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Impact of COVID-19 on European banks' credit ratings

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ABSTRACT

The aim of this paper is to analysis the impact of the COVID-19 pandemic on European banks' default risks, as measured by foreign long-term issuer credit ratings published by the main credit rating agencies. Two hypotheses are put forward: (1) The macroeconomic situation has a stronger negative impact on banks' financial conditions during COVID-19; (2) changes in the capital adequacy, assets, management, earnings, and liquidity indicators have a significant impact on changes in banks' credit ratings. The analysis has been prepared for the 2000–2021 period for listed and unlisted banks on the European stock exchanges, that received long-term issuer credit ratings from the main credit rating agencies. To the analysis has been used the ordered logit panel data models and the research has been made on the first differences to analyse the impact of the changes of the financial and macroeconomic conditions on the credit ratings changes. The obtained results suggest a direct and significant impact of the COVID-19 pandemic on the credit rating changes, but a delayed reaction.

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1. Introduction

Over the last two years, the global economy has suffered because of the COVID-19 pandemic. Unfortunately, COVID-19 appeared as a time when the global economy was already displaying signs of a slowdown. The shock associated with COVID-19 has created problems, i.e., high liquidity stress, limited access to credit, and increasing

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probability of default. Moreover, recorded private debt, including corporate and household debt, were also apparent. As a result, nearly half of the investment-grade market currently holds a triple B-rating. Central banks around the world intervened to settle markets by using a range of possible measures, mostly by decreasing interest rates, responding to the repo market to add future liquidity, increasing asset purchases (Bank of Japan), adding cash directly into the financial system (People Bank of China) or preparing various plans to counter COVID-19 (Bank of England, ECB). In some cases, regulators have proactively granted relief for regulatory financed reporting to banks affected by COVID-19 (such as SEC). Furthermore, banks also created policies associated with extending loans to hard-hit borrowers, renegotiating credit terms, providing an opportunity for ‘credit holidays’ or reducing bank provisions.

As a result, the aim of this paper is to analysis the impact of the COVID-19 pandemic on European banks’ default risks, as measured by foreign long-term issuer credit ratings published by the main credit rating agencies. This paper has been prepared because of few reasons. The lack of studies about the reaction and the factors that can impact on the credit ratings changes during COVID-19 crisis was the first reason to prepare this study. The next reason has been to check the procycality of the banks’ credit ratings. Their credit ratings should react on the changes in macroeconomic environment. The literature review and the practical analysis of the methodologies presented by credit rating agencies suggest that they use different catalogues of variables to estimate default risk. Previous studies have already drawn attention to financial factors, i.e., CAMEL indicators. They also relied on an estimation of the factors presented by one of the two biggest agencies, i.e., Fitch and Moody’s. As a result, the following hypothesis has been put forward: *Changes in the capital adequacy, assets, management, earnings, liquidity indicators have significant impacts on banks’ credit ratings changes.*

The differences between macroeconomic determinants have yet to be analysed or presented. Opinions on these factors also vary. The analysis of the methodologies presented by the Moody’s and Fitch suggests that they considered country risk. These agencies also focused on the inflation rate. In the COVID-19 pandemic, inflation trends and associated risks surrounding interest rates and exchange rates may have had direct sovereign credit implications. Higher levels of global government debt due to COVID-19 have rendered sovereign creditworthiness increasingly sensitive to interest rate adjustments. As a result, the following hypothesis is put forward: *The macroeconomic situation has a strong negative impact on banks’ financial condition during the COVID-19 pandemic.*

The knowledge about factors influencing on the credit ratings is especially significant for the financial market. They have got the direct influence on the credit risk and are taken into consideration during the investment decisions, as factors taken to the investment portfolio building.

The analysis has been prepared for the 2000–2021 period for listed and unlisted banks on the European stock exchanges by using the ordered logit panel data models. The remainder of the paper proceeds as follows. In [Section 2](#), previous studies that investigate the determinants of credit ratings were presented. [Section 3](#) reports the methodology. [Section 4](#) provides a discussion of the findings, and [Section 5](#) concludes by declaring limitations on the current study and consequently suggesting future developments.

2. Literature review

2.1. The business cycle impact on the credit ratings changes

The main study about the spiral phenomenon between ratings during financial crisis of 2008 was prepared by De Saints (2012). This is particularly strong in times of economic downturn. At this point, risks associated with a country's credit rating are shifting to notes given to banks or institutions outside the financial sector. Research on the pro-cyclical nature of rating notes was also conducted by Auh (2013). The rated entities received more pessimistic ratings in the downturn compared to the economic boom. Companies that roll their obligations towards creditors on the capital market are exposed to a stronger influence of the business cycle on the credit ratings they receive. Kiff et al. (2013) compared the effectiveness and method of assigning ratings by rating agencies and banks as part of an internal risk assessment method. It was found that rating agencies evaluate entities by considering the business cycle phase. However, banks analysed the point at which they conduct the assessment, by using not pro-cyclical. The agencies' ratings are more stable in periods of prosperity, but in times of downturn fluctuate more (Chodnicka-Jaworska 2019; Loffer, 2013). Bar-Isaac and Shapiro (2013) found that ratings are anti-cyclical. The behaviour of credit rating agencies is also influenced by other factors, namely giving less accurate ratings when the rating fee income is high, when cooperation is difficult, and a low likelihood of bankruptcy. This situation deepens in stable periods in the financial markets, when agencies are exposed to a lower risk of losing their reputation on the market. The impact has got the presence of naive investors, which further exacerbates the issue of quality ratings, however, they are still counter cyclical. Analysing the level of competition shows similar results. Freitag (2015) suggests that the business cycle phase is not considered by agencies when conducting an issuer bankruptcy risk analysis, but studies are carried out on an ongoing basis and the ratings are adjusted to market disturbances. Agencies are unwilling to frequently adjust their ratings, and that current ratings are closely related to existing ratings. There are also significant disproportions in terms of the number of announced improvements and downgrades. Trouillet (2015) noted high ratings during the boom and their low value during the financial crisis. It results in an increase in debt servicing costs. Moreover, it identifies the phenomenon of causality between ratings and the condition of the rated entity, what causes further deepening of the crisis. Isakin and David (2015) found that, during economic downturn, there was a change in the rating methodology. When analysing the bankruptcy risk of the assessed institution, the agencies consider macroeconomic risk. As a result, if the economy's condition worsens during an economic downturn, it has an impact on the assessment of issuers. DeHaan (2016) pointed out that the business cycle does not affect the rating, but companies' ratings improve when they recover from the crisis.

2.2. Covid-19 pandemic impact on the banking sector

The COVID-19 pandemic created a high default risk for banks. Financial institutions must manage various problems, such as liquidity crunch, credit squeeze, increasing

value of nonperforming loans and default risk, lower returns on credits and investments, lower interest rates and triggering contagious bank-run (Cecchetti & Schoenholtz, 2020; Goodell, 2020; Larbi-Odam et al., 2020; Stiller & Zink, 2020; World Bank, 2020). As a result, banks will have increased risk in nearly all working areas. Wilson (2020) and Tyson (2020) suggest that the impact of the COVID-19 pandemic will be more noticeable in developing countries (where banking clients are those with lower creditworthiness), because of weaker economy, political situation, or aggressive market competition. Not without significance is high loan default, difficulty recovering borrowed funds, withholding customer savings for daily living requirements, problems with receiving loans, or decreased investments due to future fear (Lagoarde-Segot & Leoni, 2013). Damak et al. (2020) suggest that these factors can strengthen the negative impact of the COVID-19 pandemic on banks' financial condition. It has been especially analysed for developed countries (BIS, 2020; Cecchetti & Schoenholtz, 2020; Stiller & Zink, 2020; Strietzel et al., 2020; World Economic Forum, 2020).

Macroeconomic COVID-19 shocks have had a direct or indirect impact on high default risk individuals and firms (Vidovic & Tamminaina, 2020); as a result, the credit risk increases. It is strictly connected with lower households and companies reserves as an effect of losing jobs – lower production is associated with lockdowns. Smaller companies will also experience problems with liquidity due to the low value of reserves and cash. This scenario can create problems with solvency and the risk of default because of increased credit risk from banks. Baret et al. (2020) suggest that the market value of collaterals provided against secured loans will decline.

In most banks, especially in developing countries, 60–80% of working assets are household savings. If depositors make decisions regarding withdrawing their savings, it can create serious problems with liquidity, that can be an effect of: the demand for cash for maintaining household health and living expenses (Baret et al., 2020); the transfer cash from banks on the capital market with higher rates of return (Chodnicka-Jaworska & Jaworski, 2020); or massive long-term withdrawal deposits (Cheney et al., 2020).

The low value of earnings (especially from borrowing activity) and banks' business models is an effect of lower interest rates. Lower production creates problems with companies' revenues and lower creditworthiness, that reduces the possibility of receiving credit. As a result, the need for long- or short-term financing decreases until the economy recovers (Ryan et al., 2020). The reaction to the described problem is delayed. Moreover, interest incomes can also decrease because in most countries, banks make decisions based on waiting fees and charges, issuing 'credit holidays', increasing credit limits, extending repayment dates, which assist people and companies during a pandemic. If banks do not propose renegotiating or changing credit conditions, the default risk of borrowers will increase. As a result, this will transfer to the banks' default risk (Ryan et al., 2020; Yousufani et al., 2020).

The highest risk and the biggest problem involve low-quality assets and higher value of non-performing loans. This situation will reduce the value of assets and banks' capitalisation. The lower value of risk-weighted assets reduces the banks' capital adequacy, which directly influences the banks' solvency and their financial

stability. Some banks will use CET1, Tier1, or Tier2 capital to support financial stability. Görg et al. (2020) and Dominguez (2010) suggest that in developing countries financial markets are less effective, regulators' activities are limited to the basic level, and moral and adverse selection problems are present.

Research on the relationship between sovereign banks shows that government debt is maintained in banks' balance sheets (Dell'Ariccia et al., 2018) by: liquidity risk reduction, credit risk assessment, and investment decisions. The growing government debt can also lead to financial repressions (Reinhart & Sbrancia, 2015). Expansionary fiscal policy, especially associated with issuing treasury bonds, can help reduce shocks on the financial market but can also create the 'doom loops' effect (Farhi & Tirole, 2018), or build the specific 'loans crowding-out' effect on the banking asset side. The sovereign debt crisis may be transformed from banking risk into sovereign risk, creating a spiral effect, what was observed during the 2008 global crisis.

3. Research design

To analyse the determinants of banks' credit ratings, all long-term foreign issuer credit ratings given to 874 European banks from the period between 1990 and 2021 from Refinitiv database are used. Until the end of July 2021, only 10 different credit ratings for banks were proposed by agencies. From 2020, S&P's credit ratings cannot be collected from the Refinitiv database, so they must be collected from the banks' websites. A separate analysis for a particular credit rating agency and a crisis period will be prepared. To decompose ratings on numerical value a linear methodology proposed by Ferri et al. (1999) has been used (Table 1).

Ordered logit panel data models – in which European banks' long-term issuer credit ratings are the dependent variable – have been used for the analysis. It has been prepared on the first difference. Logit models are defined as those that rely on the verification of the probability unit which is then transformed into its cumulative probability value from a normal distribution. The final version of the model is:

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

where Y_{it}^* is an unobservable latent variable that measures the creditworthiness of a bank i in period t ; X'_{it} is a vector of time varying explanatory variables; β is a vector of unknown parameters; Z_{it} are time invariant regressors that are generally dummy variables; ε_{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:

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

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

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

Table 1. Decomposition of Moody's, Dominion Bond Rating Service, 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.

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

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

...

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

where the τ_s ($\tau_0 < \tau_1 < \tau_2 < \dots < \tau_{22}$) are the known threshold parameters to be estimated. The following model may be named as a factor ordered probit model:

$$y_{it}^* = \beta F_{it}' + \gamma Z_{it} + \delta (F^*Z)_{it} + \varepsilon_{it}$$

where $y_{i,t}$ is the Dominion, Fitch, Moody's and S&P's long-term issuer rating for European banks. F_{it} is a vector of explanatory variables.

$$F_{it} = [\text{tier}_{it}, \text{ass}_{it}, \text{llp}_{it}, \text{npl}_{it}, \text{eef}_{it}, \text{sek}_{it}, \text{nint}_{it}, \text{roe}_{it}, \text{fee}_{it}, \text{opp}_{it}, \text{nloan}_{it}, \\ \text{dep}_{it}, \text{eop}_{it}, \text{tax}_{it}, \text{rinv}_{it}, \text{size}_{it}, \text{macro}_{it}, \text{stopy}_{it}, \text{dlug}_{it}, \text{bond}_{it}, \text{ppp}_{it}]$$

where tier_{it} is the Tier 1 ratio; ass_{it} is the leverage ratio; llp_{it} are loan loss provisions to average total loans; npl_{it} are non-performing loans to total loans; eef_{it} is the efficiency ratio; sek_{it} is the value of securities to earning assets; nint_{it} is the net interest income ratio; roe_{it} is the return on equity; fee_{it} is the commissions and fee to net

Table 2. Financial determinants of Moody's and DRBS long-term issuer credit ratings during the COVID-19 pandemic given for banks from developed European countries.

drating	>2019 developed					
	Moody		DRBS		S&P	
	Coef.	P > z	Coef.	P > z	Coef.	P > z
ddeep	-0.2189	0.003	-0.186124	0	-0.0944992	0.003
dfee			0.21176	0.001	0.0853333	0.031
dnint	2.62286	0			-0.0608317	0.162
dnloan	0.323481	0.011	-0.33435	0.023		
ddep			0.146135	0.024		
dllp					9.647141	0.000
dtier					0.729808	0.029
deop			38.46888	0.002	3.72457	0.158
dsek					0.1845214	0.123
dass					0.9364023	0.009
droe					0.8663666	0.001
drinv			0.765432	0	0.4179312	0.000
dsiz	-59.9076	0	47.23915	0.002	-29.62148	0.001
/cut1	-12.8474		-8.29265		-6.636968	
/cut2	9.024129		7.187801		-4.816147	
/cut3					4.712574	
no obs	1037		673		541	
Wald	0		0		0	
Rsqr	0.7672		0.3069		0.2168	

d-prefix: First differences; no obs: Number of observations; Wald: Probability from the Wald test; Rsqr: R^2 ratio.
Source: own elaboration.

revenue ratio; opp_{it} is the operating leverage; $nloan_{it}$ is the loan growth; dep_{it} is the deposit growth; eop_{it} is the ratio of loans to deposit; tax_{it} is the tax complement ratio, $rinv_{it}$ is the reinvestment; $size_{it}$ is the logarithm of assets ratio; $macro_{it}$ is the country's credit rating; $stopy_{it}$ is the central bank interest rates; ppp_{it} is the purchasing power parity; $dlug_{it}$ is the government debt to GDP ratio; $bond_{it}$ is the bonds interest rates; Z_{it} contains time invariant regressors that are generally dummy variables; ε_{it} is a random disturbance term.

4. Findings

4.1. Determinants of credit rating changes according to the level of country's development

The determinants of banks' credit rating changes by country's development by considering the moment of crisis and country's development is varied for agencies (Tables 2 and 3). There are too few credit rating changes for Fitch to build a model and verify the analysed phenomenon, that confirms the slow reactions of ratings in the business cycle, according to Loffer (2013).

The increase in banks measured by the logarithm of assets causes the rise of credit notes for DRBS, when Moody's and S&P's notes present opposite relationship. If we compare these results to the pre-crisis period, the analysed relationship is different. In the case of DRBS, the bigger banks, that have a higher value of assets, have a lower possibility of default. This relates to the 'too big to fail' phenomenon. Bigger banks have more opportunities to earn money, offer more financial products and use improved ways to reduce the default risk, and have access to support from the

Table 3. Financial determinants of Moody's and DRBS long-term issuer credit ratings before COVID-19 pandemic given for banks from developed European countries.

drating	2011–2019 developed					
	Moody		DRBS		S&P	
	Coef.	P > z	Coef.	P > z	Coef.	P > z
deef	−0.039185	0	−3.10915	0.005	−0.0795646	0.003
dopp	−0.0133	0	−3.31502	0.001	−0.0058461	0.016
dnint	−0.42244	0.006	−1.19627	0.88	0.7395821	0.099
dfee	0.03775	0	4.620931	0.001	0.0245794	0.275
dnloan	0.010063	0	−1.02038	0	−0.0051013	0.815
ddep	0.02069	0	−3.80765	0.004	−0.0434397	0.003
dllp	−8.38298	0	−183.6933	0.013	4.593553	0.032
dnpl					−0.5300517	0.000
dtier	−0.04622	0.065	−19.7031	0	−0.120658	0.083
deop	0.108745	0.822	7.86032	0	4.66044	0.015
dsek	−0.02216	0.031	−7.72652	0.001	0.0106844	0.157
dass	0.134065	0	36.15705	0.001	0.2946641	0.004
droe	0.325022	0	7.787185	0.038	0.5431506	0.000
dtax	0.025861	0.16	4.458598	0.056	0.1010573	0.106
drinv	0.01307	0.365	1.1158	0	0.1492888	0.000
dsiz	10.19822	0	−108.581	0.035	24.88158	0.000
/cut1	−8.88865	0	−153.999	0	−7.808609	0.000
/cut2	−3.20637	0	151.4842	0	−5.690823	0.000
/cut3	−2.20223	0			−4.790515	0.000
/cut4	2.746722	0			−3.646136	0.000
/cut5	3.287702	0			4.168119	0.000
/cut6	3.430378	0			8.715755	0.000
no obs	5218		1765		2035	
no group	406		191		236	
Wald	0		0		0	

d-prefix: First differences; no obs: Number of observations; no group: Number of groups; Wald: Probability from the Wald test.

Source: own elaboration.

government in the case of default. Smaller institutions have a lower probability to receive the same support, but, if big banks default, it can create large systemic risk. In some cases, the financial support can be excessive, and countries simply do not have enough wealth to assist banks with their financial problems. The second opinion is presented by Moody's and S&P's, especially during the COVID-19 pandemic. The positive impact of the size of banks is confirmed by Chodnicka-Jaworska (2018). It can be associated with the type of institutions that wish to receive ratings. The biggest agencies are usually the most expensive; as a result, they usually have two types of clients: large banks and those that would like to receive reputation profits from earning ratings from a recognisable institution.

Next it was testing the impact of capital adequacy indicators. Their significance has been underlined by Shen et al. (2012), Bissoondoyal-Bheenick and Treepongkaruna (2011) and Chodnicka-Jaworska (2016). Most regulators postulated that the COVID-19 pandemic will weaken capital adequacy restrictions. As a result, if we compare the significance of the capital adequacy indicators before and during the COVID-19 pandemic we observe that changes in these factors are unimportant for rating changes for notes issued by DRBS and Moody's, however, they are important to receive higher notes from S&P. Both analysed factors, i.e., Tier 1 indicator and the leverage ratio have a significant impact on rating changes, especially for DRBS notes.

As has been mentioned earlier, it can relate to the type of issuer that would like to receive ratings.

With capital adequacy indicators, i.e., loan loss provisions to average total loans and non-performing loans to total loans, there is a direct association with the asset quality factors. The significance of these factors has been observed by Poon et al. (1999), Estrella et al. (2000). The changes of both determinants are insignificant for DRBS and Moody's during the COVID-19 pandemic. Problems with loan repayments and the quality of assets have impacted banks from all around the world; as a result, these are not the most significant during the stated period. Opposite, the loan loss provisions to total loans are an important variable for S&P's credit ratings changes. It is associated with maintaining financial sources for potential problems with loan repayment during the COVID-19 pandemic. It is weaker for S&P's notes before COVID-19. This agency also places attention on the non-performing loans to total loans. The higher value of non-performing loans generates additional credit risk and as a result, indirectly impacts the default risk.

The management quality groups of determinants contain the efficiency ratio and securities to earning assets. The change of the efficiency ratio should have a negative impact on the credit rating changes, what was observed during the COVID-19 pandemic for all agencies. It is weaker for Moody's, stronger for DRBS, and positive (but very low) for S&P's. At first, it can relate to investment decisions made by banks at the first stage such as using Fintech products. Problems associated with rising revenue costs are especially important during the COVID-19 pandemic due to the unstable macroeconomic and health environment. The securities to earning assets measure the extent to which the bank's income is dependent on investment income rather than interest on loans. If the value is higher, it can generate an additional default risk. This factor is insignificant during the COVID-19 pandemic for Moody's and DRBS notes. S&P places attention on these variable changes, because during the COVID-19 pandemic, when the interest rates are lower, banks must find additional sources of profits on the capital market. S&P also assesses a lot of investment banks. Before the COVID-19 pandemic, increases in this variable were assessed as being problematic for Moody's and especially DRBS notes.

The next group of banks' risk determinants is profitability factors, including net interest income ratio, return on equity, operating leverage, loan growth, and deposit growth. The strong significance of these variables has been suggested by Pagratis and Stringa (2007), Shen et al. (2012), Hassan and Barrell (2013), and Ögüt et al. (2012). The presented research confirms this opinion. Net interest income ratio measures the lending margin charged by a particular bank. A higher lending margin may signal higher risk-taking, and as a result, exerts a negative impact on credit ratings. It has been observed for the ratings changes before the COVID-19, especially for DRBS notes. In the case of S&P's notes, the positive relationship relates to the type of sample – banks that are larger with stable credit policies. The opposite relationship has been noticed during the pandemic. Changes in the S&P's notes are negatively correlated with changes in the net interest income indicator. This is an effect of the quality of the credit portfolios. The increase this variable positively influences Moody's notes changes. It can relate to the decrease in central bank interest rates, what reduces the

borrowing interest income. As a result, banks earn less money on lending activity. Return on equity measures the profit a bank can generate given total assets and shareholders' capital. If it is higher, the default risk should be lower, what is noticed only for S&P's notes during the COVID-19. The decreasing value of interest rates reduces the interest revenue – the main source of profits in banks' income statements. Its impact is lower during the COVID-19 than before the pandemic. The pandemic time reduces banks' profits, as a result, agencies do not place such strong attention on these changes. Before the pandemic, the strongest reaction was observed for DRBS. The operating leverage should have a positive correlation with these factors and credit ratings. Changes in this factor cause a weak significant negative impact before the COVID-19 pandemic for all credit ratings. This can be related to the sample that has been considered for analysis. A high value of the loan growth suggests the possibility of receiving additional earnings by banks, but conversely, it can generate credit risk. It should be compared with deposit growth. Changes in the loan growth have a positive impact on Moody's ratings, especially during the COVID-19 pandemic. It can relate to more restrictive credit policies and difficulties in obtaining loans. In contrast, this factor creates additional profit. Its changes negatively impact the DRBS ratings' changes, but lower than before the pandemic. Too strong of a lending activity creates additional risk based on the opinion of this agency. A significant impact of the deposit growth is observed in DRBS sample. Problems with collecting money from households were observed during the pandemic. It relates to the lower interest rates and more profitable investment in the capital market. As a result, an increase in the deposits is positively assessed by this agency. Prior to the COVID-19 pandemic, in for DRBS and S&P's notes, negative relationship between this variable were observed. High-value deposit growth can generate investment risk of additional financial sources in a riskier investment. Because of the COVID-19 pandemic, decisions have been made to verify the impact of adjusting commissions and fees to the net revenue on the credit rating changes. It is especially significant for DRBS and S&P's notes. The relationship during the COVID-19 pandemic is strictly associated with seeking additional profits by banks, other than interest revenue; it is stronger than before the pandemic, especially for S&P's notes. This confirms the strong impact of the commission and fees received by banks on their profits. The tax complement ratio is positively significant for rating changes before the pandemic, especially for DRBS notes. The reinvestment rate has a lower impact during the pandemic period – it is only significant for DRBS notes. A negative relationship between these changes during the pandemic is observed for S&P. The reinvestment ratio increases the percentage of the annual cash flows that banks invest back into businesses as a new investment. Banks must make swift decisions during COVID-19 – associated with the reduced opportunity to contact clients along with borrowing and depositing activity. As a result, many banks invest in new technologies (Fintech investments) in a short time.

The analysed liquidity indicator is the loan to deposit ratio. It has a positive impact on the DRBS and S&P's ratings, especially during the pandemic. The significance of these factors was tested by Pagratis and Stringa (2007), Bissoondoyal-Bheenick and Treepongkaruna (2011) or Chodnicka-Jaworska (2016). They are

Table 4. Financial determinants of Moody's and DRBS long-term issuer credit ratings before the COVID-19 pandemic given for banks from European Union and non-European Union countries.

drating	2011–2019									
	EU				non-EU		EU		EU	
	Moody						DRBS		S&P	
	Coef.	P > z	Coef.	P > z	Coef.	P > z	Coef.	P > z	Coef.	P > z
deef	-0.03001	0.314	-0.0289	0.004	0.005495	0.929	-1.03349	0	0.0898331	0.002
dopp	-0.00108	0.738	-0.01558	0	-0.00282	0.773	-0.45984	0	-0.0185467	0.000
dnint	1.797189	0	0.32291	0.024	-8.26497	0.15	10.89381	0	0.9223459	0.053
dfee	-0.02807	0.15	0.042026	0	-0.38809	0.007	0.539375	0	0.0548165	0.020
dnloan	0.210993	0	0.011205	0	-0.07027	0.49	0.203772	0.017	-0.0351156	0.127
ddep	-0.00674	0.504	-0.02301	0	0.032148	0.696	-0.44775	0	-0.0535081	0.001
dllp	-9.66848	0.002	-7.241752	0	-11.7762	0.187	-49.34854	0.004	1.568628	0.483
dnpl	-0.846234	0.001							-0.6041941	0.000
dtier	-0.08012	0.182	-0.04601	0.076	0.188757	0.653	-1.66731	0.007	-0.0161852	0.841
deop	-6.23376	0	0.221625	0.652	-27.8477	0.006	70.07642	0	5.600284	0.004
dsek	0.0351	0.088	-0.01721	0.096	-0.56918	0.154	-1.19117	0	-0.0727247	0.001
dass	-0.39018	0	0.126764	0.001	0.223164	0.745	0.847427	0.197	0.4191169	0.000
droe	0.114034	0.51	0.257091	0	-0.703	0.136	-0.64236	0.527	0.7332984	0.000
dtax	0.460149	0.018	0.031877	0.087	10.48144	0.05	-1.59069	0.011	0.7494162	0.000
drinv	0.108228	0.001	-0.00556	0.706	-0.03365	0.83	1.766538	0	-0.1367228	0.000
dsize	-18.4338	0	10.83413	0	-18.5529	0.064	10.60377	0	29.99013	0.000
/cut1	-7.82516	0	-8.93658	0	-6.66756	0	-22.3599	0	-7.892032	0.000
/cut2	-3.50908	0	-3.25712	0	4.359254	0	-21.6669	0	-5.752866	0.000
/cut3	3.131878	0	-2.24885	0			20.2462	0	-4.792886	0.000
/cut4	4.794022	0	2.89782	0					-3.661445	0.000
/cut5			3.397753	0					4.173733	0.000
/cut6			3.540869	0					9.274447	0.000
no obs	1573		5504		532		1819		1724	
no group	126		374		32		130		195	
Wald	0		0		0.0304		0		0	

d-prefix: First differences; no obs: Number of observations; no group: Number of groups; Wald: Probability from the Wald test.

Source: own elaboration.

particularly important because of problems associated with loan repayments by companies and households. Depositors also withdraw money and formulate alternative investment decisions, what is problematic for the stability of the banking sector as it increases the liquidity risk.

4.2. Determinants of credit ratings changes according to belonging to the European Union

Analysing changes in financial indicators can influence credit rating changes – in those countries belonging to the EU – has been also prepared for the COVID-19 pandemic and prior to the pandemic. The generated results suggest that agencies have not made many credit rating adjustments. Furthermore, most of them are stable regarding EU banks. As a result, it was impossible to prepare an analysis for these banks. Tables 4–6 highlight the study before and during the COVID-19. The analysis suggests that ratings are sensitive to changes in the banks' size. The significance of this variable, for Moody's, S&P's, and DRBS notes changes, is similar for European Union banks. If banks are larger, there is an increase in credit rating changes. An opposite observation is presented for banks from countries that do not belong to the

Table 5. Financial determinants of DRBS long-term issuer credit ratings during the COVID-19 pandemic given for banks from non-European Union countries.

		>2019 non-EU Moody
drating	Coef.	P > z
deef	-0.21257	0.014
dnint	2.864806	0.008
deop	65.46926	0.044
dass	4.910013	0.021
dsize	-28.682	0.015
/cut1	-18.7412	0.049
/cut2	5.788947	0
no obs	225	
no group	75	
Wald	0.0091	

d-prefix: First differences; no obs: Number of observations; no group: Number of groups; Wald: Probability from the Wald test.

Source: own elaboration.

Table 6. Financial determinants of S&P long-term issuer credit ratings during the COVID-19 pandemic given for banks from Eurozone and European Union countries.

drating	>2019 S&P			
	UE		Euro	
	Coef.	P > z	Coef.	P > z
deef	0.1568224	0.001	0.9522337	0.000
dopp	-0.0008706	0.948	-0.1282644	0.002
dnint	-0.1722365	0.010	-1.231815	0.417
dfee	0.1262071	0.011	0.4016347	0.112
dnloan	-0.2041361	0.036	0.1128429	0.789
ddep	-0.0172332	0.663	-0.1460662	0.382
dllp	10.92026	0.001	75.19237	0.000
dtier	1.692938	0.000	4.582327	0.000
deop	3.726499	0.375	-33.15334	0.189
dsek	0.1182262	0.432	1.324742	0.099
dass	3.478055	0.000	6.468862	0.091
droe	1.177587	0.003	1.062994	0.000
drinv	-0.7390371	0.000	-0.6253709	0.422
dsize	-63.91165	0.000	-87.53908	0.226
/cut1	-8.027335		-15.71457	
/cut2	-6.159753		-11.89641	
/cut3	5.604763		17.60082	
no obs	489		327	
no group	0		0	
Wald	0.2879		0.6669	

d-prefix: First differences; no obs: Number of observations; no group: Number of groups; Wald: Probability from the Wald test.

Source: own elaboration.

EU. A similar reaction has been observed for banks that do or do not belong to the Eurozone (Table 7). This can be related to the higher stability of banks from this area and the possibility of receiving financial support from the ECB. Stronger competition in this area – i.e., more developed financial market, utilising new ways to reduce the probability of default – is also important. Banks in the Eurozone are also larger. It

Table 7. Financial determinants of Moody's and DRBS long-term issuer credit ratings before the COVID-19 pandemic given for banks from Eurozone and non-Eurozone countries.

	2011–2019									
	Moody				DRBS		S&P			
	Euro		non-Euro		Euro		Euro		non-Euro	
drating	Coef.	P > z	Coef.	P > z	Coef.	P > z	Coef.	P > z	Coef.	P > z
deef	-0.01134	0.029	-0.04916	0.029	0.040381	0.489	0.6878487	0.000	-0.1280983	0.003
dopp	-0.01018	0	0.000253	0.953	-0.11012	0	0.0174448	0.083	-0.0277069	0.000
dnint	0.006901	0.071	2.260655	0	-0.24051	0	-1.025528	0.189	-2.385223	0.049
dfee	0.068829	0	0.088014	0	0.098044	0.015	0.3460119	0.000	-0.2323723	0.000
dnloan	0.034103	0	0.127635	0	-0.0023	0.963	-0.4459606	0.000	0.0653236	0.187
ddep	-0.06877	0	-0.06206	0	-0.02069	0.707	-0.0268972	0.462	0.0185866	0.499
dllp	-1.44003	0.039	-6.483655	0.039	-58.59824	0	32.14216	0.000	-0.6377131	0.834
dnpl							-2.288932	0.000	-0.0482915	0.848
dtier	-0.22769	0	-0.02537	0.543	1.444734	0	0.162371	0.391	-0.1475642	0.142
deop	-4.82323	0	-4.86798	0	55.33795	0	69.23231	0.000	-0.9133249	0.793
dsek	0.015832	0.15	0.053361	0.014	-0.31141	0	-0.5779055	0.000	0.009463	0.437
dass	0.04091	0.29	0.300864	0.014	0.84151	0.001	0.7240772	0.000	-0.5387094	0.056
droe	0.021835	0.687	0.777075	0	1.361416	0.002	4.117357	0.000	-0.3792877	0.147
dtax							0.9145353	0.000	-0.1505798	0.168
drinv	0.023216	0.454	0.067285	0.025	0.553755	0	-0.6181587	0.000	-0.1113454	0.042
dsiz	14.66222	0	-15.8443	0	21.52957	0.034	72.4491	0.000	12.98703	0.034
/cut1	-6.06551	0	-6.51509	0	-22.7011	0	-9.333659	0.000	-6.447148	0.000
/cut2	-6.01412	0	-4.20556	0	-20.1927	0	-7.705218	0.000	-6.158119	0.000
/cut3	-3.34256	0	3.275587	0	7.261007	0	-6.273874	0.000	-4.081138	0.000
/cut4	-2.09642	0			9.573009	0	5.642746	0.000	6.266723	0.000
/cut5	3.220818	0					11.64353	0.000		
/cut6	3.502537	0								
/cut7	3.644468	0								
no obs	5976		1917		1864		1079		978	
no group	331		75		88		137		101	
Wald	0		0		0		0		0	

d-prefix: First differences; no group: Number of groups; Wald: Probability from the Wald test.

Source: own elaboration.

can be also associated with the 'too big to fail' attitude that some banks take on. Moreover, capital requirements are more restrictive. The financial condition of the mentioned is also the same due to uniform monetary policy. In Moody's and S&P's opinion, using the sample of banks, the default risk rises during the COVID-19. It can relate to the less stable economies. The banking sector is also dependent on the financial market. A stronger relationship has been noticed for Eurozone's banks.

The next group of indicators are the capital adequacy indicators. Changes in the Tier 1 ratio are statistically significant only for banks from the European Union, for DRBS notes and the Eurozone countries. It can relate to the restrictiveness of European rules. The Tier 1 ratio is especially significant for the Eurozone – also European Union banks during the COVID-19, what confirms previous results. The leverage ratio has a significant impact prior to the COVID-19 on Moody's ratings changes of European banks. It is stronger for the Eurozone subsample, especially for S&P's notes and non-Eurozone banks. The significance of the leverage ratio increases during the COVID-19. This can be related to the asset's quality and issues with loan repayments.

The loan loss provisions to total loans and the non-performing loans to total loans have a strong significant impact on the non-European Union banks' credit rating

changes and for DRBS notes. This relates to the asset's quality and issues with cash repayment in these banks. Banks from developing countries are more sensitive to the economic environment, especially during a crisis. Issues with cash repayment are an effect of job loss, companies' default risk, the developing financial market, and firms' international connections. In the case of S&P's notes, a positive reaction on the loan loss provisions indicators during COVID-19 is observed, which confirms previous results for developed countries.

Changes in the efficiency ratio have a negative impact on the credit rating changes. The higher negative impact of this variable can be observed during the COVID-19 for Moody's and S&P's notes given for non-Eurozone banks. The increase in the banks' costs creates high risk during the crisis. This variable before the COVID-19 has a stronger impact on the DRBS notes and Moody's in the sample of Eurozone banks. A positive relationship can be observed for S&P's notes for banks during the COVID-19 – particularly those from the Eurozone. The securities to earning assets, for Moody's notes, are insignificant during the COVID-19. In the case of S&P's ratings, this variable has a significant impact, especially for the Eurozone banks. This created an increase in high default risk according to the DRBS and S&P's, and for banks from non-Eurozone.

Net interest income has been observed for banks' credit rating changes prior to the COVID-19, especially for the DRBS notes. Moody's notes are more sensitive during the pandemic, especially for non-European banks. In the case of non-European Union or non-Eurozone banks, a negative relationship is associated with the risk of insecure decisions made by banks to generate profits. S&P confirms this opinion during the pandemic.

Return on equity is seen to be significant before the pandemic, especially for the DRBS, S&P credit rating changes for the Eurozone banks, confirming previous results gained for developed countries. The negative relationship is observed for the non-Eurozone banks with S&P's notes, and positive for Moody's ratings. This is an effect from a similar result for the net interest income ratio, associated with risky decision making.

The operating leverage has a significant negative impact prior to the COVID-19, especially for non-European banks. During the pandemic, this relationship is stronger for banks from the Eurozone assessed by S&P. Risky investment decisions creates additional default risk for banks from the Eurozone, where there are negative interest rates.

Changes in the loan growth on the banks' rating changes have a positive impact on Moody's ratings, especially for Eurozone banks. During the COVID-19, S&P suggests that increasing loan policy creates additional risk, especially for European Union banks. This relates to problems with repayment credits, leading to bankruptcy. A significant impact is observed for deposit growth for all ratings, but it has not been observed for S&P's and Moody's notes during the pandemic. Cheap cash with zero-cost capital is available on the market. The impact of changes in commissions and fees to the net revenue on the credit rating changes is especially significant for all notes before the COVID-19, however, negative for the non-European countries, which can be an effect from the type of business activity – it is higher for banks from

non-Eurozone countries. This relationship suggests that banks from this area seek additional profits from non-lending activities. The tax complement ratio is positively significant for rating changes before the pandemic, especially for DRBS notes, and negative for S&P's ratings. In the last opinion, increases in tax reduce net profits for banks outside the Eurozone. The reinvestment rate has a significant impact prior to the pandemic, especially for DRBS notes and non-Eurozone banks. On the other hand, S&P suggests that changes in the reinvestment ratio have a negative impact on ratings, especially during the pandemic. Making investment decisions during a crisis reduces financial sources in the case of an increased probability of default.

The analysed liquidity indicator is the loan to deposit ratio. It has a positive impact on all ratings. In the case of Moody's notes, it is especially significant during the pandemic. These agencies visualise the possibility of investing cheap capital received from households to develop banking activities. The situation associated with COVID-19 requires more restrictive credit policies.

4.3. Macroeconomic determinants of credit ratings changes

Analysing the macroeconomic risk for estimating credit rating changes relies on analysing changes in the macroeconomic variables and the country's credit rating on the banks' notes (Table 8). Factors such as: central bank interest rates, the price purchasing parity, the government debt to GDP ratio, and bond interest rates have been utilised in the analysis. Moreover, the analysis has been prepared for developed countries before and during the COVID-19. Changes in the central banks' interest rates on the ratings' changes can be observed for DRBS notes, especially during the pandemic. It is strictly associated with a decrease in the stated rates by central banks. As a result, banks' interest incomes are decreased, that causes lower revenues from borrowing activity and creates high default risk. It is weaker for Moody's and S&P's notes before the pandemic.

The price purchasing parity has a significant impact on the credit rating changes. The increasing wealth of householders has a positive impact on the stability of an economy. A stable economy creates improved conditions for banks' financial stability and reduces the default risk. This variable is especially significant during the pandemic, for S&P. Wilson (2020) and Tyson (2020) suggest that a stronger impact from the COVID-19 will be noticed in developing countries, where banks' clients are those with lower creditworthiness, create high default risk for individuals and firms (Lagoarde-Segot & Leoni, 2013; Vidovic & Tamminaina, 2020).

The central debt to GDP ratio is significant for Moody's and S&P's ratings, however, the relationship is opposite. For Moody's ratings, the increase in this variable – especially during the pandemic – stimulates the economy and increases ratings. In the case of S&P, the increase in the central debt to GDP ratio causes an increased probability of the debt crisis, as a result, creating a negative economic environment, especially during COVID-19. The increasing value of this variable is strictly associated with the expansionary fiscal policy and direct cash distributed to reduce companies' default risk. Reinhart (2002) and Reinhart and Sbrancia (2015) present an opposing opinion, that the growing government debt can also lead to financial repressions. In the future, it can also build the specific 'loans crowding-out' effect on the banking

Table 8. Macroeconomic determinants of Moody's and DRBS long-term issuer credit ratings given for banks from developed European countries.

rating	Developed >2019						Developed 2011–2019					
	Moody		DRBS		S&P		Moody		DRBS		S&P	
	Coef.	P > z	Coef.	P > z	Coef.	P > z	Coef.	P > z	Coef.	P > z	Coef.	P > z
stopy	30.974	0.22	352.714	0	1.889747	0.372	-1.02982	0	0.021086	0.934	2.258806	0.000
ppp	-0.16602	0.015	-0.300752	0.001	-2.163364	0.000	-0.0748	0	-0.10083	0	-0.067759	0.090
dlog	0.321931	0	-0.00648	0.935	-4.187986	0.000	0.05802	0	0.001766	0.863	-0.8303627	0.000
bond	-4.13209	0.091	-2.249635	0.083	-0.730755	0.360	-0.38465	0	-0.93393	0	-0.0286213	0.232
/cut1	-4.6458	0.423	20.70986	0.016	-5.92627		-17.8076	0	-21.339	0	-8.636415	0.000
/cut2	-3.51568	0.548	22.77736	0.008	-4.516891		-14.0132	0	-20.6458	0	-7.431758	0.000
/cut3			37.7874	0	6.878346		-13.1893	0	-19.0355	0	-5.924888	0.000
/cut4							-13.179	0	-16.4598	0	-5.902837	0.000
/cut5							-13.0538	0	-8.32726	0	-5.670211	0.000
/cut6							-11.6682	0	-7.36648	0	-4.898543	0.000
/cut7							-10.5433	0	-7.28397	0	-4.791544	0.000
/cut8							-4.34225	0	-7.19411	0	-3.439386	0.000
/cut9							-3.36771	0	-6.74565	0	-2.467704	0.000
/cut10							-3.22307	0			2.931804	0.000
/cut11											5.741279	0.000
/cut12											5.84167	0.000
/cut13											8.788857	0.000
/cut14											9.48208	0.000
no obs	1355		532		1329		14363		5012		13351	
no group	455		32				457		294		454	
Wald	0		0.0304				0		0		0	

no obs: Number of observations; no group: Number of groups; Wald: Probability from the Wald test.
Source: own elaboration.

Table 9. Impact of Moody's and DRBS countries long-term issuer ratings on banks' long-term issuer credit ratings given for developed European countries subsample.

drating	Developed 2011–2019			
	DRBS		Moody	
	Coef.	P > z	Coef.	P > z
macro	0.976315	0	0.438723	0
/cut1	−8.34043	0	−11.6677	0
/cut2	−8.24509	0	−7.61297	0
/cut3	−7.69836	0	−6.30418	0
/cut4	−4.29707	0	−6.2828	0
/cut5	3.815116	0	−5.19888	0
/cut6	4.988585	0	−4.84541	0
/cut7	5.069966	0	−3.58624	0
/cut8	5.158464	0	2.924428	0
/cut9	5.601067	0	6.29943	0
/cut10			6.399778	0
no obs	8064		8917	
no group	513		317	
Wald	0		0	

no obs: Number of observations; no group: Number of groups; Wald: Probability from the Wald test.

Source: own elaboration.

asset side (Sy, 2001). The sovereign debt crisis may be transformed, on the banking risk, into sovereign risk, creating a spiral effect (Dötz & Fischer, 2010), like that during the 2008 global crisis. Schularick et al. (2020) highlighted that a European strategy for the precautionary recapitalisation of banks will contribute to the re-launch of lending to the economy and to the weakening of the sovereign–bank relationship. The increasing value of capital financing measure costs by the bonds' interest rates creates higher default risk. This is particularly significant for Moody's ratings changes. The impact of this variable is strengthened during the COVID-19.

The small number of observations associated with the credit rating changes during the COVID-19 creates issues with analysing the country's effect. As a result, only the analysis of the impact of a country's credit rating changes prior to the COVID-19 pandemic has been prepared (Table 9). A strong significant relationship is observed for both credit rating agencies; however, the correlation is higher for DRBS notes. This confirms that banks' notes are strictly related to a country's conditions and economic stability.

5. Conclusions

The presented research confirms the opinion regarding the stability of banks' credit ratings during the first stage of the COVID-19. Moreover, it suggests that credit rating agencies impact the stability of the banking sector, what confirms the opinions of Freitag (2015) and Bar-Isaac and Shapiro (2013). This can raise questions regarding the significance and importance of credit ratings during the estimation of the default risk, especially during the pandemic. The described situation, especially for Fitch notes, brings another question regarding the procyclicality nature of credit ratings.

Increased bank size can bring additional risks during the pandemic. On the other hand, this can also be related to the 'too big to fail' phenomenon. Bigger financial institutions make riskier decisions (Moody's reaction). As a result, it suggests that bigger banks can have issues regarding financial stability, based on Moody's opinion.

Future work should focus on analysing this area. Lastly, this is especially disturbing since it was not observed prior to the COVID-19.

It was changed of the list of variables that significantly influence the credit rating changes. The significance of the capital adequacy indicators was reduced. This can be related to relaxing the Basel III requirements by the national supervisors. Furthermore, this situation is strictly associated with the significance of the asset's quality indicators, what should be tested in future studies. The reaction of the credit rating changes – upon changes in the quality of assets – can also be delayed. In many countries, results associated with preferential loans and financial support received from governments have been observed.

A strong significant impact of the earnings and liquidity indicators was observed during the pandemic. It is related to lower-income profits received by banks, lower interest rates, cash withdrawal by depositors, and investing elsewhere such as the capital market. The rising liquidity risk can also be a source of problems in assessing the default risk of banks.

Analysis of the macroeconomic risk for the credit ratings changes estimation confirms the strong significant impact of changes in basic interest rates by banks thereby creating additional default risk. It should be verified over a longer period, but it can have a stronger impact on the sample of banks from developing countries and outside the Eurozone. The reaction to the described problem is delayed. In addition, the price purchasing parity impact is similar. The impact of the COVID-19 is more pronounced in this area. In these countries, it can result from problems associated with large loan defaults, difficulty in recovering borrowed funds, withholding customer savings for daily living, problems with receiving loans, and/or decreased investments due to future fear.

The central debt to GDP ratio is also higher for the COVID-19. Credit rating agencies positively assess the support of government policy. It is strictly associated with this phenomenon and soon, it should be inversely evaluated. Questions regarding the 'loans crowding-out' effect or spiral effect and the negative impacts of government debt on the default risk of the banking sector should be put forward.

This analysis confirms the strong impact of the macroeconomic environment – of the COVID-19 – on the banking sector's default risk and has a direct influence on the methodology used by agencies. It also confirms the opinion regarding the lagged reaction of agencies on the changes in the situation during the pandemic.

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