

A Work Project, presented as part of the requirements for the Award of a Masters Degree in Finance from the
NOVA – School of Business and Economics

Effect of European Sovereign Debt Crisis on Banks' Stock Market Performances

Application to Portuguese Data

Artur Jorge Gonçalves Mendes #314

A Project carried out on the Finance course, under supervision of:

Professor Paulo Soares de Pinho

Lisbon, June 2012

Abstract

This paper studies the impact of the European sovereign debt crisis on Portuguese banks' share prices. I employ an event study methodology to assess the behavior of banks' share prices before, and after a credit rating announcement in relation to both the sovereign and the banks individually. I find that sovereign credit ratings have a significant impact on banks' stock market returns while individual bank credit ratings seem to have little influence. This is probably due to the fact that banks' credit ratings have been reflecting changes in sovereign ratings rather than any idiosyncratic factors of banks' solvency. Among the rating agencies studied the most predominant is Standard & Poor's. Furthermore, I find that the behavior of banks' stock returns exhibit a certain degree of market inefficiency and anticipation.

Key words: European sovereign debt crisis, banks' share return, event study, market efficiency.

1. Introduction

Financial stability risks have increased¹ substantially over the past two years due to the burst of the so-called European sovereign-debt crisis. It all began when doubts about the Greek government ability to honor their debts maturing in 2010 made credit rating agencies review the rating notation of several countries pressuring government bonds' yields to increase drastically. Ever since some European countries with special focus on those known as peripheral countries – Ireland, Portugal, Spain, and Italy – were thrown to the spotlight of the protracted crisis, which began with the late 2000s financial crisis.

In the aftermath of this first stage of the crisis – predominantly financial - and with the economies slowing as a result of tightened credit and decreasing international trade, governments all over the world were forced to take on unprecedented fiscal stimulus, expansionary monetary policy and tremendous institutional bailouts for those considered “too big to fail”.

Among the main recipients of those spectacular rescue packages were banks, which were re-capitalized at a global scale so as to stave off the banking crisis instigated by the international financial crisis started in 2007. It worked but only to postpone it as most of the money banks received from governments was without delay to the safest place banks could find in the pandemonium of the financial crisis – the so-thought haven of government debt.

As a consequence of the spectacular fiscal efforts, bailouts, and subsequent recession public finances across advanced economies suffered a sharp deterioration, raising concerns regarding the sovereign risk for those who already had weak debt positions. On top of that, the impossibility of euro area countries to use monetary policy engenders amplified difficulties for such countries. Acknowledging the weak fiscal position of some euro area countries credit rating agencies started

¹ Source: IMF, September 2011 issue of the Global Financial Stability Report

reviewing the sovereign credit ratings, especially that of peripheral countries. As a result of the concerns/downgrades, the financing costs for countries with poor fiscal balances rose immensely leaving Greece (May 2010), Ireland (November 2010), and Portugal (May 2011) no choice but default or ask for external help in order to meet their financing needs at a reasonable and viable cost.

In sum, banks are now very much in the same position they were back in 2007/8 only now the toxic assets are government bonds instead of mortgage-back securities – nobody really knows how much they are worth. With banks facing such difficulties hovers in the air the possibility of a credit shrinkage, which would probably trap the forsaken real economy in a downward spiral as argued in several studies².

Given that this is an issue of utmost importance it is imperative to study the impacts that a sovereign debt crisis can have first on banks, and consequently on the general economy. In the scope of this paper I study solely the impact on banks but the contagion to the main street is certainly a problem worthy of further research. Also, because government debt crisis are not common in developed countries, the literature studying the importance of credit rating agencies announcements on the latter countries is limited, which makes studies on this subject even more significant. This paper tries to provide a better understanding on how has the sovereign-debt crisis affected banks, in particular Portuguese banks listed on the main Portuguese stock index – PSI20.

The remainder of this paper is organized as follows: section two presents the methodology used in this paper as well as the data used and respective sources. Section three starts the empirical analysis using a rather more descriptive approach. Sections four and five continue the empirical study using a more analytical and sophisticated approach – event study. The relevant results are offered in the final of each section. Finally, section six encloses the main conclusions.

² Notably, Bernanke (1983) in one of his famous studies about the Great Depression argues that the credit squeeze helped transforming the severe but not unprecedented downturn of 1929-30 into the most severe recession of the 20th century.

2. Methodology

With this paper I aspire to assess how banks' performances are affected by credit rating announcements both at a country and bank level. This is an issue that has been affecting the life of all European citizens, especially those of the most affected countries such as Portugal and thus I believe it is important to study its consequences to the financial industry as it then distresses the non-financial ones. Furthermore, while there are several publications studying the impacts of credit rating announcements on government bonds' spreads the literature regarding its impact on banks is limited, which makes it an important topic to analyze, especially in the world we live today.

Beginning with what I call preliminary analysis, I compare the performance of banks with the performance of the other industries on the whole. This approach allows for a better understanding on how banks have performed in the past few years in comparison with the non-financial part of the economy. In addition I study the correlations between sovereign and banks' credit default swaps. Secondly, and in a more technical note I make use of the event study methodology in order to assess and quantify those impacts. Also, by employing this workhorse of empirical finance I pretend to assess the existence of market efficiency regarding credit rating types of announcements.

Notwithstanding the helpfulness of the event study tool, it is important to be aware that the use of such statistical instrument carries with it a few shortcomings, namely due to the fact that apart from the period leading to the first downgrade studied, it's difficult to find a clean estimation window. Nonetheless, I try to make the necessary adjustments to mitigate problems that may arise from the likely hindrances.

The exact detail on how I employed the event study tool is described in its corresponding section.

2.1 Data & Sources

The data used so as to perform this study was collected on Datastream and Bloomberg. From the first I obtained all the price series of banks, and other indexes used, as well as time-series of credit default swaps for both banks and the Portuguese Republic. Then I ought to calculate the return of banks' shares in order to carry out the analysis. From Bloomberg I obtained all the information regarding rating news over the period under analysis – from Jan '09 to Jan '12. I focus on the long-term ratings denominated in foreign-currency because these debt issues have extensive rating information and tend to be more liquid.

In total, considering all rating agencies that issue rating opinions³ on the analyzed institution (The Big Three⁴ and Dominion Bond Rating Service) there were 79 announcements (51 downgrades and 28 outlook revisions). Detailed information on the nature of such announcements can be found in Appendix 1. Additional details on the data used will be provided alongside with the extensive explanation of the methods used in their respective sections.

3. Preliminary Analysis

To begin the analysis on how sovereign ratings have affected banks I compare the performance of the banking industry with that of the non-banking industry from a few months before the beginning of the sovereign-debt crisis up until March 2012. For this purpose I consider that the crisis started in January 2009 when the sovereign credit rating for Portugal was first downgraded. Not by chance, the period leading up to the first downgrade was one of tremendous turmoil. That fact might distort what I am trying to assess – that the sovereign debt crisis, notwithstanding affecting the economy on the whole affects banks more severely.

³The credit ratings assigned by the several agencies are opinions on the ability of an entity or of a security issue to meet financial commitments, such as interest or repayment of principal, on a timely basis.

⁴ Name widely used when referring to the three main credit rating agencies (Standard & Poor's, Moody's, and Fitch)

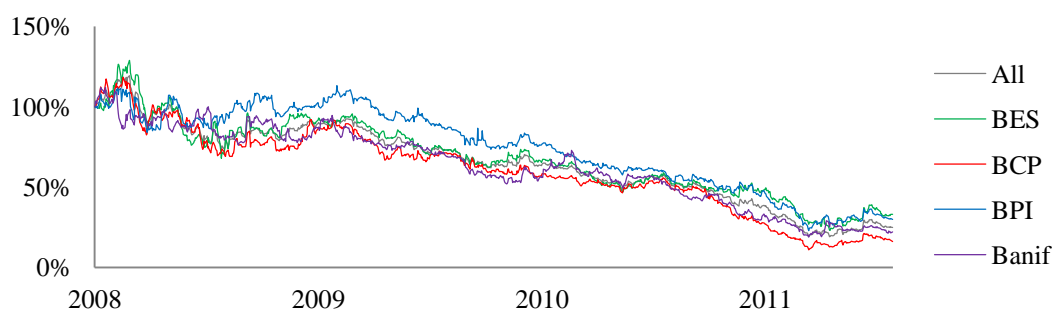
To do this comparison between banks' and the rest of the economy I used two series of daily data from Datastream – one that aggregates the entire Portuguese banking system (Portugal – DS Banks) and other, which encompasses all other industries except banks (Portugal – DS Non-Financial). Moreover, I compare individually the performance of the four publicly traded Portuguese banks against the same non-financial index (henceforth NFI).

In order to carry out this approach I compute the ratio⁵ between each bank share value to the NFI value and set the value for September, 2008 equal to 100%. Despite the simplicity of this approach, it is useful to grasp the relative performance of banks relatively to other industries. More sophisticated approaches will be developed later on.

Results (Graph 1) demonstrate clearly that, Portuguese banks' share prices have underperformed greatly the NFI. For instance, the banking industry on the whole presents a ratio of 25% in March 2012. Individually the best performer during the scrutinized period was Banco Espírito Santo (BES) but its ratio against the NFI went from 100% in the beginning of September 2008 to 33% as of the beginning of March 2012. On the other hand, Banco Comercial Português (BCP) was the one having the worst performance – as of March 2012 the ratio was of 16,2%. These figures indeed suggest that the sovereign debt crisis has been having a tremendous impact on the banks' share prices in relation to the other industries. BPI and Banif exhibit a ratio of 30% and 22% respectively.

Moreover, one can observe from Graph 1 that following the natural distress caused by the failure of Lehman Brothers in the end of 2008 banks recover modestly until concerns about the creditworthiness of sovereigns started increasing (second half of '09). Lately, since late 2011/early 2012, banks started recovering relatively to the non-financial part of the market, which signals that investors are easing the pressure on Portuguese banks (government bonds' yields) as the so-called “programa de ajustamento” seems to be producing good enough results.

⁵ $\text{Ratio}_{i,t} = \text{Bank}_{i,t} \text{ Share Value} / \text{NFI}_t \text{ value}$. This approach is borrowed from Paneta et al. (2011)



Graph 1 ratio of the banks' shares prices to the NFI. Daily data; 1 September 2008 = 100.

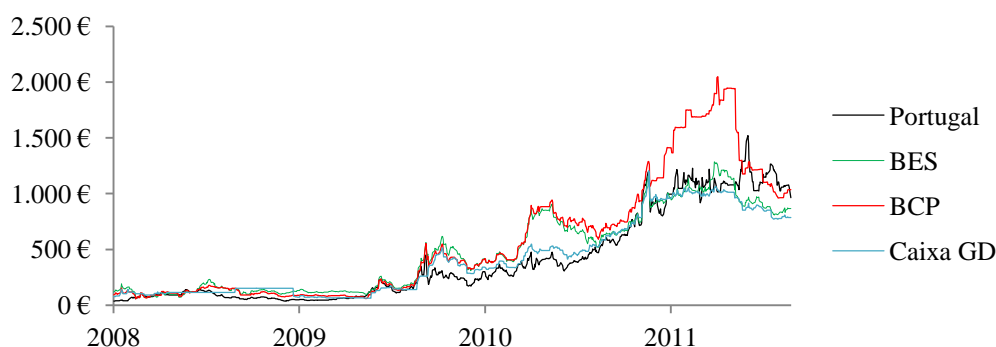
Sources: Datastream, author calculations

Secondly, I study the correlations between the sovereign and banks' credit default swaps (CDS) with the purpose of seeing if the perceived creditworthiness of banks moves together with that of the sovereign. The banks analyzed are BES, BCP, and Caixa Geral de Depósitos. Due to lack of information BPI and Banif are not examined.

In order to carry out this analysis I use the 5-year senior CDS as they are the most liquid instrument among all the maturities available and therefore represent more accurately the true relationship between sovereign and banks' CDSs.

Regarding the analyzed time-span it corresponds to the previous 5 years. The study was made by exploiting daily data collected from Datastream. So as to have a reliable continuous series I had to combine the CMA Datavision CDS series with Thomson Reuters CDS series as the first ends in 2010 and the latter begins in 2009.

As one can observe from the Graph 2, banks' and sovereign's credit default swaps have been moving quite closely, which indicates a strong relationship between the creditworthiness of the sovereign and that of banks. Moreover, it is observable that CDSs started increasing more dramatically on the end of 2009, when the sovereign debt crisis was first identified.



Graph 2 – 5 year credit default spreads from the Republic of Portugal and Portuguese banks. Source: Datastream

Calculations on the correlations between sovereign and banks' CDSs and among banks are presented below in Table 1. The computations show correlations really close to 1. In relation to the sovereign, CDS correlations range from 0,94 of BES to 0,97 of CGD. Inter banks CDS correlations range from 0,95 (BPI with BES and CGD) to 0,98 between BES and CGD.

Again, correlation coefficients show evidence of a very strong relationship between the creditworthiness of the sovereign and that of banks.

Table 1 – Correlation between sovereign and banks' CDSs

| | Portugal | BES | BCP | BPI | Caixa GD |
|----------|----------|------|------|------|----------|
| Portugal | 1 | | | | |
| BES | 0,94 | 1 | | | |
| BCP | 0,95 | 0,97 | 1 | | |
| BPI | 0,90 | 0,95 | 0,96 | 1 | |
| Caixa GD | 0,97 | 0,98 | 0,97 | 0,95 | 1 |

Sources: Author calculations based on Datastream.

4. Event Study

4.1 Introduction

In this section an event study on the effect of sovereign-debt crisis on banks' performances is carried out. In order to do so I study the impact of announcements by credit rating agencies on the return of banks' shares. This study considers all credit rating agencies that issue rating opinions on

any of the considered institutions – Standard & Poor’s, Moody’s, Fitch and DBRS. Furthermore I analyze the impact of both outlook revisions and downgrades separately.

The implementation of the event study has the advantage of using available financial market data. Furthermore, its usefulness lies on the fact that, given rationality in the market place, the effect of an event will impact the securities’ prices without delay, which makes the use of event studies an important tool in capital market research as a way of testing market efficiency.

The event study framework has several applications for various fields but especially in the world of finance. The most notable are related to announcements of: mergers and acquisitions, earnings, issues of new debt or equity or the release of macroeconomic related figures, accounting rule changes, or changes in the severity of regulation.

In this paper I conduct an event study in which the event studied is rather than a corporate level announcement, a supra company announcement where all companies are affected at the same type –announcements by credit rating agencies. Studying an event that impacts all companies simultaneously carries with it some statistical problems that will be addressed later on. Hereafter follows a brief literature review on event studies.

4.1.1 Literature Review

“There was little evidence on the central issues of corporate finance. Now we are overwhelmed with results, mostly from event studies” (Fama, 1991, p.1600)

The sentence above illustrates well the importance that event study has had in understanding the corporate world. Moreover, and even though, event studies have been introduced several decades ago, Harrington and Shriver (2007) point out that “over 35 years following its introduction by Fama, Fisher, Jensen, and Roll (1969), the short-horizon event study remains a workhorse of empirical finance and corporate finance in particular.”

Although it is still a prevalent instrument, the concept of such an important tool in finance is quite old and can be traced back to the early 1930s but it was not until the late 1960s that the event study methodology would see its biggest breakthrough. Firstly, Ray Ball and Philip Brown (1968) considered the information content of earnings. Secondly, and most importantly Fama, Fisher, Jensen, and Roll (1969) study the effect of stock splits after removing the effects of simultaneous dividend increases.

The academic developments from 1969 onwards are very much related with the methodology used by Fama et al. (1969) mainly because the subsequent research basically tried to overcome some shortcoming of this early study. The list of issues comprises the following statistical shortcomings: often abnormal returns estimators 1) are cross-sectionally correlated, 2) have different variances across firms, 3) are not independent across time for a given firm or 4) have greater variance during the event period than in surrounding periods.

Notwithstanding the large list of statistical drawbacks, contributions from several authors namely Jaffe and Mandelker (1974), Patell (1976), Beaver (1968); Mikkelson and Partch (1988), Mais et al. (1989), Cowan (1991), Karafiath and Spencer (1991), Sweeney (1991), and Salinger (1992) have helped circumventing the problems.

4.2 “Traditional” Event Study Methodology

After having briefly reviewed the academic developments of the last few decades and the several hypotheses one has when performing an event study, I now present the methodology used in this study. While the approach followed is closely related to what Fama et al. (1969) suggested, it has some modifications with the purpose of correcting statistical problems arising from the fact that the event of interest is the same for all analyzed securities. I focus primarily in A. Craig MacKinley (1997) and Khotari and Warner (2006) to carry out the analysis.

4.2.1 General Steps

Even if there is no strict methodology to conduct an event study, there is a widely accepted flow of analysis. After defining the events of interest, which on the ambit of this paper are the announcements by credit rating agencies, one has to decide upon the period over which security prices of relevant firms will be examined – this period is known as the event window.

For the sake of this paper and as stated previously the relevant firms are the Portuguese banks, explicitly those listed on the PSI 20. Moreover, the analysis uses a 5-day event window.

The event window is larger than the event of interest so as to permit the examination of periods surrounding the event. For instance, by considering an event window greater than solely the day in which the announcement is made, it is possible to study for market efficiency and anticipation, as it will be discussed below.

4.2.2 The Concept of Abnormal Return and Normal Return Models

The appraisal of the event's impact entails a measure of the abnormal return. Just like in Fama et al. (1969) the abnormal return is defined as the actual ex post difference between the realized return of the firm and the “normal return” during the event window.

The normal return is defined as the expected return without conditioning on the event taking place. The abnormal return for firm i and event date t is specified as follows:

$$AR_{i,t} = r_{i,t} - E(r_{i,t}|X_t), \quad (1)$$

where $AR_{i,t}$, $r_{i,t}$, and $E(r_{i,t}|X_t)$ are the abnormal, realized, and normal returns respectively while X_t is the conditioning information for the normal return model.

A variety of normal return models have been proposed. The importance of such model lies on the fact that with greater r-squared the greater is the variance reduction and therefore the prediction will have more power. However, r-squared is not all, as with the increase of explanatory variables goes the increase in estimation error in a way that it's important to have a model offering a high r-

squared while being at the same time parsimonious. The most purposeful models suggested in previous literature are: 1) mean-adjusted returns, (2) market model, (3) deviation from the Capital Asset Pricing Model (CAPM), or (4) deviations from the Arbitrage Pricing Theory (APT).

In this paper I use the so-called market model due to its simplicity, parsimoniously and the fact that gains arriving from employing multifactor models for event studies are limited (MacKinlay, 1997). Moreover, the implementation of statistical models such as the market model require the assumption that asset returns are independent and identically distributed through time, which while being strong assumptions, are empirically reasonable and inference using normal return models tend to be robust to deviations from assumptions.

4.2.3 Market Model

The market model is a statistical model in which the return of any given security is linked to that of a broad market portfolio. As refereed above, the statistical specification of the model is build upon the assumption of joint normality of assets returns and is as follows:

$$r_{i,t} = \alpha_i + \beta_i r_{m,t} + \varepsilon_i \quad (2)$$

$$E[\varepsilon_{i,t}] = 0 \text{ and } Var(\varepsilon_{i,t}) = \sigma_{\varepsilon_i}^2, \quad (3) \& (4)$$

where $r_{i,t}$ and $r_{m,t}$ represent the period- t return of bank i and of the market respectively, and $\varepsilon_{i,t}$ is the zero mean disturbance error term. α_i , β_i , and $\sigma_{\varepsilon_i}^2$ are the parameters of the model.

4.2.4 Estimation

Regarding the length of the estimation window, it is usually set to encompass the 120 daily observations prior to the event window. The event window is not included in the estimation window to avert the event from influencing the normal performance model parameter estimates.

I use robust methods to estimate the parameters so as to accommodate for the possibility of heteroskedasticity and autocorrelation.

4.2.5 Distribution of Abnormal Returns

Given the model parameters one has then to measure and analyze the abnormal returns. The sample of daily abnormal returns is generated as follows:

$$\widehat{AR}_{i,t} = r_{i,t} - [\hat{\alpha}_i + \hat{\beta}_i r_{m,t}], \quad (5)$$

where $\widehat{AR}_{i,t}$ represent the abnormal returns estimated by using the market model. Under the null hypothesis, conditional on the event window market returns, the abnormal returns will be jointly normally distributed with a zero conditional mean and conditional variance $\sigma^2(\widehat{AR}_{i,t})$ as presented below:

$$\sigma^2(\widehat{AR}_{i,t}) = \sigma_{\varepsilon_i}^2 + \frac{1}{L_1} \left[1 + \frac{(r_{m,t} - \hat{\mu}_m)^2}{\hat{\sigma}_m^2} \right], \quad (6)$$

where $\hat{\mu}_m$ is the average return of the market during the estimation period, and $\hat{\sigma}_m^2$ the variance of returns during the same period. The second component is due to sampling error and leads to serial correlation of abnormal returns. This problem is solved easily as in practice the length of the estimation window can be chosen to be large enough so that the second component of the right-hand side of (6) goes to zero. In fact, by using an estimation window as explained above its secure to ignore it - the variance of the abnormal returns will be solely $\sigma_{\varepsilon_i}^2$. After having estimated the abnormal returns and in order to assess the significance of the event it is paramount to make use of the distribution of abnormal returns, which under the null hypothesis - that the event has no impact on the behavior of returns - is:

$$\widehat{AR}_{i,t} \sim N \left(0, \sigma^2(\widehat{AR}_{i,t}) \right). \quad (7)$$

4.2.6 Aggregation of Abnormal Returns

Furthermore and in order to accommodate for multiple period event window one has to aggregate the abnormal returns observations. The concept used for such aggregation is again the

same used by Fama et al. (1969) - the cumulative abnormal return (CAR). For an event window going from τ_1 to τ_2 the sample cumulative abnormal return is the sum of included abnormal returns:

$$\widehat{CAR}_i(\tau_1, \tau_2) = \sum_{\tau=\tau_1}^{\tau_2} \widehat{AR}_{i,\tau}. \quad (8)$$

Moreover, and as in the variance of abnormal return in (6), asymptotically (with large enough estimation window) the variance of \widehat{CAR}_i is defined as:

$$\sigma_i^2(\tau_1, \tau_2) = (\tau_2 - \tau_1 + 1)\sigma_{\varepsilon_{i,t}}^2. \quad (9)$$

The distribution of the cumulative abnormal return under the null hypothesis is then:

$$\widehat{CAR}_i(\tau_1, \tau_2) \sim N\left(0, \sigma_i^2(\tau_1, \tau_2)\right). \quad (10)$$

4.2.7 Estimation of the Variance and *t*-test

In practice, because $\sigma_{\varepsilon_{i,t}}^2$ is unknown, one must estimate the variance of the abnormal returns.

The sample variance measure of $\sigma_{\varepsilon_{i,t}}^2$ from the estimation window is a suitable choice. Given the distribution of (cumulative) abnormal returns under the null hypothesis, tests on the veracity of the latter can be conducted using the following *t*-ratio:

$$t - test = \frac{\widehat{CAR}_i(\tau_1, \tau_2)}{Var[\widehat{CAR}_i(\tau_1, \tau_2)]^{1/2}} \sim N(0,1). \quad (11)$$

The test above allows for studying the effect of the event of interest at an individual basis. In order to study the impact at an aggregate level (i.e. banking industry on the whole) banks' abnormal returns must be aggregated cross-sectionally; however, this is not possible as the assumption that the abnormal returns are independent across securities does not hold, due to the overlap of event windows. With the overlap the implicit assumption that covariances among securities are zero does not hold. This is often referred to as clustering.

4.2.8 Inferences with Clustering

There are two ways of handling the overlapping of the event window. One is to use a portfolio approach, case in which the security level analysis can be applied directly to the portfolio. The other is to analyze the impact at a security level. This second approach is most commonly used when there is total clustering and in spite of having little power and poor finite sample properties relatively to the first, has the advantage of accommodating for situations where some firms exhibit positive abnormal returns and some other negative abnormal returns.

In the scope of this work I perform both analyses. For that I use the same banking industry portfolio as in the preliminary analysis (Portugal – DS Banks).

4.2.9 Results

Applying the methodology explained above I study the significance of all announcements made by the pertinent rating agencies. Firstly, I estimate the 5-day CARs starting on the day of the announcement (8). Secondly, I ought to estimate the variance of the CARs, which is done using (9) after estimating the variance of the abnormal returns. Finally, with the 5-day CAR and respective standard deviation I apply the *t*-test (11). The appraisal of the *t*-test is standard.

Table 1 below presents a brief summary of the results obtained by employing this so-called “traditional” event study methodology. The events are treated individually, and divided into two groups - downgrades and outlook revisions – so as to grasp the impact of each set of events⁶. The upper part of the table sums up the impacts of sovereign related announcements whereas the inferior summarizes the effect of bank related announcements. I present the average CAR across all events as well as the percentage of significant events of each set of announcements (e.g. 1/5 means that 1 out of 5 was significant). For a more comprehensive understanding please refer to Appendix 2 where the results are presented in an extensive manner, event by event.

⁶ For example, all the announcements of S&P regarding BES are considered a set of events.

Table 2 - Summary of Announcements' Effects

| Sovereign Related Announcements | | | | | | | | |
|---------------------------------|-----------|---------|-----------|-----------------------------|-----------|---------|-----------|-----------------------------|
| Bank | S&P | | Fitch | | Moody's | | DBRS | |
| | Downgrade | Out.Rev | Downgrade | Out.Rev | Downgrade | Out.Rev | Downgrade | Out.Rev |
| Banking Industry | | | | | | | | |
| %Significant Events | 1/5 | 2/4 | 2/5* | | 0/3 | 0/2 | 2/2 | |
| Average CAR | -0,41% | -4,34% | -1% | | -1% | 1% | -7% | |
| Banif | | | | | | | | |
| %Significant Events | 1/5 | 1/4** | 1/5 | | 0/3 | 0/2 | 1/2 | |
| Average CAR | -2,83% | -0,82% | -4% | | -1% | 1% | -6,04% | |
| BCP | | | | Not applicable ⁺ | | | | Not applicable ⁺ |
| %Significant Events | 2/5 | 1/4 | 2/5 | | 1/3 | 1/2** | 1/2 | |
| Average CAR | -0,46% | -3,94% | -3% | | -2% | 1% | -6,06% | |
| BES | | | | | | | | |
| %Significant Events | 3/5* | 3/4 | 3/5* | | 0/3 | 0/2 | 1/2 | |
| Average CAR | -0,68% | -6,84% | -1% | | -3% | 1% | -6,12% | |
| BPI | | | | | | | | |
| %Significant Events | 0/5 | 1/4 | 1/5** | | 0/3 | 0/2 | 1/2 | |
| Average CAR | -2,59% | -1,85% | 1% | | -2% | 2% | -7,80% | |
| Bank Level Announcements | | | | | | | | |
| | S&P | | Fitch | | Moody's | | DBRS | |
| | Downgrade | Out.Rev | Downgrade | Out.Rev | Downgrade | Out.Rev | Downgrade | Out.Rev |
| BCP | | | | | | | | |
| %Significant Events | 1/4 | 1/3*** | 1/4** | 0/1 | 0/5 | 2/4** | | |
| Average CAR | 2,19% | -5,02% | 0,16% | 1,19% | -0,86% | 2,10% | NA | |
| BES | | | | | | | | |
| %Significant Events | 2/4* | 0/2 | | | 1/5** | 2/4** | 1/2 | |
| Average CAR | 3,07% | -5,43% | NA | | -0,80% | 5,06% | -6,12% | NA |
| BPI | | | | | | | | |
| %Significant Events | 1/4** | 0/2 | 0/4 | 0/1 | 1/4** | 0/5*** | | |
| Average CAR | -0,19% | -4,53% | 2,89% | 0,15% | 1,99% | 1,89% | NA | |

The threshold for an event to be considered significant is a p-value<10%; *This percentage include cases where the CAR are significantly positive; **Significant events arising from this set of events are only positive;*** one of this outlook revision is a positive one; 1/5 (#significant Events)/ (#Total Events).
Source: Author Calculations

From the results presented in table 1 it is observable that sovereign related announcements engendered, in general, negative CARs. Particularly, announcements from S&P and DBRS caused negative average CARs across all the analyzed securities.

Also, Fitch's announcements produced negative average CARs to all securities with the exception of BPI. In relation to Moody's, the results point out a clear division between downgrades and outlook revisions with the first producing negative average CARs across the board whereas the latter generated positive average CARs, also across the board.

Breaking the analysis into downgrades and outlook revisions from S&P one observes that with exception of Banif and BPI, outlook revisions have had more impact than downgrades themselves. In fact, sovereign outlook revisions by S&P are the set of events producing the most significant average CARs.

For instance, the Portuguese banking industry on the whole underperformed the broad market, on average, by 4,34% in the 5-days following a sovereign outlook revision against the 0,41% correspondent to the parallel underperformance after a downgrade. Individually, the most affected banks by sovereign outlook revision are BES and BCP, which exhibit an average CAR of -6,84% and -3,94% respectively, which again implies a huge difference from the CARs produced by downgrades (-0,68% and -0,46%).

On the other hand, for Banif and BPI, downgrades caused more impact than outlook revisions; however, the difference between the verified average CARs is not as significant as for the cases of BES and BCP.

Nevertheless the diverse effects experienced by each bank, the above observations seem to entail that outlook revision by S&P are taken by the market as truly new information and that somehow, markets participants anticipate the downgrade with the outlook revision. In fact, by looking at Appendix 1 (chronology of downgrades/outlook revisions since January '09) it is observable that S&P is sort of the leading rating agency in the sense it anticipates the other agencies (announcements by other rating agencies come consistently after the analogous one from S&P).

As a result of the previous and the fact that rating opinions are almost perfectly substitutes it is normal that announcements made by S&P create more significant CARs in relation to other rating agencies. This is also supported by the portion of significant events engendered by the various rating agencies - S&P has the biggest portion of significant events (excluding DBRS). Announcements

coming from the newly appointed⁷ DBRS are significant across the board and produced considerable negative average CAR, ranging from -6,04% for Banif to -7,80% to BPI. However, as the sample of DBRS announcement is really limited (four downgrades/two dates), it is difficult and imprudent to draw meaningful conclusions.

Furthermore, taking into consideration individual announcements it is again detected that outlook revisions from S&P caused considerable negative average CARs. However, and because usually rating agencies review their rating opinions for all the institutions around the same date (Portugal included) it is difficult if not impossible to assess the relative contribution of individual/sovereign outlook revision to the negative CARs observed. Regarding individual rating announcements from Fitch and Moody's there is no evidence of them generating systematic negative CARs. In relation to the significance of individual announcements I find it to be very low and more surprisingly, to cause at times positive and significant CARs. This last observation may be due to the market having worst expectations regarding the awaited announcements in comparison to what actually happened. (e.g. agency issues an outlook revision when a downgrade was expected)

From these results there is evidence that markets value more sovereign than individual ratings, meaning that market participants seem to acknowledge, at the time of a sovereign related announcement, that sooner or later banks will receive the same treatment. This finding may be associated with the fact that banks' credit rating reviews have been reflecting changes in sovereign ratings rather than any idiosyncratic factors regarding banks' solvency.

Moreover, I find evidence that S&P is the predominant agency in the sense its announcements generate in general, more significant and negative CARs. Particularly, outlook revisions from S&P, probably as a result of being fresh information coming to the markets, generate the most remarkable negative average CARs.

⁷ DBRS started issuing rating opinions on BES and Portugal in 2010

Furthermore, it seems that, analogously to the relation between sovereign and individual ratings, market participants expect other rating agencies to announce something similar to that S&P has already announced. This seems to render announcements from rating agencies other than S&P rather “useless”.

4.3 Regression Based Event Study

Additionally to the traditional event study methodology I also use regression based event study methodology to evaluate the impact of credit rating agencies’ announcements on the return of banks’ shares. In order to do so, I employ once again the market model to eliminate the effects of wide economic factors leaving the portion of return that is due to firm/country specific information. Then, by using a set of dummy variables that assume a value of 1 on the day of the downgrade it is possible to evaluate the impact of such an event in banks’ performances as measured by their share prices movements. To complete the analysis I also include four lags of the dummy variable. The use of the five dummy variables is in a sense, the equivalent to have a 5-day event window and permits to study for market efficiency. This approach considers the significance of abnormal returns day-by-day, conversely to the “traditional” event study that solely studies the significance of the cumulative returns over the length of the event window. The regression estimated by using this approach is as follows:

$$r_{i,t} = \alpha_i + \beta_i r_{m,t} + \sum_{\tau=\tau_1}^{\tau_2} \gamma_{i,t} D_{\tau,t} + \varepsilon_i, \quad (12)$$

where $D_{\tau,t}$ are dummy variables assuming value one on $t = \tau$ and zero otherwise (e.g. D_{τ,τ_1} assumes value on the day of the announcement, D_{τ,τ_2} on the day after the announcement etc.) and $\gamma_{i,t}$ are the correspondent coefficients. All the remaining variables and parameters remain unaltered from what is presented in (2). With this approach the coefficients on the dummy variable correspond

precisely to the abnormal returns verified in that day. The regression is estimated by using the entire sample, from February '07 to January '12.

4.3.1 Testing for anticipation

The analysis carried out so far aims at analyzing the reaction of banks' share prices after a credit rating announcement is made.

Analogously, it is unquestionably interesting to assess if the information contained in the announcements is somehow observed by the market even before the announcements are made. To test for this hypothesis I use the very same framework as above only with a simple adaptation - the inclusion of dummy variables that assume value one in the days preceding the announcement.

For this purpose I use five new dummy variables, one for each of the five days preceding the event. These five days are a very small period of time to make such analysis as if the fundamentals of a country/bank were to induce a downgrade, they would most likely be noticeable more than five days before the actual announcement. However, due to the high frequency of downgrades during the period analyzed, using a larger window so as to study for a possible anticipation phenomenon will most likely violate the independence required for conducting such a study.

4.3.2 Results

Due to the length of the outputs generated by this regression based event study it is impossible to present the results here. However, in Table 2 below I try to sum up the results obtained. For a more comprehensive understanding please refer to Appendix 3 where the regressions' outputs are presented in an extensive manner.

The summary is made at three levels: significance (immediate impact), market inefficiency, and anticipation. The judgment of the three considered levels is made qualitatively through a very simplistic approach – either they are verified (“yes”) or not (“no”). For instance, in relation to the

Portuguese banking industry on the whole (All), country level outlook revisions from S&P caused significant impact (“yes”); the adjustment of stock prices after the announcement exhibited signs of market inefficiency (“yes”); and finally, there were no signs of anticipation to the announcement (“no”). Again, I divide the analysis of into two groups – outlook revisions and downgrades.

Table 3 - Regression Based Event Study - Outlook Revisions

| | Country Level | | | | | | | | | |
|---------------------|---------------|---------|------|-----|---------|---------|-----|---------|-------|-------|
| | S&P | | | | | Moody's | | | | |
| | All | BES | BCP | BPI | Banif | All | BES | BCP | BPI | Banif |
| Significance | Yes | Yes | Yes | No | No | No | No | No | No | No |
| Market Inefficiency | Yes | Yes | Yes | No | Yes | No | No | No | No | No |
| Anticipation | No | Yes | No | No | No | Yes | Yes | Yes | Yes | Yes |
| Bank Level | | | | | | | | | | |
| Significance | | Yes | No | No | | | No | No | Yes | |
| Market Inefficiency | NA | No | No | No | NA | NA | No | No | No | NA |
| Anticipation | | No | Yes | No | | | No | Yes | No | |
| Downgrades | | | | | | | | | | |
| | Country Level | | | | | | | | | |
| | S&P | | | | | Moody's | | | | |
| | All | BES | BCP | BPI | Banif | All | BES | BCP | BPI | Banif |
| Significance | No | Yes | No | No | No | Yes | Yes | Yes | Yes | Yes |
| Market Inefficiency | Yes | Yes | No | No | Yes | Yes | Yes | Yes | Yes | Yes |
| Anticipation | Yes | Yes | Yes | Yes | Yes | Yes | No | No | No | Yes |
| Fitch | | | | | | | | | | |
| Significance | No | No | No | No | No | Yes | Yes | Yes | Yes | Yes |
| Market Inefficiency | No | No | No | No | Yes | No | No | No | Yes | No |
| Anticipation | No | No | No | No | Yes | No | Yes | No | No | No |
| Bank Level | | | | | | | | | | |
| | BES | | | BCP | | | BPI | | | |
| | S&P | Moody's | DBRS | S&P | Moody's | Fitch | S&P | Moody's | Fitch | |
| | | | | | | | | | | |
| Significance | No | No | Yes | Yes | No | No | Yes | No | No | |
| Market Inefficiency | No | Yes | No | No | No | No | No | No | No | |
| Anticipation | No | No | Yes | Yes | Yes | No | Yes | No | Yes | |

Note: The classification of the event as significant is due based on the existence of significant negative abnormal returns (significant coefficient of the parameter associated with the dummy variable) on the day of the announcement and day after; the classification of market efficiency is due based on the existence of negative abnormal returns on the days after the announcement is made; the classification of anticipation is due based on the existence of negative abnormal returns on the days preceding the announcement
Source: Author's calculations.

I now comment briefly the results obtained, starting by the upper part of Table 2 – outlook revisions. Commencing from the significance of sovereign outlook revisions made by Standard &

Poor's, there is evidence that it indeed produce significant negative abnormal returns to the banking industry in general, and to BES and BCP in particular.

As for market inefficiency I find significant abnormal returns on the days after the announcement for all the securities studied except of BPI, which indicate that the market is not efficient as it does not adjust entirely on the day in which the announcement is made.

Regarding the anticipation, I find no significant negative coefficient in the days preceding the announcement apart from BES. Concerning country outlook revision made by the rating agency Moody's I find that they are not significant as there is no evidence of significant abnormal returns on the days announcements were made. Also, in the days after the announcement no abnormal returns are significant. However, interestingly, there is evidence of anticipation in all securities. Such anticipation may thus explain the inexistence of abnormal returns in the day the announcement is made as the stock prices were already corrected downwards.

Moreover, taking into account outlook revisions at bank level, I find its immediate effects to be practically zero with the exception of BES and BPI, when the announcement comes from Standard & Poor's and Moody's respectively. There is no indication of market inefficiency and suggestions of anticipation are weak.

In sum, I find once again evidence that markets value more sovereign than individual ratings. An observation that strengthens the hypothesis mentioned before that banks' credit rating reviews have been reflecting changes in sovereign ratings rather than any idiosyncratic factors regarding banks' solvency.

In relation to lower part of Table 2 concerning downgrades the main findings are the following. Firstly, it is observable that downgrades by Standard & Poor's are not significant across the board, the only exception being BES. Instead, they seem to be highly anticipated which might be on the root of no significance in the day of the announcement. Secondly, downgrades by Moody's

and DBRS have affected banks' share prices broadly. For both rating agencies I find the degree of anticipation to be low.

Concerning market efficiency I find that the market adjusted slowly after announcements coming from Moody's whereas DBRS's announcements do not seem to cause a slow adjustment of stock prices the only exception being BPI. Finally, the rating agency Fitch has no impact whatsoever with exception of Banif. Regarding bank level downgrade I find that the only significant for BES are the announcements by DBRS, which means little as the newly appointed rating agency reviewed their credit rating for Portugal and BES simultaneously. Standard & Poor's affects both BCP and BPI and also for both, there is a certain degree of anticipation. Once again, Fitch has no significance for both banks to which it issues rating opinions (BCP and BPI).

5. Conclusion

This paper assesses to what extent the European debt crisis have affected Portuguese banks. Firstly, I have made a comparative analysis between the performance of the banking industry and the performance of the broad index excluding the banking sector. Secondly, I have carried an event study analysis for the banks listed on the PSI20. The so-called events are supra company announcements issued by credit rating agencies, both of rating changes and outlook revisions from 2009 onwards. I analyzed the impact of announcements made by the relevant rating agencies – Standard & Poor's, Moody's, Fitch and DBRS.

From the first study I find that indeed, the banking industry has been severely impacted by this European sovereign debt crisis. The underperformance of the banking industry in relation to the remaining parts of the economy is overwhelming. Moreover, calculations on the correlations between sovereign and banks' CDSs reveal themselves to be really close to 1 indicating a strong relationship between the creditworthiness of the sovereign and that of banks.

Regarding the key results obtained with the event study they are essentially four-folded. Firstly, I find evidence that sovereign ratings are more important to banks' stock market performances than the actual bank level ratings. This finding may be associated with the fact that during this period, changes in banks' credit ratings have been reflecting changes in sovereign creditworthiness rather than any idiosyncratic factors of bank's solvency. Secondly, there is evidence that S&P is the predominant agency, seemingly because it generally anticipates its counter-parties in announcing analogous credit opinions. Thirdly, I find evidence that the market is not efficient in respect to this type of announcements. Finally, there are indications of anticipation to several announcements.

This study studies solely the particular impact that the European sovereign debt crisis has had in Portuguese banks. However, further research on the impact of a sovereign debt crisis to advanced economies in general is worthy of being carried out. Namely its impacts to the real economy not only in the short run but also in the long run. Moreover, I believe it would be interesting to carry out future research on the dynamics of banks' stock market returns after the results of sovereign debt auctions are made public.

6. References

- Fama, Eugene F., Lawrence Fisher, Michael Jensen, and Richard Roll. 1969. "The Adjustment of Stock Prices to New Information". *International Economic Review*, Volume 10: 1-21.
- Binder, John. 1998. "The Event Study Methodology Since 1969." *Kluwer Academic Publishers*.
- Ahem, Kenneth. 2009. "Sample Selection and Event Study Estimation." *Journal of Empirical Finance*, Volume 16: 466-482.
- MacKinlay, A. Craig. 1997. "Event Studies in Economics and Finance." *Journal of Economic Literature*, Volume XXXV: 13-39.
- Pynnönen, Seppo. 2005. "On Regression Based Event Study." *Acta Wasaensia*, No. 143: 327-354

- Borensztein, Eduardo et al. 2007. "Sovereign Ceilings "Lite"? The impact of Sovereign Ratings on Corporate Ratings in Emerging Market Economies." *IMF Working Paper*.
- Blundell-Wignall, Adrian and Patrick Slovik. 2011. "A Market Perspective on the European Sovereign Debt and Banking Crisis." *Financial Market Trends*, Volume 2010 – Issue 2.
- Davies, Michael. 2011. "The Rise of Sovereign Credit Risk: Implications for Financial Stability." *Bank for International Settlements Quarterly Review*, part 5, September 2011.
- IMF, September 2011. "Global Financial Stability Report – Grappling with Crisis Legacies." *World Economic and Financial Services*, IMF publication services.
- Bernanke, Ben. 1984. "Nonmonetary Effects of the Financial Crisis in the Propagation of the Great Depression." *The American Economic Review*, Volume 73: 257-276.
- Afonso, António., Davide Furceri, and Pedro Gome. 2011. "Sovereign Credit Ratings and Financial Market Linkages – Application to European Data." *ECB Working Paper Series*, No 1347.
- Banco de Portugal. 2011. "Relatório de Estabilidade Financeira." *Departamento de Estudos Económicos*.
- Hofmann, Thomas., Dr. Rolf Schneider. 2010. "Eurozone Debt Crisis: Impact on the Economy." *Economic Research & Corporate Development*, Working Paper 141.
- Panetta, Fabio., Ricardo Correa, Michael Davies, Antonio Di Cesare, José Marques, Francisco Nadal de Simone, Federico Signoretti, Cristina Vespro, Siret Vildo, Martin Wieland, and Andrea Zaghini. 2011. "The Impact of Sovereign Credit Risk on Bank Funding Conditions." *Committee on the Global Financial System Papers*, No 43
- Pollock, A. 2012. "Yet Another Sovereign Debt Crisis." *American Enterprise Institute*. March 16.
- Thomas Jr., L. 2011. "Pain Builds in Europe's Sovereign Debt Risk." *The New York Times*. July 17.
- Samuelson, Robert. 2011. "Europe's Banking Crisis." *Real Clear Politics*. September 16.
- Silva, M. 2012. "Financiamento à economia bate mínimos históricos". *Diário Económico*. April 10.
- Lehmann, Alexander. 2012. "A New 'Credit Crunch' in Emerging Europe?" *European Bank for Reconstruction and Development*. February 28.

Appendixes

Appendix 1 - Ratings Announcements

| | Institution | Date | Announcement | Rating Agency |
|----|-------------|------------|--------------------------------------|-------------------|
| 1 | Portugal | 13-01-2009 | Outlook revision | Standard & Poor's |
| 2 | Portugal | 21-01-2009 | Downgrade to A+ | Standard & Poor's |
| 3 | BES | 06-04-2009 | Outlook revision | Moody's |
| 4 | BCP | 06-04-2009 | Outlook revision | Moody's |
| 5 | BPI | 06-04-2009 | Outlook revision | Moody's |
| 6 | BCP | 30-07-2009 | Downgrade to A- | Standard & Poor's |
| 7 | BES | 16-09-2009 | Downgrade to A1 | Moody's |
| 8 | BCP | 16-09-2009 | Downgrade to A1 | Moody's |
| 9 | BPI | 16-09-2009 | Outlook revision* | Moody's |
| 10 | Portugal | 07-12-2009 | Outlook revision | Standard & Poor's |
| 11 | Portugal | 24-03-2010 | Downgrade to AA- | Fitch |
| 12 | BES | 27-04-2010 | Downgrade to A- | Standard & Poor's |
| 13 | BCP | 27-04-2010 | Downgrade to BBB+ | Standard & Poor's |
| 14 | BPI | 27-04-2010 | Downgrade to A- | Standard & Poor's |
| 15 | Portugal | 27-04-2010 | Downgrade to A- | Standard & Poor's |
| 16 | BES | 05-05-2010 | Outlook revision | Moody's |
| 17 | BCP | 05-05-2010 | Outlook revision | Moody's |
| 18 | BPI | 05-05-2010 | Outlook revision | Moody's |
| 19 | Portugal | 05-05-2010 | Outlook revision | Moody's |
| 20 | BES | 14-07-2010 | Downgrade to A2 | Moody's |
| 21 | BCP | 14-07-2010 | Downgrade to A3 | Moody's |
| 22 | BPI | 14-07-2010 | Downgrade to A2 | Moody's |
| 23 | Portugal | 14-07-2010 | Downgrade to A1 | Moody's |
| 24 | BCP | 21-07-2010 | Downgrade to A | Fitch |
| 25 | BPI | 21-07-2010 | Downgrade to A | Fitch |
| 26 | BCP | 08-11-2010 | Downgrade to BBB+ | Fitch |
| 27 | BPI | 08-11-2010 | Downgrade to A- | Fitch |
| 28 | Portugal | 30-11-2010 | Outlook revision | Standard & Poor's |
| 29 | BES | 03-12-2010 | Outlook revision | Standard & Poor's |
| 30 | BCP | 03-12-2010 | Outlook revision | Standard & Poor's |
| 31 | BPI | 03-12-2010 | Outlook revision | Standard & Poor's |
| 32 | BES | 09-12-2010 | Outlook revision | Moody's |
| 33 | BCP | 09-12-2010 | Outlook revision | Moody's |
| 34 | BPI | 09-12-2010 | Outlook revision | Moody's |
| 35 | Portugal | 21-12-2010 | Outlook revision | Moody's |
| 36 | Portugal | 23-12-2010 | Downgrade to A+ | Fitch |
| 37 | BES | 15-02-2011 | Outlook revision | Moody's |
| 38 | BCP | 15-02-2011 | Outlook revision | Moody's |
| 39 | BPI | 15-02-2011 | Outlook revision | Moody's |
| 40 | Portugal | 15-03-2011 | Downgrade to Baa1 & Outlook revision | Moody's |
| 41 | Portugal | 24-03-2011 | Downgrade to BBB & Outlook revision | Standard & Poor's |
| 42 | Portugal | 24-03-2011 | Downgrade to A- & Outlook revision | Fitch |
| 43 | BES | 28-03-2011 | Downgrade to BBB & Outlook revision | Standard & Poor's |
| 44 | BCP | 28-03-2011 | Downgrade to BBB- & Outlook revision | Standard & Poor's |
| 45 | BPI | 28-03-2011 | Downgrade to BBB & Outlook revision | Standard & Poor's |
| 46 | Portugal | 29-03-2011 | Downgrade to BBB- & Outlook revision | Standard & Poor's |
| 47 | BCP | 30-03-2011 | Outlook revision | Fitch |

| | | | | |
|----|----------|------------|--------------------------------------|-------------------|
| 48 | BPI | 30-03-2011 | Outlook revision | Fitch |
| 49 | BES | 31-03-2011 | Downgrade to BBB- | Standard & Poor's |
| 50 | BPI | 31-03-2011 | Downgrade to BBB- | Standard & Poor's |
| 51 | Portugal | 01-04-2011 | Downgrade to BBB- & Outlook revision | Fitch |
| 52 | BCP | 05-04-2011 | Downgrade to BBB- & Outlook revision | Fitch |
| 53 | BPI | 05-04-2011 | Downgrade to BBB- & Outlook revision | Fitch |
| 54 | BES | 06-04-2011 | Downgrade to Baa2 & Outlook revision | Moody's |
| 55 | BCP | 06-04-2011 | Downgrade to Baa3 & Outlook revision | Moody's |
| 56 | BPI | 06-04-2011 | Downgrade to Baa2 & Outlook revision | Moody's |
| 57 | BES | 25-05-2011 | Downgrade to BBBH | DBRS |
| 58 | Portugal | 25-05-2011 | Downgrade to BBBH | DBRS |
| 59 | BCP | 14-06-2011 | Outlook revision* | Standard & Poor's |
| 60 | Portugal | 05-07-2011 | Downgrade to Ba2 | Moody's |
| 61 | BES | 15-07-2011 | Downgrade to Ba1 & Outlook revision | Moody's |
| 62 | BCP | 15-07-2011 | Downgrade to Ba1 & Outlook revision | Moody's |
| 63 | BPI | 15-07-2011 | Downgrade to Baa3 & Outlook revision | Moody's |
| 64 | BES | 07-10-2011 | Downgrade to Ba2 | Moody's |
| 65 | BCP | 07-10-2011 | Downgrade to Ba3 | Moody's |
| 66 | BPI | 07-10-2011 | Downgrade to Ba2 | Moody's |
| 67 | BES | 20-10-2011 | Downgrade to BBB | DBRS |
| 68 | Portugal | 20-10-2011 | Downgrade to BBB | DBRS |
| 69 | Portugal | 24-11-2011 | Downgrade to BB+ | Fitch |
| 70 | BCP | 25-11-2011 | Downgrade to BB+ | Fitch |
| 71 | BPI | 25-11-2011 | Downgrade to BB+ | Fitch |
| 72 | Portugal | 05-12-2011 | Outlook revision | Standard & Poor's |
| 73 | BES | 07-12-2011 | Outlook revision | Standard & Poor's |
| 74 | BCP | 07-12-2011 | Outlook revision | Standard & Poor's |
| 75 | BPI | 07-12-2011 | Outlook revision | Standard & Poor's |
| 76 | BES | 16-12-2011 | Downgrade to BB | Standard & Poor's |
| 77 | BCP | 16-12-2011 | Downgrade to BB & Outlook revision | Standard & Poor's |
| 78 | BPI | 16-12-2011 | Downgrade to BB+ & Outlook revision | Standard & Poor's |
| 79 | Portugal | 13-01-2012 | Downgrade to BB | Standard & Poor's |

Note: * correspond to positive outlook revisions

Appendix 2 (part1) - Sovereign Downgrade

| Agency: Standard & Poor's | | | | | |
|--------------------------------------|------------------|--------------------------------------|---------|---------|--------|
| Event | Banking Industry | Bank | | | |
| | | Banif | BCP | BES | BPI |
| 13-01-2009 | | Outlook Revision | | | |
| <i>t-test</i> | -2,63*** | -0,48 | 2,05*** | 2,05*** | -0,89 |
| CAR | -8,00% | -2,10% | -8,37% | -9,79% | 5,26% |
| 21-01-2009 | | Downgrade to A+ | | | |
| <i>t-test</i> | -0,07 | 0,70 | 0,93 | -1,01 | -1,21 |
| CAR | -0,23% | 2,99% | 3,89% | -4,82% | 7,17% |
| 07-12-2009 | | Outlook Revision | | | |
| <i>t-test</i> | -0,32 | 0,53 | -1,34 | 0,29 | -1,04 |
| CAR | -0,57% | 2,21% | -4,38% | 0,71% | 2,85% |
| 27-04-2010 | | Downgrade to A- | | | |
| <i>t-test</i> | 0,37 | 4,10*** | -0,62 | 2,53*** | -1,60 |
| CAR | 0,50% | -11,40% | -1,47% | 5,39% | 3,58% |
| 30-11-2010 | | Outlook Revision | | | |
| <i>t-test</i> | -2,48*** | -0,47 | -1,44 | 2,37*** | -1,72* |
| CAR | -4,66% | -2,55% | -3,48% | -5,87% | 3,61% |
| 24-03-2011 | | Downgrade to BBB & Outlook Revision | | | |
| <i>t-test</i> | -2,52*** | -0,80 | 2,43*** | -1,74* | -1,36 |
| CAR | -5,19% | -3,57% | -6,25% | -5,12% | 3,16% |
| 29-03-2011 | | Downgrade to BBB- & Outlook Revision | | | |
| <i>t-test</i> | -1,30 | -0,39 | -1,79* | -1,76* | -0,92 |
| CAR | -2,75% | -1,67% | -4,66% | -5,22% | 2,14% |
| 05-12-2011 | | Outlook Revision | | | |
| <i>t-test</i> | -0,80 | 5,27*** | 0,07 | 2,04*** | 0,69 |
| CAR | -4,14% | 32,76% | 0,48% | -12,39% | 4,31% |
| 13-01-2012 | | Downgrade to BB | | | |
| <i>t-test</i> | 0,92 | -0,07 | 0,77 | 0,86 | 0,47 |
| CAR | 5,64% | -0,49% | 6,17% | 6,38% | 3,09% |

*** p<0.01, ** p<0.05, * p<0.1
Source: Author Calculations

Appendix 2 (part2) - Sovereign Downgrade

| Agency: DBRS | | | | | |
|---------------------|------------------|------------------|---------|---------|---------|
| Event | Banking Industry | Banif | BCP | BES | BPI |
| | | | | | |
| <i>t-test</i> | -1,72* | 0,45 | 3,92*** | 0,17 | -0,48 |
| CAR | -3,90% | 1,64% | 10,88% | 0,52% | -1,40% |
| 20-10-2011 | | Downgrade to BBB | | | |
| <i>t-test</i> | -2,59*** | 2,53*** | -0,26 | 2,90*** | 3,16*** |
| CAR | -9,38% | 13,71% | -1,24% | 12,77% | 14,21% |

*** p<0.01, ** p<0.05, * p<0.1
Source: Author Calculations

Appendix 2 (part3) - Sovereign Downgrade

| Agency: Moody's | | | | | | |
|-----------------|------------------|---------|--------------------------------------|---------|-------|--|
| Event | Banking Industry | Bank | | | | |
| | | Banif | BCP | BES | BPI | |
| 05-05-2010 | | | Outlook Revision | | | |
| <i>t-test</i> | 1,32 | 1,10 | 1,89* | -0,34 | 1,32 | |
| CAR | 1,95% | 3,27% | 4,49% | -0,83% | 3,40% | |
| 14-07-2010 | | | Downgrade to A1 | | | |
| <i>t-test</i> | -0,62 | 0,54 | 0,21 | -1,09 | -0,28 | |
| CAR | -1,27% | 1,78% | 0,56% | -3,02% | 1,30% | |
| 21-12-2010 | | | Outlook Revision | | | |
| <i>t-test</i> | 0,51 | -0,34 | -1,10 | 1,18 | 0,17 | |
| CAR | 1,01% | -1,78% | -2,51% | 2,96% | 0,39% | |
| 15-03-2011 | | | Downgrade to Baa1 & Outlook Revision | | | |
| <i>t-test</i> | -0,82 | -0,2905 | -0,35 | -0,6957 | -1,12 | |
| CAR | -1,64% | -1,29% | -0,89% | -1,98% | 2,56% | |
| 05-07-2011 | | | Downgrade to Ba2 | | | |
| <i>t-test</i> | -0,36 | -0,90 | -2,03*** | -0,87 | -0,70 | |
| CAR | -0,83% | -3,29% | -6,77% | -2,56% | 2,12% | |

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

Source: Author Calculations

Appendix 2 (part4) - Sovereign Downgrade

| Agency: Fitch | | | | | | |
|---------------|------------------|---------|--------------------------------------|---------|---------|--|
| Event | Banking Industry | Bank | | | | |
| | | Banif | BCP | BES | BPI | |
| 24-04-2010 | | | Downgrade to AA- | | | |
| <i>t-test</i> | 2,36*** | 3,11*** | 0,52 | 3,63*** | 0,14 | |
| CAR | 3,14% | -8,66% | 1,24% | 7,72% | 0,31% | |
| 23-12-2010 | | | Downgrade to A+ | | | |
| <i>t-test</i> | 0,23 | -0,11 | -0,19 | 0,88 | -0,44 | |
| CAR | 0,43% | -0,59% | -0,48% | 2,16% | -1,02% | |
| 24-03-2011 | | | Downgrade to A- & Outlook Revision | | | |
| <i>t-test</i> | -2,52*** | -0,80 | 2,43*** | -1,74* | -1,36 | |
| CAR | -5,19% | -3,57% | -6,25% | -5,12% | -3,16% | |
| 01-04-2011 | | | Downgrade to BBB- & Outlook Revision | | | |
| <i>t-test</i> | 1,22 | -0,18 | 1,30 | 0,40 | 2,52*** | |
| CAR | 2,59% | -0,79% | 3,45% | 1,21% | 6,06% | |
| 24-11-2011 | | | Downgrade to BB+ | | | |
| <i>t-test</i> | -0,90 | -1,33 | -1,79* | 2,05*** | 0,15 | |
| CAR | -4,29% | -8,13% | 12,21% | 10,42% | 0,85% | |

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

Source: Author Calculations

Appendix 3 (part1)- Sovereign Outlook Revisions

| VARIABLES | S&P banks | Moody's banks | S&P BES | Moody's BES | S&P BCP | Moody's BCP | S&P BPI | Moody's BPI | S&P Banif | Moody's Banif |
|--------------|--------------------------|--------------------------|-------------------------|-------------------------|-------------------------|--------------------------|-------------------------|-------------------------|--------------------------|--------------------------|
| PSI20 | 1.208*** (0.0419) | 1.202*** (0.0426) | 1.119*** (0.0510) | 1.114*** (0.0522) | 1.266*** (0.0499) | 1.257*** (0.0499) | 1.090*** (0.0479) | 1.096*** (0.0487) | 0.898*** (0.0503) | 0.901*** (0.0522) |
| t-5 | 0.000372 (0.00423) | 0.00837* (0.00441) | -0.000586 (0.00547) | 0.0216* (0.0113) | -0.00249 (0.00347) | 0.00127 (0.00237) | 0.0136 (0.0108) | 0.0157*** (0.00235) | -0.00318 (0.00489) | -0.00951 (0.0142) |
| t-4 | -0.0154 (0.0130) | 0.00551 (0.00385) | -0.0221** (0.0101) | 0.0146 (0.0179) | -0.0126 (0.0147) | 0.00167 (0.00372) | 0.00579 (0.00809) | 0.00572 (0.0110) | -0.00286 (0.0104) | 0.00976*** (0.00192) |
| t-3 | -0.00348* (0.00189) | -0.0146*** (0.00111) | 0.00368 (0.00361) | 0.0283*** (0.000889) | -0.00649 (0.00442) | 0.00882*** (0.00119) | -0.00782 (0.00559) | 0.0160*** (0.00283) | -0.00232 (0.00822) | -0.00658 (0.00948) |
| t-2 | 0.0172 (0.0111) | 0.00490*** (0.00131) | 0.0393 (0.0322) | 0.00518** (0.00252) | 0.00604** (0.00261) | 0.00951*** (0.00164) | 0.0175 (0.0121) | -0.00311 (0.00396) | 0.0287*** (0.00681) | -0.0151*** (0.00113) |
| t-1 | 0.00397 (0.00488) | -0.00204 (0.00172) | 0.00233 (0.00641) | 0.00111 (0.00978) | 0.00434 (0.00556) | -0.00290 (0.00235) | 0.0122 (0.0131) | -0.00401 (0.00449) | 0.0181 (0.0126) | -0.0219*** (0.00204) |
| t0 | -0.00396 (0.00977) | 0.000377 (0.00520) | -0.0281 (0.0234) | -0.0127 (0.00774) | 0.00934 (0.00783) | 0.00595 (0.00563) | -9.35e-05 (0.00209) | -0.00158 (0.00153) | 0.0192 (0.0197) | -0.00933 (0.00605) |
| t+1 | -0.0190*** (0.00391) | 0.0222 (0.0135) | -0.0129** (0.00513) | 0.0161*** (0.00388) | 0.0214*** (0.00495) | 0.0220 (0.0173) | -0.00851 (0.0102) | 0.0326** (0.0143) | 0.0145 (0.0143) | 0.0102 (0.0125) |
| t+2 | 0.00261 (0.00338) | 0.00920 (0.00794) | 0.0132 (0.00863) | 0.00788* (0.00479) | -0.00394 (0.00317) | 0.0154 (0.0130) | 0.00335 (0.00551) | -0.0120* (0.00664) | 0.0161 (0.0212) | -0.00931 (0.0161) |
| t+3 | -0.0131** (0.00581) | -0.00567 (0.00359) | -0.0200* (0.0106) | -0.000625 (0.00827) | -0.00722 (0.00579) | -0.00902 (0.00830) | -0.00498 (0.0125) | -0.00107 (0.00285) | 0.0275 (0.0211) | 0.000137 (0.00834) |
| t+4 | -0.00904* (0.00519) | -0.000472 (0.00200) | -0.0145 (0.0110) | -0.00669 (0.00732) | -0.0100** (0.00436) | 0.00193 (0.00172) | -0.00328 (0.00682) | 0.000388 (0.00626) | -0.0119** (0.00500) | -0.00505 (0.00600) |
| Constant | 0.000999** (0.000422) | 0.00115*** (0.000424) | -0.000559 (0.000496) | -0.000712 (0.000515) | 0.00108** (0.000536) | -0.00125** (0.000532) | 0.00111** (0.000535) | -0.00104* (0.000534) | 0.00174*** (0.000584) | -0.00131** (0.000594) |
| Observations | 1,304 | 1,304 | 1,304 | 1,304 | 1,304 | 1,304 | 1,304 | 1,304 | 1,304 | 1,304 |
| R-squared | 0.584 | 0.580 | 0.467 | 0.453 | 0.491 | 0.489 | 0.418 | 0.418 | 0.292 | 0.281 |

Robust standard errors in parentheses

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

Appendix 3 (part2) - Bank Level Outlook Revisions

| VARIABLES | BES | | BCP | | BPI | |
|--------------|-------------------------|-------------------------|--------------------------|-------------------------|--------------------------|-------------------------|
| | S&P | Moody's | S&P | Moody's | S&P | Moody's |
| PSI20 | 1.125*** (0.0511) | 1.102*** (0.0503) | 1.259*** (0.0499) | 1.262*** (0.0498) | 1.079*** (0.0478) | 1.094*** (0.0485) |
| t-5 | -0.0280 (0.0188) | -0.00245 (0.00362) | -0.0234 (0.0161) | -0.00774 (0.00598) | 0.0129 (0.0150) | -0.0152 (0.0176) |
| t-4 | 0.00326 (0.00878) | 0.0159** (0.00766) | -0.0117* (0.00608) | -0.00619 (0.00476) | -0.00680 (0.0115) | -0.00127 (0.00475) |
| t-3 | 0.0676 (0.0576) | 0.0122 (0.0150) | 0.00172 (0.00218) | -0.0110** (0.00470) | 0.0324* (0.0187) | 0.00288 (0.00718) |
| t-2 | 0.0106 (0.00805) | 0.0132 (0.0256) | 0.0140 (0.00859) | 0.0105*** (0.00362) | 0.0315* (0.0178) | -0.00386 (0.00520) |
| t-1 | -0.0538 (0.0390) | -0.00736 (0.00829) | -0.00444 (0.00908) | -0.000424 (0.0112) | -0.0102** (0.00466) | 0.00886 (0.00582) |
| t0 | 0.00732*** (0.00184) | -0.00735 (0.0193) | -0.00372 (0.00432) | 0.0113*** (0.00393) | 0.00826 (0.0129) | 0.00567 (0.00807) |
| t+1 | 0.0122 (0.0176) | 0.00669 (0.0127) | -0.0126 (0.00945) | -0.00684 (0.00554) | 0.00934*** (0.00324) | -0.00470 (0.00679) |
| t+2 | -0.0353*** (0.0133) | 0.0141** (0.00652) | -0.00212 (0.00951) | 0.0105 (0.0127) | 0.0233** (0.0100) | 0.0148* (0.00871) |
| t+3 | -0.00106 (0.00612) | 0.0270 (0.0166) | 0.00800*** (0.00222) | 0.0113 (0.00943) | -0.0103 (0.0106) | 0.00113 (0.00860) |
| t+4 | -0.00326 (0.0241) | 0.000701 (0.00488) | -0.0140 (0.0149) | -0.00367 (0.00519) | -0.00525 (0.0321) | 0.00587* (0.00317) |
| Constant | -0.000624 (0.000491) | 0.000913* (0.000504) | -0.00107** (0.000532) | 0.00118** (0.000536) | -0.00113** (0.000528) | 0.00107** (0.000539) |
| Observations | 1,304 | 1,304 | 1,304 | 1,304 | 1,304 | 1,304 |
| R-squared | 0.473 | 0.456 | 0.491 | 0.490 | 0.422 | 0.418 |

Robust standard errors in parentheses

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

Appendix 3 (part3) - Sovereign Downgrades (Part1)

| VARIABLES | Banks | | | | BES | | | | BCP | | | |
|--------------|-------------------------|-------------------------|-------------------------|--------------------------|-------------------------|-------------------------|-------------------------|-------------------------|-------------------------|--------------------------|-------------------------|-------------------------|
| | S&P | Moody's | DBRS | Fitch | S&P | Moody's | DBRS | Fitch | S&P | Moody's | DBRS | Fitch |
| PSI20 | 1.202*** (0.0425) | 1.203*** (0.0422) | 1.204*** (0.0422) | 1.206*** (0.0418) | 1.112*** (0.0515) | 1.114*** (0.0514) | 1.116*** (0.0512) | 1.115*** (0.0512) | 1.259*** (0.0506) | 1.260*** (0.0502) | 1.261*** (0.0502) | 1.265*** (0.0497) |
| t-5 | -0.0104 (0.00809) | 0.000226 (0.00469) | -0.00576 (0.00599) | 0.00672 (0.00562) | -0.00880 (0.00895) | 0.00564 (0.0115) | 0.0121*** (0.00341) | -0.00318 (0.00380) | -0.00639 (0.0135) | -0.00576 (0.00459) | -0.00304 (0.00678) | 0.0123* (0.00707) |
| t-4 | -0.00153 (0.00427) | -0.00374 (0.00609) | -0.00365 (0.00524) | 0.00958 (0.0111) | -0.00255 (0.00730) | -0.00778 (0.00498) | -0.0193** (0.00875) | -0.00205 (0.00833) | -0.00391 (0.00447) | -0.00270 (0.00977) | 0.00531 (0.0136) | 0.0162 (0.0171) |
| t-3 | 0.00905** (0.00392) | 0.00205 (0.00489) | -0.0153 (0.0106) | 0.00537 (0.0219) | -0.00151 (0.00592) | 0.0121** (0.00548) | -0.0122 (0.00978) | -0.00410 (0.0108) | -0.0178** (0.00774) | -0.00243 (0.00806) | -0.0168 (0.0111) | 0.00997 (0.0287) |
| t-2 | 0.00424 (0.0110) | 0.00854 (0.00667) | 0.00988* (0.00587) | 0.000223 (0.00319) | 0.00672 (0.0165) | 0.00884* (0.00458) | 0.0116*** (0.000504) | -0.00892 (0.00664) | -0.000679 (0.00830) | 0.00981 (0.00948) | 0.0234*** (0.00789) | 0.00377 (0.00483) |
| t-1 | -0.00436 (0.00491) | 0.00508** (0.00238) | -0.00921 (0.0243) | 0.00173 (0.00443) | -0.0120** (0.00551) | -0.00270 (0.00365) | -0.0246 (0.0286) | -0.00114 (0.00379) | -0.00226 (0.00561) | 0.00735*** (0.00233) | -0.00133 (0.0213) | 0.00429 (0.00582) |
| t0 | -0.00566 (0.00361) | 0.0151*** (0.00521) | -0.00881 (0.00552) | -0.0128 (0.0117) | 0.00867** (0.00391) | 0.0167*** (0.00249) | 0.0246*** (0.00514) | -0.00503 (0.00572) | 0.000250 (0.00452) | -0.0140* (0.00730) | -0.00148 (0.0115) | -0.0171 (0.0147) |
| t+1 | 0.00334 (0.00505) | -0.000871 (0.00919) | 0.0191*** (0.00304) | -0.00356 (0.00447) | 0.00530 (0.0116) | -0.00340 (0.00366) | -0.0187** (0.00771) | -0.00518 (0.00332) | 0.00300 (0.00371) | -0.000340 (0.0121) | -0.0210** (0.00982) | -0.00410 (0.00663) |
| t+2 | 0.00359 (0.00792) | -0.00169 (0.00339) | -0.0179 (0.0125) | 0.00894*** (0.00313) | 0.0104 (0.00990) | 0.00759 (0.00622) | -0.00462 (0.00283) | -0.00118 (0.00372) | 0.000275 (0.00799) | -0.00654 (0.00417) | -0.0252 (0.0203) | -0.00964 (0.00634) |
| t+3 | 0.00462 (0.00689) | -0.0106** (0.00433) | 0.00565 (0.0154) | 0.00199 (0.00853) | 0.00184 (0.0101) | -0.0134** (0.00547) | 0.00826 (0.00940) | -0.000969 (0.00957) | 0.00207 (0.00643) | -0.0102* (0.00551) | 0.00612 (0.0195) | 0.00335 (0.0110) |
| t+4 | -0.0101* (0.00526) | 0.00911 (0.00965) | 0.00673 (0.0242) | -0.00680 (0.0138) | -0.0142** (0.00720) | 0.00548 (0.0137) | 0.0286 (0.0211) | 0.00101 (0.0154) | -0.00706 (0.00431) | 0.00939 (0.00729) | -0.00493 (0.0262) | -0.0119 (0.0135) |
| Constant | 0.00103** (0.000425) | 0.00108** (0.000426) | 0.00104** (0.000419) | 0.00110*** (0.000415) | -0.000595 (0.000514) | -0.000674 (0.000518) | -0.000543 (0.000511) | -0.000565 (0.000519) | 0.00109** (0.000536) | -0.00115** (0.000535) | 0.00116** (0.000526) | 0.00124** (0.000519) |
| Observations | 1,304 | 1,304 | 1,304 | 1,304 | 1,304 | 1,304 | 1,304 | 1,304 | 1,304 | 1,304 | 1,304 | 1,304 |
| R-squared | 0.580 | 0.580 | 0.581 | 0.581 | 0.452 | 0.451 | 0.456 | 0.449 | 0.489 | 0.489 | 0.491 | 0.492 |

Robust standard errors in parentheses

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

Appendix 3 (part4) - Sovereign Downgrades

| VARIABLES | BPI | | | | Banif | | | |
|--------------|-------------------------|--------------------------|-------------------------|-------------------------|-------------------------|-------------------------|-------------------------|-------------------------|
| | S&P | Moody's | DBRS | Fitch | S&P | Moody's | DBRS | Fitch |
| PSI20 | 1.090*** (0.0486) | 1.086*** (0.0480) | 1.088*** (0.0479) | 1.085*** (0.0481) | 0.895*** (0.0509) | 0.891*** (0.0508) | 0.898*** (0.0505) | 0.898*** (0.0509) |
| t-5 | -0.0114** (0.00532) | 0.0150 (0.0106) | -0.0111 (0.0106) | 0.00195 (0.00629) | -0.00341 (0.00447) | 0.0106 (0.0133) | 0.0137*** (0.00378) | 0.00907 (0.00792) |
| t-4 | 0.00731 (0.00759) | -0.00181 (0.00560) | 0.00957 (0.0111) | 0.00225 (0.00618) | 0.00358 (0.00589) | -0.00396 (0.00693) | 0.00920 (0.00715) | -0.00191 (0.00405) |
| t-3 | -0.00184 (0.00698) | 0.00134 (0.00154) | -0.0200 (0.0144) | 0.00134 (0.0137) | -0.00705* (0.00382) | 0.00502 (0.00938) | 0.0105 (0.0247) | -0.00154 (0.00452) |
| t-2 | 0.00692 (0.0100) | 0.00251*** (0.000904) | -0.00362 (0.0152) | -0.00220 (0.00248) | 0.000357 (0.00703) | 0.0110 (0.0116) | 0.0278*** (0.00178) | -0.00626 (0.00856) |
| t-1 | -0.00280 (0.00658) | -0.00133 (0.00362) | -0.00487 (0.0203) | -0.00427 (0.00589) | 2.43e-05 (0.00776) | 0.0213*** (0.00309) | -0.00608 (0.0102) | 0.0112*** (0.00293) |
| t0 | -0.0162 (0.0128) | -0.0189*** (0.00302) | 0.0108*** (0.00128) | -0.0113 (0.0134) | -0.0110 (0.00795) | -0.0161** (0.00626) | 0.00409 (0.00675) | -0.00811 (0.0110) |
| t+1 | -0.0119 (0.00779) | 0.000475 (0.00755) | -0.00776 (0.00795) | 0.00587 (0.00564) | -0.00509 (0.00647) | 0.0117 (0.00925) | 0.0331*** (0.00104) | -0.00736 (0.00896) |
| t+2 | 0.00476 (0.00883) | -2.08e-05 (0.00139) | 0.0264*** (0.00845) | -0.0142 (0.0130) | 0.00335 (0.00821) | -0.00316 (0.00237) | -0.00126 (0.0233) | -0.00545 (0.00884) |
| t+3 | 0.00280 (0.00861) | -0.00854* (0.00454) | -0.0193 (0.0211) | 0.00146 (0.00965) | -0.00422 (0.00559) | 0.00437 (0.00766) | -0.0155 (0.0297) | -0.0125** (0.00577) |
| t+4 | -0.00358 (0.00336) | 0.0134 (0.0126) | 0.0164 (0.0197) | 0.0202** (0.00905) | -0.0109** (0.00452) | -0.0186* (0.0106) | 0.0193 (0.0323) | -0.00418 (0.00818) |
| Constant | 0.000922* (0.000537) | -0.00103* (0.000538) | 0.000903* (0.000530) | -0.00103* (0.000534) | 0.00129** (0.000601) | 0.00138** (0.000596) | 0.00143** (0.000587) | 0.00123** (0.000600) |
| Observations | 1,304 | 1,304 | 1,304 | 1,304 | 1,304 | 1,304 | 1,304 | 1,304 |
| R-squared | 0.417 | 0.417 | 0.419 | 0.418 | 0.281 | 0.284 | 0.285 | 0.282 |

Robust standard errors in parentheses

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

Appendix 3 (part5) - Bank Level Downgrades

| VARIABLES | BES | | | BCP | | | BPI | | |
|--------------|-------------------------|-------------------------|-------------------------|-------------------------|-------------------------|-------------------------|-------------------------|-------------------------|-------------------------|
| | S&P | Moody's | DBRS | S&P | Moody's | Fitch | S&P | Moody's | Fitch |
| PSI20 | 1.120*** (0.0514) | 1.117*** (0.0514) | 1.116*** (0.0512) | 1.260*** (0.0509) | 1.262*** (0.0500) | 1.261*** (0.0499) | 1.080*** (0.0482) | 1.086*** (0.0480) | 1.086*** (0.0479) |
| t-5 | -0.0186 (0.0122) | 0.000791 (0.00683) | 0.0121*** (0.00341) | 0.00716** (0.00363) | 0.00119 (0.00773) | 0.00841 (0.0196) | 0.0118 (0.0110) | 0.0152* (0.00879) | 0.000348 (0.00708) |
| t-4 | 0.00816*** (0.00120) | -0.00632 (0.0109) | -0.0193** (0.00875) | 0.0141*** (0.00533) | -0.00790* (0.00474) | 0.0195 (0.0266) | 0.0136*** (0.00422) | -0.00504 (0.00690) | 0.00997 (0.0126) |
| t-3 | -0.0124 (0.00922) | 0.00604 (0.00836) | -0.0122 (0.00978) | -0.0149 (0.0105) | -0.00856 (0.00893) | -0.000417 (0.00630) | -0.0204** (0.00993) | 0.00869 (0.00910) | -0.00363 (0.00523) |
| t-2 | -0.0163 (0.0144) | -0.00593 (0.00452) | 0.0116*** (0.000504) | -0.00799 (0.00784) | -0.00101 (0.00298) | 0.00389 (0.00542) | -0.0206 (0.0178) | -0.00125 (0.00166) | -0.000510 (0.00546) |
| t-1 | 0.00686*** (0.00258) | -0.00292 (0.00502) | -0.0246 (0.0286) | -0.000428 (0.00496) | -0.00593 (0.00715) | -0.0186 (0.0178) | 0.0144*** (0.00425) | -0.00678 (0.00608) | -0.0256** (0.0113) |
| t0 | 0.0155 (0.0146) | -0.00261 (0.00312) | 0.0246*** (0.00514) | 0.00876 (0.00937) | -0.00249 (0.0140) | 0.000989 (0.0102) | -0.00684 (0.00732) | 0.0114* (0.00630) | 0.00941 (0.00758) |
| t+1 | -0.00673 (0.00484) | -0.00355 (0.00755) | -0.0187** (0.00771) | -0.0101* (0.00535) | -0.0111 (0.00958) | 0.00709 (0.00972) | -0.0253* (0.0130) | 0.0155 (0.00951) | 0.00804 (0.00567) |
| t+2 | -0.00363 (0.00508) | 0.00900** (0.00386) | -0.00462 (0.00283) | 0.00216 (0.00350) | -0.000413 (0.00421) | -0.00422 (0.00523) | 0.000239 (0.00810) | 0.000404 (0.00728) | -0.000385 (0.00758) |
| t+3 | 0.00226 (0.0103) | 0.00691 (0.00834) | 0.00826 (0.00940) | 0.0107 (0.00877) | 0.00115 (0.0101) | 0.00263 (0.0145) | 0.00637 (0.00997) | 0.00605 (0.00488) | 0.0164*** (0.00634) |
| t+4 | 0.00610 (0.00837) | 0.00769 (0.0127) | 0.0286 (0.0211) | -0.00401 (0.00627) | 0.00945* (0.00486) | 0.00571 (0.00811) | 0.00833 (0.0111) | 0.00791 (0.00899) | 0.00291 (0.00807) |
| Constant | -0.000531 (0.000514) | -0.000648 (0.000521) | -0.000543 (0.000511) | 0.00110** (0.000537) | 0.00112** (0.000537) | 0.00132** (0.000517) | 0.000887* (0.000530) | 0.00122** (0.000540) | 0.00110** (0.000535) |
| Observations | 1,304 | 1,304 | 1,304 | 1,304 | 1,304 | 1,304 | 1,304 | 1,304 | 1,304 |
| R-squared | 0.455 | 0.450 | 0.456 | 0.491 | 0.489 | 0.491 | 0.424 | 0.419 | 0.421 |

Robust standard errors in parentheses

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

