively the VAR-8 and inverse VAR-8 models, using our panel of 12 advanced economies from 1997Q1 to 2019Q3. Figures 4a and 4b report the median impulse responses of investment to a one point of percentage increase in disaster risk as well as the 68 and 95 percent credibility intervals for both specifications. Our results suggest that disaster risk shocks have significant negative effects on investment under the VAR-8 specification with one-year ahead shocks having more and longer impact, up to 1.5%, than one-quarter ahead shocks. Under the inverse VAR-8 model, the effect is no more significant for both horizons, even at the 68% credibility level.

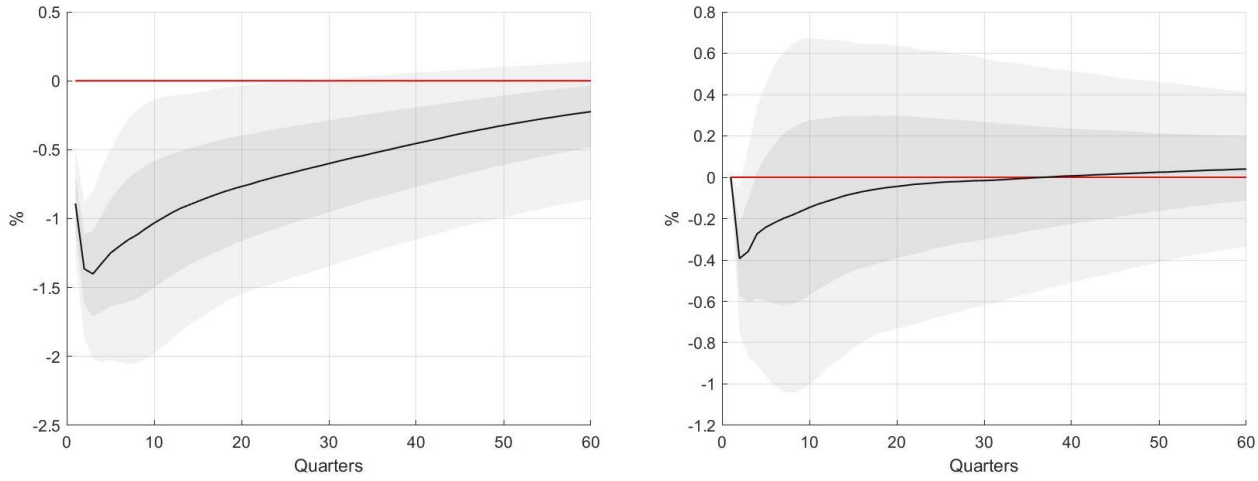
[34] Following Krippner (2013), the shadow short rate (SSR) seeks to measure the accommodation in monetary policy when the short rate is at the zero lower bound (ZLB). For Sweden, we use the main policy rate.

Figure 3a. IRFs of Investment to one-quarter ahead Disaster Risk Shocks



Notes: the chart plots the median response of investment to a one unit impulse on disaster risk. The dark and light shaded areas indicate the 68% and 95% posterior probability regions, respectively. The left (right) panel plots the IRF of investment under the (inverse) VAR-8 specification.

Figure 3b. IRFs of Investment to one-year ahead Disaster Risk shocks

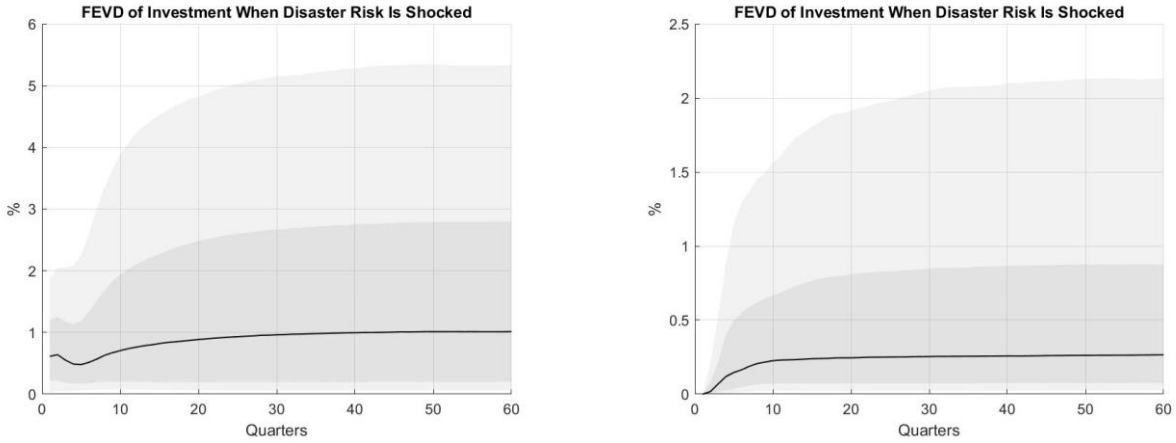


Notes: the chart plots the median response of investment to a one unit impulse on disaster risk. The dark and light shaded areas indicate the 68% and 95% posterior probability regions, respectively. The left (right) panel plots the IRF of investment under the (inverse) VAR-8 specification.

We also report the economic importance of disaster risk shocks in figure 4a and 4b. The solid lines show the amount of variation in the forecast error variance in investment that is

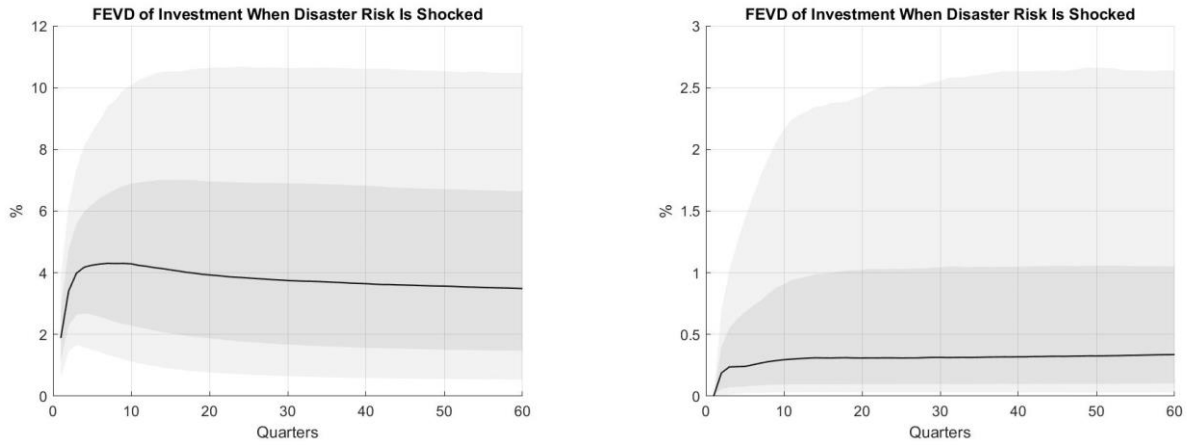
attributable to disaster risk under the VAR-8 and inverse VAR-8 model for both horizons. Disaster risk shocks explain a larger part of fluctuations in investment under the VAR-8 model with one-year ahead disaster risk shocks having more quantitative impact the one-quarter ahead risk shocks.

Figure 4a. Forecast Error Variance Decomposition of one-quarter ahead Disaster Risk shocks



Notes: The black solid lines plot the respective median estimate of the portion of the forecast error variance of investment at that is attributable to a 1 unit shock on disaster risk. The dark and light shaded areas indicate the 68% and 95% posterior probability regions, respectively. The left (right) panel plots the FEVD of investment under the (inverse) VAR-8 specification.

Figure 4b. Forecast Error Variance Decomposition of one-year ahead Disaster Risk shocks



Notes: The black solid lines plot the respective median estimate of the portion of the forecast error variance of investment at that is attributable to a 1 unit shock on disaster risk. The dark and light shaded areas indicate the 68% and 95% posterior probability regions, respectively. The left (right) panel plots the FEVD of investment under the (inverse) VAR-8 specification.

5. Concluding remarks

The aim of this paper is to explain why investment in advanced economies has taken so long to recover from the Great Recession and Eurozone crisis. By focusing on uncertainty, we have taken the footsteps of an important number of scholars who have identified uncertainty as a relevant factor behind economic slump. However, unlike many, we have created a new proxy for uncertainty by relying on disaster risk rather than on a volatility. Indeed, volatility-based proxies may fail to account an important source of uncertainty coming from the tails of a distribution since volatility is appropriate to describe the distribution of a variable only if that variable is normally distributed.

To compute our proxy for disaster risk, we have thus relied on the novel GaR approach of Adrian et al (2019) that links financial conditions to macroeconomic fragility. Our proxy identify periods of high uncertainty that are different from realized stock volatility. We find that one-year ahead disaster risk shocks have more impact on investment than one-quarter ahead shocks. However, the results are not conclusive since the degree of significance depends on the way the empirical model is specified.

Still, the methodology proposed here can be seen as a first step in evaluating the effect of time-varying country-specific disaster risk. It can be used in other applications and with other purposes. In addition, it is necessary to think more thoroughly about the features that a good (but imperfect) proxy for uncertainty should have. Should it be based on a subjective indicator, be forward-looking, constructed in real-time? In any case, this methodology has the advantage of being extremely flexible and could be used to create alternative proxies for uncertainty.

Conclusion

The overarching objective of this thesis was to provide a comprehensive understanding of the Eurozone crisis: how from a political crisis, the Eurozone experienced both a financial and an economic crises? We have argued that the economic conditions inherited from the 2000s has greatly influenced the political conflict between Eurozone member states. We have also demonstrated that uncertainty was a potential channel of transmission that allowed the political crisis to evolve into a financial and an economic crises.

In this final chapter, we aim at summarising our main findings, highlight the main contributions as well as limitations of our dissertation. Finally, we outline some avenues for further research.

1. Summary and contribution of the dissertation

The first paper studies the political dimension of the crisis and in particular how the division between debtor and creditor countries has influenced the political conflict. We focus on the Greek crisis and in particular on the negotiations over the third Greek bailout. We challenge the mainstream understanding of the negotiations as predictable or unsurprising and doomed to be won by the Europeans. We argue that outside options, domestic constraints and formal voting rules have played, by themselves, only a minor role. On the contrary, we show that double-sided incomplete information is necessary to explain both the outcome and dynamics of the negotiations. To make our case, we create a two-player game-theoretical dynamic model integrating three main features of the negotiations, namely the shadow of default, the presence of double-sided incomplete information and the exchange of costly signals with a time limit in the negotiations. In the game, the two players, the Europeans and the Greeks, exchange signals over their willingness to run the risk of a Graccident. All in all, our theoretical game suggests the outcome of the negotiations is hard to predict. This is the one of the main lessons of our game. In addition, following the logic the model, we argue that Greece could have increased its chance of getting a better deal by being more aggressive.

The second paper investigates the feedback effect of political uncertainty on financial markets. We have thus constructed a comprehensive new dataset that covers most policy developments during the Greek and Eurozone crisis. We have relied on the Reuters Factiva

database and complemented it with Eurointelligence daily reports, in order not to miss any relevant piece of news. One of the features of our dataset is that it tries to deal with some of the limitations that have been highlighted in the literature about the endogeneity and credibility of political communication. To minimise the potential endogeneity of political statements, we identify and exclude those statements that we suspect were made firstly as reaction to market swings and that have only limited informational content. For the credibility issue, we have excluded political assurances especially those from Greek policy-makers. After this cleaning phase, we thus end up with a dataset of more than 5800 new items. Each piece of news has then been coded manually along different dimensions: positive vs negative, Greek-specific vs Eurozone wide. These categories are quite common. Our dataset differs from other dataset insofar as we differentiate between soft and hard news, the former being simply pieces of news informing about future policy while the latter are actual policy decisions and other events. These categories in turn allowed us to determine whether the hard news were expected or not, using previous soft news to determine anticipations. To assess the effect of political uncertainty on Greek sovereign spreads, we rely on Exponential GARCH(1,1) models that correct for serial correlation, skewness, and time-varying volatility of the data. In terms of research design, we have no prior testable theoretical predictions because the theoretical literature on the effect political uncertainty on financial markets is quite limited. We rather use the information embedded in our dataset to answer several questions. Our main result is that financial markets did react extremely strongly to unexpected positive decisions and events. Unexpected positive news have more impact in absolute terms than unexpected negative news. Our results are also consistent with the asymmetric effect of news commonly reported in the existing literature as financial markets were sensitive to negative news as a whole (decisions, events and political communication). The daily number of Greek-specific negative developments (excluding decisions and events) has widened Greek spreads as well while we find no such effect for positive developments.

The third and final paper estimates the macroeconomic effects of uncertainty. It tries to explain the slow recovery of investment in Eurozone countries and beyond. As such, it investigates the real effect of political and financial developments. Numerous proxies for uncertainty have been developed following the Great Recession precisely to explain the protracted slump in investment in advanced economies. Many of them have been constructed as volatility-based indicators. Since those proxies may discount uncertainty from the distribution's tails, we therefore compute a new disaster risk proxy defined as the cumulative

probability of GDP falling behind a certain threshold building on the novel GaR approach developed by Adrian et al (2019). The GaR methodology is a relatively parsimonious way to compute conditional density functions as it requires only two steps. First, we estimate the quantile function of future GDP growth with quantile regressions. Second, we smooth the quantile function to recover a full probability density function by fitting the skewed t-distribution. We apply this approach to obtain one-quarter and one-year ahead proxies for 12 advanced economies that identify periods of acute uncertainty that are quite different from stock volatility, a common proxy for uncertainty. We then estimate the macroeconomic effects of disaster risk shocks using Bayesian panel structural VAR models with structural shocks being identified through two Cholesky decompositions. We find no conclusive evidence on the effect of disaster risk on investment.

2. Implications of this dissertation

This dissertation has several implications. While the model developed in paper 1 may not be generalizable as it is, it nevertheless demonstrates that informational asymmetries do play an important role in negotiations. And this has implications for the scholarly work on intergovernmental bargaining in the EU (Schneider and Cederman 1994, Hug and König 2002, König and Slapin 2006, Thomson et al. 2006, Slapin 2008 and 2011, Finke et al 2012, Wasserfallen et al 2019) and in particular for Liberal Intergovernmentalism (Moravcsik 1998, Schimmelfennig 2015, LI hereafter). Indeed, for Moravcsik (1998), informational asymmetries do not play a central role in interstate negotiations because states are the main beneficiaries of integration and as such have incentives in sharing information: transaction costs for generating information are low compared to the benefits of interstate cooperation. For him, asymmetrical interdependence on its own explains most of the distribution of gains from cooperation. However, and possibly because Moravcsik (1998) wanted to substantially demark himself from supranational theory in which supranational entrepreneurs affect bargaining outcomes precisely through their privileged access to information (see also Thomson et al 2006), he might have discounted the strategic use of information altogether. He might have made this assumption also because LI was developed at a time where European integration was mainly about market integration. In that context, distributive conflicts were thus relatively limited. At least, disagreement over market integration can be settled on the basis of the largest common multiple as argued by Genschel and Jachtenfuchs (2017). As a consequence, LI develops a power-based

analysis of interstate negotiations where information asymmetry does not affect bargaining power. It is simply the state that has more to lose from non-cooperation that has less bargaining power.

This understanding of interstate bargaining is different though from Rational Choice Institutionalism (RCI) where information is an important determinant of bargaining power (Schneider and Ershova 2018). For instance, Schneider and Cederman (1994) show that informational asymmetries significantly may affect a stakeholder's bargaining power (see also Iida 1993). Still, when informational asymmetries have been used by scholars, they have generally done so in two-level game frameworks and have focused on the ratification process (Hug and Schulz 2007, Walter et al 2016, Pahre 2006).

Our paper though is much more focused on the effect of informational asymmetries on the "exit game" to use the words of Schneider and Cederman (1994). As far as the international dimension of bargaining is concerned, the role of informational asymmetries has been under researched as the preferences of negotiators have generally been assumed to be sincere in EU studies. This is the case for instance in the special issue edited by Wasserfallen et al (2019) which studies, among other things, interstate bargaining during the Eurozone crisis. In addition to Moravcsik (1998), Bailer (2004 and 2011) explain that EU actors usually hold sincere preferences because of the nature of the EU as a forum for policy-makers. Studying Council of Ministers negotiations, she shows that for day-to-day legislative procedure, "the shadow of the future" induces ministers to hold sincere preferences, much like in a repeated game framework. Frequent interactions within the EU institutional framework thus make exchanges of information more efficient and limit extreme position-taking. On the contrary, exceptional bargains, i.e. when salience is high, are more likely to exhibit strategic moves.

Yet, this finding (or assumption) may not hold anymore and will hold less and less in the future. Genschel and Jachtenfuchs (2013) have indeed showed that European integration has reached core state powers, in particular since the Eurozone crisis. And as integration proceeds within core state powers, distributive conflicts become more likely and more acute. But unlike with market integration, disagreement cannot always be easily settled. This is all the more true for the Eurozone as the Eurozone crisis has demonstrated that risk-sharing mechanisms are necessary for the single currency to properly function (Schelkle 2017). And the elaboration of risk-sharing mechanisms requires to determine who pays and who benefits from the joint resources.

For that matter, distributive conflicts, and even if states have an interest in reaping mutual gains from cooperation, may induce them to use information strategically in order to

manipulate their counterparts' perception of the asymmetric interdependence relationship and thus obtain a larger (lower) share of the distributional gains (losses) (see Fearon 1995). Indeed, in distributive conflicts, as opposed to integrative ones, information is generally seen as a first-order strategic asset in the hands of the negotiators in order to move the negotiations to their own advantage. However, existing analyses of the politics of the crisis have hardly studied the role of information asymmetry beyond the very few papers that we have mentioned in paper 1. This paper thus try to fill this gap. What is more, we also show that the use of double-sided incomplete information does not lead to over-complex models and as such it should induce scholars to generalise its use when necessary.

The second paper contributes to the existing literature on the effect of news on financial markets in methodological, conceptual and empirical terms. Methodologically, our paper tries to address some of the main limitations of existing news datasets that may undermine the reliability of the econometric results, in particular the problem of endogeneity of political communication. This is a problem that has been identified by many authors (see *inter alia* Blinder et al 2008, Ehrmann et al 2013, Büchel 2013, Collignon et al 2013) but that has not been systematically treated. And when authors have done it, they have generally used statistical fixes by choosing dependent variables that would have been more immune to endogeneity that others (see Erhmann et al 2013 for instance) or by resorting to Granger causality tests (see Collignon et al 2013). On the contrary, we have tried to think of endogeneity in more conceptual terms by arguing that the endogeneity problem may come down to an informational content problem. In addition to this endogeneity problem, existing papers can also be quite opaque over the way news datasets are constructed: news datasets are often "black boxes." This may undermine the confidence one may have in the results. This is why we have been extremely clear, transparent and exhaustive about what is inside our dataset and how we have coded news.

Our main conceptual contribution in the paper rests on the difference that we make between expected and unexpected news. According to the efficient market hypothesis, a piece of news that has been expected by financial market is no news and should not affect the markets. Still, very few papers have tried to test this prediction and identify news that were expected and those that were unexpected (Kim and Willett 2004 for a wide range of news types, Kim et al 2004 for scheduled announcements), beyond macroeconomic news releases that is (see Caporale et al 2018). As far as the Eurozone crisis is concerned, we are not aware of any paper that has done it (Bird Du and Willett 2017 have attempted to do it but have not published their results).

This coding refinement has important empirical consequences that affect the analysis of the financial markets' behaviour during the crisis. By differentiating between expected and unexpected news, we find that financial markets did react to positive news, when they were unexpected. Our results are also consistent with the asymmetric effect of news commonly reported in the existing literature. Büchel (2013), Haupenthal and Neuenkirch (2017), Bird Du and Willett (2017), Conrad and Zumbach (2016) find such an effect during the Eurozone crisis period when differentiating between positive and negative news.

Still, this implies that the existing interpretations of a negative bias in the markets is not entirely warranted. If we solely identify the asymmetric effect of news on markets, that may be consequence of confirmation bias or loss aversion, whatever European policy-makers might have done to solve the crisis would never have been sufficient. Since the negative bias of financial markets somewhat disempowers policy-makers, the same policy-makers can rightly shift the blame to financial markets for unwarranted financial stress. Our results rather show that policy-makers had a responsibility in the development of financial stress during the Eurozone crisis.

Our findings contradict that of Büchel (2013) or Mohl and Sondermann (2013), as they indicate that political communication had at best a weak effect on Greek sovereign spreads. It is not so much uncertainty stemming from contradictory political statements, i.e. political noise, that has affected Greek sovereign spreads but rather the whole media feeding frenzy. Finally, our results differ from Collignon et al (2013) who find that volatility had an effect on the mean change in the Greek spreads as we find no such effect in a robust way.

Paper 3 has implications for the literature on the macroeconomic effects of uncertainty following Bloom (2009) and the literature on disaster risk following Barro (2006). With regard to the first literature, the main implication of the paper has to do with the measurement of uncertainty as we focus on disaster risk rather than a volatility-based proxy for uncertainty that may discount uncertainty coming from the distributions' tails. Our focus on the distributions' tails to proxy uncertainty is not unique though as some authors have relied on the full density functions of relevant variables, like Rossi and Sekhposyan (2015)[35] who proxy uncertainty as the *ex post* comparison between a forecast error and the *ex ante* unconditional distribution of forecast errors. The use of forecast errors for proxying uncertainty is problematic as it is by nature backward-looking while economic decision-making is forward-looking (this criticism

[35] Also notice Ferreira (2018) who proxies (financial) uncertainty as the cross-sectional skewness of the distribution of log returns.

also holds for Jurado et al 2015). For that matter, our approach is very similar to that of Forni et al (2021). While our proxy as well as that of Forni et al (2021) are constructed *ex post*, the GaR approach is flexible enough to allow for the construction of *ex ante* proxies (see Caldara, Cascaldi-Garcia, Cuba-Borda, and Loria 2020 or Lopez-Salido and Loria 2019). The only requirement to do so is the availability of real-time data and vintages. In addition, as rightly noted by Scotti (2016: 16): "Agents base decisions on their perceived uncertainty rather than an objective uncertainty that they do not observe." It may thus be preferable to construct uncertainty proxies using subjective data such as surveys or forecasts instead of constructing objective forecasts as in Jurado et al (2015). Here again, the GaR approach may be instrumental.

Lastly, our approach is interesting for the literature on disaster risk because we can compute relatively parsimoniously country-specific and time-varying indicators of disaster risk, thus offering a potential solution to deal with one of the limitations of this literature.

From this dissertation, we may also draw two general policy-oriented lessons. Paper 1 shows (indirectly) that policy-making is indeed a source (out of many) of uncertainty that may affect financial markets and the real economy (papers 2 and 3). Financial conditions are also an important element contributing to macroeconomic uncertainty (paper 3). When taken together, the findings from the three papers would signal that policy-makers should simultaneously constrain themselves to more discipline (through more rules and less discretion?) and design policies that minimise as much as possible uncertainty. For instance, with regard to the latter, financial regulations and macroprudential policies have been developed in the wake of the Global Financial Crisis and the Eurozone crisis to contain financial uncertainty. We will not elaborate on this dimension that has already attracted much attention. On the contrary, we would like to reflect on the wider implications of uncertainty for policy-making.

First, does policy-induced uncertainty make more policy rules desirable? The simple fact that policy-making or politics can be a source of uncertainty should not be the alibi for the creation of more policy rules and ever less discretion – as many economists would surely advocate. This view of the world is extremely short-sighted as it assumes that politics is simply a noise that impedes the economy from functioning well. This tendency of economists to treat politics simply as a disturbing factor was particularly acute during the Eurozone crisis as economists have generally blamed politics to be the cause of suboptimal collective management of the crisis (Baldwin and Giavazzi 2015). On the contrary, as noted by Matthijs and Blyth (2015:7), it is precisely "complicated bargains and distributive politics that make integrated markets and a single currency possible in the first place and assure its sustainability over the

long term." And simply assuming away all politics by taking a "what is to be done" view of the world will not help improving economic stability in the Eurozone (and elsewhere).

Second, should policy-makers always aim at systematically minimising uncertainty? Possibly not. Even though our findings and other existing findings show that uncertainty is harmful for the economy, uncertainty may also be a necessity. To see how, it may be insightful to reflect on Taleb's (2012) concept of antifragility. Taleb (2012) argues that systems can either be fragile, robust or antifragile. Fragility is the property of a system to collapse under stress and is commonly contrasted to robustness that is the ability to be indifferent to stress. Robustness may be appropriate for normal times disruptions but may fail to resist to extreme events though. Taleb (2012) explains that the exact opposite of fragility is antifragility rather than robustness. Antifragile systems indeed benefit from uncertainty and disorder. A system that is antifragile uses stressors of rather moderate levels to improve itself and be able to resist stronger shocks later.

As a matter of fact, and as the Great Moderation has demonstrated, aiming for maximum stability is not a panacea. While business cycles became less volatile during those years thanks to a systematic micromanagement of the economy, the virtual elimination of uncertainty has rendered the economy more fragile in the long-run by fostering the creation of imbalances and systemic risk that prepared the ground for the Great Recession. Yet, pushed to its extreme, antifragility would imply perfect competition and full economic and political decentralization. This horizon may be politically unfeasible but more importantly politically undesirable. As a consequence and while antifragility is theoretically appealable, it remains to be seen how this may apply to policy-making: how can policy-makers ever measure uncertainty correctly and control it? What level of uncertainty would be efficient or desirable for the economy? When should policy-makers intervene and when should they not?

3. Limitations

Through the three papers of this dissertation, we cover only fragments of the three dimensions of the Eurozone crisis. This may thus limit the scope of our findings in explaining the different dynamics at play during the Eurozone crisis. For instance, we focus on the third Greek bailout negotiations to illustrate the political conflict at the heart of the Eurozone crisis. One may rightly argue that the Eurozone crisis was way broader than the Greek bailouts. The political conflict over the reform of the governance was another important dimension of the political crisis. In addition, the Greek crisis may not be used to analyse developments in other peripheral

countries. Greece was in all likelihood insolvent while this was not the case of Spain and Ireland. Can our model thus still apply to those countries? What is more, our model integrate double-sided incomplete information as a specific and central feature of the third Greek bailout negotiations. Has incomplete information been so important in other negotiations? Alternatively, can we use this model to analyse future debt negotiations in the aftermath of the Covid-19 crisis? Similar remarks can be made with regard to our analysis of the effect of political uncertainty on financial markets. We indeed only focus on one type of asset and for only one country. As for the political model, would our findings hold for other assets and for other countries? How would have the euro dollar exchange rate reacted? What of country-specific stock returns, bank and corporate bonds? What of other peripheral sovereign spreads' response to policy developments?

What is more, each paper has its own specific limitations due to the variety in the research designs, methodologies applied and data used. In paper 1, the main limitation concerns the simplifying assumptions that we need to make in order to create a sufficiently parsimonious game-theoretical model. Indeed, we assume that Europeans can be modelled as a unitary actor. This assumption may result in underestimating the heterogeneity of the creditors having generally different motives and preferences.

For the second paper, it is the manual coding procedure that may limit the reliability of the results. The coding procedure is highly context-dependent, making the coding extremely dynamic. But in the meantime, it is subjective and thus we cannot rule out wrong classification in some cases. To mitigate this problem, at least we have tried to be as transparent and exhaustive as possible on the coding procedure, giving every possible insights into our procedure. In addition, and while the volume of data that we are dealing with remains manageable for performing a manual coding review, going fully through the dataset may be very time-consuming. As a consequence, we could have not applied the common standard of content analysis to the letter (Holsti 1969) by having different individuals coding the news. Still, we have tried to be as consistent as possible for coding equivalent news items but coding errors remain a possibility. Finally, it would also have been interesting the estimate the effect of political uncertainty on financial markets after July 2012 and up until the time when Greece left its bailout programme in 2018.

In paper 3, the main limitation has to do with data availability. It would have been optimal to have real-time GDP forecasts as well as data vintages for each country included in the panel in order to create both subjective and real-time tail risk proxies. One should also mention the inherent shortcomings of the Growth-at-Risk approach. As the GaR methodology

relies on quantile regressions to retrieve a conditional density function, the tails of a predictive density may be characterized with very few data points. We have tried to minimise this issue by using as long as possible time series. What is more, we could have extended the panel to include more countries: other Eurozone countries, other EU non- Eurozone or non-EU countries.

4. Avenues for further research

This dissertation offers several avenues for further research. First, one of the guiding principles of further research on the Eurozone crisis in particular and in European studies in general should be to integrate an interdisciplinary view of the problems. While such an agenda may face numerous barriers, such an approach would represent a significant added value. By fostering a dialogue between economists and political scientists, scholars from both disciplines may develop better analyses and policy recommendations by integrating political and economic constraints.

It could be interesting to apply concepts from one discipline to another. For instance, it could be possible to approach the erratic management of the Eurozone crisis itself through the lenses of uncertainty. In the presence of uncertainty, economists have argued for a long time that there is an option value for delaying an investment decision because an investment generally has irreversible consequences. While waiting may come with a cost, it is an opportunity to gather more information about the return of a particular investment. This is the so-called real option theory (Bernanke 1983, Dixit and Pindyck 1994, see Henry 1974 and Arrow 1968). With that perspective in mind, the kicking-the-can-down-the-road strategy used by European policy-makers throughout the crisis might have been a way for policy-makers to get more information before making irreversible decisions. Indeed, given the stickiness of European Union reforms, the assumption of irreversibility is plausible.

We can go further in that direction and apply it to an even more specific case: the Greek bailouts. Why have Eurozone policy-makers decided to repeatedly bail out Greece with a massive debt relief while there was evidence the strategy was not working? We can see the first Greek bailout as an investment decision made by Eurozone policy-makers. If they had retreat from this initial investment once the first bailout failed to bring the expected outcome, by offering a massive debt relief to Greece for instance, they would have incurred non-recoverable sunk costs: they would have simply lost the money they had put in the Greek bailout. On the

contrary, by putting more money, they would have bought more time to have more information about the Greek fiscal problems.

A second avenue for research would be to systematically study the different interlockings between the political, financial and economic dimensions of the Eurozone crisis through the uncertainty channel. Because of the breadth of the Eurozone crisis, we have only covered fragments of each of these three dimensions of the crisis. This dissertation can thus be read as a first step in reaching this ambitious objective. It would be thus quite logical to pursue this work by investigating each and every feedback loop between the political, financial and economic dimensions of the Eurozone crisis. It could also be interesting to further elaborate on the two feedback loops that we have analysed in order to deal with some limitations of the second and third papers. What is more, there could be more conceptual work on defining and measuring uncertainty as well as more theoretical work on the effect of tail risk on the one hand and political uncertainty on financial markets on the other.

Third, it may be fruitful to elaborate more on the implications of paper 1 on the role played by informational asymmetries. For instance, one may study how laggard (in terms of integration will) or weak states have influenced integration in response to the Eurozone (or migration) crisis through their manipulation of information.

Finally, it would be interesting to explore further how structural uncertainties surrounding the computation of estimates and forecasts may affect the reliability of any quantitative results and our approach to conventional probabilistic methods (see Taleb and Cirillo 2019 for instance).

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Appendix of Paper 1

Appendix A – Summary of the negotiations

In April 2014, Merkel refused to grant debt relief to the then Greek Prime Minister Samaras during their bilateral meeting in Athens. As Merkel's decision likely signed Samaras' political death[36], the refusal can be interpreted as a clear signal sent to Tsipras, who was poised to become the next Greek Prime Minister, that it would be counter-productive to seek a change in the terms of the adjustment program. In the meantime, Tsipras also raised the stakes by repeatedly pledging to oust the troika, to end austerity and obtain a major debt relief to Greek citizens would he get elected. And once elected, he allied, to most people's surprise, with the far-right, anti-bailout Independent Greeks rather than team up with a centre-left, pro-bailout party such as To Potami.

The negotiations started right after the elections as the second bailout was planned to end by end-February. As soon as January 30, only five days after the Greek elections, during the first bilateral meeting between the new Greek Finance Minister Varoufakis and Eurogroup's Chair Dijsselbloem, the latter apparently, more or less implicitly, threatened Varoufakis with Grexit in the case Greece would decide to stop implementing the agreed program (Varoufakis 2017, Dijsselbloem 2018, and Dendrinou and Varvitsioti 2019). During this encounter, Varoufakis also apparently threatened to default on the ECB if the Europeans refused to grant a debt relief to Greece. But shortly after that meeting, Tsipras sought to reassure his counterparts by publicly stating that Greece would honour his signature to the ECB and the IMF (Chrysoloras and Ruhe 2015). Few days later, on February 8, Thomas Wieser, the then head of the very influential EuroWorking Group, made Dijsselbloem's implicit threat more explicit. He described to his Greek counterparts what would happen if Greece were to disagree with the Europeans' terms and/or default to its creditors. If Greece were to follow such an uncompromising path, Greece would surely become some sort of "Venuezela-plus" outside of the eurozone (Dendrinou and Varvitsioti 2019).

After two failed Eurogroup meetings in February where the Greeks refused to comply by the creditors' terms, a deal was struck on February 20 to extend the second bailout by four months. The wording of the statement was ambiguous enough for the two sides to claim victory,

[36] Samaras' political fate was tightly linked to his ability to renegotiate the terms of the loans (and eventually exit the program). In August 2012, few months after his election, Samaras invested almost all of his political capital when he decided to accept the terms of the bailout after meeting with Chancellor Merkel, making a U-turn on his previous electoral pledges. Securing a debt relief thus became a paramount objective for Samaras to obtain a return on his political investment. Samaras even devised a plan to exit the bailout earlier than expected as a last-ditch effort to save his position. But his idea was only met with scepticism in Berlin and in the financial markets (Brown and Papadimas 2014).

even if Greece made a major concession on the substance as Tsipras repeatedly pledged that he would never seek an extension of the existing program.

On March 19, on the sides of a European Summit, key European leaders gathered with Tsipras for a special meeting on the Greek crisis. Their message to the Greek Prime Minister was clear-cut: the logic of the program cannot change and reforms are necessary for any financial support. The Greeks can have ownership of the reforms but they have to yield equivalent savings compared to those in the existing memorandum. Finally, the reforms must get the prior approval of the institutions. This message was in plain and clear wording the Europeans' understanding of the February 20 deal (Dendrinou and Varvitsioti 2019).

During Easter's weekend, Greece was close from defaulting on the IMF. Actually, Varoufakis (2018) writes that Tsipras decided to default on the IMF before calling it off at the very last minute, while keeping the threat to do it in the future (see also Dendrinou and Varvitsioti 2019)[37]. This story seems also confirmed by Blustein (2016) who reports that Varoufakis ambiguously implied to Lagarde that Greece could default on its loans during their meeting on Easter Monday.

On April 24, during the Riga Eurogroup meeting, Slovenia Finance Minister went as far as saying that the Eurogroup should talk about a plan B for Greece (Dendrinou and Varvitsioti 2019, Dijsselbloem 2018) after Varoufakis warned his counterparts that an accident could happen without further financial support. By the Monday following this infamous meeting, Tsipras side-lined Varoufakis by removing Varoufakis' close confidant Theocarakis from the Greek negotiating team and by re-appointing Chouliarakis, who had been advocating for a compromise with the Europeans from the very beginning (Varoufakis 2017, Dendrinou and Varvitsioti 2019).

In early June, the creditors presented a common offer to Greece with a slightly reduced long-term fiscal target and the full list of the reforms needed to attain it (Blustein 2016 and Dendrinou and Varvitsioti 2019). This offer did not change substantially the distribution of the adjustment costs though as it still required most of the adjustment to be carried by Greece. By accepting such a high fiscal target, Tsipras implicitly recognised that he did not need debt relief after all (Blustein 2016).

Later, during the Eurogroup of June 18, ECB's Benoit Coeuré expressed his doubts over the ability of Greek banks to reopen on the following Monday. Soon after Coeuré's threat, the Greeks worked on a consistent proposal including, for the first time, the long-asked-for pension cuts. Prior to June, the Greeks relentlessly made sure that "communication [at the technical

[37] On March 15, in a letter to the European leaders, Tsipras threatened to default on the debt Greece owed to the Europeans and the IMF if it did not receive funds rapidly (Spiegel 2015).

level] was often pointless, if it occurred at all" (Blustein 2016: 401, see also Dendrinou and Varvitsioti 2019) as they sought to negotiate at the political level, aiming at changing the logic and parameters of the program.

During the following June 22 Eurogroup meeting, the Greek proposal that included pension cuts was received as a sign of improvement by the Europeans. Yet, in coherence with their strategy, the Eurozone finance ministers decided that the Troika had to first give its green light in order to move forward. On the contrary, finance ministers discussed the possible need for capital controls in Greece. The following day, on June 23, the Troika gave its verdict: the Greek offer was sent back all barred in red. The heads of the Troika, the head of the Eurogroup and the Greek Prime Minister thus met on the morning of June 24 until the next morning to find a solution to this stalemate. Still, those high-level negotiations did not produce any conclusive outcome. The two sides were said to be about 600 million euros apart but the negotiations stumbled over the VAT hike and pensions cuts, two very sensitive issues for the Greeks. During those 24 hours, Tsipras oscillated between accepting the terms of the creditors and refusing them, eventually refusing to sign a joint proposal with the Troika. The Eurogroup that was planned on the morning of June 25 was therefore once again inconclusive (Blustein 2016 and Dendrinou and Varvitsioti 2019). And at the Summit that started on the afternoon of June 25, Merkel refused to intervene to broker a deal (Blustein 2016).

A last meeting was planned for June 27 but, facing what seemed to be an immovable European wall, Tsipras decided to unilaterally break the negotiations by calling a referendum on the terms of the latest proposal made by the creditors. The referendum, taking place after the end of the second bailout, forced Greece to impose tight capital controls. In the meantime though, the ECB maintained ELA to Greek banks at its current level but did not pulled the plug as some policy-makers advocated (Draghi 2015). Shortly after calling the referendum though, Tsipras reportedly asked President Hollande and Cyprus' President to reach out to Merkel but she eventually refused to compromise on both occasions (Dendrinou and Varvitsioti 2019).

Minutes after the No was projected to be winning the day, Tsipras unambiguously told President Hollande that he was willing to remain in the Eurozone (Dendrinou and Varvitsioti 2019, Hollande 2018) while Varoufakis handed in his resignation. It was by that time that Chancellor Merkel, Vice-Chancellor Gabriel, Foreign Minister Steinmeier and Finance Minister Schäuble decided to push for Grexit as a way to extract more concessions (Palaiologos 2016). A non-paper prepared for the Eurogroup by the German Finance Ministry was leaked to the press. It envisioned a Greek time-out from the Eurozone and the creation of a privatisation fund controlled from Luxembourg.

The July 12 Eurogroup's statement explicitly made reference to a Greek time-out but simply passed the hot potato onto the Eurozone leaders as such matters could only be dealt at this level. In the following make-or-break July 12 Euro Summit, Merkel resisted for some time but finally agreed that such reference should be removed from the leaders' statement. However, she kept insisting on the Luxembourg-based privatisation fund and at some point the negotiations were on the verge of collapsing for about 2.5 billion euros. A deal was nevertheless reached on the morning of July 13 as Merkel conceded some ground on the privatisation fund. At the end of the day, Tsipras surrendered to most if not all creditors' demands and failed to obtain a debt relief (Blustein 2016 and Dendrinou and Varvitsioti 2019).

Appendix B – Proofs of propositions 1 and 2

This appendix presents the proofs of Propositions 1 and 2.

Proposition 1. *Under complete information, the game has three equilibria. Equilibrium 1: if Europe is Grexit-averse and Greece is compromise-averse, the negotiations result in a quick fair deal for Greece. Equilibrium 2: if Europe is compromise-averse or Grexit-averse and Greece is Grexit-averse, the negotiations result in a quick asymmetric deal for Greece. Equilibrium 3: if Europe and Greece are compromise-averse, the negotiations result in a default and a Graccident happens with probability h.*

We derive the subgame perfect equilibria (SPEs) by backward induction.

Proof of Equilibrium 1. When Europe is Grexit-averse and knows that Greece is compromise-averse, i.e. always plays Challenge and Default. Since $\pi_1^E > \pi_3^E > \pi_X^E$ by assumption, Europe plays Debt relief. Thus we conclude that the outcome must be a quick fair deal.

Proof of Equilibrium 2. When Greece is Grexit-averse, Europe knows that Greece will always play Back down since $\pi_4^G > \pi_X^G$ by assumption. Since Greece knows that $\pi_4^E > \pi_3^E$, i.e. Europe prefers a delayed asymmetric deal to a delayed fair deal, Greece will play Resign. Thus we conclude that the outcome must be a quick asymmetric deal.

Proof of Equilibrium 3. When Europe is compromise-averse, it always plays No debt relief and Rejects. When Greece is compromise-averse, it always plays Challenge and Default. Thus we conclude that the outcome must be that a Graccident occurs with probability h.

Proposition 2. *Under double-sided incomplete information, the game has 4 sequential crisis equilibria and depends on the values of p and q.*

Equilibrium 1 exists only when $0 < q \leq \bar{q}$ *and* $0 < p \leq \bar{p}$*. Grexit-averse and compromise-averse Europe never grants a debt relief at the beginning of the negotiations. Compromise-averse Greece always challenge the status quo. Grexit-averse Greece randomizes its strategy between challenging the status quo and resign. In the latter case, a quick asymmetric deal occurs. In the former case, Grexit-averse Europe randomizes its strategy between rejecting and accepting a Greek offer. If Greece is compromise-averse, Greece defaults and a Graccident occurs with probability h. If Greece is Grexit-averse, a delayed asymmetric deal occurs.*

Equilibrium 2 exists only when $0 < q \leq \bar{q}$ *and* $\bar{p} < p < 1$*. Grexit-averse and compromise-averse Europe never grants a debt relief at the beginning of the negotiations. Compromise-averse Greece always challenge the status quo. Grexit-averse Greece resigns and a quick asymmetric deal occurs. Compromise-averse Greece challenges the status quo. Grexit-averse Europe randomizes its strategy between rejecting and accepting a Greek offer. Compromise-averse Greece defaults and a Graccident occurs with probability h.*

Equilibrium 3 exists only when $\bar{q} < q < 1$ *and* $0 < p \leq \bar{p}$*. Grexit-averse and compromise-averse Europe never grants a debt relief at the beginning of the negotiations. Compromise-averse Greece always challenge the status quo. Grexit-averse Greece randomizes its strategy between challenging the status quo and resign. In the latter case, a quick asymmetric deal occurs. In the former case, Grexit-averse Europe accepts the Greek offer and a delayed fair deal occurs. Compromise-averse Europe rejects the Greek offer. If Greece is compromise-averse, Greece defaults and a Graccident occurs with probability h. If Greece is Grexit-averse, a delayed asymmetric deal occurs.*

Equilibrium 4 exists only when $\bar{q} < q < 1$ *and* $\bar{p} < p < 1$*. Grexit-averse and compromise-averse Europe never grants a debt relief at the beginning of the negotiations. Compromise-averse Greece always challenge the status quo. Grexit-averse Greece resigns and a quick asymmetric deal occurs. Compromise-averse Greece challenges the status quo. Grexit-averse Europe accepts the Greek offer and a delayed fair deal occurs. Compromise-averse Europe rejects the Greek offer. If Greece is compromise-averse, Greece defaults and a Graccident occurs with probability h.*

A perfect Bayesian equilibrium consists of the players' optimal actions, given the other agents' equilibrium moves and beliefs about types. Let us thus define the players strategies and beliefs under double-sided incomplete information. Let us start with examining E's expected payoff at $\theta_E(2)$ when E is Grexit-averse. Let μ_E^* be the value of Europe's beliefs about Greece's type μ_E

that leaves a Grexit-averse E indifferent between rejecting and accepting a Greek offer. A Grexit-averse E will be indifferent between refusing and accepting a Greek offer after observing G challenging the status quo when

$$EU_E(Reject|Grexit\ averse, Greece\ challenges) = EU_E(Accept|Grexit\ averse, Greece\ challenges)$$

$$\pi_E^X \mu_E^* + \pi_E^4(1 - \mu_E^*) = \pi_E^3$$

We thus obtain $\mu_E^* = \frac{\pi_E^3 - \pi_E^4}{\pi_E^X - \pi_E^4}$. And a Grexit-averse E's best response at $\theta_E(2)$ is therefore

$$\begin{cases} \gamma = 0\ if\ \mu_E > \mu_E^* \\ \gamma = 1\ if\ \mu_E < \mu_E^* \\ \gamma \in [0,1]0\ if\ \mu_E = \mu_E^* \end{cases}$$

with γ being the probability that Europe plays Reject when Grexit-averse. Applying Bayes' rule and substituting for μ_E implies that E's best-reply correspondence can be written as

$$\begin{cases} \gamma = 0\ if\ \beta < \dfrac{q(\pi_E^X - \pi_E^3)}{(1-q)(\pi_E^3 - \pi_E^4)} \\ \gamma = 1\ if\ \beta > \dfrac{q(\pi_E^X - \pi_E^3)}{(1-q)(\pi_E^3 - \pi_E^4)} \\ \gamma \in [0,1]0\ if\ \beta = \dfrac{q(\pi_E^X - \pi_E^3)}{(1-q)(\pi_E^3 - \pi_E^4)} \end{cases}$$

with β the probability that Greece plays Challenge when Grexit-averse. The next strategy to be specified is precisely β^*. First assume that $\gamma = 1$. Then it implies that $\beta > \frac{q(\pi_E^X - \pi_E^3)}{(1-q)(\pi_E^3 - \pi_E^4)}$. Since a compromise-averse E would always reject a Greek offer, a Grexit-averse G will always resign challenging E because there is no chance of ending up with a fair deal, hence $\beta = 0$. But if $\beta = 0$, then $\beta < \frac{q(\pi_E^X - \pi_E^3)}{(1-q)(\pi_E^3 - \pi_E^4)}$, a contradiction. γ^* is therefore lower than 1. The fact that $0 < \gamma^* < 1$ yields $\beta^* = \frac{q(\pi_E^X - \pi_E^3)}{(1-q)(\pi_E^3 - \pi_E^4)}$

For β^* to be a probability, it must be that $0 \leq \beta^* = \frac{q(\pi_E^X - \pi_E^3)}{(1-q)(\pi_E^3 - \pi_E^4)} \leq 1$. That is $0 \leq q \leq \frac{\pi_E^4 - \pi_E^3}{\pi_E^4 - \pi_E^X} = \bar{q}$. In other words, a Grexit-averse E escalates when the probability q that G is compromise-averse is low enough.

Now let us determine γ^* and α^*. With $0 < \beta^* < 1$, a Grexit-averse Greece will be indifferent between challenging and not challenging the status quo after observing Europe had refused to grant debt relief when

$$EU_G(Challenge|Grexit\ averse, no\ debt\ relief) = EU_G(Resign|Grexit\ averse, no\ debt\ relief)$$

$$\pi_G^4\mu_G + [\gamma\pi_G^4 + (1-\gamma)\pi_G^3](1-\mu_G) = \pi_G^2$$

$$\gamma = \frac{\pi_G^2 - \pi_G^3 + \mu_G(\pi_G^3 - \pi_G^4)}{(1-\mu_G)(\pi_G^4 - \pi_G^3)}$$

Substituting for μ_G yields $\gamma^* = \frac{p(\pi_G^2-\pi_G^4)}{(1-p)\alpha(\pi_G^4-\pi_G^3)} + \frac{\pi_G^2-\pi_G^3}{\pi_G^4-\pi_G^3}$. Note that because a Grexit-averse E mixes at $\theta_E(2)$, E's expected payoff if the game reaches this information set is π_E^3 (randomization indeed requires equality of expected payoffs). Then a Grexit-averse E will be indifferent between granting and not granting debt relief to G when

$$EU_E(Debt\ relief|Grexit\ averse) = EU_E(No\ debt\ relief|Grexit\ averse)$$

$$\pi_E^1 = q\pi_E^3 + (1-q)[\beta\pi_E^3 + (1-\beta)\pi_E^2]$$

$$\begin{cases} \alpha = 0\ if\ \pi_E^1 > q\pi_E^3 + (1-q)[\beta\pi_E^3 + (1-\beta)\pi_E^2] \\ \alpha = 1\ if\ \pi_E^1 < q\pi_E^3 + (1-q)[\beta\pi_E^3 + (1-\beta)\pi_E^2] \\ \alpha \in [0,1]\ if\ \pi_E^1 = q\pi_E^3 + (1-q)[\beta\pi_E^3 + (1-\beta)\pi_E^2] \end{cases}$$

For there to be a sequential crisis equilibrium, then $\pi_E^1 \leq q\pi_E^3 + (1-q)[\beta\pi_E^3 + (1-\beta)\pi_E^2]$, hence $\alpha = 1$. In other words, Europeans never grant a debt relief at the first stage of the negotiations.

Finally, substituting for the value of α, we obtain $\gamma^* = \frac{p(\pi_G^2-\pi_G^4)}{(1-p)(\pi_G^4-\pi_G^3)} + \frac{\pi_G^2-\pi_G^3}{\pi_G^4-\pi_G^3}$. For γ^* to be a probability, it must be that $0 \leq \gamma^* \leq 1$, That is $0 \leq p \leq \frac{\pi_G^3-\pi_G^2}{\pi_G^3-\pi_G^4} = \bar{p}$. In other words, a Grexit-averse G escalates when the probability p that E is compromise-averse is low enough.

Hence, we can summarize the Perfect Bayesian Equilibrium of this game with double-sided incomplete information. Player E will always play no debt relief and reject when compromise-averse. When Grexit-averse, E will always play no debt relief but will randomly play reject only when $0 < q \leq \bar{q}$. When $\bar{q} < q < 1$, Grexit-averse E will always play accept. At her first information set, E's posterior beliefs coincide with his prior q while her beliefs at her second information set are given by Bayesian updating with $\mu_E = \frac{q}{q+(1-q)\beta}$.

Player G will always play challenge and default when compromise-averse. When Grexit-averse, G will randomly play challenge when $0 < p \leq \bar{p}$ and will play back down

otherwise. When $\bar{p} < p < 1$, Grexit-averse G will always play Resign. At her information set, G's beliefs are given by Bayesian updating with $\mu_G = \frac{p}{p+(1-p)\alpha} = p$.

Appendix of Paper 2

Appendix A – Additional estimation results and data description

Table 6A – AR(1) – EGARCH(1,1) with 10 lags and news – Mean Equation

ΔSpread	(41)	(42)	(43)	(44)	(45)	(46)	(47)	(48)	(49)	(50)
Hard Positive	-1.728 [1.425]	-0.007 [0.014]	-0.487 [1.344]	-0.011 [0.014]	-0.008 [0.013]					
Hard Negative	5.185 [1.283]***	0.055 [0.013]***	5.884 [1.213]***	0.054 [0.013]***	0.053 [0.012]***					
Positive Expected						-0.749 [1.240]	0.001 [0.012]	0.241 [1.192]	-0.001 [0.012]	0.000 [0.012]
Positive Unexpected						-22.370 [3.900]***	-0.210 [0.037]***	-18.597 [3.526]***	-0.217 [0.038]***	-0.196 [0.036]***
Negative Expected						1.409 [1.476]	0.022 [0.014]	2.233 [1.362]	0.020 [0.015]	0.020 [0.014]
Negative Unexpected						10.928 [2.619]***	0.115 [0.027]***	11.546 [2.458]***	0.115 [0.027]***	0.112 [0.025]***
Soft Positive NB		-0.005 [0.004]					-0.005 [0.004]			
Soft Negative NB		0.008 [0.004]**					0.008 [0.004]**			
Positive Political Statements NB			-0.454 [0.572]	-0.005 [0.006]				-0.406 [0.564]	-0.005 [0.006]	
Negative Political Statements NB			0.898 [0.437]**	0.010 [0.005]**				0.813 [0.439]*	0.009 [0.005]**	
Positive Media Reports NB			-0.665 [0.821]		-0.005 [0.008]			-0.710 [0.797]		-0.005 [0.007]
Negative Media Reports NB			0.836 [0.769]		0.012 [0.007]			0.816 [0.755]		0.011 [0.007]
T-DIST. DOF	2.278 [0.220]***	2.419 [0.257]***	2.551 [0.293]***	2.333 [0.234]***	2.510 [0.282]***	2.403 [0.257]***	2.592 [0.288]***	2.708 [0.325]***	2.499 [0.270]***	2.684 [0.316]***
Adjusted R-squared	0.079	0.079	0.068	0.081	0.069	0.119	0.119	0.104	0.124	0.107
Obs	721	721	721	721	721	721	721	721	721	721

Table 6B – AR(1) – EGARCH(1,1) with 10 lags and news – Variance Equation

Spread	(41)	(42)	(43)	(44)	(45)	(46)	(47)	(48)	(49)	(50)
Hard News	0.110 [0.074]	0.409 [0.162]**	0.243 [0.091]***	0.177 [0.086]**	0.245 [0.093]***					
Expected News						-0.070 [0.079]	0.173 [0.148]	0.051 [0.095]	-0.006 [0.091]	0.049 [0.094]
Unexpected News						0.694 [0.145]***	0.916 [0.175]***	0.850 [0.161]***	0.822 [0.157]***	0.844 [0.161]***
Soft News		0.340 [0.150]**					0.318 [0.145]**			
Political Communication			-0.003 [0.018]	0.037 [0.013]***				0.014 [0.019]	0.045 [0.014]***	
Media Reports			0.093 [0.030]***		0.091 [0.022]***			0.072 [0.030]**		0.089 [0.022]***

Table 6C – AR(1) – EGARCH(1,1) with 10 lags and Greek/Eurozone news – Mean Equation (1)

ΔSpread	(51)	(52)	(53)	(54)	(55)
G Hard Positive	-1.461 [1.509]	-0.580 [1.465]	-0.421 [1.425]	-0.009 [0.015]	-0.006 [0.014]
G Hard Negative	4.967 [1.358]***	5.195 [1.336]***	5.403 [1.246]***	0.053 [0.014]***	0.051 [0.013]***
E Hard Positive	-0.900 [3.161]	0.681 [3.283]	1.246 [3.323]	0.002 [0.032]	0.011 [0.033]
E Hard Negative	5.371 [2.699]**	5.500 [2.866]*	6.275 [2.838]**	0.050 [0.028]*	0.049 [0.028]*
G Soft Positive NB		-0.708 [0.586]			
G Soft Negative NB		0.985 [0.476]**			
E Soft Positive NB		-0.201 [0.664]			
E Soft Negative NB		0.590 [0.615]			
G Positive Political NB			-1.044 [0.801]	-0.008 [0.009]	
G Negative Political NB			0.867 [0.571]	0.011 [0.006]*	
E Positive Political NB			-0.202 [0.886]	-0.001 [0.008]	
E Negative Political NB			1.034 [0.802]	0.008 [0.008]	
G Positive Media Reports NB			-0.454 [0.865]		-0.003 [0.008]
G Negative Media Reports NB			1.169 [0.890]		0.014 [0.008]*
E Positive Media Reports NB			-0.230 [1.575]		0.000 [0.015]
E Negative Media Reports NB			-0.143 [1.569]		0.001 [0.015]
T-DIST. DOF	2.292 [0.223]***	2.439 [0.261]***	2.577 [0.299]***	2.345 [0.238]***	2.536 [0.288]***
Adjusted R-squared	0.073	0.064	0.054	0.070	0.057
Obs	721	721	721	721	721

Table 6D – AR(1) – EGARCH(1,1) with 10 lags and Greek/Eurozone news – Mean Equation (2)

ΔSpread	(56)	(57)	(58)	(59)	(60)
G Positive Expected	-0.257 [1.311]	0.642 [1.307]	0.626 [1.272]	0.005 [0.013]	-0.042 [0.048]
G Positive Unexpected	-18.721 [4.110]***	-15.984 [3.851]***	-13.137 [3.684]***	-0.175 [0.040]***	-0.554 [0.091]***
G Negative Expected	1.107 [1.663]	1.859 [1.648]	1.863 [1.481]	0.018 [0.017]	0.156 [0.053]***
G Negative Unexpected	10.622 [2.728]***	11.157 [2.699]***	11.039 [2.475]***	0.111 [0.027]***	0.244 [0.080]***
E Positive Expected	2.313 [2.977]	3.455 [2.967]	3.892 [3.011]	0.032 [0.030]	-0.123 [0.078]
E Positive Unexpected	-24.816 [8.932]***	-25.206 [10.311]**	-25.865 [10.524]**	-0.251 [0.096]***	-0.470 [0.097]***
E Negative Expected	1.069 [2.760]	1.247 [2.903]	1.319 [2.848]	0.011 [0.028]	0.094 [0.081]
E Negative Unexpected	11.925 [6.542]*	13.742 [6.723]**	14.315 [6.302]**	0.134 [0.068]**	0.277 [0.114]**
G Soft Positive NB		-0.719 [0.587]			
G Soft Negative NB		0.986 [0.475]**			
E Soft Positive NB		-0.264 [0.674]			
E Soft Negative NB		0.635 [0.596]			
G Positive Political NB			-1.121 [0.815]	-0.009 [0.009]	
G Negative Political NB			0.836 [0.586]	0.011 [0.006]*	
E Positive Political NB			-0.129 [0.874]	-0.001 [0.008]	
E Negative Political NB			1.036 [0.790]	0.009 [0.008]	
G Positive Media Reports NB			-0.436 [0.857]		-0.005 [0.028]
G Negative Media Reports NB			1.130 [0.895]		0.020 [0.026]
E Positive Media Reports NB			-0.826 [1.512]		-0.059 [0.040]
E Negative Media Reports NB			0.021 [1.499]		0.038 [0.038]
T-DIST. DOF	2.378 [0.248]***	2.574 [0.286]***	2.721 [0.334]***	2.463 [0.262]***	20.000 [4.452]***
Adjusted R-squared	0.118	0.111	0.096	0.115	0.242
Obs	721	721	721	721	721

Table 6E – AR(1) – EGARCH(1,1) with 10 lags and Greek/Eurozone news – Variance Equation

Spread	(51)	(52)	(53)	(54)	(55)	(56)	(57)	(58)	(59)	(60)
G Hard News	0.135 [0.077]*	0.253 [0.098]***	0.280 [0.099]***	0.217 [0.092]**	0.276 [0.098]***					
E Hard News	0.042 [0.102]	0.131 [0.121]	0.145 [0.120]	0.086 [0.113]	0.160 [0.121]					
G Expected News						-0.009 [0.082]	0.097 [0.098]	0.117 [0.098]	0.062 [0.095]	0.114 [0.096]
G Unexpected News						0.599 [0.171]***	0.740 [0.182]***	0.711 [0.180]***	0.692 [0.178]***	0.725 [0.181]***
E Expected News						-0.113 [0.134]	-0.077 [0.156]	-0.072 [0.155]	-0.101 [0.147]	-0.063 [0.155]
E Unexpected News						0.404 [0.273]	0.631 [0.298]**	0.620 [0.290]**	0.563 [0.287]**	0.606 [0.291]**
G Soft News		0.033 [0.012]***					0.033 [0.012]***			
E Soft News		0.036 [0.014]**					0.040 [0.015]***			
G Political Communication			-0.015 [0.024]	0.036 [0.018]**				-0.004 [0.024]	0.038 [0.019]**	
G Media Reports			0.116 [0.039]***	0.045 [0.020]**				0.096 [0.037]**	0.049 [0.021]**	
E Political Communication			0.018 [0.027]		0.108 [0.029]***			0.020 [0.028]		0.100 [0.029]***
E Media Reports			0.062 [0.048]		0.088 [0.037]**			0.067 [0.050]		0.094 [0.038]**

Table 7A – AR(1) – EGARCH(1,1) with Yield and news – Mean Equation

ΔYield	(61)	(62)	(63)	(64)	(65)	(66)	(67)	(68)	(69)	(70)
Hard Positive	-1.235 [1.320]	-0.356 [1.342]	-0.050 [1.371]	-0.232 [1.337]	-0.303 [1.361]					
Hard Negative	4.847 [1.377]***	5.708 [1.353]***	5.659 [1.374]***	5.619 [1.399]***	5.455 [1.361]***					
Positive Expected						-0.457 [1.130]	0.329 [1.158]	0.501 [1.180]	0.467 [1.143]	0.262 [1.181]
Positive Unexpected						-21.823 [4.402]***	-20.562 [4.330]***	-20.588 [4.163]***	-20.781 [4.351]***	-20.836 [4.151]***
Negative Expected						1.254 [1.466]	2.070 [1.489]	2.294 [1.497]	2.172 [1.506]	2.082 [1.484]
Negative Unexpected						11.906 [2.876]***	12.060 [2.897]***	12.219 [3.030]***	12.366 [3.020]***	11.927 [2.956]***
Soft Positive NB		-0.586 [0.384]					-0.584 [0.346]*			
Soft Negative NB		0.963 [0.348]***					0.929 [0.306]***			
Positive Political Statements NB			-0.265 [0.614]	-0.158 [0.610]				-0.225 [0.586]	-0.123 [0.567]	
Negative Political Statements NB			0.743 [0.485]	0.855 [0.498]*				0.674 [0.460]	0.811 [0.453]*	
Positive Media Reports NB			-0.956 [0.780]		-0.787 [0.736]			-1.023 [0.725]		-0.891 [0.684]
Negative Media Reports NB			1.189 [0.732]		1.477 [0.686]**			1.202 [0.665]*		1.450 [0.621]**
T-DIST. DOF	2.545 [0.286]***	2.567 [0.297]***	2.686 [0.310]***	2.566 [0.292]***	2.660 [0.306]***	2.628 [0.306]***	2.636 [0.318]***	2.737 [0.333]***	2.646 [0.314]***	2.727 [0.331]***
Adjusted R-squared	0.024	0.029	0.025	0.027	0.024	0.056	0.059	0.056	0.058	0.055
Obs	731	731	731	731	731	731	731	731	731	731

Table 7B – AR(1) – EGARCH(1,1) with Yield and news – Variance Equation

Yield	(61)	(62)	(63)	(64)	(65)	(66)	(67)	(68)	(69)	(70)
Hard News	0.114 [0.073]	0.379 [0.144]***	0.264 [0.092]***	0.205 [0.088]**	0.262 [0.092]***					
Expected News						-0.075 [0.081]	0.143 [0.137]	0.066 [0.097]	0.011 [0.095]	0.056 [0.095]
Unexpected News						0.734 [0.148]***	0.952 [0.174]***	0.934 [0.168]***	0.910 [0.165]***	0.903 [0.165]***
Soft News		0.285 [0.133]**					0.268 [0.131]**			
Political Communication			-0.002 [0.018]	0.037 [0.014]***				0.018 [0.019]	0.047 [0.015]***	
Media Reports			0.090 [0.030]***		0.088 [0.022]***			0.064 [0.030]**		0.084 [0.022]***

Table 7C – AR(1) – EGARCH(1,1) with Yield and Greek/Eurozone news – Mean Equation (1)

ΔYield	(71)	(72)	(73)	(74)	(75)
G Hard Positive	-1.184 [1.440]	-0.197 [1.462]	-0.057 [1.488]	-0.211 [1.455]	-0.213 [1.473]
G Hard Negative	4.634 [1.469]***	5.395 [1.461]***	5.440 [1.432]***	5.444 [1.480]***	5.179 [1.418]***
E Hard Positive	-1.454 [3.081]	-1.023 [3.330]	-0.766 [3.386]	-1.074 [3.219]	-1.005 [3.367]
E Hard Negative	5.706 [2.797]**	7.001 [3.123]**	6.825 [3.105]**	6.983 [3.050]**	6.590 [3.062]**
G Soft Positive NB		-0.955 [0.570]*			
G Soft Negative NB		1.115 [0.477]**			
E Soft Positive NB		0.002 [0.733]			
E Soft Negative NB		0.683 [0.672]			
G Positive Political NB			-1.285 [0.840]	-0.556 [0.886]	
G Negative Political NB			0.603 [0.624]	0.913 [0.655]	
E Positive Political NB			-0.038 [0.930]	0.144 [0.913]	
E Negative Political NB			0.921 [0.877]	0.877 [0.848]	
G Positive Media Reports NB			-0.656 [0.823]		-0.775 [0.804]
G Negative Media Reports NB			1.830 [0.906]**		1.752 [0.795]**
E Positive Media Reports NB			0.381 [1.559]		0.484 [1.515]
E Negative Media Reports NB			0.127 [1.620]		0.520 [1.476]
T-DIST. DOF	2.550 [0.286]***	2.615 [0.303]***	2.716 [0.319]***	2.574 [0.295]***	2.671 [0.311]***
Adjusted R-squared	0.024	0.023	0.015	0.022	0.018
Obs	731	731	731	731	731

Table 7D – AR(1) – EGARCH(1,1) with Yield and Greek/Eurozone news – Mean Equation (2)

ΔYield	(76)	(77)	(78)	(79)	(80)
G Positive Expected	-0.130 [1.240]	0.770 [1.272]	0.973 [1.275]	0.860 [1.245]	0.797 [1.304]
G Positive Unexpected	-18.476 [4.258]***	-16.780 [4.047]***	-16.439 [4.069]***	-17.655 [4.169]***	-16.163 [4.004]***
G Negative Expected	0.904 [1.666]	1.968 [1.688]	2.099 [1.633]	1.870 [1.710]	1.764 [1.659]
G Negative Unexpected	11.410 [3.072]***	11.777 [3.215]***	11.676 [3.105]***	11.923 [3.184]***	11.522 [3.085]***
E Positive Expected	0.907 [2.696]	0.621 [2.751]	0.687 [2.740]	0.708 [2.697]	0.841 [2.815]
E Positive Unexpected	-24.698 [10.187]**	-23.930 [11.177]**	-24.168 [11.084]**	-23.573 [10.708]**	-24.284 [11.129]**
E Negative Expected	0.563 [2.673]	1.307 [3.109]	1.337 [3.058]	1.143 [2.955]	1.161 [3.176]
E Negative Unexpected	14.537 [6.525]**	16.266 [7.102]**	16.737 [6.925]**	15.743 [6.877]**	16.781 [7.010]**
G Soft Positive NB		-0.927 [0.533]*			
G Soft Negative NB		1.087 [0.444]**			
E Soft Positive NB		-0.104 [0.723]			
E Soft Negative NB		0.661 [0.614]			
G Positive Political NB			-1.260 [0.813]	-0.704 [0.834]	
G Negative Political NB			0.474 [0.596]	0.904 [0.612]	
E Positive Political NB			0.157 [0.901]	0.209 [0.887]	
E Negative Political NB			0.759 [0.827]	0.768 [0.790]	
G Positive Media Reports NB			-0.516 [0.751]		-0.679 [0.745]
G Negative Media Reports NB			1.810 [0.854]**		1.681 [0.747]**
E Positive Media Reports NB			-0.464 [1.484]		-0.224 [1.471]
E Negative Media Reports NB			0.366 [1.361]		0.662 [1.301]
T-DIST. DOF	2.625 [0.306]***	2.719 [0.336]***	2.625 [0.330]***	2.674 [0.323]***	2.766 [0.348]***
Adjusted R-squared	0.060	0.060	0.051	0.058	0.055
Obs	731	731	731	731	731

Table 7E – AR(1) – EGARCH(1,1) with Yield and Greek/Eurozone news – Variance Equation

Yield	(71)	(72)	(73)	(74)	(75)	(76)	(77)	(78)	(79)	(80)
G Hard News	0.140 [0.077]*	0.278 [0.100]***	0.299 [0.100]***	0.244 [0.096]**	0.286 [0.097]***					
E Hard News	0.025 [0.097]	0.132 [0.120]	0.133 [0.117]	0.092 [0.115]	0.143 [0.118]					
G Expected News						-0.008 [0.085]	0.120 [0.105]	0.139 [0.107]	0.084 [0.103]	0.124 [0.100]
G Unexpected News						0.673 [0.178]***	0.874 [0.192]***	0.856 [0.195]***	0.840 [0.191]***	0.818 [0.187]***
E Expected News						-0.101 [0.130]	-0.069 [0.154]	-0.067 [0.154]	-0.085 [0.150]	-0.050 [0.150]
E Unexpected News						0.380 [0.269]	0.679 [0.304]**	0.651 [0.305]**	0.601 [0.297]**	0.618 [0.292]**
G Soft News		0.033 [0.012]***					0.033 [0.013]**			
E Soft News		0.037 [0.014]***					0.044 [0.015]***			
G Political Communication			-0.011 [0.025]	0.038 [0.019]**				0.000 [0.026]	0.041 [0.021]**	
G Media Reports			0.106 [0.039]***	0.047 [0.020]**				0.087 [0.039]**	0.056 [0.022]***	
E Political Communication			0.017 [0.027]		0.100 [0.028]***			0.025 [0.029]		0.093 [0.029]***
E Media Reports			0.068 [0.047]		0.092 [0.035]***			0.068 [0.051]		0.099 [0.037]***

Table 8A – AR(1) – APARCH(1,1) with news – Mean Equation

ΔSpread	(81)	(82)	(83)	(84)	(85)	(86)	(87)	(88)	(89)	(90)
Hard Positive	-1.064 [1.060]	-0.390 [0.850]	0.133 [1.076]	-0.383 [0.536]	-0.493 [0.600]					
Hard Negative	4.556 [1.198]***	5.780 [0.765]***	5.964 [0.960]***	5.179 [1.145]***	5.382 [1.086]***					
Positive Expected						-0.028 [1.052]	-0.569 [0.980]	-0.770 [0.989]	-0.596 [0.854]	-1.500 [1.148]
Positive Unexpected						-20.459 [4.459]***	-20.659 [3.179]***	-21.032 [3.273]***	-21.335 [5.047]***	-21.626 [3.139]***
Negative Expected						1.595 [1.321]	2.001 [1.249]	2.203 [1.376]	2.052 [1.305]	1.960 [1.264]
Negative Unexpected						13.048 [2.994]***	10.897 [1.715]***	10.875 [1.733]***	15.242 [3.276]***	10.807 [1.674]***
Soft Positive NB		-0.825 [0.342]**					-0.513 [0.347]			
Soft Negative NB		1.026 [0.251]***					0.714 [0.305]**			
Positive Political Statements NB			-0.615 [0.512]	-0.229 [0.457]				-0.495 [0.689]	-0.348 [0.588]	
Negative Political Statements NB			1.009 [0.414]**	1.277 [0.334]***				0.871 [0.521]*	0.864 [0.465]*	
Positive Media Reports NB			-0.818 [0.582]		-0.632 [0.377]*			-0.609 [0.909]		-0.675 [0.734]
Negative Media Reports NB			1.213 [0.396]***		1.529 [0.355]***			0.692 [0.864]		0.969 [0.691]
T-DIST. DOF	2.517 [0.301]***	2.347 [0.276]***	2.559 [0.317]***	2.558 [0.315]***	2.590 [0.313]***	2.642 [0.330]***	2.944 [0.343]***	2.752 [0.306]***	2.403 [0.249]***	2.150 [0.214]***
Adjusted R-squared	0.045	0.046	0.045	0.048	0.043	0.075	0.072	0.069	0.076	0.076
Obs	731	731	731	731	731	731	731	731	731	731

Table 8B – AR(1) – APARCH(1,1) with news – Variance Equation

Spread	(81)	(82)	(83)	(84)	(85)	(86)	(87)	(88)	(89)	(90)
Hard News	0.295 [0.378]	0.577 [0.628]	0.277 [0.288]	0.280 [0.325]	0.398 [0.388]					
Expected News						-0.141 [0.477]	-9.104 [7.320]	-8.648 [13.774]	-8.375 [10.687]	-157.745 [121.356]
Unexpected News						3.998 [4.139]	26.201 [47.743]	13.140 [38.417]	485.104 [663.511]	40.484 [306.542]
Soft News		0.403 [0.438]					36.498 [48.421]			
Political Communication			-0.012 [0.024]	0.059 [0.070]				14.621 [17.698]	22.215 [27.417]	
Media Reports			0.126 [0.131]		0.176 [0.171]			52.798 [76.636]		318.453 [240.939]

Table 8C – AR(1) – APARCH(1,1) with and Greek/Eurozone news – Mean Equation (1)

ΔSpread	(91)	(92)	(93)	(94)	(95)
G Hard Positive	0.367 [1.298]	0.390 [1.310]	-5.229 [7.665]	0.346 [1.304]	0.738 [0.646]
G Hard Negative	4.864 [1.391]***	5.696 [1.242]***	16.538 [8.103]**	5.796 [1.287]***	5.997 [0.921]***
E Hard Positive	-2.137 [2.905]	1.250 [3.202]	-10.930 [10.424]	1.150 [3.119]	1.351 [3.147]
E Hard Negative	1.213 [2.010]	2.885 [2.675]	15.501 [11.188]	2.907 [2.201]	3.319 [2.699]
G Soft Positive NB		-0.798 [0.454]*			
G Soft Negative NB		1.173 [0.356]***			
E Soft Positive NB		-0.163 [0.685]			
E Soft Negative NB		0.692 [0.592]			
G Positive Political NB			-1.186 [2.103]	-0.826 [0.829]	
G Negative Political NB			2.601 [1.654]	1.256 [0.591]**	
E Positive Political NB			-3.602 [3.398]	-0.097 [0.682]	
E Negative Political NB			3.967 [4.202]	1.153 [0.444]***	
G Positive Media Reports NB			-1.944 [3.210]		-0.348 [0.245]
G Negative Media Reports NB			0.123 [3.187]		1.914 [0.602]***
E Positive Media Reports NB			-3.365 [5.853]		0.373 [0.775]
E Negative Media Reports NB			3.848 [6.524]		0.583 [0.535]
T-DIST. DOF	2.696 [0.294]***	2.636 [0.327]***	14.209 [3.603]***	2.593 [0.324]***	2.690 [0.334]***
Adjusted R-squared	0.042	0.037	0.117	0.037	0.032
Obs	731	731	731	731	731

Table 8D – AR(1) – APARCH(1,1) with and Greek/Eurozone news – Mean Equation (2)

ΔSpread	(96)	(97)	(98)	(99)	(100)
G Positive Expected	1.705 [1.239]	-0.789 [1.106]	-0.917 [1.113]	-1.041 [1.113]	2.894 [1.047]***
G Positive Unexpected	-16.539 [4.005]***	-15.257 [3.204]***	-15.593 [3.514]***	-16.937 [3.279]***	-15.215 [6.086]**
G Negative Expected	1.680 [1.729]	1.708 [1.271]	1.476 [1.427]	1.925 [1.480]	1.893 [1.452]
G Negative Unexpected	11.705 [2.806]***	11.052 [2.021]***	11.680 [2.259]***	11.871 [2.165]***	14.300 [4.246]***
E Positive Expected	1.641 [3.294]	4.325 [3.055]	3.614 [3.286]	3.914 [3.000]	2.097 [2.364]
E Positive Unexpected	-25.595 [9.788]***	-26.417 [8.434]***	-27.692 [8.095]***	-27.140 [8.231]***	-28.800 [10.492]***
E Negative Expected	-2.085 [2.601]	1.331 [3.290]	3.352 [3.958]	1.312 [3.247]	-1.712 [2.579]
E Negative Unexpected	16.372 [5.377]***	13.897 [5.626]**	13.897 [5.402]**	14.914 [5.573]***	16.406 [5.948]***
G Soft Positive NB		-0.779 [0.598]			
G Soft Negative NB		0.969 [0.478]**			
E Soft Positive NB		-0.062 [0.691]			
E Soft Negative NB		0.471 [0.633]			
G Positive Political NB			-1.261 [0.993]	-0.560 [1.039]	
G Negative Political NB			0.905 [0.697]	1.033 [0.728]	
E Positive Political NB			-0.620 [1.038]	-0.071 [0.861]	
E Negative Political NB			1.419 [0.928]	0.592 [0.771]	
G Positive Media Reports NB			-0.414 [0.926]		-0.428 [0.842]
G Negative Media Reports NB			1.262 [0.937]		1.567 [0.876]*
E Positive Media Reports NB			-0.446 [1.676]		-0.593 [1.181]
E Negative Media Reports NB			-0.351 [1.932]		0.694 [1.298]
T-DIST. DOF	3.181 [0.369]***	2.999 [0.346]***	3.343 [0.374]***	2.854 [0.336]***	2.852 [0.367]***
Adjusted R-squared	0.076	0.070	0.067	0.071	0.074
Obs	731	731	731	731	731

Table 8E – AR(1) – APARCH(1,1) with and Greek/Eurozone news – Variance Equation

Spread	(91)	(92)	(93)	(94)	(95)	(96)	(97)	(98)	(99)	(100)
G Hard News	20.324 [24.893]	0.776 [0.785]	-0.010 [442.734]	0.698 [0.754]	0.580 [0.528]					
E Hard News	-31.015 [37.197]	0.221 [0.490]	0.001 [637.277]	0.037 [0.427]	0.207 [0.324]					
G Expected News						24.313 [34.475]	-6.190 [4.972]	-6.769 [12.585]	-4.494 [1.678]***	3.712 [4.993]
G Unexpected News						108.670 [164.079]	35.557 [46.961]	68.492 [81.229]	51.741 [60.520]	107.502 [126.296]
E Expected News						-32.277 [37.630]	1.201 [87.641]	0.125 [121.061]	-2.385 [71.291]	-12.942 [8.533]
E Unexpected News						45.368 [154.283]	3.651 [213.554]	8.786 [217.211]	4.730 [175.372]	34.283 [50.710]
G Soft News		0.126 [0.133]					15.171 [16.184]			
E Soft News		0.095 [0.100]					12.016 [17.350]			
G Political Communication			-219.489 [1088.739]	0.120 [0.147]				12.468 [13.211]	32.831 [33.509]	
G Media Reports			-0.002 [16.383]	0.112 [0.131]				23.293 [32.738]	14.755 [19.983]	
E Political Communication			-0.064 [124.163]		0.256 [0.232]			34.639 [50.979]		8.906 [9.603]
E Media Reports			0.000 [203.784]		0.188 [0.183]			30.069 [63.695]		1.465 [2.944]

Table 9. Macroeconomic Variables and Indices

Variable	Abbreviation	Source	Transformation	Frequency
Greek 10-year sovereign bond bid spread (in basis points)	ΔSpread	Bloomberg	First Difference	Daily
VIX Index	VIX	Bloomberg	First Difference	Daily
Euro US Dollar Exchange Rate	EURUSD	Bloomberg	Growth Rate	Daily
Euribor – OIS 3 month spread	Euribor-OIS spread	Bloomberg	First Difference	Daily
Macroeconomic news (Unemployment, CPI, IP, PMI, Retail sales, Construction)	Macronews	Reuters, Dow Jones	Dummy variable (equal to 1 on days with releases)	Daily
News Variables	(G/E) Soft Positive(Negative) NB (G/E) Positive(Negative) Political Statements NB (G/E) Positive(Negative) Media Reports NB (G/E) Hard Positive(Negative) (G/E) Expected Positive(Negative) (G/E) Unexpected Positive(Negative)	Reuters, Dow Jones Eurointelligence Associated Press Agence France Presse Market News International Athens News Agency	Dummy variables (NB) refers to count variables as the daily number of j type news (G/E) refers to respectively Greek-specific and Eurozone-wide news	Daily

Table 10. Descriptive Statistics

	Mean	Median	Maximum	Minimum	Standard Deviation	Skewness	Kurtosis	Jarque-Bera	Obs
ΔSpread	5.82	3	302	-484	47.39	-1.01	27.04	17722.01***	731
Euribor-OIS spread	0.00	-0.00	0.12	-0.12	0.02	0.11	12.17	2560.81***	731
EURUSD	-0.02	0	2.36	-2.38	0.69	-0.09	3.36	4.76*	731
VIX	-0.01	-0.12	16	-12.94	2.01	1.05	15.85	5159.53***	731

Table 11. Unit Root Tests

Series	**Phillips–Perron Unit Root Test**	**Augmented Dickey-Fuller Test**
ΔSpread	-23.54***	-23.66***
Euribor-OIS spread	-28.98***	-29.04***
EURUSD	-26.95***	-26.94***
VIX	-36.39***	-19.15***

*Notes: Phillips-Perron and Augmented Dickey Fuller tests with intercept (Ho: unit root), *** (**, *) rejects the null hypothesis at the 1% (5% and 10%) level.*

Table 12A. Granger Causality Tests for News Variables

Null Hypothesis	Obs	F-Statistic	Prob.
ΔSpread does not Granger Cause Hard Positive	731	1.173	0.279
ΔSpread does not Granger Cause HardNegative	731	0.091	0.763
ΔSpread does not Granger Cause Hard	731	1.127	0.289
ΔSpread does not Granger Cause Expected Positive	731	1.274	0.260
ΔSpread does not Granger Cause Unexpected Positive	731	2.241	0.135
ΔSpread does not Granger Cause Expected Negative	731	0.286	0.593
ΔSpread does not Granger Cause Unexpected Negative	731	0.002	0.965
ΔSpread does not Granger Cause Expected News	731	1.108	0.293
ΔSpread does not Granger Cause Unexpected News	731	0.238	0.626
ΔSpread does not Granger Cause Soft Positive NB	731	0.000	0.999
ΔSpread does not Granger Cause Soft Negative NB	731	0.050	0.824
ΔSpread does not Granger Cause Soft News NB	731	0.005	0.943
ΔSpread does not Granger Cause Positive Political Statements NB	731	0.015	0.902
ΔSpread does not Granger Cause Negative Political Statements NB	731	0.214	0.644
ΔSpread does not Granger Cause Positive Media Reports NB	731	0.023	0.878
ΔSpread does not Granger Cause Negative Media Reports NB	731	1.575	0.210
ΔSpread does not Granger Cause Political Communication NB	731	0.146	0.702
ΔSpread does not Granger Cause Media Reports NB	731	0.612	0.434

Table 12B. Granger Causality Tests for Greek-specific and Eurozone-wide News Variables

Null Hypothesis	Obs	F-Statistic	Prob.
ΔSpread does not Granger Cause G Hard Positive	731	1.262	0.262
ΔSpread does not Granger Cause G Hard Negative	731	0.005	0.943
ΔSpread does not Granger Cause E Hard Positive	731	0.605	0.437
ΔSpread does not Granger Cause E Hard Negative	731	0.056	0.813
ΔSpread does not Granger Cause G Hard News	731	1.234	0.267
ΔSpread does not Granger Cause E Hard News	731	0.743	0.389
ΔSpread does not Granger Cause G Expected Positive	731	1.606	0.205
ΔSpread does not Granger Cause G Unexpected Positive	731	0.000	0.986
ΔSpread does not Granger Cause G Expected Negative	731	0.639	0.424
ΔSpread does not Granger Cause G Unexpected Negative	731	0.192	0.661
ΔSpread does not Granger Cause E Expected Positive	731	5.801	0.016
ΔSpread does not Granger Cause E Unexpected Positive	731	4.728	0.030
ΔSpread does not Granger Cause E Expected Negative	731	0.000	0.995
ΔSpread does not Granger Cause E Unexpected Negative	731	0.696	0.404
ΔSpread does not Granger Cause G Expected News	731	3.043	0.082
ΔSpread does not Granger Cause G Unexpected News	731	0.066	0.798
ΔSpread does not Granger Cause E Expected News	731	5.014	0.026
ΔSpread does not Granger Cause E Unexpected News	731	5.093	0.024
ΔSpread does not Granger Cause G Soft Positive NB	731	0.036	0.850
ΔSpread does not Granger Cause G Soft Negative NB	731	0.627	0.429
ΔSpread does not Granger Cause E Soft Positive NB	731	0.030	0.862
ΔSpread does not Granger Cause E Soft Negative NB	731	0.580	0.446
ΔSpread does not Granger Cause G Soft NB	731	0.280	0.597
ΔSpread does not Granger Cause E Soft NB	731	0.285	0.593
ΔSpread does not Granger Cause G Positive Political Statements NB	731	0.014	0.907
ΔSpread does not Granger Cause G Negative Political Statements NB	731	0.084	0.772
ΔSpread does not Granger Cause E Positive Political Statements NB	731	0.000	0.993
ΔSpread does not Granger Cause E Negative Political Statements NB	731	1.797	0.180
ΔSpread does not Granger Cause G Positive Media Reports NB	731	0.239	0.625
ΔSpread does not Granger Cause G Negative Media Reports NB	731	1.737	0.188
ΔSpread does not Granger Cause E Positive Media Reports NB	731	0.331	0.565
ΔSpread does not Granger Cause E Negative Media Reports NB	731	0.165	0.685

ΔSpread does not Granger Cause G Political Communication NB	731	0.009	0.925
ΔSpread does not Granger Cause G Media Reports NB	731	1.073	0.301
ΔSpread does not Granger Cause E Political Communication NB	731	0.628	0.428
ΔSpread does not Granger Cause E Media Reports NB	731	0.004	0.948

Table 12C. Test of predeterminedness

	Value	P-value
E Positive Expected	0.160	0.689
E Positive Unexpected	0.615	0.433
G Expected News	0.731	0.393
E Expected News	0.021	0.884
E Unepected News	1.383	0.240

Note: Test of the validity of the first lag as instrument in a IV regression based on the difference in Hansen J statistics.

Figure 2. 20-day moving average of the number of hard news

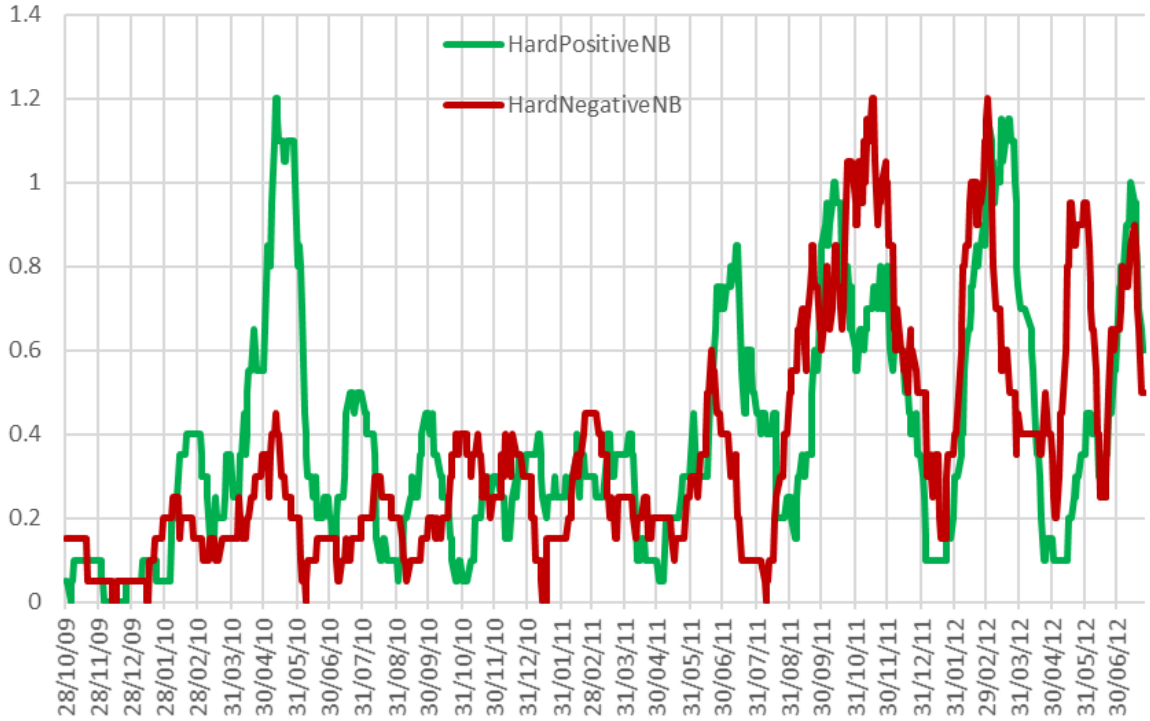

Figure 3. 20-day moving average of the number of hard news by type

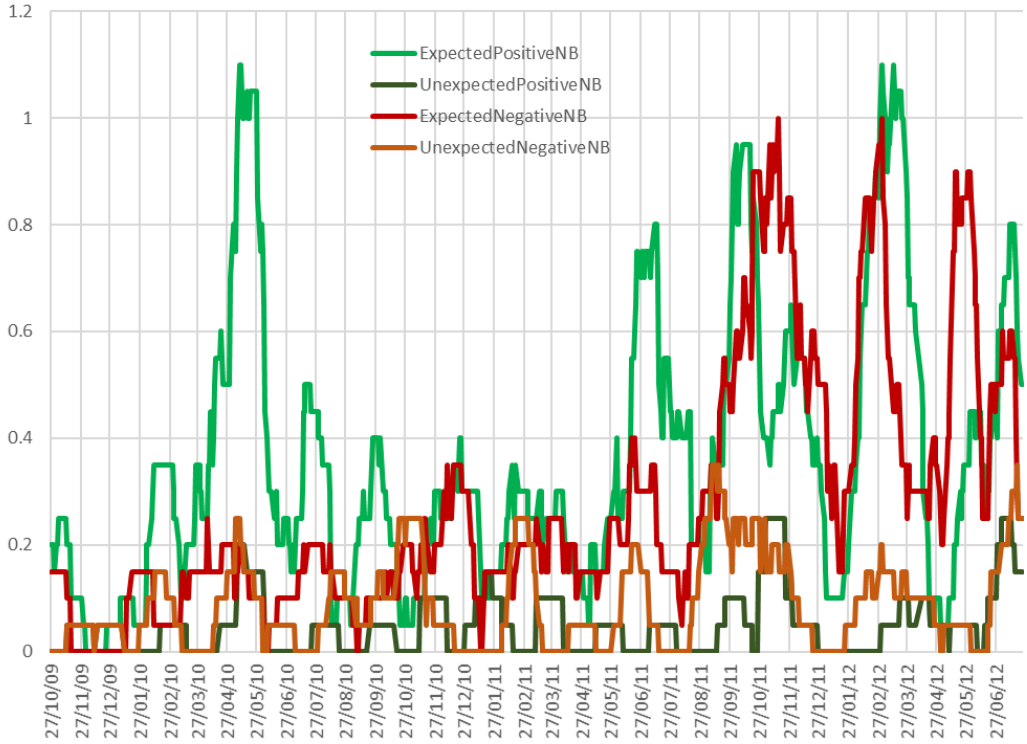

Figure 4. Hard news dummies

Figure 5. Positive hard news dummies by type

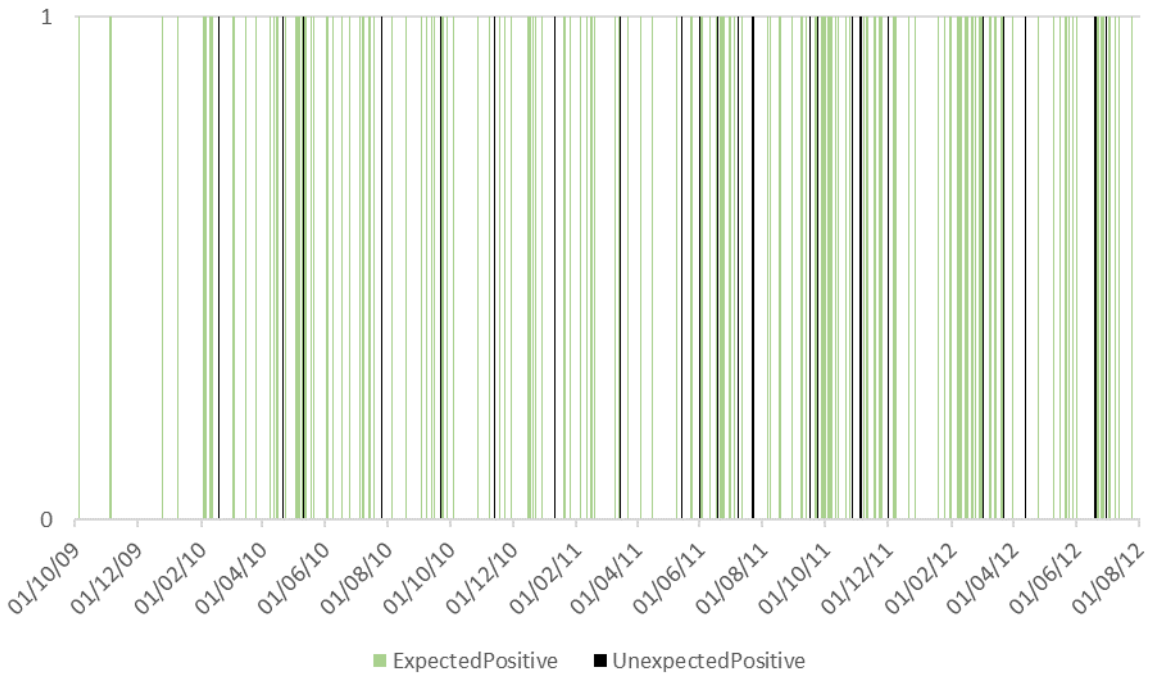

Figure 6. Negative hard news dummies by type

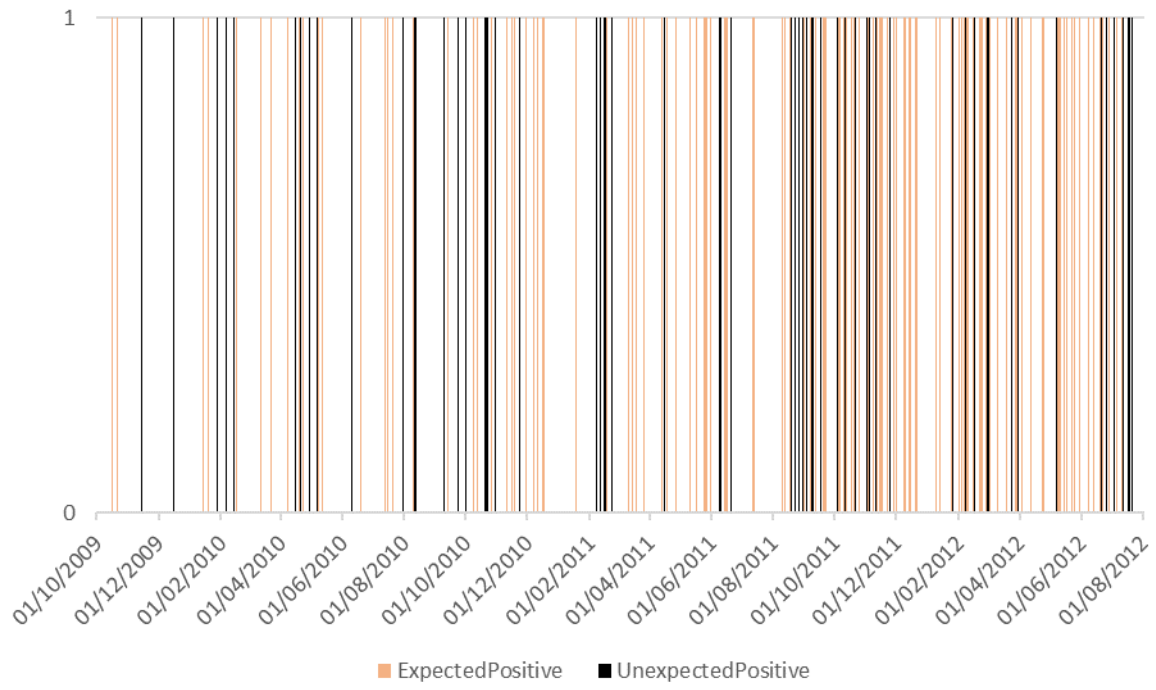

Figure 7. 20-day moving average of the number of soft news

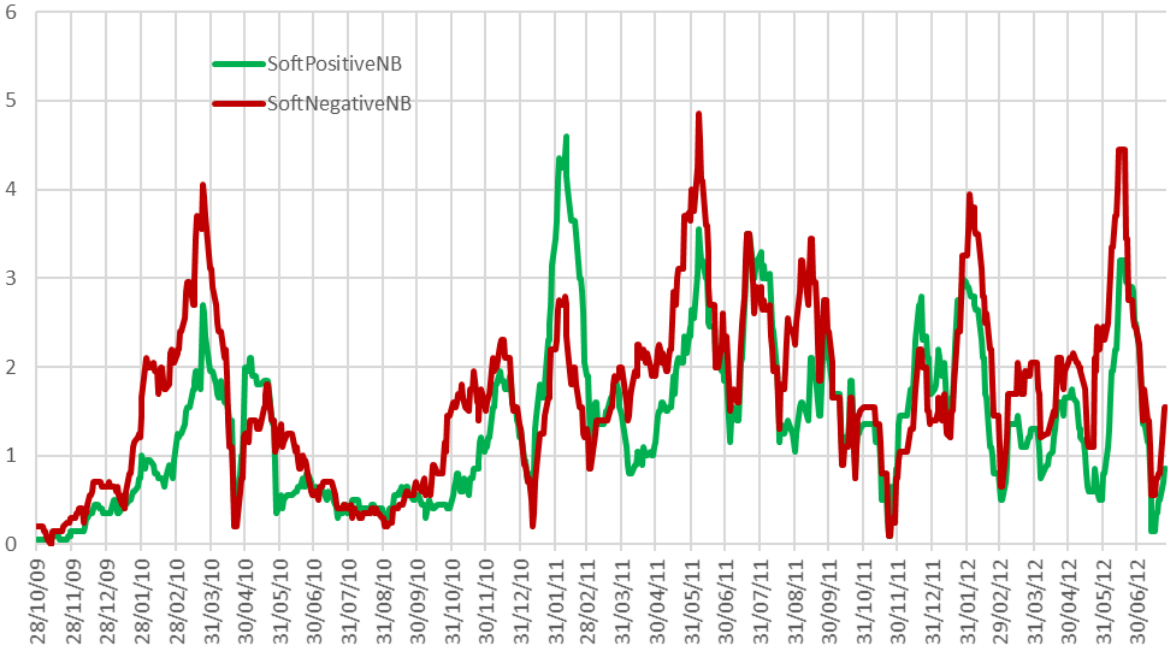

Figure 8. 20-day moving average of the number of soft news by type

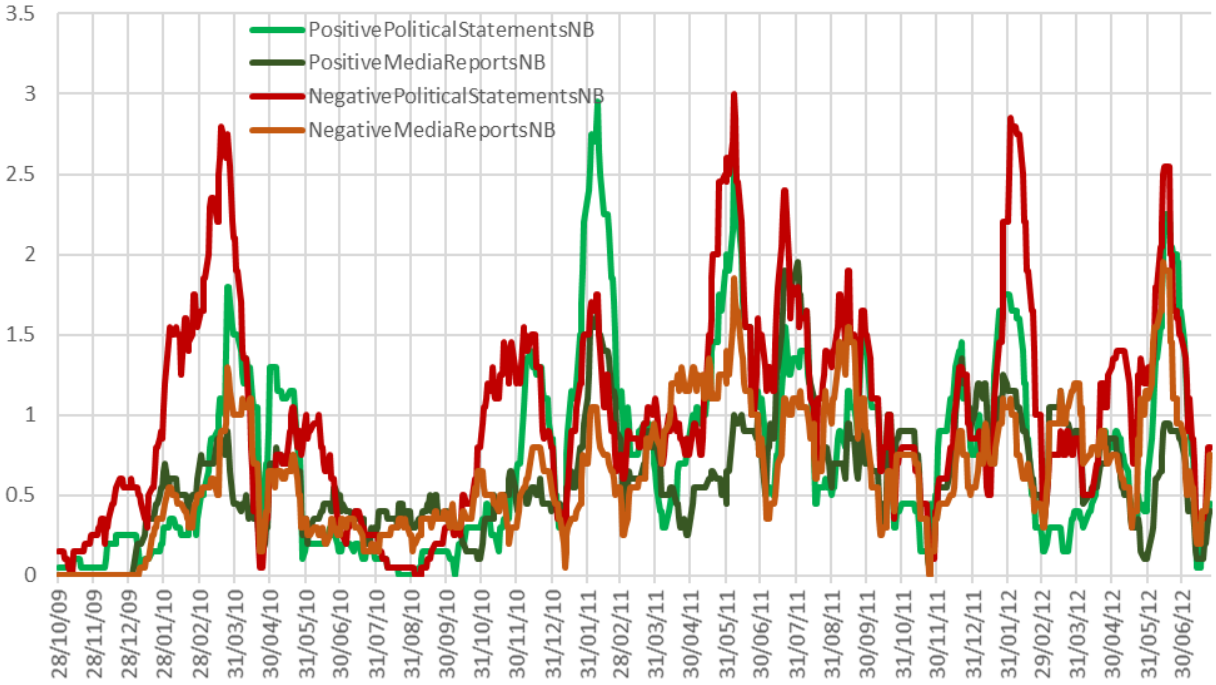

Figure 9. 20-day moving average of the number of hard news by topic

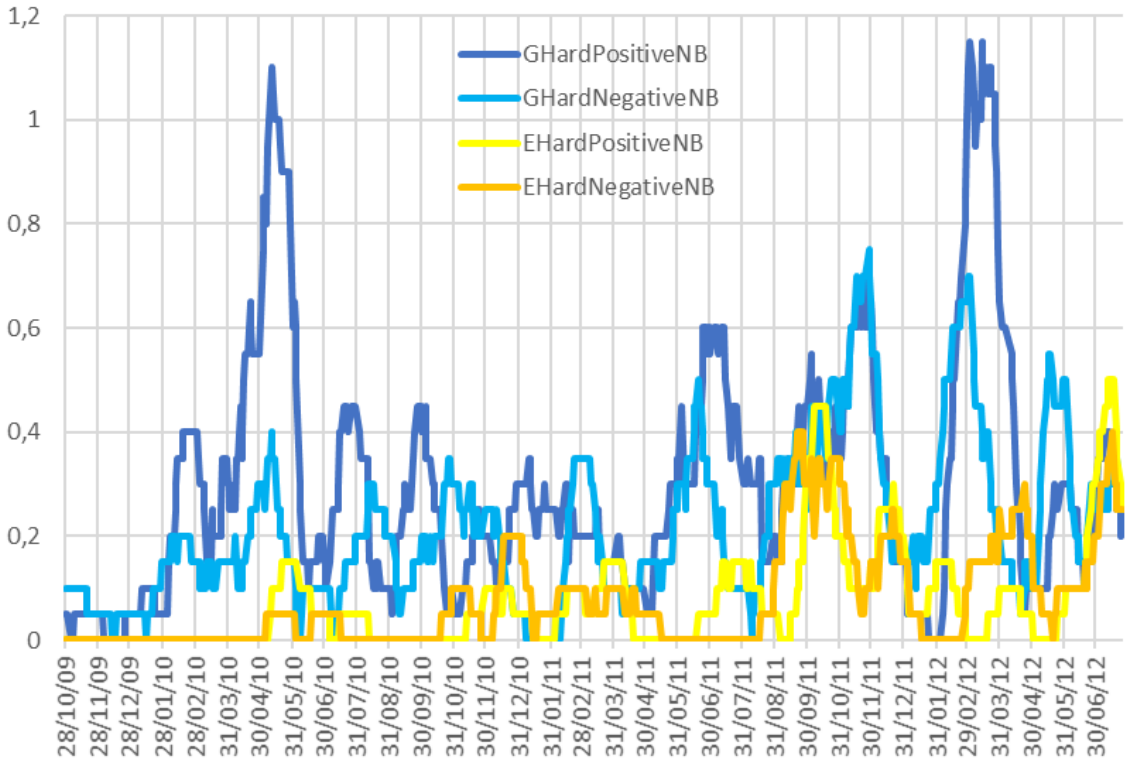

Figure 10. 20-day moving average of the number of Greek-specific hard news by type

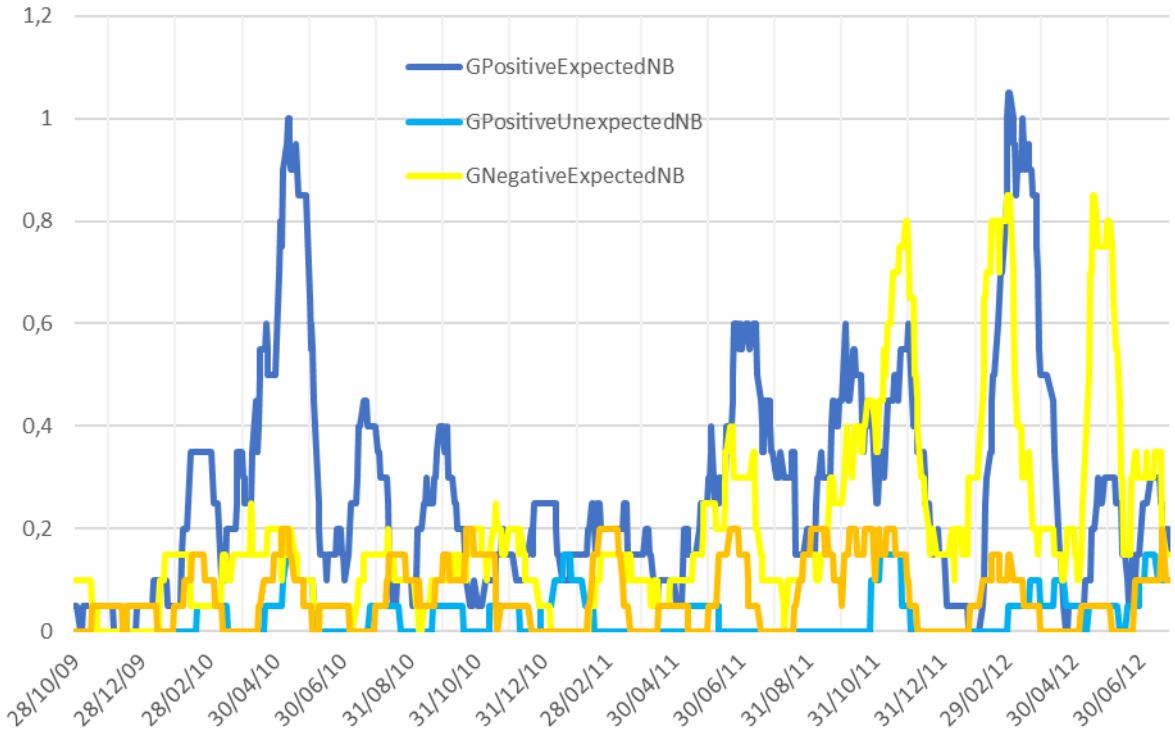

Figure 11. 20-day moving average of the number of Eurozone-specific hard news

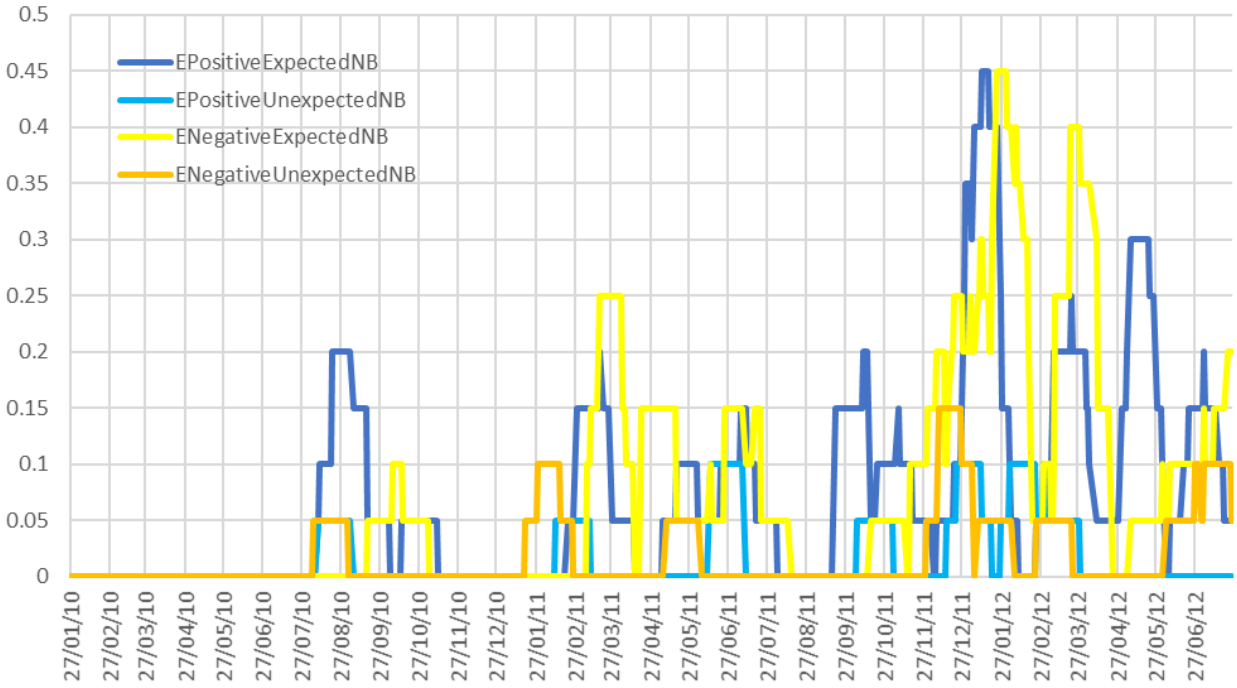

Figure 12. Greek-specific Hard news by topic (dummies)

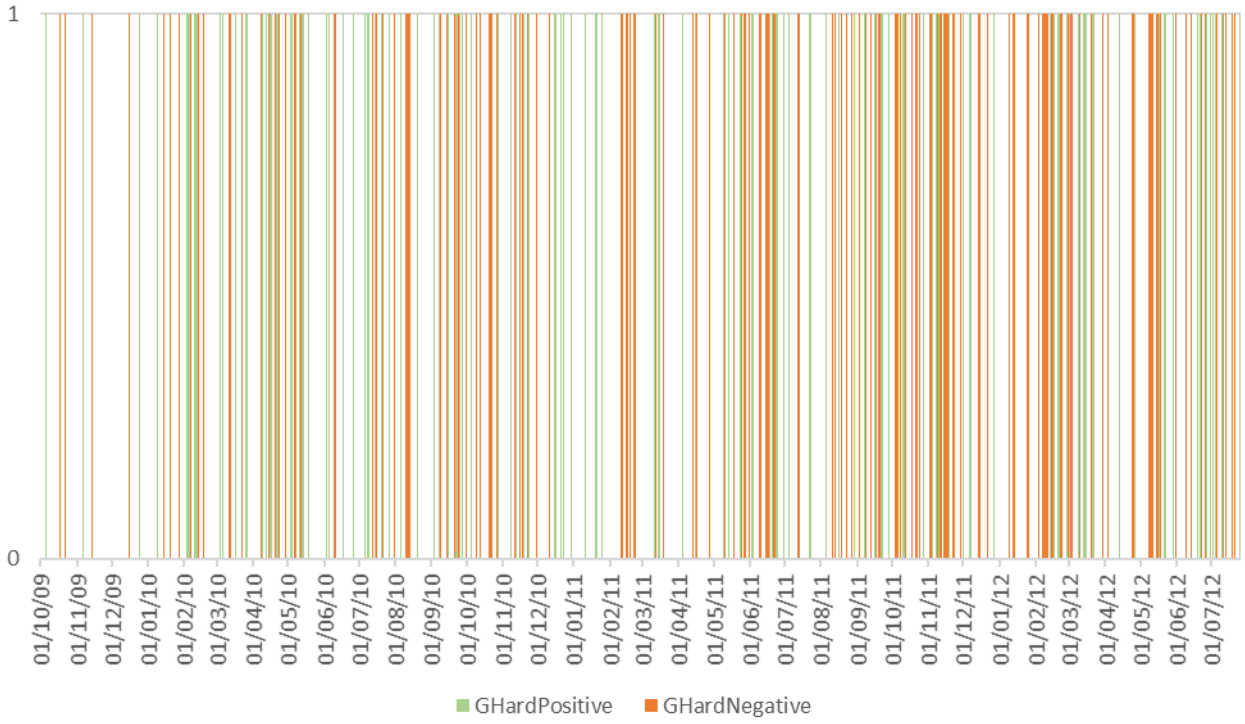

Figure 13. Eurozone-wide Hard News by topic (dummies)

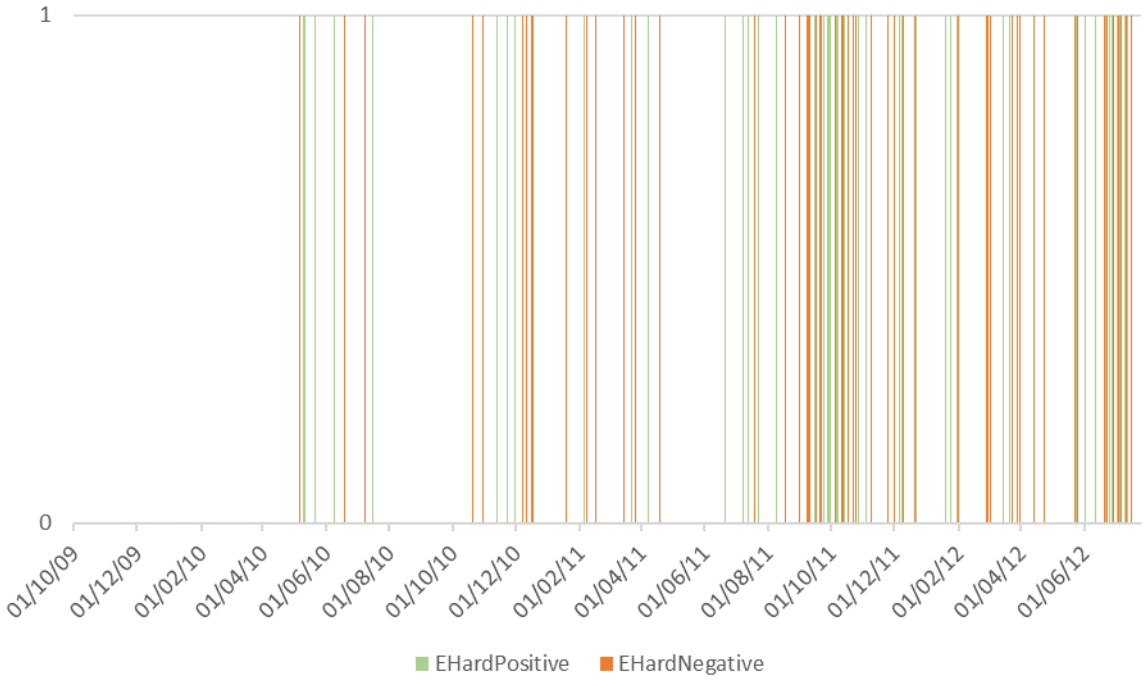

Figure 14. Greek-specific Hard news by topic and type (dummies)

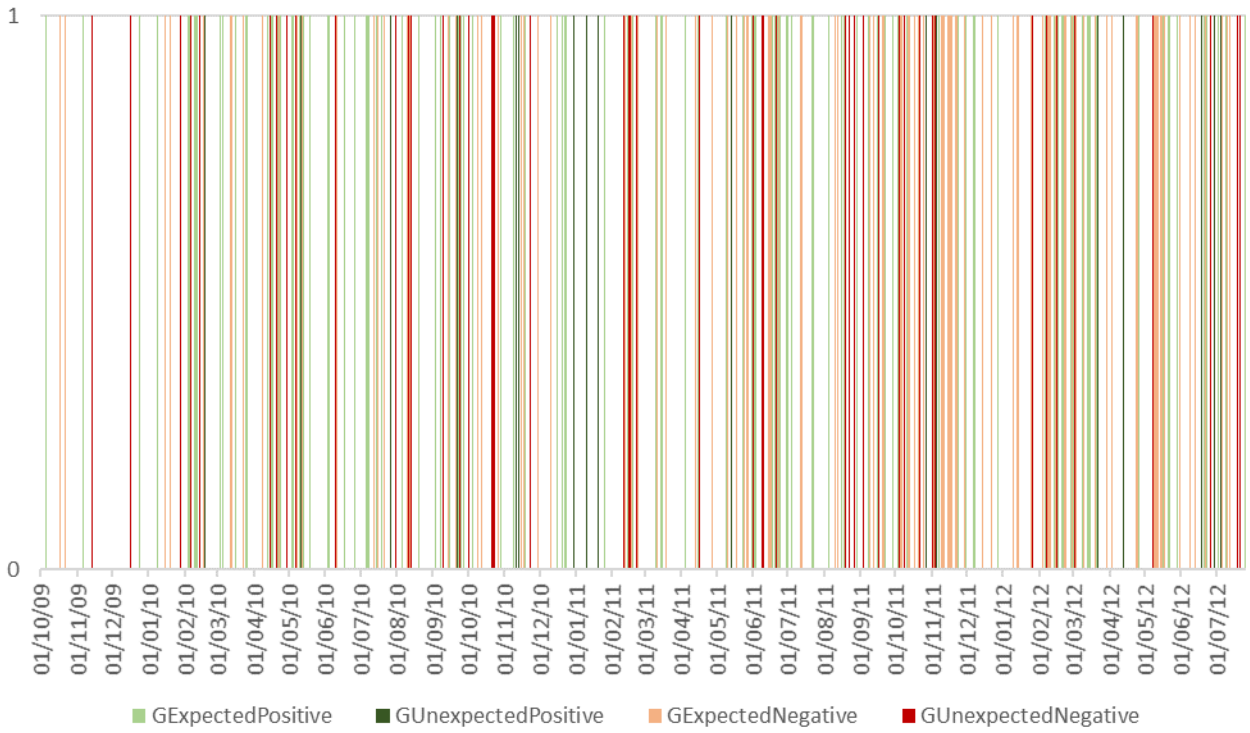

Figure 15. Eurozone-wide Hard News by topic and type (Dummies)

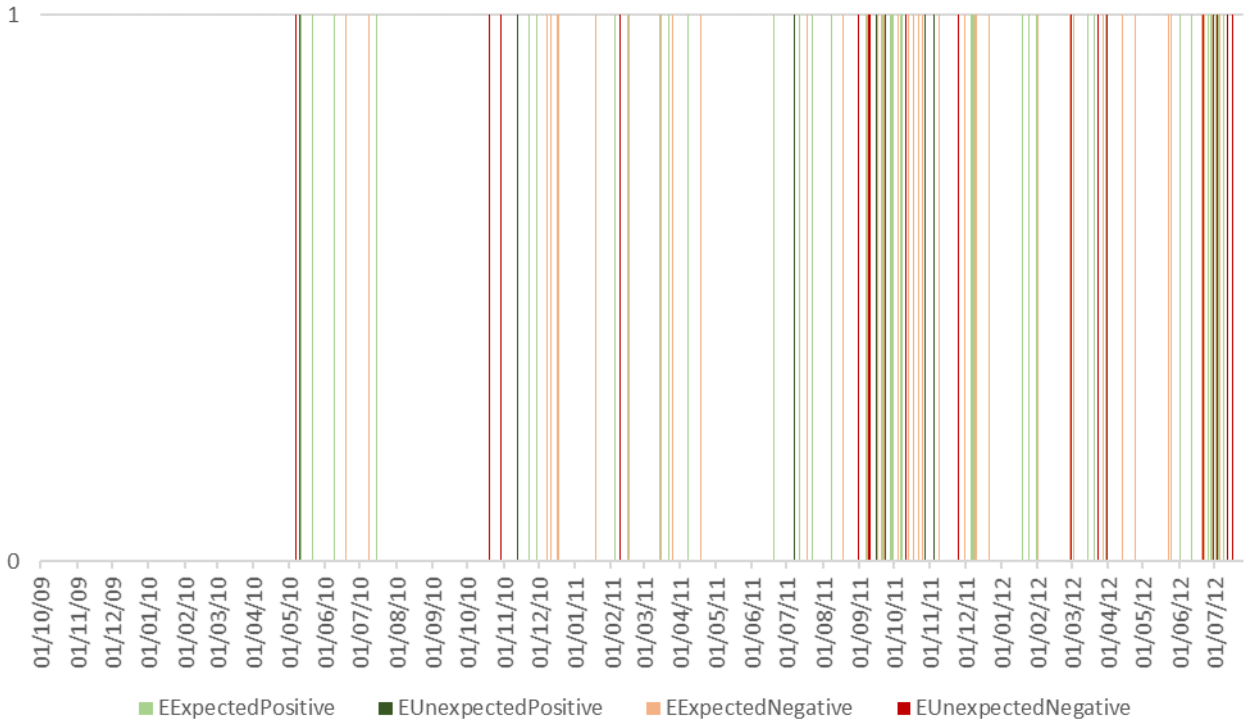

Figure 16. 20-day moving average of the number of soft news by topic

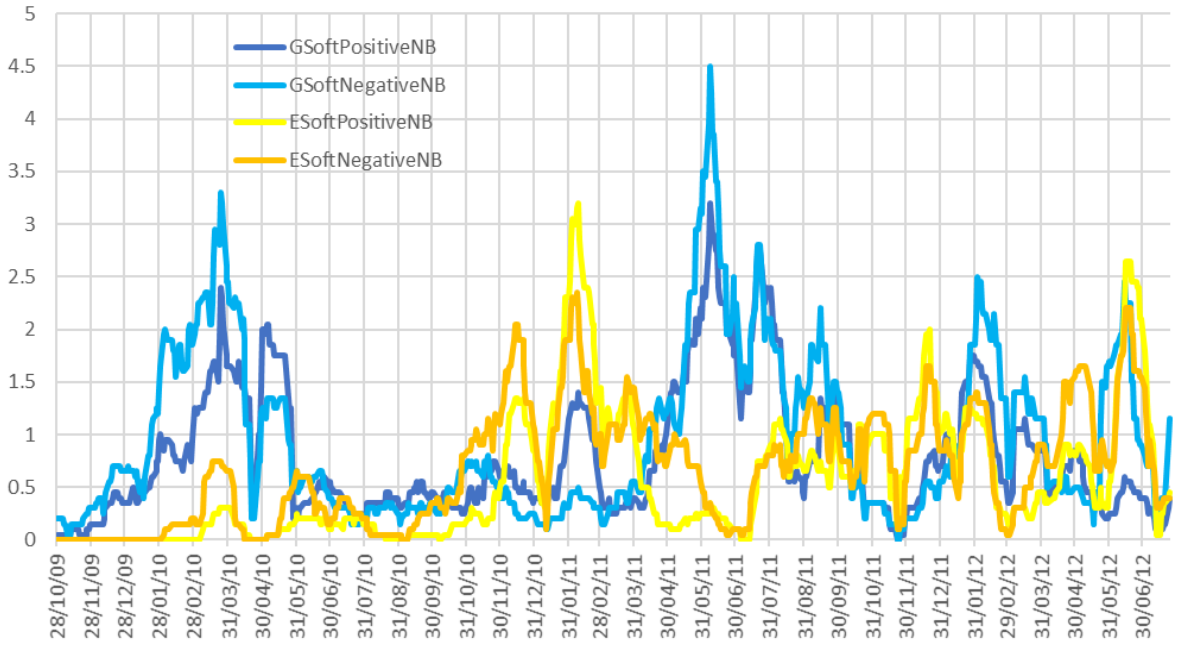

Figure 17. 20-day moving average of the number of Greek-specific soft news by type

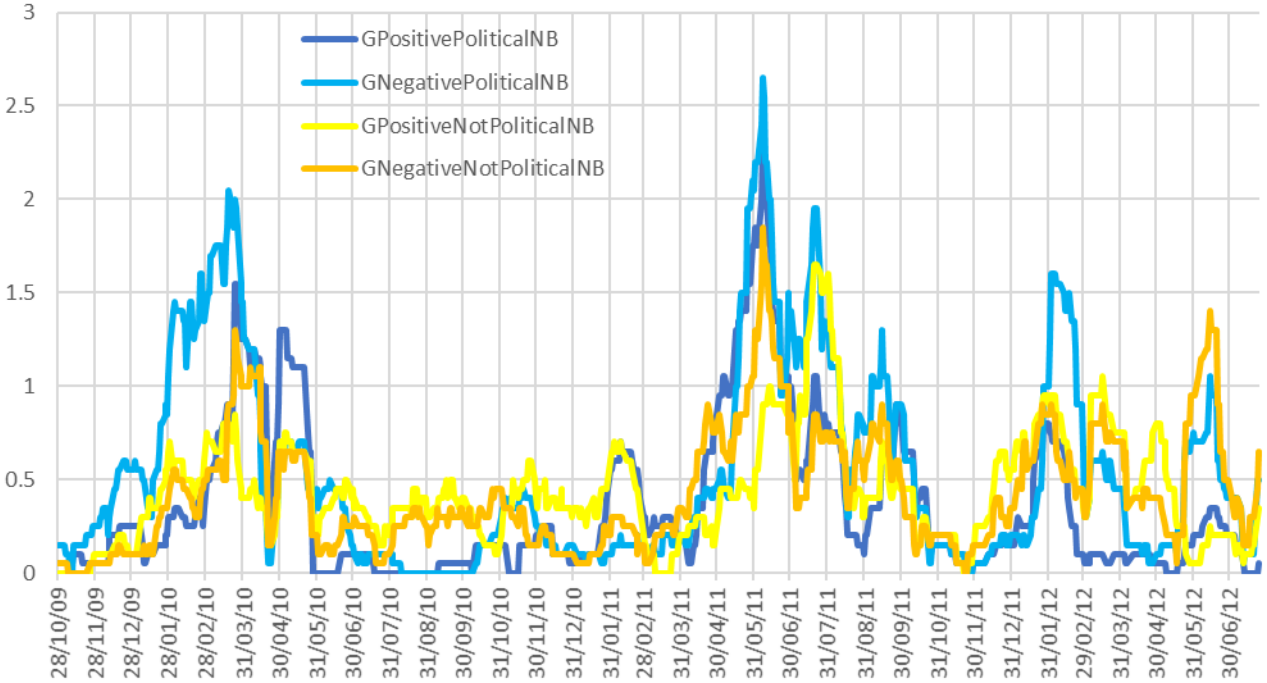

Figure 18. 20-day moving average of the number of Eurozone-wide soft news by type

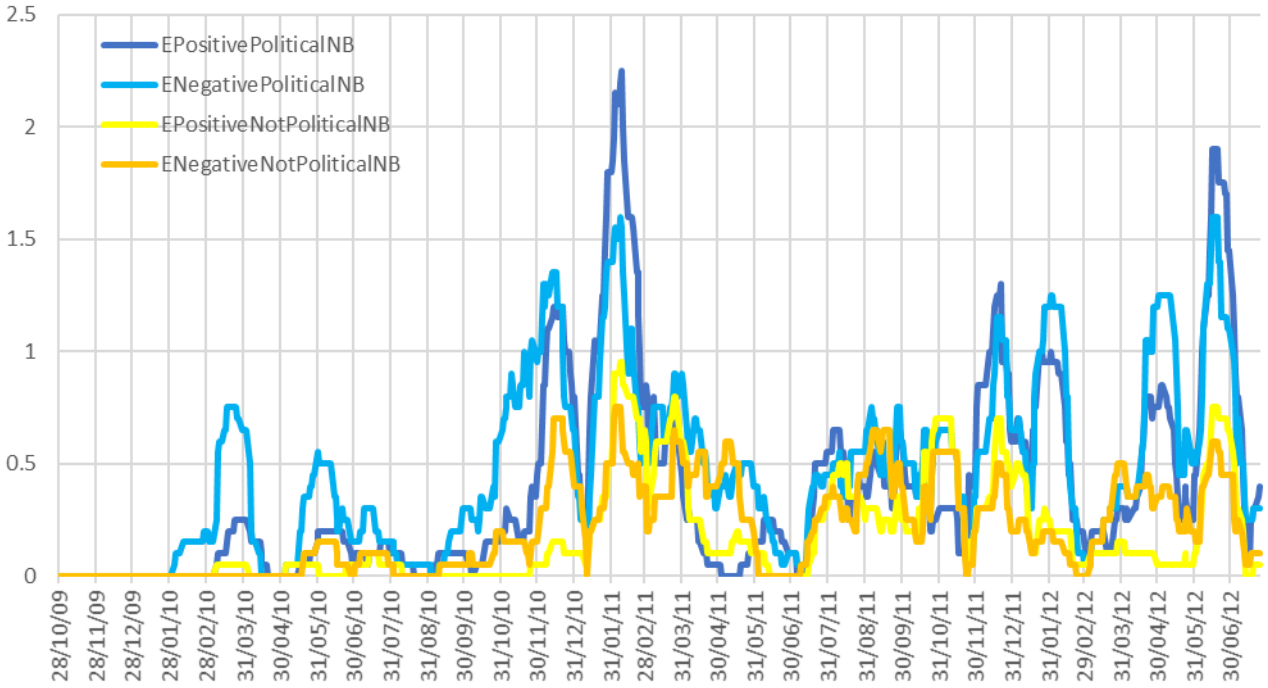

Figure 19. Evolution of the proportion of news by subject (% of total news)

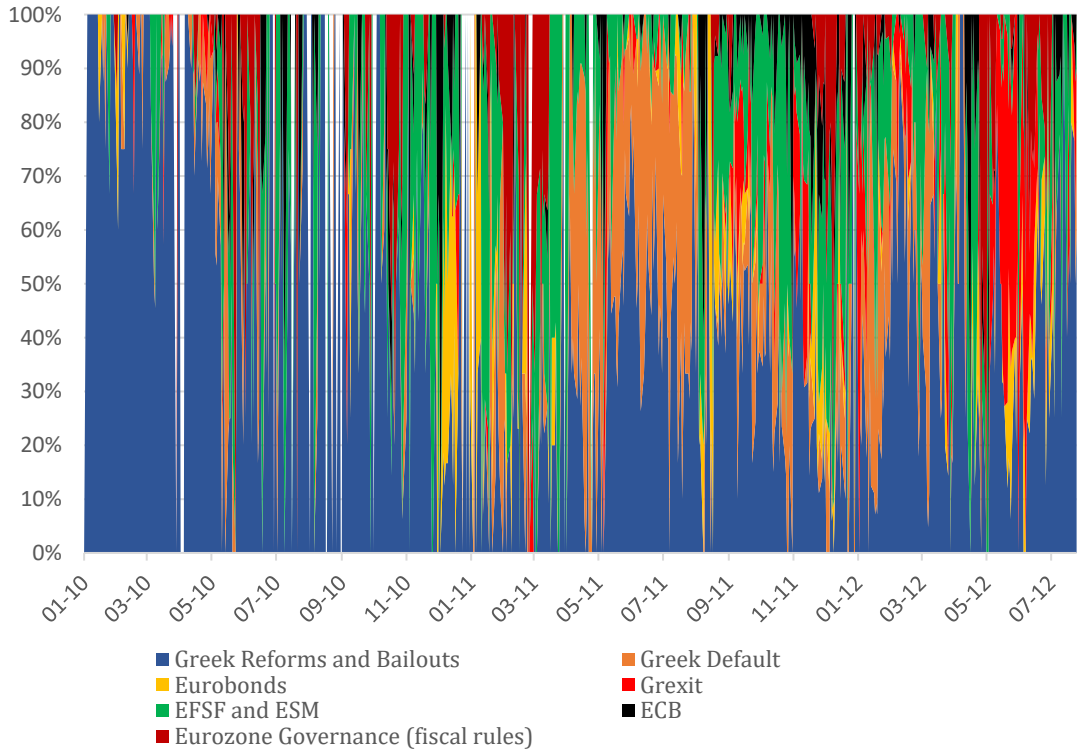

Table 13A. Greek-specific News

	Total	% of Total		% of Days with
G Total	3536			85.6%
G Negative News NB	1977	55.9%	% of Neg	69.9%
G Soft Negative NB	1790	50.6%	90.5%	66.2%
G Political Statements Negative NB	1068	30.2%	54.0%	50.8%
G Media Reports Negative NB	722	20.4%	36.5%	49.5%
G Hard Negative NB	187	5.3%	9.5%	20.8%
G Hard Expected Negative NB	140	4.0%	7.1%	15.7%
G Hard Unexpected Negative NB	47	1.3%	2.4%	6.2%
G Positive News NB	1559	44.1%	% of Pos	71.4%
G Soft Positive NB	1344	38.0%	86.2%	65.9%
G Political Statements Positive NB	594	16.8%	38.1%	38.0%
G Media Reports Positive NB	750	21.2%	48.1%	53.2%
G Hard Positive NB	215	6.1%	13.8%	23.0%
G Hard Expected Positive NB	197	5.6%	12.6%	21.2%
G Hard Unexpected Positive NB	18	0.5%	1.2%	2.3%

Table 13B. Greek-specific News (excluding soft news on days with hard news)

	Total	% of Total		% of Days with
G Total	1683			80.2%
G Negative News NB	896	53.2%	% of Neg	53.2%
G Soft Negative NB	709	42.1%	79.1%	32.4%
G Political Statements Negative NB	393	23.4%	43.9%	22.8%
G Media Reports Negative NB	316	18.8%	35.3%	23.1%
G Hard Negative NB	187	11.1%	20.9%	20.8%
G Hard Expected Negative NB	140	8.3%	15.6%	15.7%
G Hard Unexpected Negative NB	47	2.8%	5.2%	6.2%
G Positive News NB	787	46.8%	% of Pos	55.4%
G Soft Positive NB	572	34.0%	72.7%	32.4%
G Political Statements Positive NB	258	15.3%	32.8%	17.6%
G Media Reports Positive NB	314	18.7%	39.9%	24.8%
G Hard Positive NB	215	12.8%	27.3%	23.0%
G Hard Expected Positive NB	197	11.7%	25.0%	21.2%
G Hard Unexpected Positive NB	18	1.1%	2.3%	2.3%

Table 14A. Eurozone-wide News (excluding soft news on days with hard news)

	Total	% of Total		% of Days with
E Total	2265			66.1%
E Negative News NB	1280	36.2%	% of Neg	55.1%
E Soft Negative NB	1211	34.2%	94.6%	54.6%
E Political Statements Negative NB	808	22.9%	63.1%	46.5%
E Media Reports Negative NB	403	11.4%	31.5%	32.8%
E Hard Negative NB	69	2.0%	5.4%	7.3%
E Hard Expected Negative NB	54	1.5%	4.2%	5.5%
E Hard Unexpected Negative NB	15	0.4%	1.2%	2.1%
E Positive News NB	985	27.9%	% of Pos	47.9%
E Soft Positive NB	922	26.1%	93.6%	46.4%
E Political Statements Positive NB	589	16.7%	59.8%	39.1%
E Media Reports Positive NB	333	9.4%	33.8%	25.3%
E Hard Positive NB	63	1.8%	6.4%	7.3%
E Hard Expected Positive NB	51	1.4%	5.2%	5.7%
E Hard Unexpected Positive NB	12	0.3%	1.2%	1.5%

Table 14B. Eurozone-wide News (excluding soft news on days with hard news)

	Total	% of Total		% of Days with
E Total	1021			44.6%
E Negative News NB	557	54.6%	% of Neg	32.8%
E Soft Negative NB	488	47.8%	87.6%	25.6%
E Political Statements Negative NB	338	33.1%	60.7%	22.6%
E Media Reports Negative NB	150	14.7%	26.9%	13.3%
E Hard Negative NB	69	6.8%	12.4%	7.3%
E Hard Expected Negative NB	54	5.3%	9.7%	5.5%
E Hard Unexpected Negative NB	15	1.5%	2.7%	2.1%
E Positive News NB	464	45.4%	% of Pos	29.1%
E Soft Positive NB	401	39.3%	86.4%	21.9%
E Political Statements Positive NB	277	27.1%	59.7%	19.0%
E Media Reports Positive NB	124	12.1%	26.7%	10.7%
E Hard Positive NB	63	6.2%	13.6%	7.3%
E Hard Expected Positive NB	51	5.0%	11.0%	5.7%
E Hard Unexpected Positive NB	12	1.2%	2.6%	1.5%

Appendix B – Description of the coding procedure

1. *Data Releases*

All Greek public finances' statistics were closely scrutinised as they signalled Greece's ability to meet its yearly fiscal targets and the roadmap set in its adjustment programs. All data releases on Greece's public finances were therefore included in the dataset as hard news. When Greece met (missed) its fiscal target, the news was coded positively (negatively). All media reports or statements suggesting that Greece would be missing its targets were coded as negative soft news. Only media reports suggesting that Greece would meet its targets were coded as positive soft news. Positive statements were excluded out of credibility and endogeneity suspicions.

The Greek adjustment path was also highly dependent on optimistic fiscal revenues targets. We thus went through the full articles in order to check whether the data releases mentioned Greece's meeting (missing) its revenues target. Thus, when Greece met (missed) its revenues target, we coded the news positively (negatively).

In addition, GDP growth trajectory was also key in the Greek adjustment as it provided information about Greece's ability to meet its fiscal targets. Media reports about GDP growth were coded as soft news while GDP releases were coded as hard news.

European Commission, Eurostat or troika reports about Greece's fiscal targets and economic forecasts were coded as hard negative (positive) news when revised downwards (upwards). Reports showing that Greece's debt sustainability has deteriorated (improved) were coded as negative (positive) hard news.

2. *Financial Support*

a. *Bailout package and loan tranches*

News about a bailout package can have contradictory effects on spreads. On the one hand, if a bailout is being prepared, it signals that Greece has failed to adjust, hence a higher probability of default: spreads should widen. On the other, if there is a bailout in the works, it suggest that Greece will not be allowed to default in a disorderly manner: spreads should tighten. All in all, we will assume that this latter effect is dominant.

Media reports or statements suggesting Europeans' unwillingness to grant a bailout to Greece were included in this sub-category and coded negatively as soft news. We have thus coded negatively any statement that stated that Greece should not Expect any external help or that Greece had to deal with its problems on its own. We have also negatively coded any statement that implied that financial support would be conditional on Greek reforms. This last point is based on the idea that, prior to the crisis, financial markets Expected that the no-bailout clause was not credible and that all public liabilities were unconditionally guaranteed by the area as a whole.

Statements expressing unconditional support or solidarity with Greece as well as media reports that the Eurozone was mulling plans for bailouts were coded positively as soft news. In addition, prior to the first Greek bailout, We have not included reassurances by Greek but also European policy-makers that Greece needed no bailout out of endogeneity suspicions. Such statements might have been direct replies to fears in the markets about Greece being unable to meet its financial commitments without external help. Eurogroup and

European Council's decisions on Greece's bailout packages were included and coded as hard news.

In the run-up to the first Greek bailout, there was a debate among European policy-makers about whether the IMF should be part of the Greek bailout. We will assume that media reports or statements suggesting that the IMF should (not) participate in the Greek bailout were coded as negative (positive) soft news. For an IMF loan package is likely to be stricter than one solely coming from the euro zone, and will thus increase the chance of a Greek default. Media reports or statements suggesting that the IMF needs (no) more financing guarantees from the Eurozone before approving a bailout/loan tranche were coded as negative (positive) soft news.

Right after the decision to grant a second bailout to Greece in July 2011, there was also a controversy about the Finnish requirement for collateral. Media reports suggesting that the collateral deal between Greece and Finland for the second bailout was (not) progressing were coded as positive (negative) soft news. Only equivalent negative statements were included in the dataset. News that the collateral deal was off the table were coded as negative hard news. News that a deal was reached between Greece and Finland was coded as positive hard news.

Parliamentary (dis)approval in "recalcitrant" countries (Germany, the Netherlands, Austria, Finland, Slovakia (until the pro-European reshuffle that took place in October 2011)) were coded as positive (negative) hard news. News signalling support (opposition) for parliamentary approval were coded as positive soft news.

Regarding loan tranches, media reports or statements issued by single policy-makers suggesting that Greece will/may not receive its loan tranche and/or receive it conditionally were coded as negative soft news. Only media reports suggesting that Greece will receive loan tranches were included in the dataset as positive soft news. Positive statements issued by single policy-makers were not included out of endogeneity and credibility suspicions. Decisions by the Eurogroup to disburse (delay) a loan tranche were coded positively (negatively) as hard news.

Media reports or statements suggesting that the official creditors are requesting written commitment before disbursing funds were coded as negative soft news. Decisions to disburse funds only after written commitments were coded as negative hard news. Media reports or statements suggesting that Greek policy-makers will (not) commit to reforms in writing were coded as positive (negative) soft news. Statements

b. Loan Reviews

Financial support to Greece was disbursed in tranches and was conditional on Greece completing reforms' milestones and fiscal targets. And because the Greek macroeconomic situation deteriorated gradually, the memorandum had to be amended from time to time, creating space for uncertainty about Greece's ability to secure funds and enact new reforms.

The Europeans and the IMF would exert pressure on Greece to implement the program or to agree additional measures to correct for fiscal slippage. On the one hand, such news signal that the official creditors will not give free rein to Greece, implying that adjustment will proceed. On the other, they signal that the Greek situation has deteriorated to a significant extent and/or that Greece is not tackling the problem head-on. We assume that the latter effect should be dominant. And therefore, only news signalling that Greece had bowed to the creditors' pressure or that Greece and its creditors had found an agreement were coded as positive news.

Media reports or statements suggesting that completion of reviews are going badly/will be delayed were coded negatively as soft news. News signalling that negotiations have broken

down or decisions to delay the completion of a review were coded as negative hard news. On the contrary, media reports or statements suggesting that a review will resume (after a breakdown) were coded positively as soft news while actual review resumptions were coded positively as hard news.

Media reports or statements from individual policy-makers suggesting that Greece adjustment is off-track were included in the dataset and coded negatively as soft news. Statements issued by single European policy-makers and the IMF saying that Greece needed additional measures or needed to step up its efforts were also coded negatively as soft news. Statements issued by single policy-makers pressuring Greece to improve implementation were coded as negative soft news.

For equivalent positive soft news, We have included all media reports suggesting Greece was on-track but included such statements only when they were closely linked to Troika reviews and reports. Indeed, statements signalling that "Greece is on track with the program" could be particularly subject to endogeneity as they would simply aim at reassuring markets. In the same vein, we have excluded statements praising Greece for its efforts. Indeed, such statements might have a very low informational content as they are part of standard political discourse and are potentially only made for form. Reassurances by Greek policy-makers about fiscal adjustment, for instance saying that they will stick with program targets and/or are determined to implement the programs were not included as this is arguably cheap talk.

Media reports or statements suggesting new austerity announcements or privatisations are being prepared have been included into the dataset only when austerity measures were detailed. Decisions on new austerity measures or privatisations were positively coded as hard news as well as parliamentary or cabinet approval of austerity measures. Statements saying that Greece is not planning any new cuts were coded as soft negative news.

Public disagreements between Greece and the Troika on the required measures as well as public disagreements within the Troika were coded negatively as hard news. Formal reports issued by the Commission or the IMF on program reviews were also coded as hard news. Even if the institutions issue favourable opinion for review completion, whenever they raised doubts on Greece's implementation process, these news were coded as negative hard news.

c. OSI

Over the course of the Greek bailouts, the Europeans and the IMF gradually eased the repayment terms of their loans, once they realized that the Greek deteriorating situation made the repayment virtually impossible.

Media reports and statements were coded positively (negatively) as soft news when suggesting support (opposition) for an increase of the official loans' maturity and a decrease of the interest rate. Decisions on loans' repayment terms were coded as hard news.

In the run-up to the completion of the talks between Greece and its private creditors, the issue of what would happen to the ECB's holdings of Greek bonds arose. In particular, a restructuring of these bonds were seen as an additional way to ease Greece's debt burden. Media reports or statements suggesting that the ECB is (not) willing to participate in the OSI for the second Greek bailout were coded as positive (negative) news. ECB's decisions to participate in the OSI were coded as positive hard news. Media reports or statements suggesting that the ECB participation in the second Greek bailout was (not) necessary for the Greek PSI were coded as negative (positive) soft news.

3. *Greek debt restructuring*

a. A long story short

Since the beginning of the Greek crisis, there had been doubts about the Greek capacity to repay its debts in full. There had also been doubts about whether Greece would be able to escape debt restructuring even with a bailout. But up until the Deauville meeting on October 19, 2010, sovereign default was not an official option. Only Germany would design and present plans for sovereign restructuring or insist on the need to impose forced losses on private bondholders.

The debate on a specific Greek default really started in April 2011 (there was also a debate about a bond buyback in January and February 2011). Initially, the debate was about whether the (orderly) restructuring would be voluntary or not. The ECB had a very strong position in this debate. In particular, the ECB threatened to stop accepting Greek bonds as collateral if Greece's debt restructuring led to selective default. The debate was more or less settled on June 17, 2011 when Sarkozy and Merkel decided that losses on Greek bonds had to be voluntary. During the negotiations up until the July deal, there were 2 main options on the table: a rollover of Greek bonds (the French plan) or a bond swap (the German plan). The French plan for a debt rollover might have avoided a selective default according to rating agencies while the German plan for a debt swap would have been more likely rated as a default. Still, understanding that no option would avoid selective default, the ECB and the European Council found a compromise on July 2011: the ECB would continue accepting Greek bonds as collateral even after a default but member states would provide guarantees.

Negotiations between Greece and its private creditors started shortly after the June 17 decision. The new bailout that was decided in July 2011 left negotiations open between Greece and its private creditors to find a solution on how to reach the targets set by the European Council. However, the targets set in July became quickly out-of-date with Greece's fiscal situation. Negotiations started once again but got finalised only in February 2012. Throughout this period, there were renewed concerns about a forced default.

b. Coding procedure

That being said, let us now describe our coding procedure. Statements or media reports suggesting that Greece should/would default on its debt were coded as negative soft news. Only media reports signalling that Greece will not default were coded as positive soft news because of endogeneity and credibility concerns. Yet, after Greece asked for the activation of the bailout in April 2010 up until the first bailout, reassurances that default was off (on) the table were coded as positive (negative) soft news. Statements suggesting that a Greek default would be catastrophic were coded as positive soft news (such messages raised fears about a Greek default but the message was precisely aiming at saying that because of the catastrophic effects of a default, default should not be an option).

Statements or media reports suggesting that private creditors should (not) bear forced losses, even through a "soft" restructuring, were coded as negative (positive) soft news. Statements or media reports that private creditors would be forced to bear losses, even through a "soft" restructuring, were coded as negative soft news. Only media reports that private creditors would not be forced to bear losses were coded as positive soft news. Decisions (not) to force Greece's private creditors losses were coded as negative (positive) hard news.

Statements that the ECB would (not) accept Greek bonds after a Greek default were coded as positive (negative) soft news. Media reports that agency ratings will (not) treat a potential Greek PSI arrangement as default were also coded as negative (positive) soft news. The decision that the ECB would accept Greek bonds even after a default was coded as a positive hard news.

Media reports or statements suggesting support (opposition) for the rollover of Greek debt were coded as positive (negative) soft news. Media or statements suggesting support (opposition) for the swap of Greek bonds were coded as negative (positive) soft news.

Media reports suggesting that (no) progress was being made on the PSI deal between Greece and its private creditors were coded positively (negatively) as soft news. Equivalent positive statements were not included in the dataset (out of credibility and endogeneity issues) but negative statements were. Failure (success) to reach a compromise between Greece and its private creditors were coded as negative (positive) hard news. Negotiations breakdowns (resumption) were coded as negative (positive) hard news.

Media reports or statements suggesting that losses on Greek bonds should (not) increase were coded as negative (positive) soft news. Media reports or statements suggesting that losses on Greek bonds would increase were coded as negative soft news. Only media reports suggesting that losses on Greek bonds would not increase were coded as positive soft news. Decisions (not) to increase private creditors losses were coded as negative (positive) hard news.

Media reports or statements signalling the (un)willingness to include collective action clauses (CACs) in the Greek PSI deal were coded as negative (positively) hard news. Decisions (not) to include collective action clauses (CACs) in the Greek PSI deal were coded as negative (positive) hard news.

Statements or media reports suggesting support (opposition) for a buyback of Greek bonds/Brady bond plan were coded as positive (negative) soft news.

4. Crisis Resolution Mechanisms (EFSF and ESM)

As the Greek crisis gradually evolved into a systemic Eurozone crisis, European policy-makers tried to devise new crisis resolution mechanisms. They first hastily set-up the EFSF as a temporary fund and later created the ESM, a permanent crisis fund. Following the dramatic turn of events, the Europeans incrementally amended their plans by either adjusting the size of the funds or their scope of intervention.

c. Size

Like for financial support news, news about increasing the size of the funds may have contradictory effects. On the one hand, news suggesting that Europe is ready to increase the firepower of the crisis funds may imply that the existing resources are not sufficient and that more countries are close to ask for help. On the other, it may also signal the Europeans' commitment to safeguard the eurozone. We will assume that the latter effect is dominant (except for the debate that arose right after the Irish bailout following a statement by the then head of the Bundesbank Axel Weber).

Statements Expressing support (opposition) for more firepower for the EFSF and ESM were coded as positive (negative) soft news. Media reports suggesting (no) an increase in the firepower of the EFSF and ESM were also included and coded positively (negatively) as soft

news. Decisions (not) to increase the firepower of the EFSF/ESM were coded as positive (negative) hard news.

Parliamentary (dis)approval, in particular in "recalcitrant" countries (Germany, the Netherlands, Austria, Finland, Slovakia (until the pro-European reshuffle that took place in October 2011)), were coded as positive (negative) hard news. News signalling support (opposition) for parliamentary approval were coded as positive soft news.

Legal challenges to the EFSF and ESM delaying the implementation of the deals were coded as negative hard news. News reports about such challenges were coded as soft news. Decisions by the respective court were coded as positive (negative) hard news. News reports suggesting positive (negative) ruling were coding as positive soft (negative) news.

There were different identifiable debates about the size the EFSF/ESM. Starting in January 2011, there was a debate about raising the effective lending capacity of the EFSF. The headline ceiling was indeed higher that its effective capacity because the EFSF was based on state guarantees. Media reports or statements suggesting that triple-A countries refuse (accept) to increase the EFSF guarantees were coded as negative (positive) soft news. Media reports or statements suggesting that triple-A countries will have to increase the EFSF guarantees were coded as negative soft news.

Shortly after the deal to improve the flexibility of the EFSF and ESM in July 2011, calls mounted to increase the firepower of the funds. The debates really intensified in late September 2011 when policy-makers openly debated about leveraging the funds through the ECB, a banking license, the IMF resources, bond insurance, etc. News reports or statements suggesting that the EFSF would/should (not) be leveraged were coded as soft positive (negative) news. Decisions (not/delay) to leverage the EFSF were coded as positive (negative) hard news.

In December 2011, the Europeans decided to leverage their fund through the IMF. Following this decision, media reports or statements suggesting that countries (do not) support an increase in the IMF's financial capacity in order to leverage the EFSF were coded positively (negatively) as soft news. Decisions (not) to increase the IMF capacity were coded as positive (negative) hard news.

Starting in early December 2011, Eurozone policy-makers debated the relationship between the ESM and the EFSF. Policy-makers debated whether the ESM and EFSF resources should be combined permanently, or if both funds should simply operate in parallel until the EFSF Expires in 2013 raising the ceiling only temporarily or if the combined ceiling should remain capped at 500 billion euros. Delays to make a decision were coded as negative hard news. Media reports or statements supporting the last two (first) options were coded as negative (positive) soft news. The decision not to raise permanently the ESM size was coded as negative hard news.

The Europeans also started to debate whether to allow for an earlier start for the ESM by late September 2011. News reports or statements suggesting support (opposition) to such early start were coded as positive (negative) news. (Dis)agreement to do it was coded as hard positive (negative) news.

News reports or statements suggesting that the ESM paid-in capital would/should be rapidly contributed (spread out over time) and in fewer (more) tranches were coded as positive (negative) soft news. Decisions to rapidly contribute (spread out over time the contribution) to the ESM and in fewer (more) tranches were coded as positive (negative) hard news.

d. Flexibility

Statements Expressing support (opposition) for more flexibility (ability to buy bonds on primary and secondary markets, ability to recapitalise banks directly, majority voting, parliamentary powers) for the EFSF and ESM were coded as positive (negative) soft news.

Media reports suggesting discussions for (against/delay) an increase in the flexibility of the EFSF and ESM were coded positively (negatively) as soft news. Decisions (not/delay) to improve the flexibility of the EFSF and ESM were coded as positive (negative) hard news.

Media reports or statements suggesting support (opposition) for more parliamentary support were coded as negative (positive) news. Decisions (not) to increase the participation of parliaments in the decision-making process of the EFSF/ESM were coded as negative (positive) hard news.

Parliamentary (dis)approval, in particular in "recalcitrant" countries (Germany, the Netherlands, Austria, Finland, Slovakia (until the pro-European reshuffle that took place in October 2011)), were coded as positive (negative) hard news. News signalling support (opposition) for parliamentary approval were coded as positive soft news.

Legal challenges to the EFSF and ESM were coded as negative hard news. Decisions by the respective court were coded as positive (negative) hard news. News suggesting positive (negative) ruling were coding as positive (negative) news.

Making ESM loans junior only to the IMF was likely to discourage private creditors from buying the bonds of countries likely to call for ESM loans, creating a bad equilibrium. Media reports or statements suggesting that the ESM will (not) have a senior creditor status were coded as negative (positive) soft news. Decisions (not) to make the ESM a senior creditor were coded as negative (positive) hard news.

e. PSI

At Deauville, Sarkozy eventually swapped Merkel's insistence on automatic sanctions for fiscal violators for his endorsement of a sovereign insolvency procedure to be included in the coming permanent mechanism, the ESM. After this deal, the Europeans debated the parameters of the ESM's PSI: whether losses would be automatic or not, voluntary or forced, etc.

Media reports or statements suggesting support (opposition) for forced losses for private investors in the permanent eurozone mechanism (ESM) were coded as negative (positive) soft news, and even if losses were to start only after 2013 (except for the G20 statement before the Irish bailout). Media reports or statements signalling the (un)willingness to impose automatic losses on private creditors or delays to clarify how private bondholders would face losses were coded as negative (positive) soft news. Decisions (not) to impose automatic losses on private creditors or delays to clarify how private bondholders would face losses were coded as negative (positive) hard news.

Media reports or statements signalling the (un)willingness to include collective action clauses (CACs) in the ESM PSI mechanism were coded as negative (positively) soft news. Decisions (not) to include collective action clauses (CACs) in the ESM PSI mechanism were coded as negative (positive) hard news.

f. Conditions

Changes to the crisis resolution funds were generally made conditional on the approval of other reforms, such as a reform of the SGP, the creation of a competitiveness pact, the creation of a fiscal pact, etc. But as those reforms may not aim at immediate firefighting, the reforms in themselves were not coded. Only (dis)agreements were as they affected the likelihood of improving the EFSF and ESM. For instance, the debate (and proposals) about reinforced fiscal rules and closer economic coordination starting in April 2010 were not included before these reforms became clear conditions for some countries for agreeing to reforms of the EFSF/ESM in early 2011 and later on.

Statements or media reports signalling compromises (opposition) to these reforms were coded as positive (negative) soft news. Decisions were coded as positive hard news. Opposition or delays to find a compromise, in particular in Germany among German political parties, were coded as negative hard news.

5. *ECB*
    a. Collateral framework

Statements Expressing support for easing (tightening) the collateral framework were coded positively (negatively) as soft news. ECB's decisions on easing (tightening) the collateral framework were coded positively (negatively) as hard news.

    b. Bond-buying program

Statements or media reports suggesting that the ECB would (not) buy sovereign bonds were coded positively (negatively) as soft news. Obviously, the decision to buy bonds on May 9, 2010, was coded positively as hard news. After this decision had been made, statements signalling support (opposition) for the program were coded positively (negatively) as soft news.

    c. Lender of last resort

News signalling the (in)desirability/(un)willingness of the ECB to become a lender of last resort for sovereigns were coded as positive (negative) soft news.

News suggesting that the ECB would/could (not) act after governments have done their part were coded as soft positive (negative) news.

    d. Liquidity provision

Announcements of long-term liquidity programs were coded as positive hard news. Statements or media reports suggesting that the ECB is (not) looking for an exit strategy were coded as positive (negative) hard news.

6. *Political Environment*

Ownership of reforms is a very important factor determining the eventual success of fiscal and economic adjustments because it directly affects program implementation. This is all the more relevant in the case of Greece where the scale of the adjustment was unprecedented. We used

political support within the ruling majority, support from the political opposition and the wider public for the reforms as a proxy for reform ownership.

Media reports or statements suggesting that support within the ruling majority is strong (faltering) is coded positively (negatively) as soft news. For instance, news that MPs from the ruling party will defect (vote) on an austerity package vote were coded as negative (positive) soft news, or that the PM is considering cabinet reshuffle to reinvigorate implementation effort, or that the PM is considering to hold elections or referendums as he feels he does not have the sufficient legitimacy within his cabinet, party, etc. were all coded negatively. News were coded as hard news only when there was a reshuffle, a referendum or an election. Positive (negative) election results were coded positively (negatively) as hard news.

Following the November 2011 cancelled referendum or the May and June 2012 elections, news suggesting that negotiations to form a new government are going well (bad) were coded as positive (negative) soft news. Failure (success) to form a government were coded as negative (positive) hard news.

After the cancelled plan for a referendum, media reports or statements suggesting that negotiations on austerity measures within the ruling coalition are going well (bad) were coded positively (negatively) as soft news. Failure (success) or delay to reach a deal was coded as negative (positive) hard news (see also in May 2011).

Prior to the Greek plan for a referendum, media reports or statements suggesting that the opposition will (not) support the government's reform drive were coded positively (negatively) as soft news. Decisions by the opposition (not) to support the socialist government were also coded as soft positive (negative) news.

7. Grexit

Prior to the cancelled plan for a Greek referendum, media reports or statements signalling support for Grexit were coded as negative soft news. Only media reports suggesting opposition to Grexit were coded as positive soft news because of endogeneity and credibility concerns.

After this date and especially after the May Greek elections, Grexit was openly discussed by European policy-makers. Henceforth, we also included statements expressing opposition to Grexit. Media reports or statements signalling contingency planning against Grexit were coded as negative soft news. Decisions (not) to rule out Grexit were coded as positive (negative) hard news.

8. Banks and Banking Union

Media reports or statements suggesting (no) consolidation in the Greek banking sector were coded as positive (negative) soft news. (Cancellation of) mergers of Greek banks were coded as positive (negative) soft news. Greek banks attempts (failure) to raise capital were coded as positive (negative) soft news.

Results of stress tests were coded as hard positive (negative) news when the stress tests were deemed (non) credible.

News signalling the (in)desirability/(im)possibility of a banking union were coded positively (negatively) as soft news. And news signalling (in)desirability of a wide-scope banking union were coded positively (negatively).

9. Eurobonds

For news, reports or statements over Eurobonds, endogeneity issues were arguably minimal as these news were part of a debate among European policy-makers. All news were thus included in the dataset. They were positively (negatively) coded when they Expressed support (opposition) to the idea of Eurobonds. Decisions not to create Eurobonds were coded as hard negative news.

Table A. List of relevant policy-makers

	Prime Minister or Head of State	Finance Ministers
Greece	G. Papandreou	G. Papaconstantinou
	L. Papademos	E. Venizelos
	A. Samaras	Y. Stournaras
Germany	A. Merkel	W. Schäuble
		R. Brüderle
		P. Rösler
		G. Westerwelle
France	N. Sarkozy	C. Lagarde
	F. Hollande	F. Baroin
		V. Pécresse
Italy	S. Berlusconi	G. Tremonti
	M. Monti	
Spain	J. Zapatero	E. Salgado
Austria	W. Faymann	J. Pröll
		M.Fekter
Netherlands	M. Rutte	W. Bos
		J. de Jager
Belgium	Y. Leterme	D. Reynders
Finland	M. Kiviniemi	J. Katainen
	J. Katainen	J. Urpilainen
Ireland	B. Cowen	B. Lenihan
	E. Kenny	M. Noonan
Portugal	J. Socrates	F. dos Santos
	P. Coelho	V. Gaspar
Luxembourg		L. Frieden
Slovakia	R. Fico	I. Mikdos
	I. Radicova	J. Pociatek

	EU Leaders/ECB Head/IMF Head	Commissioner/ECB member/IMF staff	
European Commission	J. Barroso	J. Almunia	
		O. Rehn	
		M. Barnier	
European Council	H. Van Rompuy		
Eurogroup	J.-C. Juncker		
IMF	D. Strauss-Kahn	A. Borges	
	C. Lagarde	P. Thomsen	
ECB (and NCBs)	J.-C. Trichet M.Draghi	*Executive Board Members*	
		L. Papademos	J. Stark
		V. Constancio	P. Praet
		L. Bini Smaghi	G. Tumpel-Gugerell
		B. Coeuré	J. Paramo
		National governors	
		E. Nowotny	Y. Mersch
		G. Quaden	J. Bonnici
		A. Orphanides	M. Bonello
		E. Liikanen	K. Knot
		C. Noyer	N. Wellink
		A. Weber	C. Costa
		J. Weidmann	J. Makuch
		G. Provopoulos	M. Kranjec
		P. Honohan	M. Ordonez

Table B1. Examples of positive news (1)

Level I	Level II	Examples (headlines)	Positive News Code: Soft	Hard: Expected	Hard: Unexpected	G/E news	Political Communication /Media Report
Public finances data/ Official forecasts		Greek Jan budget revenues exceed target -Finministry (17/02/2010)			1	G	
		Greek Jan-Sept Central govt budget gap shrinks 31.1 pct (11/10/2010)		1		G	
Financial support	Bailout package/ Loan Tranches	Eurozone agreed in principle to aid Greece-German source (09/02/2010)	1			G	M
		EU promises to support Greece over deficit crisis (11/02/2010)		1		G	
		Europe can help out cash-strapped Greece without IMF: Brussels (10/02/2010)	1			G	P
		Eurogroup Agrees To Provide Collateral To Finland In Exchange For Future Aid For Athens (04/10/2011)		1		G	
		Greek Fin Min Confirms Has Received 1st Tranche Of EMU Aid (18/05/2010)		1		G	
	Loan Reviews	Greece and EU-ECB-IMF to agree on 2011 fiscal policies (21/09/2010)	1			G	M
		Greece agrees deeper austerity to secure extra funds (02/06/2011)		1		G	
		Greece eyeing cigarette and alcohol tax increase (04/01/2010)	1			G	M
		Greece orders alcohol and tobacco tax hike to counter crisis (08/01/2010)		1		G	
		Greek PM orders tough austerity measures ahead of EU verdict (03/02/2010)		1		G	
	OSI	Greek debt maturity lengthening possible -Juncker (25/05/2011)	1			G	P
		Greece to get lower rate on loans, longer maturity (14/03/2011)		1		G	
		Interview - ECB ready to forego Greece bond profit (15/02/2012)	1			G	P
Bailout funds (EFSF and ESM)	Size	Belgian Finance Minister Didier Reynders on Saturday also suggested increasing EFSF funds (06/12/2010)	1			E	P
		Deal building to pump up IMF to handle Europe fallout (01/12/2011)	1			E	M
		EU Agrees Treaty Change To Create Permanent Bailout Fund (17/12/2010)		1		E	
		Euro zone brings forward permanent bailout fund (09/12/2011)		1		E	
		ECB's Nowotny: ESM banking licence could be advantageous	1			E	P
		Finland committee to support EFSF changes-source (01/09/2011)	1			E	M
		Dutch parliament approves contribution to enlarged European bailout fund EFSF (07/10/2011)		1		E	
	Flexibility	Official: Spain open to EFSF bond-buying, lending boost (02/02/2011)	1			E	P
		Euro zone brings forward permanent bailout fund (09/12/2011)		1		E	
	Conditions	Sarkozy, Merkel outline euro zone master plan (05/12/2011)		1		E	

Table B2. Examples of positive news (2)

Level I	Level II	Examples (headlines)	Positive News Code			G/E news	Political Communication /Media Report
			Soft	Hard			
				Expected	Unexpected		
Restructuring	Disorderly Default	IMF: Greece restructuring costs outweigh benefits (20/10/2010)	1			G	P
	Forced Orderly Restructuring	Trichet warns against forced losses on sovereign bonds	1			G	P
		Merkel, Sarkozy Invoke Vienna As Basis For New Greek Aid (17/06/2011)		1		G	
		EU Confirms Plan For New Greek Loan To Buy Back Debt 'On The Table' (28/01/2011)		1		G	
	Voluntary Orderly Restructuring	Major banks accept Greek bond swap (05/03/2012)	1			G	M
		Greece Bailout Clinched, With Larger Private-Sector Haircut (21/02/2012)		1		G	
ECB policy	Collateral framework	Trichet Supports Fresh Look At Collateral Rules (15/03/2010)	1			G	P
		ECB suspends minimum credit rating threshold on collateral for Greece (03/05/2010)			1	G	
	Bond-buying	ECB defends bond buying scheme (13/05/2010)	1			E	P
	Lender of last resort	ECB Announces Bond Buying, Other Stabilization Measures: Text (10/05/2010)			1	G	
	Liquidity provision	Major central banks to provide dollars to markets: ECB (15/09/2011)			1	E	
Political environment		Greek Main Opposition May Support Bailout On Cost-Benefit (23/04/2010)	1			G	P
		Greek reshuffle, Berlin-Paris deal ease euro fears (17/06/2011)		1		G	
		Greek finance minister says opposed to euro referendum (03/11/2011)		1		G	
		Greek conservative leader writes to EU, IMF (23/11/2011)		1		G	
Grexit		Austria's Fekter: Shouldn't Force Greece To Leave Euro Zone (27/02/2012)	1			G	P
		Merkel, Hollande say want Greece to stay in the euro (16/05/2012)		1		G	
Eurobonds		IMF head Christine Lagarde piles pressure on Germany's Merkel by advocating joint debt (22/06/2012)	1			E	P
		Italy's Tremonti Says Eurobonds Will Be Necessary (13/07/2011)	1			E	P
Banking Union		ECB Knot: Euro Bank Supervisor Shouldn't Be Limited to Big Banks – Report (12/07/2012)	1			E	P
		EU agrees to seek integrated banking system: G20 (20/06/2012)			1	E	

Table C1. Examples of negative news (1)

Level I	Level II	Examples (headlines)	Negative News				
			Code			G/E news	Political Communication /Media Report
			Soft	Hard			
				Expected	Unexpected		
Public finances data/ Official forecasts		Eurostat revises upwards Greece's 2009 deficit for a third time, to 15.4 percent of GDP compared with a previous 13.6 percent estimate (15/11/2010)		1		G	
		Austerity hits Greek economy harder than forecast (12/08/2010)			1	G	
		EU-ECB-IMF Troika: Greek recession deeper than anticipated (11/10/2011)		1		G	
Financial support	Bailout package/ Loan Tranches	Greece must not expect EU bailout: ECB (06/01/2010)	1			G	P
		ECB Stark: Greece Must Do More To Get Next Tranche Of Aid (16/05/2011)	1			G	P
		Eurozone stalls Greek cash aid despite austerity deal (18/02/2012)		1		G	
		Eurogroup gives provisional approval for new Greek package (01/03/2012)			1	G	
		Euro Zone Mulls Delaying EUR5.2B Payment To Greece – Sources (09/05/2012)	1			G	M
	Loan Reviews	Greece, Troika Talks Suspended As Govt Resists Fresh Measures (02/09/2011)			1	G	
		Greek creditor talks end without decision on return of inspectors, to continue Tuesday (20/09/2011)		1		G	
		Greece's lenders demand wage and job cuts at state firms (13/10/2010)	1			G	M
		IMF-EU: Greek Reforms Broadly On Track But Challenges Exist (11/02/2011)		1		G	
		Greece slams intl debt inspectors after IMF and EU visit, says they overstepped their roles (14/02/2011)			1	G	
	OSI	Greece's Hopes For EU/IMF Loan Extension Fade (19/11/2010)	1			G	M
		Germany Wants Higher Interest Rates On Aid For Greece: FT (06/04/2010)	1			G	M
		Weidmann: No Central Bank Participation In Voluntary Greek Haircut – Report (15/02/2012)	1			G	P
Bailout funds (EFSF and ESM)	Size	Schaeuble In Letter To Lawmakers Rejects Boosting EFSF -Report (18/08/2011)	1			E	M
		Euro zone ministers delay deal on bailout fund to March 21 (14/03/2011)		1		E	
		Bigger euro firewall needed before more IMF funds: G20 (27/02/2012)		1		E	
		Euro zone raises bailout capacity to 700 bln euros (30/03/2012)			1	E	
		German Dep Fin Min: Important To Germany That EFSF Cannot Tap ECB (17/11/2011)	1			E	P
	Flexibility	Finland Opposes Using ESM for Secondary Market Bond Buying (02/07/2012)	1			E	P

	Germany:'No Automatism' For Allowing Direct EFSF-ESM Bank Aid (02/07/2012)	1		E	P
PSI	Deauville Meeting (19/10/2010)		1	E	
	Merkel: Private Creditors Must Share Losses In Future Crises (02/11/2010)	1		E	P
Conditions	Dutch, Germans Demand Conditions For Reinforcing Euro Rescue Fund (18/01/2011)	1		E	P
	EU Leaders Rebuff Franco-German Euro-Zone Plan (07/02/2011)		1	E	

Table C2. Examples of negative news (2)

Level I	Level II	Examples (headlines)	Negative News Code: Soft	Hard: Expected	Hard: Unexpected	G/E news	Political Communication /Media Report
Restructuring	Disorderly Default	Greece should consider insolvency if cannot pay debt: German central banker (19/03/2010)	1			G	P
	Forced Orderly Restructuring	ECB warns it could reject Greek bonds as collateral (19/05/2011)	1			G	P
		Euro zone's silence on selective default breaks taboo (12/07/2011)		1		G	
	Voluntary Orderly Restructuring	Merkel doesn't rule out Greek bailout change amid talk bondholders may face greater losses (29/09/2011)	1			G	P
		Greek debt swap talks end without deal, to resume next week (13/01/2012)		1		G	
ECB policy	Collateral framework	Stark: ECB would reject Greek bonds after restructuring (19/05/2011)	1			G	P
		ECB Puts Squeeze Back On Greece With Collateral Ban (20/07/2012)			1	G	
	Bond-buying	Draghi douses hopes on ECB bond buying (08/12/2011)		1		E	
	Lender of last resort	Stark: ECB must not become lender of last resort (10/11/2011)	1			E	P
	Liquidity provision	BBK Board Member Nagel: Must Discuss ECB Exit Scenarios Now (19/03/2012)	1			E	P
Political environment		Greek prime minister calls referendum on new aid deal (01/11/2011)			1	G	
		Greek Pasok Party Member Resigns Over New Austerity Measures (14/10/2011)	1			G	M
		Greek Opposition Leader Says Elections To Be Held Feb 19 (11/11/2011)		1		G	
		Greek prime minister says coalition talks with opposition failed (16/06/2011)		1		G	
Grexit		Dutch have studied Greek euro exit scenario – FinMin (15/05/2012)	1			G	P
		Merkel, Sarkozy Warn Of Greece Euro-Zone Exit If Plan Rejected (03/11/2011)			1	G	
Eurobonds		Schaeuble: no euro bonds in my lifetime either (02/07/2012)	1			E	P
		Hollande draws first blood in eurobonds battle (24/05/2012)		1		E	
Banking Union		Sweden rejects talk of ECB as pan-EU bank supervisor (22/06/2012)	1			E	P
		ECB unlikely to supervise all euro banks-Nowotny (02/07/2012)	1			E	P

Appendix of Paper 3

Construction of the FCIs. We retrieve the FCIs through a factor-augmented vector autoregression with time-varying parameters (TVP-FAVAR) based on Koop and Korobilis (2014). Unlike standard Principal Component Analysis (PCA), Koop and Korobilis' (2014) method has the advantage of allowing for time-varying variables' weights and for purging shocks that originate outside the financial and macro-financial indicators such as the business cycle[38]. The TVP-FAVAR model is specified as follows

$$x_t = \lambda_t^y Y_t + \lambda_t^f f_t + u_t$$

$$\begin{bmatrix} Y_t \\ f_t \end{bmatrix} = B_{1,t} \begin{bmatrix} Y_{t-1} \\ f_{t-1} \end{bmatrix} + B_{2,t} \begin{bmatrix} Y_{t-2} \\ f_{t-2} \end{bmatrix} + \cdots + \varepsilon_t$$

where x is a vector of financial/macro-financial indicators, Y is real GDP growth, λ_t^y are regression coefficients, λ_t^f are the factor loadings, and f_t is the latent factor, interpreted as the FCI.

[38] The FCIs were estimated using Koop and Korobilis' (2014) code (https://sites.google.com/site/dimitriskorobilis/matlab/forecasting-tvp-favar).

Table 4. List of financial indicators used to construct the FCIs

Indicators
Equity return implied or realized volatility
Sovereign bond spread with the US
Sovereign bond spread with the Germany[39]
Long term interest rate
VXO
Equity returns
Realised stock market volatility
Stock market volume
Dividend yield
Interbank rate
Commodity price
Interbank Spread
Growth rate of house prices
Term Spread

[39] For European economies.

Table 5. Description and source of the different indicators

Indicator	Description	Source
Gross Domestic Product	Annualized growth rate of real GDP	OECD
Consumer price index	Log of CPI	OECD
Total employment	Log of total employment	OECD
Wage	Log of total wages	OECD
Hours	Log of total hours worked per worker	OECD
Gross Fixed Capital Formation, excluding construction	Log of GFCF	OECD
Shadow short rate		Krippner (2013)
Stock price index	Log of stock price index	Bloomberg
Equity return realized volatility	Change in the realized volatility of equity returns	Bloomberg
Stock Market Volume	Annualized growth rate of stock market volume	Bloomberg
Equity returns	Annualized growth rate of equity returns	Bloomberg
Commodity price	Annualized growth rate of commodity prices	Bloomberg
Dividend yield	Change in dividend yield	Bloomberg
Long term interest rate	Change in the 10-year government bonds yield	OECD
Sovereign bonds spreads	Change in the yield on 10-year government bonds minus the yield on the 10-year German government bond	Bloomberg
VXO	Change in the implied Volatility of S&P 500	Bloomberg
Interbank rate	Change in 3-montth interbank interest rate	Bloomberg

Interbank Spread	Change in 3-montth interbank interest rate minus yield on three-month Treasury bills	Bloomberg
Term Spread	Change in yield on 10-year government bonds minus yield on three-month Treasury bills.	Bloomberg
House prices return	Annualized growth rate of real house prices.	BIS

Figure 5. Financial condition indices