



**UW Faculty of Management**

**Working Paper Series**

No 3/2024

**CORPORATE-TO-BANK SPILLOVER EFFECT—  
EUROPEAN AND AMERICAN PERSPECTIVE**

Patrycja Chodnicka-Jaworska

*University of Warsaw, Faculty of Management, Poland, [pchodnicka@wz.uw.edu.pl](mailto:pchodnicka@wz.uw.edu.pl)*

<https://orcid.org/0000-0001-7471-352X>

Keywords: machine learning, ESG, energy sector

JEL Classification: Q47, Q56, C58

---

UW FM Working Paper Series are written by researchers employed at the Faculty of Management of UW and by other economists, and are published by the Faculty.

**DISCLAIMER:** An objective of the series is to get the research results out quickly, even if their presentations are not fully polished. The findings, interpretations, and conclusions expressed in this Working Paper are those of their author(s) and do not necessarily the views of the Faculty of Management of UW.

**This is an open access article distributed under the Creative Commons BY 4.0 license (<https://creativecommons.org/licenses/by/4.0/>)**

**Publisher:** University of Warsaw

**Contact:** Str.: Szturmowa 1/3; 02-678 Warsaw, Poland

Telephone: +48 22 55 34 164

Fax: +48 22 55 34 001

This paper can be downloaded without charge from:

<http://arch.wz.uw.edu.pl/portale/Faculty%20of%20Management%20Working%20Paper%20Series/dzial/view-working-papers>

Information on all of the papers published in the UW Faculty of Management Working Paper Series can be found on Faculty of Management Website at:

<http://arch.wz.uw.edu.pl/portale/Faculty%20of%20Management%20Working%20Paper%20Series>

**ISSN 2300-4371 (ONLINE)**

---

# Corporate-to-Bank Spillover Effect—European and American Perspective

*Patrycja Chodnicka-Jaworska*

*University of Warsaw, Faculty of Management, Poland, [pchodnicka@wz.uw.edu.pl](mailto:pchodnicka@wz.uw.edu.pl)*

## **Abstract**

The aim of the paper is to analyze the impact of the spillover effect between long-term issuer credit ratings changes of non-financial companies and bank credit ratings (i.e., the corporate-to-bank spillover effect) in Europe and America by taking into consideration the stage of the business cycle and the regional reaction. A literature review was prepared and, as a result, the following hypothesis is proposed. A stronger corporate-to-bank spillover effect was noticed in Europe than in the U.S. An analysis was conducted for the 2000–2023 period for listed banks and non-financial companies on the European and U.S. stock exchanges which received long-term issuer credit ratings from the main credit rating agencies. For the analysis, panel data models were used.

**Keywords:** machine learning, ESG, energy sector

**JEL Classification:** Q47, Q56, C58

## **1. Introduction**

During the Global Financial Crisis (GFC), a lot of attention was put on the effectiveness of the credit ratings and their usefulness in the prediction of crises. The main idea of credit ratings is to predict the default risk of assessed entities. During the mentioned crises, many opinions regarding the lagged reaction of credit rating agencies (CRA) on the situation of the financial market were put forward. As a result, some studies have paid attention to the anti-cyclic character of credit ratings changes.

The COVID-19 pandemic brought a lot of problems for the financial market and strong recessions in some sectors. The increasing problems and uncertainty on financial markets have led to increased default risk and bankruptcies. Other companies have generated lower profits or even losses. The lax fiscal policy and high direct financial support for companies are some of the reasons for the increasing inflation rate, creating higher interest rates and a higher cost of financing on the financial market. In particular, higher interest rates increase the costs of credits and lead to higher interest costs. The mentioned situation creates problems for loan repayments, and leads to the increasing value of toxic credits, which are not paid by companies. As an effect decreasing the quality of credit portfolios, the described situation can be especially painful for banks with short-term financing based on variable interest rates and providing

---

long-term loans at a fixed interest rate during times with low interest rates. It can be also very dangerous in the case of banks which have low capital requirements.

The described phenomenon causes a transfer of liquidity and default risk from companies to banks. Such spillover effects may be observed between countries, banks, and corporate credit ratings. The corporate-to-bank credit rating spillover effect occurs when corporate credit rating changes lead to changes in bank notes, which can lead to an impact of corporate creditworthiness on bank creditworthiness. As mentioned previously, credit ratings should reduce the asymmetry of information between investors and issuers and clarify the default risk. The predictive role of credit ratings should signal a changing situation on the financial market and help to predict changes in the business cycle. In the methodologies of credit rating agencies, information about the impact of the corporate default risk on bank credit ratings changes is not included. The bad financial condition of corporate notes will cause the increasing problems regarding the quality of the credit portfolio, increasing the loan loss provisions and non-performing loans.

As a result, the aim of this paper is to analyze the impact of the spillover effect between the long-term issuer credit ratings changes of non-financial companies and bank credit ratings (i.e., the corporate-to-bank spillover effect) in Europe and America by taking into consideration the stage of business cycle and the regional reaction. A literature review was prepared and, as a result, the following hypothesis is proposed. A stronger corporate-to-bank spillover effect was noticed in Europe than in the U.S., regarding the relationship between the credit ratings of banks and companies. The need to test the presented relationship is connected with checking the opposite reaction to the bank-to-corporate credit rating spillover effect. The presented paper is a continuation of research on the relationship between the credit ratings of banks and non-financial companies, given the lack of studies on the impact of changes in sovereign and corporate credit ratings on bank notes. Previous studies have only analyzed the country-to-bank credit rating spillover effect using stock prices or indices and bank credit rating changes. The present study will help to expand upon the previous study and allow for comparison of the significance and strength of the relationship between the credit ratings of banks and corporates. This research will also be helpful to check which direction (i.e., bank-to-corporate or corporate-to-bank) is stronger, which may help to answer questions regarding the impact of sovereign credit ratings changes on corporate notes and to assess the impact of the financial condition of non-financial companies on the default risk of banks. Furthermore, the present study assesses the differences between the American and European credit rating markets. It will be also useful to analyze the relationship between credit ratings throughout the business cycle, as the present study takes into consideration the behavior of credit ratings during the last two crises—namely, the global financial crisis (GFC) in 2008–2009 and the COVID-19 crisis and the consequent recession. The analyzed relationship is significant, as it may help in assessing the contagion effect between sectors. The presented study may be relevant in terms of assessing the significance of credit rating changes in deepening crises and default risks. The presented analysis is a part of a series of studies on the relationships between credit rating changes between certain groups of entities. The analysis was conducted for the 2000–2023 period for listed banks and non-financial companies on the European and U.S. stock exchanges which received long-term issuer credit ratings from the main credit rating agencies. For the analysis, there were used panel data models.

The remainder of the paper is structured as follows. In Section 2, previous studies that have investigated the spillover effect and the reaction of credit ratings changes during crises are reviewed. Section 3 describes the methodology by reporting the features of the data sample

---

and the specifications of the models on which the empirical analysis is based. Section 4 provides a discussion of the findings, while Section 5 concludes by declaring the limitations of the current study and consequently suggesting future lines of research.

## 2. Literature review

Analysis of bank credit rating methodologies reveals that agencies typically take three types of factors into consideration: macroeconomic variables, banking sector indicators, and financial stability factors. The mentioned situation is strictly connected with the following transfer channels (BIS, 2011): First, banks invest in sovereign bonds. In their portfolio, they have sovereign debt and derivative securities. Second, the methodologies of credit rating agencies show that decreasing a country's credit ratings leads to increased default risk of banks, and has an influence on their creditworthiness. Third, by lending money, banks can receive implicit and explicit government guarantees. Fourth, collaterals are used by banks to obtain external wholesale funding and central bank re-financing.

Most popular studies have focused on estimation of the sovereign-to-banking rating spillover effect through the sovereign ceiling channel [Williams et al., 2013; Alsakka et al., 2014; Poon et al., 2017; Klusak et al., 2017; Almeida et al. 2017; Chodnicka-Jaworska, 2019]. Gibson et al. (2016) posited that sovereign default risk is a crucial factor in banking crises, and that 1980–2005 data from emerging and developed countries indicate that bank sensitivity to sovereign risk increases with exposure. Moreover, when the financial situation deteriorates, the risk of default increases, which, in turn, increases bank credit risk. Similar views were held by Alter and Schüler [2012] and Beltratti [2015]. However, Bolton and Jeanne [2011] posited that sovereign risk increases bank risk. Moreover, large direct rescues or explicit guarantees for banks are more likely to limit the short-term liquidity of government sectors and cause a sovereign debt crisis through the expanded model of financial intermediaries and government departments. Thus, later studies focused on bank risk and sovereign risk [Pisani-Ferry, 2013]. Subsequently, Acharya et al. [2014] constructed a theoretical model to simulate the transmission relationship between bank risk and sovereign risk, and found that sovereign bailouts of the financial sector lead to an increase in sovereign risk; however, sovereign risk reinforces bank risk due to the financial sector's holding of sovereign bonds. Banerjee et al. [2016] also found that, prior to the first Greek bailout, the sovereign and financial sectors exhibited a two-way negative feedback effect. However, as investors were already aware of the impending bailout and the two-way risk transfer was priced in after the first Greek bailout, this pattern disappeared in subsequent bailouts; that is, financial sector shocks lost their impact on the sovereign sector, but the strong and positive impact of sovereign default risk on its domestic financial institutions remained.

Foglia and Angelini [2020] also argued that the transmission mechanism of shocks between core and non-core banks/sovereigns is asymmetric. Differences in countries can also lead to changes in bank and sovereign relations. For example, Yu [2017] found that synchronized pre-crisis bank and sovereign credit default swaps spreading at the national level are minuscule. In the early stage of the banking crisis, there is a transference from bank risk to sovereign risk due to government guarantees. However, as government bailouts increased, the national fiscal situation increasingly deteriorated. This was followed by the reverse spillover of sovereign risk to financial sectors and banks. Fratzscher and Rieth [2019] also tested the causal relationship between sovereign risk and bank risk in some countries of the eurozone, and found that the causal relationship between them is two-way in the Eurozone as a whole;

---

however, from the results of a single-country test, only a one-way causal relationship was observed in some countries. Singh et al. [2016] used dynamic methods to test the Granger causality between two risk measures in each country, and drew similar conclusions.

The next group of studies analyzed the impact of bank credit ratings changes on sovereign notes. Hu et al. [2020] identified both positive and negative bank-to-sovereign spillover effects, and found the negative rating spillover effect to be more pronounced than the positive one.

The presented study also finds differences in the significance of the mentioned effect among agencies. The bank-to-sovereign risk transmission mechanism in the EU has been confirmed by previous contributions using CDS data [Acharya et al., 2014]. Cuadros-Solas and Muñoz [2021] found that in addition to the main economic indicators (macroeconomic, government, and institutional quality factors), the soundness of the banking system is relevant in determining the sovereign rating. In fact, with the outbreak of the crisis, the importance of these banking sector characteristics (namely, liquidity, concentration, and volume of non-performing loans) for sovereign ratings increased substantially. These results suggest a change in CRAs' policies since the onset of the crisis, involving a reappraisal of the structure of the banking sector when assessing countries' sovereign risk. Angelini et al. [2014] introduce the self-reinforcing negative spiral among sovereign difficulties, bank fragility, and economic recession. While risks arising from a European sovereign borrower can be transmitted to the country's banking sector, there is also some evidence of the bank-to-sovereign causality direction during the crisis period: The Irish and Spanish government debt sectors suffered from the financial obstacles of the domestic banking industry.

Banerjee et al. [2016] also found that prior to the first Greek bailout, the sovereign and financial sectors exhibited a two-way negative feedback effect. However, since investors were already aware of the impending bailout and the two-way risk transfer was priced in after the first Greek bailout, this pattern disappeared in all subsequent bailouts. That is, financial sector shocks lost their impact on the sovereign sector, but the strong and positive impact of sovereign default risk on its domestic financial institutions remained.

The next set of studies examines the impact of sovereign credit ratings on CDS spreads and stock prices. Abad et al. [2018] analysed the spillover effect type. They discovered that the spillover effects within and between groups of countries are influenced by the sovereign rating level, split ratings, and the degree of rating convergence. Specific rating actions induce different and/or stronger effects. The results reveal a clear pattern: downgrades of highly-rated countries lead to contagion to both highly and lowly-rated countries, while downgrades of lowly-rated countries have the opposite effect, inducing competitive effects. Split ratings intensify stock market spillover effects. Rating convergence or divergence among similarly-rated sovereigns significantly affects spillover effects. For downgrades of highly-rated countries, rating convergence mitigates the contagion effect on other highly-rated countries in the region but has a limited effect on contagion to lowly-rated countries. For downgrades of lowly-rated countries, rating convergence strengthens the competitive effect on other lowly-rated countries but has little impact on high-rated countries. Böninghausen and Zabel [2015] found strong evidence of negative spillover effects in response to downgrades, while positive spillovers from upgrades are limited at best. Moreover, negative spillover effects are more pronounced for countries within the same region. Interestingly, this cannot be explained by fundamental linkages and similarities between countries.

Mutize and Gossel [2018] found that marginal regional sovereign rating spillover impacts are quickly absorbed into capital markets trading long-term securities. The analysis further demonstrates marginal spillover effects that persist over longer time periods in sovereign

---

ratings of other countries in the same region following a sovereign rating change in one country. These results imply that the regional bilateral linkages between countries serve as channels for the flow of capital and sovereign credit rating information.

Arezki et al. [2011], in their analysis of the impact of sovereign credit ratings on CDS spreads, found that sovereign rating downgrades have statistically and economically significant spillover effects across countries and financial markets. The sign and magnitude of these spillover effects depend on the type of announcements, the source country experiencing the downgrade, and the rating agency from which the announcements originate. Downgrades to near speculative grade ratings for relatively large economies have a systematic spillover effect across Eurozone countries. Claeys and Borek [2012] discovered a two-sided relationship between rating news and sovereign risk premia. The spillover of rating news is highly heterogeneous, with substantially stronger effects for downgrades at lower grades. The impact is often weaker domestically than on the bond spreads of other sovereigns.

The next group of studies tested the spillover effect of sovereign-to-corporate credit ratings. Borensztein et al. [2007] found that, although CRAs have gradually shifted from a policy of never rating a private borrower above the sovereign (the 'sovereign ceiling'), sovereign ratings still significantly influence the credit ratings assigned to corporations. Sovereign ratings continue to have a significant and robust effect on private ratings, even after controlling for country-specific macroeconomic conditions and firm-level performance indicators.

Ho et al. [2023] found that changes in sovereign credit ratings positively impact corporate credit rating actions, particularly in the financial industry. The national culture of power distance and masculinity (individualism and long-term orientation) has a positive (negative) impact on corporate rating actions. Furthermore, the results show that national culture significantly affects the spillover effects. Specifically, the positive spillover effects reverse with higher power distance and are more pronounced with a greater long-term orientation. The main contribution of this research is to shed light on the vital role national culture plays in the spillover effects.

Augustin et al. [2018] found suggestive evidence of risk spillovers from sovereign to corporate credit risk through both financial and fiscal channels. The effects were more pronounced for firms that are dependent on banks or governments. They found no support for indirect risk transmission through a deterioration of macroeconomic fundamentals.

Sovereign rating actions frequently drive rating actions at the corporate and bank levels [e.g., Adelino, Ferreira, 2016; Almeida et al., 2017; Borensztein et al., 2013; Huang, Shen, 2015]. Additionally, banks are strongly affected by sovereign rating actions for their home country and internationally due to their holdings of sovereign debt, collateral, and implicit government guarantees [e.g., BIS, 2011; Blundell-Wignall, Slovik, 2010; Caselli et al., 2016; De Bruckyere et al., 2013]. Given the increasing prevalence of such 'split ratings', they are anticipated to be influential in the spillover evidence. Several closely related studies only use data from one CRA and are therefore unable to account for this effect [e.g., Chen et al., 2016; Drago and Gallo, 2016; Wengner et al., 2015]. Regarding the quantification of split ratings, most prior studies ignore outlook and watch actions, which have been demonstrated to be a crucial component of the information content of CRAs' actions [e.g., Kaminsky, Schmukler, 2002].

Tsoumas [2017] examined the spillover effect of a bank default on its neighbouring banks, which propagates through disrupted local economic activity in areas where the failed institution was operating through its branches. The insolvency risk of affected neighbouring banks increases considerably one year after the shock, especially during a crisis. This effect is driven by capital deterioration, an increase in non-performing loans, and a surge in profit

volatility. Moreover, this spillover effect is asymmetrically distributed, affecting more neighbouring banks with higher risk, while better-capitalised ones are not better shielded. Xu et al. [2021] demonstrate that there are spillover effects of default risk from SMEs to banks. It is notably challenging for SMEs to secure loans from the largest state-owned banks due to the fact that, in extreme cases, SMEs exhibit the highest risk spillover effects on these banks. The variations in risk spillover effects can be attributed to two main factors. First, the degree of association between SMEs and different banks varies. Second, there are differing levels of risk spillover effects among various banks.

Gao et al. [2022] examine the spillover effects of corporate bond defaults on the non-performing loans of local city commercial banks. They found that the emergence of corporate bond defaults significantly increases the non-performing loans of local banks. The spillover effects are pronounced in less diversified banks. Mechanism analyses show that illiquidity contagion, rather than the deteriorating fundamentals of local borrowers, accounts for the rise in non-performing loans. The bond defaults have spillover effects on the risk of local banks. The literature review presented demonstrates a lack of studies on the spillover effect of bank-to-corporate credit ratings.

### 3. Methodology

The aim of the study is to analyse the impact of the spillover effect between European and American non-financial companies' long-term issuer credit ratings changes and banks' credit ratings (corporates-to-banks spillover effect) by considering the business cycle and regional reactions. The literature review has been prepared, resulting in the formulation of the following hypothesis: The corporates-to-banks spillover effect is stronger in Europe than in the US. To analyse the corporates-to-banks spillover effect, all long-term issuer credit ratings provided by the main CRAs—namely, DBRS, Fitch, Moody's, and S&P—for companies listed on European and US stock exchanges are utilised. The selection of these CRAs is associated with nearly 95% of the market share in Europe and more than 50% in the US. Consequently, these agencies cover almost the entire market, and utilising ratings provided by them will facilitate comparison between European and American companies and the spillover effect between sovereign and corporate notes and banks' credit ratings. Until the end of June 2023, only a few different credit ratings were assigned to the mentioned companies by CRAs. These credit ratings are sourced from the Refinitiv database. However, as of 2021, S&P's credit ratings cannot be accessed from the Refinitiv database. To better understand the spillover effect between credit ratings, data from the period between 2000 and June 2023 have been considered. A separate analysis for each CRA, region, and business cycle period will be conducted. The analysis covers more than 7000 companies from all European countries and the US. To assess the impact of determinants on companies' credit ratings, the linear decomposition method proposed by Ferri, Liu, and Stiglitz [1999] has been employed. This methodology aligns with previous research outlined in the literature review. The linear decomposition method is presented in the table below.

**Table 1.** Decomposition of Moody's, DBRS, Fitch long-term issuer credit ratings.

Moody's Long-Term Issuer Rating		Dominion Long-Term Issuer		Fitch Long-Term Issuer Rating		S&P's Long-term Issuer Rating	
Rating	Code	Rating	Code	Rating	Code	Rating	Kod
Aaa	100	AAA	100	AAA	100	AAA	100
Aa1	95	AA (high)	96	AA+	94,74	AA+	95



Aa2	90	AA	92	AA	89,47	AA	90
Aa3	85	AA (low)	88	AA-	84,21	AA-	85
A1	80	A (high)	84	A+	78,95	A+	80
A2	75	A	80	A	73,68	A	75
A3	70	A (low)	76	A-	68,42	A-	70
Baa1	65	BBB (high)	72	BBB+	63,16	BBB+	65
Baa2	60	BBB	68	BBB	57,89	BBB	60
Baa3	55	BBB (low)	64	BBB-	52,63	BBB-	55
Ba1	50	BB (high)	60	BB+	47,37	BB+	50
Ba2	45	BB	56	BB	42,11	BB	45
Ba3	40	BB (low)	52	BB-	36,84	BB-	40
B1	35	B (high)	48	B+	31,58	B+	35
B2	30	B	44	B	26,32	B	30
B3	25	B (low)	40	B-	21,05	B-	25
Caa1	20	CCC (high)	36	CCC	15,79	CCC+	20
Caa2	15	CCC	32	CC	10,53	CCC	15
Caa3	10	CCC (low)	28	C	5,26	CCC-	10
Caa	5	CC (high)	24	RD	-5	CC	5
C	0	CC	20	D	-5	NR	0
WR	-5	CC (low)	16	WD	-5	SD	-5
		C (low)	4				
		SD/D	-5				

Source: Own elaboration.

Panel data ordered logit models have been employed in the analysis, with banks' long-term issuer credit ratings serving as the dependent variable. These models, being logit models, are defined by their reliance on verifying the probability unit, which is subsequently transformed into its cumulative probability value from a normal distribution. The final version of the model is as follows:

$$y_{it}^* = \beta x'_{it} + \gamma Z_{it} + \varepsilon_{it}$$

where  $Y_{it}^*$  is an unobservable latent variable that measures the creditworthiness of bank  $i$  in period  $t$ ;  $X'_{it}$  is a vector of time-varying explanatory variables;  $\beta$  is a vector of unknown parameters;  $Z_{it}$  are time-invariant regressors that are generally dummy variables;  $\varepsilon_{it}$  is a random disturbance term with a normal distribution.  $y_{it}^*$  is related to the observed variable  $y_i$ , which is a credit rating in this case, in the following manner:

$$y_i = -5 \text{ if } y_i^* < \tau_0$$

$$0 \text{ if } \varepsilon_0 < y_i^* < \tau_1$$

$$5 \text{ if } \varepsilon_1 < y_i^* < \tau_2$$

$$10 \text{ if } \varepsilon_2 < y_i^* < \tau_3$$

$$15 \text{ if } \varepsilon_3 < y_i^* < \tau_4$$

...

$$100 \text{ if } \varepsilon_{21} < y_i^* < 0$$

where the  $\tau_s (\tau_0 < \tau_1 < \tau_2 < \dots < \tau_{22})$  represents the known threshold parameters to be estimated. The final version of the ordered logit model is:

$$\Delta y_{it} = \alpha_1 CC1_{cjt}^+ + \alpha_2 CC2_{cjt}^+ + \alpha_3 CC1_{cjt}^- + \alpha_4 CC2_{cjt}^- + \theta \Delta CR_{jt} + \delta(F * Z)_{it} + \varepsilon_{it} ; \text{ where } \varepsilon_{it} \sim N(0,1)$$

$y_{it}$  is an unobservable latent variable that measures the creditworthiness of bank  $i$  in period  $t$ ;  
 $\Delta y_{it}$  is a change of the unobservable latent variable that measures the change in credit rating of bank  $i$  in period  $t$ ;

$CC1_{cjt}^+$  is the number of corporate rating upgrades on one note by CRA  $c$  (i.e. Moody's, S&P, Fitch, DRBS measured separately) in country  $j$  in period  $t$ ;

$CC2_{cjt}^+$  is the number of corporate rating upgrades on two notes or more by CRA  $c$  (i.e. Moody's, S&P, Fitch, DRBS measured separately) in country  $j$  in period  $t$ ;

$CC1_{cjt}^-$  is the number of corporate rating downgrades on one note by CRA  $c$  (i.e. Moody's, S&P, Fitch, DRBS measured separately) in country  $j$  in period  $t$ ;

$CC2_{cjt}^-$  is the number of corporate rating downgrades on two notes or more by CRA  $c$  (i.e. Moody's, S&P, Fitch, DRBS measured separately) in country  $j$  in period  $t$ ;

$\Delta CR_{jt}$  is a sovereign credit rating change given by CRA  $c$  (i.e. Moody's, S&P, Fitch, DRBS measured separately) in country  $j$  in period  $t$ .

We investigate corporate-to-bank credit rating spillover effects separately for each agency. Next, banks have been divided into European and American categories. Third, to account for potential structural changes in the corporate-bank channel associated with the crisis, the models are separately estimated for the pre-crisis period versus the post-crisis period. The analysis has been prepared for each CRA separately.

As the second part of our robustness test, it was modified our original rating datasets by removing banks without rating actions and generating a new sample structure of companies, sovereigns, and bank ratings. Consistent with the test methodology employed by Williams et al. [2013], we then conducted a pooled regression with new model specifications as follows:

$$\Delta y_{it} = \mu_1 CC1_{cjt}^+ + \mu_2 CC2_{cjt}^+ + \mu_3 CC1_{cjt}^- + \mu_4 CC2_{cjt}^- + \pi \Delta CR_{jt} + \gamma Z_{it} + \delta(F * Z)_{it} + \rho \text{ crisis} + \varepsilon_{it}; \text{ where } \varepsilon_{it} \sim N(0,1).$$

where *crisis* means the dummy variable, where '1' indicates a crisis in the banking sector, and '0' otherwise.

For better understanding of the described relationship, the impact of lagged corporate credit rating changes and previous changes in banks' credit ratings was also tested. Consequently, dynamic ordered logit panel data models were employed, which are:

$$\Delta y_{it} = \vartheta_1 y_{it-1} + \vartheta_2 y_{it-2} + \alpha_1 CC1_{cjt-2}^+ + \alpha_2 CC2_{cjt-2}^+ + \alpha_3 CC1_{cjt-2}^- + \alpha_4 CC2_{cjt-2}^- + \theta \Delta CR_{jt-2} + \delta(F * Z)_{it} + \varepsilon_{it}; \text{ where } \varepsilon_{it} \sim N(0,1)$$

$$\Delta y_{it} = \vartheta_1 y_{it-1} + \vartheta_2 y_{it-2} + \mu_1 CC1_{cjt-2}^+ + \mu_2 CC2_{cjt-2}^+ + \mu_3 CC1_{cjt-2}^- + \mu_4 CC2_{cjt-2}^- + \pi \Delta CR_{jt-2} + \gamma Z_{it} + \delta(F * Z)_{it} + \rho \text{ crisis} + \varepsilon_{it}; \text{ where } \varepsilon_{it} \sim N(0,1).$$

The findings received necessitate testing the impact of the collective changes in corporate credit ratings on banks' credit ratings. This test has been separately devised for European and US banks, considering the direction of these changes. Consequently, the final version of the model is as follows:

$$\Delta y_{it} = \mu_1 sCC1_{cjt}^+ + \mu_2 sCC2_{cjt}^+ + \mu_3 sCC1_{cjt}^- + \mu_4 sCC2_{cjt}^- + \rho crisis + \varepsilon_{it}; \text{ where } \varepsilon_{it} \sim N(0,1)$$

where:

$\Delta y_{it}$  is the change in the unobservable latent variable that measures the change in the credit rating of bank  $i$  in period  $t$ ;

$sCC1_{cjt}^+$  is the sum of changes in corporate credit ratings provided by Moody's, S&P, Fitch, and DRBS if there is a one-degree corporate rating upgrade in country  $j$  in period  $t$ ;

$sCC2_{cjt}^+$  is the sum of changes in corporate credit ratings provided by Moody's, S&P, Fitch, and DRBS if there are at least two-degree corporate rating upgrades in country  $j$  in period  $t$ ;

$sCC1_{cjt}^-$  is the sum of changes in corporate credit ratings provided by Moody's, S&P, Fitch, and DRBS if there is a one-degree corporate rating downgrade in country  $j$  in period  $t$ ;

$sCC2_{cjt}^-$  is the sum of changes in corporate credit ratings provided by Moody's, S&P, Fitch, and DRBS if there are at least two-degree corporate rating downgrades in country  $j$  in period  $t$ ;

$crisis$  is a dummy variable, where '1' indicates a crisis in the banking sector, and '0' otherwise.

#### 4. Findings

The aim of the study is to analyse the impact of the spillover effect between European and American non-financial companies' long-term issuer credit ratings changes and banks' credit ratings (corporates-to-banks spillover effect), considering the moment of the business cycle and regional reactions. The first step of the analysis relies on testing the corporates-to-banks credit ratings spillover effect for a particular CRA. The results are presented in tables 2 and 3. The findings show that current credit ratings changes are closely connected with previous banks' credit ratings changes, indicating a dependence on prior credit ratings changes. This relationship is observed for S&P, Moody's, and Fitch, with the strongest relationship seen for S&P. In most cases, credit ratings exhibit low volatility, though slightly stronger volatility is observed for Fitch and Moody's over the analysed period due to negative coefficients. The strongest dependence on a country's credit ratings changes is observed for Moody's and Fitch, while insignificant reactions are observed for S&P and DRBS, likely due to the methodologies of the respective CRAs. The analysed agencies, especially the three largest ones, examine banks' macro profiles and consider similar lists of macroeconomic indicators used to assess a country's credit ratings. The models presented in the paper show a significant impact of corporate credit ratings downgrades on banks' ratings changes, especially in the current period. The reaction in the case of S&P and Moody's is similar, while the strongest impact is observed for Fitch. A statistically significant impact is observed for S&P when there is a two-quarters lagged corporate credit ratings downgrade. Apart from Fitch, similar strength reactions are observed for one and two or more credit ratings declines. For S&P, an upgrade of non-financial companies' credit ratings is noticed if the agency decides to raise notes by one degree, both for the current and lagged ratings impact. However, for Fitch, a statistically

---

significant reaction is observed when the agency decides to upgrade firms' notes by at least two degrees. Moody's banks' credit ratings are most sensitive to increases in corporate notes by at least two degrees, with a higher reaction observed for two quarters lagged changes. In the case of DRBS, the corporates-to-banks credit ratings spillover effect has not been observed. The presented findings suggest several points. First, banks' notes react more strongly to downgrades of corporate credit ratings than to upgrades. This aligns with the perspective theory. Additionally, there is a noted lagged reaction to upgrades of corporate credit ratings, while banks' credit ratings react promptly to current downgrades of company notes. This is connected to the apprehension regarding negative information and the quicker response to it. The strength and significance of the spillover effect from corporate to bank credit ratings are linked to the size and reputation of the CRA. Furthermore, there is observed variation in the reaction to changes in a country's credit ratings on banks' credit ratings. In the case of corporate credit rating downgrades, a statistically significant reaction is observed if the agency decides to make changes on at least one note. For upgrades of non-financial companies' notes, a stronger reaction from the agency, with at least two degrees of note increases, is needed to observe the spillover effect on corporate-to-bank credit ratings.

**Table 2.** The spillover effect of corporate-to-bank credit ratings on S&P and Moody’s credit ratings.

$\Delta y_{it}$	S&P																Moody																	
	Coef.	P>z	Coef.	P>z	Coef.	P>z	Coef.	P>z	Coef.	P>z	Coef.	P>z	Coef.	P>z	Coef.	P>z	Coef.	P>z	Coef.	P>z	Coef.	P>z	Coef.	P>z	Coef.	P>z	Coef.	P>z	Coef.	P>z				
$\Delta y_{it}$																																		
L1.	0.06	0.00						0.06	0.00					0.06	0.00					-0.06	0.00					-0.02	0.00					-0.02	0.00	
L2.	0.05	0.00						0.05	0.00					0.05	0.00					0.00	0.85					0.06	0.00					0.06	0.00	
$\Delta CR_{jt}$			-0.01	0.37												0.34	0.00																	
L1.	0.00	0.98																		0.30	0.00													
$CC2^-_{cjt}$			0.04	0.00	0.03	0.01			-0.02	0.00						0.02	0.13				0.00	0.65			-0.02	0.00								
L1.	0.05	0.06					0.03	0.11					0.02	0.00					0.04	0.00				0.02	0.00		0.00	0.11						
$CC1^-_{cjt}$			0.03	0.00	0.02	0.00			0.03	0.00						0.01	0.47				0.00	0.45			0.02	0.00								
L1.	0.00	0.55							0.01	0.18				0.01	0.14					-0.02	0.07				-0.01	0.11			-0.01	0.28				
$CC1^+_{cjt}$			-0.02	0.00	-0.02	0.00							-0.01	0.00			0.00	0.77				0.00	0.56							0.01	0.13			
L1.	-0.01	0.24					0.00	0.51						0.01	0.01					-0.10	0.00				-0.09	0.00					-0.08	0.00		
$CC2^+_{cjt}$			-0.03	0.27	-0.03	0.28							-0.02	0.52			-0.02	0.00				-0.01	0.00							-0.01	0.00			
L1.	-0.03	0.50					-0.03	0.51							-0.02	0.65				0.02	0.00				0.03	0.00						0.03	0.00	
/cut1	-9.89	0.00	-7.94	0.00	-7.91	0.00	-9.99	0.00	-7.89	0.00	-9.99	0.00	-7.95	0.00	-10	0.00	-11.1	0.00	-10.9	0.00	-10.8	0.00	-10.7	0.00	-10.8	0.00	-10.7	0.00	-10.8	0.00	-10.8	0.00	-10.8	0.00
/cut2	-9.48	0.00	-7.82	0.00	-7.82	0.00	-9.59	0.00	-7.80	0.00	-9.58	0.00	-7.86	0.00	-9.60	0.00	-9.70	0.00	-10.2	0.00	-10.1	0.00	-9.63	0.00	-10.1	0.00	-9.67	0.00	-10.1	0.00	-9.70	0.00	-9.70	0.00
/cut3	-8.63	0.00	-7.55	0.00	-7.55	0.00	-9.30	0.00	-7.54	0.00	-9.30	0.00	-7.59	0.00	-9.31	0.00	-8.78	0.00	-9.58	0.00	-8.87	0.00	-9.34	0.00	-8.90	0.00	-9.38	0.00	-8.91	0.00	-9.41	0.00	-9.41	0.00
/cut4	-8.18	0.00	-7.01	0.00	-5.01	0.00	-8.61	0.00	-5.00	0.00	-8.60	0.00	-5.05	0.00	-8.62	0.00	-8.68	0.00	-9.36	0.00	-8.04	0.00	-8.94	0.00	-8.08	0.00	-8.97	0.00	-8.09	0.00	-9.01	0.00	-9.01	0.00
/cut5	-7.81	0.00	-6.52	0.00	-4.55	0.00	-8.20	0.00	-4.53	0.00	-8.20	0.00	-4.59	0.00	-8.22	0.00	-8.31	0.00	-8.33	0.00	-7.87	0.00	-8.65	0.00	-7.90	0.00	-8.68	0.00	-7.91	0.00	-8.72	0.00	-8.72	0.00
/cut6	-7.49	0.00	-6.08	0.00	-4.39	0.00	-7.79	0.00	-4.38	0.00	-7.79	0.00	-4.43	0.00	-7.81	0.00	-8.14	0.00	-6.78	0.00	-7.59	0.00	-7.89	0.00	-7.63	0.00	-7.93	0.00	-7.64	0.00	-7.97	0.00	-7.97	0.00
/cut7	-7.11	0.00	-5.92	0.00	-4.36	0.00	-7.51	0.00	-4.34	0.00	-7.50	0.00	-4.40	0.00	-7.52	0.00	-7.99	0.00	-6.67	0.00	-7.41	0.00	-6.55	0.00	-7.45	0.00	-6.59	0.00	-7.46	0.00	-6.62	0.00	-6.62	0.00
/cut8	-7.00	0.00	-5.80	0.00	-4.33	0.00	-7.16	0.00	-4.31	0.00	-7.16	0.00	-4.37	0.00	-7.17	0.00	-7.90	0.00	-5.88	0.00	-7.23	0.00	-6.43	0.00	-7.26	0.00	-6.47	0.00	-7.27	0.00	-6.51	0.00	-6.51	0.00
/cut9	-6.73	0.00	-5.65	0.00	-4.29	0.00	-7.05	0.00	-4.28	0.00	-7.04	0.00	-4.33	0.00	-7.06	0.00	-7.79	0.00	-4.43	0.00	-7.12	0.00	-5.69	0.00	-7.16	0.00	-5.73	0.00	-7.17	0.00	-5.76	0.00	-5.76	0.00
/cut10	-6.61	0.00	-5.49	0.00	-4.26	0.00	-6.79	0.00	-4.24	0.00	-6.79	0.00	-4.30	0.00	-6.81	0.00	-7.71	0.00	-3.08	0.00	-7.00	0.00	-4.35	0.00	-7.04	0.00	-4.38	0.00	-7.05	0.00	-4.42	0.00	-4.42	0.00

/cut11	-6.33	0.00	-5.39	0.00	-4.23	0.00	-6.66	0.00	-4.21	0.00	-6.66	0.00	-4.27	0.00	-6.67	0.00	-7.62	0.00	3.19	0.00	-6.94	0.00	-3.05	0.00	-6.98	0.00	-3.09	0.00	-6.99	0.00	-3.12	0.00
/cut12	-6.17	0.00	-5.30	0.00	-4.21	0.00	-6.39	0.00	-4.19	0.00	-6.39	0.00	-4.25	0.00	-6.41	0.00	-7.58	0.00	3.87	0.00	-6.88	0.00	3.33	0.00	-6.92	0.00	3.27	0.00	-6.93	0.00	3.26	0.00
/cut13	-5.95	0.00	-5.16	0.00	-4.16	0.00	-6.24	0.00	-4.14	0.00	-6.24	0.00	-4.20	0.00	-6.26	0.00	-7.56	0.00	4.85	0.00	-6.86	0.00	4.03	0.00	-6.90	0.00	3.97	0.00	-6.91	0.00	3.96	0.00
/cut14	-5.30	0.00	-5.05	0.00	-4.12	0.00	-6.03	0.00	-4.11	0.00	-6.03	0.00	-4.17	0.00	-6.04	0.00	-7.32	0.00	7.94	0.00	-6.82	0.00	5.01	0.00	-6.86	0.00	4.95	0.00	-6.87	0.00	4.94	0.00
/cut15	-4.92	0.00	-4.97	0.00	-4.10	0.00	-5.39	0.00	-4.08	0.00	-5.38	0.00	-4.14	0.00	-5.40	0.00	-6.53	0.00	8.30	0.00	-6.67	0.00	7.94	0.00	-6.70	0.00	7.88	0.00	-6.71	0.00	7.86	0.00
/cut16	-3.94	0.00	-4.86	0.00	-4.05	0.00	-5.01	0.00	-4.04	0.00	-5.01	0.00	-4.10	0.00	-5.03	0.00	-6.41	0.00			-6.08	0.00	8.22	0.00	-6.12	0.00	8.16	0.00	-6.13	0.00	8.15	0.00
/cut17	-2.87	0.00	-4.61	0.00	-3.95	0.00	-4.01	0.00	-3.94	0.00	-4.00	0.00	-3.99	0.00	-4.02	0.00	-5.72	0.00			-5.98	0.00	9.73	0.00	-6.02	0.00	9.67	0.00	-6.03	0.00	9.66	0.00
/cut18	3.23	0.00	-4.40	0.00	-3.85	0.00	-2.85	0.00	-3.83	0.00	-2.85	0.00	-3.89	0.00	-2.87	0.00	-4.30	0.00			-5.44	0.00	10.42	0.00	-5.47	0.00	10.36	0.00	-5.48	0.00	10.35	0.00
/cut19	6.15	0.00	-3.61	0.00	-3.36	0.00	3.27	0.00	-3.34	0.00	3.27	0.00	-3.40	0.00	3.25	0.00	-2.93	0.00			-4.18	0.00			-4.21	0.00			-4.22	0.00		
/cut20	6.43	0.00	-2.41	0.00	-2.20	0.00	6.26	0.00	-2.19	0.00	6.26	0.00	-2.24	0.00	6.25	0.00	3.17	0.00			-2.85	0.00			-2.88	0.00			-2.89	0.00		
/cut21	6.55	0.00	2.91	0.00	2.63	0.00	6.54	0.00	2.64	0.00	6.54	0.00	2.58	0.00	6.53	0.00	4.10	0.00			3.06	0.00			3.01	0.00			3.01	0.00		
/cut22	8.35	0.00	5.65	0.00	5.66	0.00	6.68	0.00	5.67	0.00	6.68	0.00	5.61	0.00	6.66	0.00	5.10	0.00			4.06	0.00			4.01	0.00			4.01	0.00		
/cut23	9.45	0.00	6.19	0.00	6.12	0.00	8.47	0.00	6.13	0.00	8.48	0.00	6.07	0.00	8.46	0.00	8.21	0.00			5.07	0.00			5.03	0.00			5.02	0.00		
/cut24	9.85	0.00	6.37	0.00	6.27	0.00	9.57	0.00	6.29	0.00	9.57	0.00	6.22	0.00	9.56	0.00	8.57	0.00			8.03	0.00			7.98	0.00			7.98	0.00		
/cut25	10.54	0.00	7.24	0.00	6.87	0.00	9.98	0.00	6.88	0.00	9.98	0.00	6.82	0.00	9.96	0.00					8.32	0.00			8.27	0.00			8.27	0.00		
/cut26			7.54	0.00	7.03	0.00	10.67	0.00	7.04	0.00	10.67	0.00	6.98	0.00	10.65	0.00					9.82	0.00			9.78	0.00			9.77	0.00		
/cut27			7.58	0.00	7.05	0.00			7.06	0.00			7.00	0.00							10.51	0.00			10.47	0.00			10.47	0.00		
/cut28			7.71	0.00	7.11	0.00			7.12	0.00			7.06	0.00																		
/cut29			7.80	0.00	7.15	0.00			7.17	0.00			7.11	0.00																		
/cut30			7.86	0.00	7.18	0.00			7.19	0.00			7.13	0.00																		
/cut31			8.03	0.00	7.24	0.00			7.26	0.00			7.20	0.00																		
/cut32			8.09	0.00	7.29	0.00			7.31	0.00			7.25	0.00																		
/cut33			8.16	0.00	7.32	0.00			7.33	0.00			7.27	0.00																		
/cut34			8.24	0.00	7.34	0.00			7.36	0.00			7.30	0.00																		
/cut35			8.72	0.00	7.49	0.00			7.50	0.00			7.44	0.00																		
/cut36			10.11	0.00	7.55	0.00			7.56	0.00			7.50	0.00																		
/cut37					9.60	0.00			9.61	0.00			9.55	0.00																		
/cut38					10.29	0.00			10.30	0.00			10.24	0.00																		
/cut39					10.98	0.00			11.00	0.00			10.94	0.00																		
no obs	37234		47671		57587		41982		57587		41982		57587		41982		36732		33145		42056		37775		42056		37775		42056		37775	
no gr	765		1173		2510		832		2510		832		2510		832		666		540		718		567		718		567		718		567	
Wald	0		0		0		0		0		0		0		0		0		0		0		0		0		0		0		0	

---

$\Delta y_{it}$  is the change in the unobservable latent variable that measures the change in the credit rating of bank  $i$  in period  $t$ ;  $CC1_{cjt}^+$  is the number of corporate rating upgrades on one note by Moody's or S&P in country  $j$  in period  $t$ ;  $CC2_{cjt}^+$  is the number of corporate rating upgrades on two notes or more by Moody's or S&P in country  $j$  in period  $t$ ;  $CC1_{cjt}^-$  is the number of corporate rating downgrades on one note by Moody's or S&P in country  $j$  in period  $t$ ;  $CC2_{cjt}^-$  is the number of corporate rating downgrades on two notes or more by Moody's or S&P in country  $j$  in period  $t$ ;  $\Delta CR_{jt}$  is a sovereign credit rating change provided by Moody's or S&P in country  $j$  in period  $t$ . Source: Own elaboration.

**Table 3.** The spillover effect of corporate-to-bank credit ratings on Fitch and DRBS credit ratings.

$\Delta y_{it}$	Fitch																DRBS															
	Coef.	P>z	Coef.	P>z	Coef.	P>z	Coef.	P>z	Coef.	P>z	Coef.	P>z	Coef.	P>z	Coef.	P>z	Coef.	P>z	Coef.	P>z	Coef.	P>z	Coef.	P>z	Coef.	P>z	Coef.	P>z				
$\Delta y_{it}$																																
L1.			-0.02	0.00			-0.02	0.00			-0.02	0.00			-0.02	0.00			-0.01	0.51			-0.01	0.51			-0.01	0.51				
L2.			-0.01	0.03			-0.01	0.02			-0.01	0.02			-0.01	0.02			-0.01	0.51			-0.01	0.51			-0.01	0.51				
$\Delta CR_{jt}$	0.00	0.06															0.05	0.98														
L1.			0.00	0.03																												
$CC2_{cjt}^-$	0.00	0.12			-0.01	0.00			-0.01	0.00							-0.12	0.81	0.02	0.94			0.03	0.90								
L1.			0.01	0.00			0.00	0.60			0.00	0.59									-0.05	0.77			-0.04	0.77						
$CC1_{cjt}^-$	-0.35	0.06			-0.26	0.10			-0.30	0.00							-0.04	0.95	-0.01	0.98			-0.11	0.32								
L1.			-0.19	0.55			-0.17	0.56			-0.10	0.59									-0.03	0.95			-0.06	0.46						
$CC1_{cjt}^+$	-0.35	0.20			-0.20	0.43							-0.09	0.70			-0.04	0.94	0.00	0.99					0.00	0.99						
L1.			-0.66	0.11			-0.62	0.13							-0.57	0.15					0.01	0.97					-0.02	0.96				
$CC2_{cjt}^+$	0.01	0.56			0.00	0.96							-0.01	0.08			0.07	0.87	-0.06	0.83					-0.07	0.76						
L1.			0.02	0.34			0.02	0.36							0.01	0.47					-0.04	0.93					-0.05	0.85				
/cut1	-9.89	0.00	-9.92	0.00	-8.25	0.00	-10.14	0.00	-8.25	0.00	-10.14	0.00	-8.15	0.00	-10.12	0.00	-7.87	0.00	-5.25	0.00	-5.09	0.00	-5.20	0.00	-5.06	0.00	-5.26	0.00	-5.10	0.00		
/cut2	-8.42	0.00	-9.51	0.00	-7.51	0.00	-9.74	0.00	-7.51	0.00	-9.74	0.00	-7.40	0.00	-9.72	0.00	-7.17	0.00	-5.22	0.00	-5.06	0.00	-5.17	0.00	-5.03	0.00	-5.23	0.00	-5.07	0.00		
/cut3	-5.79	0.00	-5.95	0.00	-5.72	0.00	-6.18	0.00	-5.72	0.00	-6.18	0.00	-5.62	0.00	-6.16	0.00	-6.48	0.00	-5.20	0.00	-5.01	0.00	-5.14	0.00	-4.97	0.00	-5.21	0.00	-5.02	0.00		
/cut4	-5.36	0.00	-5.36	0.00	-5.72	0.00	-5.58	0.00	-5.72	0.00	-5.58	0.00	-5.61	0.00	-5.57	0.00	-5.78	0.00	-5.14	0.00	-4.95	0.00	-5.09	0.00	-4.92	0.00	-5.15	0.00	-4.96	0.00		
/cut5	-4.13	0.00	-4.91	0.00	-5.31	0.00	-5.14	0.00	-5.31	0.00	-5.14	0.00	-5.20	0.00	-5.12	0.00	5.37	0.00	-5.09	0.00	-4.90	0.00	-5.03	0.00	-4.87	0.00	-5.10	0.00	-4.91	0.00		
/cut6	-4.12	0.00	-4.32	0.00	-4.18	0.00	-4.54	0.00	-4.18	0.00	-4.54	0.00	-4.08	0.00	-4.52	0.00			-5.04	0.00	-4.86	0.00	-4.98	0.00	-4.82	0.00	-5.05	0.00	-4.87	0.00		
/cut7	-3.88	0.00	-4.16	0.00	-4.13	0.00	-4.54	0.00	-4.13	0.00	-4.54	0.00	-4.02	0.00	-4.52	0.00			-4.99	0.00	-4.57	0.00	-4.94	0.00	-4.54	0.00	-5.00	0.00	-4.58	0.00		
/cut8	-3.88	0.00	-4.16	0.00	-3.90	0.00	-4.39	0.00	-3.90	0.00	-4.39	0.00	-3.80	0.00	-4.37	0.00			-4.97	0.00	5.41	0.00	-4.92	0.00	5.45	0.00	-4.98	0.00	5.41	0.00		
/cut9	-3.80	0.00	-4.13	0.00	-3.90	0.00	-4.38	0.00	-3.90	0.00	-4.38	0.00	-3.79	0.00	-4.37	0.00			-4.95	0.00			-4.89	0.00			-4.96	0.00				
/cut10	-3.80	0.00	-4.12	0.00	-3.82	0.00	-4.35	0.00	-3.81	0.00	-4.35	0.00	-3.71	0.00	-4.33	0.00			-4.68	0.00			-4.62	0.00			-4.69	0.00				



/cut11	-3.78	0.00	-4.11	0.00	-3.81	0.00	-4.35	0.00	-3.81	0.00	-4.35	0.00	-3.71	0.00	-4.33	0.00			5.43	0.00			5.48	0.00			5.42	0.00		
/cut12	-3.78	0.00	-4.10	0.00	-3.78	0.00	-4.34	0.00	-3.78	0.00	-4.34	0.00	-3.67	0.00	-4.32	0.00														
/cut13	-3.77	0.00	-4.09	0.00	-3.77	0.00	-4.32	0.00	-3.77	0.00	-4.32	0.00	-3.67	0.00	-4.30	0.00														
/cut14	-3.76	0.00	-4.09	0.00	-3.76	0.00	-4.32	0.00	-3.76	0.00	-4.32	0.00	-3.66	0.00	-4.30	0.00														
/cut15	-3.76	0.00	-4.09	0.00	-3.75	0.00	-4.31	0.00	-3.75	0.00	-4.31	0.00	-3.65	0.00	-4.30	0.00														
/cut16	-3.76	0.00	-4.09	0.00	-3.75	0.00	-4.31	0.00	-3.75	0.00	-4.31	0.00	-3.65	0.00	-4.29	0.00														
/cut17	-3.76	0.00	-3.92	0.00	-3.75	0.00	-4.31	0.00	-3.75	0.00	-4.31	0.00	-3.64	0.00	-4.29	0.00														
/cut18	-3.75	0.00	-3.90	0.00	-3.75	0.00	-4.30	0.00	-3.75	0.00	-4.30	0.00	-3.64	0.00	-4.28	0.00														
/cut19	-3.67	0.00	-3.90	0.00	-3.75	0.00	-4.26	0.00	-3.74	0.00	-4.26	0.00	-3.64	0.00	-4.24	0.00														
/cut20	-3.64	0.00	4.82	0.00	-3.75	0.00	-4.00	0.00	-3.74	0.00	-4.00	0.00	-3.64	0.00	-3.99	0.00														
/cut21	-3.64	0.00	4.83	0.00	-3.74	0.00	-3.88	0.00	-3.74	0.00	-3.88	0.00	-3.64	0.00	-3.86	0.00														
/cut22	4.65	0.00	4.93	0.00	-3.74	0.00	-3.84	0.00	-3.74	0.00	-3.84	0.00	-3.64	0.00	-3.82	0.00														
/cut23	4.66	0.00	8.08	0.00	-3.74	0.00	-3.80	0.00	-3.74	0.00	-3.80	0.00	-3.64	0.00	-3.78	0.00														
/cut24	4.76	0.00	8.14	0.00	-3.74	0.00	4.57	0.00	-3.74	0.00	4.57	0.00	-3.63	0.00	4.59	0.00														
/cut25	4.76	0.00	8.21	0.00	-3.73	0.00	4.60	0.00	-3.73	0.00	4.60	0.00	-3.63	0.00	4.61	0.00														
/cut26	7.94	0.00	8.28	0.00	-3.73	0.00	4.69	0.00	-3.73	0.00	4.69	0.00	-3.63	0.00	4.71	0.00														
/cut27	8.05	0.00	8.35	0.00	-3.71	0.00	7.17	0.00	-3.71	0.00	7.17	0.00	-3.61	0.00	7.19	0.00														
/cut28	8.12	0.00			-3.71	0.00	7.45	0.00	-3.71	0.00	7.45	0.00	-3.61	0.00	7.47	0.00														
/cut29	8.18	0.00			-3.59	0.00	7.91	0.00	-3.59	0.00	7.91	0.00	-3.49	0.00	7.93	0.00														
/cut30	8.25	0.00			-3.51	0.00	7.97	0.00	-3.51	0.00	7.96	0.00	-3.41	0.00	7.98	0.00														
/cut31	8.32	0.00			-3.51	0.00	8.02	0.00	-3.51	0.00	8.02	0.00	-3.41	0.00	8.04	0.00														
/cut32					-3.48	0.00	8.08	0.00	-3.48	0.00	8.08	0.00	-3.37	0.00	8.10	0.00														
/cut33					-3.45	0.00	8.15	0.00	-3.44	0.00	8.15	0.00	-3.34	0.00	8.17	0.00														
/cut34					4.39	0.00	8.22	0.00	4.39	0.00	8.22	0.00	4.49	0.00	8.24	0.00														
/cut35					4.45	0.00	8.29	0.00	4.45	0.00	8.29	0.00	4.55	0.00	8.31	0.00														
/cut36					4.60	0.00			4.60	0.00			4.69	0.00																
/cut37					4.60	0.00			4.60	0.00			4.69	0.00																
/cut38					4.60	0.00			4.60	0.00			4.70	0.00																
/cut39					6.69	0.00			6.69	0.00			6.79	0.00																
/cut40					7.27	0.00			7.27	0.00			7.37	0.00																
/cut41					7.64	0.00			7.64	0.00			7.74	0.00																
/cut42					7.68	0.00			7.68	0.00			7.78	0.00																
/cut43					7.85	0.00			7.70	0.00			7.94	0.00																



---

The next part of the analysis relies on testing the spillover effect of corporates-to-banks credit ratings, considering the phase of the business cycle. This will help assess the strength of the reaction during the initial stages of a crisis and differences observed during the GFC period, as well as the stability of the financial market during the COVID-19 pandemic. The results obtained are presented in tables 4 to 6.

As mentioned previously, the spillover effect of corporate-to-bank credit ratings has not been observed in the case of DRBS credit ratings. Additionally, dividing according to the business cycle moment does not facilitate the observation of this phenomenon. Regarding changes in Fitch credit ratings over recent years, there has been a noticeable low volatility in the credit ratings changes made by the agency. Consequently, it has only been possible to investigate this phenomenon for the period of the GFC. However, during this period, the corporate-to-bank credit ratings spillover effect was not observed.

In the case of S&P's subsample, the lagged variables do not exert a statistically significant influence on assessing the spillover effect of corporates-to-banks credit ratings during the GFC period, both in the case of upgrades and downgrades of notes. A stronger reaction is observed in the case of downgrades of corporates' notes compared to upgrades. However, if the companies' ratings were increased by at least two degrees, the banks' ratings rose more strongly. For the Moody's subsample, a statistically significant impact of both current and lagged changes in corporates' credit ratings has been observed on banks' notes. In both cases of upgrades and downgrades, the reaction is stronger to the previous changes in companies' credit ratings. This suggests a prolonged impact of the spillover effect of corporates-to-banks credit ratings. Similar to the previous case, the reaction is stronger for downgrades, although the differences are smaller. Generally, the reaction is stronger for Moody's subsamples than for S&P's, but the differences are marginal.

The comparison of how banks' note changes react to agencies' decisions regarding corporate credit ratings reveals that during the COVID-19 pandemic, the Moody's subsample did not exhibit a spillover effect from corporates to banks' credit ratings. However, in the case of the S&P's subsample, a stronger reaction was observed during the COVID-19 pandemic compared to the GFC period. There was a statistically significant impact observed on the downgrades of non-financial companies' notes, particularly when the agency decided to decrease a firm's ratings on one note as opposed to at least two. This suggests concerns about the spillover effect on the financial market and a recurrence of conditions similar to the GFC. Conversely, for upgrades, a statistically significant impact was noticed only for notes upgraded by one degree. The analysis of the situation during the stability period in the financial markets between these crises shows that, in both cases, the spillover effect of corporate-to-bank credit ratings is weaker than during the crisis. This suggests the procyclical nature of the phenomenon mentioned. In the case of S&P, there is a statistically significant impact of at least a two-degree downgrade of firms' ratings on banks' notes. Upgrades have a significant impact if the ratings are higher on the one note. The analysed spillover effect is observed for current credit ratings changes. Previous decisions regarding upgrades of companies' notes and current downgrades of them are important for Moody's banks' credit ratings changes. The reaction is stronger for upgrades of notes than for downgrades in the case of the Moody's subsample.



/cut14	-4.11	0.00			-4.03	0.00			-4.15	0.00			-3.87	0.00	-4.89	0.00	-3.84	0.00	-4.88	0.00	-3.84	0.00	-4.87	0.00	9.66	0.00			9.57	0.00	9.42	0.00			
/cut15	-4.07	0.00			-3.99	0.00			-4.11	0.00			-3.81	0.00	-4.44	0.00	-3.78	0.00	-4.43	0.00	-3.78	0.00	-4.43	0.00	9.79	0.00			9.71	0.00	9.55	0.00			
/cut16	-3.25	0.00			-3.18	0.00			-3.30	0.00			-3.66	0.00	-3.36	0.00	-3.63	0.00	-3.35	0.00	-3.63	0.00	-3.34	0.00	11.74	0.00			11.65	0.00	11.50	0.00			
/cut17	-1.84	0.00			-1.77	0.00			-1.89	0.00			-3.53	0.00	-2.46	0.00	-3.49	0.00	-2.44	0.00	-3.49	0.00	-2.44	0.00											
/cut18	4.02	0.00			4.13	0.00			4.01	0.00			-2.98	0.00	3.23	0.00	-2.94	0.00	3.24	0.00	-2.94	0.00	3.24	0.00											
/cut19	5.45	0.00			5.56	0.00			5.44	0.00			-2.14	0.00	5.67	0.00	-2.11	0.00	5.68	0.00	-2.11	0.00	5.69	0.00											
/cut20	7.24	0.00			7.36	0.00			7.24	0.00			2.31	0.00	5.88	0.00	2.34	0.00	5.89	0.00	2.34	0.00	5.89	0.00											
/cut21	8.63	0.00			8.75	0.00			8.62	0.00			5.61	0.00	6.02	0.00	5.64	0.00	6.04	0.00	5.64	0.00	6.04	0.00											
/cut22													5.88	0.00	9.14	0.00	5.90	0.00	9.15	0.00	5.90	0.00	9.16	0.00											
/cut23													5.99	0.00	9.83	0.00	6.02	0.00	9.84	0.00	6.02	0.00	9.85	0.00											
/cut24													7.26	0.00			7.29	0.00			7.29	0.00													
/cut25													7.32	0.00			7.35	0.00			7.35	0.00													
/cut26													7.38	0.00			7.41	0.00			7.41	0.00													
/cut27													7.52	0.00			7.54	0.00			7.54	0.00													
/cut28													7.59	0.00			7.62	0.00			7.62	0.00													
/cut29													7.76	0.00			7.79	0.00			7.78	0.00													
/cut30													7.96	0.00			7.99	0.00			7.99	0.00													
/cut31													8.08	0.00			8.10	0.00			8.10	0.00													
/cut32													8.21	0.00			8.24	0.00			8.24	0.00													
/cut33													8.55	0.00			8.57	0.00			8.57	0.00													
/cut34													9.06	0.00			9.09	0.00			9.08	0.00													
no obs	5258		3863		5258		3863		5258		3863		27093		19429		27093		19429		27093		19429		7232		6208		7232		7232		6208		
no gr	1417		550		1417		550		1417		550		2332		797		2332		797		2332		797		1686		660		1686		1686		660		
Wald	0		0.0138		0		0.0042		0		0.0051		0		0		0.0001		0		0		0		0		0		0		0		0		0.0912

$\Delta y_{it}$  is a change of the unobservable latent variable that measures the change of credit rating of a bank  $i$  in period  $t$ ;  $CC1_{cjt}^+$  is a number of corporates' ratings upgrade on one note by S&P in country  $j$  in period  $t$ ;  $CC2_{cjt}^+$  is the number of corporate rating upgrades on two notes or more by S&P in country  $j$  in period  $t$ ;  $CC1_{cjt}^-$  is the number of corporate rating downgrades on one note by S&P in country  $j$  in period  $t$ ;  $CC2_{cjt}^-$  is the number of corporate rating downgrades on two notes or more by S&P in country  $j$  in period  $t$ ;

Source: Own elaboration.



/cut20										4.15	0.00				4.08	0.00					4.03	0.00															
/cut21										4.41	0.00				4.34	0.00							4.28	0.00													
/cut22										7.61	0.00				7.54	0.00							7.48	0.00													
/cut23										9.11	0.00				9.04	0.00							8.98	0.00													
/cut24										9.81	0.00				9.74	0.00							9.68	0.00													
no obs	3655		3443		3655		3443		3655		3443		18423		16713		18423		16713		18423		16713		5237		4389		5237		4389		5237		4389		
no gr	518		441		518		441		518		441		661		514		661		514		661		514		638		487		638		487		638		487		
Wald	0		0		0		0		0		0		0		0		0		0		0		0		0.0013		0.8194		0.0003		0.7595		0.0280		0.8503		

$\Delta y_{it}$  is a change of the unobservable latent variable that measures the change of credit rating of a bank  $i$  in period  $t$ ;  $CC1_{cjt}^+$  is a number of corporates' ratings upgrade on one note by Moody's in country  $j$  in period  $t$ ;  $CC2_{cjt}^+$  s the number of corporate rating upgrades on two notes or more by Moody's in country  $j$  in period  $t$ ;  $CC1_{cjt}^-$  is the number of corporate rating downgrades on one note by Moody's in country  $j$  in period  $t$ ;  $CC2_{cjt}^-$  is the number of corporate rating downgrades on two notes or more by Moody's in country  $j$  in period  $t$ ; Source: Own elaboration.

**Table 6.** The spillover effect of corporate-to-bank credit ratings for Fitch and DRBS credit ratings, considering the business cycle phase.

$\Delta y_{it}$	Fitch												DRBS																									
	GFC												GFC								between																	
	Coef.	P>z	Coef.	P>z	Coef.	P>z	Coef.	P>z	Coef.	P>z	Coef.	P>z	Coef.	P>z	Coef.	P>z	Coef.	P>z	Coef.	P>z	Coef.	P>z	Coef.	P>z	Coef.	P>z	Coef.	P>z	Coef.	P>z	Coef.	P>z						
L1.																																						
L2.			-0.30	1.00			-0.20	1.00			-0.22	1.00			0.68	0.01			0.68	0.01	0.68	0.01			-0.02	0.61			-0.02	0.60			-0.02	0.60				
			-0.01	0.28			-0.01	0.28			-0.02	0.31			1.09	0.01			1.09	0.01	1.09	0.01			-0.01	0.75			-0.01	0.75			-0.01	0.75				
$CC2_{cjt}^-$																																						
L1.	-0.04	0.00			-0.04	0.00							30.11	1.00			30.11	1.00					-0.02	0.93			-0.03	0.87										
			-0.09	0.00			-0.09	0.00							20.06	1.00			20.06	1.00					-0.07	0.67			-0.06	0.68								
$CC1_{cjt}^-$																																						
L1.	-0.78	0.94			0.95	0.89							-10.	1.00			-10	1.00					-0.13	0.82			0.08	0.46										
			18.31	1.00			13.00	1.00							-6.67	1.00			-6.67	1.00					-0.18	0.78			0.11	0.26								
$CC1_{cjt}^+$																																						
L1.	-0.74	0.92							-0.52	0.93			0.00												-0.01	0.99							-16.3	.				
			-71.7	1.00								-55.56	1.00			0.00																			-0.05	0.90		
$CC2_{cjt}^+$																																						

L1.	0.05	0.81							0.04	0.72			0.00								0.16	0.70							9.55	0.93				
			6.66	1.00							5.21	1.00			0.00						-23.53	1.00			0.20	0.70					0.10	0.76		
/cut1	-11.22	0.00	-6.79	0.00	-11.22	0.00	-6.79	0.00	-10.71	0.00	-5.33	0.00	-8.01	0.00	-4.35	0.00	-8.01	0.00	-4.35	0.00	-27.87	1.00	-7.54	0.00	-7.37	0.00	-7.68	0.00	-7.56	0.00	-14.9	0.99	-7.46	0.00
/cut2	-7.98	0.00	-6.75	0.00	-7.98	0.00	-6.75	0.00	-7.47	0.00	-5.29	0.00	-5.93	0.01			-5.93	0.01					-6.85	0.00	-6.27	0.00	-6.98	0.00	-6.46	0.00	14.90	0.89	-6.36	0.00
/cut3	-7.93	0.00			-7.94	0.00			-7.43	0.00													-6.15	0.00	-5.76	0.00	-6.29	0.00	-5.94	0.00			-5.84	0.00
/cut4	-7.36	0.00			-7.36	0.00			-6.85	0.00													-5.75	0.00	-5.42	0.00	-5.88	0.00	-5.61	0.00			-5.51	0.00
/cut5	-6.49	0.00			-6.49	0.00			-5.97	0.00													-5.46	0.00	-5.17	0.00	-5.59	0.00	-5.35	0.00			-5.25	0.00
/cut6	-6.47	0.00			-6.48	0.00			-5.96	0.00													-5.23	0.00	-4.42	0.00	-5.37	0.00	-4.60	0.00			-4.50	0.00
/cut7	-6.46	0.00			-6.46	0.00			-5.95	0.00													-5.14	0.00			-5.27	0.00	5.51	0.00			5.61	0.00
/cut8	-6.45	0.00			-6.45	0.00			-5.93	0.00													-4.49	0.00			-4.62	0.00						
/cut9	10.79	0.00			3.55	0.00			11.54	0.00																								
no obs	6235		5148		6235		5148		6235		5148		427		420		427		420		420		2587		2413		2587		2413		773		2413	
no gr	1427		690		1427		690		1427		690		55		55		55		55		55		115		97		115		97		56		97	
Wald	0.0479		0		0.0085		0		0.9213		0.9016		1		0.0216		1		0.0216		0.0216		0.8380		0.9047		0.5279		0.7412				0.7592	

$\Delta y_{it}$  is the change in the unobservable latent variable that measures the change in the credit rating of bank  $i$  in period  $t$ ;  $CC1_{cjt}^+$  is the number of corporate rating upgrades on one note by Fitch or DRBS in country  $j$  in period  $t$ ;  $CC2_{cjt}^+$  is the number of corporate rating upgrades on two notes or more by Fitch or DRBS in country  $j$  in period  $t$ ;  $CC1_{cjt}^-$  is the number of corporate rating downgrades on one note by Fitch or DRBS in country  $j$  in period  $t$ ;  $CC2_{cjt}^-$  is the number of corporate rating downgrades on two notes or more by Fitch or DRBS in country  $j$  in period  $t$ . Source: Own elaboration.



---

The next part of the analysis relies on testing the corporate-to-bank credit ratings spillover effect by considering the phase of the business cycle and regional location. The aim of the analysis is to examine the procyclical effect and its significance in the US and Europe. The findings are presented in Tables 7 and 8. Similar to the previous case, the analysed phenomenon has not been observed for the DRBS notes, both for upgrades and downgrades. However, in the Fitch subsample, a statistically significant impact has been observed regarding the lagged decisions made two quarters prior to downgrades, which affected the credit ratings of corporates on European banks' notes during the GFC crisis. The reaction of European banks during the GFC period was stronger than for the entire sample. For S&P, similar to the entire sample, the most significant impact is from current changes. A stronger reaction is noted for downgrades than for upgrades, especially if the agency decided to decrease corporates' ratings on at least two notes. In the case of Moody's, the reaction is stronger for upgrades of companies' ratings than for downgrades, for both lagged and current agency decisions. A comparison between the GFC period and the COVID-19 pandemic shows a stronger reaction during the COVID-19 crisis for European banks, both for S&P and Moody's, with S&P's bank notes being more sensitive. During stable periods, the corporate-to-bank credit ratings spillover effect has not been observed for US banks. The reaction of European banks is weaker than during the crisis period, confirming previous results.

**Table 7.** The spillover effect of corporate-to-bank credit ratings for S&P and Moody's credit ratings, considering the business cycle phase and regional location.

$\Delta y_{it}$	S&P																Moody															
	GFC				between								COVID-19				GFC				between						COVID-19					
	Europe				Europe				US				Europe				Europe				US		Europe		Europe							
	Coef.	P>z	Coef.	P>z	Coef.	P>z	Coef.	P>z	Coef.	P>z	Coef.	P>z	Coef.	P>z	Coef.	P>z	Coef.	P>z	Coef.	P>z	Coef.	P>z	Coef.	P>z	Coef.	P>z	Coef.	P>z	Coef.	P>z	Coef.	P>z
$\Delta y_{it}$																																
L1.			0.04	0.02			0.06	0.00			0.02	0.42			-0.03	0.06			-0.15	0.01			-0.01	0.89							-0.08	0.56
L2.			0.06	0.00			0.04	0.00			0.02	0.43			-0.03	0.27			0.06	0.21			-0.01	0.89							-0.09	0.51
$CC2_{cjt}^-$	0.20	0.00			0.06	0.00			-0.03	0.97			-0.21	0.00			-0.03	0.15			0.00	0.99			0.06	0.00	0.06	0.12				
L1.			0.12	0.31			0.01	0.68			-0.04	0.97			-0.03	0.67			-0.07	0.01			0.00	1.00							-0.12	0.03
$CC1_{cjt}^-$	0.03	0.03			-0.02	0.01			0.04	0.96			0.33	0.00			0.09	0.00			0.01	0.99			-0.05	0.00	-0.12	0.01				
L1.			0.03	0.09			-0.03	0.00			0.04	0.97			0.16	0.00			0.08	0.01			-0.01	0.99							0.21	0.00
$CC1_{cjt}^+$	-0.09	0.00			-0.03	0.00			0.00	0.98			0.13	0.00			-0.12	0.00			0.01	0.97			-0.02	0.02	0.00	0.92				
L1.			-0.03	0.51			-0.01	0.20			-0.01	0.98			0.00	0.91			0.31	0.01			0.02	0.95							0.00	0.98
$CC2_{cjt}^+$	-0.15	0.07			-0.01	0.76			0.01	0.98							0.12	0.00			0.00				-0.02	0.00	-0.03	0.15				
L1.			-0.12	0.44			0.15	0.26			0.02	0.97			-0.09	0.40			-0.01	0.82			0.00								0.04	0.21
/cut1	-6.11	0.00	-8.18	0.00	-8.61	0.00	-9.95	0.00	-7.23	0.02	-7.22	0.02	-0.46	0.00	-8.33	0.00	-6.47	0.00	-3.92	0.00	-6.10	0.00	-6.20	0.00	-9.82	0.00	-9.33	0.00	-4.99	0.00		
/cut2	-5.90	0.00	-6.80	0.00	-8.42	0.00	-9.26	0.00	-6.54	0.02	-6.52	0.03	-5.69	0.00	-6.25	0.00	-5.55	0.00	-1.66	0.00	-5.69	0.00	-5.79	0.00	-8.44	0.00	-8.64	0.00	4.69	0.00		
/cut3	-5.63	0.00	-6.57	0.00	-4.47	0.00	-8.85	0.00	-5.85	0.04	-5.83	0.04	-4.64	0.00	-6.14	0.00	-5.37	0.00	12.46	0.00	-5.40	0.00	-5.51	0.00	-7.62	0.00	-8.23	0.00	8.97	0.00		
/cut4	-4.49	0.00	-6.39	0.00	-4.17	0.00	-8.57	0.00	-3.57	0.21	-3.61	0.20	-4.04	0.00	-6.03	0.00	-5.21	0.00			-3.55	0.04	-3.69	0.04	-7.42	0.00	-5.66	0.00				
/cut5	-4.37	0.00	-6.24	0.00	-4.12	0.00	-7.76	0.00	4.32	0.13	4.21	0.14	-3.99	0.00	-5.50	0.00	-5.08	0.00			4.49	0.01	4.50	0.01	-7.26	0.00	3.22	0.00				
/cut6	-4.33	0.00	-5.78	0.00	-4.09	0.00	-7.65	0.00	6.17	0.03	6.05	0.04	-3.87	0.00	-4.16	0.00	-4.86	0.00			5.19	0.00	5.20	0.00	-7.11	0.00	6.25	0.00				
/cut7	-4.30	0.00	-2.28	0.00	-4.06	0.00	-7.39	0.00	6.86	0.02	6.75	0.02	-3.86	0.00	3.52	0.00	-3.17	0.00			6.11	0.00	6.12	0.00	-6.93	0.00						
/cut8	-4.24	0.00	4.15	0.00	-4.04	0.00	-6.82	0.00	7.56	0.01	7.44	0.01	-3.83	0.00	6.81	0.00	-1.39	0.00			6.80	0.00	6.81	0.00	-6.68	0.00						
/cut9	-4.19	0.00	7.55	0.00	-4.02	0.00	-6.62	0.00					-3.81	0.00	8.75	0.00	10.50	0.00							-6.60	0.00						
/cut10	-4.16	0.00			-3.99	0.00	-6.14	0.00					-3.79	0.00											-6.49	0.00						
/cut11	-4.14	0.00			-3.96	0.00	-6.06	0.00					-3.73	0.00											-6.45	0.00						



**Table 8.** The spillover effect of corporate-to-bank credit ratings for Fitch and DRBS ratings, accounting for business cycle phases and regional location.

	Fitch				DRBS			
	GFC				between			
	Europe				US		Europe	
	Coef.	P>z	Coef.	P>z	Coef.	P>z	Coef.	P>z
$\Delta y_{it}$								
$\Delta y_{it}$								
L1.			-0.2044983	1.000	-0.0079409	0.763		
L2.			-0.0142787	0.275	-0.0051954	0.849		
$CC2_{cjt}^-$	-0.0412656	0.002					-0.130224	0.953
L1.			-0.0940024	0.000	.0057983	0.976		
$CC1_{cjt}^-$	-0.7771752	0.934					-0.0213918	0.991
L1.			14.48242	1.000	0			
$CC1_{cjt}^+$	-0.7344709	0.913					.1081462	0.946
L1.			-51.0892	0.999	0			
$CC2_{cjt}^+$	.0455212	0.803					.1959303	0.894
L1.			4.777016	0.998	0			
/cut1	-11.09184	0.000	-6.705012	0.000	-6.889572	0.000	-11.87495	0.053
/cut2	-7.850181	0.000			-5.788921	0.000	-11.08749	0.068
/cut3	-7.8101	0.000			-5.276052	0.000	-10.606	0.079
/cut4	-7.230362	0.000			-4.937533	0.000		
/cut5	-6.361773	0.000			-4.68417	0.000		
/cut6	-6.348823	0.000			-3.981759	0.000		
/cut7	-6.336002	0.000			4.328451	0.000		
/cut8	paž.93	0.000						
no obs	5904		4824		989		1582	
no gr	1383		647		26		89	
Wald	0.0490		0		0.9885		0.9514	

$\Delta y_{it}$  is the change in the unobservable latent variable that measures the change in the credit rating of bank  $i$  in period  $t$ ;  $CC1_{cjt}^+$  is the number of corporate rating upgrades on one note by Fitch or DRBS in country  $j$  in period  $t$ ;  $CC2_{cjt}^+$  is the number of corporate rating upgrades on two notes or more by Fitch or DRBS in country  $j$  in period  $t$ ;  $CC1_{cjt}^-$  is the number of corporate rating downgrades on one note by Fitch or DRBS in country  $j$  in period  $t$ ;  $CC2_{cjt}^-$  is the number of corporate rating downgrades on two notes or more by Fitch or DRBS in country  $j$  in period  $t$ . Source: Own elaboration.

The last part of the analysis relies on testing the spillover effect of corporate credit ratings on banks' credit ratings by considering the cumulative changes in credit ratings made by all assessed corporate entities on banks' ratings. This approach helps evaluate the significance of credit rating changes across all agencies affecting banks' ratings. The study examines how banks' ratings respond to changes in corporate ratings issued by other agencies, particularly during crisis periods as indicated by prior research. Consequently, the contagion effect is assessed using a crisis variable, specifically analysing crisis periods within the banking sector. The findings indicate that during banking crises, all banks' ratings tend to decrease. Moreover, there is a stronger reaction observed for S&P compared to Moody's and Fitch, confirming the procyclical nature of credit rating changes. This study reaffirms previous findings that suggest the absence of a spillover effect from corporate to banks' credit ratings for U.S. banks, even during crises. Therefore, a broad spillover effect from corporates to banks' credit ratings is also not observed. However, for European banks, significant impacts are noted, with downgrades in corporate ratings affecting banks' ratings by at least two degrees, and upgrades affecting

---

them by one degree in the case of S&P and Moody's samples, and by at least two degrees for Fitch ratings. The most pronounced reaction is observed for Moody's ratings, followed by S&P and Fitch. This study is based on current agency decisions, reflecting reactions during the same period of financial market crises. These results demonstrate that the spillover effect from corporates to banks' credit ratings is not only wide-ranging but also differs depending on the scope. For narrow effects, stronger reactions are noted for downgrades, whereas for broad effects, the stronger reactions are observed for upgrades.

**Table 9.** The impact of the cumulative changes in corporate credit ratings, as reported by all assessed agencies on changes in bank notes, accounting for business cycle phase and regional location.

$\Delta y_{it}$	S&P								Moody								Fitch							
	Europe				US				Europe				US				Europe				US			
	total		crisis		total		crisis		total		crisis		total		crisis		total		crisis		total		crisis	
	Coef.	P>z	Coef.	P>z	Coef.	P>z	Coef.	P>z	Coef.	P>z	Coef.	P>z	Coef.	P>z	Coef.	P>z	Coef.	P>z	Coef.	P>z	Coef.	P>z	Coef.	P>z
$sCC2_{cjt}^-$	0.02	0.02	0.05	0.07	0.01	0.85	0.00	0.86	-0.02	0.10	0.17	0.04	0.01	0.90	0.00	0.90	-0.02	0.07	-0.02	0.06	0.01	0.94	0.00	1.00
$sCC1_{cjt}^-$	-0.01	0.20	-0.01	0.88	-0.03	0.87			0.04	0.07	0.23	0.29	-0.02	0.92			0.02	0.41	0.02	0.38	-0.02	0.94	0.00	0.99
$sCC1_{cjt}^+$	-0.04	0.00	-0.07	0.03	-0.01	0.89			0.02	0.11	-0.25	0.00	-0.01	0.93			0.03	0.04	0.03	0.04	-0.01	0.95	0.00	0.99
$sCC2_{cjt}^+$	0.03	0.00	0.00	0.89					-0.01	0.04	0.03	0.32					-0.02	0.00	-0.02	0.00	-0.01	0.97	0.00	0.99
crisis	-1.22	0.00			-1.03	0.00			-0.70	0.00			-0.67	0.01			-0.52	0.00			-0.79	0.00		
/cut1	-7.57	0.00	-6.16	0.00	-7.62	0.00	-6.42	0.00	-10.40	0.00	-2.18	0.41	-6.94	0.00	-6.02	0.00	-8.29	0.00	-8.61	0.00	-8.10	0.01	-8.12	0.01
/cut2	-7.35	0.00	-5.06	0.00	-7.22	0.00	-5.73	0.00	-9.01	0.00	-1.48	0.56	-6.53	0.00	-5.32	0.00	-8.09	0.00	-8.40	0.00	-7.40	0.01	-7.42	0.02
/cut3	-3.50	0.00	-2.96	0.00	-6.71	0.00	-5.03	0.00	-8.45	0.00	-1.06	0.67	-6.24	0.00	-4.40	0.00	-6.64	0.00	-6.95	0.00	-6.48	0.02	-6.51	0.04
/cut4	-3.13	0.00	-2.87	0.00	-6.52	0.00	-4.81	0.00	-8.20	0.00	-0.07	0.98	-6.02	0.00	-3.80	0.00	-6.17	0.00	-6.49	0.00	-5.79	0.04	-5.81	0.06
/cut5	-3.08	0.00	-2.83	0.00	-5.36	0.00	-3.69	0.00	-8.00	0.00	1.55	0.53	-5.55	0.00	-2.55	0.00	-4.28	0.00	-4.62	0.00	-5.45	0.06	-5.47	0.08
/cut6	-3.07	0.00	-2.79	0.00	-3.76	0.00	-2.43	0.00	-7.84	0.00			-4.98	0.00	3.45	0.00	-4.20	0.00	-4.53	0.00	-5.04	0.08	-5.07	0.10
/cut7	-3.05	0.00	-2.77	0.00	3.70	0.00	3.77	0.00	-7.63	0.00			-3.60	0.00	4.50	0.00	-3.92	0.00	-4.27	0.00	-5.00	0.08	-5.02	0.11
/cut8	-3.03	0.00	-2.54	0.00	6.20	0.00	5.47	0.00	-7.57	0.00			3.72	0.00	5.42	0.00	-3.92	0.00	-4.26	0.00	-4.68	0.10	-4.71	0.13
/cut9	-3.02	0.00	-1.14	0.17	6.71	0.00	5.87	0.00	-7.10	0.00			5.09	0.00	6.12	0.00	-3.91	0.00	-4.26	0.00	-4.62	0.10	-4.64	0.14
/cut10	-3.01	0.00	7.38	0.00	7.81	0.00	6.57	0.00	-4.49	0.00			6.60	0.00			-3.89	0.00	-4.23	0.00	-4.32	0.13	-4.34	0.16
/cut11	-3.01	0.00	8.08	0.00					-2.91	0.00			7.29	0.00			-3.89	0.00	-4.23	0.00	-4.27	0.13	-4.30	0.17
/cut12	-3.00	0.00							3.49	0.00							-3.89	0.00	-4.23	0.00	-4.23	0.14	-4.25	0.17
/cut13	-3.00	0.00							3.91	0.00							-3.89	0.00	-4.23	0.00	-4.21	0.14	-4.23	0.17
/cut14	-2.99	0.00							9.42	0.00							-3.88	0.00	-4.23	0.00	-4.18	0.14	-4.21	0.18
/cut15	-2.83	0.00															-3.88	0.00	-4.22	0.00	-4.16	0.14	-4.19	0.18
/cut16	-1.75	0.00															-3.84	0.00	-4.19	0.00	-4.14	0.14	-4.17	0.18
/cut17	2.74	0.00															-3.84	0.00	-4.19	0.00	-4.12	0.15	-4.15	0.18
/cut18	7.53	0.00															-3.64	0.00	-3.99	0.00	-4.08	0.15	-4.11	0.19
/cut19	8.17	0.00															-3.63	0.00	-3.98	0.00	-4.03	0.15	-4.06	0.19
/cut20	8.42	0.00															-3.61	0.00	-3.96	0.00	5.18	0.07	5.55	0.08
/cut21																	-3.56	0.00	-3.91	0.00	5.25	0.06	5.62	0.07
/cut22																	3.80	0.00	3.86	0.00	5.70	0.05	6.06	0.05

/cut23																	3.86	0.00	3.93	0.00	6.10	0.03	6.47	0.04
/cut24																	3.89	0.00	3.96	0.00	6.28	0.03	6.65	0.03
/cut25																	7.26	0.00	7.32	0.00	6.51	0.02	6.87	0.03
/cut26																	8.47	0.00	8.53	0.00	6.80	0.02	7.16	0.02
/cut27																	8.87	0.00	8.93	0.00	7.20	0.01	7.56	0.02
/cut28																					7.90	0.01	8.26	0.01
no obs	10219		1321		2898		663		19540		1983		1666		433		22018		27627		2785		3595	
no gr	1535		735		41		35		326		273		24		22		1018		1033		47		47	
Wald	0		0		0		0.8640		0		0.0002		0.1181		0.9040		0		0		0.0787		0.9999	

$\Delta y_{it}$  is a change in the unobservable latent variable that measures the change in the credit rating of bank  $i$  in period  $t$ ;  $sCC1_{cjt}^+$  is the sum of changes in corporate credit ratings provided by Moody's, S&P, Fitch, and DRBS if there is a one-degree corporate rating upgrade in country  $j$  in period  $t$ ;  $sCC2_{cjt}^+$  is the sum of changes in corporate credit ratings provided by Moody's, S&P, Fitch, and DRBS if there are at least two degrees of corporate rating upgrades in country  $j$  in period  $t$ ;  $sCC1_{cjt}^-$  is the sum of changes in corporate credit ratings provided by Moody's, S&P, Fitch, and DRBS if there is a one-degree corporate rating downgrade in country  $j$  in period  $t$ ;  $sCC2_{cjt}^-$  is the sum of changes in corporate credit ratings provided by Moody's, S&P, Fitch, and DRBS if there are at least two degrees of corporate rating downgrades in country  $j$  in period  $t$ ;  $crisis$  is a dummy variable, where '1' indicates a crisis in the banking sector, and '0' otherwise. Source: own elaboration.

---

## 5. Conclusions

The aim of the study was to analyse the impact of the spillover effect between European and American non-financial companies' long-term issuer credit rating changes and banks' credit ratings (corporates-to-banks spillover effect), considering the business cycle and regional reactions. The hypothesis was confirmed as follows: the corporates-to-banks spillover effect is stronger in Europe than in the US. The results show that banks' ratings react more strongly to downgrades in corporates' credit ratings than to upgrades, consistent with theoretical perspectives. Furthermore, there is a lagged reaction to upgrades in corporates' credit ratings, while banks' credit ratings react immediately to downgrades in companies' ratings. This is attributed to fear of negative information and a quicker response to negative news. The strength and significance of the corporates-to-banks credit ratings spillover effect are linked to the size and reputation of the CRA. Additionally, there are varied reactions to changes in a country's credit ratings on banks' credit ratings. In the case of downgrades in corporates' credit ratings, a statistically significant reaction is observed if the agency makes changes to at least one note. For upgrades in non-financial companies' ratings, a stronger reaction from the agency, with at least two notes rising in grade, is necessary to observe the corporates-to-banks credit ratings spillover effect.

The significance of the spillover effect of corporate-to-bank credit ratings has been observed to vary with the business cycle. The findings indicate a delayed reaction to positive information and an immediate reaction to negative information. A comparison of how banks' ratings respond to changes in corporate credit ratings reveals that during the COVID-19 pandemic, no spillover effect was observed for Moody's subsample. However, in the case of S&P's subsample, a stronger reaction was observed during the COVID-19 pandemic compared to the GFC period. A stronger, statistically significant impact has been noted on the downgrades of non-financial companies' ratings. This impact is particularly pronounced when agencies downgrade firms' ratings on one note as opposed to at least two. This may reflect concerns about a spillover effect on the financial market and a recurrence of conditions seen during the GFC. Conversely, for upgrades, a statistically significant impact was observed only for upgrades by one degree.

The analysis of the situation during the stability period in the financial markets between these crises shows that in both cases, the spillover effect of corporate-to-bank credit ratings is weaker than during the crises. This suggests the procyclical nature of the mentioned phenomenon. In the case of S&P, there is a statistically significant impact of at least a two-degree downgrade of firms' ratings on banks' notes. Upgrades have a significant impact if the ratings are higher on the one note. The analysed spillover effect is observed for current credit ratings changes. Previous decisions about upgrades of companies' notes and current downgrades of them are important for Moody's banks' credit ratings changes. The reaction is stronger for upgrades of notes than for downgrades in the case of the Moody's subsample. A comparison between the GFC period and the COVID-19 pandemic shows a stronger reaction during the COVID-19 crisis for European banks, both for S&P and Moody's, but S&P's bank notes are more sensitive. During the stability period, the corporate-to-bank credit ratings spillover effect has not been



---

observed for US banks. The reaction of European banks is weaker than in the case of the crisis period, confirming previous results. The results show a wide corporate-to-bank credit ratings spillover effect, not only in a narrow range. The reaction is different from the wide corporate-to-bank credit ratings spillover effect. In the case of the narrow effect, a stronger reaction is noticed for downgrades, and for the wide effect, for upgrades.

In conclusion, the results obtained indicate that the spillover effect of credit ratings from corporates to banks is stronger than the spillover effect from banks to corporates. This phenomenon varies in significance depending on the specific agency, the severity of the financial crisis, and geographical location. Additionally, banks' credit ratings also respond to delayed decisions regarding changes in corporates' credit ratings.

The results received indicate that supervisors and investors should consider the situation in the non-financial sector when making investment decisions and assessing the probability of default risk. There is a spillover effect and contagion effect associated with the combined impact of changes in credit ratings and the sensitivity of these changes on decisions made by other agencies.

## References

- Abad, P., Alsakka, R. & ap Gwilym, O. (2018). The influence of rating levels and rating convergence on the spillover effects of sovereign credit actions. *Journal of International Money and Finance*, 85(C), 40-57. <https://doi.org/10.1016/j.jimonfin.2018.03.005>
- Acharya, V., Drechsler, I., & Schnabl, P. (2014). A pyrrhic victory? Bank Bailouts and Sovereign Credit Risk. *Journal of Finance*, 69, 2689–739. <https://doi.org/10.1111/jofi.12206>
- Adelino, M., & Ferreira, M.A. (2016). Bank ratings and lending supply: Evidence from sovereign downgrades. *Review of Financial Studies*, 29 (7), 1709-1746.
- Alsakka, R., ap Gwilym, O., & Vu, T.N. (2014). The sovereign-bank rating channel and rating agencies' downgrades during the European debt crisis. *Journal of International Money and Finance*, The impact of the Global Financial Crisis on Banks, *Financial Markets and Institutions in Europe* 49, Part B, 235–257. <https://doi.org/10.1016/j.jimonfin.2014.03.012>
- Almeida, H., Cunha, I., Ferreira, M.A., & Restrepo, F. (2017). The real effects of credit ratings: The sovereign ceiling channel. *The Journal of Finance*, 72(1), pp.249-290. <https://doi.org/10.1111/jofi.12434>
- Alter, A., & Schüller, Y.S. (2012). Credit spread interdependencies of European states and banks during the financial crisis. *Journal of Bank Finance*, 36, 3444–68. <https://doi.org/10.1016/j.jbankfin.2012.08.002>
- Angelini, P., Grande, G., & Panetta, F. (2014). *The negative feedback loop between banks and sovereigns* (No. 213) Questioni di Economia e Finanza (Occasional Papers). Bank of Italy, Economic Research and International Relations Area. <https://doi.org/10.2139/ssrn.2419943>
- Arezki, R., Candelon, B., & Sy, A.N.R. (2011). Sovereign Rating News and Financial Markets Spillovers: Evidence from the European Debt Crisis. *IMF Working Paper*, WP/11/68. <https://doi.org/10.5089/9781455227112.001>
- Augustin, P., Boustanifar, H., Breckenfelder, J., & Schnitzler, J. (2018). Sovereign to corporate risk spillovers. *Journal of Money, Credit and Banking*, 50(5), 857-891. <https://doi.org/10.1111/jmcb.12497>

- 
- Banerjee, A., Hung, C.D., & Lo, K.L. (2016). An anatomy of credit risk transfer between sovereign and financials in the Eurozone crisis. *Journal of International Financial Markets Institutions Money*, 41, 102–20. <https://doi.org/10.1016/j.intfin.2015.12.007>
- Beltratti, A., & Stulz, R. (2015). *Bank sovereign bond holdings, sovereign shock spillovers, and moral hazard during the European crisis*. Fisher College of Business, Columbus, OH, United States. <https://doi.org/10.3386/w21150>
- BIS (2011). *The impact of sovereign credit risk on bank funding conditions*, CGFS Publications No.43. Committee on the Global Financial System.
- Blundell-Wignall, A., & Slovik, P. (2010). The EU stress test and sovereign debt exposures. *OECD Working Papers on Finance, Insurance and Private Pensions*, 4.
- Bolton, P., & Jeanne, O. (2011). Sovereign default risk and bank fragility in financially integrated economies. *IMF Economic Review*, 59, 162–94. <https://doi.org/10.1057/imfer.2011.5>
- Böninghausen, B., & Zabel, M. (2015). Credit ratings and cross-border bond market spillovers. *Working Paper Series, 1831*, European Central Bank. <https://doi.org/10.1016/j.jimonfin.2014.12.007>
- Borensztein, E., Valenzuela, P. A., & Cowan, K. (2013). Sovereign Ceilings “Lite”? The Impact of Sovereign Ratings on Corporate Ratings. *Journal of Banking and Finance* 37, 4014–4024. <https://doi.org/10.1016/j.jbankfin.2013.07.006>
- Caselli, S., Gandolfi, G., & Soana, M. (2016). The impact of sovereign rating news on European banks. *European Financial Management*, 22, 142–167. <https://doi.org/10.1111/eufm.12056>
- Chen, S.S., Chen, H.Y., Yang, S.L., & Chang, C.C. (2016). Output spillovers from changes in sovereign credit ratings. *Journal of International Money and Finance*, 63, 48–63. <https://doi.org/10.1016/j.jimonfin.2016.01.007>
- Claeys, P., & Borek, V. (2012). Measuring Sovereign Bond Spillover in Europe and the Impact of Rating News. *IREA Working Papers 201219*, University of Barcelona, Research Institute of Applied Economics.
- Cuadros-Solas, P.J., & Muñoz, C.S. (2021). Potential spillovers from the banking sector to sovereign credit ratings. *Applied Economics Letters*, 28(12). <https://doi.org/10.1080/13504851.2020.1796910>
- De Bruyckere, V., Gerhardt, M., Schepens, G., & Vander Vennet, R. (2013). Bank/sovereign risk spillovers in the European debt crisis. *Journal of Banking & Finance*, 37(12), 4793–4809. <https://doi.org/10.1016/j.jbankfin.2013.08.012>
- Drago, D., & Gallo, R., 2016. The impact and the spillover effect of a sovereign rating announcement on the euro area CDS market. *Journal of International Money and Finance*, 67, 264–286. <https://doi.org/10.1016/j.jimonfin.2016.06.004>
- Foglia, M., & Angelini, E. (2020). The diabolical sovereigns/banks risk loop: A VAR quantile design. *Journal Econ Asymmetry*, 21. <https://doi.org/10.1016/j.jeca.2020.e00158>
- Fratzscher, M., & Rieth, M. (2019). Monetary Policy, Bank Bailouts and the Sovereign-Bank Risk Nexus in the Euro Area. *Rev Finance*, 23, 745–75. <https://doi.org/10.1093/rof/rfy024>
- Gibson, H.D., Hall, S.G., & Tavlas, G.S. (2016). How the euro-area sovereign-debt crisis led to a collapse in bank equity prices, *Journal of Financial Stability*, 26, 266–75. <https://doi.org/10.1016/j.jfs.2016.07.010>
- Hu, H., Prokop, J., Shi, Y., & Trautwein, H-M. (2020). The rating spillover from banks to sovereigns: An empirical investigation across the European Union, *Journal of International Financial Markets, Institutions and Money*, 64 (101161), <https://doi.org/10.1016/j.intfin.2019.101161>

- 
- Huang, Y. L., & Shen, C.H. (2015). The sovereign effect on bank credit ratings. *Journal of Financial Services Research* 47, 341-379. <https://doi.org/10.1007/s10693-014-0193-7>
- Kaminsky, G., & Schmukler, S.L. (2002). Emerging markets instability: Do sovereign ratings affect country risk and stock returns? *The World Bank Economic Review*, 16(2), 171-195. <https://doi.org/10.1093/wber/16.2.171>
- Klusak, P., Alsakka, R., & Gwilym, O. ap (2017). Does the disclosure of unsolicited sovereign rating status affect bank ratings? *The British Accounting Review, Contemporary Issues in Banking*, 49, 194-210. <https://doi.org/10.1016/j.bar.2016.08.004>
- Mutize, M., & Gossel, S. (2018). The effects of sovereign credit rating spillovers on neighbouring countries' financial markets. *The Journal of International Trade & Economic Development*, 27(8), 857-900. <https://doi.org/10.1080/09638199.2018.1458891>
- Pisani-Ferry, J. (2013). The known unknowns and unknown unknowns of European Monetary Union. *Journal of International Money Finance*, 34, 6-14. <https://doi.org/10.1016/j.jimonfin.2012.11.002>
- Poon, W.P.H., Shen, J., & Burnett, J.E. (2017). An Empirical Study of International Spillover of Sovereign Risk to Bank Credit Risk. *Financial Review* 52, 281-302. <https://doi.org/10.1111/fire.12114>
- Singh, M.K., Gómez-Puig, M., & Sosvilla-Rivero, S. (2016). Sovereign-bank linkages: Quantifying directional intensity of risk transfers in EMU countries. *J Int Money Finance*, 63, 137-64. <https://doi.org/10.1016/j.jimonfin.2016.01.003>
- Tsoumas, C. (2017). Bank defaults and spillover effects in US local banking markets. *The Journal of Economic Asymmetries*, 16(C), 1-11. <https://doi.org/10.1016/j.jeca.2017.04.001>
- Wengner, A., Burghof, H. P., & Schneider, J. (2015). The impact of credit rating announcements on corporate CDS markets: Are intra-industry effects observable? *Journal of Economics and Business*, 78, 79-91. <https://doi.org/10.1016/j.jeconbus.2014.11.003>
- Williams, G., Alsakka, R., & ap Gwilym, O. (2013). The impact of sovereign rating actions on bank ratings in emerging markets. *Journal of Banking & Finance* 37, 563-577. <https://doi.org/10.1016/j.jbankfin.2012.09.021>
- Yu, S. (2017). Sovereign and bank Interdependencies-Evidence from the CDS market, *Res Int Business Finance*, 39, 68-84. <https://doi.org/10.1016/j.ribaf.2016.07.033>
- Xu, J., Lian, D., & Yang, D. (2021). Risk Spillover: A New Perspective on the Study of Financing Difficulties for SMEs—Evidence from China, *Discrete Dynamics in Nature and Society*. <https://doi.org/10.1155/2021/5914519>