AUSTERITY AND GREECE:

A SURVEY OF THE RECENT DEBT CRISIS AND APPLICATION OF

GAME THEORY TO THE NEGOTIATIONS

by

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1 Introducton

This paper is intended to provide a survey of the Greek debt crisis and shed some light on the negotiations by using a game theoretic model. There has been much discussion in the last few years, both in the media and in academic settings, as to the best way of dealing with large sovereign debt. While using austerity measures has been the method of choice in Europe recently, not all agree it is the correct one. According to Krugman (1999), government leaders should instead be looking to Keynesian economics as their guide and, during a recession, should be employing expansionary fiscal policy while devaluing their currency rather than putting a lock on the country's coffers. In the case of Greece, it would seem as if critics of fiscal consolidation are correct in their thinking. However, in the last 50 years there have been some examples of austerity working as many claim it to, decreasing the debt to GDP ratio and promoting economic growth. The question becomes why has Greece not had this same success. Is it because austerity does not yield the same result in each case or is it because Greece is simply not correcting course enough and problems in the government need to be rectified before they benefit from the adopted measures? Or, perhaps both factors are to blame?

I suggest that austerity is bound for failure unless it is used along with expansionary monetary policy, either the lowering of interest rates or a depreciation of the currency, in order to offset the contractionary effect caused by fiscal consolidation. This is similar to the ideas in Krugman (2015), which argues that countries who have benefited from austerity implemented the policies along with a devaluation of their currency in order to cause an increase in exports. As Greece was unable to do so, Krugman (2015) blames the current policy, of using austerity to combat European sovereign debt, as the cause for Greece's economic collapse. Additionally, I believe that game theory models based on the ones developed in Aggarwal (1996) will provide insight to the factors contributing to each of the three bailouts Greece has received from their three major creditors.

In the second section I will look at the recent use of austerity to combat sovereign debt issues, outside of Greece. In the third section, I look at Greece's history in the euro and how this affects the position they are currently facing. It is in the fourth section that I will examine the conditions necessary for austerity measures to be deemed successful. Finally, in the fifth section I will use game theory as a lens to look at the previous and ongoing negotiations between the Greek negotiators and those of their creditors, while the sixth section concludes.

2   The Recent Success of Austerity

Germany, with support from other Northern European countries such as Finland and the Netherlands, is often cited as the main advocate for austerity when it comes to determining the fiscal policies of its Southern neighbours. While the German government does not seem to advise austerity measures as a solution for all countries, their own being one example, they do tend to support fiscal consolidation as a solution for the highly indebted members of the Eurozone, such as Greece, Ireland, Spain, Portugal, and Italy (Jabko, 2013). The opinion may be warranted as Jabko (2013) found that austerity could be a natural solution to high levels of sovereign debt, as a strategy to rebuild credibility among a country's creditors and to secure future financing. The German gravitation to austerity is often justified, by those outside of the EU, as stemming from the ever-present German fear of hyperinflation and the striking image of wheelbarrows full of money being pushed through the streets. However, there is likely even more cause behind the German resistance to expansionary monetary and fiscal policy. Throughout Germany's history there is evidence of Lutheran influence in the political realm and of its ideology: "faith begetting charity" (Ozment, 2012). Even though there exists a broad range of religions practices and the government remains politically secular, Lutheran ideals are pervasive. Ozment (2012) notes that both the current Chancellor of Germany, Angela Merkel, as well as the current President, Joachim Guack, have ties to the Lutheran church. Merkel grew up in East Germany with a father who was a Lutheran pastor, while Guack himself was a Lutheran pastor before starting his career in politics. A recurring theme preached by Martin Luther, the founder of the Lutheran church, was one of charity to neighbours that are in need but also one of repayment and return to self-sufficiency by those neighbours, reports Ozment (2012). This idea is very similar to the stance Angela Merkel and her government have taken with Greece, aide on the condition of

repayment and return to self-sufficiency, rather than the creation and issuance of euro bonds. Another indicator, noted by Ozment (2012), that Germany's Lutheran roots play more of a role than many people realize is that the ideals have survived both extreme rightwing and extreme leftwing politics in the form of Nazism and Communism in just the past one hundred years.

Ireland is often brought out as the poster child for austerity but success in one country by no means ensures a similar result elsewhere. While Ireland does seem to be enjoying a recovery from their recent debt crisis, with decreased unemployment rates and a now positive balance of the government finances, their experience cannot be duplicated everywhere (Kinsella, 2014). Kinsella et al. (2014) explains that Ireland's positive result was due to the openness of the economy and their strong export sector, led mainly by multinational corporations. While the Irish government achieved a 20% fiscal consolidation since 2006, the unemployment rate was decreased mainly as a result of emigration (Kinsella, 2014, pg. 21). However, the economy was boosted by a positive trade balance caused by both weakening imports and increasing exports, beginning in 2009. Kinsella et al. (2014) reports that as a result of low domestic demand, stemming from the asset bubble collapse and the previously employed austerity measures, Ireland's marginal propensity to import decreased but this was met with an increase in the export sector, resulting in a positive trade balance that gave a much needed boost to the economy. Kinsella et al. (2014) also cautions that this effect may be contained to Ireland because of the fact that their export sector is primarily made up of multinational companies, an almost unique situation with the European Union.

In addition to Ireland, Iceland also toyed with austerity to some success. McKee et al. (2012) points out that while Iceland experienced a more successful recovery than other European countries attempting to utilize austerity, they only employed modest measures and as they are not part of the Eurozone, Iceland remained in complete control of their monetary policy and were able to devalue their currency. While Spain had similarities to Ireland in the mode of entry to their debt crisis, the implementation of fiscal austerity had a rather different outcome. As explained by Homburg (2013), after implementing austerity measures, Spain faced an unchanged budget deficit that remained close to 10% of their GDP (pg. 38). Additionally, Spain is still faced with high unemployment, as of June this year the rate was 22.5%, according to Statistical Office of the European Communities (2015). The 2014 rate for those under 25 was 53.2%, as reported by Statistical Office of the European Communities (2014), meaning the country is still a long

way from a full recovery. Italy is another different case among its European neighbours. Jones (2012) explains that Italy has managed large budget deficits for close to 20 years and their government has quite a bit of experience managing that debt. Italy also differs in that the country's debt is mainly contained to the public sector and it is offset substantially by private savings, according to Jones (2012). In their case the debt crisis was caused by the habitual indecisiveness of Italy's government. This indecisiveness caused a decrease in investor confidence, which pushed Italian bond yields higher and created their current crisis (Jones, 2012).

Japan, while outside of Europe, offers another case with insight into the situation in Greece. With the exception of Iceland, the above mentioned countries are all limited in their policy making by their membership to the European Monetary Union (EMU). In that respect, they all differ quite a bit to Japan, a country with more debt relative to their GDP than even Greece, but as of yet one that has not been pulled into a debt crisis of their own and still boasts low interest rates. One aspect that sets Japan apart from Greece is that most of their debt is held by historically stable domestic creditors, such as domestic investors, institutions and their own central bank, while Greece owes most of its debt to other governments and sources outside of the country (Yoshino & Vollmer, 2014). Being apart of a monetary union, domestic investors in Greece can easily move their money into other European countries without fear of exchange rate risk. Greece also doesn't benefit from their own central bank purchasing government debt, which would reduce the amount of interest the government would have to pay on that debt and loses the ability to print money to pay off its debts (Yoshino & Vollmer, 2014). Additionally, Yoshino and Vollmer (2014) explains that while the gross debt to GDP ratio in Japan is much higher than that of Greece, the net debt to GDP ratio in Japan is substantially lower than the net debt to GDP ratio in Greece as Japan's two ratios are nearly the same since Japan's debt is largely offset by tax revenue and Greece's is not, something this paper will delve into more in the next section.

3   Austerity in Greece

In the years preceding Greece's entrance into the European Monetary Union, it appeared as though the country was on track to meet the conditions set out by the Maastricht treaty, strong exports and even stronger domestic demand meant the government's main concern was the

above EU average level of inflation, although unemployment levels were also marginally above average, according to OECD Economic Outlook (1999). OECD Economic Outlook (1999) reports that the government attempted to control inflation mainly through exchange rate policy, a tool that disappeared once they adopted the euro. In 2009 the newly elected government reported that in 1999 the Greek government paid €3 billion to Goldman Sachs to reconfigure the country's accounts, to appear as if they were compliant with the requirements set out by the Maastricht treaty, and that since then the country had been running much higher budget deficits than it had appeared (Fouskas, 2013, pg. 136).

Tax evasion is often cited as one of the biggest issues in Greece's economy and as a characteristic that sets it apart from other countries facing a debt crisis. de Boer (2013) reports that the issue of tax evasion dates back to before the 16th century, to the occupation of Greece by the Ottoman Empire, when Greek citizens were forced to pay high taxes and went to great lengths to avoid paying them. In the case of Greece, the aversion to paying taxes comes from a lack of faith in the Greek government that stems from both the influence of powers outside of Greece as well as a level of corruption within the Greek government itself. The government has a long history of clientelism and according to Kulukundis (2014) since the the Panhellenic social movement (PA-SOK) party came to power in 1981 they had been using EU funds to lure supporters with public sector jobs, at one point the practice was so widespread that 25% of the labour force in Greece had a government job (pg. 89). Even in light of this mistrust, tax evasion by individual Greek citizens is not the main problem, the issue comes from comprador bourgeoisie, the intermediaries of foreign companies in domestic markets (Fouskas, 2013). According to Fouskas (2013) this sector has grown substantially in Greece in the last couple of decades and many businesses were given large incentives in terms of tax reductions, while others registered their businesses outside of the country to avoid tax collection in Greece completely. The growing merchant fleet in Greece is an excellent example of this, as most of them are listed in such a way that they pay considerably lower tax rates and contribute very little to tax revenue.

Additional problems in the Greek government include a strong preference for military spending and limiting public information to only those stories that support their goals. Fouskas (2013) reports that the government allocated huge amounts of the budget to defence spending all in response to the perceived threat from Turkey, an idea that was supported by the United States government and their concern over military power in Turkey. The amount Greece spends on its

military is considerably larger than other Eurozone countries, in 2009 Greece allocated 3.2% of GDP to defence spending, compared with 2.4% of GDP in France and 1.4% in Germany; the amount Greece spends makes up a major proportion of their import sector as they import more weaponry than almost any other European country (Fouskas, 2013, pg. 135). Another issue, reported by Fouskas (2013), is a lack of follow through by the government, for example in 2010 the Greek government was given a list of names of wealthy individuals possibly responsible for moving over €13 billion outside of the country to avoid tax collection, it was given to them by Christine Lagarde as the French finance minister at the time, but the Greek government covered it up rather than investigate (pg. 136).

Austerity measures implemented in Greece have been hardest on the lowest income and middle class citizens in Greece, which has seen its economy shrink by 25% since 2010, reports Kulukundis (2014). The country also has an unemployment rate of 25.6%, as of April 2015, reported by Statistical Office of the European Communities (2015) and a youth unemployment rate in 2014 stated as 52.6% by Statistical Office of the European Communities (2014). In addition to a deep mistrust by the Greek people of their government, this has caused the political climate to reach a level of instability not seen since the civil war in the late 1940s, according to Kulukundis (2014), even causing the former prime minister Antonis Samaras to compare his country's temperament to that of Germany in the years before 1933. Not unlike Germany in the lead up to Hitler's rise in power, the malcontent in Greece was accompanied by a surge of popularity in both the leftwing and extreme rightwing parties. Kulukundis (2014) points out that both leftwing Syriza, whose leaders have roots in communism, and extreme rightwing Golden Dawn were peripheral parties but both saw an increase in popularity in the May 2012 election, Syriza placing third in the votes and Golden Dawn gaining a seat in parliament for the first time. The popularity of both parties continued to rise and in the January 2015 election, Syriza won the largest number of seats in parliament and Golden Dawn placed third, above the popular PASOK party (Forelle & Stimuli & Granitsas, 2015). Possibly even more surprising, is that in order to have a majority of the seats in parliament, Syriza formed a coalition government with the Independent Greeks, a far right party, based solely on the two parties opposing austerity, reports Forelle et al. (2015). While the current debt crisis and political discontent in Greece will almost certainly have a different outcome to that of the Weimar Republic, it does draw some similarities. Ironically, a monetary union across Europe was in part developed as a result of the first

and second world wars, to prevent a similar reoccurrence and yet it is largely responsible for a situation eerily familiar. The lack of acceptance of austerity measures and the political instability in Greece is just one more factor distancing them from the more successful case of Ireland, where austerity was largely accepted without protest, and cause for difficulty in negotiations for further bailouts.

4   Is there still a case for Austerity?

In light of the Greek debt crisis and the similar cases in other European countries, there has been considerable speculation as to whether austerity is the appropriate response to large amounts of sovereign debt. There are those who are steadfast supporters of fiscal consolidation, including many members of European governments and institutions, some who claim only specific types of fiscal consolidation are successful and others still who suggest the success or failure depends on the structure of the economy and political system. Schröder (2012) argues for the last group and suggests that even if some members of the European Union have had success implementing austerity measures in the past, there is no reason for it to succeed elsewhere in the union because of both the political and economic diversity across Europe. However, based on the literature it seems as if the problem with austerity is more fundamental than stemming from economic and political factors alone. While austerity is undoubtedly beneficial in curbing government's overzealous spending habits, there is a lack of evidence suggesting it does in fact promote growth and without some growth the debt, even a smaller amount of debt, will be difficult to pay back. This would indicate that austerity is likely the most successful when used in conjunction with expansionary monetary policy to stimulate growth and offset the reaction to contractionary fiscal policy. One important distinction between most of the examples discussed in this section and Greece, is that Greece is implementing austerity as a requirement for bailout funds. The Greek government did not weigh the costs and benefits and decide on this course of action because policymakers thought it would have the best outcome, they strongly disagree with its implementation but they also believe it is worth the pain, in order to stay in the euro. This may affect the result of austerity implementation and, with all the recent examples of austerity for financing, could be an interesting avenue of research. For this paper, however, I will look at austerity without context of debt negotiation, understanding that this likely misses

aspects of the story in Greece.

First looking at an argument for austerity promoting economic growth, Alesina and Ardagna (2010) claims that the success is due to the type of austerity taken on. The result of that paper suggests that governments that base their fiscal adjustments around spending cuts have considerably more success than those that rely on increasing revenue with higher tax rates. They found that in all the cases they studied, the ones with successful periods of austerity, defined as a decrease of at least 4.5% in the debt to GDP ratio after three years, were characterized by a decrease in spending of roughly 2% of GDP and also a decrease in tax revenue by about 0.5% of GDP (Alesina & Ardagna, 2010, pg. 12). On the other hand, cases with unsuccessful periods of austerity saw roughly a 1.5% of GDP increase to tax revenue and a 0.8% of GDP decrease to government spending (Alesina & Ardagna, 2010, pg. 12-13). This led the authors to their conclusion of spending based austerity as more successful than tax based austerity. Their reasoning for this was that on the demand side, if consumers believed austerity measures to be moderate and as necessary in order to avoid severe adjustment in the future, then they would view the implementation of these policies to be positive and as increasing their lifetime wealth, thereby increasing demand through a positive income effect. The difference in the type of austerity measures used came into effect through the supply side. When the government primarily implemented spending based austerity, the number of public sector jobs shrank and the wages of the remaining jobs dropped. This put a downward pressure on the wages in the private sector, consequently decreasing costs and increasing profits and investment, which in turn created growth in the economy. Alternatively, when the government looked to higher tax rates as their primary austerity target, net-incomes decreased and employees demanded higher gross-incomes to compensate. This created the opposite effect of spending based austerity in that costs increased, profits and investment decreased, and economic growth stalled. The authors believed this to be the determining factor behind the relative success or failure of governments' austerity policies.

In contradiction to the above mentioned paper, Jayadev and Konczal (2010) purports that austerity taken on during an economic downturn is never successful and that Alesina and Ardagna (2010) misinterprets their results. Jayadev and Konczal (2010) goes through the same data as the earlier authors but comes to significantly distinct conclusions, in particular, most of the successful cases used were during growth periods in the economy, not downturns and that the cases where austerity was used during downturns, the policies usually exacerbated the slowdown. The

only example of a government successfully reducing their debt to GDP ratio while in an economic downturn and also increasing growth, did so by both decreasing their interest rates and depreciating their currency. Even if a government followed those steps and dropped interest rates and depreciated their currency, they usually increased their debt to GDP ratios and/or decreased the GDP growth rate, when implementing austerity in a downturn. Additionally, Jayadev and Konczal (2010) found no cases of governments successfully using austerity when the country already had low interest rates, high unemployment and a recent recession - the situation several countries in the eurozone now face. As a result, the authors concluded that austerity during low economic growth periods does not promote growth, irrespective of the tools used to implement it.

Another source of clarity in the relative success or failure of austerity measures is examining and comparing specific past examples of austerity implementation. Perotti (2012) looks at four cases in Europe where austerity was applied, two with independent currencies and two with pegged currencies. Finland from 1992 to 1998 and Sweeden from 1993 to 1998 both abandoned their currency pegs and implemented austerity measures without any constraint on monetary policy, while Denmark in 1982 up until 1986 and Ireland during the period between 1987 and 1990 implemented austerity measures and maintained their currency peg. Denmark initially seemed to have positive results but overall had very little success, eventually raising interest rates and stalling GDP growth, but the country differs from the other three cases in that they had a much smaller export sector. Finland and Sweden were both able to depreciate their currency and increase exports significantly, and both benefited greatly from that. Ireland is possibly the most interesting case, their attempts prior to 1986 were largely unsuccessful but the second period of austerity implementation was accompanied by a relative depreciation of the Irish pound to the British sterling, the currency of Ireland's biggest trading partner, which gave a significant boost to their export sector. Each of these cases show successful austerity implementation when coupled with effective currency depreciation, causing growth in the economy from strong exports, giving credence to the idea that austerity works only in the presence of expansionary monetary policy.

Recent events in Ireland, in regard to implementation of austerity, have also proved interesting. Touted by some as the poster child of austerity in Europe, Ireland is the most recently successful case supporters of austerity have, and throughout the process it remained within the monetary

policymaking realm of the European Central Bank. As discussed earlier, Ireland has a fairly unique export sector in Europe, made up primarily of multinational corporations, which were largely unaffected by the fiscal consolidation of the government. This led to strong export growth, and as imports stalled, a considerably positive trade balance for Ireland. This is very similar to what would happen to many countries after devaluing their currency or implementing expansionary monetary policy. Therefore, while Ireland certainly did not have autonomous control of their currency, they were able to simulate a currency devaluation, greatly contributing to their economic recovery.

While not empirically tested or anecdotally exhaustive, I believe the above examples suggest a reason to think that it is not the type of austerity measures implemented or the economic structure they are imposed upon but the accompanying monetary policy, which determines the success of a government consolidating their budget. Austerity implemented during prosperous economic periods is accompanied by existing growth and contractionary fiscal policy at that point is appropriate and not harmful. However, this is not the case in economic downturns and so if austerity is to be undertaken, steps to offset the slowdown caused by the policies need to be implemented with expansionary policy elsewhere in the economy, in other words in monetary policy. This is not a guarantee that austerity will be successful as it is not sufficient but it is necessary for success.

5   Bargaining for bailouts in Greece

In order to shed some light on the ongoing negotiations between Greece and their creditors, I will follow the model developed by Aggarwal (1996). Throughout the negotiations, Greece has faced high unemployment and little to no economic growth, as described earlier. Without control of monetary policy, they are subject to the decisions of the ECB, one of their creditors, who have been keeping interest rates low and started a quantitative easing program to fuel a European recovery. This puts Greece in the situation described above, where it is quite difficult if not impossible to find a case where austerity implementation has improved the country's situation. Yet, austerity implementation is exactly what Greece's creditors are negotiating for.

Negotiations in each period are laid out as a simultaneous single move game between two play-

ers, the indebted government and its creditors, both acting under perfect information. The game is not one where each player moves at the same time, independent of one another but a game where the two parties negotiate and come to an agreement, which requires steps to be taken by each party. While they are implementing the actions agreed upon, they have no guarantee the other side will fulfill the commitment they made and that is the source of simultaneous movement. The debtor government can choose to make minimal or no adjustments, moderate adjustments or major adjustments, while the creditors can make minimal to no loan concessions, moderate concessions or major concessions. I use loan concessions as a term describing both debt forgiveness or restructuring and also the offer of further funding. The players in this specific game are the Greek government as the debtor and its three main creditors, the European Commission (EC), the European Central Bank (ECB), and the International Monetary Fund (IMF), acting collectively and referred to from now on as the Creditor Trio, or CT. There are also interactions between the multiple creditors but for the most part they have acted in unison and so will be treated as one player. The situation of Greece and its Creditor Trio is different from most other debt negotiations as the ECB and creditor governments within the eurozone and even more broadly within the EU, have more at stake than financial loss. These parties are intricately tied to Greece through their monetary union and common currency and so their interests lie in not only a repayment but also in seeing Greece's economy succeed. If the Greek economy were to collapse there is, or at least at some point there was, a risk of contagion to other vulnerable countries within the eurozone, as well as a possible drop in confidence or certainty in the euro area as a whole.

The game in each period will follow the layout shown in Figure 1.

Creditor Trio

		HC	MC	LC
	HA	HC + HA	MC + HA	LC + HA
Greece	MA	HC + MA	MC + MA	LC + MA
	LA	HC + LA	MC + LA	LC + LA

Figure 1: The layout of the debt negotiation game that takes place between the Greek government and its trio of creditors in each period of bargaining. Each game will be a 3x3 matrix, where each player has three possible actions: low or no, moderate, or high concessions (creditors) or adjustment (debtor).

The payoffs of these three by three game matrices are determined by a utility equation for each party. For Greece, their utility is positively impacted by loan concessions given but the concessions also detract from the utility of the creditors. The creditors utility is increased by adjustments made by the Greek government but this decreases that government's utility. Both parties are impacted positively by maintaining a good relationship with one another. Each of these factors affects the utilities of the parties with different weights depending on the situation they find themselves in, the weights are dependent on both the nature of the players as well as the state of the world around them so that each of their utilities look something like the following.

$$U_{Greece} = x * LC - y * FA + z * AM$$

$$U_{CT} = p * FA - q * LC + r * AM$$

LC is the amount of loan concessions given by the creditors, FA is the amount of fiscal adjust-ment agreed upon by the Greek government and AM is the value of amity to each player. The amity factor is based on the idea that while each game lasts for only one period, both players realize the likelihood of future negotiations and look to maintain good relationships. The value each party places on these relationships will likely change over time and be different from one another. The amount of goodwill given can be measured as the amount given up by each party relative to that gained. When one player concedes more than they gain, it is as if they are do-ing their opponent a favour, which in turn benefits them down the road and so the variable is determined as shown below, the same method used by Aggarwal (1996).

$$AM_{Greece} = \frac{FA}{LC} - 1$$

$$AM_{Trio} = \frac{LC}{FA} - 1$$

The values for LC and FA are given by the action taken by the Creditor Trio and Greek govern-ment, respectively, at which point AM can be calculated for each. The factors LC and FA are given a value of 1, 2 or 3 based on whether the concession or adjustment was low, moderate, or high. AM is then calculated to be anywhere between -0.67 and 2. For instance if the Greek government made high adjustments to their fiscal policy ($FA = 3$) and the Creditor Trio made

no loan concessions ($LC = 1$) then their amity values can be calculated as:

$$
\begin{aligned}
AM_{Greece} &= \frac{3}{1} - 1 \\
&= 2
\end{aligned}
$$

$$
\begin{aligned}
AM_{Trio} &= \frac{1}{3} - 1 \\
&= -0.67
\end{aligned}
$$

Substituting the factor values into their utility equations yields the following:

$$
U_{Greece} = x * (1) - y * (3) + z * (2)
$$

$$
U_{Trio} = p * (3) - q * (1) + r * (-0.67)
$$

Once the weights are determined the payoffs of each game can be calculated. Determining the weights for each player is the most subjective aspect of the model and leaves room for considerable interpretation. The guide laid out by Aggarwal (1996) suggests using a scale from 1 to 5 for each weight so that the weights are similar in magnitude to the factor values. This allows the weights to have an effect on the factors without overshadowing them. First looking at the weights for Greece, x defines how desperately the Greek government needs either further loans or debt restructuring, with 1 being fairly indifferent and 5 being quite desperate. If the government does not have a strong need for more financing they are less likely to agree to many adjustments to their fiscal policy, however if they are in a great need for liquidity they will be fairly agreeable to stricter terms. The second weight is y, which is the cost of making adjustments to their fiscal policy. If the government has a majority and a high approval rating the cost of introducing austerity measures will be somewhat low. On the other hand, if the government is an unstable coalition, or they face mounting discontent among their citizens, the cost of these austerity measures will be much higher. The last weight affecting Greece's utility equation is z, the value the government places on maintaining good relations with its Creditor

Trio. If the country is self-sufficient and has support elsewhere, this value will be relatively low but if they are highly dependent on the Creditor Trio then the value will be much higher.

The creditors face similar weights for their inputs. The first weight, p, is the value the creditors place on adjustments by the Greek government. If the creditors are financially stable and have significant debt capabilities they will be in a better position to wait for their debts to be repaid and will be able to demand higher adjustments from their debtor, consequently p will be higher. The weight on loan concessions for creditors is determined by how united they are. If for instance they are unconcerned with each other and only worried about being repaid themselves, they will be less willing to make loan concessions for fear of the other creditors being paid back before they are. In terms of the Creditor Trio, they are not considering debt restructuring so much as additional loans and so they are less likely to do so without a united front facing Greece. If they are not united, the cost of making further loans, q, will be very high. If the Creditor Trio is united and ensures they will all be paid back equally then the cost of making concessions will be low. The last weight, r, is the value the creditors place on maintaining positive relations with Greece. If they are quite happy to cut ties with Greece then r will be very low but if they would like to remain on favourable terms then r will be relatively high.

Each weight for both players is determined individually for each bargaining period, based on the context surrounding the game. For this paper, I will detail three periods of bargaining, corresponding to the three bailout packages the Greek government received from the Creditor Trio, the first bailout starting in May 2010, the second in March 2012, and the most recent in July 2015.

Before the bailout in 2010, Greece had a significant need for financial aid but not a desperate need so I decided on $x = 4$ as the first weight. The cost of making adjustments to ensure the bailout was relatively high as the Greek people, more than others, appear adverse to austerity measures but the government was more or less stable. The government at the time had significant support, in parliament and among its constituents, as they were largely viewed as innocent when it came to the crisis, the majority of culpability being laid on the previous governments. As a result, I chose $y = 3$, a moderate cost of implementing austerity measures in this period. The last weight is quite different in this series of games than it is in other periods of debt games as Greece and the majority of its creditors are tied through their fiscal union, in some ways

making the conservation of relations more important than it might be between other debtors and creditors. In this first period Greece, of course wants to remain on decent terms with the other euro area countries but it assumes the same of them, that they want to remain on good terms with Greece and that their union is mutually beneficial. As a result, they are not overly concerned with maintaining their relationship and I use $z = 3$, a moderate value to their amity factor.

At this point, before the first bailout, the Creditor Trio is financially stable. Some countries in the euro area are struggling but as a whole, they are almost certain to weather the storm and as such would not be worried about short term repayment on the bailout for Greece, the same is true for the IMF. Additionally, the EU was looking to promote confidence in the area and not display any indicators that the euro was in trouble. As such, I chose $p = 4$, a high value on the benefits of Greece's financial adjustments. I chose 4 instead of 5 as the creditors would rather see Greece recover and pay back its loans sooner, as a quick recovery would also bode well for confidence in the euro area. I decided on $q = 3$ for the weight detailing the cost of providing loans to Greece. The Creditor Trio was united and unconcerned with other creditors being paid before them, however, the creditors in the euro area were worried about the signal a bailout would create. Providing a bailout for Greece let the markets know that there was trouble, enough for them to intervene, which would cause alarm and uncertainty that would permeate the other countries in the euro area. Secondly, the bailout sent a message to other struggling euro members that there was a lifeline, if they needed it. Providing one bailout indicated that there may indeed be more to follow. Lastly, I classify the value the Creditor Trio places on maintaining relations with Greece the same way as I did for Greece. They are linked so it will not be low but they assume Greece does not want to break ties so they are roughly on the same page and I use $r = 3$.

Using the weights described above, the utility curves are as follows.

$$U_{Greece} = 4 * LC - 3 * FA + 3 * \left(\frac{FA}{LC} - 1\right)$$

$$U_{Trio} = 4 * FA - 3 * LC + 3 * \left(\frac{LC}{FA} - 1\right)$$

The payoffs can be determined for each cell in the game laid out in Figure 1. The value of LC is 1 for low or no concession (LC), 2 for moderate concession (MC), and 3 for high concession

(HC). Similarly, the value of FA is 1 for low or no adjustment (LA), 2 for moderate adjustment (MA), and 3 for high adjustment (HA). For instance, in the bottom, lefthand corner of the matrix (LA, HC), the utilities would be:

$$U_{Greece} = 4*3 - 3*1 + 3*(\frac{1}{3} - 1)$$
$$= 7$$

$$U_{Trio} = 4*1 - 3*3 + 3*(\frac{3}{1} - 1)$$
$$= 1$$

Alternatively, for the top, centre cell (HA, MC), the payoffs would be:

$$U_{Greece} = 4*2 - 3*3 + 3*(\frac{3}{2} - 1)$$
$$= 0.5$$

$$U_{Trio} = 4*3 - 3*2 + 3*(\frac{2}{3} - 1)$$
$$= 5$$

The game with all the payoffs calculated is shown below in Figure 2.

The game shown in Figure 2 has two Nash Equilibria: (HA, LC) and (LA, HC). One party is making the maximum amount of change, while the other is making the least amount possible, a variation of the well-known "Chicken" game. In this case each party will try to convince the other that they will commit to the action which ensures their preferred outcome, in this case Greece will attempt to commit to low adjustments and the Creditor Trio will attempt to convince Greece it is tied to low concessions. The danger in this type of game is that both parties will stubbornly refuse to alter their strategy and the outcome becomes (LA, LC), where neither party

	Creditor Trio		
	HC	MC	LC
HA	(3, 3)	(0.5, 5)	<u>(1, 7)</u>
MA	(5, 0.5)	**(2, 2)**	(1, 3.5)
LA	<u>(7, 1)</u>	(3.5, 1)	(1, 1)

Greece is labeled on the left spanning the rows HA, MA, LA.

Figure 2: The game matrix for the first period of bargaining between Greece and the Creditor Trio of the EC, ECB, and the IMF, resulting in the first Greek bailout in May 2010. The Nash Equilibria are underlined and the expected outcome is in bold.

does well. This is where the debt negotiations differ from a traditional simultaneous move game. The pair have considerable time to negotiate and come to an agreement before acting, while their natural inclination would be to end up at an equilibrium outcome, in some cases negotiation could move the pair to an alternative outcome, if there exists a Pareto Optimal outcome that differs from the equilibrium. In this case, if each party were to compromise somewhat and agree to (MA, MC), they would both do better than they would at (LA, LC). In order for negotiation to succeed, both parties would have to believe the other's threat of committing to low or no action and intending to force the outcome (LA, LC) over cooperating and letting the other player benefit at their preferred equilibrium outcome. The result of this negotiation period was a bailout of €110 billion given to Greece, in return for significant fiscal consolidation, including increases to VAT rates, decreases to public salaries and pensions, as well as others to total 13% of national income for the next three years Charlemagne (2010). This would imply that the two parties were successful in negotiating and avoiding an outcome where they both lose, instead (MA, MC) was the outcome of this period, large loans issued but relative to the second bailout not enormous, and significant austerity measures imposed but not as severe as the ones made down the line.

The second bailout in March of 2012 resulted from slightly different factors from the first bailout. In this period, Greece was facing an even larger amount of debt and so had an even more desperate need for funds, consequently I used $x = 5$ rather than $x = 4$ from the first period. After already facing strict austerity measures, which led to rising unemployment and falling incomes, the Greek people were even less supportive of austerity than they were before, demonstrated by the protests in the early months of 2012. As a reflection of voter sentiment, members of parliament were also less willing to back a deal that included harsh fiscal consolidation, espe-

cially with an election looming. Based on these indicators, I used a higher value for the second weight as well, $y = 4$, rather than $y = 3$ as in the first period. There was still some cohesion within the government, however, so I did not use $y = 5$. The value of Greece's relationship with the Creditor Trio was not anymore important in this period than in the first so I continued to use $z = 3$ for this game.

Leading up to the bailout in 2012 there was speculation of Grexit, a Greek exit from the eurozone, and how the rest of the euro area would be affected. Many predicted the downfall of the single currency if Greece left, stemming from contagion spreading trouble to Portugal and other vulnerable countries. As a result of this, the Creditor Trio was much more inclined to see a swift conclusion to the trouble in Greece and placed less value on the adjustments the country made, because of this I lowered the the value of the first weight to $p = 2$. While private creditors of Greece took a 50% haircut on their outstanding loans, the Creditor Trio had no reason to fear being hung out to dry as they were the parties negotiating another bailout with Greece and had much more bargaining power. This is the reason I left the second weight as it was in the first period, $q = 3$. I decreased the last weight from $r = 3$ to $r = 2$ because of their frustration with Greece at this point. The Creditor Trio knew that Greece needed the money and that they needed Greece to stay in the eurozone so resolving the situation was more important than worrying about future relations between the parties.

The two utility equations with the above discussed weights are as follows.

$$U_{Greece} = 5 * LC - 4 * FA + 3 * (\frac{FA}{LC} - 1)$$

$$U_{Trio} = 2 * FA - 3 * LC + 2 * (\frac{LC}{FA} - 1)$$

The second game with calculated payoffs is displayed in Figure 3.

The game representing the second period of negotiations has just one Nash Equilibrium, (LA, LC), both parties have a dominant strategy to play either LA or LC. However, this outcome would be disastrous for both parties as it would lead to a Greek exit from the euro and likely a spread of destruction to Portugal, Italy and other vulnerable countries within the eurozone. Similar to the first period, the natural inclination of each party is to act selfishly, which would

Creditor Trio

		HC	MC	LC
	HA	(3, -3)	(-0.5, 0.67)	(-1, 1.67)
Greece	MA	(6, -4)	(2, -2)	(0, 0)
	LA	(9, -3)	(4.5, -2)	**(1, -1)**

Figure 3: The game matrix for the second period of bargaining between Greece and the Creditor Trio, corresponding to the second bailout given to Greece in March of 2012. The Nash Equilibrium is underlined and the expected outcome is in bold.

lead to an unfavourable outcome for both. In this game, unlike the first, the parties are not able to do better by moving away from the Nash Equilibrium, as there is no Pareto improvement to be made and so they outcome expected by the model is the Nash Equilibrium of (LA, LC). Fortunately for all involved, this is not the outcome which resulted and Greece was able to secure a sizeable bailout by making large adjustments. The second bailout was large by any standard, €130 billion issued to Greece, larger than the first bailout Greece received, €110 billion, and larger than any of the bailouts to other eurozone countries - €85 billion to Ireland, €78 billion to Portugal, €110 billion to Spain - and all of it on top of a 53.5% haircut to the face value of privately owned Greek debt. The austerity measures Greece agreed to in order to secure that bailout were large as well. The adjustments included the reduction of deputy mayors and staff worth US $40 million, a reduction in overtime pay to hospital doctors by US $66 million, decreasing military spending by US $396 million, reducing pharmaceutical spending by at least US $1.3 billion, as well as a permanent European team in Athens to monitor the changes made, as reported by Castle (2012). The large changes made by both sides would imply an outcome of (HA, HC), indicating the model was unable to correctly interpret the game played in this period.

The most recent bailout is currently in the process of being finalized but the negotiations have been going on for quite some time, beginning as negotiations to unlock the last tranche of the second bailout and then turning into discussion of a third bailout after Greece missed a payment to the IMF in June. Missing that payment and being unable to make payments to other eurozone countries at the end of July meant Grexit was inevitable without financial aid but there was a significant change in view regarding a Grexit this time around. Most of Greece's debt was held by other European government and so the threat to the euro from contagion was vastly reduced

from years earlier. This put the Creditor Trio in a very good bargaining position, with little to lose, and Greece in a rather unfavourable position. The country was already struggling, with 1 in 4 people jobless, according to Statistical Office of the European Communities (2015), and no job for 1 in 2 of those under 25, reported by Statistical Office of the European Communities (2014). While at the beginning of the year there had been some indication of a return to growth, after 5 years of recession, this was undone by the uncertainty coming from the ongoing negotiations. All of these factors indicated that Greece could not afford to face the world without the euro and the support of the eurozone. Consequently, I used $x = 5$, the highest value, to describe their need for funds. The cost of making fiscal adjustments also remained very high. The governing party, Syriza, was elected on an anti-austerity platform, the Greek people voted against more austerity measures in the July referendum and tempers flared within the government. Even with all that, the majority of the country adamantly wanted to remain in the eurozone, which is why I use the same weight as in the second period, $y = 4$, rather than $y = 5$. No one in Greece wanted austerity measures but most were more afraid of Grexit so, when passing the new measures, Alexis Tsipras had the support of most members of parliament and gained more support in the opposition parties than even his own. The fear of losing the euro currency in Greece meant maintaining relations with the Creditor Trio was more important than ever, the likely reason that the hot-headed finance minister, Yanis Varoufakis, was replaced after the July referendum. In light of this, I increased the last weight to $z = 5$.

After the near disaster of Grexit in 2012, the eurozone governments and institutions made changes to avoid the situation in the future. The ECB started a monetary stimulus program and bought bonds from struggling economies in the eurozone so that yields would not be affected by the uncertainty in Greece. As a result, the risk of contagion in this period was far lower than it was three years earlier and the Creditor Trio was able to make far higher demands without worry of the consequences. Additionally, after months of heated negotiations there seemed to be significant bad blood between the Greek negotiators and those on the other side, possibly resulting in the desire for even more adjustments on Greece's part. Consequently, I raised the value of Greek fiscal adjustment to $p = 5$, the highest possible. As the creditors were in a comfortable position, I lowered the cost of them making concessions. While they would not likely be inclined to make concessions, it would not have a significant impact on them if they so chose to. I used $q = 2$ to demonstrate this. The frustration with Greece among the Creditor

Trio, and the feeling that they were overplaying their hand, also led to a decreased inclination to remain on good terms. Greek negotiators were not displaying any sort of amicable behaviour so the value of the creditors doing so dwindled and I used $r = 2$ in this period.

The utility equations reflecting the above weights are shown below.

$$U_{Greece} = 5 * LC - 4 * FA + 5 * (\frac{FA}{LC} - 1)$$

$$U_{Trio} = 5 * FA - 2 * LC + 2 * (\frac{LC}{FA} - 1)$$

The game matrix and payoffs for the most recent bailout discussions is shown below, in Figure 4.

Creditor Trio

		HC	MC	LC
	HA	(3, 9)	(0.5, 10.33)	**(3, 11.67)**
Greece	MA	(5.33, 5)	(2, 6)	(2, 7)
	LA	(7.67, 3)	(3.5, 3)	(1, 3)

Figure 4: The game matrix for the third and most recent period of bargaining between Greece and the Creditor Trio, resulting in the almost finalized third bailout of July 2015. The Nash Equilibria are underlined and the expected outcome is in bold.

In the third game, similar to the first, there are two Nash Equilibria, where one player makes a large adjustment or concession and the other makes a small adjustment or concession, or even none at all. In this game, however, compromise is not supported. Greece attempted to use their earlier strategy, of threatening economic mayhem in Europe by leaving the Eurozone, in order to force the Creditor Trio into the more favourable outcome of (LA, HC). However, this time around that threat was not credible since the Greek debt was owned mainly by other governments and the chance of contagion was slim. Instead of fearing the worst, the Creditor Trio was able to refuse any movement away from their weakly dominant strategy. Their commitment to playing "LC", regardless of any claims Greece makes about their proposed actions, should have been taken credibly by the Greek negotiators because the Creditor Trio would not do any better by altering course. However, the Greek negotiators instead seemed to believe they could force a

better outcome and steadfastly held to their strategy until the end, attempting to use insults, threats of resignation, and public referendums to sway the other side. Prime Minister Tsipras only seemed to recognize the emptiness in his contagion threat when disaster for Greece seemed almost imminent. At that point, he had no bargaining power and had to take any terms he could get to secure a third bailout. Tsipras and his new finance minister were able to secure €85 billion, considerably lower than either of the two previous bailouts but in order to do so had to agree to substantial adjustments. While obviously the Creditor Trio made some concessions, they were quite low compared with the earlier bailouts. Greece, on the other hand, conceded a great deal in terms of fiscal adjustments to unlock the much needed funds, including the deregulation of the natural gas market, selling off public assets and creating an asset fund, changes to current foreclosure laws, eurozone control over policymaking and committing to a budgetary surplus as soon as next year, among other measures described by Traynor and Henley (2015). These adjustments were in addition to those made to secure earlier, much larger, bailouts and therefore it seems as if the real world outcome is in fact the Nash Equilibrium (HA, LC).

While the model, from Aggarwal (1996), I've applied to the Greek debt crisis does not explain the entire situation it does give an idea of the strategies each side may have used. Obviously, the second bailout in 2012 turned out quite differently to what I would have predicted using this model, but the model does show some promise for explaining aspects of the first and third bailouts. An interesting result is the difference between these two periods of negotiation, in 2010 and 2015. Both games had the same equilibriums and were an example of players playing "chicken" with one another. However, the results were quite different because of steps taken by the Creditor Trio, and in particular the EC and ECB to remove any sort of bargaining weakness they had with Greece. It was their substantial amount of bargaining power that allowed them to force Greece into a position of further fiscal consolidation, in the face of low interest rates, high unemployment and little to no economic growth, the conditions where researchers are hard pressed to find any evidence of successful implementation of austerity. Greece, knowing the long term result of these policies would likely not be good, had no choice but accept them because of their lack of bargaining power and their earlier mishandling of negotiations.

6 Conclusion

The decisions made about how to handle sovereign debt are as complex as they are important and as such there is never one unanimously supported direction to take. Throughout this paper I have looked at a small sample of the many governments who have looked to austerity as the solution, and it would appear to have very limited success. In the situation Greece currently faces, austerity is quite unlikely to lower their debt to GDP ratio and promote growth in the economy. Instead, the country will potentially face even higher unemployment rates and lower quality of life for its citizens. Any decisions regarding monetary policy will come from the ECB in Frankfurt and it is fair to say policy is not decided on with Greece's best interests at the forefront. As is the nature of the union, policy is decided on to help the eurozone as a whole and with so many differences among countries, it is unlikely the ECB will ever act exactly how a central bank in Greece would. As a result, Greece has no power to lower interest rates or devalue their currency, even indirectly since they share a currency with their main trading partners. Without any sort of expansionary monetary policy to promote growth, it seems likely that these further austerity measures will only foster more discontent within Greece.

In light of the fact that high adjustments to fiscal policy will likely have negative effects on the country, it adds another level of desperation to the recent negotiations. While some economists believe that Greece would do better to leave the eurozone rather than cling to it, that path comes with considerable uncertainty. Undoubtedly returning to the drachma and seeing a massive devaluation in the currency against the euro would come with its own negative outcomes but the question is if they really would be better off in the long run. There is no way to know for sure and while the recent referendum in Greece shouted an adamant "oxi" to more austerity, there was still a resounding "nai" to remaining within the eurozone, as most people in Greece even with the lack of jobs and many without access to healthcare or housing, do not want to find out if life could be worse. This put the Greek government between a proverbial rock and a hard place, they were elected on a platform of anti-austerity but they, and their citizens, desperately wanted to remain within the eurozone. In earlier negotiations governments in Greece were able to leverage the desire its creditors had to keep Greece within the union but the Creditor Trio has since corrected many vulnerabilities to contagion of a Grexit so that the government in Greece was not able to exploit that weakness. It seems as if negotiators in Greece underestimated their

opponents and tried to cover up their losing hand with insults and belligerent negotiation tactics. From their position now it seems as if this method has failed and that the Creditor Trio has called their bluff and sought compensation for the pugnacious nature of the Greek negotiators. In hindsight, Greece may have been better off if the government had been upfront with their creditors and pleaded for an alternative way to rectify the problem, one the IMF likely would have supported. Unfortunately, history tends to repeat itself and Greece may well have another chance to do just that.

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