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Herding Behaviour among Credit Rating Agencies

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Abstract: *The aim of this paper is to identify the influence degree among the main rating agencies and the other variables that affect rating changes for sub-sovereign entities in Germany, Austria, Belgium, France, Italy and Spain, using a total of 32 territorial entities between 1996 and 2012. Due to the shortage of European sub-sovereigns with more than 2 ratings, we estimated six binary probit regressions as a combination of 3 rating agencies two to two. We conclude that Fitch is the most influential agency on the other two rating agencies, but Standard and Poor's is the leader. There are other relevant factors that explain the probability of change of rating but are less powerful with respect to the change of rating. Among the different specifications, the significant variables are almost always the same. Being a Spanish region, downgrades of country's rating, being a heavily indebted region or a weak budget performance, increase the probability of change of rating. Aging regions and rising unemployment or population growth rate also increase the likelihood of rating change. On the other hand, regions with high density, Level of Intergovernmental transfers to total revenue or Number of notches' changes by Moody's agency given for a specific region in a previous year, reduce the probability of change rating.*

Keywords: Credit Rating Agencies, Probit-regression, European sub-sovereigns entities.

Introduction

Credit Rating agencies were actually created in the beginning of the 20th century although their origin comes from the previous century due to development of the railways in EEUU. Their role has been crucial for the evolution and depth of financial markets due to the minimization of the cost of information for investors when making decisions. In addition, the presence of credit rating agencies helps markets to discipline issuers for the accurate and transparent information they provide.

The rating is a very simple way to identify a specific credit risk through a combination of letters, numbers and symbols. Ratings are divided in two categories: Investment grade (normal investments) and speculative grade (the riskiest investments). Moreover depending on the time horizon, there are short term ratings-for short term debt- and long term ratings-for bonds. Usually ratings are provided through the issuer's request and fees paid for this kind of services are main source for credit rating agencies. However, credit rating agencies may provide an "unsolicited rating" made exclusively through the issuer's public

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information. Poon (2003) showed that Standard & Poor's (S&P) unsolicited ratings are mostly lower than requested.

Nowadays, there are more than 130 rating agencies around the world, although the 3 best-known agencies (Moody's, S&P, and Fitch) have a market share of 94%. Regulation of these agencies has not been homogeneous over time or among countries. This fact is important because the distrust caused by these agencies in Europe after the last crisis could have been avoided with the presence of more regulation. Since 2012, European Authority for Financials Markets (ESMA), has been increasing the control over credit rating agencies and improving the capability to impose sanctions. Eijffinger (2012) assess the role of credit rating agencies during the 2010-11 EU sovereign debt crises. He concluded that rating agencies are lagging behind markets, that their business model is flawed, and that the lack of competition makes the big three agencies have too strong a market position. Cavallo, Powell, and Rigobon (2013) evaluated whether ratings explain a portion of the variation in other macro variables. They also considered a type of horse race between ratings and spreads as to how well they are correlated to other macroeconomic variables using high frequency data.

During the last crisis, the main credit rating agencies were continually downgrading European sovereigns and sub-sovereigns not justified by their own public scoreboard. Taking into account the rating regulatory subordination for investors and rating trigger clauses included within loan contracts, these issuers had many difficulties to tap capital markets. Some sub-sovereigns without access to financial markets were rescued by the respective central government.

Camanho, Deb, and Liu (2012) shows that competition among the credit rating agencies might inflate the ratings. Mariano (2012) shows that this appears even without conflicts of interest. This concern implicated that after the crisis of 2007, new rules were applied in an attempt to eliminate conflicts of interest and improve the assignment of ratings. In addition, the agencies declared that they are not pro-cyclical, that is, ratings do not fluctuate as a function of the economic cycle, although some empirical studies have demonstrated the opposite.

The literature about ratings has attempted to link the effect of ratings with the spread (Reisen & Von Maltzan, 1999), to verify the independence of the rating agencies' decisions (Gande & Parsley, 2014), to find spill-over effects (Rigobon, 2002), to analyze the existence of the pro-cyclicality (Gaillard, 2014), or to obtain the rating's determinants (Cheung, 1996; Afonso, 2003; Venneri, 2009).

In this context, the objective of this paper is to identify the degree of influence of the decision of one agency on another and who is the leader, and the other variables which affect rating change, being aware of the scarcity of this literature. There are few papers and focus on the securitization and sovereigns.

On the sovereign side about determinants of ratings, and in the context of developing countries, (Mulder & Monfort, 2000), using a sample of 20 emerging countries in the period 1994-1999, show that credit ratings have a degree of inertia and follow a random walk in an error correction model, and the lagged variables of debt related to export and growth of exports contribute to current ratings. (Mulder & Perrelli, 2001), using panel data for 25 countries, including emerging markets, find that in the period 1991-1999, the investment

level related to the GDP is the only significant factor. Afonso (2003) concludes that significant variables include GDP per capita for developed countries, and that external debt plays an important role in developing countries. Subsequently, Afonso, Gomes, and Rother (2009) use an ordered multinomial probit model with panel data from 66 countries in the period 1996-2005 to conclude that the significant variables are GDP per capita, GDP growth, debt, fiscal result, external debt, unemployment rate, inflation, current account balance, reserves, government efficacy and a default experience. Mellios and Paget-Blanc (2006) use an ordered multinomial logit model with data from 86 countries from Moody's, S&P and Fitch to conclude that the variations in ratings are due to GDP per capita, GDP growth, inflation, the exchange rate, history of defaults, the corruption index, and the quality of government management. More recently, Afonso and Gomes (2011) studied the determinants of global sovereign debt ratings, and their results indicate a good performance of the estimated models across agencies and time. Furthermore, Afonso, Gomes, and Rother (2011) have concluded that fiscal imbalances are reflected in the sovereign debt notations. In the European context, Afonso, Furceri, and Gomes (2012) use daily data on EU sovereign bond yields and CDS spreads to conduct an event study analysis on the reaction of government yield spreads before and after announcements from rating agencies. Their results show significant responses of government bond yield spreads to changes in rating notations and outlook, particularly in the case of negative announcements. Gaillard (2014) provides an analysis of sovereign ratings, including the recent default of Greece and concludes that credit ratings are more stable than market-based indicators, which means that their pro-cyclical role could have been much sharper. In the same year, Afonso, Gomes, and Taamouti (2014) examined EU countries from 1995 until 2011; they used sovereign ratings established by the rating agencies S&P, Moody's and Fitch concluding that rating upgrades do not have any significant effect on volatility, but sovereign downgrades increase bonds volatility after two lags.

On the sub-sovereign side, the few articles about ratings have been oriented to find out their determinants in countries such as Canada, Italy or Spain. Outside the US, (Cheung, 1996) uses an ordered multinomial probit model for nine Canadian provinces between 1969 and 1995 to conclude that the debt/GDP ratio, employment rate, provincial GDP, federal transfers, and provincial revenues can significantly explain the variations in ratings. Sabourin et al. (1999) employs a logit model for the Canadian provinces and is able to predict 63% of the ratings by S&P for the period 1976-1995. Subsequently, García-Romo, Ibarra-Salazar, and Sotres-Cervantes (2005) implement ordered multinomial logit and probit models with the Fitch rating as the dependent variable for Mexican states for the period 2000-2003; they conclude that debt/GDP, current expenditures, and primary expenditures negatively affect the rating and that budgetary savings, investment expenditures, and variables representing the social and welfare situation positively affect the rating. Venneri (2009, 2010) conducts a study of risk valuation for local Italian entities in the period 2004-2008 using an ordered multinomial probit model with data from Moody's, S&P and Fitch. This paper intends to continue this line of research by performing a study of sub-sovereign entities at European level. More recently, (Jannone-Bellot, Marti-Selva, & Garcia-Menendez, 2017), have published an article about the determinants of the sub-sovereign ratings for six European countries.

Consequences to the economy policy are relevant. The instability originated by the individual decision, not justified through its own scoreboard, to other rating agencies and the later domino effect generating high risk of sub-sovereign default, is a real problem for central governments. Governments have to deal with the disconnection between ratings and investment decision linked to the regulation and the promotion of the competitiveness in the sector. To study this degree of herding, it is used a binary probit model for sub-sovereign governments from six countries (Austria, Belgium, France, Germany, Italy and Spain) rated by Moody's, S&P and Fitch. Taking into account the scarcity of sub-sovereign governments with 3 ratings, the agency behavior are studied in pairs. Based on available information on the ratings of sub-sovereign governments, regions rated by two rating agencies are selected for a period in which there were two ratings. Through the application of a binary probit model in which the dependent variable takes the value of 1 if there is a change in rating and 0 if it remains unchanged.

The rest of the study is structured as follows. In Section 2, the business model is explained. In Section 3, the manner in which the agencies assign ratings to various agents is detailed. Section 4 gives the credit ratings for sub-sovereign governments in Europe. In Section 5, the empirical specification of the degree of influence based on the probit model is detailed. Section 6 explains the results of the estimates from previous models. In Section 7, it is seen who are leaders and followers in rating changes. Finally, in Section 8 the conclusions are summarized.

Business Model of Rating Agencies and Conflicts of Interest

Hau, Langfield, and Marques-Ibanez (2013) arrive at the conclusion that large banks and other institutions that bring more business are favoured in the assignment of ratings. There is also the possibility the threat that a rating agency may give a lower rating "unsolicited" because it does not charge any fees, suppose an incentive for it to solicit a rating.

The operative annual fees for a rating by Moody's vary from $33,000 to $275,000 per issue, which could incentivise a delay in publishing downgrades when these are very harmful to the issuer, especially when it is a question of moving from investment grade to speculative grade. Covitz and Harrison (2003) conclude that rating agencies allow themselves to be influenced by reputation incentives. Bar-Isaac and Shapiro (2011) assert that the evaluation of creditworthiness depends on the moment in the economic cycle, that is, it decreases in boom periods and improves in periods of recession.

In general, competition between agencies is considered positive, but this may lead to ratings of lower quality, either because the issuer chooses the agency that gives it a better rating or due to the effect of competition itself when it is very fierce (Bolton, Freixas, & Shapiro, 2012). Additionally, the fact that the agencies are companies listed on the stock exchange and the existence of bonuses for their employees presuppose a large incentive for obtaining results and maximizing fees received. The existence of important stockholders in the agencies that simultaneously have business in the investment field can potentially lead to a conflict of interest when there is not a clear inability to interfere in the decisions of

the agency. After uncovering the responsibility of rating agencies in the financial crisis of 2007, the agencies have attempted to apply certain new internal rules that could minimize conflicts of interest: first, a total separation between analysts and the business side; and second, the ban on receiving gifts or invitations to dinner, establishing that analysts can only accept a sandwich that costs a maximum of a few dollars. However, that the largest share of revenues should come from the issuers themselves is not seen as a root issue.

Pagano and Volpin (2010) asserts that the best model is one in which investors pay for ratings and that the agencies should have free and complete access to all information, but the free-rider problems could affect negatively the coverage and quality of the evaluations. Ponce (2009) proposes an alternate model called the "Platform-pays model", which consists of a system of compensation and liquidation with prudential supervision. The system directly assigns the rating agency based on experience and results, and the issuer pays at the beginning of the process. This model solves the problem of oligopoly. Another possibility, according to Coffee (2010), is that the fee charged by the agency is deposited into an account beyond its control that can only be charged at the expiration of the bond if the rating was appropriate a posteriori; another alternative is payment of the fee using bonds from rated bond issuers.

Other alternative, are the public credit rating agencies, either international or national (Medvedev & Fennell, 2011). The advantage is the free or low fees for the issuers/investors, but the disadvantages are the lack of reputation in the initial stages and the political pressures on them.

White et al. (2010) proposes to unlink the credit rating agencies from the financial regulation, allowing investors the use of so many sources of information as a better route for public policy, given the bad consequences of the entailment of the credit rating agencies in financial regulation.

Methodology of Rating Agencies and Pro-Cyclicality

Rating agencies use various methodologies as a function of the sector to which the entity submitted for rating belongs. Evaluating a sovereign or a sub-sovereign is not the same as evaluating an insurance company or a bank or evaluating an industrial company in comparison to a structured operation. Moreover, each agency has different analysis teams not only according to geographical areas but also according to business sectors.

In the case of sub-sovereign or regional governments in Europe, the combined variables that are taken into account for assigning a particular rating are the following: political and social stability; the strength of the institutional framework, that is, the relationship between the central government and the sub-central governments with respect to institutional support and controls; economic variables, such as GDP real growth rate, unemployment rate, per capita revenues, sectorial diversification, productivity, and infrastructure; demographic variables, such as the ageing of the population and population growth; and budget and financial variables, such as the evolution of the deficit, outstanding debt, fiscal flexibility, fiscal pressure, the degree of financial autonomy or debt burden, liquidity, access to markets, and financial management.

Until 2006 for Moody's and 2010 for S&P, the determination or allocation of ratings was a real black box. The variables they used were more or less known, but the methodology and the weighting of the variables used were not. The rating was decided by a committee of the agency itself that evaluated the report from the analysts. Based on ratings given to the sub-sovereigns analyzed, one intuitively knew the biases of the various agencies: Moody's appeared to assign more value to budgetary and financial aspects than to the remaining variables; S&P was biased towards giving more value to economic variables; and Fitch placed much more emphasis on institutional strength and the support to the regions by the central government. In fact, Al-Sakka and Gwilym (2009) show that the differences between ratings assigned by the agencies were more frequent for sovereigns than for companies.

In the case of Moody's, systematic differences between the scoring result and the committee decision have been quite evident, and at least in the case of Spanish regions, negatively so. That is, the objective rating has been much better than the rating finally assigned by the committee. The explanation given has been that the committee can independently decide on a rating that is very different from the purely objective analysis and that the agency considers other variables not included in the scoring. For example, in the case of the Generalitat Valenciana, there were differences of 4 and 5 notches between the objective rating and that decided by the committee.

For instance, in the case of S&P, the scoring comprises eight blocks: Institutional Framework, Economy, Financial Management, Budgetary Flexibility, Budgetary Performance, Liquidity, Financial Burden, and Budgetary Commitments. For each block, a value with a maximum of 1 (the best) and a minimum of 5 (the worst) is assigned. The matrix combination between the Institutional Frame and the average of the remaining blocks gives the rating result. The result can occasionally vary due to the greater or lesser extraordinary support by the state for a sub-sovereign or in the case of a serious weakness in liquidity or financial management.

Regarding whether the agencies are procyclical and generate instability in ratings because the ratings fluctuate as a function of the economic cycle, in theory, they are not because they declare that they are not procyclical. Historically, the methodology applied ("through the cycle") is supposed to estimate the probability of default over the long term, that is, between 5 and 10 years; thus, they are not affected by short-term effects. This methodology differs from that of Merton ("point-in-time") and from that applied to banking entities, that is, internal ratings-based (IRB), which would be at an intermediate point. Nowadays, both Moody's and S&P use an explicit scoring system as a guide for assigning ratings; thus, for these agencies, the applied methodology would be halfway between the traditional ("through the cycle") method and the IRB method of banks.

Nonetheless, some authors show that, agencies that assign ratings are procyclical. Cantor and Packer (1996); Ferri, Liu, and Stiglitz (1999); Mora (2006) hold that agencies are already procyclical because, in their studies on Asian countries, downgrades in ratings have been excessive in relation to the model. Nickell, Perraudin, and Varotto (2000) justify a certain level of procyclicality because, in using the transition matrices that rating agencies publish, they reflect more downgrades in periods of recession and more increases in periods of expansion. Bangia, Diebold, Kronimus, Schagen, and Schuermann

(2002) justify the existence of procyclicality in rating changes, which occur more often in recessions and less often in situations of economic expansion. There is also a procyclical effect of rating agencies without changing their methodology due to investors' expectations. The rating agency prudently adjusts the rating to make it fit this view, independent of its own quantitative and qualitative evaluation.

However, Amato and Furfine (2004) indicate that agencies change ratings very rarely, and thus, they are not modified due to small changes in the short term. They also show that, when agencies make a change, they overreact, being positively correlated with the state of the economy. Altman and Kao (1992) conclude that there is a serial correlation between rating changes to the extent that a change in rating implies a high probability of new additional downgrades.

Lugo, Croce, and Faff (2015) study the influence grade among the credit rating agencies in the rating actions and who are the leader and the followers. They conclude the leader is Fitch, but Moody's and S&P influence more on Fitch than otherwise. Their conclusion is compatible with the economic literature in which reputational concerns are higher for the credit rating agencies with a lower reputational capital.

Methodological changes introduced by the agencies, in addition to establishing scores as the guide for assigning ratings, have tended towards more ongoing supervision and greater communication and explanation of their methodology on the part of the agencies, including their reasons for changes in ratings. In addition, greater weight in determining ratings has been given to the risk of liquidity and thus to the real ability to access markets and the need for financing over twelve months.

One method of verifying posteriori whether ratings were stable during a certain period of time and whether they were appropriate is the transition matrices that agencies annually publish either globally or by sector. These matrices, which have been in existence since 1975, attempt to analyse the variations in the initial rating over time by percentage. Table 1 shows the transition matrix of S&P for sub-sovereign governments in the period 1975-2008.

Table 1
Transition matrix of S&P for sub-sovereign governments in the period 1975-2008

		Rating at the end of 5th year (%)								
Initial Rating	Number Issuers	AAA	AAA	A	BBB	BB	B	CCC/CC	SD	NR
AAA	246	72.4	17.1	0.00	0.00	0.00	0.00	0.00	0.00	10.6
AAA	840	7.40	76.9	8.6	0.00	0.00	0.00	0.00	0.00	7.10
A	369	0.00	15.2	67.5	6.80	0.00	0.00	0.00	0.00	10.6
BBB	150	0.00	0.00	16.0	50.7	0.70	0.70	0.00	0.00	22.0
BB	186	0.00	0.00	0.00	9.10	2.70	2.70	2.20	2.20	17.2
B	58.0	0.00	0.00	0.00	5.20	13.8	13.8	1.70	1.70	24.1
CCC/CC	26.0	0.00	0.00	0.00	0.00	40.7	40.7	0.00	0.00	18.5
SD	10.0	0.00	0.00	0.00	0.00	80.0	80.0	0.00	0.00	20.0

Source: Standard and Poor's

Table 1 indicates that for five years on average, AA ratings do not vary in approximately 76.9% of cases, while approximately 7.4% rise to AAA and approximately 8.6% go down to A. In mean terms, approximately 25%-50% of ratings changed category every 5 years, which reflects a certain mean variability among the large categories.

Ratings of Sub-Sovereign Governments in Europe

The European sub-sovereigns analysed represent a total of 92 entities. Of these, approximately 77% have or have had at least 1 rating by one of the three large agencies, and approximately 35% have been rated by more than one; this could be considered a high percentage for sub-sovereign governments. However, this global figure hides certain asymmetries in the breakdown by countries. The use of ratings is usual for European regional governments (Table 2). The exception is France, where only approximately 42.3% have ever had a rating and at present approximately 35% of regions have at least 1 rating.

Table 2
Regions with ratings from Moody's, S&P and Fitch

Countries	No regions	Rating in 2012	Rating in any time	More than one rating in 2012
Germany	16	10	12	6
Austria	9	7	8	2
Belgium	3	3	3	1
France	26	9	11	1
Spain	17	17	17	9
Italy	21	20	21	13
Total	92	66	72	32

Source: Own elaboration

Italy and Spain are clearly the countries where the most regions have more than one rating (53% in Spain and 62% in Italy) in comparison to the remaining sub-sovereigns in Europe. However, in France, the size of the regions and the limited access to capital markets is behind their lower use of ratings. French regions, in addition, have recently been somewhat inclined to change rating agencies, and even some regions that had 2 or 3 ratings have showed a tendency to reduce this number. In Germany, investors' use of the implicit ratings of the Länder, through Landesbanken ratings, and Fitch's statement that all the German Länder are AAA, has meant that, for some Länder, it has not been necessary to obtain a rating. Regarding the rating agencies most solicited by European sub-sovereign governments, in global basis, S&P (41.6%) has the highest market share compared to the other two agencies (32.5% Moody´s and 25.8% Fitch). However, when one does an individualized analysis by country, there is certain parity between Moody's and S&P in Spain, Italy, Germany, and Belgium. The spread of ratings among sub-sovereigns depends on the agency and on the own country. In 2013, the German Land of Bavaria, for example, had an AAA rating from Moody's, while the same agency rated the Generalitat de Catalunya as Ba3, that is, in the first solvency category below the minimum investment level.

The ratings given by the agencies are intimately related to the corresponding countries, and as a function of the evaluation of the strength of the institutional system connecting the central administration and its regions. Furthermore, the rating of the sovereign no longer has a reason to be the best rating given within the country. Regions such as the Basque Country and Navarre in Spain, the autonomous provinces of Bolzano and Trent in Italy, and the region of Flanders in Belgium have better ratings than their respective sovereigns due to their wealth and fiscal autonomy.

The evaluation of European sub-sovereigns by rating agencies has had significant differences and has depended on the countries. Fitch is the agency that rate sub-sovereigns closest to their country. For example, this agency considers all the German Länder to be AAA, just like the sovereign, and considers that the Spanish Autonomous Communities have a minimum rating of BBB, that is, that they have an investment rating only two notches below that of the sovereign, with the exception of Generalitat de Catalunya due to the weaker relationship with the country. However, in the case of Spain, Moody's and S&P views are very different from Fitch's, and the differences of rating in relation to the sovereign is much greater, even after the implementation by the Spanish government of various centralized instruments to avoid potential defaults and thus strengthen the institutional framework such as ICO ad-hoc loans in 2012, the fund for financing of payment to providers, the Autonomic Liquidity Fund, and the new Organic Law on Budget Stability and Financial Sustainability. In this sense, the ratings of Ba2 by Moody's and BB by S&P assigned to the Generalitat Valenciana are surprising (Table 3).

Regarding the variability in ratings, it can be seen that, with the financial and sovereign crisis, these downward variations in ratings have multiplied and intensified both in the quantity of downgrades and in the number of downgrades inflicted almost exclusively on Italy and Spain in 2010-2012. The downgrades occur in some cases because of the downgrades of the sovereign, which would demonstrate a certain positive correlation between them, and in some cases autonomously due to problems related to the ability to repay of some of the sub-sovereigns themselves.

Table 3
Comparison of regional and country rating interagency, May 2017

Countries	**Germany**	**Austria**	**Belgium**	**France**	**Spain**	**Italy**
Max reg Moodys	Aaa	Aa1	Aa2	A2	Baa1	A3
Min reg Moodys	Aa1	A3	A2	Baa3	Ba3	Baa2
Country Rating Moodys	Aaa	Aa1	Aa3	Aa2	Baa2	Baa2
Max reg S&P	AAA	AA+	AA	AA	A	BBB-
Min reg S&P	AA-	AA	AA	AA	B+	BBB-
Country Rating S&P	AAA	AA+	AA	AA	BBB+	BBB-
Max reg Fitch	AAA	-	AA	AA	BBB+	A
Min reg Fitch	AAA	-	AA	AA	BB	BBB
Country Rating Fitch	AAA	AA+	AA-	AA	BBB+	BBB

Source: Own elaboration

On the other hand, 2006 there were also many rating changes. Upgrades decided by Moody's due to methodology and downgrades by S&P for Italian regions. In general terms, ratings have been very stable over time in the case of sub-sovereign governments in Europe. In fact, averaging the three agencies, the number of years that ratings have been maintained unchanged is six years. However, in the cases of Spain and Italy, on average, ratings are preserved for 2 or 3 years. This behavior is influenced by the continuing downgrades of ratings for the regions of these countries during this last period of economic crisis and is due to the effect of the downgrades in the rating of the corresponding sovereign.

Specification of the Degree of Influence among Rating Agencies

The methodology used for discovering the degree of influence that some agencies exert on others has been a binary probit model. The small number of sub-sovereign rated by 3 agencies has not permitted to analyze in the same specification the degree of influence from two agencies to the third one and to know who is the leader and the followers. In fact, regions with 2 ratings are 32 (45 sometimes) meanwhile 13 with 3 ratings. Therefore, there are 6 specifications to analyse the influence between 2 credit rating agencies.

The objective of this article is only to know the degree of influence among credit rating agencies but not to analyse determinants of ratings. For that reason, specifications include a combination of variables linked to rating agencies such as rating change, rating difference or rating changes in previous period; and control variables such as country, economic, budget, demographic, debt and political variables. The introduction of control variables prevents spurious correlation.

The database has been built taking information (Table 4) from different sources and covering the period 1996-2012 for annual variables: Eurostat, national statistic offices, regions and banks are the sources of economic variables; rating agencies, external auditors, banks, central and regional governments and national statistic offices for budget variables; rating agencies, banks and central banks, central and regional governments and national statistic offices, for debt variables; Eurostat, regions and national statistics offices, for demographic variables; rating variable information from rating agencies; and Wikipedia for political variables.

The analysis of the degree of influence between rating agencies in ratings given to regions is conducted through the generation of three independent databases grouping the agencies 2 by 2 (Table 5). The assigned ratings refer to the sub-sovereigns of Germany, Austria, Belgium, France, Italy, and Spain, that is, to a total of 92 territorial entities. In the case of Moody's and S&P, the period ranges from 1996 to 2012, both inclusive and 31 entities; in the case of Moody's and Fitch, from 1998 to 2012, both inclusive and 24 entities; and finally in the case of S&P and Fitch, from 1998 to 2012 and 17 entities.

The binary probit model explains the probability that a credit rating is changed as a function of explanatory variables (combination of rating variables and control variables). It is constructed on the basis of the existence of a non-observable continuous variable (Y), which is a linear function of explanatory variables (X) with a vector β and an error ϵ. It is calculated according to the following expression:

$$Y*_{jt} = X_{jt}\beta + \epsilon_{jt}$$

$$Y = 1, Y* > 0; Y = 0, Y* \leq 0$$

Where the variable Y_{jt} is the non-observable dependent variable of a sub-sovereign j at moment t, which depends on the values of the explanatory variables X_{jt}.

In this model, the dependent variable takes value 1, i.e., if there is a rating change and 0 otherwise. It permits to know the variables which influence in a rating change, even

Table 4
Statistics by Country

VARIABLES	BUDGET	DEBT	ECONOMY	DEMOGRAPHIC	POLITICAL
AUSTRIA	S&P, Moody's, Austrian Statistic Institute, Institute, Landers, Merrill Lynch	S&P, Moody's, Austrian Statistic Landers, Merrill Lynch	Eurostat, S&P, Moody's, Merrill Lynch	Eurostat and Landers	WIKIPEDIA
BELGIUM	S&P, Moody's, Regions and Dresdner Bank	S&P, Moody's, Regions y Dresdner Bank	Eurostat, S&P, Moody's, Eurostat, S&P, Dresdner Bank	Eurostat and Regions	WIKIPEDIA
FRANCE	Ministry of Interior, Moody's, S&P, Fitch, CDC, Regions, External Auditors	Ministry of Interior, Moody's, S&P, Fitch, CDC, Regions	Eurostat, Moody's, S&P, Fitch, CDC	Eurostat and Regions	WIKIPEDIA
GERMANY	German Statistic Institute, S&P, Moody's, Fitch, Deustche Bank, Dresdner Bank, HVB, Barclays, Unicredit, Merrill Lynch	S&P, Moody's, Fitch, Deustche Bank, Dresdner Bank, HVB, Barclays, Merrill Lynch, HVB, Landers	Eurostat, S&P, Fitch, Moody's, Unicredit, Barclays,	Eurostat, Unicredit, HVB	WIKIPEDIA
SPAIN	Ministry of Finance, S&P, Moody's, Fitch, Unicredit	Bank of Spain, Regions, S&P, Moody's, Unicredit	Eurostat, Spanish Statistic Institute, S&P, Moody's, HSBC, Barclays, Merrill Lynch, Abn Bank	Eurostat, Spanish Statistic Institute	WIKIPEDIA
ITALY	External Auditors (Corte dei Conti), ABN Bank, Moody's, S&P, CDC, Regions	Bankitalia, ABN Bank, Moody's, S&P, Fitch, UBS, CDC	Eurostat, S&P, Moody's, Fitch	Eurostat	WIKIPEDIA

Source: Own elaboration

by other agency rating change or if this change has been after the other. Moreover, it is obtained the influence degree measured in probability terms through marginal effects. The common specification is the following:

$$RC_1 = f(RC_2, DIF, NOTCH, CONTROLVARIABLES)$$

Where,

- RC_1 = Rating change by credit rating agency 1 for specific sub-sovereign. It takes the value of 1 if there is a change in rating by the agency 1 in the period under consideration and 0 otherwise. Depending on the specification RC_1 is MCHANGE (MOODY'S), SPCHANGE (STANDARD AND POOR'S), or FCHANGE (FITCH).

- RC_2 = Rating change by credit rating agency 2 for specific sub-sovereign. It takes the value of 1 if there is a change in rating by the agency 2 in the period under consideration and 0 otherwise. Depending on the specification, RC_2 is MCHANGE (MOODY'S), SPCHANGE (STANDARD AND POOR'S), or FCHANGE (FITCH).

- DIF = Number of notches between the two credit agencies for the same sub-sovereign in each period of time. For example, if for an agency such as Moody's a region is Aa2 and for S&P it is AA+, the difference is 1 because Aa2 is equivalent to AA and Aa1 is equivalent to AA+. Regards to a different combination between credit rating agencies, DIF is MSPDIF between Moody's and S&P, MFITCHDIF between Moody's and Fitch, or SPFITCHDIF between S&P and Fitch

- $NOTCH$ = Number of notches' changes by each credit agency given for a specific region in a previous year: NUMNOTCHM-1 for Moody's, NUMNOTCHSP-1 for S&P and NUMNOTCHF-1 for Fitch.

- The control variables are the following:

  Country variables:

  The variable representing the rating assigned by the same agency to each country-RMSTATE for Moody's, RSPSTATE for S&P and RFSTATE for Fitch. It is an ordinal variable that takes 21 for Aaa/AAA. And dummy variable ESP (Spain), that assumes value 1 if region is Spanish and 0 otherwise.

  Economic variables:

  GDP per capita of each region in terms of PPP (Purchasing Power Parity) compared to the European Union average (PPPREGION) and the unemployment rate (UNEMP).

Demographic variables:

Regional population over 64 years of age compared to the total population (POP64A).

Regional population growth in yearly basis (POPGROWTH).

% regional population regards to national one. (SIZEPOP).

% regional density compared to national average (DENSCOMP).

Budget variables:

Operating surplus (deficit) to operating revenue (OPBALANCE).

Financing surplus (deficit) to operating revenue (SURPDEF).

Interest expenses to operating revenue (INTEREST).

Debt servicing cost to operating revenue (DEBTSERV).

Level of Intergovernmental transfers to total revenue (GOVTRANSF).

Capital Expenditures to total expenses (CAPEX).

Debt variables:

Adjusted debt to operating revenue (DEBTIC).

Total debt to operating revenue (DEBTTOT).

Short term debt to operating revenue (SHORTDEBT).

Political variables:

MAJOR is a dummy variable which takes value 1 if there is an absolute majority in the region or 0 otherwise.

Table 5
Composition Databases

Grouped agencies	Num. Observations	Num. Regions
Moody'sand S&P	333	31
Moody's and Fitch	221	24
S&P and Fitch	164	17

Source: Own elaboration

Thus, there are 6 specifications to regress, taking into account there are 3 credit rating agencies to combine 2 to 2:

$$MCHANGE = f(SPCHANGE, MSPDIF, NUMNOTCHM - 1, POP64A, POPGROWTH, DENSCOMP, SIZEPOP, UNEMP, PPPREGION, DEBTIC, SHORTDEBT, DEBTTOT, OPBALANCE, SURPDEF, INTEREST, DEBTSERV, CAPEX, GOVTRANSF, RMSTATE, ESP, MAJOR) \quad (1)$$

$$SPCHANGE = f(MCHANGE, MSPDIF, NUMNOTCHSP - 1, POP64A, POPGROWTH, DENSCOMP, SIZEPOP, UNEMP, PPPREGION, DEBTIC, SHORTDEBT, DEBTTOT, OPBALANCE, SURPDEF, INTEREST, DEBTSERV, CAPEX, GOVTRANSF, RSPSTATE, ESP, MAJOR) \quad (2)$$

$$MCHANGE = f(FCHANGE, MFPDIF, NUMNOTCHM - 1, POP64A, POPGROWTH, DENSCOMP, SIZEPOP, UNEMP, PPPREGION, DEBTIC, SHORTDEBT, DEBTTOT, OPBALANCE, SURPDEF, INTEREST, DEBTSERV, CAPEX, GOVTRANSF, RMSTATE, ESP, MAJOR) \quad (3)$$

$$FCHANGE = f(MCHANGE, MFPDIF, NUMNOTCHF - 1, POP64A, POPGROWTH, DENSCOMP, SIZEPOP, UNEMP, PPPREGION, DEBTIC, SHORTDEBT, DEBTTOT, OPBALANCE, SURPDEF, INTEREST, DEBTSERV, CAPEX, GOVTRANSF, RFSTATE, ESP, MAJOR) \quad (4)$$

$$SPCHANGE = f(FCHANGE, SPFPDIF, NUMNOTCHSP - 1, POP64A, POPGROWTH, DENSCOMP, SIZEPOP, UNEMP, PPPREGION, DEBTIC, SHORTDEBT, DEBTTOT, OPBALANCE, SURPDEF, INTEREST, DEBTSERV, CAPEX, GOVTRANSF, RSPSTATE, ESP, MAJOR) \quad (5)$$

$$FCHANGE = f(SPCHANGE, SPFPDIF, NUMNOTCHF - 1, POP64A, POPGROWTH, DENSCOMP, SIZEPOP, UNEMP, PPPREGION, DEBTIC, SHORTDEBT, DEBTTOT, OPBALANCE, SURPDEF, INTEREST, DEBTSERV, CAPEX, GOVTRANSF, RFSTATE, ESP, MAJOR) \quad (6)$$

The expected sign for explanatory variables are explained in Table 6. Thus, rating change (SPCHANGE, SPCHANGE or FCHANGE) should be positive. If a specific economy is weaker or budget performance is deteriorated rating agencies may decide a downgrade or maintain rating level, but it is not reasonable downgrades and upgrades at the same time by rating agencies.

Rating differences between rating agencies (MSPDIF, MFDIF or SPFDIF) have to have a positive sign. Due to that mostly rating changes have been downgrades, if a rating

agency rates region one or two notches more than other, it has more possibilities to review the rating. Also if a rating agency has modified some notches in the previous period (NUMNOTCHM-1, NUMNOTCHSP-1 or NUMNOTCHF-1) it is less probable a rating change in the following period. More notches less probability a rating change.

Being Spanish regions (ESP) is a dummy variable with an expected positive sign. Spanish regions have much more probabilities to suffer a rating change. Country rating (RMSTATE, RSPSTATE and RFSTATE) influences on regional rating in the same way. Therefore, a country downgrade increases rating change probability. The expected sign is negative.

Table 6
Variable Expected Sign

Variables	**Expected Sign**
SPCHANGE, MCHANGE, FCHANGE	+
MSPDIF, MFDIF, SPFDIF	+
NUMNOTCHM-1, NUMNOTCHSP-1, NUMNOTCHF-1	-
ESP	+
RMSTATE, RSPSTATE, RFSTATE	-
POP64	+
POPGROWTH	+
SIZEPOP	+/-
DENSCOMP	-
PPPREGION	-
UNEMP	+
DEBTIC, DEBTTOT, SHORTDEBT	+
INTEREST, DEBTSERV	+
OPBALANCE, SURPDEF	-
CAPEX	+
GOVTRANSF	+/-
MAJOR	-

Source: Own elaboration

Almost all European sub-sovereigns have responsibilities in the welfare state (Education, Social Services and Healthcare). Regions with a high elderly rate or with a great population growth have to deal with high pressure on the expenditure side. Accordingly, expected sign for POP64A and POPGROWTH should be positive. In the case of SIZEPOP is uncertain, because from one side, larger regions have economies of scale and less pressure on the expenditure side, but from the other hand, larger regions may have an unbalanced financing system (Spanish regions). The expected sign for DENSCOMP is negative due to economies of scale of the more dense regions.

From economic variables, PPPREGION and UNEMP expected signs should be negative and positive respectively. Richer sub-sovereign governments have fewer probabilities to be downgraded, and in a different way, regions with high unemployment rate have more probabilities of a rating change.

Debt variables (DEBTIC, DEBTTOT and SHORTDEBT) have to have a positive sign because the most indebted regional governments have fewer probabilities to repay debt. INTEREST and DEBTSERV reflect debt burden and therefore higher INTEREST or DEBTSERV greater weakness regional solvency. Thus, expected sign is clearly positive and then an increase of rating change probability.

On the budget side, OPBALANCE and SURPDEF must have a negative sign. An

improvement of budget performance supposes less probability to suffer a rating change. CAPEX has an expected positive sign because high investment plan could weaken regional government finances at least in short term, and therefore impulses rating change probability. GOVTRANSF is uncertain. From one side, higher central government revenue regards to total revenue could be interpreted as positive due to the national equalization system, but on the other hand, this could be interpreted as negative for the lack of fiscal autonomy. Finally, MAJOR is a dummy variable which expected sign is negative. This means having an absolute majority, it increases the stability and it reduces the probability of a downgrade.

Results of Estimates of the Degree of Influence between Rating Agencies

For each of the six specifications described above, it is estimated using a binary probit, obtaining the sign and the significant variables, and then calculating marginal effects to discover the degree of influence on the probability of making a rating change. The specifications are the following:

a) Moody's and S&P:

First, the influence between Moody's and S&P is estimated, taking into account regions which are rated simultaneously both Moody's and S&P, as it is seen in tables 7 and 8. Both tables reflect the best specifications with significant variables.

Using MCHANGE as dependent variable (Table 7), rating changes by S&P influences positively Moody's rating changes and greater number of notch changes in the previous year less likelihood in Moody's rating change. However, wider rating difference between Moody's and S&P less probability of Moody's rating change. These results are according to expectations. Spanish regions are more likely than other European sub-sovereigns to undergo Moody's rating changes, as it has been seen in section 4. Likewise, the change of country rating affects its regional ratings in the same way, due to the institutional framework.

Only 3 out of 6 budget variables are significant in specifications. OPBALANCE has a negative sign and it means a worst operating balance implies larger probability of Moody's change, obviously a downgrade according to expectations; but INTEREST and DEBTSERV have a negative sign which are contrary it was expected.

POP64A and SIZEPOP are significant and with positive sign and therefore either larger or aged regions are more likely to be downgraded by Moody's. Higher unemployment rates indicate more probability to have a change in a Moody's rating.

Adjusted debt to operating revenue (DEBTIC) is very significant in the three specifications and with a positive sign. It means more indebted regions have more probability to suffer downgrades by Moody's, according to expectations.

Table 7
Influence between Moody's and S&P. MCHANGE as Dependent Variable

VARIABLES	ESTIM-1	ESTIM-2	ESTIM-3
SPCHANGE	0.739***	0.556**	0.818***
NUMNOTCHM-1		-0.603**	
MSPDIF		-0.289**	-0.337***
ESP	0.562*		
RMSTATE	-0.387***		
OPBALANCE		-0.022*	-0.028**
UNEMPLOY		0.058**	0.056**
POP64A	0.113**	0.111**	0.131***
SIZEPOP	0.036***	0.018*	0.021**
DEBTIC	0.029***	0.030***	0.032***
INTEREST	-0.394***	-0.470***	-0.517***
DEBTSERV	-0.055***	-0.065***	-0.068***
C	2.720*	-3.985***	-4.380***
N OBS	316	287	316
Grupos	29	28	29
Log Likelihood	-78.64	-80.86	-86.54
Prob>2	0.000	0.000	0.000

Note: *** significant 99% ** significant 95% * significant 90%
Source: Own elaboration.

On the other side, using SPCHANCHE (Table 8) as dependent variable, Moody's rating changes also increase the probability of S&P rating change. Moreover, country rating change (RSPSTATE) influences regional rating change in the same way.

Table 8
Influence between Moody's and S&P. SPCHANGE as Dependent Variable

VARIABLES	ESTIM-1	ESTIM-2	ESTIM-3
MCHANGE	0.630***	0.769***	0.670***
ESP	0.479**	0.667***	0.458**
RSPSTATE	-0.148***		-0.195***
PPPREGION			0.007**
SHORTDEBT		-0.014*	
OPBALANCE	-0.023**	-0.048***	-0.023**
GOVTRANSF	-0.007*	-0.007	
C	1.859**	-0.688***	1.632*
N OBS	333	278	333
Grupos	31	26	31
Log Likelihood	-133.0	-114.5	-131.9
Prob>2	0.000	0.000	0.000

Note: *** significant 99% ** significant 95% * significant 90%
Source: Own elaboration.

Spanish regions have more probabilities to experience rating changes, and operating balance to operating revenue (OPBALANCE) has also negative sign, reflecting that an improvement supposes a reduction of the likelihood of S&P rating change. GOVTRANSF is a significant variable with a negative sign, explaining less tax flexibility less probability of rating change.

Likewise, there are two significant variables with a sign contrary as it was expected. First, SHORTDEBT which is significant in one specification at 90% with a negative sign, contrary as it was expected. It means regions with a high percentage of short debt have

less probability to have a downgrade. Second, PPPREGION which is significant with a positive sign, indicating, for instance, richer regions have much more probabilities to suffer a rating change.

The marginal effects of these estimates, as seen in table 9, specify variable's elasticity regards to the probability, and how to know the real impact of significant variables in specifications. The change probability is higher in S&P than Moody's. The probability of S&P rating change is 15.3%-15.8% meanwhile Moody's change probability is 7.1% or 7.9%.

Table 9
Marginal Elasticities Estimates Derived from Moody's and S&P

MCHANGE	**ESTIM-1**	**ESTIM-3**
VARIABLE	dy/dx	dy/dx
Pr(MCHANGE=1)	0.078	0.070
SPCHANGE	0.166	0.136
INTEREST	-0.076	-0.053
DEBTSERV	-0.010	-0.007
MSPDIF	-0.049	
POP64A	0.019	0.015
SIZEPOP	0.003	0.005
UNEMPLOY	0.008	
OPBALANCE	-0.004	
DEBTIC	0.004	0.003
RMSTATE		-0.052
ESP		0.089

SPCHANGE	**ESTIM-1**	**ESTIM-2**	**ESTIM-3**
VARIABLE	dy/dx	dy/dx	dy/dx
Pr(SPCHANGE=1)	0.153	0.156	0.158
MCHANGE	0.181	0.228	0.197
ESP	0.125	0.175	0.121
RSPSTATE	-0.035		-0.047
OPBALANCE	-0.005	-0.011	-0.005
PPPREGION			0.001
GOVTRANSF	-0.001	-0.001	
SHORTDEBT		-0.003	

Source: Own elaboration

The influence degree of Moody's on S&P is much higher than S&P influence on Moody's. Moody's rating change affect S&P rating change by 18.1% or 22.8%, depending on the specification, and by 13.7% or 16.7% from S&P to Moody's. The most sensitive variable in both kinds of specifications is ESP with the exception of influence of rating change. To be a Spanish region increases Moody's rating change probability by 9% and rises S&P change probability by 12.5% or 17.6%.

The remaining variables are less powerful. Country downgrade for one notch increases the region rating change probability with the same credit rating agency by 5.2% (Moody's) or by 4.7% or 3.5% in the case of S&P. A rise of 1% in unemployment rate or 1% of the elderly people in a specific region increases the Moody's rating change probability by 0.8% and by 1.5%-1.91% respectively. The rise by 10% of the Debt to operating revenue (DEBTIC) heightens only Moody's rating change probability by 4.8% or 3.9% depending

on the specification. Finally, reduction of the operative balance (OPBALANCE) by 5% increases Moody's and S&P rating change probability by 2.1% and 2.80%-5.85% respectively.

b) Moody's and Fitch:

Regards to the influence between Moody's and Fitch, this has been estimated (Tables 10 and 11), taking into account regions which are rated simultaneously both Moody's and Fitch. Using MCHANGE as a dependent variable (Table 10), Fitch's rating changes positively influence Moody's rating changes; a country downgrade by Moody's is positively correlated with a probability of region rating change; and the Spanish regions (ESP) are more likely to undergo a change of rating. These results are in line with expectations.

As discussed above, DEBTIC and OPBALANCE representing the outstanding debt and operating budget performance are significant with a positive and negative sign, respectively, according to expectations. Moreover, DEBTSERV and INTEREST, as also it has been in the last specifications are significant with a negative sign, contrary with expectations. It is unreasonable regions with higher debt burden and fewer probabilities for a rating change downwards. The negative influence of rating agencies in regions with an absolute majority in the regional parliament is also unreasonable. In fact, MAJOR is a significant variable with positive sign and therefore having an absolute majority increases the probability of rating change.

Table 10
Influence between Moody's and Fitch. MCHANGE as Dependent Variable

VARIABLES	ESTIM-1	ESTIM-2	ESTIM-3	ESTIM-4
FCHANGE	1.286***	1.084***	1.094***	1.194***
ESP	0.539*	0.581**		
MFDIF				-0.375***
SIZEPOP	-0.039*			
MAJOR			0.443*	0.465*
RMSTATE		-0.267***	-0.295***	
DEBTIC	0.005*	0.007**	0.018***	0.016**
OPBALANCE	-0.035***			-0.040***
INTEREST			-0.278**	-0.316**
GOVTRANSF	-0.012**	-0.013**		
DEBTSERV	-0.041**	-0.034*	-0.031*	-0.044**
C	-0.209	3.837***	4.073***	-0.679***
N OBS	216	216	216	216
Grupos	22	22	22	22
Log Likelihood	-87.15	-82.86	-82.03	-81.57
Prob>2	0	0	0	0

Note: *** significant 99% ** significant 95% * significant 90%
Source: Own elaboration

In specifications with FCHANGE as dependent variable (Table 11), Moody's rating changes positively influence in Fitch rating changes and country rating change also affects increasing the probability of regional rating change. Spanish regions also have more probabilities to undergo a rating change. This is according to expectations. Within economic variables, unemployment rate is positively correlated with the rating change as it was expected, but PPPREGION has a positive sign and theoretically must be negative. It is

unreasonable for richer regions to be more likely to undergo a change in rating.

Population growth with a positive sign and DENSCOMP with a negative sign are significant with the expected sign. The first is likely due to the higher probability of generating a mismatch between revenue and expenditures, and the second to achieve economies of scale. On the budget and debt side, GOVTRANSF is significant with a negative sign, reflecting that more revenue from Central Government less probability of rating change, and perhaps a positive appraisal of the equalization systems of the countries.

Table 11
Influence from Moody's and Fitch. FCHANGE as Dependent Variable

VARIABLES	ESTIM-1	ESTIM-2
MCHANGE	0.957***	1.290***
ESP	1.993***	
UNEMPLOY	0.145***	0.190***
PPPREGION	0.044***	0.029***
POPGROWTH		0.581***
DENSCOMP	-0.003***	-0.002***
MAJOR	1.036**	
RFSTATE	-0.584***	
DEBTIC	-0.014*	
GOVTRANSF	-0.036***	-0.033***
C	3.516	-6.087***
N OBS	221	221
Grupos	23	23
Log Likelihood	-48.40	-57.17
Prob>2	0	0

Note: *** significant 99% ** significant 95%
* significant 90%. Source: Own elaboration

The marginal effects of these estimates, as they are seen in table 12, specify variable's elasticity regards to the probability, and how to know the impact of significant variables in specifications. The change probability is much higher in Moody's than Fitch. The Moody's change probability is between 20.2% and 23.2% meanwhile Fitch change probability is either by 0.2% or 5.2% depending on the specification.

The influence degree from Moody's to Fitch is much higher than Fitch to Moody's. Moody's rating change affects S&P rating change between 44.6% and 38.1%, depending on the specification, and by 1.5% or 22.3% from Fitch to Moody's. Spanish regions have more probabilities to have a rating change. It is more likely in Moody's than Fitch. On Moody's side, being a Spanish region increases the probability of rating change between 15.8 and 17.8%; meanwhile, in Fitch increases by 4.9%.

The change of Country rating influences the change in the rating of the region with the same credit rating agency as it has been seen in a). One notch reduction increases the probability of rating change of Moody's and Fitch by 7.94% or 9% respectively.

The most heavily indebted regions are more likely to undergo a change in rating on the Moody's side but an inverse effect on the Fitch side. A 10% increase in debt to operating income increases the likelihood of a rating change between 1.69% and 5.6%.

Table 12
Marginal elasticities estimates derived from Moody's and Fitch

VARIABLE	dy/dx	dy/dx	dy/dx	dy/dx
Pr(MCHANGE=1)	0.22	0.203	0.232	0.221
FCHANGE	0.380	0.445	0.390	0.421
ESP	0.177	0.157	0.177	
DEBTIC	0.002	0.001	0.005	0.004
GOVTRANSF	-0.003	-0.003		
RMSTATE	-0.079		-0.090	
DEBTSERV	-0.010	-0.011	-0.009	-0.013
SIZEPOP		-0.011		
OPBALANCE		-0.010		-0.012
MFDIF				-0.111
MAJOR			0.143	0.147
INTEREST			-0.085	-0.093

VARIABLE	dy/dx	dy/dx
Pr(FCHANGE=1)	0.002	0.051
MCHANGE	0.015	0.223
ESP	0.049	
DEBTIC	-0.000	
GOVTRANSF	-0.000	-0.003
RFSTATE	-0.004	
MAJOR	0.016	
POPGROWTH		0.061
DENSCOMP	-0.000	-0.000
PPPREGION	0.000	0.003
UNEMPLOY	0.001	0.020

Source: Own elaboration

European sub-sovereigns which have more revenue from Central Government related to total revenue (GOVTRANSF) have less rating change probability. An increase of 10% of GOVTRANSF supposes a reduction of the probability by 4% or 3.7% in Moody's case, and by 0.26% or 3.53% on Fitch's side. In Moody's specification, a region 10% larger than other (SIZEPOP) has less rating change probability by 11.1%, and a deterioration of operative balance to operating revenue (OPBALANCE) by 5% increases rating change probability between 5%-6%. Finally, in Fitch specification, an increase by 1% of unemployment rate boosts the likelihood of rating change by 0.1% or 2%.

c) S&P and Fitch:

Taking into account S&P as dependent variable, as it is seen in table 13 with specifications and significant variables, the change in Fitch's rating positively influences the S&P rating change. The country rating change and OPBALANCE are significant variables with a negative sign according to expectations. These results are very similar with previous specifications.

Using Fitch change as dependent variable, as it is shown in Table 14, the change in the S&P rating also positively influences the change in Fitch's rating. As it has been seen in previous specifications, POPGROWTH and UNEMPLOY are significant with a positive sign; and DENSCOMP and GOVTRANSF are also significant with a negative sign.

Table 13
Influence from S&P and Fitch. SPCHANGE as Dependent Variable

VARIABLES	ESTIM-1	ESTIM-2
FCHANGE	0.891***	1.001***
RSPSTATE	-0.155**	
OPBALANCE	-0.021*	-0.038***
DEBTTOTAL		-0.003*
C		-0.314
N OBS	164	151
Grupos	17	16
Log Likelihood	-74.57	-69.54
Prob>2	0	0

Note: *** significant 99% ** significant 95% * significant 90%. Source: Own elaboration

Table 14
Influence from S&P and Fitch. FCHANGE as Dependent Variable

VARIABLES	ESTIM
SPCHANGE	0.956***
POPGROWTH	0.712***
DENSCOMP	-0.002**
PPPREGION	0.029**
UNEMPLOY	0.225***
GOVTRANSF	-0.035***
C	-6.570***
N OBS	164
Grupos	17
Log Likelihood	-39.48
Prob>2	0.000

Note: *** significant 99% ** significant 95% * significant
Source: Own elaboration

The marginal effects of these estimates, as they are seen in Table 15, specify variable's elasticity regards to the probability, and how to know the impact of significant variables in specifications. The change probability is much higher in S&P than Fitch. S&P change probability is by 22.7% or 22.1% depending on the specification meanwhile Fitch change probability is by 5.7%.

Fitch influences much more to S&P than otherwise. In fact, the change in the Fitch rating increases the likelihood of S&P change of 31.5% or 35.2% depending on the specification, but S&P boosts Fitch rating change probability by 15.8%. On S&P side, a reduction of one notch in the country rating increases the probability of change in the region rating by 4.7%; and deterioration by 5% on OPBALANCE raises the likelihood of rating change by 3.3% or 5.7%. On the Fitch side, a 1% increase in POPGROWTH or UNEMPLOY increases the likelihood of a rating change of 8.2% and 2.6%, respectively. On the other hand, a 10% increase in GOVTRANSF reduces by a 4.1% probability of change in rating.

Table 15
Marginal elasticities estimates derived from S&P and Fitch

	ESTIM-1	ESTIM-2
VARIABLE	dy/dx	dy/dx
Pr(SPCHANGE=1)	0.227	0.22
FCHANGE	0.314	0.352
RSPSTATE	-0.046	
OPBALANCE	-0.006	-0.011
DEBTTOTAL		-0.000

VARIABLE	dy/dx
Pr(FCHANGE=1	0.057
SPCHANGE	0.158
POPGROWTH	0.081
DENSCOMP	-0.000
PPPREGION	0.003
UNEMPLOY	0.025
GOVTRANSF	-0.004

Source: Own elaboration

Leaders and Followers in Rating Changes

After analyzing the rating change influence between rating agencies and variables which affect noticeably rating change, it will be seen which is the first rating agency (leader) that changes rating and the followers.

Taking into account the statistics, with regard to Moody's and S&P (Table 16), S&P is the one that has changed the most in the first place a greater number of times. S&P has modified rating first or alone in 56 times versus 34 by Moody's. In the cases where both rating agencies have changed the rating for the same regions and the same year, S&P has changed the first with 19 times compared to 8. This means that S&P is the leader and Moody is the follower.

Table 16
Moody's and S&P rating changes

	CHANGE NUMBER
MOODY'S FIRST OR ALONE	34
S&P FIRST OR ALONE	56
MOODY'S FIRST AND S&P SECOND	8
S&P FIRST AND MOODY'S SECOND	19

Source: Own elaboration

With respect to Moody's and Fitch (Table 17), statistics indicate Moody's change first or alone, but if both rating agencies changes rating for same regions and the same year, Fitch has changed first a little more, 16 times versus 13. This means Fitch may be the leader and Moody's the follower.

Table 17
Moody's and Fitch rating changes

	CHANGE NUMBER
MOODY'S FIRST OR ALONE	42
FITCH FIRST OR ALONE	26
MOODY'S FIRST AND FITCH SECOND	13
FITCH FIRST AND MOODY'S SECOND	16

Source: Own elaboration

Finally, considering regions rated simultaneously by S&P and Fitch, S&P has revised many more times first or alone. Besides S&P has changed first more times if Fitch has modified same ratings in the same year with 10 times versus 7. This means S&P is the leader and Fitch is the follower. To sum up, in globally basis, S&P is the leader in rating changes for European sub-sovereign governments regards to Fitch and Moody's.

Table 18
Moody's and Fitch rating changes

	CHANGE NUMBER
FITCH FIRST OR ALONE	15
S&P FIRST OR ALONE	35
FITCH FIRST AND S&P SECOND	07
S&P FIRST AND FITCH SECOND	10

Source: Own elaboration

Conclusion

The excessive power of rating agencies not only lies in the value that investors place in the opinions they provide but also derives from their inclusion in country regulations, private contracts, and the investment policies of institutional investors and banks as well as the lack of supervision and inspection on the part of national authorities. Hence, their responsibility in the recent financial crisis, with the surfacing of all manner of conflicts of interest. In the period 1996-2012 for sub-sovereign governments of 6 European countries (Austria, Belgium, France, Germany, Italy and Spain), rating changes by Moody's, S&P and Fitch, mostly have been downgrades, mainly in Spanish and Italian regions.

The key factor addressed in this article on rating agencies is whether there is influence, and the corresponding degree of influence, among the three agencies. In this sense, by using the probit model and examining the agencies 2 by 2, one can see whether this degree of influence exists. From the analysis of the marginal elasticities of the probit, one concludes that there is an influence in decision making between the agencies. Furthermore, through statistics which rating agency is the leader.

In the relationship between Moody's and S&P, Moody's has more influence on S&P than vice versa because the increase in the probability of rating modification. A rating change by S&P raises the probability of change in the rating of Moody's by approximately 18.1%-22.8%, while the probability is approximately 13.7%-16.7% the other way around.

With respect to the combination of Moody's and Fitch, it can be seen that Moody's has much more influence on Fitch than vice versa. A rating change by Fitch raises the

likelihood of a change by Moody's by approximately 38.1%-44.6%, while a change by Moody's increases the probability of a change by Fitch by approximately 1.5%-22.3%.

The final combination of S&P and Fitch indicates that Fitch has more influence on S&P than vice versa. A rating change by Fitch increases the probability of a S&P change by approximately 31.5%-35.2%, while a change by Fitch increases the probability that S&P will modify its rating by approximately 15.8%.

Therefore, in global basis, Fitch is the rating agency with the highest influence over the other two rating agencies. This could be compatible with the economic literature in which reputational concerns are higher for the rating agencies with a lower reputational capital. In addition, Fitch is the credit rating agency which has the least likelihood of rating change, considering all specifications.

Taking into account statistics among rating agencies, S&P is the leader regards to the other two agencies because S&P changes the first and Moody's and Fitch are the followers. This coincides with the paper of Gande and Parsley (2004) focused on sovereigns. There are other relevant variables, but less powerful, which explain the probability of rating change. Among different specifications, these significant variables are almost always the same. For instance, being a Spanish region, a country rating downgrade, more indebted regions or weak budget performance, increase the probability of rating change. Aged regions and the rise of unemployment rate or the population growth rate boost also rating change probability. But, on the other hand, dense regions, GOVTRANSF or NUMNOTCHM-1, reduce rating change probability.

Finally, these conclusions are relevant for the economy policy. The existence of significant influence in the decision process among credit rating agencies, and the individual decisions for the rating not justified by the own scoreboard may originate instability. It is necessary to obtain more evidences in futures studies to confirm the existence of the influence. On the government side, it is much more important to put in place additional measures in order to mitigate the domino effect generated by rating agencies.

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