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PIGS or Lambs revisited: Reassessing the Role of Rating Agencies in the European Sovereign Debt Crisis

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Abstract: This paper examines whether credit rating agencies have indeed played as active a role in the Euro crisis as previously asserted. Using panel data methods for a set of 11 EMU countries, it assesses the robustness of an earlier analysis to the inclusion of additional explanatory variables. Whereas rating agencies were previously shown to have placed a significant markup on GIPS countries during the Euro crisis, this paper finds that its size was overstated as a result of omitted variable bias, although it remains significant. A cross-agency comparison shows that the Big Three rating agencies used this markup to a differential extent, however. A subsequent analysis of the markup's effect on yield spreads finds only inconclusive evidence to refute the argument that rating agencies played an active role in the crisis. Central to the analysis is the inclusion of institutional variables from the World Governance Indicators. A novel functional form of the indicator *Rule of Law* is shown to perform well in explaining sovereign ratings, but not in the subsequent analysis of yield spreads.

Keywords: Rating agencies, Sovereign ratings, Eurozone, Euro crisis, Debt crisis

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1 Introduction

Rating agencies came under intensive scrutiny in the outburst of the 2007/08 global financial crisis. Stemming from a number of, in hindsight, apparent and considerable shortcomings particularly with regard to structured products, harsh criticism emerged in the public domain on both sides of the Atlantic. The ongoing sovereign debt crisis in Europe saw this debate reopened, challenging the role and responsibility of rating agencies in the global financial system. Particularly in the EU, the *Big Three* rating agencies – Standard & Poor's, Moody's and Fitch – had come under considerable pressure for what was perceived as overly harsh and unjustified sovereign ratings. In the eyes of many, sharp downgrades of debt issued by peripheral Eurozone countries were putting excess pressure on interest rates, thereby raising borrowing costs and thus worsening the crisis.

A recent publication by Gärtner, Griesbach, and Jung (2011, hereafter GGJ) finds evidence that lends validation to such critiques. Applying panel data methods to a set of 26 OECD countries, the authors set out to explain sovereign ratings during the crisis by a set of six macroeconomic variables. A significant markup is found, suggesting that the so called GIPS group of countries – consisting of Greece, Portugal, Ireland and Spain – were rated 2.3 notches lower than justifiable by the "previously observed procedures of rating agencies" (p. 289). A subsequent decomposition of credit ratings into an explained and an arbitrary part was used to test each component's effect on interest rate spreads of government bonds. The significant results, combined with evidence of bidirectional causality from Granger-Causality tests, suggest that the agencies did indeed play an active role in the crisis. In combination, the results indicate that self-fulfilling prophecies are a distinct possibility, in which arbitrary downgrades push countries into a downward spiral of interest rate increases and further downgrades. This, the authors argue, could potentially "drive even relatively healthy countries towards default" (p. 288).

While GGJ's method is sound with regard to early work done by Cantor and Packer (1996), who proposed roughly the same set of explanatory variables, it does not accommodate for recent advancements in the field. A more recent study by Biglaiser and Staats (2012) has found conclusive evidence that political and institutional factors may well play a role in the determination of sovereign ratings. These findings are in line with the rating methodologies published by the Big Three, which uniformly state the importance of such factors in their risk assessment. Consequently, I reestimate GGJ's models with an additional set of theoretically founded explanatory variables, to assess whether their results are robust in size and significance. Of particular interest are two institutional variables, *Government Effectiveness* and *Rule of Law*, taken from the Worldwide Governance Indicators (WGI) dataset.

In order to accurately reflect the rating agencies' self-stated treatment of institutional factors, I suggest a previously unconsidered functional form for the indicator Rule of Law. While the latter performs reasonably well in a study of rating determinants, its results are unexpected when reassessing the effect of yield spreads. A specification with Government Effectiveness, on the other hand, performed well in both estimations. Overall, the results suggest that institutional factors are relevant in the rating process and thus constitute a possible channel through which reforms can be used to improve a country's perceived creditworthiness. An agency level investigation, which was not conducted before by GGJ, shows that there are significant differences between the Big Three, both in terms of weights of determinants as in the size and significance of markups on the GIPS.

While this study builds on tools and methods proposed by Cantor and Packer (1996), its aim for completeness rather than parsimony is conceptually closer to the work of Fuchs and Gehring (2013). The usage of WGI data is furthermore a direct application of the works by Biglaiser and Staats (2012). Thematically, it is most closely related to Mora (2006), who criticizes Ferri, Liu, and Stiglitz's (1999) finding of an active role of CRAs in the 1997 Asian financial crisis. Ironically, the latter study is what GGJ find themselves most closely related to.

The paper is structured as follows. Section 2 describes credit rating agencies and their sovereign ratings in more detail, with view on their effects on financial markets and financial stability, particularly in the light of Europe's sovereign debt crisis. Subsequently, Section 3 explains how sovereign credit ratings have been explained in the literature so far and discusses the extended approach of GGJ to the Euro crisis. The empirical framework and underlying data is then outlined in detail in section 4. Following this, sections 5 and 6 present the results with regard to the robustness of the rating markup and its effect on yield spreads, respectively. Section 7 concludes and presents some channels for further research.

2 Rating agencies and their sovereign ratings

Credit rating agencies (CRAs) provide a measure of default risk, an outside opinion about the ability and willingness of borrowers to service their financial obligations. This assessment comes in the form of a rank-ordered index of default risks, typically presented as letter grades, which informs outsiders about the relative risk associated with a given security. In doing so, credit ratings reduce information asymmetries between borrowers and lenders, who may lack relevant information or resources in order to assess the credibility of borrowers themselves (White, 2010). In essence, this entails the provision of two services on the part of CRAs: On the one hand, the independent assessment of a borrower's ability to meet debt obligations provides *information services*, which have the potential to "reduce information costs, increase the pool of potential borrowers, and promote liquid markets" (De Haan & Amtenbrink, 2011, p. 1). The regular reassessment of ratings, on the other hand, entails *monitoring services*, as borrowers are induced to take "corrective actions [in order to] avert downgrades" (ibid).

The history of credit ratings can be traced back to the early nineteenth century, when mercantile rating agencies began rating merchants' ability to service their debt (for a detailed history of rating agencies, see e.g. Cantor & Packer, 1994). Ratings of securities, however, did not come into existence until the early twentieth century, when John Moody published his first manual of railroad bond ratings in 1909 (White, 2010). Another three notable firms were established until the 1930s, which would shape the playing field of credit ratings markedly: Poor's Publishing Company was founded in 1916, Standard Statistics Company in 1922 and Fitch Publishing Company in 1924. Since then, the rating business has evolved into a multi-billion dollar industry.

While there are today more than 150 CRAs scattered across the globe (White, 2010), just three of them retain about 95 percent of the market. These so called *Big Three* evolved through a number of mergers and acquisitions involving the aforementioned four CRAs. Moody's Investor Services and Standard & Poor's (S&P) currently retain a market share of 40 percent each (De Haan & Amtenbrink, 2011). Fitch Ratings, which emerged in its current form through mergers in the late 1990s, has another 15 percent.

Unlike the majority of rating agencies, which tend to be relatively small and specialized in narrow market segments, typically in national or regional corporate bond markets (Fuchs & Gehring, 2013), the Big Three by and large cover all types of financial securities. These commonly include bonds and equities but more recently also mortgage securities and derivatives. Issuers range from national and regional governments over banks to corporations. The ratings of sovereign debt, although relatively unimportant to the agencies themselves in terms of financial income (Becker, 2011), form a superior category to private ratings. As Borensztein, Cowan, and Valenzuela (2007) show, they effectively place a ceiling on private ratings, above which the latter tend not to rise.

The expansion of credit rating agencies into sovereign bond markets has mirrored the growth in bond sales (Biglaiser & Staats, 2012). According to Bhatia (2002), S&P and Moody's each rated only two and three sovereigns in 1975, respectively. Similarly, few countries issued bonds at the time. Based on an article in The Economist (2009), only 13 sovereigns, all developed countries, issued bonds in 1983. By 2008, this number had risen to 108. The number of credit ratings issued increased accordingly. By mid 2002, S&P rated 93 sovereigns, Moody's 109 and Fitch 77. Despite the tremendous growth in sovereign bond markets, only a handful of agencies has set foot in the market to a notable extent. Fuchs and Gehring (2013) identify a set of nine rating agencies that rate bonds of at least 25 sovereigns[1]. With few exceptions, economists, investors and regulators focus on the ratings assigned by the Big Three, however. Thus unsurprisingly, criticism in the wake of the European sovereign debt crisis was directed primarily at them.

2.1 Rating scales and the rating process

Historically, rating agencies have been rather secretive about the rating process and only recently improved their rating manuals to communicate their methods in more detail (Nielsen, Gkionakis, & Vernazza, 2014). According to their manuals, as well as judging from personal communication with an S&P analyst, all rating agencies use similar protocols in determining which rating to assign to a given country. The process typically involves the assessment of several categories, the so called *factors*. S&P for example examines scores to five factors – political, economic, external, fiscal and monetary – whereas Moody's looks at four factors: economic strength, institutional strength, fiscal strength and susceptibility to event risk. Each factor receives a score based on the consideration of numerous individual constituents. The final scores are then presented to a rating committee, usually consisting of a handful of senior analysts, who vote on the final rating to be assigned to the sovereign.

The information for each factor is partially based on quantitative data sources that have meanwhile been disclosed to some extent, and of whom many are publicly available (Afonso, Furceri, & Gomes, 2012). A key component to ratings that is inaccessible to the public are interviews with representatives and analysts of each sovereign, which are kept secret for competitive reasons. These, as well as the weights applied to different factors, which are likewise undisclosed, constitute the prime differences between the agencies. Their business model rests crucially on keeping these factors secret, since they are "for-profit companies largely motivated by the premiums they charge investors for [these] information" (Biglaiser & Staats, 2012, p. 518).

[1]Capital Intelligence (CI), Dagong Global, Dominion Bond Rating Services (DBRS), Feri EuroRating Services, Fitch Ratings, Japan Credit Rating Agency (JCR), Moody's Investors Service, Rating and Investment Information (R&I), and Standard & Poor's

As apparent from table 2.1, the three agencies frequently come to the same conclusion when assessing sovereign default risk. Yet, there are some notable differences between them. Alsakka and ap Gwilym (2010, p. 2625) e.g. find that "a high frequency of disagreement exists" among the Big Three, where S&P tends to assign the lowest and Moody's the highest ratings. Moody's ratings were also shown to be the most stable, whereas S&P ratings were adjusted most frequently. With regards to leads and lags, "Moody's and Fitch tend to follow S&P [downgrades] to a greater extent" than the other way around, but Moody's appears to be the first mover on upgrades.

	Fitch	**S&P**	**Moody's**
Fitch	1.000		
S&P	0.977	1.000	
Moody's	0.968	0.962	1.000

Table 2.1 **Pairwise correlation of sovereign ratings for EMU members**
Datasource: Bloomberg Terminal

The rating scales used by the Big Three differ only marginally, as evident from table 2.2. All three use alphanumerical scales ranging from triple-A to D or C, which they augment with plus and minus signs or numbers to further distinguish the relative risks associated with each letter grade. Since each rating symbol has its counterpart in the other agencies' notation, it is possible to compare the rating scales directly to one another (Cantor & Packer, 1996).

Investment grade				**Speculative Grade**			
Definition	**S&P**	**Fitch**	**Moody's**	**Definition**	**S&P**	**Fitch**	**Moody's**
Highest Quality	AAA	AAA	Aaa	Likely to fulfill obligations, ongoing uncertainty	BB+	BB+	Ba1
					BB	BB	Ba2
					BB-	BB-	Ba3
	AA+	AA+	Aa1		B+	B+	B1
High Quality	AA	AA	Aa2	High Credit Risk	B	B	B2
	AA-	AA-	Aa3		B-	B-	B3
	A+	A+	A1		CCC+	CCC+	Caa1
Strong Payment Capacity	A	A	A2	Very High Credit Risk	CCC	CCC	Caa2
	A-	A-	A3		CCC-	CCC-	Caa3
				Near default with possibility of recovery	CC	CC	Ca
						C	
	BBB+	BBB+	Baa1		SD	DDD	C
Adequate Payment Capacity	BBB	BBB	Baa2	Default	D	DD	C
	BBB-	BBB-	Baa3			D	

Table 2.2 **Sovereign rating scales and definitions**
Based on Afonso, Furceri, and Gomes (2012)

As mentioned before, the letter grades represent a rank-ordered risk assessment. Credit ratings are thus an ordinal measure of default, rather than a cardinal one. The rating of a given entity reflects

its credit risk relative to higher and lower rated entities, rather than its absolute probability of default (Cantor & Packer, 1994). The primary goal of rating agencies is therefore not to keep default rates for each respective rating category constant over time, but to maintain stability in the relative differences between them (De Haan & Amtenbrink, 2011). Studies focusing on the evolution of default rates per rating categories, such as Ammer and Packer (2000), are thus not entirely consistent with the objective of the agencies. In spite of that, an evaluation of default rates for sovereigns is hardly possible, as only a few such events have occurred in recent history.

2.2 Private versus public ratings

Sovereign credit ratings differ from private ratings in more respects than the relatively low frequency of default. As Mellios and Paget-Blanc (2006) note, much unlike private bond markets, the sovereign bond market "is characterized by the absence of a bankruptcy code" (p. 361). Whereas for private entities, borrowers' assets are seizable in case of default, lenders have no access to a sovereign's domestic assets if it should decide to default on its debt. Incentives for governments to service financial obligations instead stem primarily from the risk of being cut off from financial markets as a source of external financing, a loss of reputation or the threat of sanctions. A sovereign's creditworthiness thus depends as much on its *ability* to pay as it does on its *willingness* to do so (see e.g. Clark & Zenaidi, 1999).

Another important difference is found in the nature of sovereign bond markets. Unlike private securities, sovereign bonds are traded in illiquid secondary markets that tend to be reliably priced as they are understood well by investors (Becker, 2011). Moreover, unlike in the case of private ratings, most information comprised in sovereign ratings is available through public sources. Afonso, Gomes, and Rother (2007), for example, show how sovereign credit ratings can be constructed using publicly available data. Investors may thus find it worthwhile to conduct their own research, particularly for large countries. As a consequence, one may conclude that sovereign ratings transmit little if any information to financial markets and hence do not affect bond prices much (Becker, 2011). Yet, rating-based financial regulation, particularly requirements for risk weighted assets (RWA), brings about the reverse.

2.3 Rating-based regulation and spillover effects

In the Basel capital framework (both Basel II and Basel III), "minimum capital requirements commensurate with the underlying credit risk" (Bank for International Settlement, 2013, p. 10) are prescribed based on two non-exclusive methodologies. While the *Internal Rating-Based* approach relies on banks' own risk assessment, the *Standardized Approach* relies on external credit ratings. Jurisdictions may adopt either or both of these approaches. Table 2.3 depicts the current risk weights per credit rating interval in the Standardized Approach. Positive risk weights are assigned to bonds lower than the highest quality, with risk weights increasing sharply below the speculative grade threshold of BBB-. It is thus conceivable that institutional investors reduce their holdings of securities of a particular government gradually as ratings deteriorate towards the BBB- threshold, or even engage in fire sales if sovereigns are abruptly downgraded by several notches (De Haan & Amtenbrink, 2011).

In the Eurozone, rules and procedures for capital standards are defined in the Eurosystem Credit Assessment Framework (ECSF). Among the credit assessment information taken into account, the Eurosystem also consults external credit assessment institutions, which are the Canadian rating agency

DBRS and the Big Three[2]. White (2010, p. 212) traces this, in his words, "outsourcing of regulatory judgement" back to a 1936 decree involving the Securities and Exchange Commission (SEC). By mandating investors to use the judgement of third-party raters, credit ratings issued by the Big Three (which were until 2003 the only recognized raters) had henceforth "essentially [...] attained the force of law" (p. 213). While this and subsequent regulation strengthened the position of the Big Three markedly, it also lead external credit ratings to become of "central importance in bond markets" (p. 214).

Credit ratings	AAA to AA-	A+ to A-	BBB+ to BBB-	BB+ to B-	Below B-	Unrated
Risk weight	0	20	50	100	150	100

Table 2.3 **Ratings and risk weights for sovereign debt under Basel II and III Source: Bank for International Settlement (2013)**

It is thus not surprising that sovereign ratings are shown to have significant spillover effects on various financial markets. The majority of studies of the effects of sovereign bond ratings on financial markets is based on Cantor and Packer's (1996) landmark study of rating determinants. As Cantor and Packer show, good sovereign ratings can improve a country's access to financial markets by reducing its cost of borrowing. Moreover, Kaminsky and Schmukler (2002) as well as Ferreira and Gama (2007) have shown that a country's sovereign rating has significant effect on returns in stock markets. Downgrades were furthermore shown to have significant effects on the dollar value rated country's currency (Brooks, Faff, Hillier, & Hillier, 2004) and are closely linked to CDS markets, particularly during times of crisis (Akdogu, 2012).

2.4 CRAs in the Euro crisis

Despite the importance given to CRAs through financial regulation, criticism by policy makers against the Big Three has been a common occurrence in recent times. This has particularly been the case in the wake of the European sovereign debt crisis. Fuchs and Gehring (2013, p. 2) identify some of the most prominent critics:

> "The Russian president, Vladmir Putin, and the German Finance Minister, Wolfgang Schäuble, both speak of ratings agencies' 'abuses' and 'abusive behavior'. The Turkish Premier Recep Tayyip [Erdoğan] accuses them of 'unfair' decisions and the EU Commission President José Manuel Barosso speaks of a 'bias [...] when it comes to the evaluation of the specific situation of Europe.'"

Indeed, looking at the frequency distribution of ratings depicted in figure 2.1, ratings in the Eurozone deteriorated fiercely in just five years following the Financial Crisis. Whereas in 2007, all rating agencies rated seven out of eleven countries with AAA and none below investment grade, only five, four and three retained AAA status in 2012 for Fitch, Moody's and S&P, respectively. Five countries had either already fallen below the BBB- threshold or were graded dangerously close to it.

[2]Taken from the information system of the ECB, available online under http://ecb.europa.eu/paym/coll/risk/ecaf, last accessed on Apr 29, 2013.

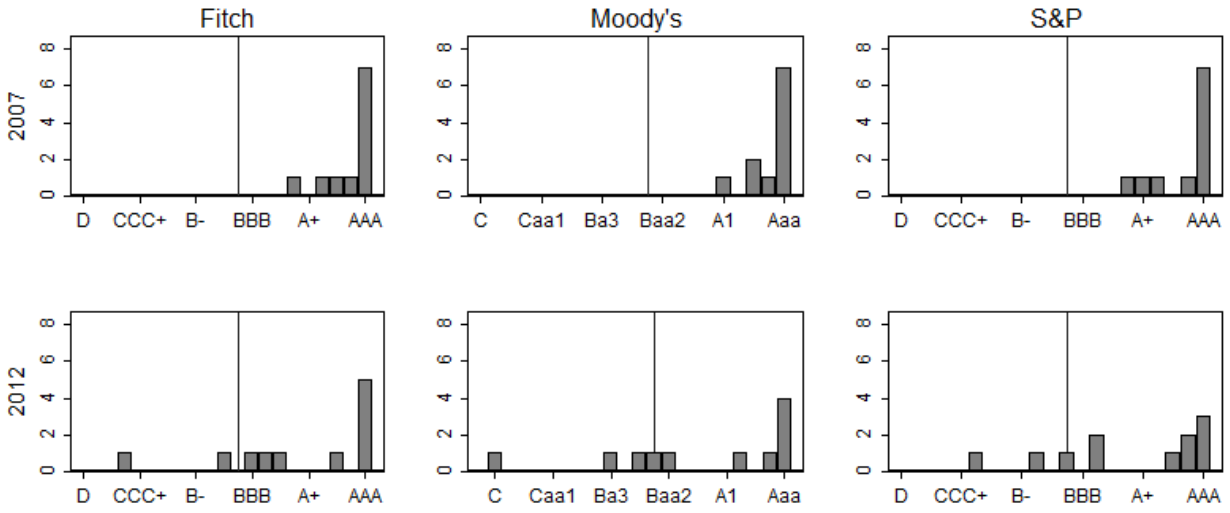

Figure 2.1 **Frequency distribution of sovereign ratings in 2007 and 2012**
Data source: Bloomberg Terminal, author's calculations

While ratings should be unaffected by fluctuations in the business cycle, it is not inconceivable that factors in the economic climate of peripheral Eurozone countries deteriorated so quickly that harsh adjustments were necessary. The mere fact that ratings decreased sharply does not lead to the conclusion that harsh downgrades were unjustified. In spite of that, the pattern which emerges in figure 2.1 is appalling nonetheless.

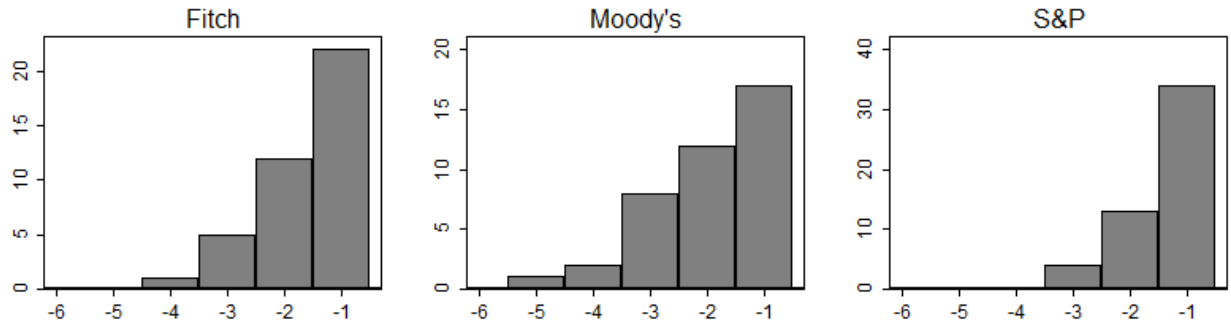

Figure 2.2 **Size and frequency of downgrades between 2007 and 2012**
Data source: Bloomberg Terminal, author's calculations

Trends were not identical across agencies, as can be seen in figure 2.2. Looking at the downgrade history of Moody's in more detail, I find that a total of 40 such events occurred during the period 2007 to 2014. In 11 of the instances, countries were downgraded by at least three notches, in 3 cases by at least four notches and in 1 case a country was downgraded by five notches at once. Greece, for example, was downgraded by three notches in 3 instances and once by four notches. While, e.g. its four-notch downgrade in June 2010 was preceded by a negative outlook change, the severity of the event caught

markets by surprise, with an ensuing surge in yield spreads (De Haan & Amtenbrink, 2011). The other two agencies show a similar but less extreme trend. Fitch also announced 40 downgrades during the same period, but only 6 downgrades exceeded two notches and only Greece was downgraded by four notches in July 2011. Standard & Poor's downgraded much more frequently than the other two agencies but by notably fewer notches per announcement. In total, S&P announced 51 downgrades since 2007 of which none exceeded three notches.

Like policy makers, scholars have paid close scrutiny to the recent developments in the Eurozone, albeit with varying degrees of criticism. Afonso et al. (2012) have found significant responses to changes in rating grades and outlook in yield spreads as well as CDS spreads. This effect was found to be particularly pronounced in the case of negative announcements and even more so after the onset of the Lehman crisis in 2008 and the subsequent debt crisis in Europe. Evidence was furthermore found for spillover effects in credit ratings from lower to higher rated countries inside the EMU, which confirms earlier results by Arezki, Candelon, and Sy (2011). Similarly to Afonso et al., Arezki et al. found that rating downgrades have significant spillover effects on CDS spreads of other countries, but also that in certain cases they can affect stock markets in other European countries.

While these findings highlight the strong implications for financial stability that sovereign ratings have carried in the Eurozone's debt crisis, they do not imply judgement errors on the part of CRAs *per se*. Although their effects were evidently harsh, rating downgrades may still have been justified by the crisis countries' unique economic and political situations.

3 Evidence of selective conservatism

An answer to the question of whether or not a particular sovereign rating was justified at any given point in time requires an understanding of how the rating was actually determined. Due to the secrecy inherent in the rating agencies' business model, the information actually contained in a credit rating is rather opaque, though. Information such as the factors used to determine ratings, the weight applied to each factor or the functional form of the rating scale are hence *a priori* unknown.

3.1 The determinants of sovereign ratings

In actu, studies of rating determinants seek to explain ratings r issued by a respective rating agency a for the debt of country i at time t as a function of some economic, political and institutional or fixed factors X, such that

$$r_{a,i,t} = f(X_{i,t}) \tag{3.1}$$

where both the factors contained in X as well as the functional form of $f(X_{i,t})$ are a priori unknown. The effect of each factor contained in X is then determined through a panel regression of the form

$$R_{a,i,t} = \alpha + \beta^I X_{i,t} + \epsilon_{a,i,t} \tag{3.2}$$

where R is a vector of sovereign credit ratings, X a vector of rating determinants with the corresponding beta coefficients contained in vector β.

The existing literature concerned with the study of sovereign rating determinants can be grouped

roughly into two groups, based on their distinction of what factors should be contained in X. While largely making use of aforementioned method, a number of contemporary authors have scrutinized the importance of determinants beyond the parsimonious set of factors that was previously considered. A distinction can hence be made between studies that use (1) a parsimonious set of explanatory variables, mostly reflecting macroeconomic conditions or (2) non-parsimonious approaches that stress the importance of a sound theoretical foundation. This study belongs to the latter group.

Research on the determinants of sovereign credit ratings has grown substantially since the reference paper by Cantor and Packer (1996) was published. This early work constitutes the first systematic analysis on the determinants of sovereign ratings. Using a parsimonious set of six explanatory variables – GDP per capita, GDP growth, inflation, external debt, level of economic development and default history – the authors find a high-fitting linear representation of S&P's and Moody's long-term foreign currency ratings. The exercise was repeated by several authors with varying adjustments to the underlying set of explanatory variables. While subsequent studies largely confirmed the results of Cantor and Packer, Juttner and McCarthy (2000) as well as Monfort and Mulder (2000) note that the results break down in the late 1990s, with the onset of financial crises across several emerging markets. Using the same methodology as Cantor and Packer (1996) with newer data, Afonso (2003) stresses the relative importance of GDP per capita, particularly with regard to developed countries, where it appears to be "virtually the sole relevant variable" (p. 72). External debt, on the other hand, was found to play a crucial role for developing countries only. In essence, what these studies have in common is that they focus on a parsimonious set of economic regressors, explaining sovereign ratings such that equation (3.1) becomes

$$r_{a,i,t} = f(e_{i,t}) \tag{3.3}$$

where $e_{i,t}$ is a vector of economic regressors such as macroeconomic conditions, trade openness, resource endowments or default history. While this results in a reasonably high fit in terms of the regression's r-squared, a second strand of literature emerged, stressing the importance of factors beyond macroeconomic conditions. The latter authors thus deviated from the parsimony inherent in aforementioned studies, by augmenting equation (3.3) with vector $p_{i,t}$ of political and institutional factors, such that

$$r_{a,i,t} = f(e_{i,t}, p_{i,t}) \tag{3.4}$$

The reference paper for a systematic inclusion of political and institutional factors as rating determinants is Biglaiser and Staats (2012). The article followed a long strand of literature in political economy, analyzing the effect of democratic institutions on government credibility in search of a so called "democratic advantage" in attracting foreign capital[3]. Little attention was paid to CRAs, however, whereby "the literature tend[ed] to ignore [their] central position [...] in financial markets" (Archer et al., 2007, p. 342). At the same time, the literature on CRAs and rating determinants had largely ignored the importance of political institutions.

The rationality for an inclusion of political and institutional factors follows from a thorough evaluation of the agency's rating manuals as well as an analysis of theories in political economy. The Big Three uniformly state in their rating manuals that political and institutional factors are taken into consid-

[3]For a review of the literature studying the "democratic advantage", see e.g. Archer, Biglaiser, and DeRouen Jr (2007, pp. 342 ff.)

eration when constructing bond ratings. Moody's (2008, p. 9) e.g. states in its rating manual that "the quality of a country's institutional framework and governance is a key consideration in the rating process". S&P includes a *political score* in its five factors, as mentioned before (Standard & Poor's, 2012), and Fitch Ratings (2002) states that it takes quality and stability of political institutions into account. However, Biglaiser and Staats (2012) note that they do not necessarily state why they do it or how strongly they are weighted.

From a theoretical standpoint, Biglaiser and Staats (2012, pp. 521 ff.) find a number of reasons why political institutions should be important for sovereign raters. For one, strong adherence to the rule of law contributes to political stability, which is a natural matter of concern for investors. Countries less committed to the rule of law were also shown to be less prone to repay their debt (Brunetti & Weder, 1998). The effectiveness of governance can moreover be considered an asset in times of distress, as effective governments are more likely to react swiftly to internal or external shocks. This reason in particular reflects the rating agencies' self-stated aim of implementing political risk into their analysis most directly. A final consideration relates to reputation: Tomz (2002) e.g. asserts that loss of reputations in one area may have spillover effects to other areas as well.

Some earlier studies incorporating political factors exist. A notable example is Mellios and Paget-Blanc (2006), who conduct a principle component analysis of rating determinants, identifying a set of thirteen economic and political factors, including Transparency International's *Corruption Perception Index*. The study was less a deliberate synergy between the political economy and economic literature as it was an exercise to reassess the relative importance of explanatory variables. A study comparable in its approach to Biglaiser and Staats (2012) is Archer et al. (2007), who found no significant effect of political institutions, however.

In contemporary literature one typically finds some governance factors as controls or at least a discussion of reasons for their exclusion. As an example for the former, Fuchs and Gehring (2013) e.g. investigate a possible home-bias in sovereign ratings, while controlling for a set of political factors. Nielsen et al. (2014) include institutional quality measures while assessing the impact of rating markups on financial markets. The goal of including political factors in these studies is, as it should generally be, to explain ratings based on a thorough theoretical foundation, to ensure that the model is as complete as possible and thusly avoids omitted variable bias.

3.2 The role of the CRAs according to GGJ

Of the numerous studies analyzing the role of ratings in Europe's sovereign debt crisis, Gärtner et al. (2011, GGJ) appear to be the first assessing whether determinants justified ratings. Studying a sample of 26 OECD countries with annual data spanning from 1999 to 2010, they estimate a regression of the form

$$R_{a,i,t} = \alpha + \beta_e^I E_{i,t} + \delta CRISIS_{i,t} + \lambda PIGS_{i,t} + \gamma(PIGS_{i,t} * CRISIS_{i,t}) + \epsilon_{a,i,t} \tag{3.5}$$

Here, as in equation (3.2), R and E are vectors containing sovereign credit ratings and economic rating determinants, respectively. The authors augment the equation with dummy variables, identifying crisis years (2009 onwards) and PIGS countries as well as their interaction to assess idiosyncratic treatment to each group that is unexplained by the economic climate E. They find that there was indeed a ceteris paribus effect for this subgroup of 2.3 notches lower a rating.

Using the results of above regression, the authors decompose credit ratings into an arbitrary and an explained part, such that

$$R_{a,i,t} = \hat{R}^{E}_{a,i,t} + \hat{R}^{P*C}_{a,i,t} + \hat{\epsilon}_{a,i,t} \tag{3.6}$$

where $\hat{R}^{E}_{a,i,t}$ is the rating part explained mostly by the economic climate and $\hat{R}^{P*C}_{a,i,t}$ the unexplained markup of the PIGS during the crisis. The residuals of equation (3.5), $\hat{\epsilon}_{a,i,t}$, are retained as well, reflecting rating markups unexplained by $\hat{R}^{P*C}_{a,i,t}$. The decomposition in equation (3.6) is used in a subsequent regression of the form

$$S_{i,t} = \eta \hat{R}^{E}_{a,i,t} + \theta \hat{R}^{P*C}_{a,i,t} + \kappa \hat{\epsilon}_{a,i,t} + \mu_{i,t} \tag{3.7}$$

where $S_{i,t}$ is the yield spread of sovereign bonds issued by country i relative to Germany's. The regression thus estimates the effect of each component in equation (3.6) on yield spreads. The results suggest that rating agencies can and do indeed influence interest rates with markups that are unexplained by economic fundamentals. GGJ conclude that rating agencies "do possess some power to drive countries with a significant debt ratio into trouble" (p. 298) and potentially "trigger processes of self-fulfilling prophecies that may drive even relatively healthy countries towards default" (p. 288).

As the authors note, the "result must be taken with a pinch of salt" (p. 298), as it depends quite crucially on explanatory power of the variables employed in regression equation (3.5). Statistically significant omitted variables could potentially reduce the estimated effect of the dummy variables ($\hat{R}^{P*C}_{a,i,t}$) as well as alter residual effect ($\hat{\epsilon}_{a,i,t}$). In essence, dummy variables such as $PIGS_{i,t} * CRISIS_{i,t}$ capture a fraction of the residual for that specific subgroup defined by country i and year t. Since the residual captures the effect of omitted variables, including those variables inevitably reduces the residual sum of squares of the model. The residuals become smaller and so does, potentially, the interaction term. This, in turn, could change the results of regression equation (3.7), which builds on the explanatory power of the previous model, and thereby alter GGJ's main conclusion.

Most notable in light of the existing literature appears to be the absence of political and institutional factors. While GGJ justify the exclusion of e.g. the Corruption Perception Index by its lack of variation in their sample or that of the World Governance Indicator's *Government Effectiveness* indicator for its high correlation with GDP per capita, the lack of political institutions as an explanatory factor is apparent. I am therefore posing the question if the results presented by GGJ are robust to the inclusion of additional explanatory variables, selected on the basis of theoretical evidence in previous studies and rating methodologies.

4 Empirical framework and data

My central point of criticism to GGJ's approach is their interpretation of equation (3.1) in terms of equation (3.3), rather than equation (3.4). By excluding theoretically relevant explanatory variables from their model, GGJ's regression potentially overstates the effect captured by the dummy variables. This concern is most strongly pronounced with regard to political institutions, which were shown to have a significant impact on bond ratings, as previously discussed. Consequently, I reestimate GGJ's

model, depicted in equation (3.5), in the form of

$$R_{a,i,t} = \alpha + \beta_e^I E_{i,t} + \beta_p^I P_{i,t} + \delta CRISIS_{i,t} + \lambda GIPS_{i,t} + \gamma(GIPS_{i,t} * CRISIS_{i,t}) + \epsilon_{a,i,t} \quad (4.1)$$

where $P_{i,t}$ is a vector of political and institutional variables with corresponding coefficients in vector β_p. Moreover, I extend vector $E_{i,t}$ by more economic variables, which I deem to be theoretically relevant in determining sovereign ratings in the Euro area. Subsequently, I use GGJ's approach to decomposing the predicted ratings via an extension of formula (3.6),

$$R_{a,i,t} = \hat{R}_{a,i,t}^{E+P} + \hat{R}_{a,i,t}^{P*C} + \hat{\epsilon}_{a,i,t} \quad (4.2)$$

where the explained part $\hat{R}_{a,i,t}^{E}$ becomes $\hat{R}_{a,i,t}^{E+P}$. The latter now captures the effect of the economic climate, the individual dummies as well as the political institutions contained in $P_{i,t}$. The decomposition is then used to reestimate equation (3.7) in the form

$$S_{i,t} = \eta \hat{R}_{a,i,t}^{E+P} + \theta \hat{R}_{a,i,t}^{P*C} + \kappa \hat{\epsilon}_{a,i,t} + \mu_{i,t} \quad (4.3)$$

Moreover, I am interested in examining differences across the three agencies. In light of some of the differences discussed in section 2, I find it conceivable that individual rating agencies used a markup on the GIPS countries to differential extents. Consequently, I reestimate equation 4.1 for each rating agency individually, to assess whether the markup placed on GIPS countries during the crisis differed across agencies.

The paper proceeds as follows. In the following two subsections the dataset is explained, detailing data sources, transformations and other adjustments as well as the motivation for choosing the employed variables and their particular specification. In the remainder of the section, the interpretations of the explanatory variables in multivariate regression are explained. Subsequently, section 5 presents the results of the estimations of equation (4.1), and section 6 does the same for the results of equation (4.3).

4.1 Data

The empirical analysis uses data for 11 out of the 17 current members of the EMU. Due to the absence of data for Cyprus, Estonia, Luxembourg, Malta, Slovenia and Slovak Republic, these countries were excluded from the analysis. Given the relatively small size of these countries – both in terms of GDP as in terms of population – it is unlikely that their exclusion should affect the model's internal validity. While data is available for all countries from 1950 to 2013, the time horizon for the analysis spans from 1999 to 2013. The reasons for this are twofold. The introduction of the common currency in 1999 poses a structural break, which is best avoided. A second structural break in the dataset exists around 1995, when the European Commission changed its standard for calculating fiscal variables such as budget balances and government debt to ESA95. Most importantly though, a reassessment of GGJ requires focusing on the same time frame.

Data on rating announcements were obtained through Bloomberg Terminal and expanded to a daily time series dataset. The ratings were then transformed linearly to a 21-point scale, with 21 the highest (AAA) and 1 the lowest (D). The exact scale applied is depicted in table 4.1, which follows directly from Afonso et al. (2012, p. 34) as well as GGJ. The ratings were subsequently collapsed to an annual dataset using the year-end rating rather than yearly averages, as is common in the literature.

S&P and Fitch	AAA	AA+	AA	AA-	A+	A	A-	BBB+	BBB	BBB-	
Moody's	Aaa	Aa1	Aa2	Aa3	A1	A2	A3	Baa1	Baa2	Baa3	
Transformation	21	20	19	18	17	16	15	14	13	12	
S&P and Fitch	BB+	BB	BB-	B+	B	B-	CCC+	CCC	CCC-	CC	SD/D
Moody's	Ba1	Ba2	Ba3	B1	B2	B3	Caa1	Caa2	Caa3	Ca	C
Transformation	11	10	9	8	7	6	5	4	3	2	1

Table 4.1 **Linear transformation of rating scale**

Following the analysis of GGJ, a benchmark model is constructed using five of the six variables they consider: *GDP per capita*, *GDP growth*, *inflation*, *primary government budget*, *government debt* and year-average *yield spreads*. The adjusted government surplus, excluding one-off sales of government assets, was excluded due to the unavailability of data. The robustness of GGJ's specification is tested through the inclusion of additional explanatory variables. These were selected by studying sovereign rating methodologies of the Big Three as well as the existing literature, particularly the reference paper by Biglaiser and Staats (2012). Three additional economic indicators are incorporated. To control for international trade and balance of payments effects, *trade openness*, measured as total trade over GDP, and the *current account balance* are included. Moreover, *population* is included to account for the size of a country. Differences in institutional quality, the explanatory variable of interest, is measured by the variables *Government Effectiveness* and *Rule of Law* of the World Bank's Worldwide Governance Indicators dataset. Table 4.2 below contains descriptive statistics for the sample in use.

Variable	**Mean**	**Std. Dev.**	**Min.**	**Max.**	**N**
Fitch	19.201	3.066	4	21	164
S&P	19.036	3.193	2	21	165
Moody's	19.109	3.553	1	21	165
Average Rating	19.154	3.191	2.667	21	164
GDP per capita	10.137	0.279	9.542	10.621	165
GDP growth	1.794	2.368	-6.143	10.391	165
Inflation	2.201	0.864	-0.947	5.024	165
Gross debt	75.358	29.296	24.600	176.200	165
Primary balance	0.547	3.797	-16.333	7.967	165
Trade openness	0.899	0.402	0.467	1.854	154
Current account	-0.720	5.846	-16.651	8.364	165
Population	16.681	1.006	15.139	18.229	165
Government effectiveness	1.454	0.522	0.214	2.264	154
Rule of law	1.372	0.452	0.351	1.977	165
Law squared	2.086	1.118	0.123	3.908	154
Yield spread (avg)	4.588	2.37	1.552	24.724	165
Yield spread (eoy)	4.566	3.044	1.299	37.473	165

Table 4.2 **Descriptive Statistics**

The data was obtained from six different sources, issued by four different publishers. GDP per capita,

GDP growth and population are taken from the European Commission Directorate General for Economic and Financial Affair's (DG ECFIN) Annual Macroeconomic Database (AMECO). Both are corrected for inflation. Data on government debt and primary balance were obtained from ECFIN's Autumn 2013 report *General Government Data*, tables 57B and 56B, respectively. Both indicators are thus based on the ESA1995 standard, calculated at the general government level and are measured in percent of GDP. Data on consumer prices is taken from the OECD's statistical database and trade openness was computed from import, export and GDP data obtained from the World Bank's World Development Indicators database. The yield spreads are calculated as the difference between the interest rate on bonds with ten-year maturity with that of Germany. Data for interest rates was obtained through Datastream, where the series *Benchmark Bond 10 Yr (Ds) - Red. Yield* was used.

All explanatory variables were inspected for outliers, missing observations, skewness and kurtosis. Time trends in GDP per capita and population were removed by transforming to natural logarithms. This is a necessary and common practice to avoid OLS estimators placing greater weight on later observations in the dataset. Where data series grow somewhat gradually over time, the differences between data points become larger towards the end of a series, which OLS estimators overstate. Logarithms are a common way of de-trending time series in order to balance the weights. Moreover, three-year averages are used for short term indicators GDP growth, inflation, primary balance, trade openness, and the current account balance. This method is adopted from previous research papers (e.g. Cantor & Packer, 1996; Fuchs & Gehring, 2013) as well as rating agencies' self-stated disregard for short-term fluctuations. In 2010, for example, S&P reacted to a sharp adjustment in Ireland's budget deficit by stating that it "did not affect our view of the underlying position of the Irish public finances"[4]. Due to biyearly measurement of the Worldwide Governance Indicators before 2002, two data points per country had to be interpolated. I chose cubic splines as a method, although the differences with a linear interpolation were marginal, given the low year-to-year variation in the indicators.

4.2 Motivation for the explanatory variables

The inclusion of the first five economic explanatory variables follows directly from GGJ, where it is in turn based on previous studies. GDP per capita and economic growth are both expected to influence sovereign ratings positively. For GDP per capita in particular one should expect a strong significance, given that its relative importance was stressed previously, as explained in section 3. Inflation is expected to affect ratings negatively, since it inversely reflects monetary stability. The primary deficit and debt burden are expected to be negatively related to the dependent variable. Since the primary deficit is included in the form of the budget balance, however, the sign of the coefficient should be positive. The yield spread of long term government bonds are expected to affect credit ratings negatively, i.e. as yield spreads increase sovereign ratings should be adjusted negatively, if at all, and vice versa.

The three additional economic regressors – current account balance, trade openness and population – were selected based on theoretical considerations in previous literature as well as information in the rating manuals of the Big Three. Previous studies, such as Fuchs and Gehring (2014) have included the same variables to assess for the external performance of a sovereign. Since ratings of government debt denoted in foreign currency are studied, balance of payments and trade considerations are relevant with regard to the availability of foreign exchange reserves. Large current account deficits are an

[4]Brown, J. M. (2010, April 22). Ireland's budget deficit highest in EU. *Financial Times*. Retrieved April 16, 2014, from http://www.ft.com/cms/s/0/0b8dbb0e-4e1e-11df-b437-00144feab49a.html

indication that a country relies excessively on funds from abroad (Cantor & Packer, 1996). Albeit, international trade has at various instances been shown to have positive impacts on economic growth, access to capital markets as well as credit ratings (Biglaiser & Staats, 2012). Population is included as a measure of the relative size of a country. As noted by Fuchs and Gehring (2013), large countries tend to be less affected by external shocks, as they are typically more diversified than smaller countries.

With regard to institutional factors, I limit my analysis to two indicators of the Worldwide Governance Indicators (WGI) dataset: Government Effectiveness and Rule of Law. These variables were perviously used in similar studies, most notably in Biglaiser and Staats (2012), but more recently also in Nielsen et al. (2014). Moreover, Moody's explicitly states in its rating manual that WGI indicators are used in the rating process. Biglaiser and Staats (2012, p. 521) furthermore note that analysts of both Moody's and Fitch have "specifically stated that they consult the WGI" in interviews with the authors. The authors of the dataset, Kaufmann, Kraay, and Mastruzzi (2011, p. 223) define Rule of Law as "the [...] extent to which agents have confidence in and abide by the rules of society, and in particular the quality of contract enforcement, property rights, the police, and the courts, as well as the likelihood of crime and violence". This captures quite closely the theoretical considerations of Biglaiser and Staats, of whom the most relevant were discussed in section 3.1. Government effectiveness is defined as "the [...] quality of public services, the quality of the civil service and the degree of its independence from political pressures, the quality of policy formulation and implementation, and the credibility of the government's commitment to such policies." (Kaufmann et al., 2011, p. 223). The various measures contained in the dataset are taken from "several hundred individual underlying variables, [obtained] from a wide variety of existing data sources. The data reflect the views on governance of survey respondents and public, private, and NGO sector experts worldwide" (Kaufmann et al., 2011, p. 220). They are thus measures of the perception of institutional quality, rather than of the variable itself.

There are two notable issues when working with the WGI dataset. One general consideration was brought to me through email conversations with one of the authors of the dataset, Daniel Kaufmann, in April 2014. As Kaufmann noted, it is inappropriate a method to include more than one indicator in the same regression. Since it is theoretically impossible to hold constant the rule of law of a country, for instance, when studying government effectiveness, a ceteris paribus interpretation of the coefficients is impossible. This, he noted, is true also with regard to the measurement applied, where the value of 0 is the median of the index, not its absence, which would be the case for an inflation of 0 for example. Moreover, the individual components of WGI are highly correlated, which will in most circumstances introduce bias to econometric models. In light of these considerations, I decided to assess the impact of the aforementioned WGI variables in separate regressions.

A second, more specific consideration relates to the functional form of Rule of Raw. As stated by Moody's (2008, p. 9) in their rating manual, the rule of law is taken into consideration, as "unstable and/or immature economic and political institutions increase the risk of unpredictable behavior in times of stress, inviting negative credit implications". They note further, however, that a strong rule of law may act as a constraint when reacting to sudden adverse shocks. To Moody's, the rule of law can thus also "act as constraint on sudden and adverse changes to a country's ability and willingness to pay its debt. The stronger the institutions, the greater the constraint". Consequently, I question that a linear representation appropriately captures the perception of the variable. Given the explanation of Moody's, it appears that the true functional form, as perceived by the agencies, may be of a parabolic shape instead. Then, initial improvements in Rule of Law improve a country's perceived

creditworthiness until a certain threshold is reached, at which the relationship turns around and the rule of law is considered a constraint. Although this has not been tried in previous studies using WGI variables to explain credit ratings, I include the square of Rule of Law, as a naive approximation of the true (parabolic) functional form of the variable.

Further variables that were considered but excluded are external balance, which is contained in a country's current account to a certain extent as well as rents from natural resources, which are insignificantly small in the Euro area. The external debt stock was excluded as its inclusion was shown to matter solely for developing countries (Afonso et al., 2007). The default history of a country was excluded, as the most recent case lies too far behind the first observation to carry a significant impact. Regime type was not considered (e.g. the polity indicator of the Polity IV dataset), since it was also shown to be insignificant in the determination of credit rating (Biglaiser & Staats, 2012, p. 521). With regard to the latter, the agencies themselves note that the type of regime is relatively unimportant, as long as it is effective. Variables related to political conflict and war were excluded as there were virtually no events of internal conflict in the database, and external conflict showed no clear statistical relationship with credit ratings.

4.3 Interpreting coefficients

To avoid erroneous repetition in the following two section, I review here in some detail the interpretation of the aforementioned explanatory variables in multivariate regressions. Since the interpretation of beta coefficients depends primarily on the unit of measurement of the independent variables, they are quite similar across the two models estimated.

In general, the main difference in the interpretation of coefficients between the two models, i.e. equation (4.1) and equation (4.3), rests on the measurement of the dependent variable. Both can basically be considered to be measured in units. For credit ratings, the dependent variable of model (4.1), the units are referred to as notches. The difference between an AAA rating and an AA+ rating, for example, is one notch. In the case of yield spreads, the dependent variable of model (4.3), the unit of measurement is in percentages. Changes in yield spreads are thus measures as percentage point changes.

For regressors measured in percent, i.e. GDP growth, primary balance, gross debt, inflation, lagged yield spreads, trade openness and current account balance, it is unimportant whether the variable reflects growth rates or fractions, e.g. of GDP. The interpretation is always in terms of a one percentage point increase in the regressor causing a ceteris paribus effect of β units on the dependent variable. For credit ratings, the coefficients are thus interpreted in terms of notch-changes in the respective credit rating. A one percentage point increase in the level of inflation, for example, would result in a ceteris paribus decrease in the credit rating of a given country of β notches. In the case of yield spreads, an increase in trade openness of one percentage point would increase the yield spread of a given country by β percentage points, everything else constant.

The interpretation is slightly different with logarithmically transformed variables, i.e. GDP per capita and population. Here, the coefficient reflects a $\beta/100$ change in the dependent variable, given a one percent change in the regressor. Hence, a one percent increase in GDP per capita would e.g. result in a change of $\beta/100$ notches in a country's credit rating. A change of one percent in the population of a country would change yield spreads by $\beta/100$ percentage points.

	Gov. Effectiveness			Rule of Law		
	Mean	Std. Dev.	Range	Mean	Std. Dev.	Range
Austria	1.81	0.15	0.46	1.85	0.05	0.17
Belgium	1.72	0.17	0.60	1.32	0.06	0.20
Finland	2.17	0.08	0.30	1.94	0.03	0.08
France	1.57	0.15	0.49	1.40	0.08	0.31
Germany	1.64	0.16	0.52	1.64	0.05	0.17
Greece*	0.62	0.15	0.53	0.71	0.16	0.52
Ireland*	1.56	0.12	0.40	1.64	0.10	0.28
Italy	0.54	0.21	0.61	0.52	0.17	0.45
Netherlands	1.89	0.15	0.43	1.76	0.05	0.15
Portugal*	1.05	0.09	0.32	1.11	0.12	0.34
Spain*	1.33	0.39	1.01	1.18	0.11	0.35

Note: GIPS countries marked with *

Table 4.3 **Means, standard deviations and range for WGI variables by country**

The interpretation of the two institutional variables in regression analysis is a little more delicate. WGI variables are essentially indexes, ranging from -2.5 (lowest) to +2.5 (highest). As evident from the ranges depicted in table 4.3, there is little variation over time per country. Whereas the sample standard deviation (table 4.2) for Government Effectiveness and Rule of Law is 0.52 and 0.45, respectively, the standard deviation per country rarely exceeds 0.2 or 0.15 each, in the same order. Interpreting the coefficient based on one unit changes in the index is thus unreasonable, since this extreme an improvement has not occurred for any country over the 14 years considered here. Instead, I assert that the coefficients should be interpreted in standardized form, i.e. in terms of standard deviation movements. With standardized coefficients, a one standard deviation (σ) change in the explanatory variable has a ceteris paribus effect of $\sigma * \beta$ units on the dependent variable. Table 4.3 contains means, standard deviations and ranges for the two institutional variables employed by country. Taking Austria's standard deviation of Government Effectiveness, for example, and assuming a hypothetical coefficient of 2.5, the ceteris paribus effect of a one standard deviation change in Government Effectiveness on the dependent variable would be $0.46 * 2.5 = 1.15$ units. Again, for credit ratings this would be interpreted as a 1.5 notch change and for yield spreads as a 1.5 percentage point change.

With regard to Rule of Law, which cannot be interpreted in isolation of its square, I suggest an interpretation based on the mean value of each country. Taking the partial derivative of some regression equation Ω with respect to Rule of Law (Law) yields

$$\begin{aligned} \frac{\partial \Omega}{\partial Law} &= \left[\dots \beta_1 Law + \beta_2 Law^2 \dots \right]' \\ &= \beta_1 + 2\beta_2 Law \qquad (4.4) \\ &\iff \\ \partial \Omega &= (\beta_1 + 2\beta_2 Law)\, \partial Law \qquad (4.5) \end{aligned}$$

By pluging in the mean of a given countries' Rule of Law for Law and its standard deviation for ∂Law, one can interpret equation (4.5) in terms of the effect of standard deviation movements from the mean. Of course, one may plug in any observed value of the index for Law, to see how a standard

deviation increase would improve a country's credit rating or yield spread, ceteris paribus on the other explanatory variables. Another common technique for square terms that is applicable here, is to solve equation (4.4) for Law, to calculate the turning point of the parabola as

$$Law = \frac{-\beta_1}{2\beta_2} \tag{4.6}$$

The solution to equation (4.6) indicates the point at which agencies' consider Rule of Law to be a constraint rather than asset, in a particular model and ceteris paribus on the other regressors.

5 PIGS or lambs? Sovereign ratings in the Euro crisis

The overall finding with regard to an extension of GGJ's model is that the markup effect appears robust in its significance, but not in its size. The re-estimation of their model specification, i.e. equation (3.5), yields a slightly higher markup than previously found by the authors. Through the inclusion of additional explanatory variables as in equation (4.1), however, the size of it is reduced markedly. Moreover, I find that there are notable differences in markups between the three agencies, which are similarly contingent on the particular model specification employed.

The following pages present these findings in more detail, with an eye for policy implications of the results. After a review of conducted robustness checks, the model of rating determinants is tested against GGJ's specification in three forms. Section 5.2 considers the rating determinants themselves, without interaction terms. Subsequently, the benchmark model of GGJ is reassessed, thus including markups, in section 5.3. Section 5.4 considers cross-agency differences in the markup placed on GIPS countries during the Euro crisis.

5.1 Robustness checks

I detect strong evidence of heteroskedasticity in my data using the Breusch-Pagan/Cook-Weisberg test. For all models presented in this section, the null hypothesis of a constant variance was rejected with at least 99 percent confidence. To correct for heteroskedasticity, I use panel-corrected standard error (PCSE) parameter estimates, while assuming panel-level heteroskedastic errors. This method was developed by Beck and Katz (1996), to correct for panel-level heteroskedasticity in dynamic models and can also correct for autocorrelation, if need be, via lagged dependent variables[5]. With regard to my specification and dataset, I found that PCSE is used in similar analyses, e.g. by Biglaiser and Staats (2012).

To test for autocorrelation in the dependent variable, I employ the Wooldridge (2010, pp. 282-283) test for autocorrelation in panel data. I do not find evidence of autocorrelation for any of the model specifications considered. This contradicts e.g. Biglaiser and Staats (2012) who find autocorrelation of the first order, as they expect, given the alleged stickiness of ratings. A potential explanation for why there is no autocorrelation in my sample may be the specific time horizon chosen, during which two crises occur. Moreover, since Gärtner et al. (2011) find evidence of bi-directional causality – plausibly due to the crises – one can safely refute the argument of sticky ratings during the studied time period for this particular set of countries.

[5]Beck and Katz (1996) show show that PCSEs are superior to generalized least squares approaches (GLS) and at least as efficient as cross-sectionally heteroskedastic and time-wise autocorrelated models (CHTA).

Another concern that has been raised in previous studies is the potential existence of country fixed effects (see e.g. Biglaiser & Staats, 2012; Gärtner et al., 2011). I thus test the robustness of my model with PCSE parameter estimates against a country fixed-effect model. Using Hausman tests, I then select the more efficient model for my analysis. Interestingly, the Hausman tests suggest the use of a country fixed-effect model for GGJ's specification and a model without fixed effects but PCSE parameters for my own specification. While GGJ do report estimates of a country fixed-effect model, they draw their main conclusions from a model without fixed-effects and proceed to use the latter in their subsequent analysis of yield spreads. Consequently, I report in this section the consistent PCSE estimates for both my own model (where they are efficient) and GGJ's model (where they were used for inference). Nonetheless, all models are presented in appendix A for comparison.

5.2 Explanatory power of the rating determinants

Before comparing the effect of additional regressors on GGJ's regression model, I am interested in comparing the explanatory power of the extended set of rating determinants to that of GGJ. There is merit in this exercise, as it constitutes a direct application, and in some cases extension, of the literature presented in section 3.1. Table 5.1 compares the effect of different sets of determinants on sovereign ratings without any dummy variables. Model (1) is a re-estimation of GGJ's specification, model (2) the extension using Rule of Law and its square and model (3) the specification using Government Effectiveness.

	(1)		(2)		(3)	
	Coefficient	P-value	Coefficient	P-value	Coefficient	P-value
GDP growth	-0.04	0.60	-0.05	0.48	-0.01	0.84
GDP per capita	1.35***	0.01	1.58**	0.04	1.15	0.11
Primary balance	0.24***	0.00	0.26***	0.00	0.20***	0.00
Gross debt	-0.05***	0.00	-0.04***	0.00	-0.04***	0.00
Inflation	-0.45***	0.00	-0.08	0.61	-0.09	0.59
Lag. yield spread	-0.55***	0.00	-0.70***	0.00	-0.72***	0.00
Trade openness			0.28	0.54	0.68*	0.06
Current account			-0.03	0.54	-0.03	0.36
Population			0.69***	0.00	0.79***	0.00
Rule of law			4.12***	0.00		
Law squared			-1.14**	0.03		
Government effectiveness					1.11***	0.00
Constant	12.92**	0.01	-5.70	0.47	-1.36	0.86
Observations	153		143		143	
R-squared	0.85		0.89		0.88	
Number of countries	11		11		11	

Note: The dependent variable is the average rating between the three agencies, i.e. $\frac{1}{3}\sum_{a=1}^{3} r_{a,i,t}$. The models are estimated using PCSE parameter estimates.
*** p<0.01, ** p<0.05, * p<0.1

Table 5.1 **Comparison of model specifications without dummy variables**

In general, both model (2) and model (3) possess an improved explanatory power compared to model (1) of GGJ. The R-squared is four and three percentage points higher in each extended models, respectively.

The results suggest that the theoretical considerations were sound and the explanatory power of the model improved over that of GGJ.

All variables in model (1) have the expected sign, with the exception of GDP growth, which is fortunately insignificant though. The same is true for the two extended models, where the sign is similarly reverted but the coefficient insignificant. This is also the case for the current account balance. The remaining additional variables are all significant at least at the 10 percent level, with the exception of trade openness in the Rule of Law estimation.

The institutional variables both perform well in their respective regressions and are highly significant. All else constant, a one standard deviation increase in Government Effectiveness leads to 1.11 standard deviations a notch an increase in a country's average rating. In the case of Portugal, for example, a one standard deviation increase in the perceived effectiveness of its government would lead to $0.39 * 1.11 \approx 0.43$ notches an increase in its average credit rating, ceteris paribus. The coefficients of Rule of Law and its square both possess the expected signs, indicating an inverse u-shape with a turning point around 1.84. A one standard deviation increase in the perceived rule of law of Spain from its mean, for example, would lead to a $(4.12 - 2 * 1.14 * 1.18) * 0.11 \approx 0.16$ notches an increase in its credit rating. A relevant question with regard to policy would be by how much a country would have to increase its perceived rule of law in order to achieve a one notch improvement in its average credit rating. In the case of Spain, this would require an increase of about 0.7 points in Rule of Law, assuming the country is at its mean. An increase of this magnitude would place Spain roughly midway between the Netherlands and Finland. In terms of Government Effectiveness, Spain would have to exceed the index's maximum by about 2.5 percent in order to achieve a one notch improvement in its average rating, which is of course impossible. Consequently, the main institutional channel through which a country could potentially improve its perceived creditworthiness would be to target reforms at components of the Rule of Law index. Of course, such considerations have to be taken with a grain of salt. One has to keep in mind that they are merely hypothetical, as they rest on the ceteris paribus assumption. Moreover, institutions can in reality of course not be copied quite so simply.

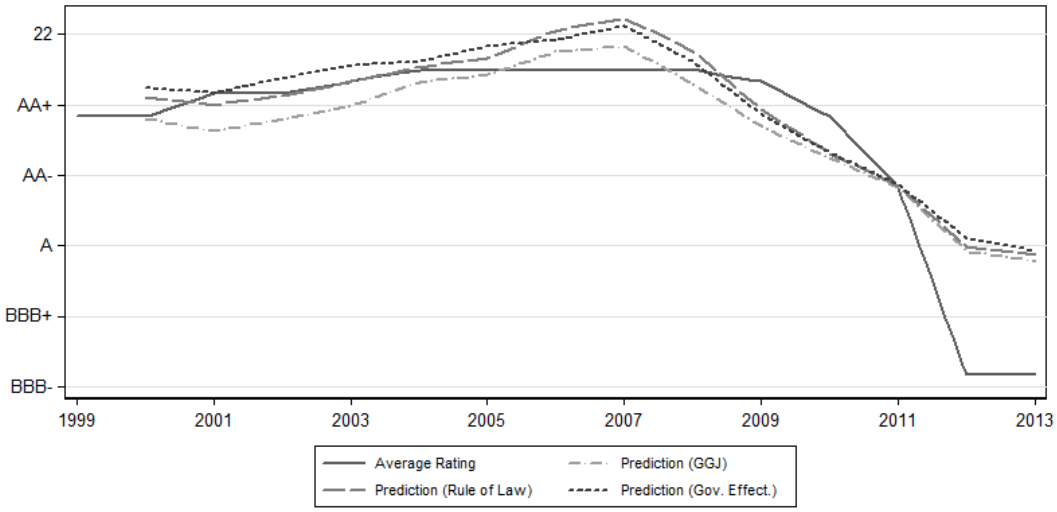

Figure 5.1 **Actual and predicted ratings of Spain**
Author's calculations

Figure 5.1 above depicts the observed average credit rating together with the predictions based on the three different specifications. Two observations are notable: (1) The three specifications predict ratings similarly during the crisis, but differ significantly in tranquil times and (2) institutional factors predict a substantially higher rating during tranquil times. A third striking feature of the graph is Spain's credit rating in the last two years of the sample period. In all model specification excluding crisis or PIGS markups, Spain should have a credit rating of about two notches higher than is observed.

5.3 Introducing the markup

Table 5.2 compares the models with interaction terms against GGJ's specification. Of interest here is particularly the coefficient of the GIPS∗Crisis dummy, which measures the idiosyncratic treatment of rating agencies to that subgroup. Model (1) contains the estimation results of equation (3.5) and model (2) and model (3) those of equation (4.1), with Rule of Law and Government Effectiveness, respectively. Overall, the estimation results are better than those without interaction term in table 5.1. GDP growth, although still insignificant, now possess the expected sign and both balance of payments variables have become significant. The coefficient of the current account balance still points opposite the direction that it is expected to, however.

	(1)		(2)		(3)	
	Coefficient	P-value	Coefficient	P-value	Coefficient	P-value
GDP growth	0.09	0.29	0.04	0.55	0.09	0.22
GDP per capita	0.11	0.83	0.18	0.80	-0.48	0.51
Primary balance	0.01	0.89	0.12***	0.01	0.07	0.13
Gross debt	-0.06***	0.00	-0.05***	0.00	-0.06***	0.00
Inflation	-0.24	0.15	-0.09	0.53	-0.17	0.27
Lag. yield spread	-0.36***	0.00	-0.44***	0.00	-0.49***	0.00
Crisis	0.35	0.17	0.33	0.13	0.39*	0.09
GIPS	-1.39***	0.00	-1.93***	0.00	-2.04***	0.00
GIPS∗Crisis	-2.57***	0.00	-1.40**	0.02	-1.59***	0.01
Trade openness			0.93**	0.04	1.83***	0.00
Current account			-0.13***	0.00	-0.14***	0.00
Population			0.46***	0.00	0.72***	0.00
Rule of law			8.97***	0.00		
Law squared			-2.82***	0.00		
Government effectiveness					0.87*	0.08
Constant	25.03***	0.00	8.80	0.25	16.74**	0.03
Observations	139		130		130	
R-squared	0.90		0.92		0.92	
Number of countries	11		11		11	

Note: The dependent variable is the average rating between the three agencies, i.e. $\frac{1}{3}\sum_{a=1}^{3} r_{a,i,t}$. The models are estimated using PCSE parameter estimates.
*** p<0.01, ** p<0.05, * p<0.1

Table 5.2 **Regression results compared to GGJ**

The interaction term GIPS∗Crisis is highly significant in all specifications, which shows that GGJ's results are indeed robust to the inclusion of additional explanatory variables. While it is even stronger

in the re-estimation of their model, possibly due to the exclusion of the adjusted primary balance, its effect is reduced markedly in the extended models. When controlling for the additional economic regressors as well as Rule of Law and Government Effectiveness, the markup placed on GIPS countries during the crisis is reduced to 1.4 notches and 1.59 notches, respectively. Simultaneously though, the individual dummy for the GIPS countries is increased by at least half a notch, implying that GIPS countries were, on average, treated about 2 notches worse than other EMU members.

The coefficient of Rule of Law has increased substantially, when compared to the results in the previous section. One plausible explanation is that it was biased downwards by omitting the significant dummy variables for GIPS and Crisis. This suggest that once arbitrary treatment during the crisis on GIPS is controlled for, the potential improvement in a country's rating through Rule of Law is disproportionally higher for countries that on average rank relatively low on the index. The coefficient is not all too extreme, though, considering its abstract interpretation. Looking again at Spain, a one standard deviation increase in Rule of Law from its mean would increase its credit rating by $(8.97 - 2 * 2.82 * 1.18) * 0.11 \approx 0.26$ notches, ceteris paribus. For Greece, which ranks substantially lower on the index, the ceteris paribus effect would be about 0.8 notches. For Government Effectiveness, the ceteris paribus improvement in the average credit ratings for the two countries would be $0.87 * 0.11 \approx 0.1$ notch and $0.87 * 0.16 \approx 0.14$ notches, respectively.

With regard to policy, Spain would have to increase its perceived rule of law by 0.43 points in order to achieve a one notch improvement in its perceived credit rating, i.e to a level about midway between Germany and the Netherlands. Greece on the other hand would only require a 0.18 point increase in its perceived rule of law, which would only be halfway to its next peer, Portugal. An improvement in its Rule of Law to the very level of Portugal (0.43 points), would improve Greece's rating by 2.4 notches. In terms of Government Effectiveness, the countries would have to improve on the index by 1.15 points, which for Greece would place it almost exactly on the level of Belgium. For Spain, this would imply an improvement to 2.33, which is almost 0.4 points higher than Finland, the highest ranking country in the sample. Consequently, the results suggest that countries can benefit most swiftly by improving their perceived rule of law, although those with relatively ineffective governments may benefit substantially from addressing those inefficiencies with reforms.

Strong ceteris paribus improvements can also be achieved by increasing trade openness, where a one percentage point increase over a three-year horizon would improve an average credit rating by 0.93 and 1.83 notches, depending on the specification. However, the strongest ceteris paribus improvement in a GIPS country's average credit rating would, ad absurdum, be achieved by not being a GIPS country.

5.4 Cross-agency variation in markup

To assess differences in the markup used for GIPS countries during the crisis between agencies, I reestimate equation (4.1) for each agency. Tables 5.3 and 5.4 show the regression results for Rule of Law and Government Effectiveness, respectively. Looking at GGJ's specification, which is included in both tables, it appears that there are indeed some measurable differences in the markup placed on GIPS countries by the three agencies. While differing at most by 0.73 notches, Fitch has used the lowest markup (2.31 notches) and S&P the highest (3.04 notches). Moody's markup is closer to that of Fitch than to that of S&P's.

As in the case of pooled ratings before, the effect of Rule of Law and its square is highly significant

and the effect of the markup reduced markedly, by around one notch or more across agencies. When including Government Effectiveness instead, the markup is reduced by almost one notch for Fitch, by 0.8 of a notch for S&P and by 1.3 notches for Moody's. As a result, Moody's appears to have placed the least a markup on GIPS countries, if any. In both specifications, the coefficient's significance is reduced notably, being only marginally significant in the second specification and turning insignificant altogether in the second. S&P's markup remains the largest irrespective of the specification. This seems somewhat in contrast to their downgrade history discussed in section 2.4, where the agency was shown to having downgraded more frequently but less severely than its two competitors.

Another notable observation is the increase in the overall GIPS markup, i.e. over the entire sample period, across agencies and in both specifications. While the markup for GIPS countries during the crisis decreases in size, the overall markup does the opposite. This suggests that GIPS countries were rated lower, on average, over the entire sample horizon, and that this difference was not due to differences in Rule of Law or Government Effectiveness, *inter alia*. This suggests that rating agencies decided to disregard the implications of their rating determinants to some extent for GIPS countries, specifically with regard to the additional four factors.

Looking at the rating determinants, it appears that the agencies apply similar weights in most cases. Two notable difference are the coefficients of inflation and lagged yield spreads. Only S&P appears to consider the effect of inflation on creditworthiness, as it is insignificant in the regressions of the other two agencies. Looking at lagged yield spreads, it appears that Moody's placed much higher weight on it in determining ratings than the other agencies did; more than twice as much as S&P and around two thirds more than Fitch. Moreover, GDP growth appears to be weighted only by Fitch, whose ratings in turn appears to be unrelated to GDP per capita and the primary balance of a country.

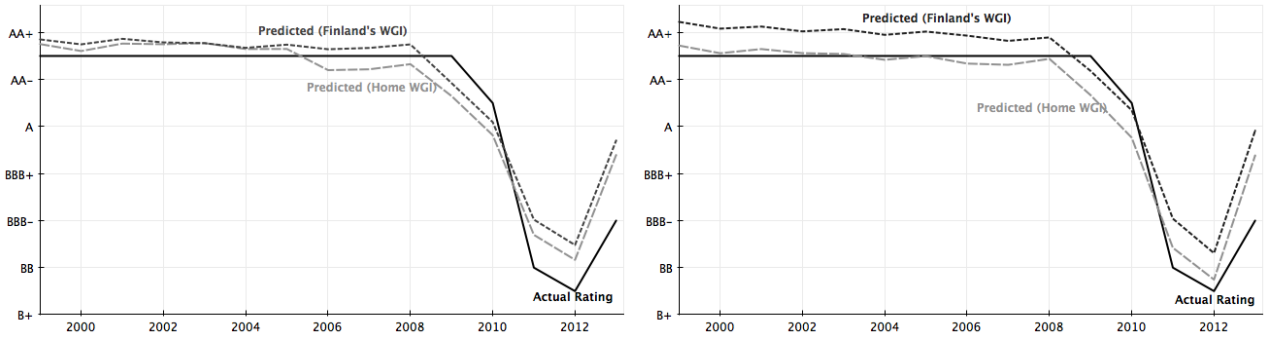

Figure 5.2 **Simulation of substituting Finland's institutions into Portugal for Moody's rating Rule of Law (left panel) and Government Effectiveness (right panel) Author's calculations**

Again, one may hypothetically pose the question by how much a country could improve its credit rating, if it was to perfectly imitate the quality of institutions in another country. As evident from figure 5.2, if Portugal were to perfectly imitate Finland's Government Effectiveness (right panel), for example, its predicted credit rating issued by Moody's would be one notch higher from 2006 onwards. If the country were to imitate Finland's Rule of Law instead (left panel), its predicted credit rating would increase by up to one notch in 2006 or 0.6 a notch during the crisis.

	Fitch				S&P				Moody's			
	(1)		(2)		(3)		(4)		(5)		(6)	
	Coefficient	P-Value	Coefficient	P-Value	Coefficient	P-Value	Coefficient	P-Value	Coefficient	P-Value	Coefficient	P-Value
GDP growth	15.25*	0.06	10.17	0.13	3.63	0.68	-1.24	0.87	9.29	0.39	4.20	0.64
GDP per capita	-0.28	0.56	-0.39	0.59	1.08**	0.02	0.90	0.17	-0.41	0.52	0.03	0.97
Primary balance	-0.05	0.25	0.05	0.21	0.00	0.97	0.11**	0.01	0.05	0.34	0.19***	0.00
Gross debt	-0.06***	0.00	-0.06***	0.00	-0.05***	0.00	-0.05***	0.00	-0.06***	0.00	-0.05***	0.00
Inflation	-0.15	0.31	0.02	0.91	-0.36**	0.03	-0.25*	0.10	-0.19	0.33	-0.04	0.80
Lag. yield spread	-0.30***	0.00	-0.38***	0.00	-0.27***	0.00	-0.27***	0.01	-0.52***	0.00	-0.65***	0.00
Crisis	0.66***	0.01	0.59***	0.00	0.14	0.58	0.21	0.35	0.22	0.47	0.18	0.51
GIPS	-1.75***	0.00	-2.23***	0.00	-1.03**	0.02	-1.55***	0.00	-1.38**	0.01	-2.02***	0.00
GIPS∗Crisis	-2.31***	0.00	-1.21**	0.03	-3.04***	0.00	-2.06***	0.00	-2.48***	0.00	-0.94	0.17
Trade openness			0.82*	0.05			1.00**	0.03			0.97*	0.07
Current account			-0.11***	0.00			-0.13***	0.00			-0.17***	0.00
Population			0.43***	0.00			0.46***	0.00			0.49***	0.00
Rule of law			8.63***	0.00			9.59***	0.00			8.70***	0.01
Law squared			-2.72***	0.00			-3.07***	0.00			-2.68**	0.01
Constant	28.85***	0.00	15.40**	0.05	14.77***	0.00	0.45	0.95	30.80***	0.00	10.54	0.27
Observations	139		130		140		130		140		130	
R-squared	0.90		0.93		0.90		0.92		0.89		0.91	
Number of countries	11		11		11		11		11		11	

*** p<0.01, ** p<0.05, * p<0.1

Table 5.3 **Effect of *Rule of Law* on GGJ model across agencies**

	Fitch				S&P				Moody's			
	(1)		(2)		(3)		(4)		(5)		(6)	
	Coefficient	P-Value	Coefficient	P-Value	Coefficient	P-Value	Coefficient	P-Value	Coefficient	P-Value	Coefficient	P-Value
GDP growth	15.25*	0.06	14.68**	0.03	3.63	0.68	3.72	0.63	9.29	0.39	8.82	0.33
GDP per capita	-0.28	0.56	-1.03	0.16	1.08**	0.02	0.16	0.82	-0.41	0.52	-0.57	0.53
Primary balance	-0.05	0.25	0.00	0.98	0.00	0.97	0.06	0.19	0.05	0.34	0.14**	0.01
Gross debt	-0.06***	0.00	-0.07***	0.00	-0.05***	0.00	-0.06***	0.00	-0.06***	0.00	-0.06***	0.00
Inflation	-0.15	0.31	-0.06	0.68	-0.36**	0.03	-0.33**	0.04	-0.19	0.33	-0.11	0.53
Lag. yield spread	-0.30***	0.00	-0.43***	0.00	-0.27***	0.00	-0.33***	0.00	-0.52***	0.00	-0.70***	0.00
Crisis	0.66***	0.01	0.65***	0.00	0.14	0.58	0.28	0.25	0.22	0.47	0.25	0.37
GIPS	-1.75***	0.00	-2.34***	0.00	-1.03**	0.02	-1.67***	0.00	-1.38**	0.01	-2.12***	0.00
GIPS∗Crisis	-2.31***	0.00	-1.39***	0.01	-3.04***	0.00	-2.24***	0.00	-2.48***	0.00	-1.14*	0.09
Trade openness			1.69***	0.00			2.00***	0.00			1.80***	0.00
Current account			-0.12***	0.00			-0.13***	0.00			-0.17***	0.00
Population			0.68***	0.00			0.76***	0.00			0.73***	0.00
Government effectiveness			0.82*	0.07			0.82	0.11			0.95*	0.09
Constant	28.85***	0.00	23.06***	0.00	14.77***	0.00	9.11	0.19	30.80	0.00	18.04*	0.06
Observations	139		130		140		130		140		130	
R-squared	0.90		0.93		0.90		0.91		0.89		0.90	
Number of countries	11		11		11		11		11		11	

*** p<0.01, ** p<0.05, * p<0.1

Table 5.4 **Effect of *Government Effectiveness* on GGJ model across agencies**

6 Impact on yield spreads

The existence of a significant markup in credit ratings as such must not necessarily have detrimental consequences for GIPS countries. The crucial question is whether or not this markup influences financial markets significantly enough for government bond yields to be affected. Combined with the finding of bi-directional causality between credit ratings and yields spreads by GGJ, this would indeed suggest an active involvement of the CRAs in the Euro crisis.

The negative relationship between credit ratings and yield spreads has already been proven at various instances. Gómez-Puig (2006) and Manganelli and Wolswijk (2009), for example, find such a relationship between ratings and yield spreads in the EMU area, in 1996 to 2001 and 1999 to 2008, respectively. Later work by Attinasi, Checherita, and Nickel (2009) as well as Zoli and Sgherri (2009) finds that this relationship remains stable in the wake of the most recent financial crisis. All four studies build on earlier work by Kamin and Von Kleist (1999) as well as Eichengreen and Mody (2008), whose work identified this relationship for developing countries during the 1990s.

Previous evidence of a negative relationship between credit ratings and yield spreads combined with bi-directional causality does already by itself suggest that self-fulfilling prophecies could be a distinct possibility. As a result, even healthy countries could be trapped in a downward spiral of rating downgrades and yield increases that escalate borrowing costs to unsustainable levels. This, as GGJ note, could potentially drive even healthy countries towards default. The remaining question is whether arbitrary markups on the part of the rating agencies could potentially be part of this mechanism. Since the markup reflects arbitrary judgement, in the sense that it is unexplained by the economic and institutional control variables, a significant effect on yield spreads would suggest that CRAs could have been a driving force in the Euro crisis.

GGJ found significant evidence for such an effect. According to their estimation results, the markup alone has a ceteris paribus effect of -1.36 percentage points on yield spreads. This results rests on the decomposition of their benchmark model according to equation (3.6), however. Since my results indicate that their benchmark model overstated the markup, it appears reasonable to suspect that its effect might have been overstated as well. To investigate this, I reestimate the results of GGJ by decomposing the credit rating according to equation (4.2), which is based on the extended benchmark model in equation (4.1). The decomposition is then regressed on yield spreads to infer whether or not the effect found by GGJ is robust to a reduction in the markup, i.e. to the inclusion of additional regressors in the benchmark model.

Table 6.1 shows the results of a re-estimation of GGJ's model in equation (3.7). While my results are all highly significant, they differ from those of GGJ in some respects. Looking at the effect of credit ratings on yield spreads in column (1), my results suggest an effect of 0.23 percentage points more than previously found by GGJ. Similarly, The effects of the fundamentals in isolation of the markup, depicted in column (2), is also slightly stronger than in GGJ, by about 0.15 percentage points. In column (3) the rating markup is added. Again, the effect is a little stronger than in GGJ, by about 0.29 percentage points. It is quite likely that this is the result of a smaller sample, however. Since GGJ study 26 OECD countries, their regression most likely understates the events that took place during the crisis while, while they are not controlled for. The effect of the markup in combination with the individual components in column (4) is virtually identical to GGJ, however. Comparing my result

to the -1.62 percentage points in GGJ, they differ only on the margin. Similarly to GGJ, I also find that markets do not take economic fundamentals fully into account. However, the significance of the individual factors differs notably from those in GGJs paper. While the two insignificant factors in table 6.1 – inflation and the lagged yield spread – are highly significant in GGJ, four out of the six significant factors of mine they had previously found to be insignificance. My results thus suggest that markets take economic fundamentals more closely into account than previously suggested. Another notable difference between my results and GGJ's, is the high coefficient of the residual term. In their previous estimation, the effect of the residual did not exceed 0.33 percentage points, which is substantially smaller to my results. This could potentially be the result of the reduced sample as well, however.

	(1)		(2)		(3)		(4)	
	Coefficient	P-Value	Coefficient	P-Value	Coefficient	P-Value	Coefficient	P-Value
GDP per capita							1.74*	0.05
GDP growth							-0.69***	0.00
Primary balance							0.18**	0.03
Inflation							-0.11	0.68
Lag. yield spread							0.06	0.74
Gross debt							0.04***	0.00
Crisis							-1.91***	0.00
GIPS							3.02***	0.00
Rating	-0.63***	0.00						
Fundamentals $\hat{R}^E$			-0.57***	0.00	-0.57***	0.00		
Markup $\hat{R}^{P*C}$					-1.64***	0.00	-1.64***	0.00
Residual $\hat{\epsilon}$			-1.42***	0.00	-1.38***	0.00	-1.38***	0.00
Constant	16.58***	0.00	15.53***	0.00	15.53***	0.00	-15.60*	0.09
Observations	164		139		139		139	
R-squared	0.43		0.54		0.55		0.60	
Number of countries	11		11		11		11	

Table 6.1 **The effect of decomposed ratings on yield spreads according to GGJ**

With regard to the extension using Rule of Law, the results did not turn out as expect. Given that the markup itself was reduced through an extended specification, I would have expected the effect of the markup on spreads to be reduced as well. As evident from table 6.2, however, the opposite is the case. Controlling for a country's Rule of Law, among others, the markup's ceteris paribus effect on yield spreads increases from -1.64 percentage points to -2.12 and -2.05 percentage points.

I see two possible explanations for this. On the one hand, the previously untested specification of Rule of Law – assuming a parabolic functional form – could be wrong. A misspecification could lead to biases in the model's coefficients, which then potentially caused the effect of the markup to be overstated. On the other hand, the functional form could be correct but misrepresented in the current specification due to e.g. further omitted variable bias. This too could lead to incorrect effects the model considered here. Either way, the results presented in table 6.2 do not suggest in any way that GGJ's findings, reproduced in table 6.1 are incorrect.

	(1)		(2)		(3)	
	Coefficient	P-Value	Coefficient	P-Value	Coefficient	P-Value
GDP per capita					2.22*	0.10
GDP growth					-0.63***	0.00
Inflation					-0.14	0.61
Gross debt					0.06***	0.00
Primary balance					0.24**	0.01
Trade openness					-0.58	0.53
Current account					-0.10	0.22
Population					0.02	0.95
Lag. yield spread					0.08	0.65
Rule of law					-1.00	0.87
Law squared					1.26	0.54
Crisis					-1.63***	0.00
GIPS					3.36***	0.00
Fundamentals $\hat{R}_{i,t}^{E+P}$	-0.54***	0.00	-0.57***	0.00		
Markup $\hat{R}^{P*C}$			-2.12***	0.01	-2.05***	0.00
Residual $\hat{\epsilon}$	-1.59***	0.00	-1.69***	0.00	-1.69***	0.00
Constant	14.90***	0.00	15.40***	0.00	-22.98*	0.10
Observations	130		130		130	
R-squared	0.64		0.64		0.70	
Number of counties	11		11		11	

Table 6.2 **The effect of decomposed ratings on yield spreads with Rule of Law**

The results in table 6.3, on the other hand, are in line with my expectations. As a result of controlling for just four additional explanatory variables including Government Effectiveness, the markup's effect on yield spreads is reduced to the extent that it turns insignificant. In this case, the previous reduction in the markup of the agencies eliminated the effect previously found by GGJ, which suggested that unexplained markups of the rating agencies could influence yield spreads. If one was to disregard the conflicting results in the previous table, e.g. by concluding that the assumptions regarding the functional form of Rule of Law are wrong, this could be considered conclusive evidence for a less active role by the CRAs. As only the coefficients of the fundamentals and residual components are significant in column (2), the markup did evidently not affect yield spreads and thus not precipitate events in the crisis.

	(1)		(2)		(3)	
	Coefficient	P-Value	Coefficient	P-Value	Coefficient	P-Value
GDP per capita					4.73***	0.00
GDP growth					-0.65***	0.00
Inflation					-0.17	0.53
Gross debt					0.06***	0.00
Primary balance					0.20**	0.02
Trade openness					-2.31***	0.01
Current account					0.00	0.95
Population					-0.37	0.12
Lag. yield spread					0.33	0.13
Government effectiveness					0.52	0.62
Crisis					-1.55***	0.00
GIPS					3.84***	0.00
Fundamentals $\hat{R}_{i,t}^{E+P}$	-0.68***	0.00	-0.68***	0.00		
Markup $\hat{R}^{P*C}$			-0.55	0.55	-0.55	0.50
Residual $\hat{\epsilon}$	-1.90***	0.00	-1.86***	0.00	-1.86***	0.00
Constant	17.82***	0.00	17.82***	0.00	-41.18***	0.00
Observations	153		139		139	
R-squared	0.64		0.64		0.70	
Number of countries	11		11		11	

Table 6.3 **The effect of decomposed ratings on yield spreads with Government Effectiveness**

Overall, the evidence is not conclusive, however. Given that the two specifications yield opposite results, the previous findings of GGJ can neither be confirmed nor refuted. Even though the results using Government Effectiveness strongly suggest that GGJ's findings may be inaccurate, I assert that the conflicting results using Rule of Law should not be ignored. Given my contradictory results, the results of GGJ should be considered valid due to the distinct lack of evidence to disprove them. Further research, e.g. addressing the validity of my selected functional form of Rule of Law would be needed in order for the results in table 6.3 to be considered conclusive.

7 Conclusion

This paper revisited the debate on credit rating agencies' role in the Euro crisis. Whereas a previous study by Gärtner et al. (2011, hitherto GGJ) reported evidence of a significant rating markup placed specifically on the GIPS group of countries during the crisis years, I find that a lack of explanatory variables has lead to an overestimation. While the markup did in fact appear robust in all but one case, its size was shown to be somewhat lower than previously estimated. The effect was altered by the addition of just four variables, one of which to reflect differences in institutional quality across Eurozone countries.

An analysis on agency-level has shown considerable differences in the rating models of the Big Three. Apart from some differences in the weights applied to determinant factors of credit ratings, the agencies were shown to have used markups on GIPS countries to a differential extent. Considering a purely economic set of rating determinants, Fitch appears to use the lowest markup on GIPS countries and S&P the highest. The inclusion of an institutional factor reduced the markup of Moody's the most to the extent that it turned insignificant in one out of two cases. S&P's markup appeared to be most

robust to an extension of the employed model and continued to rank highest in terms of the markup used.

Looking at the institutional factors considered, countries were shown to derive the highest ceteris paribus improvement in credit ratings by changing their perceived rule of law. Improvements in the perceived effectiveness of governance are important for countries with a relatively low average rank in the index, such as Italy or Greece, but less so for higher ranking countries, such as Spain. While the exercise is inherently hypothetical in nature, it does suggest that reforms in the considered areas can improve a country's perceived creditworthiness markedly. Further research could address this result in more detail, by inspecting the individual components of the employed WGI indexes. Depending on the weights applied to their individual components, some areas for reform may be more conducive with regard to improving credit ratings than others.

A critical finding of GGJ remains untouched. Using Granger-Causality tests, the authors showed that credit rating not only have a significant impact on yield spreads, but that the reverse is true as well: government bond spreads have had a significant impact on credit ratings around the window of the Euro crisis. This, does indeed open the possibility for self-fulfilling prophecies, were even healthy countries could be trapped in a downward spiral of rating downgrades and yield spread increases. With regard to this, one may consider the case of Spain, whose credit rating deteriorated from an unanimous triple-A rating in 2007, to a BBB- by two of the Big Three in 2012. In just five years, Spain's rating hence dropped by eight to nine notches across agencies.

The authors found further evidence of a significant effect of the rating markup on yield spreads, suggesting that rating agencies may have played an active role in the course of the Euro crisis. A reinvestigation could neither confirm nor refute these findings , as their results were too ambivalent to be conclusive. Whereas a specification using WGI's Government Effectiveness indicator did indeed remove the effect of the markup, the reverse occurred when controlling for Rule of Law instead. While I suspected that an extension of GGJ's model would reduce the markup, which would in turn reduce its effect on yield spreads, the results with regard to the latter are too inconclusive to make a reliable inference. While I can thus neither confirm nor refute the final results of GGJ, the analysis has brought to light several nuances with regard to the determinants of sovereign ratings and the agencies role in the Euro crisis.

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A Detailed robustness checks

This section considers robustness checks of each model specification in the main body of the paper. The following list contains the table captions, table number and page number of each model used in this paper.

List of models

Regarding the dataset and specification in consider it viable to assess the robustness of my own specification – essentially a pooled OLS with PCSE parameter estimates – against a country fixed effect model. The models' relative efficiency is assessed using Hausman tests. Table A.1 compares the model in table 5.2 to a fixed effect model. Hausman tests select a country with fixed effects in case of models (1) and (2) as well as (3) and (4), but not in the case of models the remaining specifications. Table A.2 depicts fixed effect versus PCSE models of GGJ's specification across rating agencies, i.e. models (1), (3) and (5) in tables 5.3 and 5.4. In all three cases, Hausman tests select the model with fixed effects as the consistent and more efficient specification. Table A.3 compares a PCSE model with a country fixed effect model for my own specification, using Rule of Law across agencies, i.e. model (2), (4) and (6) in table 5.3. Similarly, table A.4 compares my specification using Government Effectiveness, which corresponds to table 5.4. In all cases, Hausman tests select the PCSE parameter estimates over a model with country fixed effects.

With regard to the models in section 6, a comparison with country fixed effects would be largely irrelevant, since (a) the decomposition took place with PCSE models, making it questionable why fixed

effects should be necessary in the ensuing model, (b) GGJ did not consider country fixed effects, which is why they would not be comparable, and (c) because previous literature did neither find evidence of a necessity for using a country FE model when studying the considered relationship. A cursory comparison of FE models with the PCSE estimators using Hausman tests also suggested strongly to use the latter. Given the aforementioned reasons, I decided not to include the extensive tables since their results are to be anticipated and do thus not add any value to this paper.

	(1)		(2)		(3)		(4)		(5)		(6)		(7)		(8)	
	Coefficient	P-value	Coefficient	P-value	Coefficient	P-value	Coefficient	P-value	Coefficient	P-value	Coefficient	P-value	Coefficient	P-value	Coefficient	P-value
GDP growth	-4.44	0.60	5.96	0.69	9.32	0.29	8.17	0.63	4.37	0.55	-5.34	0.75	9.07	0.22	5.29	0.72
GDP per capita	1.35***	0.01	0.71	0.79	0.11	0.83	-1.17	0.67	0.18	0.80	-3.37	0.29	-0.48	0.51	-4.34	0.24
Primary balance	0.24***	0.00	0.03	0.77	0.01	0.89	0.02	0.80	0.12***	0.01	0.11	0.28	0.07	0.13	0.07	0.45
Gross debt	-0.05***	0.00	-0.09***	0.00	-0.06***	0.00	-0.09***	0.00	-0.05***	0.00	-0.08**	0.02	-0.06***	0.00	-0.08**	0.01
Inflation	-0.45***	0.00	-0.12	0.66	-0.24	0.15	-0.34	0.26	-0.09	0.53	-0.20	0.36	-0.17	0.27	-0.18	0.41
Lag. yield spread	-0.55***	0.00	-0.34**	0.01	-0.36***	0.00	-0.30**	0.02	-0.44***	0.00	-0.44***	0.01	-0.49***	0.00	-0.50***	0.00
Crisis					0.35	0.17	0.87*	0.08	0.33	0.13	0.41	0.43	0.39*	0.09	0.61	0.21
GIPS					-1.39***	0.00			-1.93***	0.00			-2.04***	0.00		
GIPS∗Crisis					-2.57***	0.00	-2.06***	0.00	-1.40**	0.02	-0.97	0.10	-1.59***	0.01	-1.27**	0.02
Trade openness									0.93**	0.04	2.94	0.14	1.83***	0.00	2.95	0.16
Current account									-0.13***	0.00	-0.11**	0.04	-0.14***	0.00	-0.08	0.13
Population									0.46***	0.00	-0.95	0.89	0.72***	0.00	7.28	0.31
Rule of law									8.97***	0.00	10.55*	0.09				
Law squared									-2.82***	0.00	-3.03	0.14				
Government effectiveness													0.87*	0.08	1.38*	0.08
Constant	12.92**	0.01	20.54	0.45	25.03***	0.00	39.25	0.17	8.80	0.25	65.92	0.52	16.74**	0.03	-53.56	0.61
Country fixed effect	NO		YES		NO		YES		NO		YES		NO		YES	
Observations	153		153		139		139		130		130		130		130	
R-squared	0.85		0.82		0.90		0.86		0.92		0.87		0.92		0.87	
Number of countries	11		11		11		11		11		11		11		11	

Note: The dependent variable is the average rating between the three agencies, i.e. $\frac{1}{3}\sum_{a=1}^{3} r_{a,i,t}$.
Models without fixed effect are estimated using PCSE parameter estimates. Models with fixed-effect use robust standard errors.
*** p<0.01, ** p<0.05, * p<0.1

Table A.1 **Robustnes check of model in table 5.2**

	Fitch				S&P				Moody's			
	(1)		(2)		(3)		(4)		(5)		(6)	
	Coefficient	P-Value	Coefficient	P-Value	Coefficient	P-Value	Coefficient	P-Value	Coefficient	P-Value	Coefficient	P-Value
GDP growth	15.25*	0.06	14.53*	0.05	3.63	0.68	4.72	0.54	9.29	0.39	5.41	0.57
GDP per capita	-0.28	0.56	-1.07	0.58	1.08**	0.02	-0.41	0.84	-0.41	0.52	-2.19	0.38
Primary balance	-0.05	0.25	-0.02	0.65	0.00	0.97	-0.01	0.91	0.05	0.34	0.09	0.15
Gross debt	-0.06***	0.00	-0.08***	0.00	-0.05***	0.00	-0.08***	0.00	-0.06***	0.00	-0.10***	0.00
Inflation	-0.15	0.31	-0.21	0.15	-0.36**	0.03	-0.43***	0.01	-0.19	0.33	-0.38**	0.04
Lag. yield spread	-0.30***	0.00	-0.25***	0.00	-0.27***	0.00	-0.20***	0.00	-0.52***	0.00	-0.46***	0.00
Crisis	0.66***	0.01	1.04***	0.00	0.14	0.58	0.66**	0.03	0.22	0.47	0.92**	0.01
GIPS	-1.75***	0.00			-1.03**	0.02			-1.38**	0.01		
GIPS∗Crisis	-2.31***	0.00	-1.97***	0.00	-3.04***	0.00	-2.56***	0.00	-2.48***	0.00	-1.67***	0.01
Constant	28.85***	0.00	37.17*	0.06	14.77***	0.00	31.16	0.13	30.80***	0.00	51.05**	0.05
Country fixed effect	NO		YES		NO		YES		NO		YES	
Observations	139		139		140		140		140		140	
R-squared	0.90		0.85		0.90		0.85		0.89		0.86	
Number of countries	11		11		11		11		11		11	

Note: Models without fixed effect are estimated using PCSE parameter estimates. Models with fixed-effect use robust standard errors.
*** p<0.01, ** p<0.05, * p<0.1

Table A.2 **Robustnes check of GGJ specification across agencies**

	Fitch				S&P				Moody's			
	(1)		(2)		(3)		(4)		(5)		(6)	
	Coefficient	P-Value	Coefficient	P-Value	Coefficient	P-Value	Coefficient	P-Value	Coefficient	P-Value	Coefficient	P-Value
GDP growth	10.17	0.13	3.76	0.79	-1.24	0.87	-8.67	0.62	4.20	0.64	-11.10	0.57
GDP per capita	-0.39	0.59	-4.16	0.13	0.90	0.17	-1.79	0.51	0.03	0.97	-4.17	0.34
Primary balance	0.05	0.21	0.05	0.50	0.11**	0.01	0.09	0.47	0.19***	0.00	0.21	0.13
Gross debt	-0.06***	0.00	-0.08***	0.00	-0.05***	0.00	-0.08**	0.03	-0.05***	0.00	-0.08**	0.03
Inflation	0.02	0.91	-0.06	0.76	-0.25*	0.10	-0.35	0.13	-0.04	0.80	-0.18	0.44
Lag. yield spread	-0.38***	0.00	-0.41***	0.00	-0.27***	0.01	-0.24	0.11	-0.65***	0.00	-0.67***	0.00
Crisis	0.59***	0.00	0.58	0.12	0.21	0.35	0.33	0.59	0.18	0.51	0.31	0.61
GIPS	-2.23***	0.00			-1.55***	0.00			-2.02***	0.00		
GIPS∗Crisis	-1.21**	0.03	-1.02*	0.08	-2.06***	0.00	-1.54***	0.01	-0.94	0.17	-0.33	0.65
Trade openness	0.82*	0.05	2.98	0.12	1.00**	0.03	2.86	0.14	0.97*	0.07	3.00	0.23
Current account	-0.11***	0.00	-0.10*	0.10	-0.13***	0.00	-0.10*	0.06	-0.17***	0.00	-0.15**	0.02
Population	0.43***	0.00	1.90	0.80	0.46***	0.00	-1.33	0.80	0.49***	0.00	-3.42	0.69
Rule of law	8.63***	0.00	8.26	0.11	9.59***	0.00	10.53*	0.10	8.70***	0.01	12.87*	0.09
Law squared	-2.72***	0.00	-2.53	0.14	-3.07***	0.00	-2.79	0.19	-2.68**	0.01	-3.78	0.11
Constant	15.40**	0.05	28.09	0.81	0.45	0.95	55.43	0.45	10.54	0.27	114.24	0.34
Country fixed effect	NO		YES		NO		YES		NO		YES	
Observations	130		130		130		130		130		130	
R-squared	0.93		0.87		0.92		0.85		0.91		0.86	
Number of countries	11		11		11		11		10		11	

Note: Models without fixed effect are estimated using PCSE parameter estimates. Models with fixed-effect use robust standard errors.
*** p<0.01, ** p<0.05, * p<0.1

Table A.3 **Robustnes check of Rule of Law extension across agencies**

	Fitch				S&P				Moody's			
	(1)		(2)		(3)		(4)		(5)		(6)	
	Coefficient	P-Value	Coefficient	P-Value	Coefficient	P-Value	Coefficient	P-Value	Coefficient	P-Value	Coefficient	P-Value
GDP growth	14.68**	0.03	11.87	0.37	3.72	0.63	2.25	0.89	8.82	0.33	1.76	0.92
GDP per capita	-1.03	0.16	-4.83*	0.10	0.16	0.82	-2.86	0.41	-0.57	0.53	-5.33	0.29
Primary balance	0.00	0.98	0.03	0.72	0.06	0.19	0.04	0.74	0.14**	0.01	0.16	0.22
Gross debt	-0.07***	0.00	-0.08***	0.00	-0.06***	0.00	-0.09**	0.03	-0.06***	0.00	-0.09**	0.03
Inflation	-0.06	0.68	-0.05	0.82	-0.33**	0.04	-0.34	0.17	-0.11	0.53	-0.16	0.49
Lag. yield spread	-0.43***	0.00	-0.46***	0.00	-0.33***	0.00	-0.31*	0.06	-0.70***	0.00	-0.75***	0.00
Crisis	0.65***	0.00	0.75**	0.03	0.28	0.25	0.51	0.36	0.25	0.37	0.56	0.35
GIPS	-2.34***	0.00			-1.67***	0.00			-2.12***	0.00		
GIPS∗Crisis	-1.39***	0.01	-1.17**	0.03	-2.24***	0.00	-1.96***	0.00	-1.14*	0.09	-0.67	0.28
Trade openness	1.69***	0.00	3.06	0.13	2.00***	0.00	2.81	0.17	1.80***	0.00	2.98	0.26
Current account	-0.12***	0.00	-0.07	0.20	-0.13***	0.00	-0.06	0.25	-0.17***	0.00	-0.10*	0.08
Population	0.68***	0.00	8.59	0.22	0.76***	0.00	6.90	0.32	0.73***	0.00	6.34	0.43
Government effectiveness	0.82*	0.07	1.22	0.11	0.82	0.11	1.26	0.11	0.95*	0.09	1.66*	0.08
Constant	23.06***	0.00	-71.08	0.49	9.11	0.19	-62.23	0.55	18.04*	0.06	-27.37	0.81
Country fixed effect	NO		YES		NO		YES		NO		YES	
Observations	130		130		130		130		130		130	
R-squared	0.93		0.87		0.91		0.84		0.90		0.86	
Number of countries	11		11		11		11		11		11	

Note: Models without fixed effect are estimated using PCSE parameter estimates. Models with fixed-effect use robust standard errors.
*** p<0.01, ** p<0.05, * p<0.1

Table A.4 **Robustnes check of Government Effectiveness extension across agencies**