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# **Bank rating migrations**

## **before and since the onset of the financial crisis**

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### **Abstract**

This paper analyses bank rating dynamics in Europe and the United States from 2000 to 2016. In particular, two questions are addressed: (i) whether the rating agencies replicate prior changes in ratings made by other agencies (*the lead-lag strategy*) and (ii) whether previous rating signals (changes in ratings and in watchlist status) issued by an agency influence the likelihood of that agency making further rating changes (*rating momentum*). The results obtained constitute further evidence of the interdependence between the downgrades and upgrades issued by pairs of agencies. This interdependence increased significantly since the onset of the global financial crisis, when banks experienced a significant deterioration in their financial situation and the rating agencies were in the spotlight. The results also provide evidence that *rating momentum* is an important factor in predicting future rating actions and that, following the onset of the crisis, agencies are more likely to conduct subsequent downgrades than upgrades. Therefore, the findings suggest that rating dynamics are good predictors of upcoming rating actions, and that CRAs adopted more conservative behaviour since the onset of the crisis.

JEL Codes: G21, G24, G32

Keywords: Bank ratings, rating agencies' competition, *lead-lag* rating strategy, *rating momentum*, financial crisis and rating policy.

## 1. Introduction

Over the past two decades, ratings have assumed an increasingly important role in financial markets as a result of the growing number and complexity of financial products and their expanding relevance in various areas of financial regulation in the United States (US) and Europe (EU).<sup>1</sup> The aim of ratings is to reduce market failures that arise from information asymmetries among investors, regulators and issuers. Ratings provide information for investors about an issuer's level of credit risk. This allows the issuer to reduce the cost of financing, as the investors have more information and, consequently, the uncertainty associated with operations is reduced. If an entity maintains a high rating, financing costs may be lower, and vice versa.

Despite the importance of ratings in financial markets and in regulation, the capabilities of the credit rating agencies (CRAs) have been questioned. In the Mexican crisis of 1994-1995 and the Asian crisis of the late 1990s, the rating agencies were accused of reacting to the changes taking place rather than anticipating them (Reisen and Maltzan, 1999; Ferri *et al.*, 1999), and doubts were raised regarding their ability to provide a forward-looking indicator of risk. Later, with the Enron and Parmalat scandals, the agencies were once again in the spotlight, as they rated these companies as investment grade until a few days before their collapse (Hill, 2004; Danvers and Billings, 2004). In 2008, the agencies were accused of relaxing their rating criteria during the period of economic growth leading up to the outbreak of the Global Financial Crisis (GFC) (SEC, 2008 and IMF, 2010). In 2010, when the peripheral Eurozone countries experienced a sovereign debt crisis, the rating agencies again became the centre of attention when they drastically reduced the ratings of these countries. In this case, the CRAs were accused of precipitating the sovereign debt crisis by downgrading the ratings of Eurozone countries too severely and too quickly, ignoring some of the reforms that had been implemented (Altdörfer *et al.*, 2019).

In response to the criticisms received, the CRAs have defended themselves by arguing that their ratings are devised with a medium and a long-term perspective (Through-The-Cycle). As such, they ignore transitory changes in the solvency of the products that they assess; that is, they do not issue ratings using a "Point-In-Time" perspective. In this context, some previous studies (Altman and Rijken, 2004 and 2006, among others) find evidence that the CRAs do employ the Through-The-Cycle perspective. However, hard evidence of this perspective is unclear, because agency ratings often exhibit markedly procyclical behaviour, characterised by the issuance of favourable ratings during periods of economic growth and by severe downgrades when a crisis occurs (Bangia *et al.*, 2002; Catarineu-Rabell *et al.*, 2005; Amato and Furfine, 2004; Zicchino, 2005; Salvador *et al.*, 2014 and 2018). Furthermore, empirical studies (Blume *et al.*, 1998; Ferri *et al.*, 1999; Gärtner *et al.*, 2011; Alp, 2013; Baghai *et al.*, 2014) have also found that the rating agencies have become more conservative over time, hardening their standards mainly during periods of downturn. Along the same lines, theoretical models (Bolton *et al.*, 2012; Bar-Isaac and Shapiro, 2013; and Opp *et al.*, 2013) predict that rating agencies apply greater restrictiveness during periods of crisis.

Besides this criticism, the CRAs have also been in the spotlight due to the conflicts of interest arising from their business model (Bank of England, 2011) that may contribute to the issuance of biased and

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<sup>1</sup> The Joint Forum report (2009) provides a summary of how ratings are used in different countries' financial regulations.

inflated ratings. Notable among these conflicts is that most of the agencies' revenue comes from the same issuers that are requesting evaluation (Bolton *et al.*, 2012). This may induce a client that is dissatisfied with their assigned rating to approach another agency in pursuit of a higher rating, in what is known as rating shopping (Bolton *et al.*, 2012, Mathis *et al.*, 2009; Sangiorgi *et al.*, 2009; Skreta and Veldkamp, 2009). The agencies, aware of this behaviour and wanting to avoid a loss of market share, may be incentivised to issue lower quality ratings. Another no less important conflict of interest stems from the fact that as well as issuing ratings, the agencies also offer advisory or consulting services for the products that they subsequently assess. This encourages clients to contract these ancillary services in order to obtain a higher rating. In this line, Hau *et al.* (2013) present evidence of the relationship between these ancillary services and the ratings obtained. Specifically, they find evidence that agencies give higher ratings to large banks and entities that are most likely to provide the agency with additional business. Additionally, the structure of the rating industry has also been criticised for being uncompetitive, as the three main CRAs (Standard and Poor's -S&P-, Moody's and Fitch) operate in an oligopolistic market (Dittrich, 2007). In fact, the three main CRAs account for more than 94% and 87% of the U.S. and European market share (ESMA, 2013; SEC, 2013), respectively. In this context, McNamara and Vaaler (2004) argue that the entry of new firms into the rating industry could have positive effects, such as increased competition, fewer conflicts of interest and increased rating quality. In contrast, Becker and Milbourn (2011) present evidence that the quality of the ratings predicting default is lower as the competences among the CRAs increase.

These criticisms have also affected the regulators, who have been accused of assigning excessive importance to ratings and of ineffective supervision of the rating agencies. In this regard, the International Organisation of Securities Commissions (IOSCO) revised its code of conduct with the aim of increasing transparency, independence and competition among the rating agencies and of reducing the conflicts of interest deriving from their business model. However, this has not been the only reform: in 2009, the European Parliament approved a new regulation (EC No. 1060/2009), which compels CRAs to register in the states in which they operate primarily. In May 2011, this regulation was amended (EC No. 513/2011), establishing the European Securities and Markets Authority (ESMA) and both centralised supervision and registration of rating agencies. Finally, on January 16, 2013, the European Parliament adopted a new directive (2013/14/EU) that regulates rating agencies, which came into force on 20 June 2013. The main objectives of this last reform were to reduce over-reliance on external public debt ratings among investors; to mitigate conflicts of interest caused by the agencies' various activities; and to increase both transparency and competition in the sector.

In the United States, a series of reforms were also carried out. The Dodd-Frank Wall Street Reform and the Consumer Protection Act of 2010 imposed restrictions on the agencies to prevent the conflicts of interest resulting from their business model and demanded greater transparency through publication of the rating methodologies and the ratings issued. Lastly, the Basel Committee conducted a review of the role of the ratings issued by the rating agencies in the calculation of regulatory capital requirements (Sundmacher and Ellis, 2011).

At the same time that the regulators were implementing various reforms to strengthen their supervision and avoid conflicts of interest, most banks experienced rating downgrades due to the hardening of rating

policies and the significant deterioration of their financial situation (Laeven and Valencia, 2013; European Central Bank, 2008a and 2008b; Salvador *et al.* 2018). This deterioration was characterised by a substantial increase in the need for liquidity and a reduction of profitability, undermining their ability to generate capital. In response, between late 2008 and early 2009, some countries took substantial measures to rescue and restructure their financial sectors, including the introduction of recapitalisation packages and the nationalisation of some banks (Laeven and Valencia, 2013; Chiarella *et al.*, 2019; Carbo *et al.*, 2020). These public measures eroded public resources and reduced economic growth, amplifying rather than absorbing shocks to the economy (BIS, 2011; De Bruyckere *et al.*, 2013). Thus, this reveals that changes in banks' ratings can affect not only banks' financing costs but also the creditworthiness of sovereigns and thus economic growth.

In this context, in which the behaviour of the CRAs and the quality of the ratings issued have been widely questioned, we analyse the behaviour of the bank ratings issued by the three main CRAs (S&P, Moody's and Fitch). In particular, two questions are addressed: (i) whether the rating agencies replicate prior changes in ratings issued by other agencies (the *lead-lag strategy*) and (ii) whether previous rating changes (changes in ratings and in watchlists) issued by an agency increase the likelihood of the same agency applying a further rating change in the same direction (rating *momentum*). These two issues are of particular importance to the quality of the ratings, because they allow us to analyse the stability of ratings throughout the economic cycle. In so doing, we can determine whether the agencies actually implement a Through-The-Cycle strategy in an industry with an oligopolistic structure (Dittrich, 2007), where in order to maintain its reputation and market share each rating agency tends to respond to changes carried out by the others (Güttler and Wahrenburg, 2007; Camanho *et al.*, 2012, Alsakka *et al.*, 2014). Therefore, this behaviour may affect the quality of the bank ratings as an indicator of credit risk, which may subsequently affect banks' financial costs and the public resources of sovereigns.

To address these two questions, we analyse the dynamics of the ratings issued for a sample of EU and U.S. banks from 2000 to 2016. To do so, we consider different models to determine the significance and the marginal effects of the prior changes made by an agency itself and by its competitors on the probability of the current rating being changed. Furthermore, by considering both EU and U.S. banks in the sample, we can in turn determine: a) whether the CRAs reacted similarly in these geographic areas since the GFC and b) whether the CRAs reacted to the changes made by their competitors in a particular way depending on the geographic location considered.

The *lead-lag* strategy and rating *momentum* have been analysed in prior literature, but the focus has been limited to sovereign and corporate ratings (Carty and Fons, 1993; Lando and Sködeberg, 2002; Hamilton and Cantor, 2004; Güttler and Wahrenburg 2007; Alsakka and Gwilym, 2009; Alsakka and Gwilym, 2010). Furthermore, most of the studies on rating momentum have considered only one of the three CRAs and only the period before the onset of the GFC. In fact, only Alsakka and Gwilym (2009) analyses the rating momentum of sovereign ratings issued by the three main CRAs, but from 2000 to 2006. Likewise, Güttler and Wahrenburg (2007) and Alsakka and Gwilym (2010) analyse the *lead-lag* strategy, but also before the onset of the financial crisis and for the specific cases of corporate and sovereign ratings, respectively. Alsakka *et al.* (2014) analyse the *lead-lag* strategy adopted during the financial crisis only for

the rating downgrades issued, focusing on a sample of 84 banks that were included in the stress tests imposed by the European Banking Authority in 2011. Therefore, to the best of our knowledge, we contribute to the literature by analysing these two issues (*lead-lag* strategy and rating *momentum*) for the particular case of a large sample of EU and U.S. banks. Furthermore, to the best of our knowledge, this is the first study to analyse both the rating upgrades and downgrades issued before and since the onset of the GFC. This makes it possible to test whether the CRAs changed their behaviour in the wake of the financial crisis.

The results obtained in the analysis of the dynamics between the rating changes issued by pairs of rating agencies (*lead-lag* strategy) show that during the period before the crisis, there is an interdependence between the upgrades and downgrades issued by the three main CRAs. In particular, the results show that before the onset of the financial crisis, S&P acts as a leader, while Moody's acts as a follower, in both upgrades and downgrades. This *lead-lag* strategy increases significantly with the onset of the subprime crisis and the subsequent sovereign debt crisis in the EU, when most banks experienced a significant deterioration of their financial situation (Laeven and Valencia, 2013) and the CRAs were again in the spotlight. This implies that the CRAs adopted more conservative behaviour, as the downgrades issued by a 'leader' agency in the previous 12 months have a greater effect on the likelihood of a subsequent downgrade by the 'follower' agency since the onset of the crisis. Furthermore, during this period, we also identify a change in the interdependence among the downgrades issued by the CRAs, as Fitch becomes the leader and S&P becomes the follower. The CRAs' adoption of conservative behaviour during this period is also confirmed by the fact that although there is a significant relationship between the upgrades, none of the CRAs clearly acts as leader. Thus, this interdependence between the rating adjustments (upgrades and downgrades) conducted by the CRAs suggests that they use different models and methodologies (Alsakka *et al.*, 2014).

Regarding *rating momentum*, the results provide evidence that both rating changes and watchlists issued in the previous 12 months by a particular agency increase the likelihood of the same agency applying a further rating change in the same direction. Furthermore, the findings show that with the onset of the crisis, the evidence of upgrade *momentum* decreases, and the CRAs are more likely to conduct subsequent downgrades. Thus, these results contribute further evidence that with the onset of the crisis, the CRAs also adopt more stringent behaviour, as they are more prone to conduct subsequent downgrades, meanwhile they are more cautious to conduct subsequent upgrades.

Finally, it should be emphasised that regarding both *lead-lag* actions and rating *momentum*, there are significant differences in the agencies' behaviour depending on the geographic area in which the banks conduct their main activity. This finding highlights the existence of a certain degree of heterogeneity in the behaviour of rating agencies across EU and U.S. banks.

Following this introduction, the structure of the paper is as follows. The second section briefly reviews the literature on the rating dynamics (*lead-lag* strategy and rating *momentum*). The third section specifies the sample employed and presents a descriptive analysis of rating behaviour during the period analysed. The fourth section explains the methodology and the variables used. The fifth section presents the empirical results and, finally, the last section presents the conclusions.

## 2. Review of the literature on rating migrations

In relation to the first of our research questions, regarding the *lead-lag* strategy, Güttler and Wahrenburg's (2007) paper is of central importance. These authors analyse the ratings issued by S&P and Moody's for near-to-default bond issuers during the period 1997-2004 and find evidence of significant interdependence among short-term (from 1 to 180 days) changes in these ratings. Specifically, these authors report that in response to a rating change by one of the 'leader' agencies, there is an increase in the probability of a 'follower' agency making a rating change of a greater magnitude in the short time.

Similarly, Alsakka and Gwilym (2010) identify a certain degree of interdependence among the sovereign ratings issued by the three major agencies during the period 1994-2009. Specifically, Fitch is found to be most dependent on the changes made by one or both of the other agencies. In contrast, S&P is the least dependent on the other agencies, as its signals are issued more frequently and therefore its ratings are less stable. Finally, the ratings issued by Moody's usually adopt a Through-The-Cycle position: this agency produces the fewest negative signals, but when it does modify ratings, the modifications are more sharply than those of its competitors. Nevertheless, it should be noted that it is Moody's that has usually taken the initiative in upgrading sovereign ratings.

To the best of our knowledge, only Alsakka *et al.* (2014) specifically analyse the *lead-lag strategy* in the case of bank ratings issued by the three main rating agencies. These authors focus on the issuer ratings of 84 banks from 21 EU countries that were included in the stress tests imposed by the European Banking Authority in 2011, paying particular attention to the *lead-lag* strategy adopted only during the financial crisis and with respect to rating downgrades. The results presented in this study suggest that following the onset of the financial crisis, there is a strong interdependence in the downgrades carried out by the three main CRAs. Thus, when a bank suffers a rating downgrade by one agency, there is a greater probability of their experiencing a more severe downgrade by another agency. In particular, these authors find evidence that S&P tends to be the leader in European bank rating downgrades during the crisis period, while Moody's appears to be more cautious when acting as a follower in bank rating downgrades. This suggests that S&P may have greater focus on reputational credibility among market participants. However, Moody's appears to be more cautious and to put a greater emphasis on rating stability.

These results provide empirical corroboration of the hypotheses presented in the theoretical studies of Bar-Isaac and Shapiro (2013), Manso (2013) and Opp *et al.* (2013) on the greater restrictiveness of the criteria applied by the rating agencies during the recessionary phase of the business cycle. In the same vein, Skreta and Veldka (2009) present a theoretical model of the interdependence among the changes in the ratings issued by different agencies. They attribute the existence of this interdependence during times of economic downturn to the greater complexity of the products evaluated.

In this context of interdependence, studies such as Camanho *et al.* (2012) have analysed the potential effect of increased competition among agencies on the quality of the ratings issued, hypothesising that increased competition among a small number of competitors will spur agencies to improve their accuracy and thus the quality of the ratings issued. However, if there were many rating agencies, they would have a stronger incentive to increase their market share, which would tend to reduce the quality of the ratings

issued. Therefore, if, during a downturn in the economic cycle, the rating agencies appear reluctant to downgrade the ratings issued, it is because they have a greater interest in maintaining their market share. Conversely, if the agencies react more dynamically, lowering their ratings in response to the reduced creditworthiness of bond issuers or financial products, it is because they have an overriding interest in improving their reputation in terms of accuracy. In this respect, Becker and Milbourn (2011) analyse the effect of Fitch's entry into the rating industry, traditionally dominated by Moody's and S&P, examining a sample of some 1.1 million corporate ratings in the US during the period 1995-2006. These authors suggest that an increase in competition in the rating market is associated with a deterioration in the quality of the ratings. Specifically, these authors find evidence that Fitch's arrival in the market provoked a reduction in rating quality. They argue further that the entry of a new competitor is also associated with a weaker correlation between the ratings issued and bond yields.

Regarding the second of our research questions, related to rating *momentum*, previous studies in this field have mainly focused on corporate and sovereign ratings (see, for example, Carty and Fons, 1993; Lando and Sködeberg, 2002; Hamilton and Cantor, 2004; Mah and Verde, 2004; Fuertes and Kalotychou, 2007; Livingston *et al.*, 2008; Alsakka and Gwilym, 2009). Among the studies on corporate ratings, Carty and Fons (1993), Lando and Sködeberg (2002), Mah and Verde (2004) and Hamilton and Cantor (2004) report evidence of the existence of rating *momentum* in the case of rating downgrades issued, while this effect is considered practically non-existent in the case of rating upgrades. However, Hamilton and Cantor (2004) show that this pattern is weaker when previously issued watchlists and outlooks are considered. This latter finding highlights the effectiveness of watchlists and outlooks as forward indicators of possible rating changes in the short and medium term, respectively. In the same vein, Fuertes and Kalotychou (2007) analyse rating *momentum* during the period 1981–2004 with respect to the corporate ratings issued by Moody's in 72 emerging countries. These authors found that prior downgrades have a significant effect on the likelihood of a future downgrade being made, and that this effect is not significant in the case of upgrades. The authors also report a significant positive effect of the time elapsed from when a company receives a given rating until a downgrade is issued.

Therefore, most of the existing literature has focused on analysing the rating *momentum* for sovereign and corporate ratings, considering only the effect of rating signals issued by one of the three main CRAs and only the period before the onset of the financial crisis. In this regard, only Alsakka and Gwilym (2009) analyse the rating *momentum* for the three rating agencies for sovereign ratings, but they also focus on the years before the start of the crisis. Likewise, it should be noted that the literature on the lead-lag strategy is very limited, since only Güttler and Wahrenburg (2007) and Alsakka and Gwilym (2010) address this question, again for the pre-crisis period and for the specific cases of corporate and sovereign ratings, respectively. In fact, for the case of bank ratings, only Alsakka *et al.* (2014) analyse the lead-lag strategy, limiting their focus to downgrades, the period of the financial crisis, and 80 banks that were included in the stress test mandated by the European Banking Authority in 2011.

In this context, the present study, to the best of our knowledge, is the first to analyse both the dynamics of bank ratings in terms of *lead-lag strategy* and rating *momentum* for a time horizon covering the period before and since the financial crisis. Unlike previous studies, this makes it possible to test whether the



CRAAs adopted more conservative behaviour with the onset of the financial crisis and the various criticisms they received. Furthermore, unlike previous studies, this paper investigates these questions considering rating downgrades and upgrades in both periods (before and since the onset of the crisis) and for the three main CRAAs. At the same time, this study is the first to focus on a large international sample of bank ratings from the EU and the US.

In this context, Salvador *et al.* (2018) consider a sample of EU and U.S. banks and report that at the onset of the financial crisis, their ratings were significantly downgraded due not only to the banks' deteriorating financial condition but also to the agencies' tightening of their criteria. These authors present evidence that with the onset of the crisis, the tightening of criteria led to the ratings issued by Fitch, S&P and Moody's being downgraded by 40%, 19.2% and 15.83%, respectively. In addition, it is shown that the determinants of rating adjustments had differing impacts in the EU and the US. This result suggests that the increased strictness of rating policy and its relative importance in the downward adjustment of ratings vary depending on the group of countries analysed, thus demonstrating that the behaviour of rating agencies is influenced by geographic location.

### 3. Sample

This paper analyses the dynamics of the bank ratings issued by the three major rating agencies in the EU and the US. Specifically, we consider two questions regarding the probability of a rating agency changing its assessment of a bank according to: (i) the previous rating changes applied by the other agencies (*lead-lag strategy*) and (ii) the rating changes made and the watchlist status previously issued by the agency being analysed (*rating momentum*). To analyse these two issues, we take into account the ratings issued at the end of each month from January 2000 to December 2016. Furthermore, in order to analyse the possible differential impact of the financial crisis that began in 2008 and the subsequent criticism levelled at the CRAAs, we divide the sample into two sub-periods: the period before (2004–2007) and since the onset of the financial crisis (2008–2016).<sup>2</sup>

Among the different types of ratings, we use the banks' long term issuer ratings issued by Fitch, S&P, and Moody's.<sup>3</sup> This choice was made primarily because this type of rating reflects the total probability of default on the basis of both the intrinsic solvency of the bank and the possibility of it receiving external assistance from shareholders and/or economic authorities in the event of bankruptcy. The issuer ratings were obtained from the ORBIS and Creditviews databases published by Bureau van Dijk and Thomson Reuters, respectively. The categorical scale of the ratings (AAA/Aaa, AA/Aa1, ... C, D) has been transformed into a numeric one, consisting of 21 categories (Annex 1). On this numeric scale, higher values are associated with greater creditworthiness. As can be seen in Annex 1, two groups of ratings can be clearly differentiated depending on their credit risk: investment grade (from AAA/Aaa to BBB–/Baa3) indicates a low credit risk, while the speculative grade (from BB+/Ba1 to D) indicates either a high credit risk or the bankruptcy of the bank has already occurred.

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<sup>2</sup> The period of financial crisis is defined as starting in January 2008, following Salvador *et al.* (2014, 2018) and Alsakka *et al.* (2014), who took this date as marking the onset of turbulence in the financial markets, featuring events such as the collapse of Bear Stearns and Lehman Brothers in the US and the nationalisation of the Royal Bank of Scotland in the UK.

<sup>3</sup> Specifically, we use Fitch's Long Issuer Default Rating and Moody's Long-Term Bank Deposits Ratings. In the case of S&P, the rating used is the long-term foreign currency rating (Caporale *et al.*, 2011; Shen *et al.*, 2012, Williams *et al.*, 2013; Alsakka *et al.*, 2014; Salvador *et al.*, 2018).

As shown in Table 1, the analysis of *lead-lag* strategy and of rating *momentum* is based on 654 and 1,441 banks, respectively. In the *lead-lag* analysis, the number of banks is relatively low, because only 654 banks (45.3%) out of 1,441 were rated by at least two agencies.

Table 1 also shows the banks' distribution according to the geographic area in which they operate primarily. It can be seen that the weight of each country in the sample (subpanel A) depends on the agency considered (Fitch, S&P and Moody's). Thus, according to subpanel B, the largest proportion of banks evaluated by Moody's (47.1%) and Fitch (37.4%) is located in Germany. Their next major country is the US, which accounts for 31.5% and 29.2%, respectively, of the banks assessed by Fitch and Moody's. However, in the case of S&P, the largest proportion of evaluated banks (46.5%) is in the US. Other countries with significant representation in the sample are Spain, the United Kingdom, France and Italy, which jointly account for 28.8%, 19.4% and 14.8% of the banks evaluated by S&P, Fitch and Moody's, respectively. Moreover, Table 1 also shows that Fitch has the highest market share in the sample (78%), followed by S&P (46%) and Moody's (39%). As pointed out by Becker and Milbourn (2011) and Salvador *et al.* (2014), Fitch's high market share is due to the fact that this agency has more extensive experience in the valuation of banks, which is valued positively by those that ask to be evaluated.

< Insert Here Table 1 >

Table 2 shows that during the economic growth period, most of the rating signals analysed (rating changes and watchlists) are positive. Specifically, as row (16) shows, positive signals represent 79.1%, 55.7% and 76.4% of the total number of rating signals issued (excluding stable rating signals) by S&P, Fitch and Moody's, respectively. Conversely, as shown in row (15), the negative signals represent 20.9%, 44.3% and 23.6% for S&P, Fitch and Moody's, respectively. This tendency is inverted following the onset of the financial crisis, where negative signals represent 80% for S&P, 81.8% for Fitch and 76% for Moody's. In contrast, the positive signals for S&P, Fitch and Moody's represent 20%, 18.2% and 24%, respectively.

This change in trend suggests that credit ratings are procyclical, as proposed by Bangia *et al.* (2002), Catarineu-Rabell *et al.* (2005), Amato and Furfine (2004), Zicchino (2006) and Salvador *et al.* (2018), among others. This procyclical behaviour calls into question whether the rating agencies really follow a Through-The-Cycle strategy, as they claim in their methodological reports (e.g., Moody's, 2007).

< Insert Here Table 2 >

At the same time, if we focus on the extent of the rating changes made by the rating agencies, Table 2 shows that most rating downgrades were by one-notch. Specifically, before the onset of the crisis, one-notch downgrades represent 76.7%, 88.4% and 78.7% for S&P, Fitch and Moody's, respectively (see row 3). Conversely, since the onset of the financial crisis, the downgrades of one-notch represents a lower percentage in Fitch (66.8%) and Moody's (63.3%), while in S&P one-notch downgrades represents, 80% (row 3). Moreover, it is also observed that during the whole period analysed, most of the upgrades were also by one notch (row 7). In particular, before the onset of the financial crisis, 92.3%, 85.9% and 68.1%

of the upgrades issued by S&P, Fitch and Moody's, respectively, were of one-notch. Likewise, during the financial crisis, upgrades of one-notch represent for S&P, Fitch and Moody's 90.5%, 84.5% and 57.2%, respectively.

Therefore, the distribution of rating changes in Table 2 seems to indicate that since the start of crisis, the rating agencies adopted a more conservative pattern of behaviour, as rating downgrades dominate. In addition, the fact that most rating adjustments (downgrades and upgrades) were one-notch changes suggest that the rating agencies were more cautious in deciding whether to adjust the rating of a bank. Furthermore, it should be highlighted that the heterogeneous weights assigned to the different rating signals and the varying extent of the rating changes made provide evidence of significant differences among the rating policies of the three major agencies (Alsakka *et al.*, 2014, Salvador *et al.*, 2018).

Table 3 shows the distribution of the dataset events used to analyse the questions raised regarding *lead-lag strategy* and *rating momentum*. Overall, we can observe that with the onset of the financial crisis, there is a change in the behaviour of the rating agencies. In the case of the *lead-lag* strategy, we note that before the onset of the crisis, most of the downgrades and upgrades issued by the CRAs are autonomous: that is, one agency's rating changes do not follow previous rating changes conducted by the other CRAs in the previous 12 months (Güttler and Wahrenburg 2007; Alsakka and Gwilym, 2010; Alsakka *et al.*, 2014). Specifically, during this period, autonomous upgrades (rows 12a, 12b and 12c) make up between 71% and 74% of all upgrades. Similarly, 84%, 62% and 88% of S&P, Moody's and Fitch's downgrades, respectively, are autonomous (rows 7 a, 7 b and 7 c).

In contrast, since the onset of the crisis, the percentage of autonomous rating changes decreased. In particular, the autonomous downgrades issued by S&P, Moody's and Fitch dropped to 25%, 36% and 41%, respectively (rows 7a, 7b and 7c). Similarly, in the case of upgrades, there is a decrease in the percentage of autonomous signals, as autonomous upgrades dropped to 69% for S&P, 64% for Moody's and 68% for Fitch (rows 13a, 13b and 13c). This also implies that since onset of the crisis, the CRAs adopted more conservative behaviour, because they increased the percentage of rating changes following previous rating changes conducted by the other CRAs in the previous 12 months.

Regarding *rating momentum*, Table 3 also reports asymmetries between the downgrades (upgrades) that follow previous ratings signals issued by the same agency in the last 12 months and in the same direction (e.g. see Livingston *et al.*, 2008; Alsakka and Gwilym, 2009). Overall, the percentage of downgrades following previous negative signals issued by the same agency (rows 16a, 16b and 16c) is significantly higher than in the case of upgrades (rows 17a, 17b and 17c). Focusing on each period, we note that before the crisis, the downgrade *momentum* represents 53% for S&P, 41% for Moody's and 28% for Fitch. In contrast, the upgrades that follow previous rating signals issued by the same rating agency (see rows 17a, 17b and 17c) represent 35% for S&P, 25% for Moody's and 23% for Fitch. Furthermore, in Table 3 we can also observe that with the onset of the crisis, the number of downgrades that followed negative signals issued by the same agency in the last 12 months increased, as they rose to 60% for S&P, 67% for Moody's and 50% for Fitch. However, in the wake of the crisis, the upgrades that followed previous positive

signals issued by the same CRA represent 65% for Moody's, but 15% for S&P and Fitch. These results, together with the fact that most downgrades were made by one-notch, suggest that with the onset of the financial crisis, the CRAs adopted more conservative behaviour, as they conducted downgrades gradually.

< Insert Here Table 3>

In short, the pattern of rating changes shows that with the onset of the financial crisis in 2008, there was a change in the behaviour of the rating agencies, reflecting the procyclical nature of their evaluations, as pointed out by Bangia *et al.* (2002), Catarineu-Rabell *et al.* (2005) and Salvador *et al.* (2018), among others. Thus, these results call into question whether these agencies in fact follow a strictly Through-The-Cycle strategy, as they claim in their methodology reports, and thus ignore transitory changes in the asset situations of the banks evaluated, the financial markets and the rating changes made by their competitors. Furthermore, the descriptive analysis for the entire period analysed indicates the existence of a certain degree of interdependence in the behaviour of the three agencies. This interdependence increased significantly following the financial crisis, particularly for downgrades. At the same time, the results constitute further evidence that the rating agencies adopted more conservative behaviour following the financial crisis as they gradually adjust their ratings. Moreover, the fact that the CRAs react to rating signals issued previously by their competitors but each take different rating actions suggests that they use different methodologies (Alsakka *et al.*, 2014).

#### 4. Methodology and variables

The Granger causality test, based on an ordered probit model (Güttler and Wahrenburg, 2007; Alsakka *et al.*, 2014), is conducted to analyse possible interdependence among the rating changes issued by the three major rating agencies, that is, the *lead-lag* strategy. In this regard, Equation 1 reflects a situation in which rating changes by agency A, acting as a follower, can be influenced by those made in the last 12 months by agency B, acting as the leader. Similarly, Equation 2 represents a situation in which the rating changes conducted by agency B, acting as a follower, are influenced by those made during the last 12 months by agency A, acting as the leader. This analysis emerges from the fact that the rating changes conducted by the CRA are not random events (Alsakka *et al.*, 2014). Furthermore, in order to test for a possible impact of the financial crisis on the lead-lag strategy, these equations are estimated separately for the periods before and since the start of the financial crisis<sup>4</sup>. The specification of these equations for each period is therefore as follows:

$$RC_{i,t}^{A*} = \beta_1 \sum_{h=1}^3 RC_{i,t-h}^{B*} + \beta_2 \sum_{h=1}^3 RC_{i,t-h}^{A*} + \gamma_1 Rating_{i,t}^A + \gamma_2 Trend_{i,t}^A + \gamma_3 USA_{i,t}^A + \varepsilon_{i,t} \quad (1)$$

<sup>4</sup> As a robustness check, we estimate these equations for the whole period considering a crisis dummy variable that takes a value equal to unity for the years following the outbreak of the financial crisis and 0 otherwise. Moreover, we consider the interaction of this crisis dummy variable with the rest of the main explanatory variables. The results (available upon request) are robust to those presented in the paper.

$$RC_{i,t}^{B*} = \beta_1 \sum_{h=1}^3 RC\_DW_{i,h}^A + \beta_2 \sum_{h=1}^3 RC\_UP_{i,h}^A + \gamma_1 Rating_{i,t}^A + \gamma_2 Trend_{i,t}^A + \gamma_3 USA_{i,t}^A + \varepsilon_{i,t} \quad (2)$$

where  $RC_{i,t}^*$  is a latent variable related to the ordinal variable  $RC_{i,t}$ , which reflects in Equation 1 (2) the rating changes conducted by agency A (B) that acts as a follower in month  $t$ , by -2 or more notches, -1 notch, and 1 and 2 notches.

$RC\_DW_{i,h}$  is a dummy variable that takes the value 1 if the rating of bank  $i$  is downgraded by the agency that acts as the leader B (A) during one of the three predefined time windows  $h$ , with  $h=1$  for downgrades carried out in the previous month,  $h=2$  for changes made in the preceding 2-6 months and  $h=3$  for those carried out in the previous preceding 7-12 months. Otherwise, this variable takes the value 0.<sup>5</sup> The significance of this variable allows us to determine whether the downgrades made by rating agency A (B), which acts as a follower, are influenced by past downgrades carried out by agency B (A), which acts as the leader in each predefined time window. Consequently, the sign of this variable is expected to be negative, because a downgrade made by the agency that acts as the leader (B) will reduce the probability of the agency that acts as a follower (A) carrying out an upgrade.

In the same way,  $RC\_UP_{i,h}$  is a dummy variable that takes the value 1 if the rating of bank  $i$  is upgraded by the agency that acts as the leader B (A) during one of the three predefined time windows  $h$ , with  $h=1$  for upgrades carried out in the previous month,  $h=2$  for those made in the preceding 2-6 months and  $h=3$  for those carried out in the preceding 7-12 months. If not, this dummy variable takes the value 0. As in the case of the downgrades, the significance of  $RC\_UP_{i,h}$  allows us to determine whether the upgrades conducted by rating agency A (B), which acts as a follower, are influenced by past upgrades carried out in the three predefined time windows by agency B (A), which acts as the leader. In this case, the sign of this variable is expected to be positive, because an upgrade made by the agency that acts as the leader (B) will increase the probability of the agency that acts as a follower (A) carrying out an upgrade.

In order to determine whether the interdependence among agencies' rating decisions depends on the bank's rating ( $i$ ), an ordinal variable ( $Rating_{it}$ ) is included to reflect the rating of bank  $i$  at moment  $t$ , as shown in Annex 1. Furthermore, this variable allows to control for the asset situation of each of the banks analysed, as the ratings measure the total probability of default on the basis of both the asset situation of each bank and the possibility of it receiving external assistance from shareholders and/or economic authorities in the case of (near) bankruptcy.

A continuous temporal variable ( $Trend_{i,t}$ ) is also introduced to control for the possible time effects associated with each month in which banks may experience a change in their credit risk. This variable corresponds to the month  $t$  in which a bank  $i$  experiences a change in its rating by the rating agency A (B) acting as a follower.

Finally, a dummy variable ( $USA_{i,t}$ ) is included to determine whether there is heterogeneity in the possible interdependence among the rating agencies' evaluations depending on the geographic area in which the

<sup>5</sup> The specification of these time windows considers the rating changes issued by the other agencies in the previous 12 months, as in Güttler and Wahrenburg (2007), Alsakka and Gwilym (2010) and Alsakka *et al.* (2014).

bank operates primarily. This dummy variable takes the value 1 if the main activity of bank  $i$  occurs in the US and 0 otherwise. If this variable is significant, it would imply that the agencies' reactions to changes made by their competitors differ between the US and EU. In this regard, Nickell *et al.* (2000) and Kadam and Lenk (2008) observe that the probability of a rating change may depend on the geographic area analysed.

To address the second question raised in this paper regarding rating *momentum*, we estimate Equations 3 and 4 separately for upgrades and downgrades, respectively. Moreover, these equations are estimated for the periods before and since the onset of the crisis to test for a possible impact of the financial crisis on the behaviour of the CRAs<sup>6</sup>. Thus, the following ordered probit specification is defined for each period as follows:

$$UP\_RC_{i,t}^* = \beta_1 Watchlist\_UP_{i,t} + \beta_2 Upgrade_{i,t} + \gamma_1 USA_{i,t} + \gamma_2 Rating_{i,t-1} + \gamma_3 Duration_{i,t} + \varepsilon_{i,t} \quad (3)$$

$$DW\_RC_{i,t}^* = \beta_1 Watchlist\_DW_{i,t} + \beta_2 Downgrade_{i,t} + \gamma_1 USA_{i,t} + \gamma_2 Rating_{i,t-1} + \gamma_3 Duration_{i,t} + \varepsilon_{i,t} \quad (4)$$

In these equations,  $UP\_RC_{i,t}^*$  ( $DW\_RC_{i,t}^*$ ) is an unobservable variable related to the ordinal variable  $UP\_RC_{i,t}$  ( $DW\_RC_{i,t}$ ), which takes the value 1 or 2 if the issuer rating of bank  $i$  issued by the agency analysed is upgraded (downgraded) by one or more notches, respectively, in month  $t$ , and 0 otherwise.

$Watchlist\_UP_{i,t}$  ( $Watchlist\_DW_{i,t}$ ) is a dummy variable that takes the value 1 if in the last 12 months a positive (negative) watchlist has been issued on the rating of bank  $i$  and 0 otherwise.

$Upgrade_{i,t}$  ( $Downgrade_{i,t}$ ) is a dummy variable that takes the value 1 if the rating of bank  $i$  has been upgraded (downgraded) during the previous 12 months and 0 otherwise<sup>7</sup>.

$Duration_{i,t}$  refers to the time elapsed from a bank obtaining a rating until this rating is changed at the moment ( $t$ ). It should be highlighted that the empirical evidence regarding the expected sign of this determinant is inconclusive. On the one hand, Lando and Skodeberg (2002), in a study of corporate ratings, argue that the longer a given rating is maintained, the less likely it is to change. However, Carty and Fons (1993) find evidence that a longer time spent within a given rating category is associated with a greater probability of change. Similarly, in their analysis of corporate ratings for 72 emerging countries issued by Moody's, Fuertes and Kalotychou (2007) report evidence of a significant positive effect of the time elapsed from a company receiving a certain rating until this rating is downgraded. Finally, for the case of sovereign ratings of emerging countries, Alssaka and Gwilym (2009) observe that the time elapsed is associated with the probability of a Moody's rating being upgraded, but of an S&P rating being downgraded.

<sup>6</sup> As in the *lead-lag* strategy, we estimate Equations (3) and (4) for the whole period, considering a crisis dummy variable that takes a value equal to unity for the years since the outbreak of the financial crisis and 0 otherwise. Moreover, we consider the interaction of this dummy variable with the rest of the main explanatory variables. The results (available upon request) are robust to those presented in the paper.

<sup>7</sup> According to the literature, prior watchlist status and rating changes are defined for a window of 12 months before the current rating change (Lando and Skodeberg, 2002; Hamilton and Cantor 2004; Alsakka *et al.*, 2009).

Lastly, in order to determine whether the rating of bank  $i$  at time (month)  $t-1$  influences the probability of a rating change, we consider an ordinal variable,  $Rating_{i,t-1}$  (see Annex 1). Finally, and as in the case of the *lead-lag* strategy, a dummy variable ( $USA_{i,t}$ ) is included, taking the value 1 if bank  $i$  mainly operates in the US and 0 otherwise. This variable allows us to determine whether agencies' behaviour differs systematically between the US and EU.

## 5. Empirical results

### 5.1. *Lead-lag* strategy before the onset of the crisis

Table 4 shows the results derived from the *lead-lag* strategy - Equations (1) and (2)- by pairs of agencies before the outbreak of the financial crisis, which is a period characterised by increases in ratings, as shown in Table 2. Overall, it is observed that there is an interdependence among the bank rating adjustments conducted by the three main agencies. This implies that when a bank experiences a rating change (upgrade or downgrade) by one agency that acts as a leader, it is very likely that it will experience another rating change in the same direction by another agency that acts as a follower.

In this sense, it can be observed (see Table 4) that before the onset of the crisis, there is a certain relationship among the upgrades issued by each pair of rating agencies. Specifically, the subpanels A.1 and B.2 show that when S&P acts as a follower, there is a significant relationship between its rating changes and the upgrades issued by Fitch in the last 12 months ( $h=1, h=2$  and  $h=3$ ) and the upgrades issued by Moody's in the last month ( $h=1$ ). In particular, the marginal effects associated with the changes made by Fitch and Moody's in the previous month increase the likelihood of S&P carrying out a multiple-notch upgrade by 26.2 and 31.4 percentage points (pp), respectively. Furthermore, upgrades issued by Fitch in the previous 2-6 months ( $h=2$ ) and the previous 7-12 months ( $h=3$ ) increase the probability of S&P conducting a multiple-notch (one-notch) upgrade by 3.4 pp (1.4 pp) and 2.4 pp (1.4 pp). Similarly, upgrades issued by Fitch in the previous 7-12 months ( $h=3$ ) increase the probability of S&P conducting a multiple-notch (one-notch) upgrade by 3 pp (1 pp).

In contrast, when S&P acts as the leader and Fitch (Subpanel A.2) and Moody's (Subpanel B.1) as followers, previous upgrades issued by S&P have a greater effect on the probability that the other two CRAs will also conduct an upgrade than when S&P acts as a follower. Specifically, we note that upgrades conducted by S&P at one month ( $h=1$ ), at 2-6 months ( $h=2$ ) and at 7-12 months ( $h=3$ ) significantly increase the probability of Fitch applying an upgrade of multiple notches (one-notch) by 13.2 pp (9.5 pp), 27.5 pp (2.7 pp) and 12.9 pp (2.7 pp), respectively. Likewise, we observe that upgrades made by S&P (the leader) one month and 2-6 months earlier significantly increase the likelihood of Moody's conducting a multiple-notch upgrade by 34.2 pp and 22.9 pp, respectively. Therefore, these results suggest that in the case of upgrades, Fitch and Moody's are more dependent on the upgrades previously issued by S&P than the reverse.

Similarly, the analysis of the rating upgrades issued by Moody's and Fitch (Subpanels C.1 and C.2) reveals that there is a certain relationship among the upgrades issued by this pair of CRAs. The upgrades

carried out by Fitch in the previous 12 months ( $h=1$ ,  $h=2$  and  $h=3$ ) significantly increase the probability of Moody's conducting an upgrade by more than one-notch. In particular, the marginal effects associated with the downgrades conducted by Fitch at one month ( $h=1$ ), at 2-6 months ( $h=2$ ) and at 7-12 months ( $h=3$ ) increase the probability of Moody's applying a multiple notch upgrade by 30.9 pp, 9.4 pp and 12.8 pp, respectively. Conversely, upgrades issued by Moody's between two and 12 months earlier ( $h=2$  and  $h=3$ ) significantly increase the probability of Fitch applying an upgrade of more than one-notch by 23.2 pp and 21.4 pp, respectively. These results suggest that upgrades previously issued by Fitch have a greater effect on the probability of Moody's also conducting a downgrade than the reverse.

In the same vein, Table 4 shows that there is also a relationship between the downgrades issued by each pair of rating agencies. Specifically, in the subpanels B.1 and C.2, we observe that when Moody's acts as a follower, there is a significant relationship among the downgrades issued by S&P and Fitch for each time window ( $h=1$ ,  $h=2$  and  $h=3$ ). Specifically, the marginal effects associated with the downgrades carried out by S&P increase the probability of Moody's carrying out a multiple-notch (one-notch) downgrade by 79.6 pp (0.6 pp) for  $h=1$ , 55.7 pp (16.4 pp) for  $h=2$ , and 70.1 pp (7.1 pp) for  $h=3$ , respectively. Similarly, downgrades issued by Fitch in the previous one month, 2-6 months and 7-12 months increase the probability of Moody's carrying out a multiple-notch (one-notch) downgrade by 51.6 pp (18 pp), 34.1 pp (24.8 pp) and 36.8 pp (23.7 pp), respectively. Conversely, we note that when Moody's acts as a leader, only its downgrades issued between 2 and 6 months earlier have a significant effect on the probability of S&P (Subpanel B.2) also conducting a multiple-notch (one-notch) downgrade, by 21.4 percentage points (14.50 pp). Similarly, only downgrades issued by Moody's in the previous month have a significant effect on the probability of Fitch (Subpanel C.1) also conducting a multiple-notch (one-notch) downgrade, by 41 pp (15.7 pp). These results suggest that in the case of downgrades, Moody's is more dependent on the downgrades previously issued by S&P and Fitch than vice versa.

Subpanels A.1 and A.2 show that the relationship between the rating downgrades issued by S&P and Fitch is only significant for downgrades issued 2-6 months earlier by this pair of CRAs. In this case, the results show that S&P acts as leader while Fitch acts as follower. Considering this time window ( $h=2$ ), previous downgrades issued by S&P increase the probability of Fitch conducting a one-notch downgrade by 20 pp and a multiple-notch downgrade by 40 pp. On average, these effects are smaller when Fitch acts as a leader, since the likelihood of a later downgrade by S&P increases by 24.2 pp (for a one-notch downgrade) and by 18.9 pp (for a multiple-notch downgrade).

Lastly, the significant negative coefficient of the variable  $Rating_{it}$  reveals that the lead-lag behaviour for downgrades is more pronounced for banks with lower ratings, especially for the rating adjustments conducted by Fitch and Moody's (Subpanel C.1 and C.2) and when Moody's acts as a follower of S&P (subpanel B.1). Moreover, it is noted that only when Fitch follows Moody's (Subpanel C.1), Fitch is more prone to downgrade the ratings for banks operating in the US, as is reflected in the negative coefficient of the variable  $USA_{it}$ .



Therefore, the results presented in Table 4 show that before the onset of the financial crisis, there is a significant interdependence among the upgrades and downgrades conducted by the three main rating agencies. In particular, we could observe that S&P acts as a leader while Moody's acts as a follower in both bank rating upgrades and downgrades. This is consistent with Alssaka and Gwilym (2009) evidence of downgrades previously issued by S&P have a greater effect, on average, on the probability of Fitch and Moody's also conducting a downgrade than vice versa. Furthermore, these results show that when Moody's acts as a follower, this CRA tends to react with multiple-notch adjustments. Thus, this relationship among the ratings issued by the pairs of CRAs suggests that there is common information that flows among them and influences their rating actions (Alsakka *et al.*, 2014). At the same time, it shows that the timing of the rating adjustments made by the CRAs tends to differ, since they use different models and different methodologies. In this sense, as pointed out by Camanho *et al.* (2012) and Alsakka *et al.* (2014), S&P might be more interested in its reputational credibility and thus seem to react more promptly in changing its ratings. Meanwhile, Moody's is more conservative and places greater emphasis on rating stability, but it is more likely to adjust its ratings to a greater extent when taking rating action.

## 5.2 Lead-lag strategy since the onset of the crisis

Table 5 shows the results of the analysis of the *lead-lag* strategy in the wake of the financial crisis. Comparing these results with those obtained before the onset of the crisis (Table 4), we observe a significant change in the interdependence between the downgrades issued by each CRA. In all cases, we find evidence that previous downgrades issued by one rating agency significantly increase the probability of a multiple-notch downgrade by another rating agency. This suggests that since the onset of the GFC, when the rating agencies were accused of relaxing their rating criteria and of inaccurately downgrading sovereign ratings (IMF, 2010), CRAs adopted more conservative behaviour, reacting to a greater extent to the actions of other rating agencies.

In this regard, subpanels A.1 and A.2 of Table 5 consider the possible interdependence between the rating downgrades conducted by S&P and Fitch. We note in subpanel A.1 that downgrades made by Fitch (the leader) in the preceding 12 months ( $h=1$ ,  $h=2$  and  $h=3$ ) significantly increase the probability of multiple-notch downgrades by S&P. This probability increases by 37.6 pp (if the downgrade is conducted one month before,  $h=1$ ), 25.2 pp (if the downgrade is conducted 2-6 months before,  $h=2$ ), and 10.8 pp (if the downgrade is conducted 7-12 months before,  $h=3$ ). Likewise, in subpanel A.2, we note that changes made by S&P (the leader) significantly increase the probability of a multiple-notch downgrade by Fitch (the follower) for all the time windows ( $h=1$ , 2 and 3). In particular, the marginal effects associated with the changes made by S&P one month, 2-6 months and 7-12 months earlier increase the likelihood of Fitch carrying out a multiple-notch downgrade by 24 pp, 20.9 pp and 17.3 pp, respectively. These findings show that the downgrades carried out by each of these two agencies lead to a multiple-notch downgrade by the other agency. In fact, the marginal effects reveal that rating downgrades previously issued by one of the CRAs decrease the probability of the others conducting a one-notch downgrade. Furthermore, a comparison of the marginal effects suggests that downgrades previously issued by Fitch acting as a leader have a greater effect, on average, on the probability of S&P also conducting a downgrade than vice versa.

Subpanels B.1 and B.2 in Table 5 show the interdependence between the downgrades issued by S&P and Moody's for each time window. Banks that were downgraded by Moody's in the preceding 12 months ( $h=1, 2$  and  $3$ ) are more likely to experience a multiple-notch downgrade by S&P than vice versa. This suggests that in the case of downgrades, S&P acts as follower, while Moody's acts as leader. In particular, the marginal effects associated with the changes made by Moody's increase the likelihood of S&P conducting a multiple-notch downgrade by 38.2 pp ( $h=1$ ), 25.1 pp ( $h=2$ ) and 10.5 pp ( $h=3$ ), respectively. Similarly, the downgrades previously issued by S&P significantly increase the probability of Moody's carrying out a multiple-notch downgrade for each time window considered by 18.8 pp ( $h=1$ ), 20.8 pp ( $h=2$ ) and 17.9 pp ( $h=3$ ), respectively.

Finally, subpanels C.1 and C.2 in Table 5 examine the *lead-lag* relationship between Fitch and Moody's for downgrades. As in *Alsakka et al.* (2014) banks that were downgraded by Fitch in the last 12 months are significantly more likely to experience a multiple-notch downgrade by Moody's (Subpanel C.2). Specifically, the probability of Moody's issuing a multiple-notch downgrade for a bank that has previously been downgraded by Fitch extends to 19.4 pp ( $h=1$ ), 17 pp ( $h=2$ ) and 11.2 pp ( $h=3$ ), respectively. However, only the downgrades issued by Moody's in the previous seven months ( $h=1$  and  $h=2$ ) significantly increase the probability of Fitch also issuing a downgrade (Subpanel C.1). In this case, a downgrade issued by Moody's in the preceding month increases the likelihood of Fitch issuing a multiple-notch downgrade by 20.60 pp. This effect is less marked if a longer time period is considered (2-6 months), as then the probability increases to only 9.8 pp. The results show that Moody's is more dependent on the downgrades previously issued by Fitch than the reverse.

Regarding upgrades, Table 5 shows that none of the CRAs clearly acts as a leader. In this sense, in subpanel A.1, we observe that upgrades made by Fitch (the leader) in the last month significantly increase the likelihood of S&P carrying out a one-notch upgrade by 24.4 pp and a multiple-notch upgrade by 39.3 pp. This effect is less marked for the period 7-12 months ( $h=3$ ), where this probability increases, but only up to 22.5 pp (by 8.30 pp for a multiple-notch upgrade). Conversely, subpanel A.2 shows that upgrades made by Fitch are independent of upgrades issued by S&P in the last 12 months. These results indicate that unlike in the period before the onset of the GFC, Fitch clearly acts as a leader, while S&P acts as a follower.

The relationship between the upgrades conducted by S&P and Moody's is shown in subpanels B.1 and B.2 of Table 5. In this case, we note that when S&P acts as a leader (Subpanel B.1), its rating upgrades of the last month increase the probability that Moody's (the follower) will also conduct a multiple-notch upgrade by 61.3 pp and a one-notch upgrade by 8.8 pp. This effect is weaker when Moody's acts as a leader (subpanel B.2), since its upgrades carried out in the previous 2-7 months increase the probability of S&P also conducting a multiple-notch upgrade by 5.7 pp and a one-notch upgrade by 13.9 pp. Therefore, these results suggest that Moody's is more dependent on the upgrades previously issued by S&P than vice versa.

Lastly, subpanels C.1 and C.2 in Table 5 show the interdependence between the upgrades issued by Fitch and Moody's. We observe in subpanel C.1 that upgrades made by Moody's (the leader) in the preceding 12 months ( $h=1$ ,  $h=2$  and  $h=3$ ) significantly increase the probability that Fitch will also conduct an upgrade. Specifically, the marginal effects associated with the upgrades carried out by Moody's at one month ( $h=1$ ), at 2-6 months ( $h=2$ ) and at 7-12 months ( $h=3$ ) increase the probability of Fitch of applying a multiple- notch (one-notch) upgrade by 34.3 pp (22.2 pp), 18.1 pp (20.6 pp) and 10.1 pp (15.7 pp), respectively. In contrast, when Fitch acts as the leader (Subpanel C.2), their upgrades affect Moody's probability of issuing an upgrade only in the one month and 7-12 months' time windows. According to the marginal effects, an upgrade issued by Fitch in the last month and in the preceding 7-12 months increases the likelihood of Moody's upgrading the bank rating by multiple-notches (one-notch) by 21 pp (15.70 pp) and 14.5 pp (13.6 pp), respectively. Thus, it can be concluded that Fitch is more dependent on the downgrades previously issued by Moody's than the reverse.

It should be emphasised that in cases in which Fitch and Moody's act as followers (Subpanel A.2, B.1, C.1 and C2), these CRAs are more prone to upgrade U.S. banks' ratings, as indicated by the positive coefficient of the variable  $USA_{it}$ . In contrast, when S&P acts as a follower of Fitch (subpanel A.1), the smallest negative adjustment occurs among the U.S. banks, as shown by the negative coefficient of the variable  $USA_{it}$ . These findings contribute empirical evidence (e.g. see Bellotti *et al.*, 2011; Shen *et al.*, 2012; Salvador *et al.*, 2018) of the existence of a degree of heterogeneity in the actions of the rating agencies depending on the geographic area in which they operate<sup>8</sup>. Furthermore, in the relationship among the rating changes issued by S&P and Fitch (Subpanels A.1 and A.2), it is noted that the probability of experiencing an upgrade is higher (lower) for those banks with higher ratings, as reflected by the positive and significant coefficient of the variable  $Rating_{it}$ . This implies that following the onset of the financial crisis, these two CRAs upgraded their ratings for healthier banks to a greater extent.

Therefore, the results presented in this section constitute evidence of the interdependence between the main CRAs' bank rating adjustments (upgrades and downgrades). As in Alssaka *et al.* (2014) a downgrade issued by one agency that acts as a leader tends to be followed by a multiple-notch downgrade from another agency that acts as a follower. In this regard, the results show that since the onset of the crisis, when the CRAs were in the spotlight, they adopted more conservative behaviour (Baghai *et al.*, 2014; Opp *et al.*, 2013; Salvador *et al.* 2018), and so the interdependence of the three CRAs' downgrades has increased significantly. Specifically, since the onset of the crisis, Fitch becomes the leader, while S&P becomes a follower in downgrades. In such case, it should be highlighted that Fitch's leadership in rating downgrades could be attributed to this agency's greater experience in the valuation of banks (Becker and Milbourn 2011; Salvador *et al.* 2014). Moreover, the conservative behaviour adopted by the CRAs during this period is also confirmed by the fact that none of them clearly acts as a leader in upgrades. This is because Moody's acts as a leader of Fitch, but follows the upgrades previously carried out by S&P. Likewise, S&P acts as a leader of Moody's, but it is a follower of the upgrades previously conducted by Fitch. Finally, Fitch acts as

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<sup>8</sup> Other studies highlighting the existence of heterogeneity in rating behaviour between the different geographic areas are Rojas-Suarez (2001), Ferri *et al.* (2001), Ferri and Liu (2003), Poon *et al.* (2009) and Caporale *et al.* (2011).

a leader of S&P, but it is a follower of the upgrades previously made by Moody's. Consequently, these findings call into question whether CRAs really issue their ratings with a medium- and long-term perspective (Through-The-Cycle) and consequently ignore transitory changes in the asset situation of the banks evaluated, the financial markets and the rating changes made by their competitors.

### 5.3. Rating *momentum* before the onset of the crisis

This section presents the rating *momentum* results based on the estimation of Equations (3) and (4). In order to analyse the possible impact of the financial crisis on rating *momentum*, these equations are estimated separately for the periods before and since the start of the financial crisis, as it is evident that with the onset of the financial crisis, a structural change occurred in the behaviour of the rating agencies (see Table 2).

Table 6 reports the results of the estimation of Equation (3), which analyses the upgrade *momentum* for the period before crisis. The results indicate that banks that have experienced an upgrade are more likely to be upgraded again by the same agency, as reflected by the positive and significant coefficient of the variable  $Upgrade_{it}$ . Specifically, the marginal effects show that prior rating upgrades increase the likelihood that S&P, Fitch and Moody's will carry out a subsequent upgrade of one-notch by 41.2 pp, 30.7 pp and 17.7 pp, respectively. In the cases of Moody's and Fitch, the marginal effects regarding the probability of a multiple-notch upgrade are greater (52.8 pp and 43.3 pp, respectively). Furthermore, we note that banks that had a positive watchlist status within the previous 12 months are more likely to be upgraded by one-notch (multiple notches) at S&P by 9.1 pp (1 pp), at Fitch by 3.2 pp (0.6 pp) and at Moody's by 7.3 pp (4.9 pp). Therefore, unlike Alssaka and Gwilym (2009) that only found a significant negative effect on upgrades momentum in Moody's, these results provide evidence that both prior rating upgrades and positive watchlist status can be considered useful tools in predicting future rating upgrades. However, it is evident that upgrade momentum is dominated by prior rating upgrades rather than by watchlist status.

< Insert Here Table 6 >

Table 6 also shows that banks with higher ratings (according to the rating scale presented in Annex 1) are less likely to experience a subsequent rating upgrade. This inverse relationship arises because before the crisis, many of the banks analysed had a rating of Aaa/AAA or AA+/Aa1 and consequently were unlikely to experience any further upgrades, as these categories represent the top categories on the rating scale. Moreover, we also note that in all cases, the lowest probability of experiencing a subsequent rating upgrade occurred among U.S. banks, as is reflected in the positive coefficient of the variable  $USA_{it}$ . Finally, it should be highlighted that in all cases, the coefficient of the variable  $Duration_{it}$  is positive and significant as it is also found by Carty and Fons (1993) for corporate ratings. Consequently, the longer a bank retains a particular credit rating, the more likely it is to obtain a subsequent upgrade, which is consistent with the upward trend in bank ratings prior to the outbreak of the crisis (see Table 2).

Regarding downgrade *momentum*, the results obtained from Equation (4) are shown in Table 7. The findings show that during this period, downgrades issued in the previous 12 months increase the likelihood that S&P, Fitch and Moody's will execute a subsequent one-notch downgrade by 23.6 pp, 33.7 pp and 24.7

pp, respectively. However, these marginal effects are greater for multiple-notch adjustments for all three CRAs (47 pp, 40.7 pp and 53.9 pp, respectively). This suggests that when these agencies downgrade a bank twice, a multiple-notch downgrade is more likely to be issued the second time. Moreover, as in Alssaka and Gwilym (2009) the findings show that negative watchlists have a significant positive effect on the probability of a subsequent rating downgrade. Thus, as in the case of rating upgrades, watchlists are good predictors of forthcoming downgrades, although their effect is weaker than that of prior rating downgrades.

< Insert Here Table 7>

Furthermore, it is noted that the level of rating is significant and positive in the cases of Moody's and Fitch. This suggests that during this period, these CRAs were more likely to downgrade those banks with higher ratings (Aaa/AAA or AA+/Aa1). Finally, we observe in Table 7 that duration is significant in the cases of Fitch and Moody's. In particular, for Fitch, we observe that duration has a significant and positive effect on the probability of experiencing a downgrade. This implies that when Fitch adjusts bank ratings that have been stable for a long period, it is more likely to issue a downgrade. Conversely, in the case of Moody's, duration has a negative effect on the probability of experiencing a downgrade. Thus, as it is pointed out by Fuertes and Kalotychou (2007) for sovereign ratings, having a stable Moody's rating for a long time decreases the probability of subsequently being downgraded. This latter result, together with the fact that for Moody's, the marginal effects are higher for a multiple-notch rating adjustment, seems to indicate, as in the *lead-lag* strategy, that Moody's places greater emphasis on rating stability.

To sum up, before the outbreak of the crisis, the results show that previous rating upgrades (downgrades) and positive (negative) watchlist status issued by a CRA are important factors in predicting subsequent rating upgrades (downgrades) by the same CRA.

#### 5.4. Rating *momentum* since the onset of the crisis

Table 8 reports the results of the estimation of Equation (3) since the outbreak of the GFC. In this case, we note that both prior upgrades and positive watchlist status increase the probability of a subsequent upgrade by the same CRA. Specifically, prior rating upgrades increase the likelihood that S&P, Fitch and Moody's will carry out a subsequent upgrade of one-notch (multiple notches) by 35.7 pp (32.1 pp), 28.8 pp (35.1 pp) and 14.6 pp (21.8 pp), respectively. Likewise, positive watchlist status increases the probability of an upgrade of one-notch (multiple notches) at S&P by 3.1 pp (0.4 pp), at Fitch by 5.1 pp (1.2 pp) and at Moody's by 7.6 pp (5.8 pp). If we compare these effects with the results presented in Table 6 (before the GFC), the effect of prior rating upgrades and positive watchlist status decreases, except for the positive watchlist issued by Fitch, in which the effect increases. These results constitute further evidence that the start of the financial crisis and the criticisms the agencies received led to them adopting more cautious behaviour, suggesting that they conducted upgrades only when improvement of the asset situation of the bank evaluated was evident.

< Insert Here Table 8>

Table 9 shows the results obtained from the estimation of Equation (4) for the period since the onset of the GFC, regarding the probability of being downgraded in response to downgrades issued by the same agency during the previous 12 months (downgrade *momentum*). As in the period before the onset of the crisis (Table 7), we observe that both previous downgrades and negative watchlist status have a significant positive effect on the probability of a subsequent rating downgrade. In particular, the marginal effects show that downgrades conducted in the previous 12 months increase the probability of a further one-notch rating downgrade by 41.1 pp at S&P, 22.9 pp at Fitch and 21.1 pp at Moody's. It should be highlighted that at Fitch and Moody's, downgrades issued in the last 12 months have an even stronger effect on the probability of a further multiple-notch adjustment. Prior downgrades increase the likelihood of a subsequent multiple-notch upgrade by 59.7 pp at Fitch and by 51.1 pp at Moody's, while at S&P they only imply an increase of 39.5 pp. This result seems to indicate that Fitch and Moody's, unlike S&P, tended to implement sharp downgrades since the onset of the financial crisis. Furthermore, comparing the marginal effects between the upgrades and downgrades, we note that the previous downgrades issued have a greater effect on the probability that the same CRA will conduct a subsequent downgrade than in the case of upgrades.

Moreover, comparing these results with those obtained before the start of the crisis (Table 7), we note that the change in rating *momentum* is not the same across the three CRAs. On average, we note that for Fitch, with the start of the crisis, the effect of prior downgrades increases the likelihood of subsequent downgrades, which are typically multiple-notch downgrades. In contrast, for S&P and Moody's, the probability of experiencing a multiple-notch downgrade as a consequence of prior downgrades issued by the same CRA decreases. However, it should be highlighted that for S&P, the effect of prior downgrades on the likelihood of subsequent one-notch downgrades increases. Thus, these differences in rating *momentum* suggest that the CRAs' methodologies and rating policies differ, as they adjust the ratings differently.

Regarding *duration*, Tables 8 and 9 show that retaining a credit rating for a long period increases the likelihood of obtaining a subsequent rating change in the same direction. Furthermore, we also observe that banks with higher (lower) ratings are more (less) likely to experience a downgrade (upgrade). This implies that with the onset of the crisis, a period characterised mainly by a downward trend in ratings, highly rated banks had a higher probability of being downgraded than upgraded by the CRAs. Finally, for both rating upgrades and downgrades at Fitch and for downgrades at Moody's, it is observed that banks that conduct their main activity in the US are less likely to experience a rating downgrade.

< Insert Here Table 9 >

In short, the results suggest that for the entire period analysed (before and since the onset of the financial crisis), previous rating and watchlist status changes by a CRA are important predictors of subsequent rating changes by the same CRA. However, with the onset of the crisis, the evidence of upgrade *momentum* decreases. In fact, during this period, CRAs are more reluctant to conduct subsequent upgrades, while they are more likely to conduct subsequent downgrades. These results contribute additional evidence that in the

wake of the crisis, the rating agencies adopted more stringent behaviour because of the criticism they received, which centred on their relaxation of their rating criteria before the crisis. Furthermore, it is noted that among the three CRAs during this period, S&P and Fitch are most dependent on the downgrades and upgrades previously issued by themselves. In contrast, Moody's is less dependent on its previous rating changes, suggesting that Moody's places more weight on rating stability. Consequently, although previous rating signals are a good tool to predict future rating actions by the same agency, the effect of these signals depends on the economic cycle and varies across agencies.

## 6. Conclusions

In the wake of the subprime crisis and the European sovereign debt crisis, the three principal rating agencies (S&P, Moody's and Fitch) were criticised because of the conflicts of interest deriving from their business model, their lack of transparency and the quality of the ratings they issue. In response to these criticisms, the CRAs adjusted their rating criteria, and regulators undertook various reforms to strengthen their supervision and avoid conflicts of interest. In this context, this paper analyses the dynamics of the bank ratings issued by the three major rating agencies for a sample of banks operating in the EU and the US from 2000 to 2016. Specifically, two main questions are addressed: (i) whether the rating changes made by an agency at a given time respond to previous changes made by its competitors (the *lead-lag* strategy) and (ii) whether the rating changes made at a given time respond to previous changes made by and watchlist issued by the same agency (rating *momentum*). Additionally, the period of analysis allows us to test whether the rating dynamics and the CRAs' behaviour changed with the onset of the financial crisis and thus to test the claim traditionally made by the CRAs, namely that their ratings are drawn up according to a medium- and long-term perspective (Through-The-Cycle).

Focusing on the analysis of the rating dynamics, the results show that before the crisis, there is a certain interdependence among the bank rating adjustments carried out by the CRAs (*lead-lag* strategy). This implies that when a bank experiences a rating change by one of the agencies that acts as a leader, it is very likely to experience another rating change in the same direction by another agency that acts as a follower. In particular, the results show that S&P acts as a leader in both downgrades and upgrades, suggesting that it may be more interested in its reputational credibility and thus seems to react more promptly in changing its ratings. On the other hand, the results show that Moody's acts as a follower in both upgrades and downgrades, as this CRA usually puts more weight on rating stability. However, when it decides to carry out a rating adjustment, it makes frequent use of multiple-notch downgrades and upgrades. These findings suggest that the rating agencies use different models and methodologies.

This *lead-lag* strategy increased significantly since the onset of the crisis, when banks experienced a deterioration of their asset situation (Laeven and Valencia, 2013) and the CRAs were once again in the spotlight. Following the crisis, a rating downgrade issued in the previous 12 months by an agency acting as a leader significantly increases the likelihood of another agency, acting as a follower, conducting a subsequent multiple-notch downgrade. During this period, Fitch became the leader in downgrades issued by the three CRAs, while S&P became a follower. Fitch's leadership in rating downgrades could be

attributed to this agency's greater experience in the valuation of banks, as pointed out by Becker and Milbourn (2011) and Salvador *et al.* (2014). Additionally, the results show that in the wake of the crisis, the relationship among the upgrades conducted by pairs of CRAs strengthens, but none of them clearly acts as a leader. This strengthening of the relationship suggests that the CRAs have adopted more conservative behaviour in the wake of the crisis. Furthermore, these findings call into question whether CRAs actually do follow a Through-The-Cycle strategy and consequently ignore transitory changes in the asset situation of the banks evaluated, the financial markets and the rating changes made by their competitors.

Regarding rating *momentum*, we find that it is clearly dominated by prior rating changes (upgrades or downgrades) rather than by (positive or negative) watchlist status. Likewise, a comparison of the period before and after the outbreak of the crisis shows that with the onset of the crisis, the evidence of upgrade *momentum* decreases, and the CRAs are more likely to conduct subsequent downgrades. This implies that the CRAs have adopted more conservative behaviour and that they are more reluctant to conduct subsequent upgrades.

These findings are significant and have important economic implications. As pointed out by Fuerte and Kalotychou (2007), rating dynamics are an important factor for risk management and pricing, as previous rating changes affect the probabilities of rating transitions. Moreover, rating dynamics have implications for the economic authorities, as the rating agencies seem to respond to previous rating changes by other agencies and not only to changes in the asset situations of the banks evaluated according to their credit risk models. This fact calls into question the quality of the ratings issued by the three major rating agencies (S&P, Moody's and Fitch). In this context, the rating agencies may have contributed to the credit crunch and to financial instability in some developed countries through their tightened assessment criteria and increased interdependence, at a time when banks were experiencing severe difficulties and some countries had taken substantial measures to rescue and restructure their financial sectors. The actions of the rating agencies may thus have increased the instability of financial markets and of the economic system. Our results suggest that although the credit rating agencies play an important role in the financial markets, there is a need for the relevant authorities to enact greater regulation and supervision of these agencies.

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## Annexes

### Annex 1. Ratings and numerical scores

	Fitch		Standard and Poor's (S&P)		Moody's	
	Rating	Scale 22	Rating	Scale 22	Rating	Scale 22
<i>Investment</i>	AAA	21	AAA	21	Aaa	21
	AA+	20	AA+	20	Aa1	20
	AA	19	AA	19	Aa2	19
	AA-	18	AA-	18	Aa3	18
	A+	17	A+	17	A1	17
	A	16	A	16	A2	16
	A-	15	A-	15	A3	15
	BBB+	14	BBB+	14	Baa1	14
	BBB	13	BBB	13	Baa2	13
	BBB-	12	BBB-	12	Baa3	12
<i>Speculative</i>			<i>Speculative</i>			
	BB+	11	BB+	11	Ba1	11
	BB	10	BB	10	Ba2	10
	BB-	9	BB-	9	Ba3	9
	B+	8	B+	8	B1	8
	B	7	B	7	B2	7
	B-	6	B-	6	B3	6
	CCC+	5	CCC+	5	Caa1	5
	CCC	4	CCC	4	Caa2	4
	CCC-	3	CCC-	3	Caa3	3
	CC	2	CC	2	Ca	2
	C	1	C	1	C	1
	D	0	D	0	D	0
	WR		WR		WR	

**Note:** Transformation of the categorical ratings assigned by Fitch, S&P and Moody's into the numerical scale defined in this study (Scale 22). As the score decreases, so does credit quality, and consequently the probability of default increases.

**Table 1. Distribution of banks rated in the sample by country**

Subpanel A								
Lead-lag strategy								
Country	Number of Banks by Country				Weight of the countries			
	Rated	Fitch vs S&P	Moody's vs Fitch	S&P vs Moody's	Fitch vs S&P	Moody's vs Fitch	S&P vs Moody's	
Austria	4	3	4	3	0.6%	1.3%	0.9%	
Belgium	6	5	5	6	1.0%	1.6%	1.9%	
Czech Republic	3	3	3	3	0.6%	0.9%	0.9%	
Denmark	5	4	4	5	0.8%	1.3%	1.5%	
Finland	4	3	3	4	0.6%	0.9%	1.2%	
France	16	13	11	12	2.6%	3.4%	3.7%	
Germany	216	211	8	7	42.0%	2.5%	2.2%	
Greece	5	5	5	5	1.0%	1.6%	1.5%	
Ireland	11	7	7	9	1.4%	2.2%	2.8%	
Italy	43	24	26	26	4.8%	8.2%	8.0%	
Luxembourg	9	5	4	6	1.0%	1.3%	1.9%	
Netherlands	12	9	9	6	1.8%	2.8%	1.9%	
Norway	8	2	7	3	0.4%	2.2%	0.9%	
Poland	11	2	10	3	0.4%	3.1%	0.9%	
Portugal	8	4	7	3	0.8%	2.2%	0.9%	
Spain	34	20	28	18	4.0%	8.8%	5.6%	
Sweden	4	3	3	4	0.6%	0.9%	1.2%	
United Kingdom	27	17	21	15	3.4%	6.6%	4.6%	
United States of	228	162	154	186	32.3%	48.3%	57.4%	
Total	654	502	319	324	100%	100%	100%	
Subpanel B								
Rating momentum								
Country	Number of Banks by Country				Weight of the countries			
	Rated	Fitch	Moody's	S&P	Fitch	Moody's	S&P	
Austria	18	14	6	5	1.2%	1.3%	1.1%	
Belgium	8	6	6	7	0.6%	0.5%	1.1%	
Czech Republic	5	3	5	3	0.3%	0.3%	0.9%	
Denmark	12	4	12	5	0.8%	0.4%	2.1%	
Finland	6	3	4	6	0.4%	0.3%	0.7%	
France	58	33	22	29	4.0%	2.9%	3.9%	
Germany	539	527	18	218	37.4%	47.1%	3.2%	
Greece	8	6	7	5	0.6%	0.5%	1.3%	
Ireland	15	8	12	12	1.0%	0.7%	2.1%	
Italy	96	45	60	54	6.7%	4.0%	10.7%	
Luxembourg	17	7	9	14	1.2%	0.6%	1.6%	
Netherlands	16	12	11	11	1.1%	1.1%	2.0%	
Norway	25	10	21	4	1.7%	0.9%	3.8%	
Poland	17	13	14	3	1.2%	1.2%	2.5%	
Portugal	13	11	8	5	0.9%	1.0%	1.4%	
Spain	74	53	46	25	5.1%	4.7%	8.2%	
Sweden	8	3	5	7	0.6%	0.3%	0.9%	
United Kingdom	52	35	33	24	3.6%	3.1%	5.9%	
United States of	454	327	260	232	31.5%	29.2%	46.5%	
Total	1441	1120	559	669	100.0%	100.0%	100.0%	
Market Share	100%	78%	39%	46%				

**Note:** Distribution of the number of banks and observations by each rating agency (Fitch, S&P and Moody's) during the period analysed (from 2000 to 2016). The last three columns show for each question analysed (*lead-lag* strategy and *rating momentum*) the weight of each country above the total number of ratings issued by each rating agency during the period analysed.

**Table 2. Distribution of signals (change ratings and watchlist) regarding issuer ratings for banks before and since the start of the financial crisis**

		Before the onset of the crisis						Since the onset of the Crisis					
		S&P		Fitch		Moody's		S&P		Fitch		Moody's	
		N	%	N	%	N	%	N	%	N	%	N	%
(1)	Banks	525		648		488		598		1106		456	
(2)	Rating Changes	315		358		442		1127		1165		1340	
(3)	Downgrade = 1 notch	33	76.7%	122	88.4%	74	78.7%	695	80.3%	613	66.8%	659	63.3%
(4)	Downgrade > 1 notch	10	23.3%	16	11.6%	20	21.3%	170	19.7%	304	33.2%	382	36.7%
(5)=(3)+(4)	Total Drowngrades	43	100%	138	100%	94	100.0%	865	100%	917	100%	1041	100%
(6)	Upgrade = 1 notch	251	92.3%	189	85.9%	237	68.1%	237	90.5%	209	84.3%	171	57.2%
(7)	Upgrade > 1 notch	21	7.7%	31	14.1%	111	31.9%	25	9.5%	39	15.7%	128	42.8%
(8)=(6)+(7)	Total Upgrades	272	100%	220	100%	348	100%	262	100%	248	100%	299	100%
(9)=(5)	Total Downgrades	43	13.7%	138	38.5%	94	21.3%	865	76.8%	917	78.7%	1041	77.7%
(10)=(8)	Total Upgrades	272	86.3%	220	61.5%	348	78.7%	262	23.2%	248	21.3%	299	22.3%
(11)=(9)+(10)	Total Rating Changes	315	100%	358	100%	442	100%	1127	100%	1165	100%	1340	100%
(12)	Negative Watchlist	55	35.9%	99	55.9%	45	30.4%	412	88.0%	438	89.2%	673	73.6%
(13)	Positive Watchlist	98	64.1%	78	44.1%	103	69.6%	56	12.0%	53	10.8%	242	26.4%
(14)=(12)+(13)	Total Watchlist	153	100%	177	100%	148	100%	468	100%	491	100%	915	100%
(15)	Negative Signals	98	20.9%	237	44.3%	139	23.6%	1277	80.1%	1355	81.8%	1714	76.0%
(16)	Positive Signals	370	79.1%	298	55.7%	451	76.4%	318	19.9%	301	18.2%	541	24.0%
(17)=(18)+(19)	Total Signals	468		535		590		1595		1656		2255	
Mean rating		16		16.23		16.82		15.80		15.82		15.33	
Adjustment on Bank Rating with the onset of the crisis								-1%		-3%		-9%	

**Note:** Distribution of signals regarding issuer ratings of the banks before and since the start of the financial crisis.

**Table 3. Distribution of rating changes for banks before and since the start of the financial crisis**

Panel A. S&P		Before the onset of the Crisis		Since the onset of the Crisis	
(1.a)	Total Banks rated by S&P	525	100%	598	100%
(2.a)	Banks rated only by S&P	68	13%	70	12%
(3.a)	Banks rated Not only by S&P	457	87%	528	88%
(4.a)	Banks rated by S&P and Moody's	270		272	
(5.a)	Banks rated by S&P and Fitch	388		480	
(6.a)	Total Downgrades issued by S&P	43	100%	865	100%
(7.a)	Autonomous downgrades issued by S&P	36	84%	214	25%
(8.a)	Total Downgrades of S&P as Follower	7	16%	651	75%
(9.a)	Downgrades of S&P as Follower of Moody's	4		351	
(10.a)	Downgrades of S&P as Follower of Fitch	3		300	
(11.a)	Total Upgrades issued by S&P	272	100%	262	100%
(12.a)	Autonomous upgrades issued by S&P	192	71%	180	69%
(13.a)	Total Upgrades of S&P as Follower	80	29%	82	31%
(14.a)	Upgrades of S&P as Follower of Moody's	43		47	
(15.a)	Upgrades of S&P as Follower of Fitch	37		35	
(16.a)	Downgrades Momentum	23	53%	522	60%
(17.a)	Upgrades Momentum	94	35%	40	15%

  

Panel B. Moody's		Before the onset of the Crisis		Since the onset of the Crisis	
(1.b)	Total Banks rated by Moody's	488	100%	456	100%
(2.b)	Banks rated only by Moody's	141	29%	115	25%
(3.b)	Banks rated Not only by Moody's	347	71%	341	75%
(4.b)	Banks rated by Moody's and S&P	270		272	
(5.b)	Banks rated by Moody's and Fitch	278		293	
(6.b)	Total Downgrades issued by Moody's	94	100%	1,041	100%
(7.b)	Autonomous downgrades issued by Moody's	58	62%	375	36%
(8.b)	Total Downgrades of Moody's as Follower	36	38%	666	64%
(9.b)	Downgrades of Moody's as Follower of S&P	15		348	
(10.b)	Downgrades of Moody's as Follower of Fitch	21		318	
(11.b)	Total Upgrades issued by Moody's	348	100%	299	100%
(12.b)	Autonomous upgrades issued by Moody's	257	74%	192	64%
(13.b)	Total Upgrades of Moody's as Follower	91	26%	107	36%
(14.b)	Upgrades of Moody's as Follower of S&P	46		40	
(15.b)	Upgrades of Moody's as Follower of Fitch	45		67	
(16.b)	Downgrades Momentum	39	41%	699	67%
(17.b)	Upgrades Momentum	86	25%	193	65%

  

Panel C. Fitch		Before the onset of the Crisis		Since the onset of the Crisis	
(1.c)	Total Banks rated by Fitch	648	100%	1106	100%
(2.c)	Banks rated only by Fitch	183	28%	557	50%
(3.c)	Banks rated Not only by Fitch	465	72%	549	50%
(4.c)	Banks rated by Fitch and Moody's	278		293	
(5.c)	Banks rated by Fitch and S&P	388		480	
(6.c)	Total Downgrades issued by Fitch	138	100%	917	100%
(7.c)	Autonomous downgrades issued by Fitch	122	88%	372	41%
(8.c)	Total Downgrades of Fitch as Follower	16	12%	545	59%
(9.c)	Downgrades of Fitch as Follower of Moody's	8		277	
(10.c)	Downgrades of Fitch as Follower of S&P	8		268	
(11.c)	Total upgrades issued by Fitch	220	100%	248	100%
(12.c)	Autonomous upgrades issued by Fitch	157	71%	169	68%
(13.c)	Total Upgrades of Fitch as Follower	63	29%	79	32%
(14.c)	Upgrades of Fitch as Follower of Moody's	31		56	
(15.c)	Upgrades of Fitch as Follower of S&P	32		23	
(16.c)	Downgrades Momentum	38	28%	462	50%
(17.c)	Upgrades Momentum	50	23%	36	15%

**Note:** Distribution of the rating changes rated by each pair of rating agencies before and since the start of the financial crisis.

**Table 4. Lead-lag strategy between rating agencies before the onset of the crisis**

Subpanel A.1						Subpanel A.2					
		Marginal effects						Marginal effects			
S&P as follower of Fitch (RC)		<=-2 notchs	=-1 notch	=1 notch	>=2 notch	Fitch as follower of S&P (RC)		<=-2 notchs	=-1 notch	=1 notch	>=2 notch
RC_DW by Fitch h=1		-1.395 ***	18.90	24.20	-39.30	RC_DW by S&P h=1		-1.151 ***	40.00	20.00	-34.30
RC_DW by Fitch h=2						RC_DW by S&P h=2					-6.20
RC_DW by Fitch h=3						RC_DW by S&P h=3					
RC_UP by Fitch h=1		1.323 **	-1.70	-8.30	-16.20	RC_UP by S&P h=1		0.766 ***	-4.00	-18.80	9.50
RC_UP by Fitch h=2		0.337 **	-1.00	-3.80	1.40	RC_UP by S&P h=2		1.227 ***	-4.40	-25.80	2.70
RC_UP by Fitch h=3		0.254 **	-0.80	-3.00	1.40	RC_UP by S&P h=3		0.732 ***	-3.70	-17.80	8.60
USA		-0.043				USA		-0.221			
Trend		0.009				Trend		-0.004			
Rating		-0.075				Rating		-0.105			
N		216				N		173			
Pseudo R <sup>2</sup>		7.3%				Pseudo R <sup>2</sup>		6.6%			
Subpanel B.1						Subpanel B.2					
		Marginal effects						Marginal effects			
Moody's as follower of S&P (RC)		<=-2 notchs	=-1 notch	=1 notch	>=2 notch	S&P as follower of Moody's (RC)		<=-2 notchs	=-1 notch	=1 notch	>=2 notch
RC_DW by S&P h=1		-3.065 ***	79.60	0.60	-53.50	RC_DW by Moody's h=1		-1.237 ***	21.40	14.50	-31.50
RC_DW by S&P h=2		-2.307 ***	55.70	16.40	-45.60	RC_DW by Moody's h=2					-4.30
RC_DW by S&P h=3		-2.736 ***	70.10	7.10	-50.70	RC_DW by Moody's h=3					
RC_UP by S&P h=1		0.948 ***	-3.00	-10.80	-20.40	RC_UP by Moody's h=1		1.492 ***	-3.40	-6.90	-21.00
RC_UP by S&P h=2		0.651 **	-2.40	-8.80	-11.70	RC_UP by Moody's h=2		0.086			31.40
RC_UP by S&P h=3		0.289				RC_UP by Moody's h=3		0.346 *	-1.80	-2.90	1.00
USA		-0.07				USA		-0.292	1.90	2.90	-2.20
Trend		0.005				Trend		0.004	0.00	0.00	0.00
Rating		-0.122 ***	0.70	2.10	1.00	Rating		0.003	0.00	0.00	0.00
N		264				N		202			
Pseudo R <sup>2</sup>		9.9%				Pseudo R <sup>2</sup>		7.5%			
Subpanel C.1						Subpanel C.2					
		Marginal effects						Marginal effects			
Fitch as follower of Moody's (RC)		<=-2 notchs	=-1 notch	=1 notch	>=2 notch	Moody's as follower of Fitch (RC)		<=-2 notchs	=-1 notch	=1 notch	>=2 notch
RC_DW by Moody's h=1		-1.799 **	41.00	15.70	-47.50	RC_DW by Fitch h=1		-2.195 ***	51.60	18.00	-44.60
RC_DW by Moody's h=2		-1.018	15.60	20.20	-27.50	RC_DW by Fitch h=2		-1.736 ***	34.10	24.80	-34.70
RC_DW by Moody's h=3						RC_DW by Fitch h=3		-1.807 ***	36.80	23.70	-36.30
RC_UP by Moody's h=1		0.795				RC_UP by Fitch h=1		0.866 ***	-3.10	-12.20	-15.50
RC_UP by Moody's h=2		0.995 ***	-4.10	-20.00	0.90	RC_UP by Fitch h=2		0.291 *	-1.50	-5.20	-2.70
RC_UP by Moody's h=3		0.927 ***	-3.90	-18.50	1.10	RC_UP by Fitch h=3		0.386 *	-1.90	-6.70	-4.20
USA		-0.596 ***	4.40	14.60	-9.90	USA		0.066			
Trend		-0.004				Trend		0.005			
Rating		-0.138 ***	1.10	3.30	-2.30	Rating		-0.079 ***	0.50	1.50	0.30
N		200				N		280			
Pseudo R <sup>2</sup>		10.9%				Pseudo R <sup>2</sup>		8.7%			

**Note:** Results of the estimation of the models Eq. (1) and Eq. (2) for the issuer rating downgrades by each pair of rating agencies during the period before the outbreak of the crisis. The dependent variable  $RC_{it}$  refers to a bank rating change by the potential follower agency for bank  $i$  at month  $t$ . This variable can take the value -2 for downgrades of more than one-notch, -1 for downgrades of one-notch, 1 for upgrades of one-notch and 2 for upgrades of more than one-notch. The independent variable  $RC\_DW_{i,h}$  in Eq. (1) and Eq. (2) is a dummy variables that take the value 1 if a bank  $i$  was downgraded by the potential leader in three predefined windows of time ( $h=1$  for 1 month,  $h=2$  for 2-6 months, and  $h=3$  for 7-12 months) and 0 otherwise. Likewise,  $RC\_UP_{i,h}$  in Eq. (1) and Eq. (2) is a dummy variable that takes the value 1 if a bank  $i$  was upgraded by the potential leader in three predefined windows of time ( $h=1$  for 1 month,  $h=2$  for 2-6 months, and  $h=3$  for 7-12 months) and 0 otherwise. *Trend* is a continuous variable corresponding to the month in which a bank  $i$  experiences a change in its rating by the rating agency acting as a follower. *Rating<sub>it</sub>* is the level of rating of the bank  $i$  at the moment  $t$ . *USA<sub>it</sub>* is a dummy variable that takes the value 1 if the bank  $i$  carries out its primary activities in the US and 0 otherwise. The estimations consider Huber-White robust standard errors. The impact of each variable on the probability of a rating upgrade is also shown, that is, the marginal effect in percentage points. Marginal effects are not reported for those variables that are not significant at least 10%. \*\*\* Significant at 1%, \*\* Significant at 5%, \* Significant at 10%.



**Table 5. Lead-lag strategy between rating agencies since the onset of the crisis**

Subpanel A.1						Subpanel A.2					
Marginal effects						Marginal effects					
S&P as follower of Fitch (RC)	<=-2 notchs	=-1 notch	=1 notch	=2 notch		Fitch as follower of S&P (RC)	<=-2 notchs	=-1 notch	=1 notch	=2 notch	
RC_DW by Fitch h=1	-1.362 ***	37.60	-14.50	-20.90	-2.20	RC_DW by S&P h=1	-0.787 ***	24.00	-5.10	-17.50	-1.40
RC_DW by Fitch h=2	-1.061 ***	25.20	-2.70	-20.30	-2.20	RC_DW by S&P h=2	-0.706 ***	20.90	-3.40	-16.10	-1.40
RC_DW by Fitch h=3	-0.487 **	10.80	0.30	-9.80	-1.30	RC_DW by S&P h=3	-0.58 ***	17.30	-3.00	-13.10	-1.10
RC_UP by Fitch h=1	2.145 ***	-13.90	-49.80	24.40	39.30	RC_UP by S&P h=1	0.626				
RC_UP by Fitch h=2	0.315					RC_UP by S&P h=2	0.28				
RC_UP by Fitch h=3	0.96 ***	-11.10	-19.70	22.50	8.30	RC_UP by S&P h=3	-0.257				
USA	-0.223 **	4.30	1.60	-5.00	-0.80	USA	0.246 ***	-6.00	-1.50	6.60	0.90
Trend	0.011 ***	-0.20	-0.10	0.20	0.00	Trend	0.013 ***	-0.30	-0.10	0.40	0.00
Rating	0.034 **	-0.60	-0.30	0.80	0.10	Rating	0.059 **	-1.50	-0.30	1.50	0.20
N	846					N	657				
Pseudo R <sup>2</sup>	15.8%					Pseudo R <sup>2</sup>	13.1%				
Subpanel B.1						Subpanel B.2					
Marginal effects						Marginal effects					
Moody's as follower of S&P (RC)	<=-2 notchs	=-1 notch	=1 notch	=2 notch		S&P as follower of Moody's (RC)	<=-2 notchs	=-1 notch	=1 notch	=2 notch	
RC_DW by S&P h=1	-0.627 ***	18.80	-6.90	-8.20	-3.70	RC_DW by Moody's h=1	-1.294 ***	38.20	-20.20	-15.50	-2.50
RC_DW by S&P h=2	-0.709 ***	20.80	-6.50	-9.90	-4.40	RC_DW by Moody's h=2	-0.991 ***	25.10	-6.80	-15.60	-2.70
RC_DW by S&P h=3	-0.603 ***	17.90	-6.20	-8.00	-3.70	RC_DW by Moody's h=3	-0.455 ***	10.50	-1.00	-7.80	-1.70
RC_UP by S&P h=1	2.31 ***	-20.30	-49.80	8.80	61.30	RC_UP by Moody's h=1	-0.02				
RC_UP by S&P h=2	0.157					RC_UP by Moody's h=2	0.669 ***	-10.10	-9.50	13.90	5.70
RC_UP by S&P h=3	-0.259					RC_UP by Moody's h=3	0.061	-1.20	-0.30	1.20	0.30
USA	0.543 ***	-13.40	-0.40	8.90	4.90	USA	0.12				
Trend	0.025 ***	-0.60	0.00	0.40	0.20	Trend	0.006 ***	-0.10	0.00	0.10	0.00
Rating	0.02					Rating	-0.025				
N	832					N	751				
Pseudo R <sup>2</sup>	19.8%					Pseudo R <sup>2</sup>	11.3%				
Subpanel C.1						Subpanel C.2					
Marginal effects						Marginal effects					
Fitch as follower of Moody's (RC)	<=-2 notchs	=-1 notch	=1 notch	=2 notch		Moody's as follower of Fitch (RC)	<=-2 notchs	=-1 notch	=1 notch	=2 notch	
RC_DW by Moody's h=1	-0.609 ***	20.60	-9.90	-8.00	-2.70	RC_DW by Fitch h=1	-0.619 ***	19.40	-6.70	-8.70	-4.00
RC_DW by Moody's h=2	-0.314 ***	9.80	-3.10	-4.80	-1.80	RC_DW by Fitch h=2	-0.561 ***	17.00	-4.80	-8.30	-4.00
RC_DW by Moody's h=3	-0.159					RC_DW by Fitch h=3	-0.378 **	11.20	-2.80	-5.60	-2.90
RC_UP by Moody's h=1	1.688 ***	-23.40	-33.10	22.20	34.30	RC_UP by Fitch h=1	1.107 ***	-18.30	-18.40	15.70	21.00
RC_UP by Moody's h=2	1.189 ***	-21.30	-17.40	20.60	18.10	RC_UP by Fitch h=2	0.394				
RC_UP by Moody's h=3	0.848 ***	-18.10	-7.70	15.70	10.10	RC_UP by Fitch h=3	0.873 ***	-16.30	-11.70	13.60	14.50
USA	0.195 **	-5.70	1.10	3.20	1.40	USA	0.537 ***	-13.80	-0.80	9.10	5.40
Trend	0.001					Trend	0.02 ***	-0.50	0.00	0.30	0.20
Rating	0.009					Rating	0.001				
N	630					N	900				
Pseudo R <sup>2</sup>	7.0%					Pseudo R <sup>2</sup>	15.9%				

**Note:** Results of the estimation of the models Eq. (1) and Eq. (2) for the issuer rating downgrades by each pair of rating agencies during the period since the outbreak of the crisis. The dependent variable  $RC_{it}$  refers to a bank rating change by the potential follower agency for bank  $i$  at month  $t$ . This variable can take the value -2 for downgrades of more than one-notch, -1 for downgrades of one-notch, 1 for upgrades of one-notch and 2 for upgrades of more than one-notch. The independent variable  $RC\_DW_{i,h}$  in Eq. (1) and Eq. (2) is a dummy variables that take the value 1 if a bank  $i$  was downgraded by the potential leader in three predefined windows of time ( $h=1$  for 1 month,  $h=2$  for 2-6 months, and  $h=3$  for 7-12 months) and 0 otherwise. Likewise,  $RC\_UP_{i,h}$  in Eq. (1) and Eq. (2) is a dummy variable that takes the value 1 if a bank  $i$  was upgraded by the potential leader in three predefined windows of time ( $h=1$  for 1 month,  $h=2$  for 2-6 months, and  $h=3$  for 7-12 months) and 0 otherwise.  $Trend$  is a continuous variable corresponding to the month in which a bank  $i$  experiences a change in its rating by the rating agency acting as a follower.  $Rating_{it}$  is the level of rating of the bank  $i$  at the moment  $t$ .  $USA_{it}$  is a dummy variable that takes the value 1 if the bank  $i$  carries out its primary activities in the US and 0 otherwise. The estimations consider Huber-White robust standard errors. The impact of each variable on the probability of a rating upgrade is also shown, that is, the marginal effect in percentage points. Marginal effects are not reported for those variables that are not significant at least 10%. \*\*\* Significant at 1%, \*\* Significant at 5%, \* Significant at 10%.

**Table 6. Estimation rating of *momentum* dynamics in upgrades before the onset of the crisis**

S&P		Marginal effects			
	UP	0 Notch	=1 Notch	>=2 Notchs	Average Change
Upgrade	2.52 ***	-72.30	41.20	31.10	36.15
Watchlist_UP	0.723 ***	-10.00	9.10	1.00	5.05
USA	-0.273 ***	2.40	-2.20	-0.20	
Duration	0.118 ***	-1.00	1.00	0.10	
Rating	-0.075 ***	0.70	-0.60	-0.10	
N	5346				
Pseudo R <sup>2</sup>	12.5%				
Fitch		Marginal effects			
	UP	0 Notch	=1 Notch	>=2 Notchs	Average Change
Upgrade	2.83 ***	-74.00	30.70	43.30	37.00
Watchlist_UP	0.53 ***	-3.80	3.20	0.60	1.90
USA	-0.21 ***	0.90	-0.80	-0.10	-0.45
Duration	0.10 ***	-0.50	0.40	0.10	0.25
Rating	-0.10 ***	0.40	-0.40	-0.10	-0.25
N	9177				
Pseudo R <sup>2</sup>	11.7%				
Moody's		Marginal effects			
	UP	0 Notch	=1 Notch	>=2 Notchs	Average Change
Upgrade	2.52 ***	-70.50	17.70	52.80	35.25
Watchlist_UP	0.83 ***	-12.20	7.30	4.90	6.10
USA	-0.56 ***	5.60	-3.70	-1.90	-2.80
Duration	0.19 ***	-1.60	1.10	0.50	0.80
Rating	-0.09 ***	0.70	-0.50	-0.20	-0.35
N	6700				
Pseudo R <sup>2</sup>	13.4%				

**Note:** Results of the estimation of the model (Eq. 3) for the issuer rating issued by each rating agency before the onset of the crisis. The dependent variable is *UP*, which takes the value 1 or 2 if the issuer rating of bank *i* issued by the agency analysed is upgraded by 1 or more notches, respectively. Otherwise, this variable takes the value 0. *Watchlist\_UP<sub>t,i</sub>* is a dummy variable that takes the value 1 if in the last 12 months a positive watchlist has been issued on the rating of bank *i* and 0 otherwise. *Duration<sub>t,i</sub>* refers to the time elapsed from when a bank obtains a rating until this rating is changed. *Rating<sub>t-1</sub>* is the level of rating of the bank *i* at the moment *t-1*. *USA<sub>t,i</sub>* is a dummy variable taking the value 1 if bank *i* mainly operates in the US and 0 otherwise. The estimations consider Huber-White robust standard errors. The impact of each variable on the probability of a rating upgrade is also shown, that is, the marginal effect in percentage points. Marginal effects are not reported for those variables that are not significant at least 10%. \*\*\* Significant at 1%, \*\* Significant at 5%, \* Significant at 10%.

**Table 7. Estimation of rating *momentum* dynamics in downgrades before the onset of the crisis**

S&P		Marginal effects			
	DW	0 Notch	=1 Notch	>=2 Notchs	Average Change
Downgrade	3.111 ***	-70.70	23.60	47.00	35.30
Watchlist_DW	1.114 ***	-6.50	4.90	1.60	3.25
USA	-0.042				
Duration	-0.053				
Rating	-0.009				
N	4077				
Pseudo R <sup>2</sup>	15.4%				
Fitch		Marginal effects			
	DW	0 Notch	=1 Notch	>=2 Notchs	Average Change
Downgrade	2.962 ***	-74.40	33.70	40.70	37.20
Watchlist_DW	0.704 ***	-4.40	3.90	0.50	2.20
USA	-0.053				
Duration	0.042 *	-0.10	0.10	0.00	0.05
Rating	0.041 **	-0.10	0.10	0.00	0.05
N	8313				
Pseudo R <sup>2</sup>	13.1%				
Moody's		Marginal effects			
	DW	0 Notch	=1 Notch	>=2 Notchs	Average Change
Downgrade	3.221 ***	-78.60	24.70	53.90	39.30
Watchlist_DW	1.4 ***	-15.80	11.50	4.30	7.90
USA	-0.451 ***	1.80	-1.40	-0.40	-0.90
Duration	-0.121 ***	0.40	-0.30	-0.10	-0.20
Rating	0.046 *	-0.20	0.10	0.00	0.05
N	4769				
Pseudo R <sup>2</sup>	21.7%				

**Note:** Results of the estimation of the model (Eq. 3) for the issuer rating issued by each rating agency before the onset of the crisis. The dependent variable is *DW*, which takes the value 1 or 2 if the issuer rating of bank *i* issued by the agency analysed is downgraded by 1 or more notches, respectively. Otherwise, this variable takes the value 0. *Watchlist\_DW<sub>it</sub>* is a dummy variable that takes the value 1 if in the last 12 months a negative watchlist has been issued on the rating of bank *i* and 0 otherwise. *Duration<sub>it</sub>* refers to the time elapsed from when a bank obtains a rating until this rating is changed. *Rating<sub>t-1</sub>* is the level of rating of the bank *i* at the moment *t-1*. *USA<sub>it</sub>* is a dummy variable taking the value 1 if bank *i* mainly operates in the US and 0 otherwise. The estimations consider Huber-White robust standard errors. The impact of each variable on the probability of a rating upgrade is also shown, that is, the marginal effect in percentage points. Marginal effects are not reported for those variables that are not significant at least 10%. \*\*\* Significant at 1%, \*\* Significant at 5%, \* Significant at 10%.

**Table 8. Estimation of rating *momentum* dynamics in upgrades since the onset of the crisis**

S&P		Marginal effects			
	UP	0 Notch	=1 Notch	>=2 Notchs	Average Change
Upgrade	2.888 ***	-67.80	35.70	32.10	33.90
Watchlist_UP	0.681 ***	-3.40	3.10	0.40	1.75
USA	-0.022				
Duration	0.176 ***	-0.40	0.40	0.00	0.20
Rating	-0.055 ***	0.10	-0.10	0.00	-0.05
N	20343				
Pseudo R <sup>2</sup>	13.1%				
Fitch		Marginal effects			
	UP	0 Notch	=1 Notch	>=2 Notchs	Average Change
Upgrade	2.81 ***	-63.90	28.80	35.10	31.95
Watchlist_UP	0.95 ***	-6.40	5.10	1.20	3.15
USA	-0.38 ***	0.90	-0.70	-0.10	-0.40
Duration	0.13 ***	-0.30	0.30	0.00	0.15
Rating	-0.06 ***	0.10	-0.10	0.00	-0.05
N	16334				
Pseudo R <sup>2</sup>	15.7%				
Moody's		Marginal effects			
	UP	0 Notch	=1 Notch	>=2 Notchs	Average Change
Upgrade	2.38 ***	-36.40	14.60	21.80	18.20
Watchlist_UP	1.68 ***	-13.40	7.60	5.80	6.70
USA	-0.04				
Duration	0.14 ***	-0.30	0.20	0.10	0.15
Rating	-0.05 ***	0.10	-0.10	0.00	-0.05
N	23198				
Pseudo R <sup>2</sup>	32.9%				

**Note:** Results of the estimation of the model (Eq. 3) for the issuer rating issued by each rating agency since the onset of the crisis. The dependent variable is *UP*, which takes the value 1 or 2 if the issuer rating of bank *i* issued by the agency analysed is upgraded by 1 or more notches, respectively. Otherwise, this variable takes the value 0. *Watchlist\_UP<sub>it</sub>* is a dummy variable that takes the value 1 if in the last 12 months a positive watchlist has been issued on the rating of bank *i* and 0 otherwise. *Duration<sub>it</sub>* refers to the time elapsed from when a bank obtains a rating until this rating is changed. *Rating<sub>it-1</sub>* is the level of rating of the bank *i* at the moment *t-1*. *USA<sub>it</sub>* is a dummy variable taking the value 1 if bank *i* mainly operates in the US and 0 otherwise. The estimations consider Huber-White robust standard errors. The impact of each variable on the probability of a rating upgrade is also shown, that is, the marginal effect in percentage points. Marginal effects are not reported for those variables that are not significant at least 10%. \*\*\* Significant at 1%, \*\* Significant at 5%, \* Significant at 10%.

**Table 9. Estimation of rating *momentum* dynamics in downgrades since the onset of the crisis**

S&P		Marginal effects			
	DW	0 Notch	=1 Notch	>=2 Notchs	Average Change
Downgrade	3.069 ***	-80.60	41.10	39.50	40.30
Watchlist_DW	0.739 ***	-6.10	5.40	0.80	3.10
USA	-0.002				
Duration	0.041 ***	-0.20	0.20	0.00	0.10
Rating	0.046 ***	-0.20	0.20	0.00	0.10
N	25308				
Pseudo R <sup>2</sup>	32.5%				
Fitch		Marginal effects			
	DW	0 Notch	=1 Notch	>=2 Notchs	Average Change
Downgrade	3.195 ***	-82.60	22.90	59.70	41.30
Watchlist_DW	0.713 ***	-5.30	4.00	1.30	2.65
USA	-0.097 ***	0.40	-0.30	-0.10	-0.20
Duration	0.082 ***	-0.40	0.30	0.10	0.20
Rating	0.026 ***	-0.10	0.10	0.00	0.05
N	28574				
Pseudo R <sup>2</sup>	31.6%				
Moody's		Marginal effects			
	DW	0 Notch	=1 Notch	>=2 Notchs	Average Change
Downgrade	2.857 ***	-72.20	21.10	51.10	36.10
Watchlist_DW	0.821 ***	-6.80	4.60	2.20	3.40
USA	-0.185 ***	0.90	-0.60	-0.30	-0.45
Duration	0.137 ***	-0.70	0.50	0.20	0.35
Rating	0.036 ***	-0.20	0.10	0.10	0.10
N	31053				
Pseudo R <sup>2</sup>	29.3%				

**Note:** Results of the estimation of the model (Eq. 3) for the issuer rating issued by each rating agency since the onset of the crisis. The dependent variable is *DW*, which takes the value 1 or 2 if the issuer rating of bank *i* issued by the agency analysed is downgraded by 1 or more notches, respectively. Otherwise, this variable takes the value 0. *Watchlist\_DW<sub>i,t</sub>* is a dummy variable that takes the value 1 if in the last 12 months a negative watchlist has been issued on the rating of bank *i* and 0 otherwise. *Duration<sub>i,t</sub>* refers to the time elapsed from when a bank obtains a rating until this rating is changed. *Rating<sub>i,t-1</sub>* is the level of rating of the bank *i* at the moment *t-1*. *USA<sub>i,t</sub>* is a dummy variable taking the value 1 if bank *i* mainly operates in the US and 0 otherwise. The estimations consider Huber-White robust standard errors. The impact of each variable on the probability of a rating upgrade is also shown, that is, the marginal effect in percentage points. Marginal effects are not reported for those variables that are not significant at least 10%. \*\*\* Significant at 1%, \*\* Significant at 5%, \* Significant at 10%.