

# *The Contribution of ESG Information to the Financial Stability of European Banks*

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## SUMMARY

Nowadays more and more economic actors publish information regarding sustainability, through economic (E), social (S), and governance (G) performance. In the case of banks, ESG performance is important as they affect most of the industries through their investments and loans. In this research our aim is to investigate the relationship between financial stability and ESG performance. We applied panel regressive methods during the analysis. The sample consisted of stock exchange listed lending institutions (243 banks) from the European Union (EU) and the European Free Trade Association (EFTA). Our results show that ESG performance reduced the ratio of non-performing loans significantly. Furthermore, the positive effect of regulatory capital has been confirmed. Consequently, we can assert that the economic, social, and governance performance have beneficial impacts on financial stability. Therefore, the consideration of these pieces of information should be important for the investors and the regulators as well.<sup>1</sup>

KEYWORDS: ESG information, financial stability, banking system, Europe, green finance, panel VAR

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One of the ambitious tendencies of our days is the enforcement of sustainable aspects in the economy. The ideas of different corporate sustainability movements (for example, *triple-bottom-line*, *CSR – Corporate Social Responsibility*, green economy, etc. (Tóth, 2019)) have also emerged in the financial sector. While the movements are different in their names, their goal is the same: the inclusion of environmental, social ethic, governance and other aspects (which are called non-financial performances) in the mindset of the economic actors. It also made an impression on the financing options, since the green bonds relating to environmental or climate protection investments have been playing an increasingly important role (Mihálovits, Tapaszi, 2018). In the early 2000s a new term, *green banking* emerged with the connection between banks' operations and environmental factors examined (Pintér, Deutsch, 2011). Today, we can see the dominance of the use of *green finance*. In the Hungarian terminology, we also see the terms green finances and sustainable finances; the use of 'sustainable' emphasises that the environmental factors are considered along with the social and governance factors, interpreted in a wider sense. It is important to highlight that the term *sustainable finances* should not be confused with financial sustainability. In this study, green finances mean that during the development of their strategy and operations certain financial institutions consider not only economic effectiveness, but also sustainable development (Pintér, Deutsch, 2012).

It can be seen that the definition of non-financial performance is full of challenges. However, the measurement and quantification of such performance is even more complex. Companies report on their non-financial performance in different reports (for example, integrated annual report, sustainability report, etc.), the assessment of which (for example,

with content analysis) is a task requiring resources and time. This problem – on the model of credit rating agencies well known in the financial market – resulted in the emergence of sustainability rating agencies (ESG rating agencies). Several rating agencies apply ESG (Environmental Social and Governance) performance assessment methods to make certain companies' non-financial performance measurable and comparable. These agencies provide sectoral rankings and unique qualifications based on ESG-information published by the companies. As *Matolcsy* (2020) also points out, the promotion of sustainability and the different economic, social and environmental aspects can greatly improve competitiveness. So, making the financial products green is essential since these help channel the capital in environment-friendly investments. The National Bank of Hungary plays an active role in this process. On the one hand, it encourages the green bond portfolio already separated in the currency reserves, as well as the reduction of the ecological footprint of the financial institutions.

In this research we examine the contribution of ESG performances to the financial stability among European banks. We used the ESG score from the Refinitiv Eikon database for our research. This assessment means a comprehensive corporate score in which environmental, social and governance pillars are taken into account with different weights.

## LITERARY REVIEW

Why do companies publish ESG information? There are several theories in connection with corporate disclosure (Lakatos, 2013), out of which the following theories can be connected mainly to the publication of ESG information (Dumitru et al., 2017; Ortas, Gallego-Alvarez, Etxeberria, 2015).

The stakeholder theory deals with the social actors connected to business entities. According to the theory, when determining the information intended for disclosure, the companies seek to satisfy the information needs of the stakeholders (An, Davey and Eggleton, 2011). The information needs of the stakeholders affect the ESG disclosure practice of the companies both directly and indirectly. The employees and the investors can even request information about sustainability directly (via email, phone, etc.), or the investors can influence the disclosure practice through rating agencies indirectly.

Most authors connect legitimacy theory with the disclosure of ESG information (Ortas, Gallego-Alvarez, Etxeberria, 2015). According to the organisational legitimacy theory, a company can only operate in a framework created by members of the society (Pereira Eugénio, Costa Lourenço, Morais, 2013). So, the idea is based on the society's preconception, thus the leaders must communicate such information that impact the opinion of users about the given organisation (Cormier, Gordon, 2001).

Based on the signalling theory, to eliminate informational asymmetry, companies communicate such information to the stakeholders that indicate superiority over their peers, thereby making their business attractive (An, Davey, Eggleton, 2011; Campbell, Shrivs, Bohmbach-Saager, 2001; Shehata, 2014). There are many tools for a company to show a positive picture, one of the most effective ones if it publishes favourable financial and non-financial information for the stakeholders (An, Davey, Eggleton, 2011; Watson, Shrivs, Marston, 2002). Of course, a company should only follow this practice if the expenditure spent on signalling is lower than the achieved increase in income (Szántó, 2009).

According to the principal-agent theory, the

different goals and informational asymmetry result in mutual distrust between the principal and its agent (Kaliczka, Naffa, 2010). It resembles the relationship between executives and owners, creditors and shareholders, or managers and employees (Jensen, Meckling, 1976). The reports are put together by the executives (agents), based on which the owners (principals) assess performance in the given year (Jensen, Meckling 1976; Lakatos 2009; Mohl 2013). In this relationship the business executives have more information and advantage, so the owners are unable to assess the decisions accurately. The agent, i.e. the executive can benefit from the fact that their actions cannot be monitored, so their personal interests can be prioritised (Barako, 2007). The controversial interests between the two parties generate the agent costs, with residual losses occurring if the executives – opposed to the decisions of the owners – wish to maximise their own well-being (Jensen, Meckling, 1976; Shehata, 2014)

From the theories it can be seen that the disclosure of ESG information could affect profitability either by reducing the agent fees, or by presenting a more favourable investment possibility, thereby reducing the cost of capital of the businesses. As a result, ESG-focused investments have become prevalent also among the investors. One of their benefits is that they can reduce portfolio risks, making a more crisis-proof portfolio possible (Broadstock et al., 2021; Kanamura, 2020). In addition, it could also improve consumers' judgement, which may generate extra income, and can have a positive effect on corporate effectiveness and labour force recruitment as well. The study by *Raihan, Bakar and Islam* (2015) confirmed a positive relationship between the amounts spent on CSR activities by banks and productivity.

In accordance with the above, the attitude of the banks towards CSR has changed due to

recognising its importance for their reputation. Reputation may affect their transactions in connection with stakeholders and their relationship with other companies indirectly, as well as their capacity to allocate resources (Carnevale, Mazzuca, 2014). During the crisis the banks had to respond to the mistrust of the clients, thus they had to emphasise consideration of social aspects, taking into account the safety of depositors. CRS activities also improve the banks' reputation, which positively affects operation (Deutsch, Pintér, 2018).

With respect to ESG information, the banks' role is dual: they are present on the 'market' of non-financial information both as reporters and as those using reports. As creditors or investors, they use the ESG information of their potential clients and interests to assess their entire risk profile (Gyura, 2020). Due to their financing nature, they can have a multiplier role since they can enforce ESG aspects in their pricing, lending and investment policies and strategies with a positive effect (Elekes, 2018). In addition, they publish their own non-financial information to their stakeholders. The ESG strategy of the banks is not only about their own operation – as it is the case in other sectors – but they increasingly enforce it in their client related analyses and lending strategies (Gyura, 2020). ESG aspects could be considered important in the case of commercial banks and at the level of central banks. *Lentner, Szegedi and Tatay* (2015) emphasise the need for developing a strategy relating to the social responsibility of central banks, which could facilitate more efficient operation and communication, strengthening the financial stability of countries. In addition, *Mihálovits and Tapaszi* (2018) point out that climate change may pose a severe risk to global development and financial stability in the long run.

Today, however, not only the information needs of the stakeholders affect the ESG

disclosure practices of banks, but also the different regulations. Sustainability aspects have drawn the market's attention, while the regulatory side also strives to keep up with them. *Dobrąnszky-Bartus and Krenchel* (2020) examine the EU's taxonomy regulation which determines the conditions under which a listed company may be qualified green. The regulation governs financial services, but it indirectly encourages other market players to make their operation more sustainable. EU Directive 2014/95 orders companies of specific public interest to publish non-financial reports starting from 2017. They have to report on environmental, social and ethical factors and impacts (European Parliament and Council, 2014). EU Directive 2013/34 defines banks and credit institutions as specific public interests (European Parliament and Council, 2013). Besides, in 2019, the European Union introduced a separate regulation on disclosures relating to sustainability in the financial service sector. Its purpose is to ensure transparency in connection with the industry's actors and the sustainable investments they carry out. As *Gyura* (2020) also points out, compliance or non-compliance with regulations is a factor considerably influencing profitability. One of the new elements of compliance with regulations focuses on the management of clients granted credit, and the Capital Requirement Directive (CRD) also includes ESG factors.

### Former research results

The studies of ESG disclosure primarily seek to explore the scope of factors influencing ESG disclosure, or its impact on the effectiveness of ESG disclosure. This subchapter presents the variables formerly published and studied in literature, primarily in terms of factors influencing financial performance.

The assessment of financial performance may have several variables such as different market indicators (Tobin-Q, stock price) or accounting (e.g. ROA, ROE, EPS) indices reflecting actual performance. As a control variable, mainly the corporate size, the sector and its specific characteristics, the ownership structure, the capital structure/leverage, risk, R&D intensity or even advertisement costs are applied. Studies also dealing with international comparison take into account control variables reflecting the external environmental and macroeconomic aspects (such as GDP growth rate, inflation or population) (Deutsch, Pintér, 2018).

The study conducted by *Buallay* (2019) social and governance (ESG examined the effect of ESG disclosure on success using a sample composed of 235 banks. According to the conclusions of the survey, ESG disclosures positively influence success (ROA, ROE, Tobin-Q). Examining the ESG components individually, they yielded different results: disclosure relating to environmental factors had a positive influence on ROA and Tobin-Q, and disclosure relating to CSR was negatively associated with the mentioned three variables. Disclosure pertaining to corporate governance had a negative impact on ROA and ROE, but it positively affected Tobin-Q. The study conducted by *Birindelli et al.* (2018) found a positive relationship between the size of the banks and ROE, and the ESG disclosure of banks.

The study by *Tommaso and Thornton* (2020) analysed the impact of ESG factors on banking success, examining the three ESG components separately. The environmental, governance and social dimensions all had a negative effect on the banks' share prices. The same can be observed in the case of Tobin-Q. The research highlighted a negative relationship between regulatory capital and banking success as well.

*Deutsch and Pintér* (2018) examined the factors influencing the profitability of banks

including CSR aspects. Based on the results they concluded that capital adequacy has a positive, and liquidity coverage has a negative influence on the net income of the examined banks (ROE, ROA), and the impact of the bank social performance index damaging the return on assets has also been confirmed. *Fain* (2020) analysed the relationship between ESG performance and financial performance examining banks, though it has not been confirmed. In their study, *Ortas, Gallego-Alvarez and Etxeberria* (2015) examined the scope of environmental sustainability disclosure factors. Their study highlights a positive relationship between corporate size and disclosure, and between ROA and disclosure. *Brammer, Brooks and Pavelin* (2006) confirmed a negative relationship between corporate social performance and earnings per share. *Dell'Atti et al.* (2017) demonstrated the positive effect of CSR on financial result using a sample composed of 75 prominent international banks. In the case of social, environmental and governance systems, an opposite relationship has been proved. The ESG's negative influence on financial indicators can be explained by the fact that the investors believe they withdraw the resources used for ESG performance from other investments (Tommaso, Thornton 2020).

As we have already seen, the impact of ESG disclosure on profitability cannot be judged unambiguously since its positive and negative effects have both been confirmed in the literature. However, there have been fewer studies attempting to examine the influence of disclosure on financial stability.

### Theoretical model

Although most examinations focus on the impact of ESG on profitability, their impacts on financial stability cannot be considered

secondary. Through the reviews of Čihák and Schaeck (2010), Creel, Hubert and Labondance (2015), Mérő (2021) and Sánchez Serrano (2021), the proportion of non-performing credits can be interpreted as a key indicator of systemic bank crises, thus providing a focus for the examination of the banks' financial stability. As stable banking operation fundamentally determines their success in financial intermediation, identifying additional factors that influence financial stability can be seen as a key. The banking system is full of dangers as operation is based on deposit collection and lending, which is important in terms of the national economy (Botos, 2016). The capacity of the banks to absorb credit losses largely depends on the available regulatory capital, gradually strengthened under the Basel bank regulations in the past decades. Liquidity rules also appeared in Basel III following the 2008 global financial crisis. The bank's profitability should ensure the running cost of these liquidity and capital buffers (otherwise, the bank's operation would not be reasonable for the owners). Meanwhile, due to the logic of banking operation economies of scale receive a serious role (also, it determines the bank's supervisory ranking in the Banking Union countries at system level). The internal regulatory qualities of the management also receive a role in lending carried out on the asset side. Meanwhile, the change in capital can be influenced by external shocks such as changes in the regulatory, institutional and economic environment. Based on all these, financial stability can be defined in the following (1) terms as regards the banking system.

$$\text{financial stability} = f(\text{profitability}, \text{liquidity}, \text{size}, \text{regulatory capital}, \text{management}, \text{shocks}) \quad (1)$$

Population with model variables (2) is presented in the following section. The data come from the financial database *Refinitiv*

*Eikon*. The ESG score of *Refinitiv Eikon* is composed of three pillars, which are taken into account with different weights in the case of banks. The score of the environment pillar (14.4%) measures the company's influence on the living and dead environmental systems, including air, earth and water, and the whole ecosystem. When determining the social pillar's score (49.6%), they assess the company's capability to evoke trust and loyalty among their employees, clients and society by applying the best management practices. The score of the third component, the governance pillar (36.0%), measures the company's systems and processes, ensuring that the board members and the managers act in favour of the long-term shareholders. In our model, there is the ESG score formulated with the listed weights ( $ESG_t$ ). We estimated financial stability using the proportion of non-paying loans ( $NPL_t$ ). In the case of capital adequacy, we rely on the Basel capital adequacy ( $CA_t$ ) index (regulatory capital compared to the value of assets weighted with risk) and the amount of ( $L_t$ ) liquidity (ratio of funds and other short-term loans provided to other banks to the balance sheet total). The return on assets applied during the measurement of profitability ( $ROA_t$ ) presents economies of scale, return on equity ( $ROE_t$ ), the effectiveness of the owner's capital investment, while the price-earnings ratio ( $P/E_t$ ) presents the expectations of the capital market. The size ( $TA_t$ ) was determined by the ratio of assets measured in EUR to the annual GDP of the given country measured in EUR. The change of the regulatory environment is shown as the variable  $dummy_{base2}$  representing the introduction of Basel 2, the EU membership as  $dummy_{eu}$  and the introduction of the euro as  $dummy_{ez}$  while the economic environment is shown as the variable indicating the recession years of the Eurozone ( $dummy_{ez\_recession}$ ). The application of variables in our model is substantiated by *Table 1*.

Table 1

**JUSTIFICATION OF VARIABLES INCLUDED IN THE MODEL BASED ON LITERATURE**

	Index	Bibliography			
Profitability	ROE	Buallay (2019)	Birindelli et al. (2018)	Deutsch, Pintér (2018)	
	ROA	Buallay (2019)	Ortas et al. (2015)	Deutsch, Pintér (2018)	
	P/E	Tommaso, Thonrton (2020)	Brammer et al. (2006)	Dell'Atti et al. (2017)	Dell'Atti et al. (2017)
Size	BST/GDP	Ortas et al. (2015)	Birindelli et al. (2018)	Deutsch, Pintér (2018)	
Balance sheet structure	liquidity	Deutsch, Pintér (2018)			
	regulatory capital	Tommaso, Thonrton (2020)			
Management	ESG	Tommaso, Thonrton (2020)	Birindelli et al. (2018)	Fain (2020)	Buallay (2019)

Source: self-edited

$$\begin{aligned}
 [\ln(NPL_t)] = & \omega + \beta_1 [\ln(NPL_{t-1})] + \beta_2 [\ln(ROA_t)] + \\
 & + \beta_3 [\ln(ROE_t)] + \beta_4 [\ln(P/E_t)] + \beta_5 [\ln(L_t)] + \\
 & + \beta_6 [\ln(TA_t/GDP_t)] + \beta_7 [\ln(CA_t)] + \beta_8 [\ln(ESG_t)] + \\
 & + \beta_9 dummy_{basel2} + \beta_{10} dummy_{eu} + \beta_{11} dummy_{ez} + \\
 & + \beta_{12} dummy_{ez\_recession} + \varepsilon_t
 \end{aligned}
 \tag{2}$$

Based on the above, we can formulate the following intuitions in connection with the model: it is coupled with a low rate of non-payment if the bank's profitability is high ( $\beta_2, \beta_3, \beta_4 < 0$ ), if it is sufficiently liquid ( $\beta_5 < 0$ ) and it has a high capital buffer ( $\beta_7 < 0$ ), as well as due to its size, it is sufficiently robust in the case of unique losses ( $\beta_6 < 0$ ). In the case of the ESG index (and its subcomponents) examining the development and prudence of the internal standards and processes against the external environment, we also expect an inverse relationship ( $\beta_8 < 0$ ), that is,

high ESG scores coupled with a low rate of nonperformance.

## DATA AND METHODOLOGY

### Data

We examined the timelines between 2002 and 2018 of European Banks included in the database Refinitiv Eikon during our work. Our sample contains credit institutions listed in the European Union (EU) and the European Free Trade Association (EFTA); we analysed the data of 243 banks. Based on *Table 2*, we can establish that the logarithmic values of the examined timelines correspond to the conditions of weak stationarity expected from the regression input variables.



**DESCRIPTIVE STATISTICS OF TIMELINES INCLUDED IN THE STUDY**

	ESG	BST/GDP	CA	ROE	ROA	P/E	Liquidity	NPL
Average	3.8070	-3.8588	-1.9014	-4.4701	-2.2971	2.4225	-2.7439	-3.6933
Median	3.9631	-3.8370	-1.9126	-4.8019	-2.3643	2.4526	-2.5837	-3.7241
Maximum	4.5541	2.9181	1.7351	0.0000	2.4424	8.1147	-0.1609	0.6628
Minimum	0.4311	-17.9867	-4.7105	-14.6010	-7.9753	-5.8901	-11.0603	-7.8180
Dispersion	0.6291	2.4344	0.3310	1.7565	1.1160	0.9860	1.1669	1.4547
Asymmetry	-1.9645	-0.3550	2.2894	1.1625	-0.1630	-1.0518	-1.2564	0.0923
Pointedness	8.2331	3.8439	25.8840	5.3526	4.9278	15.4832	7.1143	2.7015
Normal all.: Jarque-Bera statistics	1,806	171	59,775	1,496	521	17,648	3,151	6
<i>p</i>	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0436
Observations	1,012	3,370	2,634	3,283	3,271	2,643	3,254	1,221
Stationarity: Im, Pesaran and Shin W-stat	-7.0377	-1.4880	-29.2441	-23.5828	-27.9410	-14.3567	-9.0000	-19.1915
<i>p</i>	0.0000	0.0684	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

Source: own calculation using Eviews 11

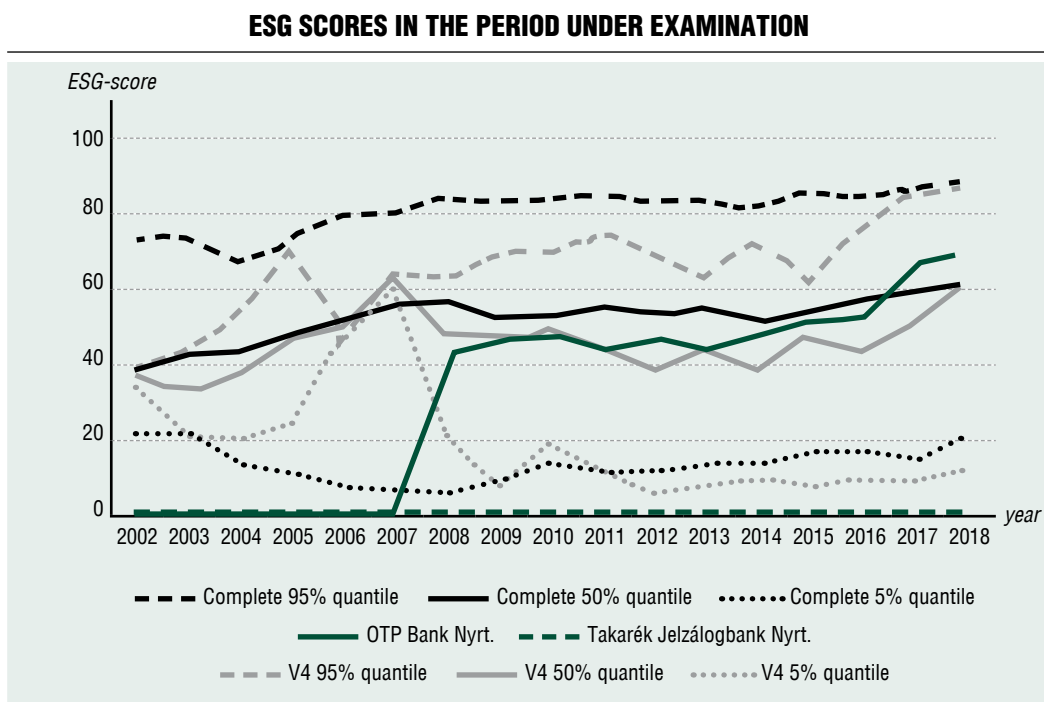
If we examine the value of the ESG index for every reporting year, we can establish that the values of banks with indicators in the specific year (of the altogether 243 European banks) gradually increased from the average level of 40% in 2002 to 60% by 2018, while the values of the 5 and 95% quantiles did not change significantly (which means no systemic improvement). If we examine the values of the V4 countries individually (Czech Republic 2 banks, Hungary 2 banks, Poland 11 banks, Slovakia 3 banks), it is apparent that their

mean and extreme values are similar to the whole sample, so they are neither better nor worse than that. (Figure 1)

During the examination of ESG information for the Hungarian banks, the database Eikon Refitiv yielded information on two banks (OTP and FHB/Takarék Group), and only OTP Bank Nyrt. had similar or better values than the whole sample. The other 10 banks included in the Crefoport database – present in the Hungarian market with an obligation to submit non-financial reports – were not used



Figure 1



Source: own calculation using Eviews 11

in the sample due to the number of employees not reaching 500 (thus not required to submit reports as per the regulation) or being subsidiaries of foreign banks (7 banks), so their ESG information is incorporated in the group reports. Out of the remaining 4 banks (OTP Bank Nyrt., MKB Nyrt., Takarék Jelzálogbank Nyrt., Budapest Hitel és Fejlesztési Bank Zrt.) only two banks appear in the database Eikon Refinitiv, so in the case of the domestic banking market, we can only report on the values of OTP Bank Nyrt. reaching, then exceeding the European average.

### Methodology

Panel databases also have cross-sectional ( $N$ ) and time series ( $T$ ) dimensions, thereby providing more information than the pure

cross-sectional or pure time-series databases. When analysing panel data, we estimate the value of the dependent variable ( $y$ ) with such explanatory variables ( $x$ ) for which cross-sectional and time-series data are also available. Unobserved variables in this model type are included in the residual ( $u_i$ ) (Wooldridge, 2010).

We align a Pooled OLS panel regression to explore the simultaneous effects within a year of relationships between the variables included in the examination. Afterwards, we describe the long-term impact of shocks arising from the specific variables on the non-paying credits with a panel-vector autoregression (panel VAR) model suitable for describing deeper endogenous interactions, including previous fiscal years. We examine the dispersion of this variable as reflected in other variables with variance decompositions.

In the following paragraphs, we present these procedures.

The panel regression residual cannot be connected to the group (time independent –  $u$ ), but it can relate to the complete regression (time dependent –  $\epsilon$ ). Pooled OLS (3) is the simplest form of panel regressions since the unique cross-sectional or time-dependent effects are missing ( $u_i = 0$ ):

$$y_{it} = \omega + \beta X'_{it} + \epsilon_{it}. \tag{3}$$

In the case of Pooled OLS, we assume that the slope is the same in all groups in all periods. This simple formula is only pre-exploratory, and it only tests if it can be integrated into the ESG-index model. In terms of diagnostics, we only looked for non-autocorrelation of the residuals.

In the case of vector autoregressive (VAR) models, there is no determinant causal expectation between the explanatory and the outcome variables as for conventional (e.g. OLS) regressions, we would rather expect prior endogeneity, so the endogenous variables become the linear functions of its own and other variables' lagged values. This procedure builds on the dynamic interactions of  $N$ -numbered time series variables as per the following:  $y_t = (y_{1t}, \dots, y_{kt})'$ . We can express the VAR-model in the following reduced (4) form based on Lütkepohl and Kratzig (2004):

$$y_t = A_1 y_{t-1} + \dots + A_p y_{t-p} + \epsilon_t. \tag{4}$$

In this formula,  $y_t$  is a vector containing model variables ( $N \times 1$ ),  $A_i$  is a matrix containing ( $N \times N$ ) autoregression coefficients and the unobserved residue with ( $N \times 1$ ) normal distribution, which is the vector containing a discrete representation of white noise process, as well as a positive definite covariance matrix. In the case of a stable VAR-model input variables, weak stationarity is

an essential requirement (Lütkepohl, 2005), while the number of lags for the model is determined through the information criteria of Akaike and Schwarz along the minimum value applied in the case of various lag models. Thereby, we ensure data consistency and asymptotic normality, while the eigenvalues and moduli of the VAR-process with a value below 1 facilitates stability (Brooks, 2014; Lütkepohl, 2005). During the expression of the panel VAR-models, this aspect of model diagnostics is widely applied nowadays (for example Akbar et al., 2020; Gabriel and de Santana Ribeiro, 2019; Jouida, 2018)

Short- and long-term restrictions can also be expressed in the case of VAR-model parameters. While we present the succession of shocks with the short-term restriction of Cholesky, we introduce the appearance of shocks with the long-term restriction of Blanchard-Quah. To do so, the structural (5) variant of the reduced VAR-form must be introduced ( $p$  lag and three variables, with  $A$  and  $A^S$  structural coefficients):

$$Ay_t = A_1^s y_{t-1} + \dots + A_p^s y_{t-p} + Bu_t \tag{5}$$

where:  $\epsilon_t = A^{-1}Bu_t$  and  $S = A^{-1}B$ .

With the long-term restriction (6) of Blanchard-Quah (1989) used in our study, the shock is searched only in the row of the  $F$ -matrix where the variable appears, with the cumulated long-term effect of the shock being null, and with as long-term multiplier ():

$$(I - A_1 - \dots - A_p)^{-1} \epsilon_t = \Psi \epsilon_t = Fu_t \text{ and} \tag{6}$$

$$F = \begin{bmatrix} f_{11} & 0 & 0 \\ f_{21} & f_{22} & 0 \\ f_{31} & f_{32} & f_{33} \end{bmatrix}, \text{ while } S = \begin{bmatrix} s_{11} & s_{12} & s_{13} \\ s_{21} & s_{22} & s_{23} \\ s_{31} & s_{32} & s_{33} \end{bmatrix}$$

The structure of the  $F$ -matrix describing the long-term effects is based on the sequence

of variables included in the VAR-model<sup>2</sup> – considering that there will be a shock that will impact every variable, and the variable at the end of the sequence will be the one that will only affect itself. In our case, the ESG-variable describing the bank’s standard operation ( $y_{ESG} f_{12:19}=0$ ), its weight in the national economy ( $y_{TAGDP} f_{23:29}=0$ ), the supply of regulatory capital ( $y_{CA} f_{34:39}=0$ ), the different profitability indicators ( $y_{ROE} f_{45:49}=0$ ;  $y_{ROA} f_{56:59}=0$ ;  $y_{P/E} f_{67:69}=0$ ) and liquidity ( $y_L f_{78:79}=0$ ) have obvious hierarchical effect on the proportion of non-paying loans ( $(y_L f_{78:79}=0)$ ).

The VAR-parameters themselves do not include much information; we use impulse response functions (IRF) in the case of VAR-models to explore relationships between the variables that are dynamic timewise. The reactions between these variables are shown as reflected in the unit growth of structural shocks, provided that the shock returns to zero in the next periods, and all other shocks have a zero value. The IRF basically relies on the previously presented short- and long-term structural restrictions of the residual matrix. The variance decomposition also used to show results indicates the weight of certain shocks in the short- and long-term progress of variables, namely, what percentage of the uncertainty of the  $i$  variable can be attributed to the  $j$ th shock after  $h$  period.

## RESULTS

Based on the Pooled OLS regression results of the conventional panel aligned to the time series, it can be established (*Table 3*) that ESG had a significantly negative effect on the amount of non-paying loans. All these confirm our prior expectations that the banks with more financial stability have higher ESG indicators. We received results according to the intuition with respect to regulatory capital and

ROE. In ROA, the coefficient with a plus sign is considered surprising (though robust). The different external, institutional and regulatory shocks were coupled with a larger value of non-paying loans.

Considering the endogenous effects between certain variables, the results can be considered as indicative; thus we present our results received using the panel VAR-model. To determine the optimal number of lags, we take into account the information criteria of Akaike (AIC) and Schwarz (SIC), the minimum values of which help determine the best model (*Table 4*). It can be seen that we have to estimate the panel VAR-model in this case with 0 and 1 year lag.

The stability of the model is indicated through the location of inverse roots within the unit circle and the moduli values below 1 (*Table 5*).

In the case of aggregated impulse response functions received with long-term restrictions, we describe the 68% confidence intervals with 1 standard error and the 95% confidence intervals with 2 standard errors (*Figure 1*). During the study of aggregated impulse response functions our finding has been confirmed, according to which the ESG effect is negative, significant and long-term. We only experienced a similarly negative and significant long-term effect in the already mentioned ROE, regulatory capital ratio, and P/E. However, larger size in the proportion of GDP (with 68% significance level after 4 years) and ROE can be easily coupled with a higher non-payment rate (highlighting the presence of the moral risk ‘too-big-to-fail’). Meanwhile, liquidity position resulted in a significant outcome only in the short-term (with 95% confidence interval for 2 years and 68% confidence interval for 4 years).

The results received during the variance decomposition (*Figure 2*) show that the ESG-index is among the three most important measures if we examine the dispersion of the

**RESULTS FOR PANEL POOLED OLS ALIGNED TO THE MODEL  
AND THE ESG-INDEX**

Variable	ESG	
	Coefficient	p-value
C	-0.6332	0.1856
NPL(-1)	0.7709	0.0000
ROE	-0.2517	0.0067
ROA	0.1944	0.0135
P/E	-0.0114	0.8612
Liquidity	0.0308	0.2956
BST/GDP	0.0050	0.7895
CA	-0.2351	0.0756
ESG	-0.2041	0.0025
DUMMY_BASEL2	0.4521	0.0000
DUMMY_EU	0.1529	0.0996
DUMMY_EZ	0.2416	0.0003
DUMMY_EZ_RECESSION	0.1571	0.0228
Durbin-Watson stat	1.8022	
Breusch-Pagan	0.6131	-0.4336
<i>R-squared</i>	0.8622	
Adjusted <i>R-squared</i>	0.8575	

Source: Own calculation using Eviews 11

non-payment rate, with ROE (explaining nearly 40% of the NPL-rate in a 5-year timeline) and ROA (10-5%) indicating a weight exceeding 5% in the long run.

It is apparent that in terms of the key indicator for financial stability, i.e. the rate of non-performing loans, the ESG-index used for describing the more refined non-

financial characteristics of operation could also be fitting, in addition to the conventional financial indicators. In our work, this was primarily supported by our results measured in the case of impulse response functions, and we arrived at the same conclusion, to a lesser extent, during the examination of variance decomposition.

Table 4

**VAR-MODEL LAG DEPENDING ON THE INFORMATION CRITERIA**

Lag	LogL	LR	FPE	AIC	SIC	HQ
0	-633.85	NA	0.0000	10.4473	11.3341	10.8077
1	207.72	1513.54*	0.0000*	-1.608133**	0.6975*	-0.6713*
2	255.05	79.25	0.0000	-1.3497	2.3747	0.1636
3	300.92	71.10	0.0000	-1.0685	4.0748	1.0213
4	353.98	75.69	0.0000	-0.8990	5.6631	1.7673

Note: \*\*\*:  $p < 0,01$ ; \*\*:  $p < 0,05$ ; \*:  $p < 0,1$

Source: Own calculation using Eviews 11

Table 5

**VAR-MODEL LEG DEPENDING ON THE INFORMATION CRITERIA**

Variable	Root		Modulus
	Real	Imaginary	
1	0.9807		0.9807
2	0.9037		0.9037
3	0.8252		0.8252
4	0.7986	0.0155	0.7987
5	0.7986	0.1554	0.7987
6	0.6312	-0.0559	0.6337
7	0.6312	0.0559	0.6337
8	0.3536		0.3536

Source: Own calculation using Eviews 11

**SUMMARY**

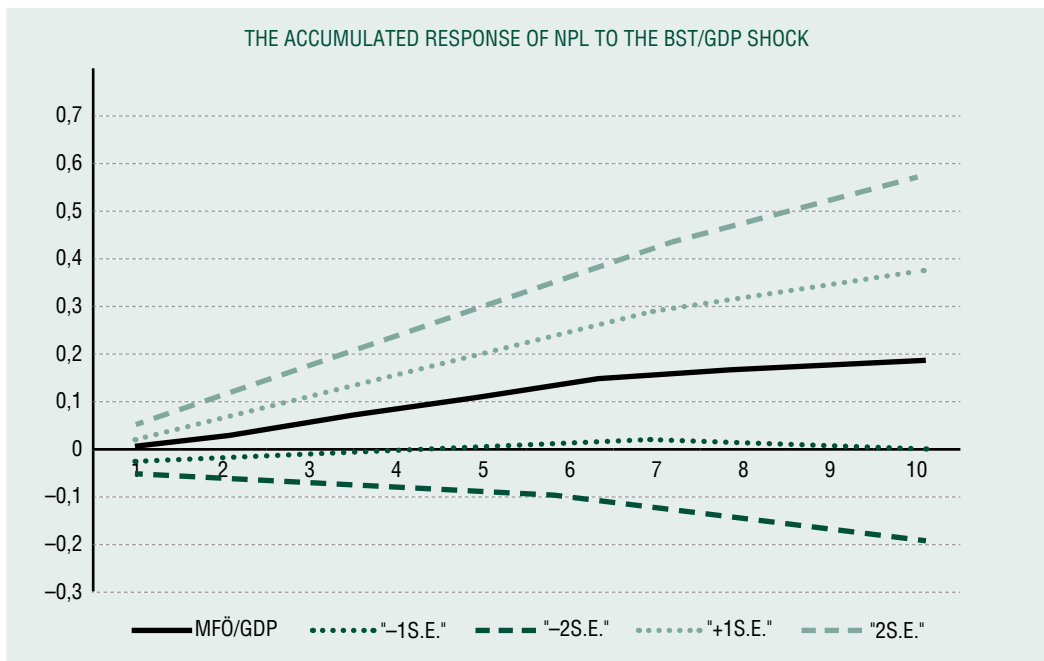
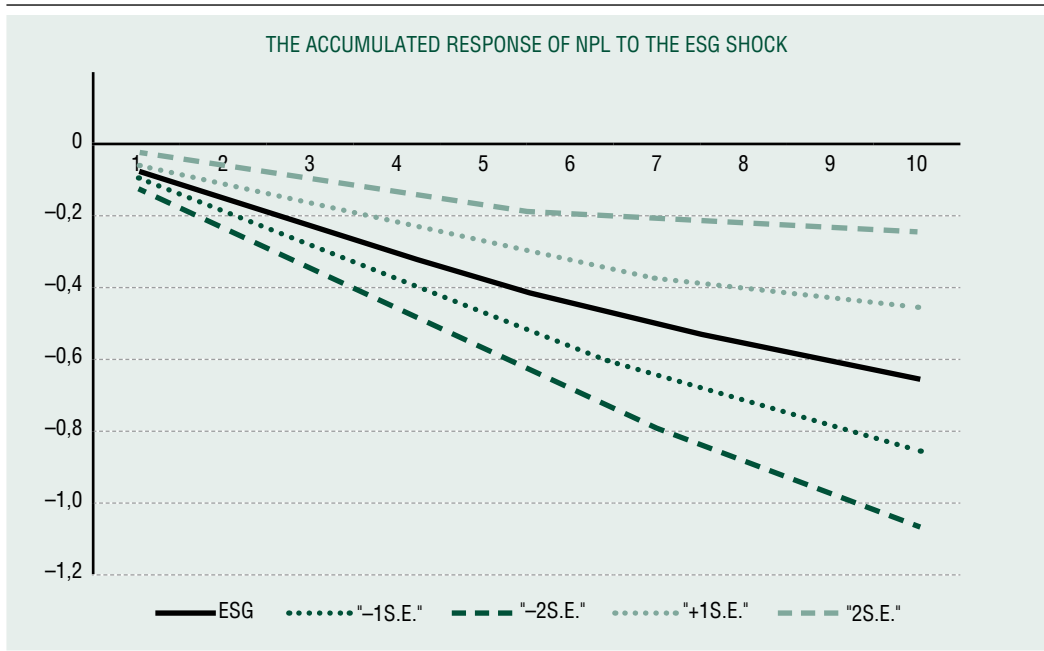
The significance of the role of ESG information in banking operation is unquestionable. On a theoretical level environmental, social, and governance performance can improve the judgement, operation, and success of the banks through many channels. The purpose

of our research was to examine if there is a positive relationship between the rate of non-paying loans and ESG performance among the credit institutions listed in the EU and EFTA countries.

Based on our results we can establish that ESG performance had a significant negative effect on the level of non-paying

Figure 2

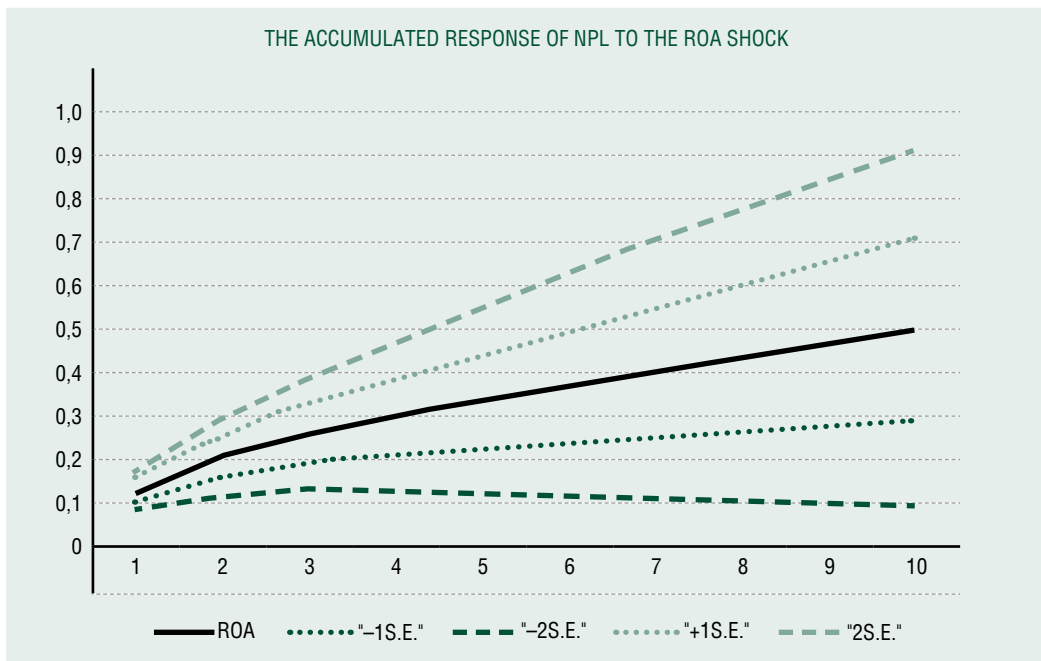
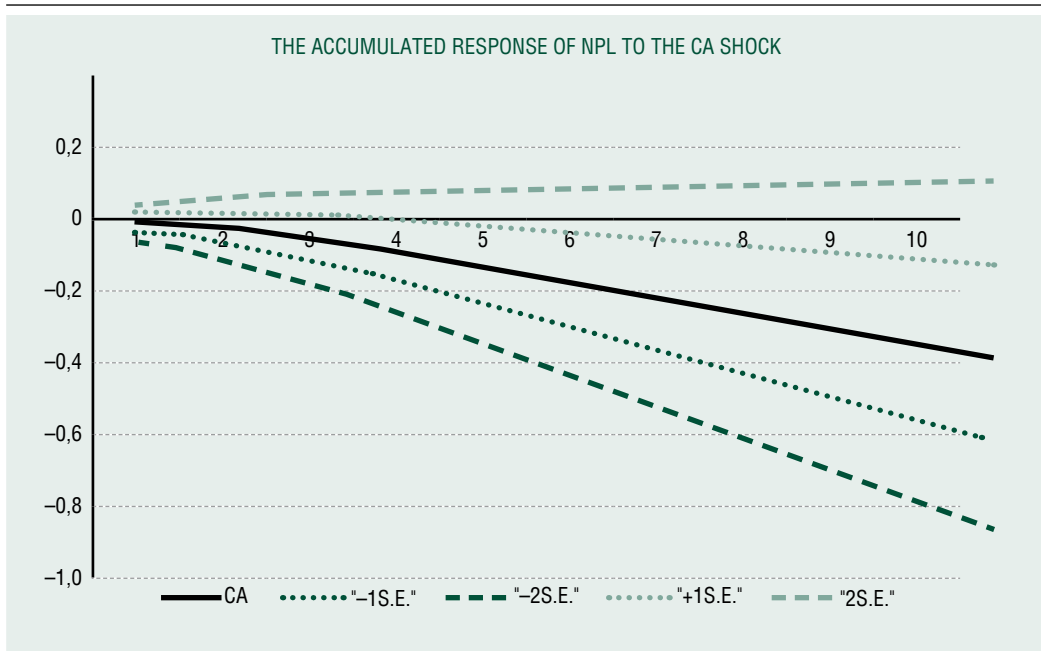
**AGGREGATED IMPULSE-RESPONSE FUNCTIONS OF LONG-TERM RESTRICTION  
IN THE CASE OF A MODEL EXAMINING ESG-INDEX**



Source: Own calculation using Eviews 11

Continuation of figure 2

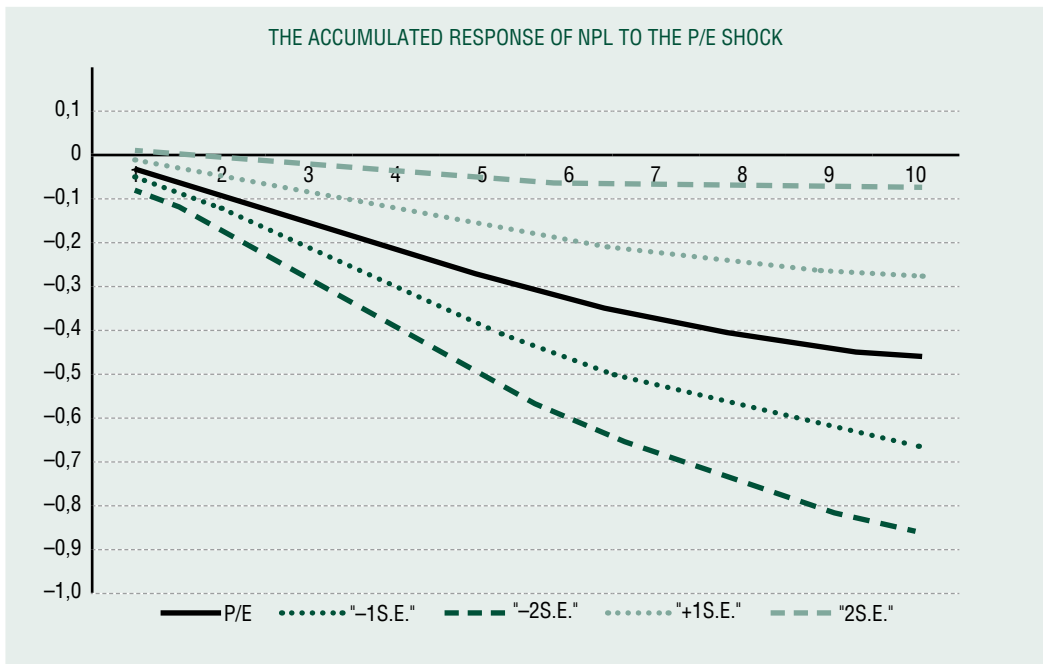
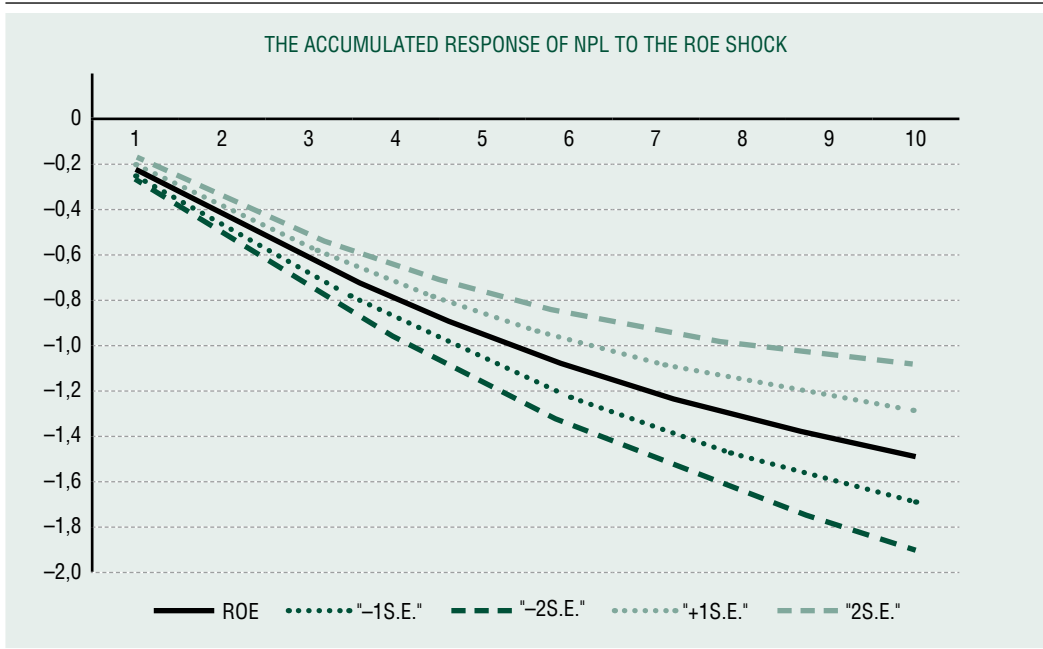
**AGGREGATED IMPULSE-RESPONSE FUNCTIONS OF LONG-TERM RESTRICTION  
IN THE CASE OF A MODEL EXAMINING ESG-INDEX**



Source: Own calculation using Eviews 11



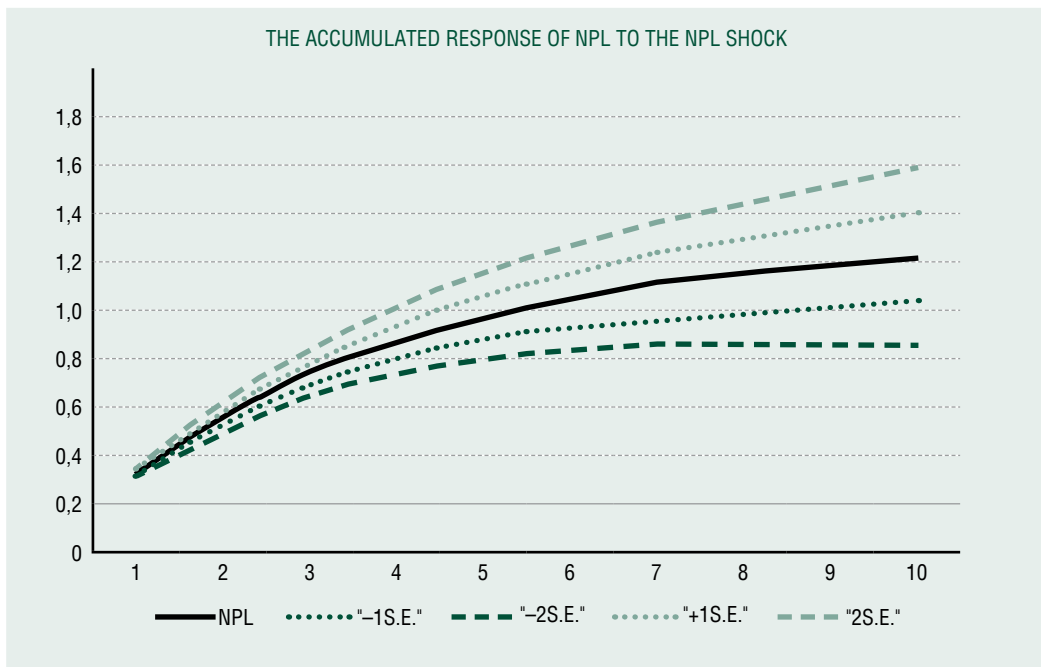
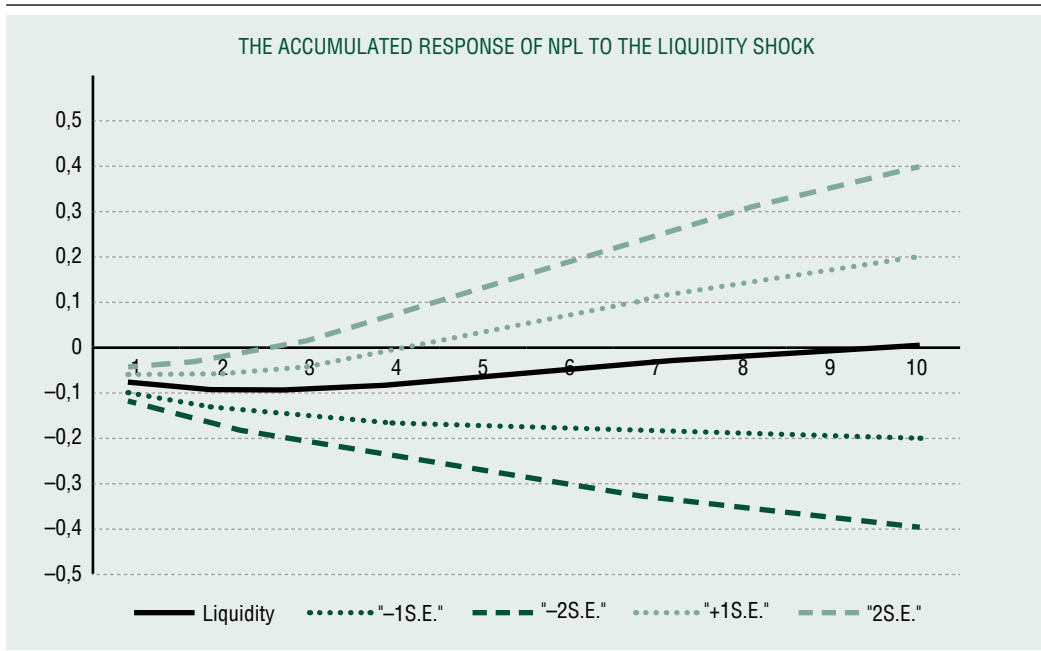
**AGGREGATED IMPULSE-RESPONSE FUNCTIONS OF LONG-TERM RESTRICTION  
IN THE CASE OF A MODEL EXAMINING ESG-INDEX**



Source: Own calculation using Eviews 11

Continuation of figure 2

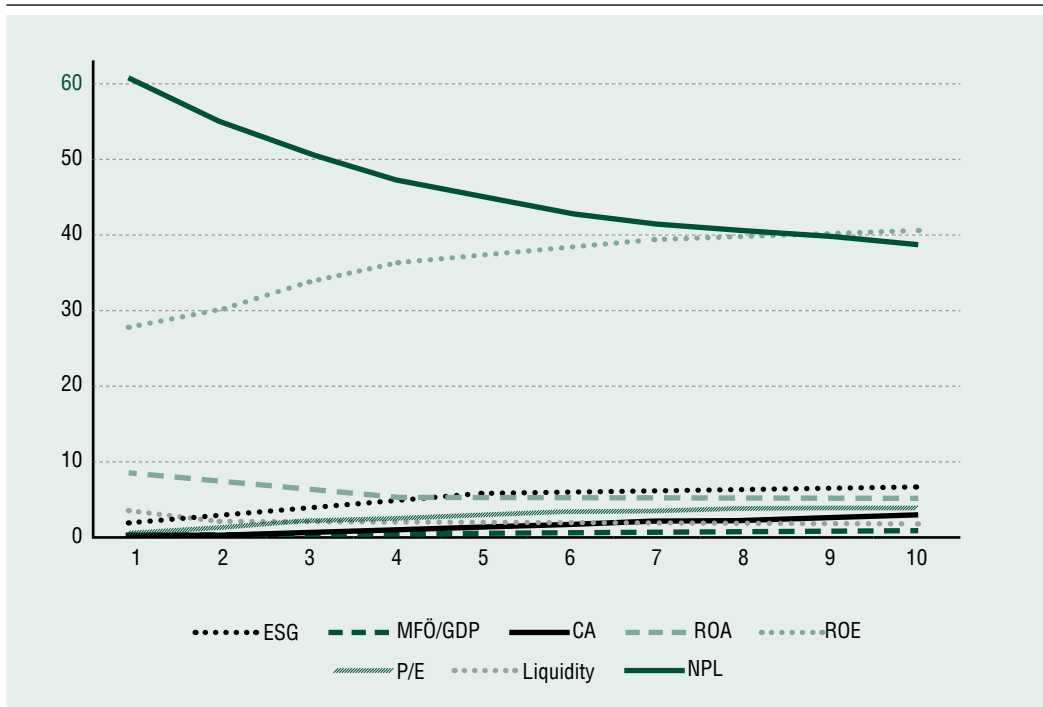
**AGGREGATED IMPULSE-RESPONSE FUNCTIONS OF LONG-TERM RESTRICTION  
IN THE CASE OF A MODEL EXAMINING ESG-INDEX**



Source: Own calculation using Eviews 11

Figure 3

**VARIANCE DECOMPOSITION WITH LONG-TERM RESTRICTION IN THE CASE OF A MODEL EXAMINING ESG-INDEX**



Source: Own calculation using Eviews 11

loans. Unsurprisingly, the regulatory capital generated a risk-mitigating impulse. Based on the examination we can state that the environmental, social and governance factors had a positive impact on profit, therefore we can consider it an aspect which the banks, the investors and the regulators should also address. This could be crucial in managing the economic effects of the COVID-19 pandemic too, as the restrictions affecting several fiscal quarters will cause stress in the quality of credit portfolios despite the various moratorium options. It should be possible to better identify the banking operators both from investor and regulatory point of view.

A number of other questions could be raised in connection with the topic, including the examination of the effects of certain sub-indicators. As for the impact of subindices on operational safety and profitability, there is no unity in the literature, so a deeper exploration could offer numerous possibilities. The expansion of the research time horizon or the scope of institutions included in the sample, or even comparison with another sector could yield interesting conclusions. However, the difference between banks performing well, averagely or poorly could only be explored more deeply by means of quantile regression. ■

NOTES

- <sup>1</sup> This research was supported by the EU-funded Hungarian grant EFOP-3.6.1-16-2016-00008.
- <sup>2</sup> In our case, it means the following script: *var var1. ls 0 1 esg ta\_gdp ca roa roe pe liq npl @ c dummy\_basel2 dummy\_eu dummy\_ez dummy\_ez\_recession*

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