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Contested Sovereignty
The case of Greece

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Contested sovereignty: The case of Greece

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Abstract

This thesis examines the issue of political versus economic incentives to default, with regard to the present Greece debt crisis. It is hypothesized that when a country has strong political incentives to not default on its debt it will choose not to do so, despite such a course being advantageous according to economic rationale. To assess this issue, a sovereign default model is calibrated to match the economy of Greece. The model mimics the core movements of the data quite well, with exception of spreads and debt-to-output-ratio, and it predicts a default for Greece every 312.5 years. The sensitivity analysis illuminates a high sensitivity to the assumption of a highly patient borrower, resulting in low spreads and a low debt-to-output ratio.

Since the early thirties no Western European country has defaulted on its debt. It has been regarded as a rather remote phenomenon occurring in distant developing countries, or in socialist/post-socialist republics.[1] This track record has however been challenged in the aftermath of the financial crisis erupting in 2007, starting with socialisation of several banks in various countries. The most extreme example of a bank bailout had been in Iceland, which has been subject to speculations as to whether or not the country will default on at least parts of its debt. Iceland has been followed by a debt crisis in several EMU countries, most notably Greece, Spain and Portugal.

The economic crisis, and potential implications for EMU countries, has spilled over from being a purely economic matter to also encompass a political crisis. Despite several bailouts from the other member countries and the IMF, the Greek crisis still lingers on. The need for a Greek haircut and political reforms within the EU, in order to avoid a Greek default, seems to become even more urgent by the day.[2] One might thus ask whether or not Greece should already have defaulted on her debt, instead of continuing to service it and implement austerity packages rendering social unrest. There must certainly be some important incentives that make a default an implausible outcome. That constitutes the basis for this thesis, to test whether or not Greece indeed should have defaulted and, if so, what other credible motives it had for not doing so could be.

The nature of sovereign debt differs greatly from common commercial debt, as it is not enforceable. As pointed out by Obstfeldt and Rogoff (1996), a sovereign default is more related to a sovereign's *willingness* rather than *ability* to service its debts. There might be several situations where a government might be able, but not willing, for many reasons, to service their debts. Consistent with the theory that it is a question of will rather than ability, one could argue that harsh political implications associated with a default might deter such

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[1] Notable exceptions are state/municipal defaults which occur from time to time, as Oregon in 2000.
[2] See for instance de Grauwe (2010) or Bolton and Jeanne (2011) on the issue of financial without fiscal/political integration in EMU.

actions. Such logic might particularly apply to the case of Greece, as it is a minor country in the EU/EMU. Whilst one cannot be explicitly certain about the nature of political consequences, the mere existence of a worst-case scenario could work as a strong incentive to avoid default.[3] However, one must first lay the foundation as to whether it is in the economic interest of the government to default. For this purpose the model presented in Arellano (2008) is calibrated to match the Greek business cycle, and used to assess whether or not it would have been beneficial for Greece to default on its debt.

Assuming that the Greek sovereign places a high valuation of future consumption, the results indicate that the government exposed to these conditions would find it profitable to indeed default prior to Q12011 only in 10% of the cases. Under this assumption the model is adequately able to mimic the core movements of data, except for underestimating spreads and debt holdings. A sensitivity analysis reveals that the whether or not default would have been a more economically plausible route depends mostly on how future consumption is valued compared to present day consumption.

The thesis is structured as follows: at first the earlier research on sovereign default incentives and the founding hypothesis is outlined. Thereafter the sovereign debt model of Arellano (2008) is described accompanied by a non-technical summary at the end. In addition this section includes the European integration theory that constitutes the basic political rationale. Potential issues with underlying theory and model application are scrutinized in section III, entitled Methodology. Subsequently the data movement, the empirical results from the simulations and the sensitivity analysis is shown. The thesis ends with some concluding remarks.

I. Earlier research and hypothesis

A. Literature survey

Within the literature of sovereign debt explaining why countries continue to honour their debts, there are four major reasons:

- Reputation – Denied access to financial markets and reduced bilateral trade.
- Sanctions – The possibility of direct sanctions imposed on the countries.
- Expectations – Governments repay debt in order to build up a expectations
- "Supersanctions" – The country's sovereignty may be challenged through confiscation of overseas assets, loss of independent fiscal policy and as a last resort – "Gunboat diplomacy".

For obvious reasons the last option is hardly acceptable nowadays, hence the other explanations are regarded as more plausible. Notably the explanations for national debt repayments in much of recent literature overlap, as a reduction in trade might as well be attributable both to reduced access to financial institutions and other forms of trade sanctions imposed upon the target country.

The reputation model, initially developed by Eaton and Gersowitz (1981), states that the default of a sovereign will imply less future consumption due to costs associated with a tarnished reputation; hence countries will choose to service their debts. Likewise, if the costs associated with a default under weigh the gains, or the country only intends a big one-time

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[3] There exists today no legal possibility of exit from the EMU, albeit that might be regarded as the likely outcome of a Greece default. For a discussion of the legal aspects applying to this, see Athanassiou (2009).

borrowing, the country will instantly choose to default on its debt, as being a rational utility maximizing, the state it has little incentive to service the debt.

Eaton and Gersowitz (1981) assumed in their model that a country defaulting will forever be excluded from the bond markets. This assumption has been empirically shown to fail: Gelos et al (2004) finds that time of exclusion from the financial markets has steadily fallen since the 1980s. At first it took about four years to regain access to financial market, in the Eighties, falling to on average four months in Nineties. Thereby as the assumption fails to hold empirically, alternatives are developed to account for the set-backs. An extension is provided by Cole and Kehoe (1998), which argues that there exist spillover effects to other areas beyond the ability to acquire external debt financing. Therefore a sovereign perceived as risky in one instance is likely to be risky in others and thus faces costs in other areas as well. Alfaro and Kanczuk (2005) suggest that sovereigns will, in order to prevent a huge loss of reputation, endure times of hardship and delay a default until the recession is over. Thereby the sovereign is able, even in the future, to smooth consumption in a downturn by acquiring debt at lower interest rates than what otherwise would be possible. Their results however indicate that welfare gains from not defaulting at all are larger overall, but it reduces the chance to smoothen consumption.

From the viewpoint that there are other aspects of default than international credit market access, Rose (2005) stresses that a sovereign default bears strong costs of reduced bilateral trade for approximately the following fifteen years. Martinez and Sandleris (2008) elaborate on the same data, finding that a sovereign default also affects trade relations with other countries than the creditor. However, Zymek (2010) argues that declines in trade and trade cost associated with the default are actually are related to restricted access to financial markets, similar to the argument pressed by Bulow and Rogoff (1989) that a default de facto leads to poorer access to trade credits. Another aspect of declined trade flows linked with the occurrence of a default is presented by Borensztein and Panizza (2006). They find that a significant decline in the value-added growth of export oriented sectors is associated with a default.

There is a growing body of literature regarding the development of dynamic stochastic general equilibrium (DSGE) models; amongst these are Aguiar and Gopinath (2006), Arellano (2008) and Perez (2011). The authors develop their models based on the framework of Eaton and Gersowitz (1981) to calibrate the likelihood and effects of a sovereign default. Aguiar and Gopinath (2006) study in their article the difference between a temporary shock and a shock to permanent underlying growth trend, for the advent of sovereign defaults. Transitionary shocks are found to blow over quite easily and should rarely lead to a sovereign default, persistent shock on the other hand leas to a significant increase in defaults. The authors as well consider bailouts in the model, concluding that this does not affect the sovereign default rate to any greater extent. Arellano (2008) extends the idea by factoring trade balance, output, interest rate spreads and consumption into a dynamic stochastic general equilibrium (DSGE) model, using associated historical default costs to calculate historical default probabilities. The model was empirically validated by the case of Argentina's default in late 2001: Arellano demonstrated that the model could adequately predict the occurrence of the sovereign default.

Perez (2011) uses a similar framework of incomplete markets to calibrate when and how default is the optimal choice of the sovereign. The author considered several scenarios related to growth shocks and found that weak punishments make the sovereign borrow beneath the optimal level, indicating that if the consequences of default were tougher the sovereign would

likely achieve a higher level of utility. Regarding sovereign default and mechanisms/costs associated with it, there is a whole bunch of relatively recent studies in addition to those listed above. Among these studies are: Mendoza and Yue (2008) on endogenous costs; Cuadria and Horacia (2008) on political uncertainty; and Broner et al (2008) on secondary debt markets, to name a few.

In another line of research, Bulow and Rogoff (1989) find a paradox in the nature of the reputation model. If countries still can smooth consumption after default defaulting by saving at market interest rate, it will rise the probability of a default equal one. Therefore to prevent a country from defaulting on its debt there should be direct sanctions associated with a default, imposed on the borrower by the lender to deter such behaviour. Kletzer and Wright (2000) argue that even in the absence of real sanctions, the threat of exclusion can be credible and fearful threat for opportunistic sovereigns. Wright (2002) similarly argues that financial institutions could join together and exclude the "bad" sovereign. The author however acknowledge that the exclusion must be total, in order to be fully effective in deterring sovereign defaults.

A third approach, presented by Sandleris (2008), is that neither the sanctions nor the reputation arguments are credible, but that it is actually a game of politics, where the sovereign gives the impression of being one of the good guys, thus gaining better lending terms (or more FDI), both in terms of lesser interest rates and more available liquidity. The argument is that in the game lend-and-borrow, the government will continue to repay as long it will benefit in terms of borrowing conditions from the lender. For the purpose of the game, Sandleris (2008) applies a set of stringent assumptions under which the model is valid. Hence, it is difficult to test the model empirically, although the rationality of the framework remains.

Mitchener and Weidenmeir (2010) distinguishes between two methods of extracting debt from sovereign defaulters in nineteenth and early twentieth century: either the sovereign is obliged to surrender its fiscal sovereignty or become subject to "gunboat diplomacy", wherein a show of force by the lender implies military conflict may occur should terms agreeable to them not be settled. The implementation of the former solution would result in a state surrendering the ability to conduct fiscal policy on its own in order to prevent moral hazard behaviour in servicing the loan. Hence in this case the sovereign more or less ceased to be sovereign, instead became a puppet of its creditors, a situation which could last for years. The other way to enforce debt, "gunboat diplomacy", was implemented through seizing custom houses or the letting warships sail into debtor ports. Mitchener and Weidenmeir (2010) find that these super sanctions made sovereigns more willing to service their debt, suggesting such methods are indeed effective measures to reduce the probability of default among states.

B. Research questions

The purpose of thesis will be to elaborate on and answer two main question regarding sovereign debt and default, related to the Greek debt crisis:

- **A:** According to model prediction, would it be beneficial for Greece (or any other EMU-country) to default?
- **B:** Considering that A is true, what are the then the underlying incentives?

C. Hypothesis

One can hypothesize that countries will keep up debt payments beyond what is economically preferable from the country's point of view, considering there are strong political implications

that would become as a result from a default. While this can be regarded as highly reasonable, it is difficult to formalize into to a practically testable hypothesis as default motives are endogenous to the sovereign. A more proper hypothesis to be tested can thus be formulated as:

- It has not been economically preferable for Greece to default on their debt, as of Q12011.

II. Theoretical underpinnings

The underlying theoretical foundations of this thesis build on both European integration and economic theory. A political rationale for EU countries, associated with not defaulting on their debt, is formulated with a basis in European integration theory wherein due to the potential political implications for the country and the union as a whole a default is considered politically implausible. On the other hand, a government is accountable to its citizens, and a sovereign pushing beyond what is beneficial to its domestic economy will impose extra costs on its subjects, lowering their welfare. Refusal to default, despite it being potentially beneficial from the perspective of that nation's citizenry, could be deemed irrational in economic terms.

A. Economic theory

For the purpose of testing the hypothesis against an economic framework, I selected Arellano (2008). In the absence of present day model frameworks designed for mature economies, as the Greek, I decided to go with developed in the enviroment of emerging economies. However, as the bulk, indeed almost all, of sovereign default literature regards the cases of emerging economies this is where I start. The model environment of Arellano (2008) is set in the case of a small open economy, trading bonds with foreigners in financial markets for purpose of consumption smoothing. The set of contracts of bonds and interest rates available on the market, reflect the default probabilities of specific country in a risk-neutral fashion. The equilibrium interest rate the government faces depends on the perceived probability of default. The bonds have a non-contingent face value, hence risk neutral lenders will simply charge extra for the additional risk associated with bonds. Default happens at the equilibrium level as the asset structure is incomplete. Furthermore, the default is related to a temporary exclusion from the financial markets in addition to a negative output shock.

A1. The Model

Suppose that the government's aim is to maximize the utility of the households, which are by nature risk averse, and their preferences are given by the following expression:

$$E_o \sum_{t=0}^{\infty} B^t \, u(c_t) \tag{1}$$

Where $0 < B < 1$ is a discount factor used to discount the utility of future consumption, u is a strictly concave utility function and c corresponds to consumption at time t. The households in the economy receive a stochastic stream of the good y, and the consumption of households depend on that stream. The shock is assumed to follow a Markov process, with a transition density function of $f(y', y)$ drawn from the complete subset of $Y \subset \mathbb{R}_+$. In addition to the stream of y, the households also receive a lump sum of goods from the government.

In order to maximize the utility of the domestic consumers the government enters the international bond market, wherein following the framework of Eaton and Gersovitz (1982), a

one-period discount bond B' is available at the given price $q(B', y)$. The price corresponds to government probability of default, which depends on the size of B' and the size of the output shock, y. When purchasing (issuing) the bond with a negative face value, the governments enters into the agreement on providing $-q(B', y) B'$ goods in $t + 1$, while receiving B' number of goods at time t that is transferred to the households as a lump sum. In the next period of time the government then can choose to either honour its debt obligations and deliver $-q(B', y) B'$, or default on its debt and suffer from a temporary exclusion from the financial markets along with a penalized production level.

Considering the case when the government chose to uphold its debt obligations to its creditors, the resource constraint of the economy is given by:

$$c = y + B - q(B', y)B' \qquad (2)$$

The government, being benevolent, effectively makes use of the access to financial markets to smooth the consumption path and thereby dampen effects of shocks to domestic income. However, facing incomplete assets markets the set of bond contracts available to the government differs between different states of y. Therefore the uncertainty imposed by the stochastic structure of the income fluctuations cannot fully be insured against. The government might thus for some states find it beneficial rather to default than repay. In case the government chooses to default, the consumption equals the domestic production:

$$c = y^{def} \qquad (3)$$

In the default state the economy suffers not only from being excluded from the financial markets, but also from a lower output level. Hence, $y^{def} = h(y) \leq y$, for which $h(y)$ is an increasing function.

Foreign lenders can optionally borrow (lend) to the small open economy, or borrow (lend) at the global risk-free interest rate as much as they want to. The rate of the risk-free interest rate is constant at $r > 0$. The creditors can observe the economy in every state of time with perfect information, hence it is not possible for the government to "cheat" on its lenders and lenders pursue a risk-neutral pricing strategy. The price of the bonds available should thus equal the opportunity cost, e.g. risk-free rate $(1 + r)$ and a compensation for the extra risk. For as long as this assumption holds there will be lenders willing to supply the country with bonds, enabling the government to smooth consumption. The complete set of bonds available to the sovereign is determined by:

$$\phi = qB' - \frac{(1-\delta)}{1+r} B' \qquad (4)$$

The probability of default is denoted δ, bounded in the interval $0 \leq \delta \leq 1$, which is endogenously determined by the government in question. Foreign lenders are assumed to never default on their obligations, hence for $B' \geq 0$ the default risk is zero and equals the risk-free rate. Otherwise the bond price equals the risk-free rate plus the compensation for risk. This given, the bond price satisfy:

$$q = \frac{(1-\delta)}{1+r} \qquad (5)$$

Following an endogenously determined default rate in the interval between 0 and 1, the bond price q lies in the interval $[0, (1 + r)^{-1}]$. The gross interest rate can thus be defined as

the inverse of the discounted bond price, $1+r^c = 1/q$, where r^c is the interest rate paid by the country. The spread, e.g. the relative risk between the country bond and the risk-free rate, is defined as $r^c - r$.

The decision-making process within the model takes place as follows: at first the government starts out with initial asset level B; observe the shock y; then determines whether to default or repay its debt. If the government chooses to repay, it takes the bond price schedule $q(B', y)$ as given and performs the credit market operations. Thereafter the lenders observe the price q, and choose B' accordingly. Finally consumption c takes place in the model.

Non-technical summary: The nature of the model is set in a continuous state. The agent's actions in the models decision-making process depends ultimately not only present day consumption, but consumption into the indefinite future. The consumption depends on state of the economy: in an economic upturn consumption is higher and vice versa in a downturn. In addition the government can buy bonds from foreign lenders, to smooth consumption between up and downturns. The state of the economy tomorrow, and thus the choice of bonds, depends solely on the state of the economy today. If the government decides not to repay the bonds, the government will be temporary unable to borrow and will suffer from a lower domestic output.

A2. Recursive Equilibrium

The recursive equilibrium of the model is characterized the inability to forcefully commit the sovereign to debt obligations, along with sequential actions of government, international creditors and households. For each period of time the households consume the endowment y, in addition to any surplus from the governments credit market operations outlined above. Given that foreign lenders are risk-neutral, they are willing to supply the government with one-period zero coupon bond for any bond price which equal their opportunity cost. Hence, the bond price must satisfy the following expression:

$$q(B', y) = \frac{\left(1-\delta(B', y)\right)}{1+r} \tag{6}$$

The government observes the endowment shock and the initial level of B, then decides whether to default or to repay the debt. Notably, default is only an option when the government is in debt, i.e. $B < 0$. Considering that the government chooses to uphold its debt for the current period, it chooses a new level of assets B', acknowledging that the price of debt depends on the state of B' and y.

A benevolent government, maximizing utility for the citizen, will choose to default whenever it is regarded as more profitable for the citizens. The value function, given this option to default or repay can thus be expressed as:

$$v^0(B, y) = max_{\{c,d\}}\{(v^c(B, y), v^d(y)\} \tag{7}$$

Here v^c is the notation of value function in case of repayment and v^d denotes the value function in the case of a default. The maximization problem of the sovereign is thus in each period to choose the optimal level of B' and/or defaulting, chosen by on period-to-period basis. Let the value function of default be formalized as:

$$v^d(y) = u(y^{def}) + \beta \int [\theta v^0(0, y') + (1 - \theta) v^d(y')] f(y', y) dy' \qquad (8)$$

In each period subsequent to the default event there is a probability the sovereign will be allowed reentry into the financial markets, defined as $0 \leq \theta \leq 1$. Likewise, for all periods of default, the country suffers from a lower output, y^{def}. The value of defaulting thus depends on the possibility of regaining access to the credit channel, thereby ending the situation of financial autarky and the experience of penalized output. If we next consider the value function of repaying debt, it can be expressed as:

$$v^c(y, B) = max_{(B')}\{u(y - q(B', y)B' + B) + \beta \int v^0(B', y') f(y', y) dy'\} \qquad (9)$$

When the government stays in credit relations, it chooses the welfare optimizing policy function B' given available contracts and income state. The decision on whether to default or uphold its debt obligations is made on a period-by-period basis, whereas the government for a certain set states always will choose to repay/default on its debt. Furthermore the government face a lower bound on debt, $B' \geq -Z$, in order to prevent Ponzi[4] schemes. This bound is introduced as an "invocation of common sense", as the debtor should be reasonably able to repay its debt (Ljungqvist and Sargent, 2000). Otherwise it would possibly be in the borrower's interest, in cases where a default is certain, to simply take on a huge loan today and default by tomorrow.

The policy of the sovereign can be summarized as for some set whereas default is the optimal choice, others whereas repayment is the optimal choice. The sets for which it is optimal for the sovereign to repay its debt can be defined as:

$$A(B) = \{y \in Y : v^c(B, y) \geq v^d(y)\} \qquad (10)$$

For which $A(B)$ corresponds to a set of y and B, where repayment is the optimal choice. Periods where default is the optimal choice for certain level of B, $\tilde{A}(B) = D(B)$, are defined as:

$$D(B) = \{y \in Y : v^c(B, y) < v^d(y)\} \qquad (11)$$

The optimal policies of all actors in the model are defined, thus one can now proceed with a more formal definition of the recursive equilibrium for the aggregated states of the economy $s = \{y, B\}$. The recursive equilibrium is defined as a set of policy functions for: i) the households consumption c(s); ii) government choice of assets $B'(s)$, sets for which repayments A(B) and defaults D(B) are optimal; and iii) price schedule for bonds $q(B', y)$, such that:

1. Given government chosen policy function $B'(s)$, the aggregate consumption $c(s)$ satisfy the resource constraint defined above.

2. Given the bond price function $q(B', y)$, the sovereign's policy functions $B'(s)$ repayments sets $A(B)$ and default sets $D(B)$, satisfy the governments optimization problem.

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[4] A Ponzi scheme is a fraudulent investment option which pays returns to investors by subsequent investors' money, rather than the profit of the organisation/investment. In this case it would be characterised by a sovereign that consistently increase debt between periods, paying the rate by the new loans.

3. The given bond price schedule $q(B', y)$ corresponds to the default probability of the borrower and assures that the lenders break even.

For further proofs and characteristics of model features omitted here, the reader is advised to see Arellano (2008).

Non-technical summary: The foreign creditors are able to observe economy in every state, therefore the price of the government bond equals the risk that the government defaults in addition to the risk-free income. The government chooses whether to default or repay based on the expected value of the respective choices, which depends on the state of the economy and the bond holdings in that period. Therefore it will be optimal for the government to default in some economic states with certain bond positions, whilst it will be sub-optimal otherwise.

B. European integration theory

I derive the political logic for understanding the behaviour of sovereigns in this case, from Moravscik (1998) and Weiler (1999), these being main the theories of European integration. The political perspective is used a baseline view of the nature of EU integration logic, which is assumed to exercise a profound influence on the actions of sovereigns within the union. Hence, the nature of sovereigns outlined here constitutes the underlying argument of why a default would be unlikely due to political circumstances.

B1. A supranationalist approach to European integration

Weiler's main focus point to date is the evolution of legal organisms within the community, notably the interplay between law and politics. In the early evolutionary stage of the community's development the European Court of Justice (ECJ) could play an active and important role in advancing European integration in the face of a lack of political progress. When the will of European governments waned and active political integration stalled in 1960s, there was another actor that could instead advance the European project on a legal basis. The integration by law was made possible by presence of a loose legal framework that the court an implicit mandate to fill.

This must typically be regarded as an outcome of the specific historical circumstances: there was room for internal supranational entrepreneurs to proceed in the process of integration, even without the explicit political will of the member states involved. One might argue however that following Single European Act there has continuously been a strong political will for further European integration. Consequently there has been little room or need for the court to pioneer integration through legal cases. Despite the fact that the court has not played such an integral part of European integration recently, the logic of how interplay between supranational actors and members act remain.

The central concepts of Weiler (1999) are related to the interplay between exit and voice in the evolution of the European integration project. A closure of the member states exit, or rather selective exit, has spurred development for increased voice within the community. Exit here, following Hirschman's terminology, indicates the ability to escape obligations to the community, the ability of non-compliance with agreements and laws of the community. Let voice be defined as the member states power to act and have influence over the decision-making process, thus shaping the development of the community. Weiler (1999) mainly leaves out the third part of Hirschman's theory, loyalty, from this analysis, though he suggests

that this might become a prominent feature in the future European community. In time we will see that countries develop a feeling of loyalty to the community, for instance when the community expands and smaller nations would find it tougher to promote their views on their own

I would argue that the present debt crisis of the EU and the associated debt negotiations have furthered elucidated the argument of Weiler (1999), albeit one can state that Greece (among others) have earlier chosen a "selected exit" by not fulfilling the Maastricht criteria (60% government debt/max 3% budget deficit), by "cheating" the community. However, following the discovery that Greece had consistently misreported its statistics, the crisis severely worsened and permanently closed the door for selective exits.

What remains is thus the total exit, which is implausible for many reasons endogenous to the Greek government and not directly observable. Considering that we have not seen a total exit, this option from the Greek point of view has to be regarded as implausible. What is left to build legitimacy in Greece for increased integration within the EU/EMU is thus either enhanced voice or loyalty to the community. While some countries as Germany and France have demanded increased voice, ability to effectively punish the "bad guys", this is hardly an option for Greece. Rather if Greece is to sustain the legitimacy of further integration it has to rely on loyalty to the community. This outlines the core of my argument for the nature of the member state: despite the fact that Greece would view a selective exit in the form of a default as tempting, the country will choose not to due to loyalty to the community.

B2. A liberal intergovernmentalist approach to European integration

Moravscik (1998) promotes a liberalist intergovernmentalist approach, where the member states and the supranational actors play the main part. Member states are strong, competent and have perfect information, making them able to make rational decisions, effectively maximizing their utility. European integration takes place solely for the purpose of increasing the welfare of the involved states, and these will spur integration to exclusively fit their own preferences. Accordingly the integration process takes place through three major steps. At first the formation of national preferences takes place, when member states form their plans of action and preferences for increased integration. Here the countries will decide how and to what extent European integration should be developed. Subsequently there is the negotiation process, where the major players participate in interstate bargaining. In this process it is a matter of asymmetrical interdependence, based on how important the issue is regarded vis-à-vis the national preferences of each member state. The bargaining power is determined in the negotiation game by the threat of sub-optimal outcomes, such as exclusion from the deal, or having to resort to unilateral policy alternatives (e.g. a unilateral withdrawal from the EU/EMU for Greece). Subsequently the member states appoint supranational institutions in order to prohibit free-riding, ensuring that the commitments are credible.

Let us then, in the light of the theoretical background, consider the European debt crisis. National preferences are formed with basis in the domestic political economic situation. This should result in a core preference for continuous prosperous existence of the Eurozone at minimal costs to the domestic political and economic situation. Earlier this could be achieved, at relatively little cost, by the fact that the supranational actors set to supervise the budgetary rules under article 126 (TFEU) did not function effectively. However, as this is no longer an option there is increased need for revision of the treaty and hence a new bargaining game takes place. In a similar fashion to Greece the major players of the EMU (France and Germany) have shaped their national preferences, but are in quite a different bargaining

position than Greece, France and Germany being the core of the EMU with largest economies whilst Greece is remote little country accounting only for a small part of the total EMU economy.

Conclusively one might argue that there could an EMU without Greece, but that Greece cannot remain within the EMU without the approval of the big players. Therefore when situated in the negotiation process Greece is to a large extent highly asymmetrically dependent on the other players. Consequently the sovereign must learn to play along the lines of others, under threat of being excluded from the community. One could thus make the argument that the country is not in the position to make decisions in this matter independent from EU concerns, making a default politically implausible.

III. Methodology

From a methodological viewpoint, there are some important issues related both to the underlying economic and political assumptions that are crucial for maintaining the validity of the model used and the implicative hypothesis presented above. In the methodological section these aspects are discussed and evaluated in order to ensure that the analysis and tools utilized are suitable.

A. Economic aspects

The main economic issue is to define the model in such a way that it adequately fits the data, thereby verify the suitability of the use of the specified model framework. The initial model framework stems from the paper of Eaton and Gersovitz (1981), hence the model is bound to inherit some of the counterfactual flaws of their original model. Amongst these is the assumption that governments are presumed to hold bonds only for a short-term consumption smoothing, which has the affect a government will not accumulate debt (wealth) over time. In turn this affects the underlying incentive structure for sovereigns to default, affecting the price of government debt and thus spreads.

This illustrates the issue of limiting the model to short-term bonds, excluding the long-term bonds. One the other hand though, short-term bonds might be more suitable for this purpose. Inclusion of long-term bonds will bear other implications, which should require a change in the underlying theoretical framework to remain valid as there are other drivers for bond holdings present. A related fact is that short-term bonds are the only way of insuring against endowment shocks and loans are only used for this purpose within the model, which is unreasonable. In reality bonds might be issued for other purposes, such as capital accumulation, particularly in the case of emerging markets or other matters not directly relating to consumption smoothing (Sturznegger and Zettlemayer, 2006). To what extent this really affects the validity of the model is difficult to tell, but one should keep in mind that these are aspect that might influence model adversities versus the real data.

In the original model Eaton and Gersovitz (1981) also assumed that a country will be permanently excluded from borrowing from foreign creditors following a default. This assumption can easily be relaxed by instead assuming a temporary period of exclusion, which has been found to be empirically valid (Gelos et al, 2004). A related theoretical proposition is the *Bulow and Rogoff paradox*: if a country still can save at the world interest rate after being excluded it is always optimal to default on the debt and invest abroad (Bulow and Rogoff, 1989), thus leading up to the sanction argument described before in the literature review. Whilst this is solved within the model by a total exclusion from both borrowing and saving, it

still poses a challenge to the underlying core assumptions of the model. A solution to this within the framework is to assume a direct output shock, wherein under times of financial autarky the country suffers from a penalized output. Arellano (2008) rationalizes this model ingredient by arguing that a government default spills over to the private sector, leading to contraction for private debt as well and the inability to obtain credit funding leads to a lower output. Sturzenegger (2002) finds further empirical evidence of these negative effects of defaults on domestic output. Following this argument, this instance produces similar results to direct sanctions. For a benevolent sovereign aiming to maximize the utility of households, anything that makes defaults more costly also discourages the government from going down that road.

Another counterfactual aspect with the framework is that all debt is held by foreigners, no debt is issued among the citizens of the country. If the sovereign chooses to default there are no domestic debtors hurt, making it simply a "foreign affair". The exact implications of this on model properties are however difficult to estimate, although a government with huge domestic creditors should be less inclined to default the debt. However, considering the case of emerging markets, or in this case Greece, the bulk of debt is held by foreign creditors and this might not be too much of an issue for validating the model. A comparable concern would be that in real life defaults are rarely ever total defaults. The vast majority are rather partial defaults, or simply defaults on the interest rate payments for a limited period of time (Obstfeldt and Rogoff, 1996). In this framework there is no recovery rate after a default: the debt is reset to zero when the government once again obtains access to the financial markets.

Certainly this is a counterfactual oddity with the model, but can it motivated by the use of short time bonds? When a government accumulates only a scarce amount of bonds that are due in the next period, one might suggest that the incentive for restructuring process due to small losses is limited. In contrast to this Yue (2010) finds that within a Nash bargaining game, creditors tend to demand higher recovery rates for small amount of debt compared to high debt. When comparing the model of endogenous debt renegotiation with the one without, the latter renders much fewer equilibrium defaults and lower spreads. Thereby one can hypothesise that defaults play an integral part in asset markets for emerging economies, where defaults are not rare (Arellano, 2008). However this logic does not necessarily apply to developed countries, which commonly do not default (Reinhart and Rogoff, 2009). In such case the problem might not be that severe for using this framework on a country as Greece.

B. Political aspects

From the political aspects there are issues bounded with the use of a residual explanation, rather than an explanation that can statistically validated. Alternatively one could of course have incorporated political factors into the model instead, to account for this explanation within the framework. Among studies using a similar set up with political aspects, the results do not differ much from those dealing with economic aspects alone (Hatchondo et al, 2009, Andreasen et al, 2011). It is rather difficult to in an effective manner model and adequately quantifies political costs or perspectives in a fruitful way that can be validated vis-à-vis the real world data. Hatchondo and Martinez (2010) provides an overview of the bulk of studies into this area, both regarding empirical as well as theoretical studies. The authors conclude that most studies find that it is mostly a question of ability to penalize the defaulter directly by lenders holding enforceable political power. A notable exception is Guembel and Sussman (2009), which constructs a model under which the government chooses to upholds it debt under a set of rather strong assumptions, without any fear of retribution. On overall we are

back to the original economic explanation by Bulow and Rogoff (1989), the sanctions argument outlined above is a necessity.

The main issue associated with the use of residual explanation in this way is that it can only be at best a plausible hypothetical explanation. How can one rule out that the course of action the sovereign chooses is not motived by an alternative political motive, omitted from the analysis due to an overemphasis on European integration? There are certainly many other plausible theoretical understandings of government action which could have been applied to this problem. One can however argue that given the EU-specific nature of the situation, the environmental settings in which governments must act and the importance of the outcome to the European project, this is a highly relevant angle. A theoretical understanding for this situation, on the action of member states in the integration project, should be regarded as a valuable tool for examining the political nature of the problem studied. Most notably these theories are bounded with various underlying issues, making them less than perfect for understanding European integration. For instance, the extreme knowledge Moravscik (1998) attributes to governments in this affairs, making them perfectly able to foretell the future of integration, is sure to be a subject of doubt. Comparatively Weiler (1999) underemphasises the member states' roles and individual interests, in favour of supranational influences that force governments into a reactive rather than proactive relationship with the integration process. However, as the purpose of the thesis is not to determine which theoretical understanding of EU/EMU development is the "best", but rather to put the issue of a Greek sovereign default in the context of the European project. One can thus argue that any eventual flaws inherited from the residual explanations suggested are not deal breakers when evaluating the arguments outlined before.

Another political aspect of sovereign defaults is the domestic pressure. Borenzstein and Panizza (2008) apply a panel data setting to a number of historical defaults, testing for a number of factors that are hypothesised to be related to sovereign defaults. Most importantly the authors find that a default is usually accompanied by a sharp decline in public support. Often there is also a change of ruling cabinet by the time of next election. One could thus state that it should exist a strong internal pressure for the governments not to default on their debt, if they wish to stay in power. The authors do not however clarify whether the change in government is actually due to an economic crisis preceding the default event or, if it related to the specific sovereign default. One could possibly hypothesise that in case of an economic crisis, as in Greece, there is huge internal pressure to default rather than implement harsh austerity packages to service the debt. Any changes in government would then rather be related with an ongoing crisis and inability to effectively solve the crisis, rather than explicitly a default.

In the classical Eaton and Gersovitz (1981) set up, governments are more or less autocracies, always able to pay their debt if they want by raising taxes − an assumption challenged by Andreasen et al (2011) for being a totally unrealistic. The authors develop a framework for a setting where the government must obtain acceptance from a majority of households, in order to repay the default. In their model the government must first propose a tax programme to be accepted or rejected by voters, and thereafter decide whether or not to default. Authors calibrate their model to match the most recent Argentina default event, and then the authors compare their results to those of Arellano (2008). The findings implicate little if any improvement in the fit of the data. This elucidates the issue of de facto quantifying political costs within a sovereign default model, all asides from this being potentially relevant explanations of deviations from the classic rationale of a sovereign default.

If one considers external pressure to repay debts, aside from the practical possibilities of exclusion/sanctions there are really no de jure rights to enforce repayment, due to the international fundament of "sovereign immunity" (Obstfeldt and Rogoff, 1996). Accordingly a sovereign cannot be sued in a foreign court for defaulting, in the way a company can. This has been the ruling doctrine in international law since the 19th century, albeit as Panizza et al (2009) argues this has started to loosen in the last decades. Since the 1950s the inclusion of the word sovereignty and the sanctity of it has started to fall apart, yet there remain no international de jure possibilities to enforce sovereign debt. This does however not indicate the lack of de facto political methods of pressure. Shown by Mitchener and Weidenmeir (2010), and outlined above, gunboat diplomacy could effectively make 19th century sovereigns pay up to the imperial powers of Europe and the US. The sovereignty of these countries was indeed challenged, and not regarded as entitled to immunity of the imperial states. Whilst such manners are no longer politically plausible, one might argue that the sovereignty can today still be regarded as challenged under a political and economic union. Following my argument on the nature of EU member states outlined in section B2, states being inter-dependent and intertwined by international agreements with other states in union could be regarded as not fully sovereign. Not by the means of threat from foreign gunboats, but due to potential political consequence that could follow a default. This might be typically important in cases when the sovereign already has to a large extent surrendered political power, albeit not direct control over fiscal policy, to foreign entities e.g. the EU. It becomes a question not only of power sharing within the union, but also of solidarity between EU states. One might thus question whether or not an EU state is to be regarded as sovereign in these affairs to the letter.

IV. Empirical analysis

In this section I calibrate the model to match the properties of Greek economy, along with solving for the optimal decision rules. The parameters and decision rules are used to run simulations of the economy, to evaluate the model vis-à-vis the real data. Additionally, to further evaluate the parameter choices, a sensitivity analysis with the model parameters shifted is also performed and outlined below.

A. Data

The financial crisis in Europe has shed light on underlying issues relating to the financial stability of several member states. Of these the most notable case would be Greece, with a debt level far above 100 % of GDP as of 2012, a rampaging budget deficit and subject to two bailout packages from fellow EU countries and the IMF. The crisis has struck hard on already pressured Greek economy, which had experienced a slowdown in growth since the onset of the crisis in 2007. The business cycle statistics of Greece are display below in table I:

Table I Business cycle statistics Greece

	Std	Corr(x,y)	Corr (x,sr)
Output(y)	5.99		-0.65
Consumption	3.84	0.80	-0.47
Trade balance	0.46	-0.23	0.43
Spreads(sr)	5.64	-0.65	

Source: Based on authors calculation of OECD/IFS data

The data on the Greek economy in Table 1 are quarterly seasonally adjusted series expressed in real terms. Data over consumption, trade balance, debt service-to-GDP and output was taken from the Organization of Economic Development (OECD). Consumption and output were logged and de-trended using a linear filter. The series starts in 1980 and stretches until 2011, the latest data available at present time. The series on trade balance, which also start in 1980, was divided by output and is expressed in terms of per cent. In order to obtain spreads for the Greek economy, data on interest rates was taken from the International Financial Statistics (IFS) and the series of Government Bond Yield starts in 1992. For the purpose of risk-free interest, data on the 3-year US bonds was used over the same time span. The spreads were calculated in the fashion described above, where risk-free rate was subtracted from the gross interest rate of Greece.

If one then proceeds to examine the Greek business cycle, it shares several characteristics with that of Argentina. For instance, an interesting stylised fact is that Greece shares the tendency for countercyclical interest rates, whilst these are usually acyclical in developed countries (Neumeyer and Perry, 2005). Aguiar and Gopinath (2007) conclude that among developing countries all the common characteristics of the business cycle on the economy are amplified compared to the case of developed countries. The authors find that the volatility of output for the years 1980-2003 for emerging markets was almost twice that of industrialized countries. These earlier findings are in line with what one expects, if comparing to Argentina as described in Arellano (2008). One main difference is that whilst consumption tends to more volatile than output in emerging economies, in Greece the situation is the opposite. One possible explanation to this could be the better access to the international as well a domestic credit market, where the ability to smooth consumption is better (Aguiar and Gopinath, 2007).

B. Calibration

The model is solved numerically using discrete state space technique, in order to obtain a finite set of possible choices of the sovereign to find the optimal solutions via value function iteration (see Judd (1998) for a throughout description of method). This is the most commonly used method to solve sovereign default models, albeit a few studies as Hatchondo et al (2012) use interpolation methods instead. For the purpose the costs of defaulting on the output, the specification adopted in Arellano 2008 and most later default studies is used, for which the output cost is asymmetric:

$$h(y) = \{\hat{y} \ if \ y > \hat{y}, y \ if \ y \leq \hat{y}\} \tag{12}$$

$\hat{y}$ corresponds to a lower penalised output experienced in case of financial autarky. This specification of default costs makes the bond price less sensitive to state of y, compared to other studies such as Aguiar and Gopinath (2006) or Yue and Mendoza (2009). The cost entailed to defaulting is therefore higher in the case of an economic upturn than in an economic downturn. This specification extends the range of risky loans that might be attractive to the borrower, thus improving the fit of the model to mimic the real-world situation (Arellano 2008).

In line with other sovereign default studies, the standard constant relative risk aversion (CRRA) utility function was used for the simulations:

$$u(c) = \frac{c^{1-\sigma}}{1-\sigma}$$

The risk aversion was set to 2, as is standard within the literature. The lenders discount factor, the risk-free interest rate r, was set to match average of the US 3-years bond over the period of time. For modeling of the GDP development, it is assumed to follow a stochastic log normal AR(1) process, of the functional form:

$$\ln(y_t) = \rho \ln(y_{t-1}) + e_t^y$$

The process has the following properties: ρ is the autocorrelation coefficient, whilst e_t is i.d.d. shocks with an expected zero-mean, $E[e^t]$ and expected variance, $E[e^2] = \eta_y^2$. These stochastic properties are estimated and discretized into a 21-state Markov chain using *Tauchen's method* (Tauchen and Hussey, 1991).

The borrowers discount factor, β, determines the borrower's preference, or patience, for future consumption today. Reducing this parameter make the borrower's value of future consumption lower, relative to present day consumption, thus increasing the relative value of default today. During the present economic crisis, the Greek government has displayed a strong reluctance to default on their debt, which could be regarded as a high patience for future consumption. However, as stated above the argument of the thesis is that this can be explained by political factors prevailing over economic. One cannot therefor use the Greek unwillingness for a default in the recent episode as proxy for setting the time discount factor.

Instead one could follow the method of Arellano (2008) to set the parameter to match number of defaults by Greece in the last century. In order for a method as such to be valid however, one would have to assume that country is in essence the same then and now. Greece has arguably gone through a major transition in both political and economic reality during the post-war period, making this a difficult method to proxy valuation of future consumption. In addition during the period of dictatorship, Greece remained in default between 1932-64 (Reinhart and Rogoff, 2009). What we can observe though is that Greece has since becoming a democracy in 1974, refrained from defaulting despite all increasing levels of debt. This is however much in line with the tendency of developed countries overall, as many developed have held high levels of debt without defaulting (Cecchetti et al, 2010). Thus suggesting that the valuation of future consumption and borrowing possibilities are rather high in these countries, as well are the possibilities. In line with this a high β should be chosen to reflect this characteristic properly. For this purpose β was set to 0.975, which can be compared to

0.953 in Arellano (2008), 0.9 in Aguiar and Gopinath (2006) or 0.88 in Mendoza and Yue (2008), as quite high.

The probability of reentry following a default, θ, is calibrated to match the standard deviation of the current account following the lines of Arellano (2008). The calibrated parameter takes the value of 0.248, which corresponds to an exclusion period of approximately one year. This is a shorter period of exclusion from the financial markets than the parameter in other studies including Aguiar and Gopinath (2006) and Chatterjee and Eyigungor (2009), but longer than in Arellano (2008). The fit of the probability-of-reentry parameter is difficult to evaluate vis-à-vis real time data, as developed countries usually do not default (Sturznegger and Zettelmeyer, 2006). Therefore all data available is for cases of emerging economies, for which business cycles and spreads usually differ from those of developed countries.

The cost of default on output, $\hat{y}$, is following Arellano (2008) calibrated to match the average debt service-to-GDP. The average debt-service costs for Greece during this period was 6.41 % of GDP, thus $\hat{y}$ was calibrated to 0.962. The other variables, along with the calibrated parameters are displayed in full below in table II:

Table II Parameters

	Values	Background
Risk-free rate	r = 1.55 %	US – 3 year interest rate
Risk aversion	$\sigma = 2$	According to literature
Stochastic structure of data	$\rho = 0.95\ \eta = 0.011$	Greece GDP
Borrowers discount factor	$\beta = 0.975$	A patient borrower
Calibrated parameters	Values	Target statistics
Re-entry probability	$\theta = 0.248$	Trade balance volatility of 0.46 %
Output cost in default	$\hat{y} = 0.9642$	Debt service cost of 6.41 %

C. Simulations

The quantitative predictions of the baseline model are displayed below in table III, vis-à-vis the characteristics of the data. In order to make the model comparable to the data, a sample window of 125 periods prior to a default event was chosen to mimic the development of the Greek economy from 1980 to 1Q2011. In order to do this the model was simulated over 1 000 000 quarters, from here a couple of hundred default episodes containing 125 prior quarters were selected.[5] There after the average of these default periods were calculated and the results are shown below in table III:

Table III Baseline model simulations for Greece

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[5] Notably increasing the number of default episodes included or simulated quarters provides no improve of the predictive abilities of model on the data.

	Default episode	Std	Corr(x,y)	Corr (x,sr)
Output (y)	-9.78	4.06		-0.532
Consumption	- 9.85	4.07	0.993	-0.5613
Trade balance	- 0.30	0.47	-0.1513	0. 3287
Spreads (sr)	1.44	2.53	-0.532	

Other statistics

Mean debt/output:	2.93	Default rate:	0.32
Mean spread:	1.78		

The results indicate that we have a fair match vis-à-vis the Greek data, displayed in table 1. The model tends to undershoot the volatility of the Greek GDP throughout the period, whilst it pretty accurately fits the volatility of consumption and the trade balance. However, the model terribly underestimates spreads, which is a well-known issue related to the use of one-period bonds instead of long-term bonds within the sovereign default literature (Chatterjee and Eyigungor 2011). One can argue though that the purpose of short term bonds sharply differ from the use of latter term bonds, whereas the latter aren't use for short time consumption smoothing. Arellano (2008) suggests that adjusting the pricing kernel for risk-averse lenders, renders more volatile spreads. However, this tends to reduce the overall fit of the model on the data, with the exception of spreads.

In the model calibrated here a plausible explanation is that low spreads are related to the high β value. When borrowers put high value on future consumption relative to present day consumption they will tend to adjust their borrowing accordingly. Consequently the sovereign does not push its borrowing limit to the extent where defaulting on the loans becomes tempting, hence we observe a very low mean debt/output ratio. The effects of choosing a lower value of the beta are examined more below in the sensitivity analysis section. Considering the correlation between the variables, the model catches the core movements fairly. The trade balance and spread are both countercyclical, mimicking the feature of the real business cycle statistics. One anomaly is the close but unitary correlation between consumption and output. This is typically explained by the issue of low bond holdings: when little resources are borrowed from abroad, all domestic consumption stems from domestic output.

The default rate is on a yearly basis, indicating we will see a default within the model by every 78th year. This can be compared to a predicted default every 125 quarter, or 31.25 years. One could thus state, assuming the model is correctly specified, that it would be economically preferable for Greece, if exposed these conditions, to default in about 40 % of

cases. Notably, the default rate is to a large extent driven by choice of the time preference parameter β, but also affected by the other parameters in the model and the state space. It is a problematic fact that no later data than the first quarter of 2011 is available, as the situation has worsened since then. The longer and more severe a downturn becomes, the greater the value of default compared to the value of not defaulting.

D. Sensitivity analysis

In order to further evaluate the model fit, in this section the lower different values of the parameters are tested for and shown below in table IV. Following the line of argument above, the choice of β is of main importance for the model's performance. In the sensitivity analysis I tested the model with different choices of time preference for the borrower, holding all other values, variables and grid points fixed:

Table IV Sensitivity analysis

$\beta = 0.965$	Default episode	Std	Corr(x,y)	Corr (x,sr)
Output(y)	-10.25	4.03		-0.3231
Consumption	-7.83	5.93	0.9770	-0.3396
Trade balance	-3.79	1.62	-0.702	0.3765
Spreads(sr)	18.64	3.92	-0.2975	

Other statistics

Mean debt/output:	6.91	Default rate:	1.91	
Mean spread:	2.21			

$\beta = 0.945$	Default episode	Std	Corr(x,y)	Corr (x,sr)
Output (y)	-8.98	3.96		-0.3055
Consumption	-5.95	5.80	0.9265	-0.4104
Trade balance	-4.52	2.46	-0.5706	0.4803
Spreads(sr)	22.49	7.18	-0.3055	

Other statistics

Mean debt/output:	9.28	Default rate:	3.92	
Mean spread:	4.53			

The results are striking, just a small change in the β leads to a drastic increase in the default rate in the model. Lowering the value from 0.975 to 0.965 tends to make defaults about 6 times more likely to occur with this parameter value, hence the spreads are higher, particularly prior to a default episode. If we continue and set beta value to 0.945, the value of default doubles the default rate.[6] Lowering the β even more leads an even higher default frequency until it reach a breaking point around 6-7 % per year, the results are however not displayed here in particular as providing no further insights. Likewise, we now observe high interest rate spikes in periods prior to default, which is in line with original model and reasonable. The mean debt also increases a lot compared to the previous low rate of 2.5 % of GDP. One can further observe that the government's will to make use of borrowing, tends to make the consumption less dependent domestic production. This leads to a more volatile trade balance and consumption, compared to the baseline model. Arguably, as the government becomes more impatient of future consumption, it is also becomes further inclined to actively alter the path of domestic consumption in the present period. Thereby the rates of defaults also increase drastically. In order instances, apart from spreads and correlation between consumption/output, there is a worsening if any change compared to the baseline model. The sensitivity analysis though illustrates the fact that the choice of time preference in the model is of crucial effect to make use of this model under the framework of this thesis.

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V. Concluding remarks

The present economic crisis has shaken the very foundations of the European integration project, illuminating an apparent divergence of interest between the member states and the community as a whole. The recent crisis episode has challenged national sovereignty and control over fiscal policies in the light of high stakes for the union, despite it being explicitly stipulated in the Maastricht treaty that no country within the EMU is responsible for the debt obligations of another. In similar fashion the specific fiscal policies of individual member states are national, not community competences. The aggravated situation has resulted in

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[6] A default rate of 1.92 and 3.92 corresponds to a default every 25 and 52 years respectively. Hence in order to obtain a default frequency of at least 1 default per 125 quarters, a β of roughly 0.95 or lower has to be assumed.

several rescue packages to EMU countries, in exchange for harsh austerity programmes by member states. In the case of Greece, default has even become a potential outcome as a solution to the rampaging debt.

In this thesis, the framework of Arellano (2008) is applied to economy of Greece, in order to evaluate whether or not it would have been viewed as economically preferable to default on their debt rather than keep servicing it. A hypothesis was formulated that if there are considerable political costs associated with a default, a country will deter from defaulting far beyond what is rational in strictly economic terms. The political aspect of defaulting was motivated by the foundations of European integration theory, on asymmetric interdependency (Morascvik, 1998) or loyalty to the community (Weiler, 1999). The model parameters where set to match the same empirical movements as in the original study, over the period 1980 to Q12011, the latest data available. An exception was the time preference parameter β, which was to characterize a very patient lender with a high value of future consumption. The baseline model was to a large extent able to mimic the core characteristics of the Greek business cycle, predicting a default in about 10 % of the cases, therefore suggesting that, under the assumption that Greece is to be considered a patient borrower, it has yet not been economically viable to default. To give further substance to this argument a sensitivity analysis was carried out, testing for slightly lower values of β. Evidently if one assumes just a little less patient borrowers, the value of default rises and thus the default frequency. On the other hand the performance of model weakens for all factors other than spreads.

In conclusion, one cannot – operating under the assumptions outlined in this thesis – find that it would have been according to economic rationale for Greece to default on their debt prior to Q12011. It is thus not possible to reject the hypothesis stated above, that it has not yet been in the interest for Greece to default. Whether or not there exists a conflict of interest between the political and economic perspectives one is simply not able to tell from the baseline results of this study. It is however important to note that this conclusion relies on the assumption of the borrower's high valuation on future consumption. When letting the borrower become more impatient, it immediately increases the default rate, making it economically beneficial for Greece to default on her loans.

One certain setback is the lack of available data: if later information for the latest period also could have been taken into account it could have produced another result. From these conclusions it is difficult to provide further substance to the theory of European integration, likewise to make policy implications. What we can acknowledge though is that for Greece's actions to be in line with an economic rationale, it is necessary that the government has a high preference for further consumption, otherwise their actions would be irrational. Yet again, whether or not this is a typical characteristic of developed countries in general or is particular to Greece is difficult to determine.

From a modelling perspective the spreads (and debt level) are far below real-life experience, so one should be cautious in regard to what implications that can be drawn from the results of the model. Later studies assessing this topic should ideally include data covering latter parts of a prolonged recession as well, as defaults tend to occur in the end of recessions (Sturznegger and Zettlemeyer, 2006). In addition refined models, similar to the one of Andreasen (2011), could effectively improve the understanding of the domestic (and international) political aspects related to a sovereign default. Hopefully this could lead to a set of research projects, revitalizing European integration studies from the view of political economic concerns, something this thesis initially set out to be a part of.

References

Andreasen, E., Sandleris, G., and Van Der Ghote, A., 2011, The Political Economy of Sovereign Defaults, Business School Working Papers 2011-07, Universidad Torcuato Di Tella.

Alfaro, L., and Kanczuk, F., 2005. Sovereign debt as a contingent claim: a quantitative approach, *Journal of International Economics*, vol. 65(2), 297-314

Athanassiou, P., 2009, Withdrawal and expulsion from the EU and EMU, some reflections. Legal working paper series, No 10 / december 2009

Aguiar, M., and Gopinath, G., 2006, Defaultable Debt, Interest Rates and the Current Account, *Journal of International Economics* 69(1): 64–83.

Aguiar, M., and Gopinath, G., 2007, Emerging Market Business Cycles: The Cycle Is the Trend, *Journal of Political Economy*, University of Chicago Press, vol. 115, 69-102

Arellano, C. 2008. Default Risk and Income Fluctuations in Emerging Economies, *American Economic Review*, 98:3, 690–712

Bolton, P., and Jeanne, O., 2011, Sovereign Default Risk and Bank Fragility in Financially Integrated Economies, *IMF Economic Review* 59, 162–194

Borensztein, E., and Panizza, U., 2006, Do sovereign defaults hurt exporters?, Inter-American Development Bank Working Paper 553

Broner, F., Alberto, M., and Jaume, V, 2010, Sovereign risk and secondary markets, *American Economic Review* 100(4): 1523–55.

Bulow, J., and Rogoff, K., 1989, Sovereign Debt: Is to Forgive to Forget?, *American Economic Review* 79, 43–50.

Cecchetti, S., Moharty, M.S., and Zampolli, F., 2010, The Future of Public Debt: Prospects and Implications, Paper presented to Bank of India's International Research Conference, February 12.

Chatterjee, S., and Eyigungor, B., 2011, Maturity, indebtedness, and default risk, Working Papers 11-33, Federal Reserve Bank of Philadelphia.

Cole, H.L. and Kehoe, P.J., 1998, Models of sovereign debt: partial versus general reputations. *International Economic Review* 39, 55–70.

Cuadra, G. and Horacio S., 2008, .Sovereign Default, Interest Rates and Political Uncertainty in Emerging markets, *Journal of International Economics* 76, Issue 1, 78-88

De Gauwe, P., 2010, How to embed the Eurozone in a political union, in Baldwin, R., Gros, D., and Laeven, L., ed.: *Completing the Eurozone Rescue: What More Needs to Be Done?* (Centre for Economic Policy Research).

Eaton, J. and Gersovitz, M. 1981, Debt with Potential Repudiation: Theoretical and Empirical Analysis, *Review of Economic Studies* 48, 289-309.

Gelos, G. R., Sahay, R., and Sandleris, G., 2004, Sovereign Borrowing by Developing Countries: What Determines Market Access?, IMF Working Papers 04/221, International Monetary Fund.

Guembel, A., and Sussman, O., 2009. Sovereign Debt without Default Penalties, *Review of Economic Studies*, vol. 76(4), pages 1297-1320, October.

Hatchondo, J. C., Martinez, L., Saprizia, H., 2009, Heterogeneous Borrowers in Quantitative Models of Sovereign Default, *International Economic Review,* Volume 50, Issue 4, 1129-1151

Hatchondo, J. C., and Martinez, L., 2010. The politics of sovereign defaults, *Economic Quarterly*, Federal Reserve Bank of Richmond, issue 3Q, 291-317.

Hatchondo, J.C., Martinez, L., and Roch, F., 2012, Fiscal Rules and the Sovereign Default Premium, March 2012, Working Papers No. 12-01, Federal Reserve Bank of Richmond.

Judd, Kenneth. L., 1998, *Numerical Methods in Economics*, MIT Press Books, The MIT Press

Kletzer, Kenneth M., and Wright. Brian. D., 2000. Sovereign Debt as Intertemporal Barter. *American Economic Review* 90(3): 621–639.

Ljungqvist, L., and Sargent, T., 2000, *Recursive macroeconomic theory*, MIT Press

Mitchener, K. J., and Weidenmier, M D.,2010, Supersanctions and Sovereign Debt Repayment, 29 *Journal of International Money and Finance* 19-36

Mendoza, E. G. and Yue, V. Z. (2008), "A solution to the default risk-business cycle disconnect", NBER Working Paper No. 13861

Martinez, J. V., and Sandleris, G., 2011, Is It Punishment? *Journal of International Money and Finance*, Elsevier, vol. 30(6), pages 909-930, October.

Moravscik, A, 1998, *The choice of Europe: Social Purpose and State Power from Messina to Maastricht*. Routledge, 1998

Neumeyer, Pablo. A., and Fabrizio, P., 2005. Business cycles in emerging economies: the role of interest rates, *Journal of Monetary Economics*, vol. 52(2), pages 345-380, March.

Obstfeld, M., and Rogoff, K. 1996, *Foundations of International Macroeconomics*, MIT Press

Panizza, U., Sturzenegger, F., and Zettelmeyer J., 2009,The Economics and Law of Sovereign Debt and Default, *Journal of Economic Literature*., 47:3, 651–698

Perez, Leonardo. P., 2011, Optimal costs of sovereign default, Working Papers Series 236, Central Bank of Brazil, Research Department.

Reinhart, C.M., and Rogoff, K., 2009, *This Time Is Different: Eight Centuries of Financial Folly*, Princeton University Press.

Rose, Andrew K. 2005, One Reason Countries Pay Their Debts: Renegotiation And International Trade, *Journal of Development Economics* 77(1, Jun), 189-206.

Sandleris, G., 2008, Sovereign defaults: Information, investment and credit, *Journal of International Economics*, vol. 76(2), pages 267-275

Sturzenegger, F., and Zettelmeyer, J, 2006, Defaults in the 90s, Manuscript, Universidad Torcuato Di Tella.

Tauchen, G., and Hussey, R., 1991, Quadrature-Based Methods for Obtaining Approximate Solutions to Nonlinear Asset Pricing Models, *Econometrica*, Econometric Society, vol. 59(2), 371-96,

Weiler, J,. *The Constitution of Europe: Do the New Clothes Have an Emperor? and Other Essays on European Integration*, 1999

Yue, Vivian Z., 2010, Sovereign default and debt renegotiation, *Journal of International Economics*, vol. 80(2), 176-187.

Zymek, R. 2010. Sovereign Default, International Lending and Trade, unpublished.

Appendix

Computational algorithm used to solve the model:

1. Start out with a guess with the parameters to calibrated, θ and $\hat{\gamma}$, along with bounds of the discrete state space for assets consisting of 200 equally space grid points.

2. Start out with a guess of the bond price schedule, so that $q(B', y) = 1/(1 + r)$ for B' and y.

3. Taking the bond price schedule as given, solve for the optimal policy rules for assets holding $B'(B', y)$, consumption $c\ (B', y)$, repayment sets $A(B)$ and default sets $D(B)$ by value function iteration in each period. Iterate until convergence for the given bond price.

4. Update the bond price schedule $q^1(B', y)$ with the default and repayment sets so that the lenders break even. Compare the new price to the old $q^0(B', y)$, iterate until convergence. If the convergence criterion is not met, go back to step 3 and update using a Gauss-siedel algorithm.

5. Compute business cycle statistics for a couple of hundred default events, if it matches the data stop, otherwise adjust parameters and grid points, and return to step 2 for another try.