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FUNDACIÓN DE LAS CAJAS DE AHORROS
DOCUMENTO DE TRABAJO
Nº 427/2008

De conformidad con la base quinta de la convocatoria del Programa de Estímulo a la Investigación, este trabajo ha sido sometido a evaluación externa anónima de especialistas cualificados a fin de contrastar su nivel técnico.

ISSN: 1988-8767

La serie **DOCUMENTOS DE TRABAJO** incluye avances y resultados de investigaciones dentro de los programas de la Fundación de las Cajas de Ahorros.
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Determinants of abnormal liquidity after rating actions in the Corporate Debt Market•

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Abstract:

The influence of rating announcements on corporate debt market liquidity has been previously overlooked. Based on an event study, we examine the effects of the announcements of effective rating changes, outlook notices, and CreditWatch placements provided by credit rating agencies on abnormal liquidity in the Spanish corporate debt market. We propose several measures of trading activity as proxies of liquidity since other more usual liquidity measures are not suitable for this kind of analysis. Also, by means of cross-section regressions, we establish what factors determine the sign and intensity of the liquidity reactions. The presented results indicate that factors related to the characteristics of the rating announcement, the issuing company and the economic environment are relevant in light of several hypotheses.

Keywords: Rating agencies, rating changes, liquidity

JEL classification: G12, G14, C34

•The information provided by AIAF, Fitch and Moody's is appreciated. Any errors are solely the responsibility of the authors. This work has been funded by the Ministerio de Ciencia y Tecnología (ECO2008-02752, SEJ2006-14354 and SEC2005-08931-C02-01), the Junta de Comunidades de Castilla-La Mancha (FEDER PAI-05-074 and PCI08-0089) and the Region of Madrid (UCM940063).

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1. Introduction

This study examines the impact on the Spanish corporate debt market liquidity of the rating action announcements: actual rating changes, outlook notices (or medium-term rating trends), and CreditWatch placement (warnings of a possible short-term rating change), made by the three largest international agencies: *Moody's*, *Standard and Poor's* and *Fitch*. We also identify the determinants of abnormal liquidity by considering the peculiarities of the change in question, the issuer and the economic environment.

Many authors present evidence of the informative content of rating announcements. Most of them have focused on analyzing the effects of those announced changes on the stock prices (e.g., Hand *et al.*, 1992; Elayan *et al.*, 2001 or, for the Spanish market, Abad & Robles, 2006). Some others analyzed these effects on corporate debt prices (e.g., Kliger & Sarig, 2000, Steiner & Heinke, 2001; in the European case, Gropp & Richards, 2001, Dallocchio *et al.*, 2006; or, in the Spanish case, Abad *et al.,* 2007). In the above mentioned sources, we can find hypotheses regarding the effects of rating change announcements that postulate the expected performance of corporate debt prices, as well as possible determinant factors. However, none of them addresses the expected liquidity performance.

Ratings and rating changes can result in a specific market dynamic that could not only affect prices, but could also directly concern the market liquidity. This dynamic maybe caused by the way in which investors use ratings, as well as by its actual informative content. For example, the proliferation of "rating triggers" in the management of portfolios based on rating changes could force operators to increase their sales transactions, and could even cause a liquidity crisis.

In spite of the importance of the impact of rating actions on debt liquidity, there is almost no theory or empirical research on that question. To our knowledge, the first work on that topic is the paper by Abad *et al.* (2007), where the effects of rating announcements on yield spreads and different liquidity measures were analyzed in the Spanish corporate debt market.

Based on the work of Abad *et al.* (2007), in this study we analyze how several liquidity measures respond to rating change announcements. We also formulate different hypotheses that link the potential effect to different characteristics of the issue (such as sector, size, etc.), rating change characteristics (such as the type of rating action in question, or if that action is expected by the market, etc.), and economic environment characteristics. Finally, we define the possible explanatory factors of the liquidity response under these hypotheses.

A key factor in this analysis is how abnormal liquidity measures are defined. We consider a wide range of variants of abnormal liquidity measures based on different aspects of trading activity: trading volume, trading frequency and market share. These proxies are only a part of the proposed liquidity measures in the literature. As we comment later, other more popular measures are clearly inappropriate for our analysis, e.g. the age or the amount outstanding, or can be considered as unsuitable for our analysis, e.g. the bid-ask spread.

To carry out the analysis, we analyze a sample of daily corporate bond and commercial paper notes data. This database of Spanish corporate fixed income assets contains information about the trading volume per transaction, making it possible to develop trading activity measures. First, we perform an event study to determine if the rating changes generate significant abnormal liquidity, and then we analyze the effects of the determinants by mean of a cross-section regression analysis.

The next section formulates the hypotheses addressing the reaction of liquidity to rating announcements. Section 3 presents the liquidity measures analyzed. Section 4 describes the database. Section 5 shows the results of the empirical analysis. The main conclusions are summarized in section 6.

2. Liquidity Response to Rating Announcements

The literature shows different and sometimes conflicting theories regarding the expected effects of rating changes on prices in stock and debt markets. However, these theories do not address the expected liquidity performance. Starting from these theories, in this paper we state and test a set of hypotheses about the effect on liquidity to rating announcements that Table 1 summarizes.

First, the "information content hypothesis" (ICH ahead) states that rating agencies handle confidential information. Therefore, rating revisions include new information for the market that is rapidly included into prices. From the ICH theory, we hypothesize that this inclusion of new information into prices goes with a higher activity in the market. However, market microstructure models assert that the response of trading activity after new information is related to the existence of asymmetric information among agents and market makers (e.g., see Balduzzi *et al.*, 2001). Informed investors anticipate such information and increase their activity before the announcement. Before the news is released, the volatility increases and after the trading activity decreases.

The agencies strategic behaviour can influence the information content of rating. Some authors, such as Howe (1995), Löffler (2004) or Altman & Rijken (2006), indicate that agencies apply a "through-the-cycle" methodology to achieve stability in the ratings. In similar terms, Fledelius *et al.* (2004) and Löffler (2005) assert that when the rating of a company is changed, the agency wants to be quite sure that this adjustment is stable and is not going to be reversed shortly after ("reversal aversion"). Respect to the investors, the economic environment may also be relevant (Dialynas & Edington, 1992) since in periods of prosperity investors will assume higher levels of risk.

In addition, agency behaviour could reflect a "moral hazard risk problem" that would undermine the reliability of their ratings.[1] Almost all rating agency revenue comes from rating fees. One method for acting in the interest of issuers is to delay rating downgrades. Under this behaviour, the rating changes would have no effect because the market would not value them.

Moreover, to safeguard their reputation, agencies may prefer to proceed slowly so as not to make mistakes (Steiner & Heinke, 2001; Hull *et al.,* 2004). The loss of reputation associated with giving a good rating to a high-risk company is more serious than that resulting from assigning a poor rating to a low-risk company, since the first error could mean economic losses for investors. According to Holthausen & Leftwich (1986) and Ederington & Goh (1998), this asymmetry means that the agencies allocate more resources to revealing negative than positive information. Therefore, the impact on liquidity will be greater in downgrades than in upgrades.

In addition to rating changes, the agencies make other different rating-related decisions, e.g. outlook notices or CreditWatch placements.[2] Altman & Rijken (2007) found that bond ratings provide a better prediction of the default risk when they are adjusted for outlooks. In this

[1] Steiner & Heinke (2001) show that agencies may systematically overrate issuers to gain market share or maintain leadership. Covitz & Harrison (2003) analyze if agencies are biased favouring issuer interests at the expense of investor. Boot *et al.* (2006) provide a model based on an implicit contract between the credit rating agency and the firm that should prevent further downgrades. An agency initiates a monitoring regime through the credit watch procedure and an issuer implicitly promises to start specific actions to mitigate the possible decline of its rating.

[2] The placing on the CreditWatch list occurs after special events (changes in regulation, unexpected changes in management, merger announcements, etc.) indicating that the rating is under review for a likely change in a short period of time. Outlooks indicate the credit worthiness trend in a medium-term time frame.

respect, this refinement of the assigned rating can provide useful information to the market. Steiner & Heinke (2001) and Hull *et al.* (2004) confirmed the impact on prices of the placement on the CreditWatch list.

Sometimes, the performance of institutional investors conditions the final effect of rating changes. Credit ratings allow making a distinction between investment and speculative grade debt. Some clauses force the investors' decisions on the observed rating (e.g. pension fund often only are allowed to deal with investment grade issues) and influence the effects caused by rating changes, even though the changes contain no new information for the market.[3] As well, institutional investors usually use a buy-and-hold strategy that could diminish the impact of rating changes on liquidity.

It is important to notice that differences in the regulation affecting firms can lead on differences in the information content of rating changes (Schweitzer *et al.*, 1992). Thus, for highly regulated sectors, such as financial sector or governmental firms, the market has more public information and the debt of these enterprises is almost guaranteed by the State. Then the impact of rating announcements on that type of firm is diminished. This effect may be also observed for larger or more profitable firms. For instance, effects of downgrades on larger firms may be influenced by to the *too-big-to-fail* paradigm since market may consider that large corporations have systemic importance.[4]

3. Liquidity Measures

Liquidity is hard to define. It refers to the ease with which an asset can be traded in a short period of time without causing a significant impact on the price. Liquidity affects the valuation due to transaction costs. Since investors cannot regularly cover their risk, they demand an *ex ante* risk premium that results in lower asset prices. Thus, for identical promised cash flows, the illiquid bonds will be traded less frequently at lower prices and with higher yield spreads. Liquidity premium is the difference between the return required of a liquid security and the one corresponding to an illiquid security.

[3] Similarly, specific markets, such as the Eurobond market, may simply require the presence of a particular minimum rating before listing the debt issue.

[4] This term is used in banking to describe how regulators may deal with severely financially troubled large banks.

The literature has analyzed, almost exclusively for the U.S. debt markets, different features of liquidity. A wide range of market condition variables and security-specific characteristics have been used as proxies for liquidity, but is a market-related variable – the bid-ask spread – the most frequently used. A key factor to explain this is that most databases for the U.S. market have this information but they usually do not have data on transaction prices and trading volumes. In this respect, Elton & Green (1998) and Alexander *et al.* (2000) suggest that the best liquidity proxy is the trading volume. Fleming (2001) finds that the best result is provided by the number of transactions, and Longstaff *et al.* (2005) stress the role of the amount outstanding.[5] Houweling *et al.* (2005) compare nine liquidity proxies (issued amount, listed, euro, on-the-run, age, missing prices, yield volatility, number of contributors and yield dispersion) for a sample of Eurobonds and find very few differences between the different measures. Edwards *et al.* (2007) remark the role of trade size and issue size, besides other liquidity proxies, to determine the transaction costs in the US corporate bond market.

In our case, most of the proposed liquidity measures in the literature are clearly inappropriate, e.g. the age of the bond or the amount outstanding are independent of an eventual rating action. Moreover, the bid-ask spread, could be considered unsuitable for our analysis. In general, a typical off-the-run corporate bond is only traded several times per year and, in the context of an illiquid market, the bid-ask spread measure can be considered as anecdotic or artificial. To trade a seasoned corporate bond, the dealer should contact one of a number of "buy-side" clients and obtain the bond. The final price will depend on the search and transaction costs regardless of the quoted bid-ask spread. Even the US corporate bond market, the world's largest one, is described as highly illiquid by recent papers such as Edwards *et al.* (2007) and Mahanti *et al.* (2008), who emphasize problems of conventional measures of liquidity in this market.

In this study we propose different proxies for corporate bond liquidity to obtain measures of abnormal liquidity. We focus the analysis on market condition variables. Specifically, we analyze the evolution of the trading volume and the frequency of trading. In addition, since the life cycle of commercial paper notes is extremely regular, we include the expected market shared proposed by Díaz *et al.* (2006).

[5] Other works use variables such as interest rate volatility (Kamara, 1994), trading frequency (Shulman *et al.*, 1993), investment funds growth (Fridson & Jónson, 1995), or number and dispersion of trades (Houweling *et al.*, 2002).

To analyze the effect of rating changes, we study these variables on the day on which the rating change is announced in the news (day $t = 0$) and on days around it. Due to infrequent trading, these variables are often unavailable on days $t = -1$, $t = 0$ and $t = +1$. For this reason, we analyze window-spanning excess of liquidity from t = t_1 to t = t_2, where t_1 is the last trading day before the announcement and t_2 is the first trading day after the announcement.

The trading volume on day t_2 is obtained from a measure of the effective trading volume for each of the outstanding issues of issuer *i*. Then, we compute the logarithmic rate of change of the trading volume between session t_2 and the last session prior to t_2 during which an asset of the issuer was traded, t_1. Specifically:

$$cV_{i,(t_2-t_1)} = v_{i,t_2} - v_{i,t_1} \qquad (1)$$

where $v_{i,t1}$ *and* $v_{i,t2}$ are the logarithm of the trading volume of the outstanding issues of issuer *i* on days t_1 and t_2, respectively.

The abnormal trading volume variable, $AV_{i,(t_2-t_1)}$, is obtained by comparing the observed rate of change $cV_{i,(t_2-t_1)}$ with the expected in the absence of the event:

$$AV_{i,(t_2-t_1)} = cV_{i,(t_2-t_1)} - E(cV_{i,(t_2-t_1)}) \qquad (2)$$

where $E(cV_{i,(t_2-t_1)})$ is the expected or "normal" rate of change of the trading volume on average between all the issues of issuer *i*, considered as the benchmark.

The expected trading volumes in t_1 and t_2 are calculated from three alternative measures during the three months previous to t_1 and to t_2. Two measures are mean daily trading volumes; the first one is calculated *per* traded day (related to the average transaction size) and the second one *per* working day (related to the trading frequency).[6] Thus, they are computed as the average total traded volume of the issue in the last three months, divided by the number of days on which the asset is traded during that period (*per* traded day) or divided by the number of working days in the last three months regardless of whether or not the issue has been traded (*per* working day). The third measure is the accumulated trading volume of the asset in the last three months. Finally, we obtain the logarithmic rate of change between t_2 and t_1 of the mean traded volumes per day (TVTD), the mean daily trading volume (TVWD), and mean trading volume accumulated in the last three months (TVA).

[6] Consequently, this latter measure is corrected if the asset is kept outstanding for less than three months.

The second abnormal liquidity measure is based on comparing the mean trading frequency to the different outstanding issues by the issuer on the first day of transactions after the event and the day prior to the event. These frequencies are calculated for each issue as the ratio between the number of trading days and the number of days on which trading could have taken place, i.e., working days in a predefined window. Specifically, the measure of abnormal frequency is calculated as:

$$AF_{i,(t_2-t_1)} = f_{i,t_2} - f_{i,t_1} \tag{3}$$

where f_{i,t_2} and f_{i,t_1} are the logarithms of the two relative frequencies mentioned above. We consider different sizes of the windows in which f_{i,t_2} and f_{i,t_1} are calculated. For the first windows, in which we measure the frequency after the event, we select 1- and 2-week and 1- and 2-month after t_2 windows. For the second windows, in which we measure the frequency before the event, we consider 1-, 2- and 3-month after t_1 windows, and the entire period since issue after t_1.[7] In this way, we are able to see what happens to abnormal liquidity as the date of the rating change announcement approaches and, furthermore, if the impact is only observed in the market immediately after the event or it is more long-lasting.

As remarked previously, the trading activity performance of commercial paper notes over their short life cycle is very regular. In this respect, the issuing activity of new commercial paper notes by large corporations is constant. Institutional investors trade these instruments very actively after issue. After a few days, trading ceases almost completely. The regularity in the life cycle is also observed by Díaz *et al.* (2006) for Spanish government bonds. Although the evolution of market share of both groups of assets differs widely, it follows a uniform pattern in both cases. For government bonds, it presents an initial spike with a subsequent exponential drop. For commercial paper, it shows a sharp initial drop and a much smoother exponential decline afterwards. This is related with the fact that institutional investors take up positions on the recently issued commercial paper note and then its trading loses appeal and it becomes residual.[8]

We apply the model proposed by Díaz *et al.* (2006) to study the behavior of the weekly market share of each issue as a smooth, non-linear function of its age.[9] The market share is expressed in relative terms with respect to the total volume traded on the market during the week

[7] We also consider other windows before and after, but we do not include the results to save space.

[8] The average market share of a commercial paper note the first week is 33.4% dropping to 2.7% the following week.

[9] This model is inspired by actuarial methods used to model human mortality (see Heligman & Pollard, 1980).

and, therefore, it eliminates possible data trends and possible volume fluctuations between weeks without relevance for asset liquidity. They define the market share of asset *i* during week *t* as the ratio between the nominal volume traded *per* asset and the total volume traded *per* all the outstanding issues. The market share permits to compare the different degrees of liquidity between issues and to monitor the evolution of the liquidity of an issue throughout its lifetime.

In our case, the original expression of Díaz *et al.* (2006) is adapted to the performance of the commercial paper market share. In particular, the final expression we estimate is:

$$MS_{it} = \beta_1^{(Age_{it}-\beta_2)^{\beta_3}} + \beta_4 \cdot \beta_5^{Age_{it}} + u_{it} \qquad (4)$$

where $\beta_i, i = 1,...,5$ are the parameters to be estimated, and u_{it} is an error term *i.i.d.* with zero mean and constant variance.

Equation (4) is estimated from the weekly market share of each commercial paper note traded in the sampling period of 1998 to 2004. We consider all the outstanding issues for each day of the week, despite of whether or not they were traded. In other words, when a commercial paper note was not traded during a session, its market share was zero and it was taken into account to calculate the mean market share of all the commercial paper notes of the same age.[10]

Figure 1 shows the result of the estimation.[11] These estimated market shares are the ones we use as the benchmark market shares that a commercial paper note should achieve as a function of its age and regardless of whether a rating event occurs. Thus, we define abnormal market share as the difference between the rate of market share change observed around the rating event and that expected of a typical commercial paper note of the same age:

$$AMS_{i,(t_2-t_1)} = cMS_{i,(t_2-t_1)} - E(cMS_{i,(t_2-t_1)}) \qquad (5)$$

where $cMS_{i,(t_2-t_1)} = ms_{i,t_2} - ms_{i,t_1}$, $ms_{i,\tau}$ is the market share in logarithms during week τ, and *E*(.) indicates the expected value according to model (4).

[10] The model was also estimated on the basis of effective volume as a dependent variable. The results are similar to those obtained using the market share.

[11] All the details have been omitted to save space, but they are available on request from the authors.

4. Data

The original data set consists of daily observations derived from actual transactions in all commercial paper notes and corporate bonds traded on the secondary market of AIAF (*AIAF Mercado de Renta Fija* **-** Fixed Income Market).[12] This is by far the leading and almost only Spanish corporate fixed income market and is run by the Spanish security dealers association. At present, AIAF is one of the leading European corporate fixed income markets. In fact, in 2006, it was the second largest European market in mortgage-backed securities[13] and the first largest in covered bonds ("*Cédulas Hipotecarias*").[14]

We compute the abnormal liquidity measures from daily observations of trading volume and transactions carried out on all commercial paper notes and bonds traded on the secondary corporate debt market, AIAF. The database of bonds begins in 1993, whereas the commercial paper database begins in 1998, and both end in 2004. For each reference, AIAF provides daily information on the number of transactions and the nominal and effective transaction volumes. We excluded from the sample issues with special characteristics, such as floating interest rate issues, convertible bonds, issues with tax incentives, etc.

The sample we analyze in this paper consists of rating action announcements of *Fitch*, *Standard and Poor's* and *Moody's* from June 1993 to December 2004. Part of this information was provided by *Fitch* and *Moody's*. We also use the "*Hemeroteca de El País*" ["*El País*" newspaper library] to obtain information on the announcements of *Standard and Poor's*. The original sample was composed of 349 rating announcements, including rating changes, outlook changes, and CreditWatch placement.

From the database, we select the issues of re-rated companies, and we exclude the cases that lacked the minimum of liquidity around the announcement date. The final sample consists of 158 rating action announcements that affect 1058 issues (271 bonds and 787 commercial paper

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[12] Corporate fixed income assets are also listed through the electronic trading system of the Spanish stock exchanges and through three of the four Spanish stock exchange markets (Barcelona, Bilbao and Valencia).

[13] ESF Securitisation Data Report, Spring 2007.

[14] Spanish *Cédulas Hipotecarias* are equivalent to German *Pfandbriefe* and French *Obligations Fonciéres*.

notes).[15] Table 2 shows the 158 events divided into six categories: rating upgrades or downgrades, positive or negative outlooks, and CreditWatch placement for negative or positive reasons. In all, the sample contains 109 rating announcements that affect the bond market and 120 that affect the short-term market. Of these, 71 simultaneously affect both markets.

Table 2 also shows the number of expected rating announcements. So as other authors, we used the CreditWatch placement to distinguish between expected and unexpected rating changes. When a rating change is preceded by a placing on the CreditWatch list in the same direction, it could be anticipated by the market and would not provide new information. In both market segments we find more than 50% of expected rating events. Finally, of the 229 announcements, 143 involve a decline of creditworthiness and 86 involve improvement. This seems to indicate a somewhat increased credit risk in the Spanish corporate debt market during the studied period.

Table 3 shows the classification of rating announcements according to the number of notches the debt shifts after the rating change. Although the three agencies used different symbols to designate the different credit risk categories, is easy to determine the equivalence between these symbols. This allows us to transform the ordinal scale applied by the agencies into a numeric scale in which the highest values denoted greater probability of default.[16] Table 3 also shows in parentheses those changes that imply an entrance into speculative grade. As we can see, only two rating downgrades in the case of bonds caused a drop to the speculative grade.

Focusing on the agency, the 49% of the rating actions are by *Moody's*, the 27% by *Fitch*, and the remaining 23% by *S&P's*. As well, we find similar percentages for the two market segments individually. Finally, the 68% of the announcements correspond to firms in the financial sector (savings or commercial bank), and the 18% correspond to governmental enterprises.

[15] In many cases, the rating changes affect companies whose issues are not traded around the event. Other issues are not traded in the secondary market because they are fully incorporated into the investors' portfolios. Moreover, some large issuers put their debt into circulation on other international markets.

[16] Rating Aaa of Moody's and AAA of Fitch and S&P corresponds to 1 on the numeric scale, rating Aa1 and AA+ to 2, rating Aa2 and AA to 3, and so on.

5. Empirical Results

5.1. Estimation of Abnormal Liquidity

Almost all issuers affected by rating actions simultaneously maintain various issues on the market, especially in the case of commercial paper notes. On most days, several references of each issuer are traded on the secondary market. To avoid correlation in the cross section resulting from the fact that the trading activity of the references issued by the same company may be highly correlated, we construct portfolios with all the bonds on the one hand and all the commercial paper notes on the other, before computing the liquidity measures. In this way, all the outstanding references of each issuer were aggregated and weighted by the volume of issues traded on the corresponding day in a portfolio, which was treated as an individual observation.

In the event analysis, we used two statistics to test the null hypothesis of inexistence of abnormal performance due to the rating action announcement, i.e., zero mean abnormal liquidity: a standard *t-ratio* and, to avoid the effects of non-normality, the Wilcoxon rank test.

The results are shown in Table 4. The first panel shows the mean abnormal liquidity after upgrades and downgrades in the corporate bond portfolios. The results for the commercial paper portfolios are shown in the second panel. The table shows the results for the two kinds of proxies of abnormal liquidity: the trading volume-based and the trading frequency-based measures.[17]

As we can see, in the case of bonds, downgrade announcements imply a significantly positive abnormal liquidity for trading frequency liquidity proxies, whereas no significant excess liquidity is observed for trading volume. Notice that increased liquidity after the rating downgrade announcement is only observed in the measures based on the shortest post-event windows, less than one month. In addition, liquidity increases more as the announcement date approaches, i.e., it is more clearly observed for the shortest pre-event windows. The results are independent of the test we use.

For rating upgrade announcements on bonds, the excess liquidity is also significantly positive. This result is robust to the way of calculating liquidity (volume or frequency) and the

[17] To save space, we only show results for pre-event windows of 1, 3 months and the entire period (1M, 3M, T) and post-event window of 1 week and 1 month (1w, 1m). The results for removed windows are similar.

test used (parametric or non-parametric). For the frequency measures the effect is greater immediately after the announcement and it diminishes after that date just as for downgrades.

In the case of the short-term corporate debt market, the market share is also analyzed as liquidity proxy. The mean abnormal liquidity is not significant when we use the trading volume but a significant drop of the mean market share occurs, whereas with the frequency measures we observe a significant positive effect on liquidity, except in one window (Table 4, right panel). These apparently opposing results should not come as a surprise in view of the differences between both measures. While the market share is compared on two specific days (before and after the event), in the case of frequency the comparison concerns what happens in windows around the event. This result indicates that the abnormal market share decreases immediately after the downgrade announcement, and at the same time the abnormal trading frequency increases in windows subsequent to the announcement (the abnormal frequency is higher in the narrowest windows).

For rating upgrades, significant effects are detected only with the frequency-based measure. The effect is positive in all the windows, indicating an increase in abnormal frequency after the upgrade. This increased trading activity diminishes as the post-event window is broadened, indicating that its intensity decreases as time passes after the announcement.

In short, for both segments we find a significant positive response of liquidity to changes in both directions. An increased, more intense frequency is observed in the periods closest to the announcement date. In the case of commercial paper notes, the downgrade announcements cause a reduction of market share. These results are in tune with the informative content hypothesis but counter other hypotheses that postulate asymmetric performance for credit rating upgrade and downgrade announcements.

5.2. Determinants of Abnormal Liquidity

The purpose of this section is to analyze the determining factors of liquidity movements as result of rating announcements. To do so, we estimate a multiple regression model in which the variable to be explained is the measure of abnormal liquidity. The model is as follows:

$$\begin{aligned} AL_{i,(t_1-t_2)} = {} & \beta_0 + \beta_1 EXP_i + \beta_2 NOTCH_i + \beta_3 GRAD_i + \beta_4 AG_i + \beta_5 W_i + \beta_6 O_i + \\ & + \beta_7 IRV_i + \beta_8 FIN_i + \beta_9 GOV_i + \beta_{10} LSIZE_i + \beta_{11} AGR_i + \beta_{12} EP_i + u_i \end{aligned} \tag{6}$$

where $AL_{i,(t_1-t_2)}$ denotes each of the described abnormal liquidity measures in the event window.

In model (6), the explanatory variables help to verify the different hypotheses shown in Section 3. Thus, to test the informative content hypothesis, we include different variables: *EXP*, which equals one if the announcement is preceded by a placement on the CreditWatch list in the same direction, and zero otherwise,[18] and *NOTCH* which indicates the number of notches the debt rating changes. We also define *GRAD*; this variable is equal to one when there is a shift from investment grade to speculative grade, and zero otherwise. This latter variable also allows us to test the hypothesis of pressure on prices associated with rating triggers. This variable is only included in the models for downgrades in the case of bonds, since only in this case the sample contains shifts from investment to speculative grade.

To analyze the effect of agencies strategic behaviour we include several variables. First, the variable *AG*, which equals one if the announcement is by *Moody's* and zero if it is by *S&P* or *Fitch*, is used to verify the hypothesis of reliability of agencies and competition between them. To test the hypothesis of long-term orientation of rating versus other agency actions, we include *W*, which equals 1 if the announcement is a CreditWatch list placement/retirement, and zero otherwise; and *O*, which equals 1 if the event is an outlook change, and zero otherwise. If these rating actions incorporated useful short-term information, then their effect will be positive.

To consider the effects of the economic cycle, the model included the one year Euribor inter-annual rate of change (*IRV*).[19] If investors are more concerned with risk in periods of economic crisis, we expect a positive effect of this variable.

We included two variables to analyze the importance of regulation affecting the issuer: *FIN*, which equals one if the announcement refers to a company from the financial sector, and zero otherwise, and *GOV*, which equals one in the case of a governmental enterprise, and zero otherwise.

Finally, to analyze the effect of company-specific characteristics, we include three variables. One distinguishes between large and small firms. We call it *LSIZE* and equals one if

[18] Although this is the habitual definition of expected rating changes, we also construct a variable that is worth 1 if the announcement is preceded by a rating action in the same direction in the three preceding months (*E3M*).

[19] In addition, we alternatively consider the growth rate of the economy (*GRE*).

the logarithm of asset is above the mean, and zero otherwise. The other two are performance measures: the firm asset growth rate (*AGR*) and its economic profitability (*EP*).[20, 21]

In order to take into account the possibility that some other simultaneous event that affect the issuer occurs in the event window we include two control variables in the model: *ISS* which indicates the number of issues that constitute the portfolio and *DAY* which measures the number of days in the event window, i.e., between t_1 and t_2.

Model (6) was estimated separately for the sample of downgrade and upgrade announcements, for the sample of bonds and commercial paper, and for the different abnormal liquidity measures provided in Section 4.[22] We estimated the models by ordinary least-squares. In order to correct the potential effects of heteroskedasticity in the variance-covariance matrix of the OLS estimator, we calculate the White's estimator of this matrix. Before estimating the models, we test the existence of significant correlations between the explanatory variables. The presence of multicolinearity in the models is ruled out, since the highest correlation found do not exceed 0.45 in any case.

5.2.1. Results for Downgrades

Tables 5 and 6 show the estimation of model (6) results in the case of downgrades. The first shows the results for volume measures and the last the results related to frequency measure.

The model for the estimation of abnormal liquidity of bonds calculated by trading volume is shown in left panel in Table 5. As we can see, no significant effects are found in nearly all the variables regardless of the trading volume measure used. Therefore, the results do not support any of the proposed hypotheses. They are not surprising, however, since we have not found a significant response of these abnormal-liquidity variables to the rating changes (see Table 4). We only observe that the growth rate of the company has a significant negative effect in the case of

[20] The economic profitability of the fiscal year has been calculated as the pre-tax results to total assets ratio.

[21] We obtain the firm balance sheet information from different sources; for financial firms, it was provided by the CECA (Spanish Confederation of Savings & Loans) and the AEB (Spanish Commercial Banking Association), while for the remaining firms it was obtained from SABI database (Iberian Balance Sheet Analysis System).

[22] The segmentation of the sample by announcement type (rating changes, outlook notices or CreditWatch placements) would be interesting but, unfortunately, it is not possible due to the small size of the resulting subsamples..

abnormal liquidity measured as the mean daily volume of trading (TVWD). This would suggest that the faster the asset-growth of the issuer, the lower the additional trading volume associated with the rating announcement. The effect of this variable on the models for TVWD and TVA is also negative, although not significant. The number of issues in the portfolio also shows a negative correlation with the trading volume, as the corresponding parameter is significant in the case of TVWD and TVA**.**

In the case of commercial paper notes (right panel, Table 5) we observe certain effects for trading volume and market share measures. In particular, we observe that the abnormal volume is lower for financial issuers than for the others when we use the mean volume per trading day**.** The estimated value for the remaining trading volume measures has a negative sign, although the parameter is not significant.

We also observe that placement on the CreditWatch list and outlook changes provided different information than the rating downgrades themselves, as the impact of variables *W* and *O* is negative for the three volume measures and significant at 10% for measures TVTD and TVWD, respectively. In the case of the market share no significant effect is found, although for *FIN* and *W* the estimated effects are negatives and the p-values are relatively low.

When we estimate the models for the trading frequency measures (Table 6), the results are sharply different. In the case of bonds (left panel), we find some significant factors, which seem to depend on the size of the window used to calculate the relative frequency before and after the announcement.[23] We observe that the explanatory ability of the model is greater for narrower post-event windows and in one of the models the constant is significantly positive, as we expect in light of the results presented in Table 4. [24]

In general, we find no response of the abnormal liquidity to the rating agency in question, except in the model for measure *3m-1m*, in which variable *AG* has a significant negative effect at 10%. Just as in the case of the volume-based measures, the expected events do not lead to a differential effect. The number of notches the rating jumps does not provide any information either. These results are contrary to the informative content hypothesis. The variable *GRAD* is only significant at 10% in the case of measure *T-1w*. The sign of the effect is negative, contrary

[23] In computing the liquidity measures, the sample sizes change. This is since there is not enough data in some cases to calculate the relative frequency in the corresponding pre- or post-event window, especially in the bond sample.

[24] The constant term of the model is directly related with the mean of the endogenous variable. It is very probable that this parameter be significant when this mean is different from zero. This is analyzed in the event study.

to what we expect, since the hypothesis of restrictions on institutional investors implies more market activity after the shift from investment to speculative grade. Even so, it should be noted that, in the sample there are only 2 such grade shifts corresponding to governmental enterprises.

As for the variables used to test regulation hypothesis, the results are ambiguous. In the models for the shorter post-event windows, we observe that being in the financial sector cause significant effects. The effect is positive for *T-1m* and negative for *3m-1w*. In the case of *GOV*, significant effects with a different sign are also observed for the shorter post-event windows and, depending on the size of the pre-event windows. This result seems to indicate that the liquidity increases much earlier than the date of the rating change. However, as that date approaches, the effect becomes negative. This result would support the hypothesis of regulation, since it suggests that if there is more information about the companies on the market, the impact on abnormal liquidity is lower on the days nearer to the event.

Regarding to the effects of the different rating actions, we observe that a placement on the CreditWatch list does not affect abnormal liquidity whereas a change of outlook does it. In all the models, except for those calculated with the longest pre-event window, we observe that an outlook change has significant positive effects. It seems that in the bond segment, the information content of these outlook changes is important to investors and it increases their trading activity.

On the other hand, the economic cycle do not give information to the market. In contrast, the inherent characteristics of the issues provide relevant information. In particular, economic profitability and the growth rate of the company's asset have a negative effect on liquidity that according to the models for the shorter post-event windows. This result indicates that the market reaction to downgrades depends on the information that investors have on the re-rated companies. The impact of downgrades is weaker on companies with better performance, suggesting that investors use other information beside the rating announcements. Finally, no effects related to the firm size are observed, except for one abnormal liquidity measure for which this effect is positive. This result does not support the too-big-to-fail hypothesis.

The right panel of Table 6 shows the results for rating downgrades in the commercial paper segment in the case of the trading frequency measures. Here, the explanatory ability of the analyzed variables is greater than in the case of bonds. The adjusted R-square of the models range from 0.412 to 0.165, and the model as a whole is statistically significant in all the cases**.**

Also in this case, the rating agency or the fact that the action is expected, do not provide relevant information in any case. The number of notches that the rating shift after the announcement has a significant positive impact on most of the measures, and the corresponding estimator is positive for all of them. This result supports the informative content theory, because the higher the rating jump, the greater the effect on abnormal liquidity.

Being in the financial sector always has a negative effect on liquidity which is significant in the case of measure *3m-1w*. Variable *GOV* also has a significant impact on the models corresponding to the 3-month pre-event windows. According to the regulation theory, the impact is negative which indicates that the reaction of the commercial paper liquidity to a downgrade is weaker for governmental firms.

The type of rating action does not seem to provide relevant information to explain the abnormal frequency measures. A certain effect, however, is found in the case of the economic cycle. For instance, the estimator is positive and the p-values are relatively low in 3 models. This result suggests a greater impact of rating downgrades when economic conditions worsen.

We observe sharp changes related to the performance of the firms. The higher the economic profitability, the lower the abnormal frequency caused by a downgrade in commercial paper notes. This relationship is clearly significant in all the models**.** At the same time, the asset growth rate has a negative impact, although it is significant only in 3 models. Finally, the company size also has relevant information. For large firms, the abnormal frequency after the event has always been lower than for medium-sized companies, which supports the too-big-to-fail hypothesis.

5.2.2. Results for Upgrades

Table 7 shows the estimation of model (6) when abnormal liquidity is trading volume-based.[25] In the case of bonds (left panel), only three variables have significant impacts and, although each one is only significant for two trading volume measures**,** the signs are the same in the one for which the variable was not significant. Specifically, we observe that the parameter associated with *FIN* is significant and negative, indicating a lower increase in abnormal bond liquidity for financial issuers. Just as for downgrades, this result supports regulation hypothesis.

[25] In this case, the sample for some trading frequency measures is very small, especially in the case of bonds. Therefore, it is not possible to simultaneously estimate the effect of all the variables under consideration. Thus, we made an initial estimation by individually including the variables, and we selected those which showed a greater correlation with the endogenous variable. This criterion was used in all the models for upgrades.

The parameter associated with economic profitability (*EP*) is also significant and negative, showing a lower impact for the more profitable companies. On the contrary, the parameter associated with *EXP* is positive, which indicate that the excess liquidity in bonds after upgrades is greater for the expected events. This result disagrees with the informative content hypothesis, although it could be related to the loss of reputation hypothesis. According to that hypothesis, agencies allocate more resources to revealing negative information than positive. As a result, after upgrades, investors do not pay attention to the placements on the CreditWatch list, but rather seem to wait for confirmation of the change to make their decisions.

In regard to the commercial paper notes (right panel, Table 7) no significant effects are found except for *AG* in the case of TVTD. This suggests that, just as in the bond segment, when the announcement is made by *Moody's*, the impact on abnormal liquidity is different than when the announcement is made by the other agencies.

Table 8 shows the results of the estimation of model (6) using trading frequency as liquidity proxy. In two of the models, the constant is significantly positive, as we expect in light of the results presented in Table 4. As we can see, for bonds two variables that characterize the announcements have significant parameters: *AG* and *NOTCH*. Variable *AG* has a significant positive parameter in two models. In this case, the rating upgrades made by *Moody's* increase the frequency of abnormal bond trading to a higher extent than the other two agencies. The parameter of *NOTCH* is also significant and positive only in one of the models indicating that the higher the number of notches the rating shifts upward, the greater the increase of abnormal liquidity.

On the other hand, the economy's growth rate has a negative impact on one model. As postulated by the economic environment hypothesis, investors attach more value to upgrades when the general economic situation is worse. Just as when the liquidity is computed via volume, the firm economic profitability has a negative impact on abnormal frequency.

When we analyze the results for trading frequency measures in the short-term market (see right panel, Table 8), we find a good number of variables that significantly affect liquidity. Moreover, the variables and the signs of the effects reflect the situation in the bond market. When an enhanced outlook change is announced, liquidity increases to a smaller extent than when other announcements are made. This indicates that the rating refinement contains different information for investors than a change *per se* or a placement on the CreditWatch list. It seems that the actions of commercial paper market investors do support the hypothesis of Altman & Rijken (2007) that outlooks offer a better adjustment of ratings in the forecast of the default risk. In accordance with the regulation hypothesis, the impact on abnormal liquidity is weaker when the announcement refers to financial firms subject to more regulations. Just as for bonds, upgrades related to the most profitable issuing companies result in a lower liquidity increase in the market in accordance with the baseline hypothesis.

Finally, the effects of upgrade announcements differ in the commercial paper notes segment according to the cycle phase. Just as with the volume-based measures, worsening economic conditions cause less impact of upgrades on abnormal liquidity. This also could be related to the agency loss of reputation hypothesis.

6. Conclusions

We analyze the impact of credit rating agencies' announcements of rating changes, outlook changes and placement on the CreditWatch list on the liquidity of the Spanish corporate debt market, and in particular on the liquidity of bonds and commercial paper notes. Data from the Spanish corporate fixed income market allows us to perform this kind of analysis. Specifically, our objective was to answer several questions: Do rating announcements have any impact on the liquidity of the Spanish corporate debt market? And, if so, what are the determinants of that effect? Are they the ones that could be expected in the light of the reinterpreted hypotheses formulated by other authors to explain the impact on prices? Two methodologies are used to answer these questions: event analysis and cross-section regressions. Also, a set of 9 variables are identified to measure abnormal liquidity, three trading-volume based and 6 trading-frequency based. For commercial paper notes, we also analyze the market share.

With regard to the first question, our findings indicate that both rating upgrade and downgrade announcements cause a significant increase in abnormal liquidity, which is clearly evident when trading frequency is used as the liquidity proxy. In accordance with the informative content hypothesis, that evidence reveals that both types of announcements contain relevant information for Spanish corporate debt market investors and they cause the same kind of reaction: increases in trading activity of the securities by the firms targeted by the announcement.

Regarding to the study of the determinants of abnormal liquidity, the results were consistent with the literature in several ways. First of all, as some authors argue, the stability of ratings forces investors to seek additional information from other sources. For instance, Spanish market investors combine the information contained in the announcements with the characteristics of the issuer, its profitability, the growth it has experienced, and its size. Secondly, we find clear evidence in favor of the regulation hypothesis. In general, when announcements refer to financial firms, subject to greater regulation, there is a weaker impact on trading frequency. The same is true for governmental firms, though in a less explicit way. Thirdly, the impact of the announcements is not independent from the economic cycle and the results support the proposed hypothesis, i.e., they are counter-cyclical in the case of downgrades and cyclical in the case of upgrades. Fourthly, as it is postulated in the informative content hypothesis, the higher the number of notches the rating shifts, the greater the impact on trading frequency.

On the other hand, we found data that disagree with the most frequent position in literature regarding the credibility of the rating agencies. In contrast to other markets, the Spanish market grants greater credibility to the rating upgrades made by *Moody's*, which may be related to its higher relative weight, illustrated by almost 50% of the rating actions analyzed in our sample, and to the fact that it has been operating for a longer time on the Spanish market.

In a final conclusion, these results provide new evidence that makes it possible to assess the role of the rating agencies in the financial market. They help to understand the determinants of the abnormal liquidity in the corporate bond market that follows a rating change. The results suggest that the information these changes contain is not complete, in the sense that investors base their decisions also on other factors. This could be a general pattern in all international markets or could indicate a specific Spanish situation. However, in order to answer this question, data for other countries need to be generated.

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Table 1. Summary of hypothesis about the effect on liquidity to rating announcements

Hypothesis	Effects on liquidity
Information content hypothesis	• Rating changes cause an increase in activity • The greater the jump in notches, the greater the expected reaction • Expected changes cause no effects on liquidity
Market microstructure	• After rating actions a lower level of market activity is expected
Agencies behaviour	• Stability of ratings: Rating changes do not affect liquidity • Refinement of ratings: Other rating actions increase liquidity more than rating changes does • Moral hazard risk problem: Rating changes have no effect on liquidity • Competition between agencies: Different effect related with different agency • Reputation of the agencies: The impact on liquidity is greater for downgrades than for upgrades
Economic environment	• the effects of rating announcements differ according to the current phase of the economic cycle
Investment restrictions	• Downgrades from investment to speculative grade increase the liquidity • Upgrades from speculative to investment grade do not affect liquidity • Buy-and-hold strategies diminish the impact of rating changes on liquidity
Differences in regulation	• Lower impact of rating changes for financial firm's liquidity than for other firms. • Lower impact of rating changes for governmental firm's liquidity than for other firms.
Characteristics of the firm	• too-big-to-fail: Effects for banks and large corporations different than for smaller companies • Differences on liquidity related with company's profitability or growth rate
Asymmetries	• The impact on liquidity is different for downgrades than for upgrades • The impact on liquidity is different depending on the market segment

Table 2. Distribution of Rating Announcements Analyzed

	Bonds	**Commercial Paper Notes**	***Total***
Downgrades	73	70	**143**
Of rating	38 ***(25)*** [24]	36 ***(25)*** [24]	74
Of outlook	12 [8]	9 [8]	21
CreditWatch list	23 [15]	25 [15]	48
Upgrades	36	50	**86**
Of rating	17 ***(9)*** [12]	23 ***(12)*** [12]	40
Of outlook	11 [8]	20 [8]	31
CreditWatch list	8 [4]	7 [4]	15
Total	109 ***(34)*** [71]	120 ***(37)*** [71]	**229**

Note: Expected announcements are in parentheses. Coincidences between segments are in brackets

Table 3. Distribution of Rating Grade Changes

	Bonds		**Commercial Paper Notes**		
Notches	Downgrades	Upgrades	Downgrades	Upgrades	*Total*
1	29	12	30	13	84
2	38	19	34	32	123
3	2	2	4	1	9
4	1	3	2	3	9
5				1	1
6	2 (1)				2
10	1 (1)				1
Total	73	36	70	50	229

Note: Notches is the number of categories that the debt rating changes. In the case of outlook changes and CreditWatch list inputs, it is considered that a shift of one grade has occurred. The changes that imply entering or leaving the speculative grade are in parentheses.

Table 4. Abnormal Liquidity

	Bonds						Commercial paper notes					
	Downgrades			Upgrades			Downgrades			Upgrades		
	AL %	T-ratio	WRT	AL %	T-ratio	WRT	AL %	T-ratio	WRT	AL %	T-ratio	WRT
Volume Measures												
TVTD	-0.087	-0.450	0.096	0.834	2.523**	2.001*	-0.177	-0.623	0.175	0.025	0.105	0.193
		(0.653)	(0.924)		(0.012)	(0.045)		(0.533)	(0.861)		(0.916)	(0.847)
TVWD	0.063	0.712	1.644	0.628	2.129**	2.332**	-0.455	-1.396	0.921	-0.039	-0.116	0.303
		(0.476)	(0.100)		(0.033)	(0.020)		(0.163)	(0.357)		(0.908)	(0.762)
TVA	-0.148	-0.630	0.431	1.355	3.234**	2.843**	-0.706	-1.561	1.551	-0.402	-0.787	0.666
		(0.529)	(0.667)		(0.001)	(0.005)		(0.119)	(0.121)		(0.431)	(0.505)
Frequency Measures												
T-1w	0.354	8.815**	5.626**	0.371	3.923**	2.951**	0.692	21.367**	6.843*	0.701	14.42**	5.639**
		(0.000)	(0.000)		(0.000)	(0.003)		(0.000)	(0.000)		(0.000)	(0.000)
T-1m	0.089	2.258**	1.860*	0.217	2.575**	2.613**	0.284	7.890**	6.101**	0.349	6.861**	5.254**
		(0.024)	(0.063)		(0.010)	(0.009)		(0.000)	(0.000)		(0.000)	(0.000)
3m-1w	0.408	9.232**	5.752**	0.511	5.035**	3.551**	0.509	15.243**	6.539**	0.556	14.15**	5.295**
		(0.000)	(0.000)		(0.000)	(0.000)		(0.000)	(0.000)		(0.000)	(0.000)
3m-1m	0.197	4.768*	3.891**	0.311	4.092**	3.077**	0.118	3.242**	2.808**	0.139	3.424**	3.148**
		(0.000)	(0.000)		(0.000)	(0.002)		(0.001)	(0.005)		(0.001)	(0.002)
1m-1w	0.276	5.848**	4.391**	0.334	3.122**	2.485**	0.270	7.770**	5.686**	0.292	7.674**	5.252**
		(0.000)	(0.000)		(0.002)	(0.013)		(0.000)	(0.000)		(0.000)	(0.000)
1m-1m	0.060	1.493	1.423	0.088	1.183	1.216	0.053	1.550	1.806	-0.062	-1.393	2.218
		(0.135)	(0.155)		(0.237)	(0.224)		(0.121)	(0.071)		(0.164)	(0.027)
Market Share												
MS	--	--	--	--	--	--	-0.883	-1.886*	2.048**	-0.467	-1.006	0.811
								(0.059)	(0.041)		(0.315)	(0.417)

Note: AL%: Mean abnormal liquidity in percentage. WRT: Wilcoxon rank test. TVTD: total volume traded in the last three months divided by the number of days on which each asset is traded during that period. TVWD: mean daily trading volume in the last three months. TVA: mean daily trading volume accumulated in the last three months. Abnormal frequencies calculated as the difference of the logarithm of the mean trading frequency of a pre-event window (PREW) with respect to a post-event window (POSTW): PREW-POSTW., where PREW= 1, 3 months and the entire period since the issue (1M, 3M, T) and POSTW= 1 week and 1 month (1w, 1m). MS is the abnormal market share computed as the difference between the rate of change of the market share observed around the rating event and the one expected according to the model (5). * and ** indicate significance at least at 10% or at 5%, respectively. p-value is in parentheses.

Table 5. Determinants of abnormal liquidity after rating downgrades: Volume measures

	Bonds			Commercial paper notes			
	TVTD	TVWD	TVA	TVTD	TVWD	TVA	MS
Constant	-0.666	1431	1.504	3.238	1.310	1.893	2.155
	(0.656)	(0.475)	(0.458)	(0.255)	(0.413)	(0.287)	(0.474)
Expected (EXP)	-0.035	-0.281	-0.311	-1.413	-0.805	-0.582	-0.551
	(0.960)	(0.754)	(0.735)	(0.312)	(0.367)	(0.558)	(0.703)
No. of Notches Shifts (NOTCH)	0.234	0.177	0.207	0.273	0.255	-0.314	0.197
	(0.472)	(0.621)	(0.561)	(0.896)	(0.817)	(0.812)	(0.934)
Shift from invest. to spec. (GRAD)	0.061	0.258	0.026	--	--	--	--
	(0.953)	(0.849)	(0.984)				
Moody's (AG)	0.394	0.324	0.160	-0.372	-0.658	-0.987	-0.398
	(0.402)	(0.534)	(0.769)	(0.735)	(0.366)	(0.254)	(0.715)
CreditWatch List (W)	0.427	0.661	0.879	-4.468*	-2.025	-2.651	-4.036
	(0.610)	(0.530)	(0.431)	(0.094)	(0.173)	(0.120)	(0.150)
Outlook (O)	0.764	0.611	0.679	-1.682	-1.392*	-0.114	-1.371
	(0.376)	(0.553)	(0.518)	(0.284)	(0.064)	(0.910)	(0.401)
Interest rate variation (IRV)	-0.692	-1.687	-2.020	2.704	1.818	0.901	1.523
	(0.389)	(0.132)	(0.111)	(0.180)	(0.336)	(0.580)	(0.444)
Financial Sector (FIN)	0.438	-0.241	-0.153	-4.150*	-0.369	-1.818	-3.468
	(0.554)	(0.813)	(0.883)	(0.053)	(0.730)	(0.211)	(0.115)
Governmental Enterprise (GOV)	-0.148	-1.662	-1.619	-1.393	0.346	1.703	-2.063
	(0.939)	(0.459)	(0.474)	(0.508)	(0.812)	(0.270)	(0.385)
Large Size (LSIZE)	0.141	-0.678	-0.619	-0.794	-0.615	-0.328	-0.697
	(0.876)	(0.581)	(0.623)	(0.574)	(0.499)	(0.739)	(0.637)
Asset growth rate (AGR)	-1.258*	-0.782	-0.989	0.474	1.102	-0.203	0.383
	(0.088)	(0.450)	(0.342)	(0.774)	(0.290)	(0.857)	(0.804)
Economic Profitability (EP)	5.528	-5.292	-7.654	-15.350	12.572	-9.084	-7.988
	(0.683)	(0.728)	(0.633)	(0.564)	(0.512)	(0.700)	(0.766)
No. of issues (ISS)	-0.215	-0.565**	-0.621**	0.115	0.034	0.083	0.105
	(0.308)	(0.047)	(0.032)	(0.172)	(0.498)	(0.108)	(0.236)
Window size (DAY)	-0.002	-0.003	-0.003	0.002	0.063	-0.016	0.020
	(0.662)	(0.512)	(0.570)	(0.987)	(0.271)	(0.827)	(0.846)
Adjusted R-squared	-0.038	-0.005	0.022	0.039	-0.029	-0.043	0.017
F	0.824	0.979	1.107	1.193	0.864	0.805	1.083
F p val	(0.641)	(0.487)	(0.373)	(0.312)	(0.594)	(0.652)	(0.395)
Obs	68	68	68	63	63	63	63

Note: See Table 4 note. EXP: *dummy* equal to one if the announcement is preceded by a CreditWatch list input/output in the same direction, NOTCH: number of notches that the debt rating changes, GRAD: *dummy* equal to one when the announcement implies a shift from investment grade to speculative grade, AG: *dummy* worth 1 if the announcement is from *Moody's*, W: *dummy* equal to one if the announcement is a CreditWatch list input/output, O: *dummy* equal to one if the announcement is a change in outlook, IRV: is the rate of inter-annual variation of the Euribor at one year, FIN: *dummy* equal to one when the announcement refers to a financial sector company, GOV: *dummy* equal to one when a governmental enterprise is involved, LSIZE: *dummy* equal to if the logarithm of the company asset is above the mean, AGR: is the growth rate of the company asset, EP: is the economic profitability of the company, ISS: is the no. of issues that form the portfolio, DAY: is the number of days in the window (t_1, t_2). TVTD: total volume traded in the last three months divided by the number of days on which each asset is traded during that period. TVWD: mean daily trading volume in the last three months. TVA: mean daily trading volume accumulated in the last three months. MS is the abnormal market share computed as the difference between the rate of growth of the market share around the rating event and the one expected according to the model (5). Estimation by OLS with the White's estimator of the variance-covariance matrix robust for heteroskedasticity. * and ** indicate significance at least at 10% or at 5%, respectively. p-value is in parentheses.

Table 6. Determinants of abnormal liquidity after rating downgrades: Frequency measures

	Bonds						Commercial paper notes					
	T-1w	*T-1m*	*3m-1w*	*3m-1m*	*1m-1w*	*1m-1m*	*T-1w*	*T-1m*	*3m-1w*	*3m-1m*	*1m-1w*	*1m-1m*
Const.	0.185	-0.029	0.907**	0.275	0.523	0.216	0.858**	0.502**	0.732**	0.326	0.503**	0.146
	(0.428)	(0.913)	(0.001)	(0.284)	(0.238)	(0.427)	(0.000)	(0.027)	(0.000)	(0.117)	(0.006)	(0.492)
EXP	0.038	-0.146	0.115	0.018	0.032	0.014	0.009	-0.170	-0.068	-0.140	0.044	-0.060
	(0.765)	(0.244)	(0.347)	(0.872)	(0.788)	(0.899)	(0.914)	(0.231)	(0.520)	(0.274)	(0.707)	(0.658)
NOTCH	0.068	-0.027	0.043	-0.017	0.063	0.003	0.068	0.120	0.138	0.212**	0.132*	0.144**
	(0.153)	(0.643)	(0.385)	(0.743)	(0.315)	(0.952)	(0.526)	(0.250)	(0.213)	(0.004)	(0.100)	(0.043)
GRAD	-0.518*	0.039	-0.198	-0.100	-0.449	-0.361	-0.098	-0.056	-0.262*	-0.035	-0.030	-0.053
	(0.095)	(0.933)	(0.546)	(0.802)	(0.282)	(0.383)	(0.379)	(0.732)	(0.051)	(0.825)	(0.825)	(0.691)
AG	-0.089	0.015	-0.164*	-0.029	-0.106	0.023	-0.024	-0.013	-0.078	-0.009	-0.028	-0.021
	(0.369)	(0.860)	(0.089)	(0.756)	(0.460)	(0.829)	(0.709)	(0.855)	(0.274)	(0.911)	(0.725)	(0.817)
W	0.014	-0.165	0.099	0.101	0.124	0.173	0.028	-0.124	0.077	-0.011	0.092	-0.050
	(0.941)	(0.324)	(0.542)	(0.515)	(0.557)	(0.272)	(0.845)	(0.491)	(0.612)	(0.948)	(0.601)	(0.799)
O	0.088	-0.055	0.351**	0.264*	0.268**	0.298**	0.000	-0.179	0.030	-0.242	-0.093	-0.154
	(0.484)	(0.702)	(0.009)	(0.062)	(0.029)	(0.050)	(0.998)	(0.300)	(0.780)	(0.139)	(0.455)	(0.285)
IRV	-0.115	0.018	0.198	0.148	0.029	0.009	0.149	0.268	0.057	0.225	0.006	0.120
	(0.643)	(0.925)	(0.244)	(0.332)	(0.900)	(0.968)	(0.105)	(0.102)	(0.560)	(0.162)	(0.963)	(0.533)
FIN	0.032	0.238*	-0.399**	0.109	-0.232	-0.102	--	--	--	--	--	--
	(0.828)	(0.063)	(0.044)	(0.535)	(0.399)	(0.526)						
GOV	0.491**	0.366*	-0.208	0.181	-0.270	-0.103	0.114	-0.155	-0.475**	-0.333**	0.200	-0.107
	(0.027)	(0.050)	(0.365)	(0.399)	(0.360)	(0.602)	(0.485)	(0.542)	(0.005)	(0.012)	(0.268)	(0.651)
LSIZE	0.175	-0.069	-0.005	-0.056	0.000	-0.232	-0.019	-0.057	-0.187**	-0.118	-0.116	-0.125
	(0.218)	(0.575)	(0.974)	(0.767)	(0.998)	(0.119)	(0.781)	(0.570)	(0.033)	(0.205)	(0.166)	(0.188)
AGR	-0.468**	-0.196*	-0.786**	-0.218	-0.251	0.068	-0.337**	-0.364**	0.055	-0.240*	-0.084	-0.140
	(0.001)	(0.096)	(0.000)	(0.227)	(0.353)	(0.653)	(0.010)	(0.011)	(0.670)	(0.061)	(0.529)	(0.288)
EP	-3.298	3.474	-10.78**	-2.182	-6.332	-0.284	-5.678**	-4.649**	-5.101**	-5.106**	-5.516**	-5.324**
	(0.160)	(0.151)	(0.000)	(0.407)	(0.170)	(0.917)	(0.000)	(0.019)	(0.004)	(0.021)	(0.011)	(0.029)
ISS	0.033	0.040	-0.007	-0.010	-0.007	-0.016	-0.007	0.008	-0.001	0.008	-0.005	0.008
	(0.311)	(0.220)	(0.835)	(0.756)	(0.898)	(0.671)	(0.233)	(0.198)	(0.847)	(0.150)	(0.455)	(0.133)
DAY	-0.001	0.000	0.000	0.003	-0.004	0.003	-0.041**	-0.021	-0.027*	0.003	0.016	0.022
	(0.205)	(0.857)	(0.685)	(0.404)	(0.754)	(0.682)	(0.035)	(0.357)	(0.075)	(0.879)	(0.488)	(0.371)
Adj. R^2	0.120	0.158	0.282	0.114	-0.078	-0.029	0.412	0.233	0.258	0.306	0.207	0.165
F	1.420	1.748*	2.373**	1.504	0.798	0.898	3.959**	2.400**	2.338**	3.032**	2.107**	1.913*
F p_val	(0.206)	(0.082)	(0.019)	(0.153)	(0.663)	(0.567)	(0.000)	(0.014)	(0.022)	(0.003)	(0.034)	(0.053)
Obs	44	57	50	56	40	52	56	61	51	61	56	61

Note: See note in Table 5. Abnormal frequencies calculated as the difference of the logarithm of the mean trading frequency of a pre-event window (PREW) with respect to a post-event window (POSTW): PREW-POSTW., where PREW= 1, 3 months and the entire period since the issue (1m, 3m, T) and POSTW= 1 week and 1 month (1w, 1m).

Table 7. Determinants of abnormal liquidity after rating upgrades: Volume measures

	Bonds			Commercial paper notes			
	TVTD	TVWD	TVA	TVTD	TVWD	TVA	MS
Constant	4.060	6.002	6.415*	2.346	2.631	0.711	2.457
	(0.170)	(0.115)	(0.081)	(0.444)	(0.366)	(0.705)	(0.397)
Expected (EXP)	2.212**	2.953*	2.215	--	--	--	--
	(0.041)	(0.052)	(0.114)				
Expected (E3M)	--	--	--	0.488	1.508	0.173	-0.116
				(0.735)	(0.312)	(0.832)	(0.906)
No. of grade shifts (GRAD)	0.117	0.545	0.258	0.277	-0.033	-0.573	-0.249
	(0.767)	(0.290)	(0.573)	(0.710)	(0.967)	(0.280)	(0.680)
Moody's (AG)	0.047	-0.098	0.067	1.710*	1.221	0.543	0.687
	(0.964)	(0.934)	(0.956)	(0.100)	(0.275)	(0.297)	(0.423)
CreditWatch List (W)	1.404	2.803	1.856	-0.759	-1.795	-0.902	-1.573
	(0.368)	(0.143)	(0.302)	(0.660)	(0.328)	(0.235)	(0.222)
Outlook (O)	0.535	1.157	0.367	-0.120	0.307	0.478	0.294
	(0.584)	(0.369)	(0.754)	(0.917)	(0.801)	(0.459)	(0.781)
Economy Growth Rate (GRE)	0.027	0.217	0.120	--	--	--	--
	(0.921)	(0.487)	(0.695)				
Interest rate variation (IRV)	--	--	--	-1.329	-0.080	0.835	0.830
				(0.451)	(0.970)	(0.388)	(0.551)
Financial Sector (FIN)	-3.524	-5.591*	-5.074*	-3.218	-3.166	-0.322	-2.213
	(0.164)	(0.082)	(0.100)	(0.212)	(0.212)	(0.844)	(0.358)
Large Size (LSIZE)	-0.856	-1.179	-1.242	-0.605	-0.354	0.517	0.163
	(0.450)	(0.367)	(0.332)	(0.517)	(0.727)	(0.406)	(0.839)
Economic Profitability (EP)	-69.313	-118.677*	-108.041*	-72.529	-68.887	-22.661	-48.500
	(0.195)	(0.075)	(0.086)	(0.202)	(0.216)	(0.489)	(0.369)
Adjusted R-squared	-0.029	0.075	0.020	-0.069	-0.051	0.034	-0.085
F	0.904	1.278	1.070	0.664	0.746	1.185	0.589
F p_val	(0.539)	(0.303)	(0.421)	(0.736)	(0.665)	(0.332)	(0.798)
Obs	32	32	32	48	48	48	48

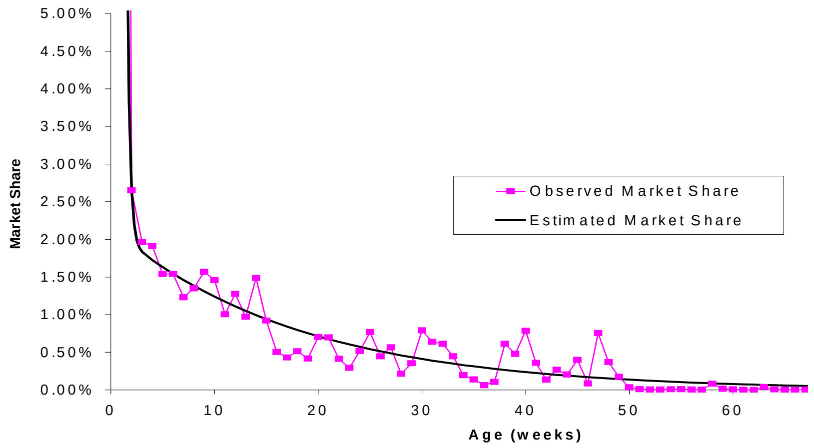
Note: See note in Tables 4 and 5. E3M: dummy worth 1 if the announcement has been preceded by an announcement in the same direction in the three previous months, GRE: is the growth rate of the economy (GDP). MS is the abnormal market share computed as the difference between the rate of growth of the market share observed around the rating event and the one expected according to the model (4).

Table 8. Determinants of abnormal liquidity after rating upgrades: Frequency measures

	Bonds						Commercial paper notes					
	T-1w	*T-1m*	*3m-1w*	*3m-1m*	*1m-1w*	*1m-1m*	*T-1w*	*T-1m*	*3m-1w*	*3m-1m*	*1m-1w*	*1m-1m*
Const	-0.175	-0.350	0.924	0.557	0.733	0.818*	0.484	0.193	0.353	0.042	0.799**	0.271
	(0.864)	(0.660)	(0.193)	(0.311)	(0.225)	(0.052)	(0.163)	(0.607)	(0.209)	(0.880)	(0.004)	(0.346)
EXP	0.068	0.300	0.003	0.390	-0.386	0.131	--	--	--	--	--	--
	(0.924)	(0.429)	(0.992)	(0.273)	(0.305)	(0.425)						
E3M	--	--	--	--	--	--	-0.082	-0.110	0.082	-0.056	-0.043	-0.128
							(0.572)	(0.455)	(0.376)	(0.613)	(0.683)	(0.247)
NOTCH	0.163	0.212*	-0.028	-0.018	-0.057	-0.035	-0.035	-0.007	-0.007	0.037	-0.011	0.004
	(0.500)	(0.085)	(0.748)	(0.878)	(0.567)	(0.632)	(0.510)	(0.925)	(0.860)	(0.524)	(0.796)	(0.944)
AG	0.539	0.439*	0.335	0.205	0.741*	0.328**	0.107	0.176	0.041	0.158	0.103	0.130
	(0.199)	(0.093)	(0.260)	(0.415)	(0.068)	(0.044)	(0.396)	(0.159)	(0.665)	(0.119)	(0.250)	(0.252)
W	0.207	0.468	-0.167	-0.106	-0.386	-0.180	-0.104	-0.163	0.055	-0.077	-0.185	-0.233
	(0.773)	(0.308)	(0.612)	(0.766)	(0.270)	(0.282)	(0.560)	(0.429)	(0.726)	(0.625)	(0.230)	(0.208)
O	-0.285	0.000	-0.258	0.130	-0.565	-0.098	-0.111	-0.213	0.102	-0.203	-0.185	-0.277*
	(0.674)	-1,000	(0.272)	(0.644)	(0.114)	(0.487)	(0.481)	(0.192)	(0.356)	(0.118)	(0.124)	(0.050)
GRE	-0.121	-0.121**	-0.065	-0.077	-0.008	0.015	--	--	--	--	--	--
	(0.160)	(0.008)	(0.367)	(0.116)	(0.877)	(0.642)						
IRV	--	--	--	--	--	--	-0.197	-0.392**	-0.069	-0.297	-0.242	-0.334
							(0.268)	(0.023)	(0.695)	(0.107)	(0.134)	(0.111)
FIN	0.373	-0.021	-0.026	-0.408	-0.144	-0.786**	0.237	0.167	0.172	0.041	-0.402**	-0.246
	(0.503)	(0.961)	(0.961)	(0.323)	(0.700)	(0.031)	(0.329)	(0.495)	(0.397)	(0.831)	(0.031)	(0.183)
LSIZE	0.383	0.056	-0.356	-0.010	0.042	-0.279	0.045	0.022	0.050	0.023	-0.046	-0.079
	(0.246)	(0.711)	(0.379)	(0.969)	(0.854)	(0.185)	(0.713)	(0.866)	(0.634)	(0.818)	(0.613)	(0.463)
EP	-6.100	-2.993	-6.625	-9.053	-14.451	-13.834**	4.660	2.319	0.169	1.218	-9.412**	-3.445
	(0.571)	(0.726)	(0.363)	(0.109)	(0.177)	(0.012)	(0.484)	(0.717)	(0.970)	(0.737)	(0.025)	(0.302)
Adj. R^2	-0.565	0.250	0.380	0.357	0.629	0.681	-0.126	0.007	-0.175	-0.008	-0.052	0.013
F	0.519	1,593	2.020	1.924	3.265	4.317*	0.513	1.032	0.437	0.963	0.786	1.063
F p_val	(0.804)	(0.276)	(0.202)	(0.219)	(0.180)	(0.061)	(0.853)	(0.435)	(0.902)	(0.486)	(0.631)	(0.413)
Obs	13	17	16	16	13	15	40	45	35	45	40	45

Note: See note in Table 5. E3M: dummy worth 1 if the announcement has been preceded by an announcement in the same direction in the three previous months, GRE: is the growth rate of the economy (GDP). Abnormal frequencies calculated as the difference of the logarithm of the mean trading frequency of a pre-event window (PREW) with respect to a post-event window (POSTW): PREW-POSTW., where PREW= 1, 3 months and the entire period since the issue (1m, 3m, T) and POSTW= 1 week and 1 month (1w, 1m).

Figure 1. Weekly market share in the commercial paper notes segment



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