WHEN A SOVEREIGN SHOULD DEFAULT?

A REAL OPTIONS APPROACH

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Very Preliminar. Please, do not quote.

ABSTRACT

The purpose of this paper is to explore the evolution of the sovereign risk premium in the euro area countries using a real options approach to the analysis of their solvency. Specifically, we will look at the willingness of governments to attend their debt obligations, valuating the options of total or partial default. To estimate the value of these options we apply the Longstaff and Schwartz (2001) algorithm. We also use panel data models to study the robustness of these measures over the evolution of the risk premium of each country.

Key words*:* Default, Risk Premium, Sovereign Debt, Real Options.

JEL Codes: H63; G12; G17

1. INTRODUCTION

The Euro Area sovereign debt crisis has shown the transcendence of a close analysis of the estimation of the risk premium of the government bonds. Traditionally, risk premium has been associated with corporate bonds (e.g., Merton, 1974), the ones considered to be *defaultable,* while government bonds were considered as *risk-free* assets. Nevertheless, the Euro Area crisis has provided clear evidence that government bonds are also risk of default. However, default events in the case of corporations is defined by clear laws, whereas governments can modify laws and have some room for deciding when to default, and also to influence in the consequence of such events since creditors generally possess a limited power over government.

This paper aims to shed some light on some of the observed puzzles on the relationship between the risk premium of sovereign bonds and the solvency of the corresponding States. Thus, we show that the risk premium a country treasury has to pay in the capital markets can be explained in terms of the expected willingness of governments to meet their debt commitments. To evaluate this willingness, we extend the fundamentals and valuation models provided by real options' approach. The rationale for the use of this real options approach is based partially on the analogy between the rights associated with the issuance of corporate debt decision by firms and associated with the issuance of sovereign debt by the states but, at the same time, taking into account the special characteristics of the sovereign debt.

Thus, while in the case of corporate bonds, option models use the effective capacity of a company to meets its debt commitments (Equity Call Models *a la* Merton, 1974), in the case of sovereign bonds, option models must focus on the *willingness* to meet those debt commitments. Indeed, Governments can repudiate the debt alleging the illegitimacy of previous governments to assume the debt, national interest or just their national sovereignty, regardless of their actual ability to meet payments.

This raises a peculiar option-right for the issuer of sovereign debt, that will be exercised when the cost associated to a default are lower than the expected benefits. Thus, government willingness to default at a given time depends on the relationship that exists between the savings derived from the unmet commitments and the associated costs for breaking those commitments. Such costs include those arising from the difficulty of future access to capital markets and/or penalties from international organizations (Eaton and Gersovitz, 1981; Panizza *et al*., 2009; Richmond and Dias, 2008; Borensztein and Panniza, 2009).

Clark and Zenaidi (1999) estimate the value of an (American) option of not attending the outstanding debt of 21 countries. In that paper, Clark and Zenaidi recognize the random character of the future outstanding debt, but not of the costs of default, that are approach by a constant. This assumption allows them to apply an analytical solution of the valuation problem using the algorithm proposed by Dixit and Pyndick (1994) for the valuation of a perpetual American option.

Our research extends the paper of Clark and Zenaidi (1999), relaxing some of the restrictions imposed to the debt repudiation option to better capture the flexibility that governments have to decide when to default. Thus, we allow both the outstanding debt and the cost of defaults to be both stochastic processes, and also including the option of a partial default. In this way, we add the possibility of a debt *haircut*, or *loss given default*, when the government maintains the willingness to pay part (but not all) of the debt. We also focus our paper on the Euro Area countries, where alternative options for the government (i.e.: currency devaluations) are not available.

By generalizing the model, we lose the opportunity to use a closed form solution for the option valuation. Instead of this, we use the algorithm proposed by Longstaff and Schwartz (2001) (LSM) that combines Monte Carlo simulations, Dynamic programming and statistical regression. In this way, we are able to exploit the flexibility of aggregating different stochastic processes (as multiple sources of uncertainty), and overcome the constraints posed in the evaluation of American options through appropriate dynamic programming.

Once we have modeled the value of the sovereign default option, we check the robustness of the estimated values for the Euro Area countries by comparing its value with the market risk premium. In this analysis we also add other variables commonly used in the literature such as the average maturity of the outstanding debt, the short term interest rate, or the credit rating.

The rest of the paper is organized as follows. In the second section, we present the model for the sovereign default option. In the third section we show the estimated values of this option for the euro area countries. The fourth section presents the links between the estimated sovereign default option and the debt risk premium. Finally, section Five resumes the main relevant conclusions of the paper.

2. A MODEL OF THE SOVEREIGN DEFAULT OPTION

As we mentioned in previous section, the government willingness to default in any given moment, depends on the relationship between the expected savings in debt payments from the default and the costs associated with that default. Specifically, in the event of default, the benefit for the government is the reduction in the outstanding debt (that will depend on the magnitude of the debt haircut), less the associate default costs. Using options' terminology, the expected savings would be the *underlying asset*, while the default costs would be called the *strike price*. In this section we are going to model both variables as stochastic processes with special features derived from the nature of sovereign debt.

The Underlying asset: Government savings through debt default

Government savings derived from a debt default include two components: the outstanding level of debt in the moment of the default, and the haircut to the debt (measured as a percentage). Savings will be the product of both variables.

For the debt haircut (*Q*) we are going to consider different scenarios. Thus, for each country we will estimate the sovereign default option to be equal to 25%, 50%, 75% or 100% of the outstanding debt. The result of the Greek sovereign debt restructuring in 2013 is consistence with the existence of partial defaults.

Regarding the outstanding level of sovereign debt (*D*) where the haircut is applied, Governments issue various types of assets (e.g. Treasury notes and bonds) with different maturities and characteristics. In this analysis we assume that the option to stop paying will affect the overall outstanding debt, regardless of the issuance or the specific characteristics of each issue. We consider *D* to be a geometric Brownian motion stochastic process (Figure 1 shows the evolution of this variable for several European countries),

$$dD_t = \alpha D_t dt + \sigma D_t dW_t \qquad [1]$$

Where D_t is the outstanding level of debt; α and σ represents, respectively, the drift and volatility of the model; and dW_t is a Wiener process with mean equal to zero and variance equal to *dt.* Parameters for equation (1) are estimated in Table 1 using a logarithm transformation of the outstanding level of debt (constant prices as 2012).

As can be seen in Table 1, there are significant differences both in the estimated drifts and volatilities across the European countries. There are some with drifts close to 1% or even negative, such as Belgium, Denmark, Sweden and Italy, while other countries like Ireland or Rumania are above 10% and United Kingdom, Portugal and Poland are also above the 7.5%.

Assuming that it is possible to diversify the country credit risk investing in other European country it is possible to discount the outstanding level of debt using a risk free rate (r), resulting into the following risk-adjusted process for the outstanding level of debt,

$$dD_t = (r - \delta) D_t dt + \sigma D_t dW_t \qquad [2]$$

where δ is the *convenience yield* . For the estimation of process (2), we use the relationship between the quarterly variations of the outstanding level of debt and the FTSE Europe Index between 2000 and 2012 (We have also use alternative indexes like Eurostoxx 50 without big differences with the presented estimates). Estimated Values for the returns from the CAPM equations are shown in Table 2 using values of 6% and 1.32% as market risk premium and risk free rate estimated from the interest rates of the 10-year German Bund.

The Strike Price: Costs linked to a sovereign default

Costs linked to a sovereign default are the second key element in the valuation of Government willingness of fulfillment of debt obligations. Estimation of these costs is far from simple. Panizza et al. (2009), enumerates the main costs that a default have on a debtor government:

- *Capital Market Exclusion*. Richmond and Dias (2008) estimate that a defaulting country needed 5.7 year to regain partial access to financial markets (defined as a year with net positive flow to the public sector) and 8.4 for full market access (a year with a net flow to the public sector greater than a 1% of GDP).
- *Cost of Borrowing*. Borensztein and Panniza (2009) estimate in 400bp the spread increase the year after the default, 250bp the second year and around 100bp in the long run (although the later are not statistically significant).
- *Sanctions*. Some authors report a temporary reduction of international trade after a default. Borensztein and Panniza (2009) find a reduction in net trade credit of 0.5pp the year of the default as well as on the following year.
- *Domestic Costs*. A default can reduce output, or in the case of a crisis make already bad output states worse. Borensztein and Panniza (2009) estimates a 1.2pp drop in GDP growth if a government is in default and an extra 1.4 for the first year of the default. Nevertheless, they do not find any lasting effect of the default into the GDP growth. Panizza et al. (2009) gives an estimation of 1.3pp of reduction in GDP growth as a consequence of the default. Sturzenegger (2004) estimates in 0.6 the lost derived from a default and 2.2 in the case of a jointly banking crisis.

In this paper, we focus the costs of default (*C*) on the additional costs associated with the financing of future Government needs. From this perspective, we define two variables: the first is the spread (*s*, or default premium) that the Government would have to offer to new investors after the haircut on previous debt holders, and the second is the new financing needs of the Government after the haircut. In the later case, if the Government has a solid primary surplus, then the cost is lower since the need to issue new debt is lower (reduced to the requirements of refinancing the remaining outstanding debt after the haircut) and creditors have less leverage to ask for repayment of debts. On the former variable, if Government has a primary deficit, then after a haircut, investors would fear of a new default and would ask for a higher return on investment on bonds (although this higher premium might be moderated by a more solid financial position of the Sovereign after the reduction in the outstanding level of debt). This spread should be related to the haircut applied. Thus, the values of *s* range from 1-2% for 50% haircuts, between 2.5-3.5% for 75% haircuts and above 5% when the haircut is of the 100%.

Using above mentioned variables, we define the cost of default as follows,

$$C_t = \frac{1}{r} s_Q \cdot \left[(1 - Q) \cdot D_t + \frac{1}{r} d_t \right] \quad [3]$$

where d_t is the primary deficit, and $(1 - Q) \cdot D_t$ is the remaining debt after the default. Finally s_Q is the spread increase after the haircut.

Therefore, the cost of default is not constant but dependent on the outstanding level of debt after the default. In fact, in some cases where the primary surplus is big enough to attend the repayment of the outstanding debt after the haircut, producing a situation of $C_t < 0$. Figure 2 presents the relationship between primary balance and outstanding debt at 2012Q4. As can be seen, Germany, Italy, Austria, Sweden and specially Norway are in a situation with negative default costs.

Value of the sovereign default option

The value of the sovereign default option for a Government (*V*) would be a nonlinear function of the outstanding debt and the costs associated to the default (4).

$$V_t = Max(0; Q * D_t - C_t) \quad [4]$$

To obtain this value, we simulate both D_t and C_t over next ten years (quarterly data) looking for the optimal moment for a government to default using the LSM algorithm each quarter.

3. THE SOVEREIGN DEFAULT OPTION FOR THE EUROPEAN COUNTRIES

In this section we present the results of applying the model presented in previous section for European countries using Eurostat values to simulate the evolution of each variable, and simulating their future evolution using 300.000 simulated paths (150.000 paths plus their antithetical counterparts). We then analyze backward each quarter to obtain cases where the Government prefers to default rather than attend payments using the LSM algorithm.

Results from the computation of the Sovereign default Option in December 2012 are shown in Table 3 and Figure 3. Each country values are computed separately and presented in different panels both in monetary units and relatively to the outstanding debt. Values have been computed for different haircut (Q) and spread (s) scenarios, although both variables are closely related, assuming that the bigger the haircut, the bigger the spread considered. Therefore, not all combinations of Q and s are considered. Thus, when Q is equal to 25% or 50%, we compute the option value for spreads between 1% and 2%. In those cases, we found that the option has zero value when the spread is close to or above the 1.5%. When Q is equal to 25%, there is no spread scenario that gives value to the option (i.e. spread increase after default should be inferior to 1% to compensate government for the default). For Q equal to 75% we have considered spreads of 2.5% and 3.5%, while for Q equal to 100% we consider spreads ranging from 10% to 50% depending on the country.

As we expected, there is a negative relationship between the spread after the default (s) and the value of the sovereign default option. That is, the higher the penalty that markets give to the sovereign debt for a haircut, the less valuable (and likely) the option that the government have on defaulting its debts. There is also a positive relationship between the size of the haircut (Q) and the value of the option, especially for those countries with higher outstanding debt.

Analyzing country by country, and starting with France (Table 3, panel A), we find that, even with spreads of 50% there is a positive value for the default option with Q equal to 100%. This is a consequence of the very low primary deficit that government have (see Figure 2). This circumstance produces that the strike price is very low compared to the interest savings produced by a default of all the outstanding debt (Q=100%). Nevertheless, we should take into account that the model presented in this paper is a simplification, and other costs not considered in the model could be higher than the value of the default obtained here.

In the case of Ireland (Table 3, panel B), the default value is higher than the one we obtained for France. As it was the case in the later, the value for Q=100% is quite high, although in this case, the cause of this is the growth speed of the outstanding debt, producing considerable savings in case of a complete default.

For Spain (Table 3, Panel C), the scenarios where the default has any value is reduced compared with other countries, and concentrated in those cases where the market penalty to the default is not high. The reason for this outcome is that Spanish Government runs a higher primary deficit, compared to the outstanding debt, increasing the costs of default and reducing the expected benefits.

Belgium (Table 3, Panel D) presents a similar pattern to the one we found for France. There is a positive (and high) option value for Q=100%, even for very high spreads (even with an unlikely 200% spread the option remain valuable), as a consequence of the high level of debt and reduced primary deficit.

Portugal (Table 3, Panel E) is in a similar position to Ireland. The outstanding debt growth rate is elevated, so a complete debt default would potentially help them to keep the level of debt low and compensate the linked costs. Poland also presents a similar pattern (Table 3, Panel J).

In Italy (Table 3, Panel F), by contrast, we find a country with a positive primary surplus. Thus, in the case of a debt default, the Government would not need to finance any new debt issuance, so, strike price is equal to zero. This is also the case of Sweden (Table 3, Panel K), Germany (Table 3, Panel M) and especially in Norway (Table 3, Panel L), where the primary surplus is especially relevant.

Results in the case of Greece (Table 3, Panel G) are not so different from those we found for other countries, in spite of been the only one that has suffered an effective partial default. Finland (Table 3, Panel I) presents values similar to those of Greece, given the evolution of the outstanding debt, and the relationship between primary balance and debt.

In Denmark (Table 3, Panel H), outstanding debt present a negative growth rate producing a number of scenarios where the option has no value, while in those scenario where there is some value this is the lower of all the countries considered. The next country with lower option values is Netherlands (Table 3, Panel N), with similar values of debt and primary deficit.

To summarize these results, in Figure 3 we present the option value for a scenario Q=50% and s=1%, and also for the scenario of Q=75% and s=2.5%. The option value present similar values for most of the countries considered, although the country with a higher value is Ireland, followed by Cyprus, Portugal, Poland and U.K. (all of them with high growth rates for the outstanding debt). By contrast, in Norway the strong primary surplus makes this analysis pointless.

4. RELATIONSHIP BETWEEN THE RISK PREMIUM AND THE OPTION OF SOVEREIGN DEFAULT

In order to analyze the consistency of the computed values for the Sovereign Default Options, we study the relationship between the sovereign risk premium and the option value in this section. To do so, we specify a panel data model where we explain the Sovereign Risk Premium as a function of the default option as well as other control variables.

Investors would take into account when deciding whether to invest or not into a given sovereign bond, the likelihood of a default. In the case of a corporate bond this is related with the economic soundness of the company, but as we have shown, in the case of a sovereign, governments have more room to decide to default even when they are not forced to do so. Therefore, market participants would take into account if a default would compensate a government or if creditors have some leverage to force government repayment of debts. Thus, the higher the option value, the higher will be the risk premium that investors will ask to compensate them for the risk involved in the investment.

Additionally, we include in the model other variables usually considered in the literature, such as the average debt maturity, short-term interest rates and the sovereign credit rating.

The dependent variable will be the Sovereign spread (*RiskPrem*) computed as the difference between the Sovereign 10-year interest rates and the German equivalent (therefore, Germany is excluded from the model). To explain the Sovereign Spread, we used the Option value (*DO*), average debt maturity (*MAT*) and the short term interest rate (*INT*) and Fitch's credit rating (*RATING*)[1]. In the later, we have transform the

[1] Similar results are obtained if we use S&P or Moody's instead.

ratings into a numerical variable where the higher the rating, the higher the value of the variable. The final model is as follows:

$$RiskPrem_{it} = \alpha_i + \beta_1 DO_{it} + \beta_2 MAT_{it} + \beta_3 INT_{it} + \beta_4 RATING_{it} + \beta_Y YEAR_t + \upsilon_{it}$$

where *i* identifies each country, *t* indicates the year of observation (from 2008 to 2013), β_j are the coefficients to be estimated, $YEAR_t$ denotes the set of time dummy to control for year effect and υ_{it} represents the random disturbance for each observation. In order to address the potential endogeneity of some of the variables we use a GMM methodology.

We compute the option value (*DO*) for each country annually from 2008 to 2012 for two different scenarios (Q=50% and *s*=1%; and Q=75% and *s*=2%). Results are presented in Table 4. Hansen and second order correlation tests have the expected values.

Results confirm the positive relationship between the Sovereign spread and the Default option we computed in previous section. This positive relationship is consistent regardless of the scenario we use for the computation of *DO*, and even when we take into account the credit rating.

5. CONCLUSIONS

In the present paper, we have look at a different approach to the determinants of the sovereign spreads in Europe. To do so we have used a methodology based on real options. Thus, this work follows the proposal of Avinash Dixit in the XVI Annual International Real Options Conference (London, 2012) to promote the application of the real options approach to the evaluation of macroeconomic aspects.

The government decision capacity to default on its debt obligations (totally or partially), independently of its economic capacity to attend its debts constitute a key difference between sovereigns and corporations. In this paper we have proposed a model of Sovereign Default Options that take into account the added costs on future debt issuances of a default as well as the savings produced by not paying interests and principal over defaulted debt.

We have estimated the Sovereign Default Option for a set of euro area (and non euro area) countries, for several values of the haircut and spread, in a given date: 2012Q4. The results show that there are significant differences in the values of the option for different countries. Obtained results, although informative, are not complete since other factors might contribute to the costs associated to a default, such as reduction in economic growth. This could be produced by a reduction in foreign investment, spillovers of increases of the interest rates to the whole economy, and losses for domestic investors in sovereign debt, all of them depressing the economy and reducing future tax revenues. These circumstances are not included in the model and advice to further research and improvement on the model.

Nevertheless, despite the drawbacks of the proposed model, the obtained results are able to explain (at least) partially the sovereign spread in the euro area. Although we only use 5 years, we find a positive relationship between the estimated value of the Default Option and the Sovereign Spread. Increase the frequency in the sample, is other of the future lines of improvement of the analysis.

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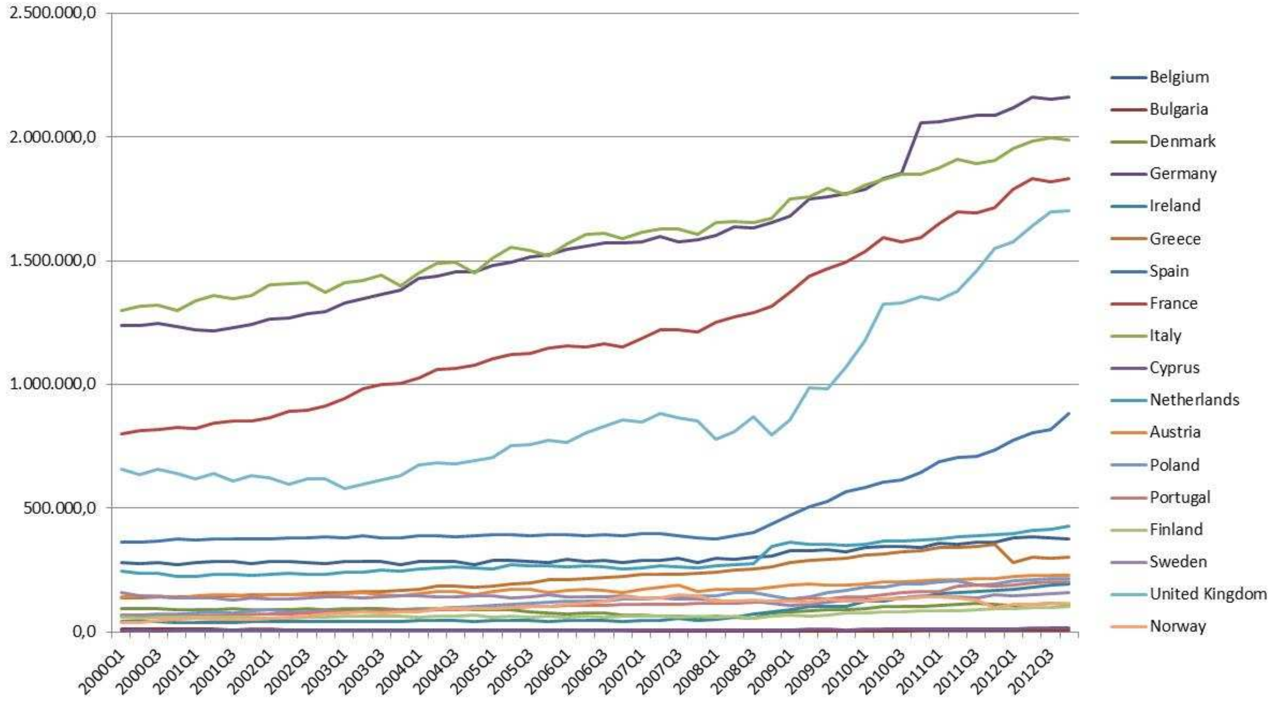
Figure 1. Evolution of the sovereign debt in the Euro Area (and other European countries) at current prices (millions of euros)



Goverment consolidated gross Debt (million Euros) quarterly data obtained from Eurostat, from 2000Q1 to 2012Q4.

Figure 2. Relationship between primary balance (surplus/deficit) and the outstanding sovereign debt

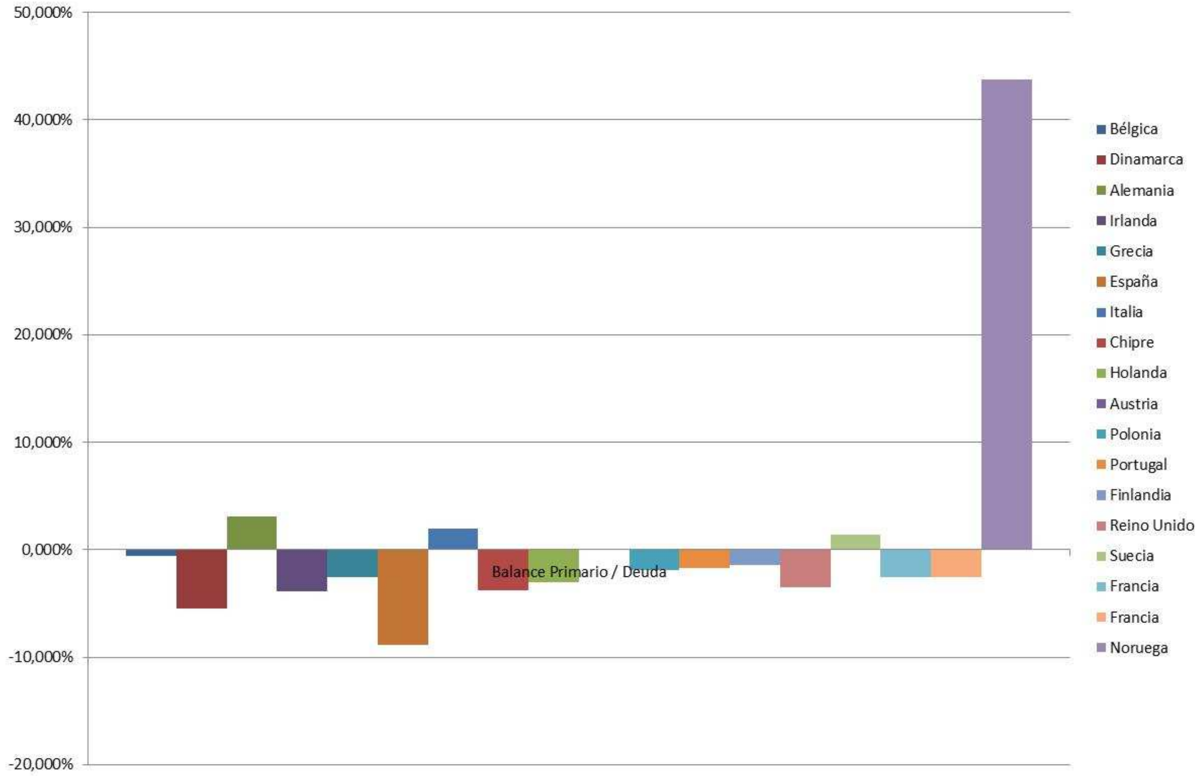


Figure 3. Value of the sovereign default option for euro area countries as a proportion of the outstanding debt.

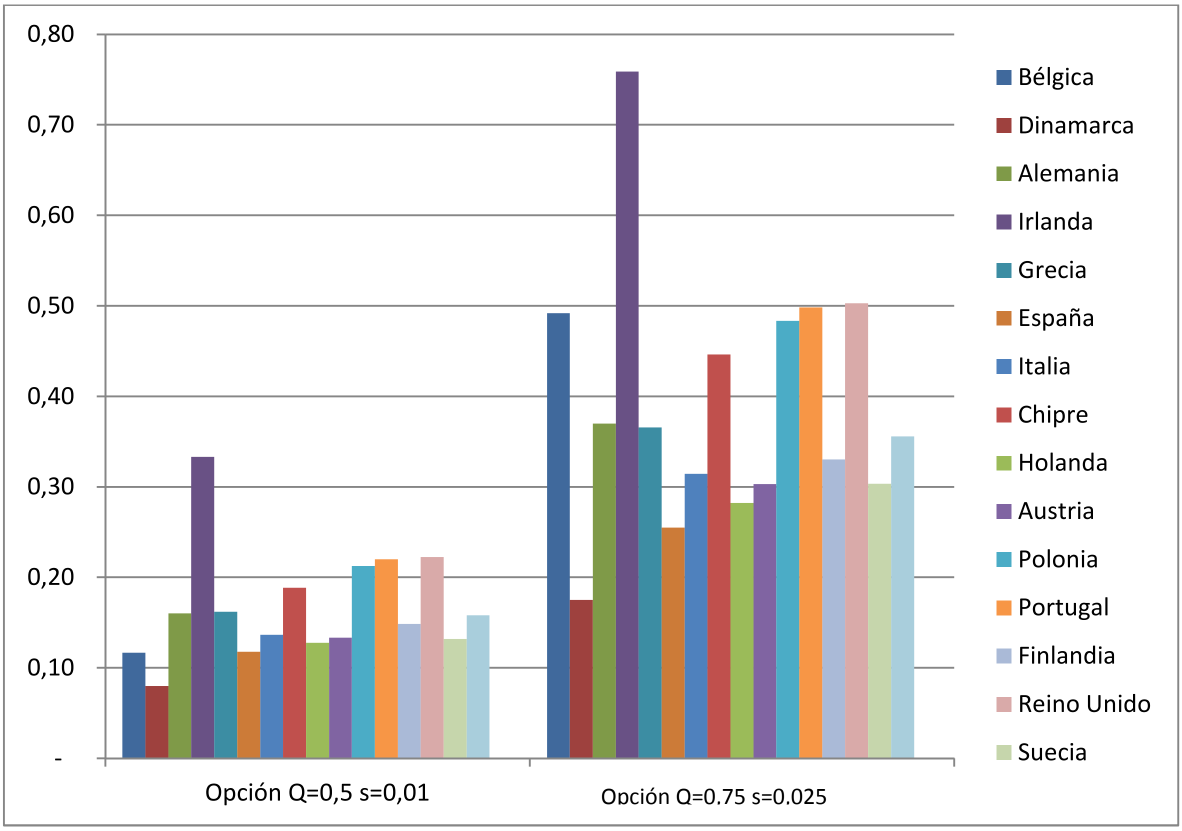


Table 1. Parameter estimates of the Geometric Brownian motion for the outstanding level of debt

	BELGICA	DINAMARCA	ALEMANIA	IRLANDA	GRECIA	ESPAÑA	FRANCIA	ITALIA	CHIPRE
$\hat{\alpha}$	0,0047	-0,0009	0,0345	0,1160	0,0452	0,0492	0,0494	0,0141	0,0632
$\hat{\sigma}$	0,0428	0,1280	0,0338	0,1314	0,0804	0,0652	0,0295	0,0282	0,1127

	HOLANDA	AUSTRIA	POLONIA	PORTUGAL	RUMANIA	FINLANDIA	SUECIA	UK	NORUEGA
$\hat{\alpha}$	0,0289	0,0245	0,0772	0,0771	0,1115	0,0364	-0,0095	0,0812	0,0561
$\hat{\sigma}$	0,0758	0,0810	0,1043	0,0540	0,1650	0,1141	0,0963	0,0946	0,1663

Table 2. Estimated Values for the returns of Sobereign Debt from the CAMP

	Belgium	Denmark	Germany	Ireland	Greece	Spain	France	Italy	Cyprus
μ	1,501%	0,979%	1,401%	0,500%	0,875%	1,162%	1,324%	1,452%	0,508%
	Netherlands	**Austria**	**Poland**	**Portugal**	**Romania**	**Finland**	**Sweden**	**United Kingdom**	**Norway**
μ	1,022%	1,610%	1,610%	1,253%	0,413%	1,124%	1,570%	1,088%	1,988%

Table 3. Sovereign Default option values for several countries (December 2012)

PANEL A: FRANCE

HAIRCUT	SPREAD 1,00%	1,50%	2,50%	3,00%	3,50%	25,00%	50,00%
25%	-						
50%	289,577 (0.16)	-					
75%			652,289 (0.36)	386,673 (0.21)	122,026 (0.07)		
100%						1866,570 (1.02)	1100,220 (0.60)

PANEL B: IRELAND

HAIRCUT	SPREAD 1,00%	1,50%	2,50%	3,00%	3,50%	30,00%	40,00%
25%	-						
50%	64,089 (0.33)	-					
75%			146,030 (0.76)	90,163 (0.47)	32,579 (0.17)		
100%						443,831 (2.31)	379,605 (1.97)

PANEL C: SPAIN

HAIRCUT	SPREAD 1,00%	1,50%	2,50%	3,00%	3,50%	10,00%	15,00%
25%	-						
50%	104,073 (0.12)	-					
75%			225,528 (0.25)	79,460 (0.09)	-		
100%						770,955 (0.87))	512,913 (0.58)

PANEL D: BELGIUM

HAIRCUT	SPREAD 1,00%	1,50%	2,50%	3,00%	3,50%	30,00%	200,00%
25%	-						
50%	43,752 (0.12)	-					
75%			184,502 (0.49)	63,031 (0.17)	26,768 (0.07)		
100%						324,246 (0.86)	53,826 (0.14)

PANEL E: PORTUGAL

HAIRCUT	SPREAD 1,00%	1,50%	2,50%	3,00%	3,50%	25,00%	50,00%
25%	-						
50%	45,080 (0.22)	-					
75%			102,072 (0.50)	63,806 (0.31)	25,820 (0.13)		
100%						331,354 (1.62)	273,488 (1.34)

PANEL F: ITALY

HAIRCUT	SPREAD 1,00%	1,50%	2,50%	3,00%	3,50%	25,00%	50,00%
25%	-						
50%	271,361 (0.14)	-					
75%			625,311 (0.31)	453,949 (0.23)	280,425 (0.14)		
100%						-	-

PANEL G: GREECE

HAIRCUT	SPREAD 1.00%	1.50%	2.50%	3.00%	3.50%	25.00%	50.00%
25%	-						
50%	49,217 (0.16)	-					
75%			111,159 (0.37)	64,950 (0.21)	20,124 (0.07)		
100%						306,522 (1.01)	177,742 (0.58)

PANEL H: DENMARK

HAIRCUT	SPREAD 1.00%	1.50%	2.50%	3.00%	3.50%	25.00%	50.00%
25%	-						
50%	8,882 (0.08)	-					
75%			19,444 (0.18)	6,765 (0.06)	-		
100%						16,559 (0.15)	-

PANEL I: FINLAND

HAIRCUT	SPREAD 1.00%	1.50%	2.50%	3.00%	3.50%	25.00%	50.00%
25%	-						
50%	15,329 (0.15)	-					
75%			34,075 (0.33)	21,166 (0.21)	8,203 (0.08)		
100%						107,351 (1.04)	86,282 (0.84)

PANEL J: POLAND

HAIRCUT	SPREAD 1.00%	1.50%	2.50%	3.00%	3.50%	10.00%	20.00%
25%	-						
50%	46,292 (0.21)	-					
75%			105,194 (0.48)	67,760 (0.35)	26,025 (0.12)		
100%						378,555 (1.74)	366,055 (1.68)

PANEL K: SWEDEN

HAIRCUT	SPREAD 1.00%	1.50%	2.50%	3.00%	3.50%	25.00%	50.00%
25%	-						
50%	20,819 (0.13)	-					
75%			47,942 (0.30)	39,239 (0.25)	22,051 (0.14)		
100%						-	-

PANEL L: NORWAY

HAIRCUT	SPREAD 1.00%	1.50%	2.50%	3.00%	3.50%	25.00%	50.00%
25%	-						
50%	-	-					
75%			-	-	-		
100%						-	-

PANEL M: GERMANY

	SPREAD						
HAIRCUT	1.00%	1.50%	2.50%	3.00%	3.50%	25.00%	50.00%
25%	-						
50%	346,144 (0.16)	-					
75%			798,955 (0.37)	584,550 (0.27)	370,613 (0.17)		
100%						-	-

PANEL N: NETHERLANDS

	SPREAD						
HAIRCUT	1.00%	1.50%	2.50%	3.00%	3.50%	25.00%	50.00%
25%	-						
50%	54,556 (0.13)	-					
75%			120,535 (0.28)	67,682 (0.16)	14,874 (0.03)		
100%						298,535 (0.70)	171,275 (0.40)

PANEL O: AUSTRIA

	SPREAD						
HAIRCUT	1.00%	1.50%	2.50%	3.00%	3.50%	25.00%	50.00%
25%	-						
50%	30,293 (0.13)	-					
75%			68,808 (0.30)	45,708 (0.20)	22,239 (0.10)		
100%						-	-

PANEL P: UNITED KINGDOM

	SPREAD						
HAIRCUT	1.00%	1.50%	2.50%	3.00%	3.50%	25.00%	50.00%
25%	-						
50%	378,273 (0.22)	-					
75%			854,851 (0.50)	508,898 (0.30)	170,328 (0.10)		
100%						2 554,203 (1.50)	-

Table 4. Risk Premium models

	Dependent variable: Sovereign Risk Premium			
	Pannel 1: Sovereign default option (Q=.5 s=0.01)		Pannel 2: Sovereign Default option (Q=0.75 s=0.02)	
	(1)	(2)	(3)	(4)
Intercept	2451.752***	1913.156***	2341.94 ***	1424.846**
	(180.131)	(147.918)	(1.282)	(430.80)
Maturity	-26.221	-56.416***	-23.629	21.846
	(24.006)	(9.172)	(58.995)	(59.185)
Sovereign default option	0.0005***	0.0001*	0.0002**	.00058*
	(0.0001)	(0.0001)	(.00009)	(.0003)
Ranking Fitch	-130.851***	-92.781***	-120.981***	-103.999***
	(5.401)	(9.909)	(11.809)	(11.696)
Short-term interest rate	60.515***	84.047*	43.72**	92.984**
	(60.5152)	(49.552)	(19.064)	(37.885)
Year dummies		Yes		Yes
No. Obs.	68	68	64	64
Wald test	3305.16***	1313.89 ***	2025.27***	636.96***
m_1	-0.99	-1.03	-1.01*	-1.15
m_2	-1.08	-1.08	-1.09	-1.01
p-value m_2 test	0.281	0,281	0.275	0.819
Hansen test	10.08	5.80	4.69	3.96
p-value Hansen test	0.259	0.564	0.196	0.914