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

Simon Ganem
LSE, European Institute

Draft paper – please do not quote or circulate

Abstract

In Spring 2014, Greek Prime Minister Samaras asked Chancellor Merkel to start debt talks in line with promises made by the Eurogroup in November 2012 but she turned down Samaras' offer. For many commentators, this decision was made to keep leverage on the likely coming new Greek government, and signal that any challenge to the status quo will cause financial support to stop. This analysis misses an important part of the story though as refusing Samaras' offer endogenously reinforced the momentum for Tsipras as debt relief was critical for Samaras' political survival. Puzzlingly, Merkel had significant political leeway to (quietly) discuss with Samaras while negotiating with Tsipras, under the scrutiny of a very critical public opinion, could have entailed significant audience costs for Merkel had Tsipras not almost immediately yielded by taking ownership of the memorandum. Eventually, the "signalling" strategy chosen by Chancellor Merkel failed as Tsipras challenged the status quo and himself threatened the Europeans with Grexit. The deal reached on the brink of Grexit was therefore extremely costly for Merkel as an important share of her backbenchers challenged her authority, the IMF refused to enter the program and the German public opinion was clearly dissatisfied with her management of the situation. So why did Merkel refuse to cooperate with Samaras in the first place? Using a signalling game-theoretical framework, we will show that double-sided incomplete information is a necessary condition for explaining the bargaining dynamics leading to the third Greek bailout. Even if both Germany (as representative of creditor countries) and Greece were more Grexit-averse than compromise-averse, incomplete information about each other's preferences ordering induced the players to take risks, exchange threats and escalate a conflict in order to make the opponent yield first.

Keywords: bargaining power, game theory, incomplete information, Greek crisis, bailout

Section 1. Introduction

When Merkel and Samaras met in April 2014 in Athens, relative normality had come back to the Eurozone since mid-2012. Ireland exited its bailout in December 2013. Portugal was on its way to redemption after three years of economic adjustment. The eurozone has been stabilised thanks to the ECB action in July and September 2012. The final touches on the governance of the EMU were being brought after an intense institutional-building process in the first two years of the crisis (crisis resolution mechanism, banking union (in progress), monitoring mechanism, new fiscal rules, etc.). Even Greece's situation was apparently under control: the spreads were back to bearable levels, the macroeconomic situation was slowly improving and the troika was relatively happy with the implementation effort.

It is in that context that during their meeting, Samaras asked Merkel to start talks on the terms of the official loans since Greece had achieved a primary surplus for 2013, ahead of schedule[1]. However, Merkel turned down Samaras' offer (Dabilis 2014). With no green light from the Eurozone's paymaster, Europeans thus eluded the question for months and negotiations on loans' terms never took place.

The common explanation for this often overlooked decision is that Merkel and the Europeans considered Samaras to be a lame duck (see Varoufakis 2017), bound to lose the looming general elections to SYRIZA (see Kalyvas 2015) while Europeans knew that there was a financing gap in the Greek adjustment program that ought to be filled. By granting debt relief (and the last loan tranche) to Greece, they would thus have lost leverage in the coming negotiations with SYRIZA, something Samaras acknowledged in 2017[2].

Yet, this explanation is only part of the picture for the simple reason that Samaras' political fate was tightly linked to his ability to renegotiate the terms of the loans (and eventually exit the program). As Malkoutzis puts it (2014):

> "The philosophy underpinning [Samaras'] government's action […] was that Greece should meet, and if possible exceed, its fiscal targets in order to secure a reduction of its debt as had been proposed at a Eurogroup meeting in November 2012."

Debt relief was thus the goal Samaras was aiming for all along his term. Without the carrot Samaras promised to his coalition and voters, his chances of keeping control of the cabinet and Parliament would vanish, paving the way for new elections he was indeed likely to lose to SYRIZA.

It is no wonder that the implementation effort outrightly crumbled right after this episode. As evidence of his panic, Samaras devised a plan to exit the bailout earlier than expected as a last-ditch effort to save his position. But this plan was only met with scepticism in Berlin and in the financial markets (Brown and Papadimas 2014). Eventually, the program's last review was never completed and what happened next is known: the failure to elect a new President in December forced Samaras to call snap elections that were won by SYRIZA in January. After an infamous and lengthy showdown full of twists and turns, the new Greek Prime Minister, Alexis Tsipras, eventually yielded to most if not all of the Europeans' bailout terms.

In addition, the deal with SYRIZA, as tough as it was for Greece, was particularly costly in political terms for Chancellor Merkel. The cost in terms of popularity is difficult to measure as Merkel decided to open the borders to Syrian refugees quite at about the same time in August 2015. But it is quite clear that the protracted and hard negotiations ended up inflaming the German public opinion once again. After a respite of several months, front pages of German newspapers started once again to take aim at the Greek bottomless pit. A YouGov poll held in July 2015 showed that a majority of Germans (51%) considered that the German government had handled the Greek debt crisis badly. This figure contrasts a lot with the very high level of satisfaction attained in Spring 2012 and 2013 (see Pew Research 2013). The number of Grexit supporters among the German public increased markedly between February and July 2015 from 48% to 58% (YouGov opinion poll, see Wagstyl and Robinson 2015). Finally, the third bailout also signalled the unease within Merkel's party: 73 CDU/CSU MPs, representing as much as a fourth of the conservative group in the Bundestag, did not vote for the third bailout package on 19 August 2015. Such rebellion among the ranks of Merkel's party was unprecedented, even when compared with the debt relief vote that took place in November 2012 when 33 MPS from the CDU/FDP ruling coalition voted against it or abstained. Last but not least, the IMF left the negotiations' table while its presence had repeatedly been presented as a *sine qua non* condition for any bailout.

In comparison to this debacle, making concessions to Samaras rather than financially support a populist political party, whose agenda was precisely to challenge Germany's authority, would have been quite benign. What is more, the domestic constraints in Spring 2014 were quite limited: Merkel had been triumphantly re-elected in September 2013, the new junior coalition partner in government and in the Bundestag, the SPD, fully supported Merkel's European policy. With benefit of hindsight, it would seem that the Eurozone had missed an important opportunity to solve (quietly) the Greek crisis once and for all when they refused to negotiate with Samaras. In this paper, we will try to explain this puzzle: why did Merkel and other Greece's official creditors refuse to grant debt relief to Samaras in April 2014? In other words, why did they prefer to pave the way for a showdown with SYRIZA? By answering this question, we will also answer another question that is often deemed puzzling: why did Greece engage into brinkmanship?

In this paper, we will therefore focus on analysing the bargaining dynamics and the determinants of bargaining power during the third Greek bailout negotiations. In particular, we will study the role played by incomplete information in the observed dynamics of escalation. In order to solve the puzzle, we will rely on game theory and construct a model that describes, in a simplified manner, the observed strategic interactions between Greece and its creditors (we will be using the words or expressions "creditors", "the Europeans", "Merkel" and "Germany" interchangeably, see section 4 for more justification) in the run-up to the third bailout.

We will argue that, while domestic constraints and formal voting rules might have played a role in the bargaining outcome, incomplete information was a necessary condition for the negotiations to unfold the way they did. For domestic constraints and formal voting rules would reinforce the credibility of a negotiator when making a threat to walk away from the negotiations, in a context of incomplete information, rather that explain why a negotiator decides to go over the brink.

More specifically, our formal game-theoretical analysis yields two main results. First, under double-sided incomplete information, it is rational for Grexit-averse Europeans to refuse to grant debt relief to Greece in the initial stage of the negotiations in order to conceal the weakness of their hand. Second, under certain conditions, it is rational for Grexit-averse Greek policy-makers to enter into brinkmanship, in particular because the initial decision to refuse a fair deal to Greece convey very few information about Greece's creditors true preferences. Our model would also suggest that the brinkmanship strategy followed by Greece was definitely not doomed to fail if Europe was also Grexit-averse. On the contrary, we believe that the Greek strategy failed most likely because Greek policy-makers did not play well with the cards they held and were plausibly not "aggressive" enough.

Our results should nevertheless be taken with caution as our game is a simplification of a process that was much more complex and circumvoluted. For instance, in the game, the probability distribution of the types of players is common knowledge. Obviously, in the real world, "objective" probability distributions are subject to interpretation. As such, we cannot totally discard that other elements might have shaped the perceptions of the players. The Europeans might have suffered from a certain dose of overconfidence when initially refusing to grant debt relief to Samaras. They might have wrongly anticipated that all the warnings they issued prior to Tsipras' election had convinced him that they were compromise-averse with a too high probability, preventing escalation. Similarly, Tsipras might have wrongly expected that the Europeans would yield quickly if threatened with Grexit.

Anyway, we believe that this paper makes at least two interesting contributions. First, it makes a contribution to the literature on the negotiations over the Greek bailout, trying to fill a gap by highlighting the role played by incomplete information. Second, it makes a contribution to the literature on intergovernmental negotiations (in particular for negotiations over the adjustment to debt crises) by providing a relatively parsimonious formal model that still takes into account double-sided incomplete information which is an important feature of the real world.

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 simply make plausible assumptions about the players' preferences ordering without elaborating at length about how the players reached their ordering. In particular, we will not analyse the domestic process that has led the stakeholders in the negotiations to define their bargaining positions the way they did.

This article proceeds in three steps. In section 2, we will 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. In section 3, we will propose a narrative of why the negotiations between Greece and its creditors escalated, highlighting the role of incomplete information and signalling, and why the Europeans eventually prevailed at the end of the day. In section 4, we will develop a game-theoretical framework with double-sided incomplete information to determine under what conditions can escalation occur. In section 5, we will draw some concluding remarks.

Section 2. Bargaining over the Greek bailouts

The Greek (and Eurozone) crisis has attracted the attention of an important number of scholars from a very wide range of disciplines. In particular, studies have started to emerge in the recent years on the negotiations between Greece and its European partners in order to decipher their outcomes and bargaining dynamics.

While preferences are obviously central in negotiations, the analysis of their determinants is beyond the scope of this paper. It is still interesting to observe that in the existing studies (not specifically focusing on the Greek bailouts), preferences were found to be generally derived from national considerations, be they economic (see Schimmelfennig 2015, Tarlea et al's 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 consdierations) or even ideational (see Brunnermeier, Landau and James 2016, Bulmer 2014, Schäfer 2016, Blyth 2013, Zahariadis 2016a).

Bargaining power is another central element of negotiations and it comes from different sources. First, 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. This theory also predicts that the more a negotiator is constrained at home, paradoxically 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 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 change. 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.

The specific evidence on domestic constraints as a source of bargaining power during the Greek bailout negotiations is mixed. Resorting to Putnam's two level game theory, Zahariadis (2016b) studies the effect of bargaining power on the choice of a strategy during the Greek bailouts, the hypothesis being that a government with fewer bargaining power is more likely to adopt a soft rather than hard bargaining strategy. In line with standard predictions, he argues that governments with fewer power resources, worse best alternative to negotiated agreement and fewer domestic constraints are more likely to follow a soft bargaining strategy. On the contrary, for Lim et al (2018), domestic constraints certainly played a role but not the one expected. Greece indeed 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 which credibly signalled that Greece could not achieve full adjustment solely through internal devaluation.

Second, bargaining power depends on a state's best alternative to a negotiated agreement, i.e. its outside option. This is a standard prediction in International Relations that the state who has more to lose from non-cooperation has less bargaining power (Keohane and Nye 1977, see also Moravcsik 1998 and Putnam 1988). Similarly, the most impatient negotiator has to make the most concessions (Rubinstein 1988). To date, the evidence on this source of bargaining power is much more convincing compared to the evidence on domestic constraints. Because the failure to reach an agreement would bring "mutual assured destruction," Schimmelfennig (2015) argues that the negotiations exhibited elements of a chicken game with hard bargaining and brinkmanship. 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 because 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 whose capacity to withhold the consequences of non-agreement had reduced bargaining power, at least in the heightened period of the Eurozone crisis[3].

Third, bargaining power can come from formal voting rules as predicted by rational choice institutionalism (Shepsle 2006). Indeed, 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. Indeed, under unanimity, each state can have a veto power and decisions needs to be made at the lowest common denominator. In such settings, the state with the most extreme preferences is generally the pivotal voter and 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.

Absent from all these analyses though is the question of incomplete information (or asymmetric information) while this notion is central in 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, in particular the value of their outside option, in order to receive a better settlement. Incomplete information is also a necessary condition for brinkmanship, whose process resembles to the dynamics observed during the third Greek bailout negotiations, to occur (see Powell 1987 and 1988). Otherwise, the state with the greater resolve would never face resistance to its initial challenge and there would be no crisis. But so far, and it is to some extent puzzling, only few papers have studied the role played by incomplete information on the Greek bailouts' negotiations. Incomplete information is also present in Putnam's work as it can play a role at the international level of negotiations.

Some scholars have nevertheless took that path and studied the effect of informational problem during the Greek bailouts' negotiations by resorting to game theory. Pitsoulis and Schwuchow (2015) used incomplete information to explain what has often been deemed an irrational 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, followed a strategy of brinkmanship by deliberately raising the costs of reforms and taking advantage of the Europeans' incomplete information about Greece's commitment not to bow. As the costs of reforms increase, so should have the credibility of Greece's commitment not to yield.

Hennessy (2017) adopted a somewhat similar approach by looking at the role of costly signalling during crisis bargaining over the three Greek bailouts but instead took the perspective of Greece. She assumes that Greece has only incomplete information about the Europeans' commitment to support it. She set-ups a formal model 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, Greece could shirk major adjustment without punishment. After 2012 though, she argues that the exchange of credible signals induced Greece to comply with conditionality. In particular, she holds that the Europeans' threat to withdraw its financial support was credible enough and induced Greece to yield at the end of the day.

The small number of papers integrating asymmetric information when studying EU politics or bargaining within the EU may be explained by the fact that national preferences in the EU are generally assumed to be sincere and free of strategic considerations. The reason for making this assumption is quite simple: frequent interactions within the EU make exchanges of information more efficient (Bailer 2004 and 2011 and Moravcsik 1998, Finke et al 2012, Thomson et al 2006). However, the victory of Tsipras and SYRIZA in January 2015 may make this assumption a step too far when analysing the third bailout's negotiations. Tsipras and SYRIZA had no record in power while, unlike mainstream Greek political parties, there was an important internal divide within the party's central committee on the question of Grexit (see Tsebelis 2016). It was also unclear whether the Greek public would support its government if negotiations get nasty. All of this plausibly made Greece's preferences uncertain for its creditors. Similarly, it was unclear what the position of Germany, a major stakeholder in the negotiations, was 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). Merkel was much more ambiguous. She indeed held Greece back in 2012 (Spiegel 2014). But at that time Greece represented a systemic risk to the Eurozone while this was no more the case in 2015, at least financially.

But while the two papers of Pitsoulis and Schwuchow (2015) and Hennessy (2017) based on information problems are insightful (and complement one another to some extent), the assumption of one-sided incomplete information results into a superficial and somewhat partial analysis where the behaviour of one stakeholder in the negotiations is static. On the contrary, a situation where both sides possess incomplete information is a more natural setting and allows for a more thorough and a more dynamic analysis of bargaining strategies. And as Powell (1988) shows, the incorporation of double-sided incomplete information is not trivial as it significantly changes the analysis of bargaining dynamics in the context of escalation strategies.

Section 3. A narrative of the negotiations over the third Greek bailout

During the negotiations, Greece and its creditors engaged into a series of more or less serious confrontations that progressively escalated into a full-scale showdown. Such a brinkmanship strategy followed during the negotiations over the third Greek bailout would suggest that stakeholders were trying to signal to one's opponent that it would be ready, truly or not, to bear the consequences of no-agreement, thus forcing one's opponent to blink first. For escalating the confrontation may reveal genuine aversion to compromise on terms of the bailout or exploitation by a negotiator pretending to be compromise-averse, whatever may be the underlying reasons for having such preferences. What is more, escalating the confrontation might have enabled each side to test the credibility of its opponent's threat.

But going the bluff way is risky. Grexit-averse Europeans pushing Greece towards the brink for tactical reasons may well end up with Grexit if Greece is truly compromise-averse. And even if Greece eventually backs down, the delay in reaching a deal and the prior showdown with Greece would cost the creditors dearly in political terms as a new bailout will be felt as a significant concession by outraged public opinion. As a matter of fact, on the 10th of July 2015, the Bild newspaper wrote about the Europeans' decision not to walk out from the negotiations' table: "what a defeat!" As for the Europeans, it is extremely risky for Greece to challenge the Europeans if Greece is Grexit-averse. If the Europeans are eventually ready to let Grexit happen, all that Tsipras would obtain is public humiliation and complete surrender, if not worse.

Contrary to many commentators at the time of the negotiations, the negotiations were not doomed to be won by the Europeans. Greece's negotiating position was not as weak as it seemed if the Europeans were indeed Grexit-averse. Letting Grexit happen would have had dramatic political consequences for the Europeans as it would have caused political contagion. Once the European project is no more irreversible, any anti-euro political party gaining power could bring its country out of the euro. But the odds were clearly in favour of the Europeans who could let the clock ticking waiting Greece's reserves to deplete up until the time Greece would come beg for mercy. In order to scare Grexit-averse Europeans away, Grexit-averse Greece would have to make the bluff credible enough by devising a consistent strategy with a powerful plan B if pushed around by the Europeans. For instance, a proper plan B directly able to force the creditors' hand would have been the introduction of a parallel currency and/or a significant unilateral default on Greece's official creditors, as planned by Varoufakis as it was later revealed.

Negotiating in the shadow of incomplete information

While the existing analyses of the third Greek bailout fail to integrate this often overlooked episode, the negotiations between Greece and the Europeans started as soon as Spring 2014 when Merkel refused to grant debt relief to Samaras. This was 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. Since after more than a year and a half of relatively faithful (by Greek standards) implementation, Samaras could not obtain a reward, Tsipras should not expect such concession without prior significant pledges and acts of good will. Confronting the creditors would only end up delaying the implementation of a programme whose terms will not fundamentally change or end up with Grexit, simply cost Tsipras his political capital after failing to meet the expectations of his voters he himself raised uselessly. Actually, this first signal that signed Samaras' political death warrant was followed by many more threats that challenging the policy stance in Greece would lead to Grexit.

Before his election, Tsipras also sent signals to the creditors by pledging to end the troika, the end of austerity and a major debt relief to Greek citizens if he gets elected. And once elected, he kept on the same rhetoric and quickly escalated the showdown with Greece's creditors. While under the direct threat of the ECB to cut liquidity to their banks, the Greeks held their ground and refused to accept a simple extension of the second bailout. It is only after two failed Eurogroup meetings that Chancellor Merkel reportedly intervened and pressured the Eurogroup to find a deal which was achieved on the 20th of February. This deal was ambiguous enough for the two sides to claim victory, even if Greece made a major concession on the substance. A disastrous outcome for the Eurozone had just been avoided as the deadline was postponed by 4 months but the points of contention remained intact, in particular on debt relief.

In the next four months following this compromise, the negotiations got nowhere. The Greeks would present new plans, that would be refused by the creditors. And creditors' plans would meet stern Greece's disapproval. However, the creditors consistently followed the same strategy throughout the negotiations. They conceded as little ground as possible on conditionality and kept on insisting that any additional support would come after Greece had accepted their terms and that debt relief would not be granted upfront but would be a reward after all the measures have been implemented.

On the contrary, Tsipras, even if he was likely bluffing at the end of the day, never played his cards rightly while time played in favour of the creditors. As a matter of fact, Varoufakis (2017) explains that Merkel's decisive intervention in February made Tsipras acquire the certitude that Merkel would yield at the eleventh hour. This certitude was reinforce by that fact that whenever the negotiations at lower-level were deadlocked, Merkel personally made sure that they never broke off completely by giving some insignificant concession. Merkel's behaviour made Tsipras unwilling to antagonize her and the other creditors. However, all the ground Merkel was apparently letting go during bilateral meetings (in March or in April for instance) was quickly taken back during the lower-level negotiations. In the meantime, the end of the program extension was approaching and Greece's economic situation was worsening. And in late June, just before the end of the extension period, Merkel refused to intervene once again and bridge the divided positions. Tsipras thus had to threw his own plan B at the worst possible moment by calling a referendum and default on the IMF.

It is still difficult to decipher the logic of this decision: was it simply a last stand, or truly a move to improve Greece's bargaining power? Existing justifications and explanations remain contradictory (see Varoufakis 2017 and Tsebelis 2016). What is certain is that this solution was not the most radical option available to Tsipras. More importantly, this decision came after a series of renunciations plausibly signalling his readiness to compromise. Indeed, Greece never presented the creditors with a consistent Plan B nor they ever truly broke off the negotiations when pushed around by the creditors. On several occasions, Greece threatened to default (mainly to the IMF) but never did so until the very last moment in late June when the economic situation of the country had significantly worsened. For instance, in a letter sent to the European leaders on the 15th of March, Tsipras threatened to default on the debt Greece owed to the Europeans and the IMF if it did not receive funds rapidly (Spiegel 2015). However, when there was the opportunity to transform the threat into an hard decision in April, Greece decided to pay the IMF. Actually, Varoufakis (2018) writes that Tsipras decided to default on the IMF in April before calling it off, while keeping the threat to do it. To some extent, this story is confirmed in Blustein (2016) where he reports that Varoufakis ambiguously implied to Lagarde that Greece could default on its loans during their meeting on Easter Monday. In addition, Tsipras also offered Varoufakis' head in April to the creditors – he removed Theocarakis, Varoufakis' Deputy and close friend from the negotiating team – while the combative attitude of his Finance Minister during negotiations was precisely what protected Tsipras' bluff from being exposed. By side-lining Varoufakis, he might have well signalled the weakness of his hand and his unwillingness to pull the plug if pushed to. In June, as the deadline was approaching, Tsipras also accepted the new long-term fiscal target of 3.5% of GDP set in the common position of the creditors, implicitly recognising that he did not need debt relief after all (Blustein 2016). Eventually, his move did not strengthen his hand during the negotiations as the creditors (rightly) believed that he was not serious about leaving the eurozone and was rather ready to swallow the political costs of backing down.

Merkel, Gabriel and Steinmeier indeed decided to push for Grexit only as a way to force Greece to completely surrender and Schäuble was apparently instrumental in this strategy when he went public with a plan for a Greek timeout from the common currency (Palaiologos 2016). But Grexit was never seriously envisaged, in spite of public statements issued. The day following the referendum, Merkel reportedly asked Hollande his opinion about Grexit but did not insist after Hollande gave his thumbs down, understanding this was a non-negotiable red line (Palaiologos 2016). What is more, other major stakeholders such as Italy, the European Commission and the ECB were strongly against Grexit (see Henning 2017). While its role played during the negotiations has been criticised by several commentators as being political, the ECB never went as far as to fully cut Greece off from ELA in spite of pressures, as reported by Draghi in mid-July, and even after Tsipras called a referendum that would take place after the second bailout ended.

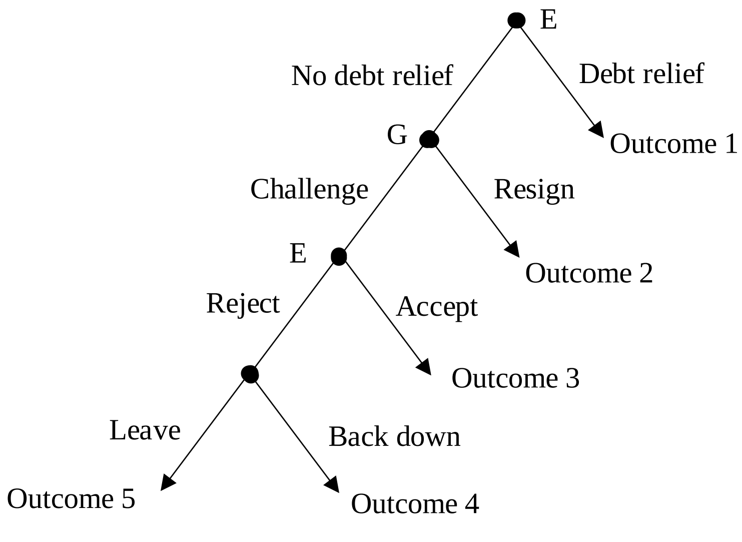
Section 4. A signalling game with double-sided incomplete information

In this section, we will develop a formal game that models (and thus greatly simplify) the negotiations on debt relief between Greece and its creditors in the run-up to the third Greek bailout. The logic of the game is inspired by Varoufakis (2017). We will model a two-player signalling game with double-sided incomplete information.

Let us call the two players G (for Greece) and E (for the Europeans). Voluntarily abstaining from describing the complexity of group dynamics that would take place within the group of European creditors made of sovereign states and international and regional organizations (this could be an interesting topic for future research, see Henning 2017), let us assume that assume that 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 2015, Hennessy 2017). In addition, let us assume that the preferences of the Europeans are represented by Germany which is the *pivotal voter* in this group. Germany had apparently the most extreme position in the group of creditors while the negotiations took place under the unanimity rule.

The bargaining 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. On the contrary, if E *does not grant debt relief* to G, then G decides to *challenge* the status quo 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 programme, *E* has to decide whether to *reject* or *accept* debt relief after a challenge. If *E accepts*, the game ends with a G obtaining a debt relief. On the contrary, if *E rejects* the challenge, *G* must decide whether to *back down* or *leave the Eurozone*. If *G backs down*, the game ends with G continuing adjusting without a debt relief. If *G leaves the Eurozone*, both players bear the costs of Grexit and the game ends (see figure 1).

Figure 1. The bargaining game with complete information



There are 5 possible outcomes in this bargaining game. 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. The *third outcome* is a delayed fair deal with Greece if Tsipras decides to ask for new 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 leave and yield to Europe's conditions. The *fifth outcome* is Grexit if Greece decides to leave.

That being said, we assume that each player can be of two types, depending on the desirability of one's outside option, i.e. the desirability of Grexit. Each player can be *compromise-averse* or *Grexit-averse*. Payoffs are assumed to be illustrative of a zero-sum game in line with the political economy of adjustment and rebalancing (see Frieden 2015).

At the core of a debt crisis, there lies a distributive issue: who will bear the costs? Indeed, debt crises generate losses that need to be swallowed through adjustment. And adjusting to a debt crisis can be achieved either through the debtor's fiscal adjustment or through debt relief or through a mix of the two solutions. Intuitively, creditor countries prefers adjustment to be fully borne by the debtor country, i.e. adjustment through fiscal adjustment, while debtor countries prefer adjustment through debt relief. Henceforth, a player (depending on its position in the game) will obtain a higher payoff if it is able to shift the burden of adjustment onto its opponent. In addition, we will assume that shifting the losses of adjustment onto one's opponent generates political benefits for a player.

From these considerations, we obtain the following preferences' orderings (see table 1 for a summary). 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), a deal without debt relief. In addition, Greece always strictly prefers a quick asymmetric deal (outcome 2) to a delayed one (outcome 4). Greece's type depends on whether Grexit is preferred to an asymmetric deal or not. If Greece is Grexit-averse, Greece prefers a new asymmetric deal (outcomes 2 or 4) to Grexit (outcome 5). On the contrary, if Grexit is compromise-averse, Greece prefers Grexit to a new asymmetric deal.

Similarly, Europe always prefer a quick deal to a delayed one. Europe also prefers a fair deal with Samaras (outcome 1) than a delayed asymmetric deal with Tsipras (outcome 4). For supporting a populist party, even if most of adjustment still lies on Greece, is assumed to be more costly than taking more of the share of adjustment from a country ruled by a mainstream party. When compromise-averse, Europe prefers Grexit (outcome 5) to any other option short of a quick asymmetric deal (outcome 2). When Europe is Grexit-averse, it prefers any option to Grexit.

Table 1. Preferences' ordering by player's type

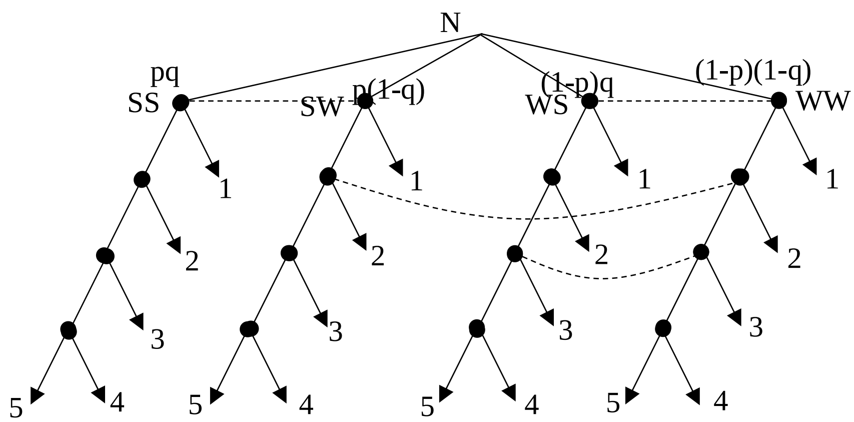
Europe	Preferences ordering (outcome n°)
Compromise-averse (S)	2>5>1>4>3
Grexit-averse (W)	2>1>4>3>5

Greece	Preferences ordering (outcome n°)
Compromise-averse (S)	1=3>5>2>4
Grexit-averse (W)	1=3>2>4>5

As a novel element in the analysis of the Greece-Europe negotiations over the third Greek bailout, we assume that both players have incomplete information over the other player's preferences ordering: each player only privately observes its own type. Nature determines whether a player is compromise-averse (S(trong)) or Grexit-averse (W(eak)). We assume that p is the probability that Greece is compromise-averse and q is the probability that Europe is compromise-averse (see figure 2). These probabilities are common knowledge.

The bargaining game thus turns into a signalling game with double-sided incomplete information. When bargaining, a Grexit-averse Greece (Europe) is therefore unsure whether it faces a Grexit- or a compromise-averse Europe (Greece).

Figure 2. The signalling 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 3). For a summary and description of the different parameters of the game, see table 2.

Figure 3. Simplified bargaining game with incomplete information

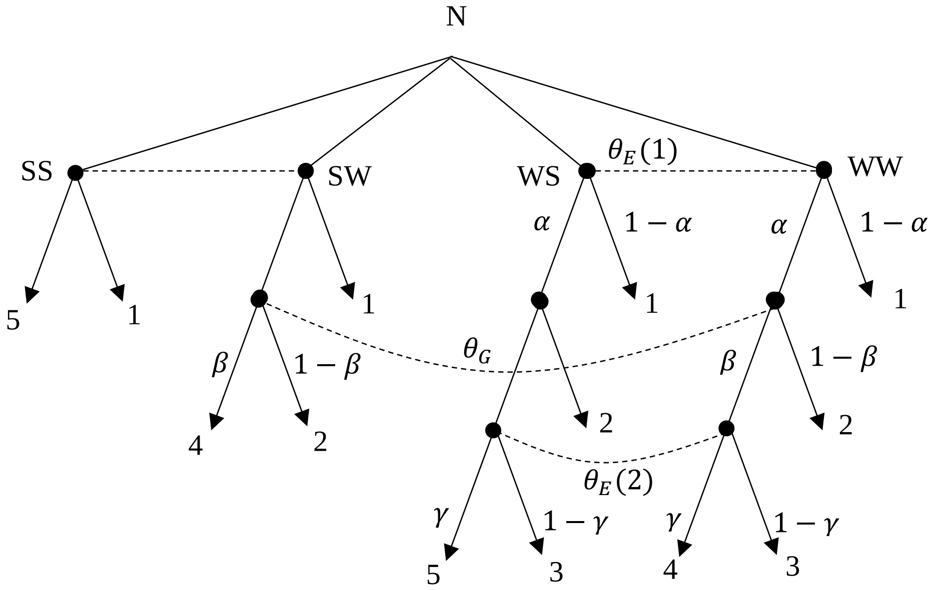


Table 2. Parameters of the game

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^5	Payoff of outcome 5 (Grexit/default) for player i
p	Probability that Europe is compromise-averse
q	Probability that Greece is compromise-averse
α	Probability that Europe plays No debt relief when Grexit-averse
γ	Probability that Europe plays Escalate 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: payoffs are always determined in political benefits/costs for policy-makers

From our assumptions, playing (Challenge, Leave) is a strictly dominant strategy for a compromise-averse G (SS and WS nodes), irrespective of the strategy E selects. 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), Grexit (outcome 5) is a Perfect Bayesian Equilibrium (PBE).

Let us now analyse what happens when at least one the players is Grexit-averse. When this is the case, there is no pooling or separating equilibrium as a player, when Grexit-averse, has an incentive to conceal its true type. A player has incentives to escalate if it anticipates its opponent to be Grexit-averse as well and conversely. A Grexit-averse G will thus have incentives to bluff in order obtain a better deal, typically outcomes 1 or 3. Similarly, a Grexit-averse E will also have incentives to bluff in order to reach outcome 2 or at least outcome 4. In order to conceal their type when Grexit-averse, E and G must be mixing their strategies.

Let us thus define the players mixed strategies and beliefs. 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. Since a Grexit-averse E will be indifferent between refusing and accepting a Greek offer after observing G challenging the status quo when

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

$$\pi_E^5\mu_E^* + \pi_E^4(1-\mu_E^*) = \pi_E^3$$

We thus obtain $\mu_E^* = \frac{\pi_E^3-\pi_E^4}{\pi_E^5-\pi_E^4}$. And a Grexit-averse E best response at $\theta_E(2)$ is therefore

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

Applying Bayes' rule and substituting for μ_E implies that E's best-reply correspondence can be written as

$$\begin{cases} \gamma = 0 \; if \; \beta < \dfrac{q(\pi_E^5-\pi_E^3)}{(1-q)(\pi_E^3-\pi_E^4)} \\ \gamma = 1 \; if \; \beta > \dfrac{q(\pi_E^5-\pi_E^3)}{(1-q)(\pi_E^3-\pi_E^4)} \\ \gamma \in [0,1]0 \; if \; \beta = \dfrac{q(\pi_E^5-\pi_E^3)}{(1-q)(\pi_E^3-\pi_E^4)} \end{cases}$$

The next strategy to be specified is β^*. First assume that $\gamma = 1$. Then it implies that $\beta > \frac{q(\pi_E^5-\pi_E^3)}{(1-q)(\pi_E^3-\pi_E^4)}$. 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 $\beta < \frac{q(\pi_E^5-\pi_E^3)}{(1-q)(\pi_E^3-\pi_E^4)}$, a contradiction. γ^* is therefore lower than 1. The fact that $0 < \gamma^* < 1$ yields $\beta^* = \frac{q(\pi_E^5-\pi_E^3)}{(1-q)(\pi_E^3-\pi_E^4)}$

For β^* to be a probability, it must be that $0 \le \beta^* = \frac{q(\pi_E^5-\pi_E^3)}{(1-q)(\pi_E^3-\pi_E^4)} \le 1$. That is $0 \le q \le \frac{\pi_E^4-\pi_E^3}{\pi_E^4-\pi_E^5} = \bar{q}$. Note that $\bar{q} = \mu_E^*$

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

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

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

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

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 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 $\pi_E^1 \le q\pi_E^3 + (1-q)[\beta\pi_E^3 + (1-\beta)\pi_E^2]$, hence $\alpha = 1$. Otherwise, there would be a separating equilibrium where a Grexit-averse E would always grant debt relief to G and a compromise-averse E would never grant debt relief to G.

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 $0 \le \gamma^* \le 1$, That is $0 \le p \le \frac{\pi_G^3-\pi_G^2}{\pi_G^3-\pi_G^4} = \bar{p}$

Hence, we can summarize the Perfect Bayesian Equilibrium of this game. 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 play reject only when

$p \leq \bar{p}$. 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 leave when compromise-averse. When Grexit-averse, G will play challenge when $0 \leq q \leq \bar{q}$ and will always play back down. At her information set, G's beliefs are given by Bayesian updating with $\mu_G = \frac{p}{p+(1-p)\alpha} = p$

Section 5. Concluding remarks

Why did Merkel and other Greece's official creditors decide not to grant debt relief and prefer the risk of a showdown with Tsipras? With the help of a game-theoretical model, we have tried to show that this specific decision and the resulting escalation was a rational strategy to follow in a context of asymmetric information. It was also rational for Tsipras and Greek policy-makers to engage into brinkmanship in order to obtain a better deal for Greece.

References

Ardagna, Silvia, and Francesco Caselli. 2014. "The political economy of the Greek debt crisis: a tale of two bailouts." *American Economic Journal: Macroeconomics* 6 (4): 291-323.

Bailer, Stefanie. 2004. "Bargaining success in the European Union: The impact of exogenous and endogenous power resources." *European Union Politics* 5 (1): 99-123.

Bailer, Stefanie. 2011. "Structural, domestic, and strategic interests in the European Union: Negotiation positions in the Council of Ministers." *Negotiation Journal* 27 (4): 447-475.

Blustein, Paul. 2015. *Laid Low: Inside the Crisis That Overwhelmed Europe and the IMF.* CIGI.

Brunnermeier, Markus K., Harold James, and Jean-Pierre Landau. 2018. *The Euro and the battle of ideas*. Princeton University Press.

Bulmer, Simon. 2014. "Germany and the Eurozone crisis: Between hegemony and domestic politics." *West European Politics* 37 (6): 1244-1263.

Dreher, Axel, and Nathan M. Jensen. 2007. "Independent actor or agent? An empirical analysis of the impact of US interests on International Monetary Fund conditions." *The Journal of Law and Economics* 50 (1): 105-124.

Fearon, James. D. 1995. "Rationalist explanations for war." *International organization* 49 (3): 379-414.

Finke, Daniel and Stefanie Bailer. 2019. "Crisis bargaining in the European Union: Formal rules or market pressure?" *European Union Politics* 20 (1): 109-133.

Frieden, Jeffry. 2015. The political economy of adjustment and rebalancing. *Journal of International Money and Finance*, 52: 4-14.

Dabilis, Andy. 2014. "Merkel: Surplus First, Then Debt Relief Talk." *GreekReporter.com,* April 11, 2014.

Hagemann, Sara, Sara B. Hobolt, and Christopher Wratil. 2017. "Government responsiveness in the European Union: Evidence from Council voting." *Comparative Political Studies* 50 (6): 850-876.

Hennessy, Alexandra. 2017. "Good samaritans vs. hardliners: the role of credible signalling in Greek bailout negotiations." *JCMS: Journal of Common Market Studies* 55 (4): 744-761.

Henning, Randall C. 2017. *Tangled Governance: International Regime Complexity, the Troika, and the Euro Crisis.* Oxford University Press.

Hug, Simon and Thomas König. 2002. "In view of ratification: Governmental preferences and domestic constraints at the Amsterdam Intergovernmental Conference." *International Organization* 56 (2): 447-476.

Kalyvas, S. N. 2015. "What Really Happened In Greece." *ForeignAffairs.com,* September 14, 2015.

Keohane, Robert O., Joseph S. Nye. 1977. *Power and interdependence*.

Krehbiel Keith. 1998. *Pivotal Politics: A Theory of US Lawmaking*. Chicago: University of Chicago Press.

Krehbiel, Keith. 2008. "Pivots." In *The Oxford Handbook of Political Economy* edited by Barry R. Weingast and Donald Wittman, 223–240. Oxford University Press.

Lehman, Howard P., and Jennifer L. McCoy. 1992. "The dynamics of the two-level bargaining game: the 1988 Brazilian debt negotiations." *World Politics* 44 (4): 600-644.

Lim, Darren J., Michalis Moutselos, and Michael McKenna. 2019. "Puzzled out? The unsurprising outcomes of the Greek bailout negotiations." *Journal of European Public Policy* 26 (3): 325-343.

Lundgren, Magnus, Stefanie Bailer, Lisa M. Dellmuth, Jonas Tallberg, and Silvana Târlea. 2019. "Bargaining success in the reform of the Eurozone." *European Union Politics* 20 (1): 65-88.

Malkoutzis, Nick (2014). "Greece: Where did it all go wrong?" *MacroPolis.gr,* December 17, 2014.

Moravcsik, Andrew. 1998. *The choice for Europe: social purpose and state power from Messina to Maastricht*. Routledge.

Moschella, Manuela. 2017. "When some are more equal than others: National Parliaments and intergovernmental bailout negotiations in the Eurozone." *Government and Opposition* 52 (2): 239-265.

Palaiologos, Yannis. 2016. "Merkel proposed Grexit to Hollande before key Eurogroup in July 2015." *ekathimerini.com*, February 21, 2016.

Pitsoulis, Athanassios, Soeren C. Schwuchow. 2017. "Holding out for a better deal: Brinkmanship in the Greek bailout negotiations." *European Journal of Political Economy*, 48: 40-53.

Powell, Robert. 1988. "Nuclear brinkmanship with two-sided incomplete information." *American Political Science Review* 82 (1): 155-178.

Putnam, Robert D. 1988. "Diplomacy and domestic politics: the logic of two-level games." *International organization* 42 (3): 427-460.

Reuters (2014a). "Greek primary surplus in 2013 was 0.8 pct/GDP-Commission." *Reuters.com.*

Brown, Stephen, and Lefteris Papadimas. 2014. "Samaras tells Germany that Greece can exit bailout early." *Reuters.com*, September 23, 2014.

Rickard, Stefanie J., and Teri L. Caraway. 2014. "International negotiations in the shadow of national elections." *International Organization* 68 (3): 701-720.

Rothacher, Jan-Ulrich. 2015. "How Domestic Politics Shaped the French Government's Position During the Euro Crisis." *European Politics and Society* 16 (2): 256-279.

Rubinstein, Ariel. 1982. "Perfect equilibrium in a bargaining model." *Econometrica: Journal of the Econometric Society* 50 (1): 97–109.

Schäfer, David. 2016. "A banking union of ideas? The impact of ordoliberalism and the vicious circle on the EU banking union." *JCMS: Journal of Common Market Studies* 54 (4): 961-980.

Schimmelfennig, Frank. 2015. "Liberal intergovernmentalism and the euro area crisis." *Journal of European Public Policy 22* (2): 177-195.

Shepsle Kenneth. 2006. "Rational choice institutionalism." In *The Oxford Handbook of Political Institutions* edited by Rod A.W. Rhodes, Sarah A. Binder and Bert A. Rockman, 23–38. Oxford: Oxford University Press.

Slapin, Jonathan. B. 2006. "Who is powerful? Examining preferences and testing sources of bargaining strength at European intergovernmental conferences." *European Union Politics* 7 (1): 51-76.

Spiegel, Peter. 2014. "Inside Europe's Plan Z." *FT.com*, May 14, 2014.

Spiegel, Peter. 2015. "Tsipras letter to Merkel: the annotated text." *FT.com*, March 22, 2015.

Ehlers, Fiona, Julia A. Heyer, Horand Knaup, Peter Müller, Ralf Neukirch, René Pfister, Christoph Schult and Timo Steppat. 2015. "Schäuble's Push for Grexit Puts Merkel on Defensive." *Spiegel.de*, 17 July, 2015

Stone, Randall W. 2008. "The scope of IMF conditionality." *International Organization* 62 (4): 589-620.

Târlea, Silvana, et al. 2019. "Explaining governmental preferences on economic and monetary union reform." *European Union Politics* 20 (1): 24-44.

Thomson, Robert, Frans N. Stokman, Christopher Achen and, Thomas König. 2006. *The European union decides*. Cambridge University Press.

Tsebelis, George. 2016. "Lessons from the Greek crisis." *Journal of European Public Policy* 23 (1): 25-41.

Varoufakis, Yanis. 2017. *Adults in the Room: My Battle with Europe's Deep Establishment.* Random House.

Wagstyl, Stefan, and Duncan Robinson. 2015. "German parliament backs latest Greek bailout." *FT.com*, August 19, 2015.

Zahariadis, Nikolaos. 2016a. "Values as barriers to compromise? Ideology, transnational coalitions, and distributive bargaining in negotiations over the third Greek bailout." *International Negotiation* 21 (3): 473-494.

Zahariadis, Nikolaos. 2016b. "Bargaining power and negotiation strategy: Examining the Greek bailouts, 2010–2015." *Journal of European Public Policy* 24 (5): 675-694.

[1] The 27 November 2012 Eurogroup statement stated that Greece would obtain debt relief once it reaches a primary surplus

[2] Europeans might also have looked on a SYRIZA victory with a favourable eye as SYRIZA was generally unconnected to vested interests and would have been ready to implement radical structural reforms more easily (Blustein 2016).

[3] Frieden and Walter (2018) makes 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.

Short bio

Simon Ganem is a PhD candidate in European Political Economy, working on the Eurozone crisis with a particular focus on the Greek crisis. Simon's PhD thesis span the political, financial and economic dimensions of the crisis. His research interests include the Eurozone crisis, macroeconomics, political economy, decision theory, crisis management and optimum currency area theory.

Prior to the PhD, Simon worked as a research intern at Bruegel and Coe-Rexecode, and as an apprentice in the Economic Research team at Natixis CIB. He also won the first prize of a contest organised by Le Cercle des Economistes with a project of a Eurozone-wide Unemployment Insurance Scheme.

He holds a Bachelor's degree in Economics and a Master's degree in International Economics from Université Paris-Dauphine. He also holds a Master's degree in European Affairs from Sciences Po Paris and a Master's degree in European Political Economy from the LSE. The main purpose of his LSE Master's Dissertation was to quantify the effect of optimum currency area criteria on economic resilience in the Economic and Monetary Union.