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Moody's credit ratings and the stock market performance of Portuguese rated firms

LUÍS PACHECO
Centro de Investigação em Gestão e Economia (CIGE)
Universidade Portucalense, Oporto - Portugal
luisp@upt.pt

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LUÍS PACHECO
Centro de Investigação em Gestão e Economia (CIGE)
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ABSTRACT

Never has the issue of sovereign credit ratings attracted such an interest by policy and opinion makers, bankers and journalists, or even the public opinion, as witnessed in the last couple of years. In spite of being accused of contributing to the instability of financial markets, credit rating agencies have undoubtedly a role in financial markets, affecting its performance and guiding investor's decisions. This paper analyzes the impact of the announcement of changes in Moody's ratings over the performance of a set of rated firms quoted in the Portuguese stock market. Following an event study methodology, we collect ratings and outlook announcements by that major credit agency over the period 2006-2011. We find a significant response of share prices to changes in ratings, with that response anticipating the announcement. We think that could be explained by previous sovereign rating changes or to the contagion effects of a bearish market. When analyzing the period after January 2010, we observe a stronger reaction to announcements, which is understandable given the greater influence and market sensitivity to rating agencies.

Keywords: Credit Rating Agencies, Event Studies, Stock Market, Moody's, Sovereign Debt Crisis, Portugal

JEL Codes: E44; G10; G14; G24

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Universidade Portucalense – Economics and Management Department (CIGE – Centro de Investigação em Gestão e Economia), Rua Dr. António Bernardino de Almeida, 541-619, 4200 – 072 Porto, Portugal, tel: 351-225572606, fax: 351-225572010, e-mail: luisp@upt.pt. The usual disclaimer applies.

"There are two superpowers in the world today in my opinion.
There's the United States, and there's Moody's Bond Rating Service.
The United States can destroy you by dropping bombs,
and Moody's can destroy you by downgrading your bonds".

Thomas Friedman (remarks at "News Hour", 13th February, 1996)

1. Introduction

Never has the issue of sovereign credit ratings attracted such an interest by policy and opinion makers, bankers and journalists, or even the public opinion, as witnessed in the last couple of years[1]. Portugal is a case in point, with recent downgrades by the major credit agencies prompting the call for a financial rescue plan by the *troika* (IMF/ECB/EC).

The credit rating literature has mainly focused on analyzing the effects of bond rating changes on individual stock returns, existing less literature on whether changes in sovereign or individual ratings have any impact on stock markets. To contribute to this research, this paper analyzes the impact of the announcement of changes in Moody's ratings over the performance of a set of rated firms quoted in the Portuguese stock market[2]. Following an event study methodology, we collect ratings and outlook announcements by that major credit agency over the period 2006-2011.

The remainder of the paper is organized as follows: section 2 reviews the main literature, section 3 describes the data and the methodology and section 4 presents the results. Closing the paper, section 5 presents a short summary of our work.

[1] A credit rating represents an assessment of the overall creditworthiness of an obligor in terms of both its capacity and willingness to meet its financial commitments as they fall due. Accordingly, rating agencies provide an evaluation of a country's creditworthiness and impart a rating to that country. In the case of Moody's the grade goes from Aaa to C. Rating agencies also provide an "outlook" or "watchlist" with prospective changes in ratings. The outlook is typically positive, stable or negative, where a positive (negative) outlook means that a rating may be revised upward (downward).

[2] Moody's began rating the creditworthiness of countries in 1974. The first rating for Portugal was assigned in 1995 and for a Portuguese firm in 2006.

2. Review of the literature

In the last twenty five years several papers examined the response of stock returns to bond rating changes. This literature is primarily focused on the information content of bond rating change announcements. If rating agencies base their rating changes on publicly available information, the efficient market hypothesis (EMH) predicts that stock prices will not adjust in response to the ratings change event. Therefore to the extent that stock prices are found to react to bond rating changes, this implies either evidence against the semi-strong form EMH, or, the presence of some private information available only to rating agencies that has, as a consequence, come into the public domain. That is, rating changes may unveil (new) private information, thus fuelling rallies or downturns. Some of the main papers in this field are Glascock et al. (1987), Hand et al. (1992), Goh and Ederington (1993), Barron et al. (1997), Dichev and Piotroski (2001), Joo and Pruitt (2006) and Afonso et al. (2011). According to Subasi (2008, p. 47), the main findings of these studies are three fold: first, if credit ratings are associated with significant market returns, this result supports the idea that rating agencies reveal new information to financial markets; second, in general, downgrade announcements are associated with significant negative returns in both stock and bond markets; finally, upgrade announcements rarely have an impact on stock and bond markets.

Nevertheless, the line of research that we are interested in is the effect of changes in sovereign ratings over stock markets and individual shares. Kaminsky and Schmukler (2002) analyzed the impact of changes in sovereign rating and outlook on financial markets in emerging markets, founding that downgrades were associated with two percent increase in average bond yield spreads and about one percent decrease in average stock returns. Further, those authors found contagion effects between emerging markets and that rating changes lagged market movements. Previously, Richards and Deddouche (1999), using emerging market bank-level data, examined the impact of bank ratings on bank stock prices. Also Brooks et al. (2004), using a sample of developed and emerging markets over thirty years examined the impact of sovereign rating changes on stock markets. Their results indicated that rating downgrades for foreign currency were associated with significant negative excess returns, while for rating upgrades weren't detected positive excess returns. More recently, Arezki et al. (2011) show that sovereign rating announcements have statistically and economically

significant spillover effects both across countries and financial markets, implying that rating agencies announcements could spur financial instability. Also, the sign and the magnitude of the spillover effects depends both on the type of announcements, the source country experiencing the downgrade and the rating agency from which the announcement originate. Those authors also show that rating agencies have not anticipated the macroeconomic weaknesses of European economies consecutive to the financial crisis[3].

But should sovereign rating have a clear impact on stock markets? Several authors consider that stock market participants, being rational and well informed, don't consider sovereign rating as new information, since those rating changes are anticipated by the market and hence incorporated in prices well before the change occurs (see Goh and Ederington, 1993 and Reisen and Maltzan, 1999). Nevertheless, if negative rating announcements take markets mostly by surprise, that could either imply that fundamentals are not fully discounted by market participants or that, at least on some occasions, rating events diverged from such fundamentals. Finally, Reinhart (2001) examines whether rating agencies actions anticipated the crisis of the 1990's. With a large sample of countries and crises, the author concludes that rating changes far from being leading indicators of crises have turned out to be lagging indicators of financial collapses. So, the aftermath of rating changes could be something uneventful, with no changes after the announcement and with variables maintaining the gains or losses observed in the preceding days.

3. Data and research methodology

To analyze the impact of credit ratings on the Portuguese stock market, we collect individual ratings emanated from Moody's credit rating agency since 2006[4]. The rating announcements are obtained from its web page. For the selected firms, our observation period for which we have both rating and outlook changes includes 49 events, of which17 are downgrades. The others are outlooks, predominantly negative and in the

[3] This delay by rating agencies is also evidenced in papers by Mora (2006) and White (2010).

[4] Deciding to choose only one rating agency we opted for Moody's due to its historical presence and influence (confirmed, for instance, by Arezki et al., 2011).

period didn't occur any upgrades[5]. Table 1 reports the different credit rating events for Portugal and Table 2 presents the rating events for the seven selected firms.

Table 1: Moody's sovereign rating announcements and actions for Portugal

Date	Rating		Outlook	
	upgrades	downgrades	upgrades	downgrades
05-07-2011		from Baa1 to Ba2		negative
05-04-2011		from A3 to Baa1		on review
15-03-2011		from A1 to A3		negative
21-12-2010				possible downgrade
13-07-2010		from Aa2 to A1		stable
05-05-2010				possible downgrade
29-10-2009				negative

Source: *Moody's*

Comparing both tables we clearly see that Moody's tends to downgrade the PSI-20 firms the day after Portugal's downgrade. Also, the data shows that changes in outlook are followed by changes in rating. As we can see, roughly 67 percent of the changes in outlook are followed by a change in rating, being the time interval between changes around two months (see also Figure A1 in the Appendix).

[5] We consider changes in outlook given that they tend to anticipate movements in the rating notation, so that the information content of the outlook is in itself valuable for explaining the movements of share prices.

Table 2: Moody's rating announcements and actions for the selected quoted firms

BRISA		
Date	**Rating**	**Rating Action**
08-07-2011	Baa3	Downgrade
06-04-2011	Baa1	Possible downgrade
22-12-2010	Baa1	Unchanged
24-12-2008	Baa1	Possible downgrade
04-08-2008	Baa1	Downgrade
29-11-2006	A3	New

PT		
Date	**Rating**	**Rating Action**
29-07-2011	Baa3	Confirm negative outlook
08-07-2011	Baa3	Possible downgrade
07-06-2011	Baa3	Downgrade
06-04-2011	Baa2	Possible Downgrade
05-03-2007	Baa2	Confirm only (P.R.)

BPI		
Date	**Rating**	**Rating Action**
15-07-2011	Baa3	Downgrade
06-04-2011	Baa2	Possible downgrade
09-12-2010	A2	Possible downgrade
14-07-2010	A2	Downgrade
05-05-2010	A1	Possible downgrade
16-09-2009	A1	Confirm only (P.R.)
06-04-2009	A1	Possible downgrade
13-04-2007	A1	New

BES		
Date	**Rating**	**Rating Action**
15-07-2011	Ba1	Downgrade
06-04-2011	Baa2	Possible downgrade
09-12-2010	A2	Possible downgrade
14-07-2010	A2	Downgrade
05-05-2010	A1	Possible downgrade
16-09-2009	A1	Downgrade
06-04-2009	Aa3	Possible downgrade
13-04-2007	Aa3	New

BCP		
Date	**Rating**	**Rating Action**
15-07-2011	Ba1	Downgrade
06-04-2011	Baa3	Possible downgrade
09-12-2010	A3	Possible downgrade
14-07-2010	A3	Downgrade
05-05-2010	A1	Possible downgrade
16-09-2009	A1	Downgrade
06-04-2009	Aa3	Possible downgrade
13-04-2007	Aa3	New

EDP		
Date	**Rating**	**Rating Action**
08-07-2011	Baa3	Downgrade
06-04-2011	Baa1	Possible downgrade
17-03-2011	Baa1	Downgrade
21-12-2010	A3	Possible downgrade
09-06-2009	A3	Downgrade
19-10-2007	A2	Confirm only (P.R.)
27-03-2007	A2	Possible downgrade

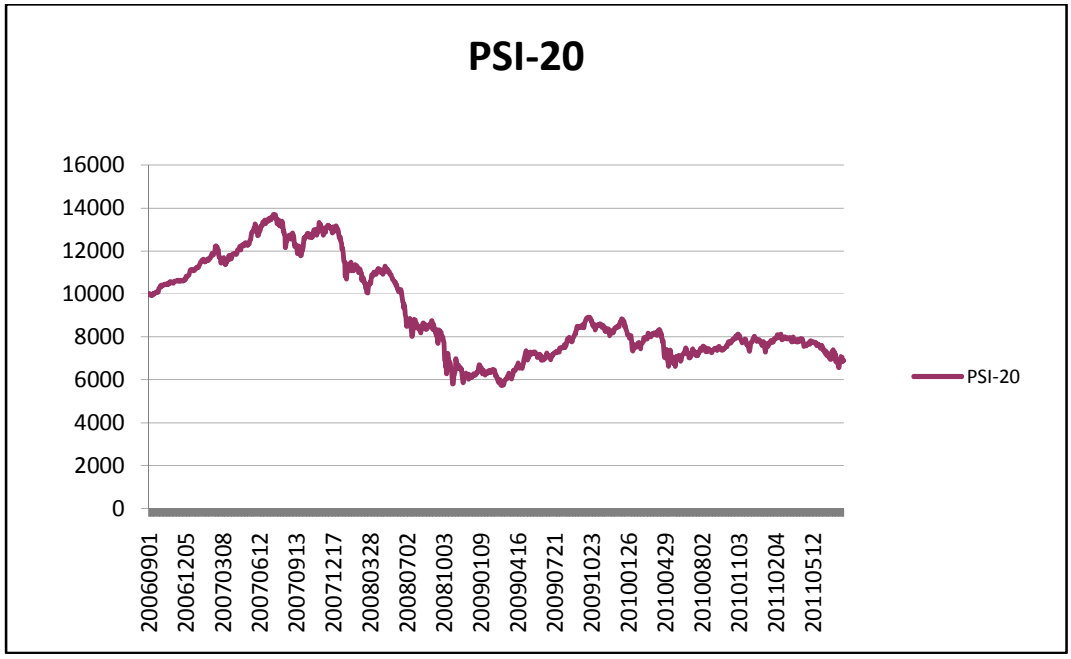
REN		
Date	**Rating**	**Rating Action**
08-07-2011	Baa3	Downgrade
06-04-2011	Baa2	Possible downgrade
17-03-2011	Baa1	Downgrade
21-12-2010	A3	Possible downgrade
13-07-2010	A3	Downgrade
05-05-2010	A2	Possible downgrade
28-04-2008	A2	New

Source: *Moody's*

Concerning the stock market data, we obtained daily quotes for seven individual shares and for the PSI-20 market index from the site *bolsapt.com*. We analyzed the period from September 2006 to the end of July 2011[6].

The performance of the PSI-20 index in the considered period is illustrated by the following graph:

Figure 1: PSI-20 index

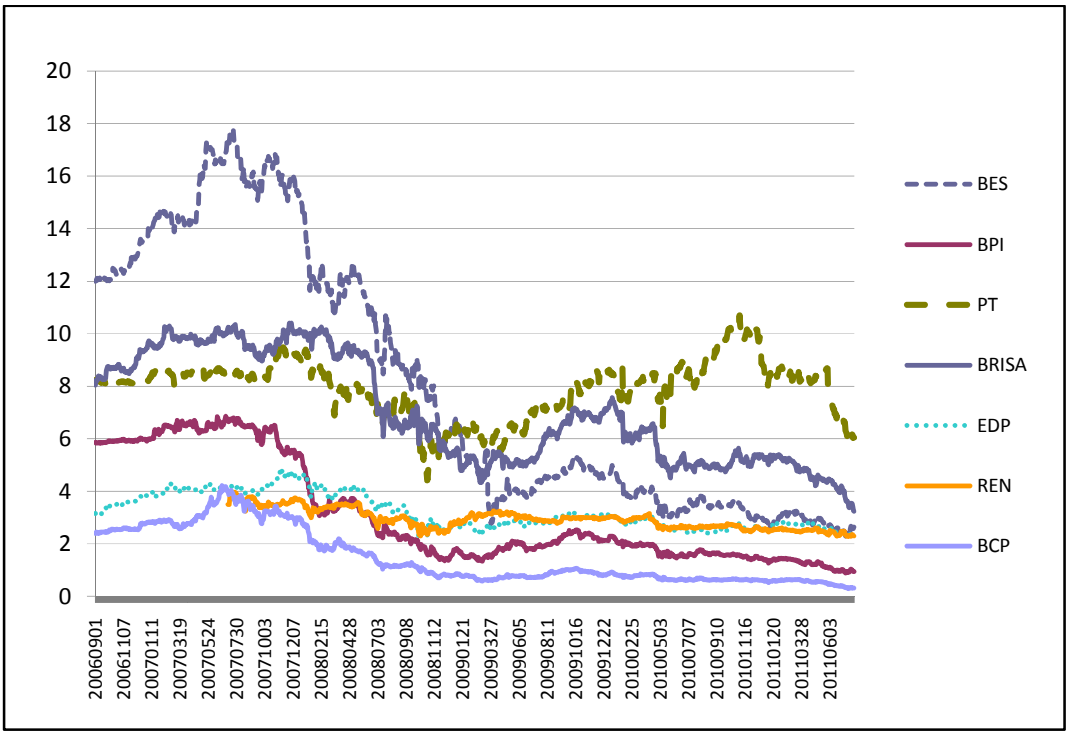


Source: www.*bolsapt.com*

The performance of these seven shares in the considered period is illustrated by the following graph:

[6] 1263 days, except for REN, that starts in July 2007. We choose this period because only after 2006/2007 did some Portuguese quoted firms started being rated by Moody's. This period also encompasses the start of the sub-prime crisis, the ensuing financial and economic crisis and the recent sovereign debt crisis felt in Europe.

Figure 2: Selected shares (values in €)



Source: www.*bolsapt.com*

The methodological starting point of this paper is to recognize that standard time-series techniques may not be well suited when dealing with the analysis of rating announcements and stock market performance. Stock market quotes are typically highly volatile on a day-to-day basis and rating announcements are infrequent, occurring on a single day. So, to overcome these problems, most papers have so far used event study techniques, where each individual credit rating and outlook changes is defined as a single event[7]. Afterwards, it is defined an event period, comprising the six prior event days, the event day and the four pos-event days, over which stock returns will be examined. The use of this narrow window allows reducing contamination problems which may bias the results of the analysis.

The event study methodology allows us to study the effect of a downgrade on the evolution of stock prices around the event. Of course, other factors might take place at

[7] An important reference for such an approach applied to sovereign ratings is Gande and Parsley (2005). For one of the first applications of event study methodology to financial markets see Brown and Warner (1980).

the same time, which also affect the evolution of stock prices[8]. Standard event-study methodology requires linking rating events to abnormal returns. Traditionally, daily risk adjusted abnormal market returns (*ar*) are derived from the conventional market model:

$$ar_{it} = r_{it} - (\alpha_i + \beta_i \, r_{mt}) \quad (1)$$

where r_{it} is the return on asset i at day t

r_{mt} is the corresponding return on the PSI-20 index at day t, and α_i and β_i are the market model parameters obtained from an OLS regression applied to all the period.

Afterwards, we compute the average abnormal return (*aar*) in each window day:

$$aar_t = \frac{1}{N}\sum_{i=1}^{N} ar_{it} \quad (2)$$

where N is the number of events. The average abnormal return is also aggregated through the event window, originating the cumulative average abnormal returns (*caar*). For any interval ($t_1 = -6$, $t_2 = 4$) in the event window, *caar* is defined as:

$$caar\,(t_1, t_2) = \sum_{t=t_1}^{t_2} car_t \quad (3)$$

The null hypothesis (H0) that the event has no impact in share prices before the announcement could be tested by the following statistics:

$$\theta_1 = \frac{aar_t}{var(aar_t)^{1/2}} \sim N(0,1) \quad (5)$$

$$\theta_2 = \frac{caar(-6,\ 4)}{var(caar(-6,\ 4))^{1/2}} \sim N(0,1) \quad (6)$$

The results for these statistics are in the Appendix (Tables A4 and A5).

[8] We are not controlling for those factors and we assume that on average there is no particular bias in the event studies. We expect that those other factors influence stock prices both positively and negatively in a random way.

4. Empirical results

Performing an OLS regression we obtain the following estimated β and R^2 for each share:

Table 3: Estimated β and R^2

Shares	β	R^2
BES	0,282 (5,71) ***	0,025
BPI	1,034 (28,72) ***	0,396
BCP	1,244 (35,222) ***	0,496
PT	0,934 (30,103) ***	0,418
BRISA	0,404 (11,525) ***	0,095
EDP	0,969 (40,724) ***	0,568
REN	0,522 (17,156) ***	0,221

Note: the values in brackets represent the t-statistics and *** denotes a 1% significance level.

A simple normality test shows that the abnormal returns do not present a normal distribution with zero mean and constant variance (see Table A1 in the Appendix)[9].

Concerning the individual abnormal returns (Figures A2 and A3 in the Appendix) we concluded that with the exception of Brisa and PT the *caar* are negative since the beginning of the event window, decreasing rapidly in the following days, with the exception of Brisa and EDP. At the end of the event window only BPI is positive, with EDP barely untouched. This suggests the possibility of market anticipation of the announcement. There is also a different performance of the *caar* after day 0. For instance, PT continues to decrease, whereas BES and BCP seem to stabilize around session 3. Since it is risky to take conclusions from individual shares, the following figures present the *average abnormal returns* and the *cumulative average abnormal*

[9] Even that the distributions aren't normal, the central limit theorem assures that if the values for the abnormal returns for all the shares are i.i.d. then the average distribution of the sample's abnormal returns converges to normality as the number of shares in the sample increases.

returns before and after an announcement, but now in aggregate terms. For presentation purposes we distinguished between banks (BES, BPI and BCP) and ex-banks (PT, BRISA, EDP and REN). Table A2 in the Appendix presents the values of those two variables for these different groups: total, banks and ex-banks.

Figure 3: Average abnormal returns before and after an announcement

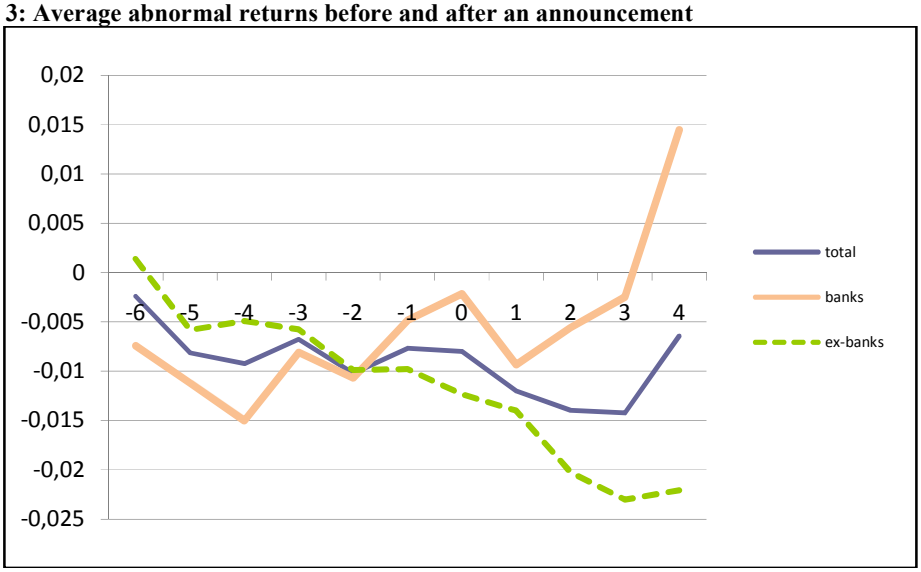
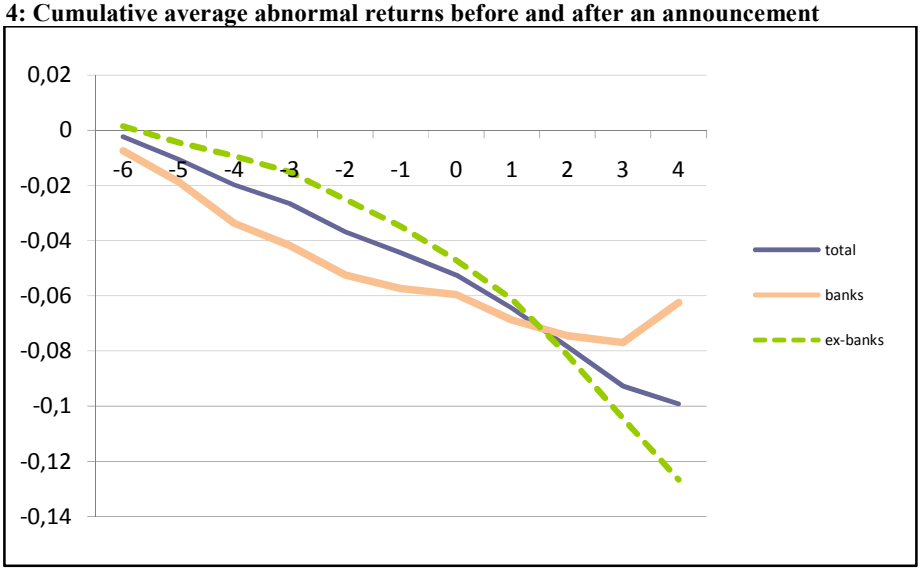


Figure 4: Cumulative average abnormal returns before and after an announcement



The figures present some evidence of an anticipation of the downgrade by the market players, yet with some reversal after day 0. This reversal is stronger in the banking sector, while ex-banks continue to display negative abnormal returns. Notice that, since usually the firm downgrade occurs days after the sovereign downgrade, it is natural to

observe some anticipation, whereas the bearish sentiment felt in the market also contributes.

Nevertheless, when we consider only a more recent period beginning in January 2010, as marking the inception of the sovereign debt crisis, the *average abnormal returns* and the *cumulative average abnormal returns* present a somehow different pattern (Figures 5 and 6). Table A3 also presents these results.

Figure 5: Average abnormal returns before and after an announcement (after January 2010)

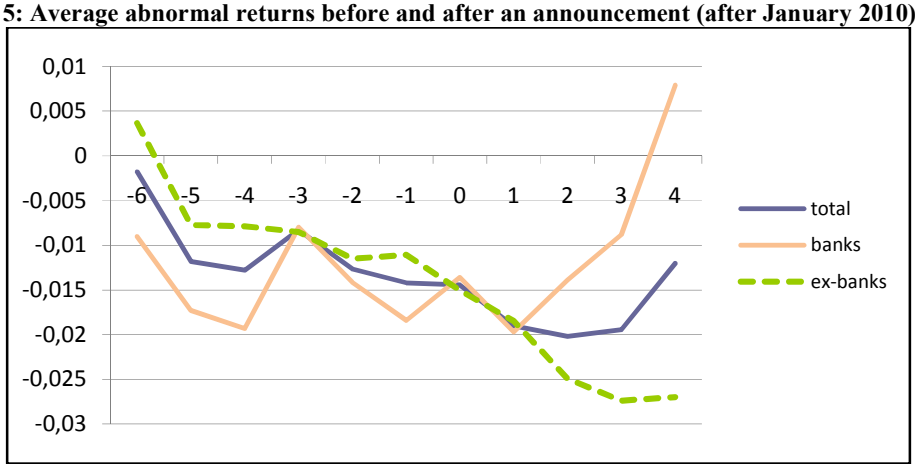
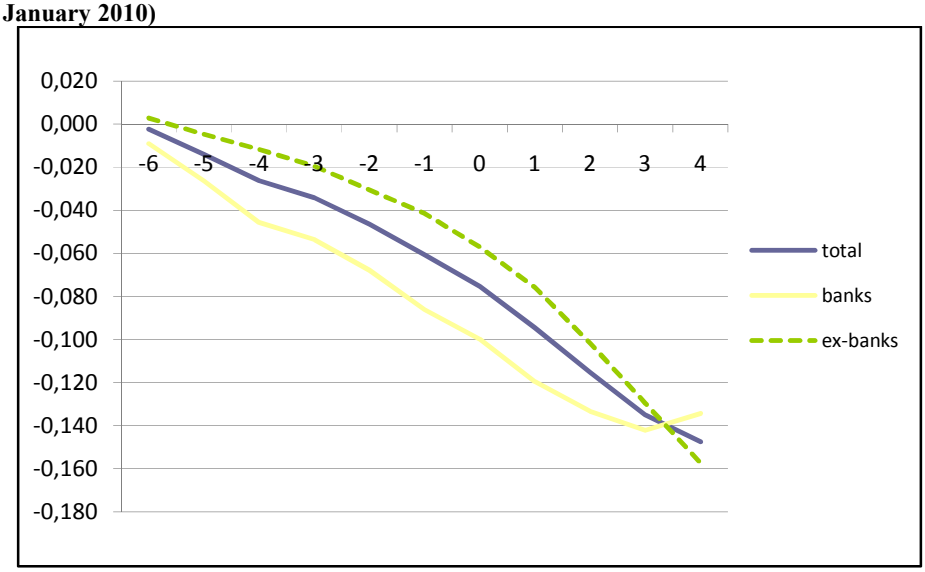


Figure 6: Cumulative average abnormal returns before and after an announcement (after January 2010)



Now all the shares, and in particular the banking ones, display a stronger negative reaction to downgrades, anticipating those events. At the announcement date we observe a total *aar* of -1,5% and the numbers continue to decrease in the following

days. Also, now is clearly the banking sector that pushes down the abnormal returns, before and after an announcement, albeit being the first to start to recover.

In terms of significance, Table A4 and A5 in the Appendix show the results for statistics θ_1 and θ_2. The average abnormal returns are more significant after the announcement date, albeit aren't significant for the banking sector. Considering only the period after January 2010, the significance tests are slightly more robust, nevertheless continuing weak for banks. Notice that, in both cases we continue to observe highly significant average abnormal returns after the announcement date. In relation to the cumulative average abnormal returns they only become significant after the announcement date (with the exception of the banking sector). Also in the period after January 2010, the results for the cumulative average abnormal returns become more significant in the post-announcement phase, suggesting the presence of a drift or contagion in share prices.

Finally, we analyze causality between sovereign credit ratings and share prices. In order to perform a causality test between announcements and stock returns we transform the ratings into a discrete variable, ranging from 1 to 17 (Table A3 in the Appendix)[10]. We do not find causality between ratings and returns and we could not reject the null in all cases, except for PT, where we reject the null that the stock returns do not cause the rating (Table A4 in the Appendix).

5. Conclusion

This paper analyzes the impact of the announcement of changes in credit ratings over the performance of a set of rated firms quoted in the Portuguese stock market. We find a significant response of share prices to changes in both the credit rating notations and in the outlook. This response seems to anticipate the announcements, either due to a previous sovereign downgrade or to the contagion effects of a bearish market outlook. Also, when analyzing the period after January 2010, we observe a stronger negative reaction to announcements, which is understandable given the greater influence and

[10] Afonso et al. (2011) perform a similar analysis.

market sensitivity to rating agencies. These conclusions shed some light on the connection between share prices' performance and individual credit ratings. The fact that negative rating events don't take share prices by surprise can either imply that fundamentals are already fully discounted by market participants or that rating events go, with some delay, after such fundamentals. This is a simple exercise, which could benefit from several extensions: first, it would be interesting to study whether the three main rating agencies affect stock prices differently; also, an additional extension would be to use more complete models to compute abnormal returns; finally, since usually individual rating changes occur days after a sovereign rating change, we could also relate the individual firms performance in the stock market with changes in sovereign ratings.

Appendix

Figure A1: Ratings (source: *Moody's*)

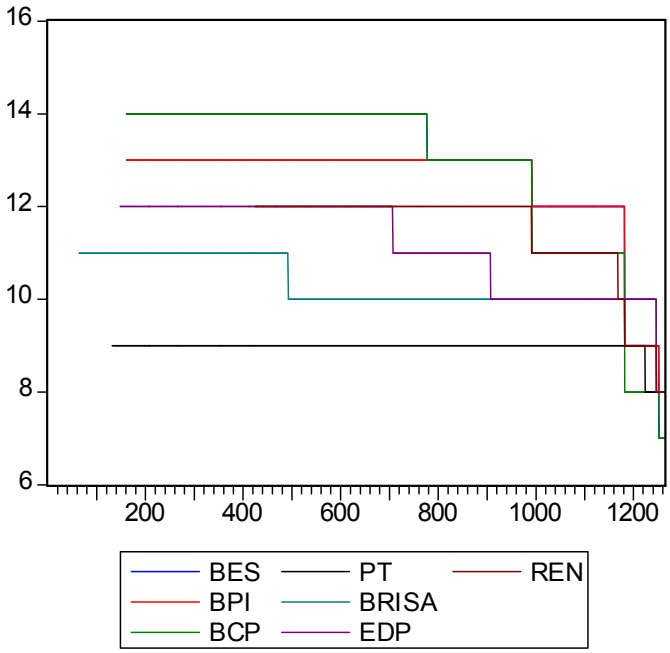


Table A1: Abnormal returns – normality test

	BES	BPI	BCP	PT	BRISA	EDP	REN
Skewness	-3,882756	0,228166	-0,128972	-0,451994	-0,854495	0,079787	-0,364509
Kurtosis	75,50917	9,823372	4,907130	22,28858	8,971082	7,191521	12,29321
Jarque-Bera	279632,0	2459,146	194,7518	19606,56	2028,374	925,1677	3769,078
Prob.	0	0	0	0	0	0	0
Nº. of observ.	1262	1262	1262	1262	1262	1262	1041

Figure A2: Abnormal returns for the individual shares

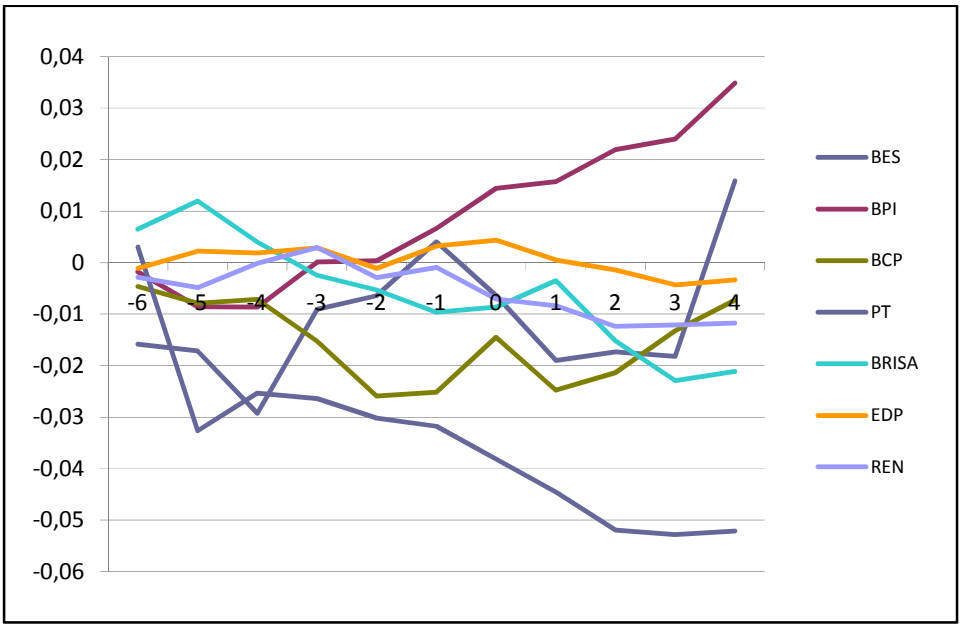


Figure A3: Cumulative average abnormal returns for the individual shares

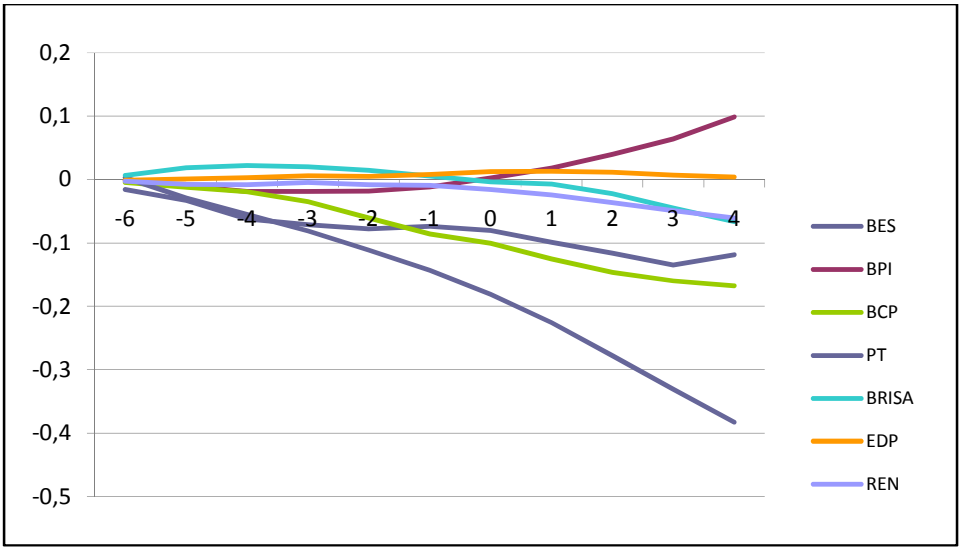


Table A2: Average abnormal returns and cumulative average abnormal returns

Days	Total		Banks		Ex-Banks	
	AAR	CAAR	AAR	CAAR	AAR	CAAR
-6	-0,002	-0,002	-0,007	-0,007	0,001	0,001
-5	-0,008	-0,011	-0,011	-0,019	-0,006	-0,004
-4	-0,009	-0,020	-0,015	-0,034	-0,005	-0,009
-3	-0,007	-0,027	-0,008	-0,042	-0,006	-0,015
-2	-0,010	-0,037	-0,011	-0,052	-0,010	-0,025
-1	-0,008	-0,044	-0,005	-0,057	-0,010	-0,035
0	-0,008	-0,052	-0,002	-0,059	-0,012	-0,047
1	-0,012	-0,064	-0,009	-0,069	-0,014	-0,061
2	-0,014	-0,078	-0,006	-0,074	-0,020	-0,081
3	-0,014	-0,093	-0,002	-0,077	-0,023	-0,104
4	-0,006	-0,099	0,014	-0,062	-0,022	-0,127

Table A3: Average abnormal returns and cumulative average abnormal returns (after January 2010)

Days	Total		Banks		Ex-Banks	
	AAR	CAAR	AAR	CAAR	AAR	CAAR
-6	-0,002	-0,002	-0,009	-0,009	0,003	0,003
-5	-0,012	-0,014	-0,017	-0,026	-0,008	-0,008
-4	-0,012	-0,026	-0,019	-0,046	-0,007	-0,007
-3	-0,008	-0,034	-0,008	-0,054	-0,008	-0,008
-2	-0,012	-0,046	-0,014	-0,068	-0,011	-0,011
-1	-0,014	-0,061	-0,018	-0,086	-0,011	-0,011
0	-0,015	-0,075	-0,014	-0,100	-0,016	-0,016
1	-0,019	-0,095	-0,020	-0,120	-0,019	-0,019
2	-0,021	-0,115	-0,014	-0,133	-0,026	-0,026
3	-0,020	-0,135	-0,009	-0,142	-0,028	-0,028
4	-0,012	-0,148	0,008	-0,134	-0,028	-0,028

Table A4: Values for θ_1 and θ_2 and significance levels

Days	Total		Banks		Ex-Banks	
	θ_1	θ_2	θ_1	θ_2	θ_1	θ_2
-6	-0,721	-0,077	-1,011	-0,345	0,186	0,034
-5	-2,449	-0,338	-1,525	-0,865	-0,784	-0,109
-4	-2,784**	-0,634	-2,044	-1,563	-0,661	-0,230
-3	-2,036	-0,851	-1,100	-1,938	-0,776	-0,372
-2	-3,079**	-1,179	-1,453	-2,434*	-1,330	-0,615
-1	-2,311*	-1,426	-0,661	-2,659*	-1,317	-0,856
0	-2,406*	-1,682	-0,294	-2,759*	-1,663	-1,159
1	-3,614***	-2,067	-1,273	-3,194***	-1,882	-1,503
2	-4,203***	-2,515*	-0,761	-3,454***	-2,722*	-2,001
3	-4,284***	-2,971**	-0,340	-3,570***	-3,098**	-2,566*
4	-1,932	-3,177***	1,968	-2,898**	-2,970**	-3,109**

Table A5: Values for θ_1 and θ_2 and significance levels (after January 2010)

Days	Total		Banks		Ex-Banks	
	θ_1	θ_2	θ_1	θ_2	θ_1	θ_2
-6	-0,440	-0,048	-1,201	-0,205	0,298	0,055
-5	-2,283*	-0,297	-2,298*	-0,596	-0,801	-0,093
-4	-2,388*	-0,557	-2,567*	-1,033	-0,741	-0,231
-3	-1,527	-0,724	-1,060	-1,214	-0,821	-0,384
-2	-2,401*	-0,986	-1,882	-1,534	-1,163	-0,600
-1	-2,745*	-1,285	-2,445*	-1,951	-1,154	-0,814
0	-2,884**	-1,599	-1,809	-2,259*	-1,667	-1,123
1	-3,711***	-2,004	-2,616*	-2,705**	-1,972	-1,490
2	-4,057***	-2,446*	-1,846	-3,019**	-2,761*	-2,003
3	-3,830***	-2,864**	-1,174	-3,219***	-2,946**	-2,550**
4	-2,429*	-3,129**	1,049	-3,040**	-2,941**	-3,096**

Where *, ** and *** denotes, respectively, 2,5%, 1% and 0,5% significance levels.

Table A3: Moody's rating system

Characterization of debt and issuer		Rating	Linear transformation
Highest quality	Investment grade	Aaa	17
High quality		Aa1	16
		Aa2	15
		Aa3	14
Strong payment capacity		A1	13
		A2	12
		A3	11
Adequate payment capacity		Baa1	10
		Baa2	9
		Baa3	8
Likely to fulfill obligations, ongoing uncertainty	Speculative grade	Ba1	7
		Ba2	6
		Ba3	5
High credit risk		B1	4
		B2	3
		B3	2
Very high credit risk		Caa1	
		Caa2	
		Caa3	1
Near default with possibility of recovery		Ca	
Default		D	

Table A4: Causality test

	F stastistic	Prob.
RBES do not cause RATBES	0,51011	0,76879
RATBES do not cause RBES	1,23358	0,29106
RBPI do not cause RATBPI	0,86470	0,50420
RATBPI do not cause RBPI	1,15335	0,33033
RBCP do not cause RATBCP	0,29688	0,91474
RATBCP do not cause RBCP	0,45017	0,81334
RPT do not cause RATPT	8,38842	0,00000
RATPT do not cause RPT	0,86252	0,50569
RBRISA do not cause RATBRISA	1,77413	0,11525
RATBRISA do not cause RBRISA	1,03545	0,39519
REDP do not cause RATEDP	1,22728	0,29399
RATEDP do not cause REDP	1,91286	0,08950
RREN do not cause RATREN	0,62824	0,67827
RATREN do not cause RREN	0,27058	0,92925

Note: results obtained using 5 lags

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CIGE – Centro de Investigação em Gestão e Economia
Universidade Portucalense – Infante D. Henrique
Rua Dr. António Bernardino de Almeida, 541/619
4200-072 PORTO
PORTUGAL

http://www.upt.pt
cige@uportu.pt

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