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Overview

The ***Journal of Banking and Financial Economics*** **(JBFE)** is an open access journal. The submission of manuscripts in free of fee payment. This journal follows a double-blind reviewing procedure.

Aims and Scope

JBFE publishes high quality empirical and theoretical papers spanning all the major research fields in banking and financial economics. The aim of the journal is to provide an outlet for the increasing flow of scholarly research concerning banking, financial institutions and the money and capital markets within which they function. The journal also focuses on interrelations of financial variables, such as prices, interest rates and shares and concentrates on influences of real economic variables on financial ones and vice versa. Macro-financial policy issues, including comparative financial systems, the globalization of financial services, and the impact of these phenomena on economic growth and financial stability, are also within the *JBFE*'s scope of interest. The Journal seeks to promote research that enriches the profession's understanding of the above mentioned as well as to promote the formulation of sound public policies.

Main subjects covered include, e.g.: [1] ***Valuation of assets***: Accounting and financial reporting; Asset pricing; Stochastic models for asset and instrument prices; [2] ***Financial markets and instruments:*** Alternative investments; Commodity and energy markets; Derivatives, stocks and bonds markets; Money markets and instruments; Currency markets; [3] ***Financial institutions, services and regulation***: Banking efficiency; Banking regulation; Bank solvency and capital structure; Credit rating and scoring; Regulation of financial markets and institutions; Systemic risk; [4] ***Corporate finance and governance****:* Behavioral finance; Empirical finance; Financial applications of decision theory or game theory; Financial applications of simulation or numerical methods; Financial forecasting; Financial risk management and analysis; Portfolio optimization and trading.

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Proposals of Special Issues should be submitted to at jbfe@wz.uw.edu.pl. All proposals are being reviewed by the Editorial Team on the basis of certain criteria that include e.g.: the novelty, importance and topicality of the theme; whether the papers will form an integrated whole; and the overall 'added value' of a Special Issue.

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The Impact of Nominal Negative Interest Rates on the Economy – Literature Review

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ABSTRACT

Until recently, negative nominal interest rates of the central bank were in the sphere of theoretical considerations. In 2009, the Swedish Central Bank was the first to implement a negative interest rate policy (NIRP). Since then, the NIRP has been implemented by the National Bank of Denmark, the European Central Bank, the Swiss National Bank and the National Bank of Japan. Unfortunately, due to the large number of simultaneous factors affecting the economy, it is extremely difficult to determine the long-term effects of NIRP implementation. Furthermore, the magnitude of the impact and the global extent of the coronavirus pandemic would have a significant impact on the dilatation, so the focus was on pre-pandemic issues. This paper is a literature review and it aims to synthetize information about the impact of negative interest rates on the market – in financial and real spheres. In this paper, both the results of scientific research and the opinions of experts were used, then the impact of negative nominal interest rates on the financial and real sectors was assessed. The results show that most authors highlight an adverse impact of negative interest rates on the stability of the banking sector regardless of the country. The greatest fear of the NIRP implementation by central banks is that the potential behavior of economic entities cannot be predicted with certainty, especially when it comes to cash deposit withdrawals from banks.

JEL Classification: E43; E44; E52; E58

Keywords: interest rates, nominal negative interest rates, NIRP, monetary policy.

1. INTRODUCTION

A completely new phenomenon in the world of finances are negative nominal interest rates that, until the global financial crisis of 2007–2009, were widely recognized as an unrealistic economic phenomenon (Brózda-Wilamek, 2017). Following the turmoil in the global financial markets, major central banks in the world economy gradually lowered their key interest rates, eventually bringing them down to a very low level, even below zero. It is worth emphasizing that the implementation of a negative interest rate policy (NIRP) itself raised many questions

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and uncertainties, as nominal interest rates had never been negative in the history of economics (Altavilla et al., 2020).

The existing relations between the creditor and the debtor related to the flow of money from the borrowed capital were as follows: the creditor provides the capital and in return, the debtor pays the creditor for this capital (Gafrikova, 2016). In the case of negative interest rates, the relationship is reversed: the creditor pays for making capital available to the debtor. Kolany (2015) calls this a fantasy and considers it absurd. Klepacki's (2016) view of the NIRP is less severe – unconventional and controversial. Thornton and Vasilakis (2019) have a similar viewpoint.

However, the scale of the effects of the implementation of the NIRP, primarily for financial markets, is indisputable. Monetary policy affects the size of money supply, and the use of the NIRP as an atypical instrument is visible in many spheres (Arteta et al., 2016). Therefore, the effects of the NIRP implementation are felt by many groups of stakeholders, especially those whose activities are based on generating a profit in the financial sector (Lopez et al., 2018).

Due to the relatively short period of time since the introduction of negative interest rates, there are many questions about their impact on the economy, both in the short run and in the long run. The impact of the NIRP phenomenon on the economy was immediately investigated in many studies, which results in an upward trend in the number of scientific publications on this topic. Nonetheless, the number of unknowns related to the NIRP implementation makes it necessary to further investigate the phenomenon. This paper is the collection and synthesis of information on the NIRP. Its value for science is a combination of theory (scientific papers) and the opinions of practitioners (experts), thus it may constitute a starting point for further research. The aim of the paper is to synthesize the information about the impact of negative interest rates on the market – in financial and real sphere. In order to achieve it, the following research question was posed: What is the impact of the NIRP implementation on the financial and real sphere?

The research method used was a critical literature review which includes both scientific research and statements of experts in the field of finances. Due to the "new reality" created by the coronavirus pandemic and emergency interventions by both central banks and governments to protect the economy from the crisis, the study focuses only on experiences before the outbreak of the COVID-19 pandemic. Therefore, the stage of selecting the references was as follows: the Google Scholar database was used to search for scientific papers, limiting the year of publication to 2020. Then, articles were selected that extensively dealt with the subject of NIRP. In order to find expert opinions on the issue, the Google engine was used to search for the phrase "negative interest rate policy" in both Polish and English. The last stage was a comparison of the research results and expert opinions on the impact of the NIRP implementation on the financial and real sphere.

2. LITERATURE REVIEW

2.1. Negative interest rates in theory and practice

Hicks (1937) stated that interest rates must always be positive. When there is no cost of owning money, it is better to be able to have it at one's disposal than to borrow it if the interest rate is equal to zero. As central banks' interest rate cuts approached zero, some economists believed that it was impossible to go below that level (see Buiter, 2009). The introduction of the NIRP was all the more risky as there was very little economic theory supporting it (Eisenberg & Krühner, 2018). The response to the implementation of a negative nominal interest rate policy may vary in different countries (Thorntona & Vasilakis, 2019).

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As Kolany (2015) notes, zero interest rates "are not the product of the market, but the result of arbitrary decisions by a narrow group of central bankers". This is the result of a political game of priorities such as bank safety and state solvency. The budget deficit is financed by debt instruments that bear interest. Therefore, the lower the interest rate on the instrument, the lower the cost of debt. In the case of negative interest rates, the lender pays the borrower's debt. Randow and Kennedy (2016) argue that the NIRP is an effect of desperation because traditional monetary policy tools have failed.

Goodfriend (2000, p. 41) and Brózda-Wilamek (2017) claim that the interest rate could be negative if maintaining and managing cash were associated with some extraordinary costs or mental discomfort. In this reasoning, the deposit is seen as a cost source for the bank. However, in the classic model of the banking system, banks' activity consists in transforming deposits into loans, the interest on which (higher than interest on deposits) is the bank's income. Therefore, the capital transferred by depositors is the basis for financing the bank's activities, an opportunity and a source of profit generation. The more money is deposited with the bank, the more funds it will have to spend on loans (ceteris paribus). As a result, it will be possible to obtain proportionally higher income.

Randow and Kennedy (2016) report that as of mid-2016, about 500 million people lived in the world of negative nominal interest rates. In their opinion, economically, this is a new financial era. The implementation of the NIRP was smooth and trouble-free, although there are still no mechanisms that would prevent withdrawing deposits and escaping to paper currency if the rates are even lower (Lilley & Rogoff, 2019).

In terms of economic activity, the introduction of negative interest rates on outstanding securities or existing types of contracts has been associated with a high degree of uncertainty of the effects. As noted by Bech and Malkhozov (2016), the experience to date suggests that the impact of the policy of moderate negative rates on money markets and other interest rates is similar to the positive rate mechanism. In turn, theoretically, interest rates may fall indefinitely, and financial institutions, instead of maximizing profit, will minimize losses.

The NIRP implemented by central banks had various origins that resulted mainly from the current financial situation. The aim of the National Bank of Denmark was to mitigate the side effects of unconventional monetary policy and counteract the pressure on the appreciation of the Danish krone (Gafrikova, 2016; Brózda-Wilamek, 2017). The Swiss National Bank had similar reasons for the application of the NIRP which was primarily concerned with discouraging foreigners from investing in francs, which was to translate into slowing their appreciation. By contrast, the Swedish Central Bank, by applying the NIRP, wanted to counteract deflation and stimulate lending to the private sector to stimulate economic growth. The purpose of introducing negative interest rates by the European Central Bank (ECB) was to increase inflation and boost economic activity in the short term, following the region's debt crisis. However, central banks have maintained interest rates below zero for longer than expected (Horowitz, 2020). The dates of the introduction of negative nominal interest rates by central banks are as follows:

- July 2009 – Swedish National Bank (Sveriges Riksbank)[1],
- July 2012 – National Bank of Denmark (Danmarks Nationalbank),
- June 2014 – European Central Bank,
- December 2014 – Swiss National Bank (Schweizerische Nationalbank, Banque Nationale Suisse),
- January 2016 – National Bank of Japan (Nippon Ginkō).

[1] In December 2019, Sveriges Riksbank became the first bank to hike its key interest rate above zero.

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2.2. Threats of the NIRP implementation

The President of the European Central Bank Christine Lagarde treats the transfer of negative interest rates onto depositors as a concern (Goldstein, 2019). However, negative interest rates may enhance market development by ensuring stronger economic development, lower unemployment, and lower costs of borrowing money. Lagarde argues that if not for the introduction of this unconventional policy, euro area citizens would be, overall, worse off (Goldstein, 2019). Furthermore, Lagarde claims that this was the reason for economic growth in the euro zone and this is an argument for such a monetary policy to be correct (Horowitz, 2020). However, Bundesbank President Jens Weidmann and Dutch central bank Governor Klaas Knot are skeptical of the easing policy and are reluctant to further cut interest rates, while the Bank of Italy Governor, Ignazio Visco, believes that asset purchases are better than the policy of negative interest rates (Stirling, 2019).

The NIRP may lead to the loss of central banks' control over the implemented monetary policy, with such risk increasing the more, the more negative rates are. Klepacki (2016) calls this phenomenon the risk of excessively low interest rates. Moreover, the NIRP is mainly applied in Europe and it is unpredictable how other economies will behave in the face of the introduction of negative interest rates.

According to Lilley and Rogoff (2019), the biggest counterargument to the introduction of the deep NIRP is that it has not been tried out before, so the effects remain in the sphere of guesswork and speculation. Among the concerns about the introduction of the NIRP, Bech and Malkhozov (2016) distinguish between the ways of treating floating rate instruments and the ability of the market infrastructure to accept them. There is considerable uncertainty about the behavior of actors, including consumers, in the event of deepening negative interest rates.

Among the risks of the NIRP, Klepacki (2016) notices:

- very low predictability of the effects of this phenomenon,
- different date of risk materialization (short, medium and long-term),
- no historical reference (comparable sequence of events) in linear terms,
- advanced effect of globalization and the accompanying phenomena of centralization and contagion,
- the possibility of the emergence of new accompanying risks.

Reinbold and Wen (2017) point out that the use of negative interest rates in relation to monetary theory raises several doubts. The first is the mere implementation of negative nominal interest rates. The second is their stimulating effect and their impact on aggregate demand. The third is the effectiveness of maintaining negative nominal interest rates in the long term. Generally, the NIRP entails certain threats, it may (Narodowy Bank Polski, 2016, pp. 18–19):

1) increase the propensity of economic entities to convert bank deposits to cash,
2) worsen the profitability of the banking sector,
3) pose threats to the financial stability of pension funds and insurance companies,
4) be conducive to the emergence of speculative bubbles in financial markets.

Hence, the policy of negative interest rates affect investment. Investors, particularly insurers, may be reluctant to invest in securities with negative cash flow. Here, attention should be paid primarily to pension funds which invested capital in safe assets, but with low interest rates. Their negative profitability resulted in the search for other, more profitable, although less safe financial instruments.

Gafrikova (2016) points out that the continued negative interest rates are accompanied by an increased risk of imbalance in the real estate and mortgage markets, as low interest rates encourage households to borrow and consume. This results in an increase in the prices of real estate that is purchased on credit by households. High household debt is dangerous for the entire

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financial sector and is the reason for the crisis of 2007–2009. Moreover, pursuing a policy of negative interest rates, with a purpose other than stopping the appreciation of the currency, can pose a risk when the currency is already low in value.

Some commercial banks, especially large ones, use this form of central bank policy because a large percentage of loans comes from wholesale markets that also have negative interest rates. Boungou (2020) observed that banks' risk-taking was lower in countries where negative rates were adopted. Moreover, the size and capitalization of a country's banking system have a meaningful effect on this result. The analysis by Lopez et al. (2018) shows that banks withstood the introduction of the NIRP well, with the exception of small banks. A widely discussed issue in the literature is that commercial banks pass interest rates to retail depositors (Bech & Malkhzov, 2016; Randow & Kenedy, 2016).

Fries et al. (2017) show a simulation model designed to handle negative and close-to-zero risk factors. However, forecasting NIRP effects using models is burdened with a large error because the time period since their introduction is still too short and they are accompanied by decisions made by central banks (Honda & Inoue, 2019).

2.3. Impact on the financial and real spheres

Negative nominal interest rates mean that investors who hold securities till maturity will not get back the full amount invested (Randow & Kennedy 2016). Moreover, a decline in the purchasing power of money, which additionally reduces profitability, in this case increases the loss on investment. Government bonds, so far providing low rates of return but guaranteeing the security of funds, can no longer be used as instruments for investing pension capital. Gatnar (2019b) notes that on August 23, 2019, the government bond yields of four countries – Denmark, the Netherlands, Germany and Switzerland – reached a negative level along the entire length of the curve, i.e. from one to 50 years.

Negative rates put pressure on the profitability of financial institutions (Brunnermeier & Koby, 2017). The NIRP has reduced the profitability of banks (Molyneux et al., 2017). This is due to the fact that NIRP effects cause the erosion of the net interest margin (Genay & Podjasek, 2014; Hannoun, 2015; Chaudron, 2018). The implementation of the NIRP generates costs, including those incurred by commercial banks for maintaining central bank liabilities (Bech & Malkhozov, 2016). Commercial bank representatives claim that negative interest rates translated into lower earnings of their institutions – this can also be seen in scientific research papers (Brunnemeier & Koby, 2018; Eggertsson et al., 2019; Horowitz, 2020). It is essential especially for small banks as it increases the risk of their operations (Nucera et al., 2017). Moreover, such a policy does not encourage saving money and raising capital, but rather encourages borrowing and spending (Horowitz, 2020). Gafrikova (2016), analyzing the impact of negative interest rates on commercial banks' deposits, commercial banks' loans and their financial results, points out that analyses of the impact of negative interest rates on the economy are extremely difficult, as central banks may conduct other activities at the same time. Attention should also be paid to the influence of the political situation in a given country, as well as the general economic situation of a country and financial behavior of its citizens.

The application of the policy of negative interest rates and other non-standard measures adopted by central banks lowered interest rates on loans, even to a negative level and therefore increased the demand for them (Gafrikova, 2016). Lopez et al. (2018) showed that when positive and negative interest rates are low, losses in banks' interest income are almost exactly offset by savings on deposit expenses and gains in non-interest income. Bottero et al. (2019) showed that Italian banks with more liquid assets increased the supply of credit when the NIRP was implemented. On the other hand, negative interest rates on deposits encourage withdrawals from the bank. A rational depositor will prefer to hold cash rather than pay the bank to hold it.

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A larger number of depositors secures the bank's financial liquidity, as it reduces the probability that the deposits will be withdrawn at one time. On a macroeconomic scale, the risk of a run on banks is related, inter alia, with the outbreak of the financial crisis and high inflation. In turn, on a microeconomic scale, individual entities will massively withdraw their deposits if they notice that they have to pay the bank for them. This mainly applies to large enterprises with huge cash holdings (Altavilla et al., 2020). Research conducted on the Swedish market shows that deposit and lending rates do not follow policy rates when they turn negative (Eggertsson et al., 2019). Khayat's (2018) research shows that commercial banks are reluctant to pass interest rates to depositors because they are afraid of their deposit withdrawals. Instead, commercial banks choose alternatives, for instance, to store assets in foreign currencies, which leads to currency depreciation. Nonetheless, other studies show that banks pass negative rates to their corporate depositors without experiencing a decline in funding, and that the degree of influence increases as rates move stronger into the negative territory (Altavilla et al., 2020).

An alternative to depositing cash in a bank is to keep it in the savings sock (Gafrikova, 2016). Keeping it at home or in one's wallet does not generate profits or costs, therefore the return on investment is 0%. In the case of positive, even slightly above-zero rates, interest-bearing deposits are rational. Therefore, the policy limiting cash demand is an important complement to the policy of negative interest rates (Rognile, 2016). According to Rognile (2016), the far reaching step is the departure from cash, although the elimination of larger denominations from circulation should be sufficient.

Central banks that adopted the NIRP gave their primary motivations for the policy as the stabilization of inflation expectations and support of economic growth (Jobst & Lin, 2016). Indeed, the NIRP appears to be effective in boosting economic growth and overcoming a deflationary spiral (Czudaj, 2020). However, it should be noted that too much inflation can imbalance financial stability (Reinhart & Rogoff, 2009). The risk of instability in the financial sector has been increasing since the introduction of the NIRP, especially due to the negative impact on the bond market and the banking sector (Kurowski & Rogowicz, 2017). It is essential to understand how the NIRP affects the stability of the entire financial system (English et al., 2018). Bruna and Tran (2020) point out that unexpected decisions made by central banks regarding crucial interest rates may cause shocks in the financial market. Asset purchases and forward guidance must be connected with NIRP (Boungou, 2020).

Although the introduction of the NIRP is an element of monetary policy, it has implications for fiscal policy. Most of all, negative interest rates reduce the cost of public debt. Therefore, they not only enable cheap debt rollover, but also encourage the government to become indebted (Arteta et al., 2016). Excessive indebtedness at a time when interest rates remain low creates enormous threats to the financial stability of the state, as in the event of an increase in interest rates, the cost of public debt will increase and thus will necessitate drastic cuts in fiscal policy (Blanchard, 2019).

The interest rate is one of the basic instruments influencing the price level, as it directly affects aggregate demand and aggregate supply (Iwaszczuk & Szydło, 2016). Thus, it also affects the components that make up GDP – consumption, investment, government expenditure and net exports. Rognile (2016) argues that negative interest rates help stabilize aggregate demand, but at the cost of an ineffective subsidy for the paper currency.

Negative interest rates become a source of monetary policy opportunities, which may (Klepacki, 2016):

- stimulate the currency policy in order to discourage foreigners from investing, and this prevents the appreciation of national currencies,
- encourage banks to lend money to the private sector, which increases consumption, economic growth, but also inflation,

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- lead to forward guidance (the belief that central banks will take action to stimulate the economic situation and keep inflation within the established inflation target channel),
- provide cheap financing of government debts.

Analyses carried out by Dong and Wen (2017) show that it is optimal for central banks to introduce negative nominal interest rates at a time when aggregate demand for investment and consumption is extremely weak, because the NIRP should theoretically not only translate into a reduction in the cost of loans, but also stimulate investment expenses. Research by Altavilla et al. (2020) indicates that negative interest rates are a stimulus for the entire economy through firm asset rebalancing. Boucinha and Burlon (2020) showed that the NIRP stimulus to the economy has been effective in easing financing conditions and thus it ultimately contributes to price stability. As a result, the policy of negative interest rates improved the macroeconomic situation, as also pointed out by Lagarde (Horowitz, 2020).

Monetary policymakers need to know what effects changes in interest rates have on banks' health because this may influence their willingness to lend, providing an additional mechanism through which monetary policy can affect the real economy (see Van den Heuvel, 2012). According to Coeuré (2016, as cited by Boungou, 2020), the NIRP aims at increasing the supply of credit by taxing banks' excess reserves at the central bank and, in fine, at supporting growth. The larger the loan, the more visible the effects of a lower interest rate are (Horvath et al., 2018).

Another of the impacts of the NIRP on the real economy is the fact that the zero interest rate limit prevents the safe asset market from being accounted for, which may result in the need to decrease production in order to adjust demand to supply (Caballero & Farhi, 2017).

Gatnar (2019a) believes that negative interest rates are a problem as they encourage debt and discourage saving. It should be emphasized that negative interest rates reduce the costs of loans for business entities and households, thus creating demand for them. On the other hand, long-term saving allows for building capital that can then be invested. The accumulated assets can be a source of capital which, in the event of retirement, will become a source of income.

It is worth noting that in the event of negative interest rates, it is mainly debtors that benefit because they can earn from their debt. An interesting phenomenon is the occurrence of negative mortgage interest rates in the face of negative interest rates, which means that the bank-lender pays the borrower to take the loan (Osborne, 2020). Therefore, it is possible to obtain a dual source of income from real estate investments. First, when buying a property, an investor takes out a mortgage which is partially repaid by the lender at the time of negative interest rates. Secondly, positive inflation means that the real mortgage is worth less and less due to the falling value of money. However, the second potential source of income from investment in real estate is the possibility of renting it for a fee.

3. DISCUSSION

The main effect of the policy of negative interest rates is their negative impact on the stability of the banking sector in Europe and in the world. Limiting the returns on savings and creating the borrowing capacity of institutions with low credibility causes consumption to increase, and therefore increases the circulation of money and inflation, with the simultaneous risk of insolvency of borrowers. When inflation is higher than desired, with the simultaneous bankruptcy of indebted entities, the banking sector may become illiquid and this may cause an economic domino effect, analogous to the one that formed the basis of the crisis of 2007–2009.

Banks offer their clients benefits not only in the form of interest. As institutions of public trust, they owe their status primarily to ensuring the security of the funds deposited. In addition, transactions made through banking services are quick and convenient. Storing cash, especially

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a larger amount, involves the cost of security measures against theft or damage, i.e. the cost of installing a safe, monitoring, insurance, etc.

People who act rationally decide to keep less cash in banks when high inflation is expected and the interest on the funds in the account is low. Therefore, they reduce their deposits, which results in a reduction in the money supply in the banking sector. As a result, nominal bank lending rates must rise more than the expected rise in inflation for the profit-maximizing banks to break even. Under the NIRP, the conventionally defined real interest rate (nominal interest rate ≈ real interest rate + inflation) tends to overestimate the real interest rate level (namely, the real interest rate may be more negative than the traditional Fisher rule suggests).

Some of the research studies suggest that monetary policy can still be effective at the zero lower bound (Swanson, 2018; Czudaj, 2020). Lilley and Rogoff (2019) emphasize that in the face of negative interest rates, protective tools should be implemented to prevent them from being transferred to retail clients who have small bank deposits. An interesting approach is that the central bank may legally require large corporations to keep cash, savings and loans in the banking system once the NIRP is implemented (Reinbold & Wen, 2017). Similar requirements can be imposed on commercial banks that deposit cash with a central bank.

Many authors emphasize that too little time has passed since the NIRP was first implemented. Therefore, analyses of its effects upon the economy can at best be defined in the short term. As presented in the study, the state of the art is largely based on exploratory research that deals with the NIRP impact and focuses mainly on describing the behavior of market entities in the reality of negative interest rates. The first area to expand research is the identification of long-term NIRP effects.

Another area to be analyzed is the determination of the level of financial knowledge of citizens regarding issues related to interest, especially in the area of negative interest rates. Next, the potential impact on the purchasing behavior of consumers should be identified. Does the NIRP increase consumption? Does society save in the face of NIRP? If so, what are the ways to save? It would also be worth taking into account the culture of a given country.

In addition, it is worth carrying out simulations that take into account the variant of deepening interest rates. Therefore, it would be possible to check how economic agents will behave when interest rates reach, for example, 5%, 10% and 20%. Is there a limit below which there are only losses and what is the limit?

It should be noted that the research disrupting factor is the outbreak of the coronavirus pandemic, the effects of which are visible both in the real and financial spheres. Unfortunately, the pandemic causes changes in the behavior of all economic operators, making it difficult to determine ex-post effects of COVID-19. Thus, it cannot be inferred that the behavior would have been the same prior to the pandemic and that it is impossible to apply the ceteris paribus clause when treating the long-term impact as a continuous process. Moreover, the specter of the financial crisis as a potential pandemic effect has prompted central banks around the world to implement a number of preventive measures. The simultaneous use of many monetary policy instruments effectively disrupts the research process on the separate impact of the NIRP on the economy.

4. CONSLUSIONS

The implementation of the NIRP was associated with great uncertainty as it impacts the entire economy. Although several years have passed since the implementation of the NIRP, the effects on the economy cannot be clearly assessed. Interest rates, despite being negative, are still close to zero. Some, as pointed out in the study, argue that their mechanism of influence is similar to that of positive interest rates. Moreover, the long-term consequences of their application and a further

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reduction in their level are unpredictable. In addition, the research conducted so far has not given any clear answers when it comes to the impact of interest rates in the short term.

Negative interest rates are seen as a stimulus to the economy. However, they do not have to be the only factor causing this. Therefore, carrying out analyses concerning this area is very difficult, and their results cannot be clearly interpreted. Moreover, the ceteris paribus model assumption, facilitating the evaluation of the conducted research, cannot be used for several reasons. The first one is the fact that when the negative interest rate changes (regardless of the size), the behavior of market players is unknown. Second, too many factors can shape the economic situation, including the economic impact on countries with positive interest rates. The third reason is that the impact of the applied forward guidance policy may disrupt the sudden reaction of economic agents to changes in the negative interest rate. The fourth reason is the complexity of monetary policy instruments that can be used simultaneously.

Negative nominal interest rates, by definition, generate a loss in the absence of inflation. The higher the inflation, the lower the real interest rate, and with negative nominal interest rates, it is even lower. Therefore, securities that are perceived as safe and with negative interest cannot be invested in, inter alia, pension funds. Moreover, they are no longer attractive at all because it is better to hold cash than to invest in an instrument that will make a loss. On the other hand, it is an opportunity for governments because they are able to issue government bonds with negative interest rates and thus finance public debt if the demand side wishes to purchase them. However, cheap public debt cost creates a fear of over-indebtedness and can be a cause of financial instability in a country.

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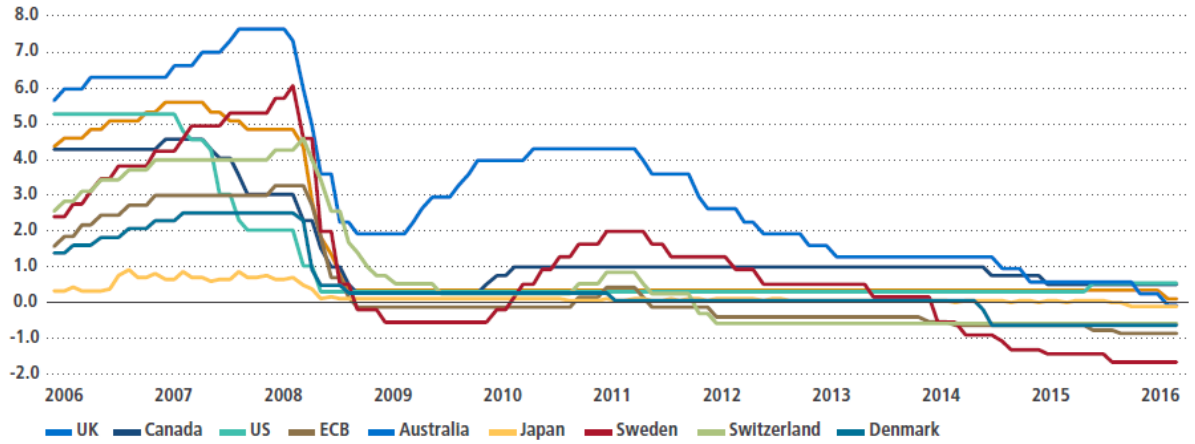
APPENDIX

It is extremely difficult for a person who lacks knowledge of economics and finance, especially the transmission channels of interest rate effects, to understand the economic situation caused by the implementation of negative nominal interest rates. A better understanding of the policy of negative interest rates and the whole picture of the impact of the internationalization of the financial market is possible by analyzing the time series of the interest rates of central banks that have decided to go beyond the zero bound in their history. It is particularly important to take into account the period before the financial crisis of 2007–2009 (see Figure 1).

Figure 1
Interest rates of selected central banks in the period 2006–2016



Source: https://www.pimco.no/en-no/resources/education/investing-in-a-negative-interest-rate-world/ (access: 9.10.2021).

It is true that this chart does not take into account the recent years but it perfectly illustrates the genesis of implementing negative interest rates in practice. Central banks in the face of the financial crisis drastically cut interest rates down to levels close to zero, and the bank of Sweden was the first to cross this bound.

Figure 1 shows another interesting relationship – the higher the interest rates are during economic prosperity, the greater the possibility of lowering them when a crisis occurs. The reduction in interest rates is intended to stimulate the economy in terms of increasing consumption. The larger it is, the greater the expected results are. When interest rates are low and their cut may shake the economy, the policy of shaping the expectations of market participants becomes more important.

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Information Asymmetry, Capital Structure and Equity Value of Firms Listed on the WSE

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ABSTRACT

The paper investigates the impact of capital structure and information asymmetry on the value of companies listed on the Warsaw Stock Exchange. The study was conducted using the ordinary least squares (OLS) method on a sample of 273 companies in 2017 and the GMM dynamic panel-data approach with instrumental variables. Data retrieved from the Notoria, Bloomberg and Orbis databases were used. The results show that despite its impact on reducing the cost of capital, increasing debt does not lead to an increase in equity value. Therefore, the benefits of higher short-term leverage are limited and visible only for long-term debt. On the other hand, despite bigger information asymmetry, companies are valued higher, which means that asymmetrical information does not necessarily hurt valuation in the short term but in the long term. The results contribute to the literature on firms' use of leverage under information asymmetry, showing higher trust in cash flow than profits in books.

JEL Classification: A1, B2, C5, G1, G2, G3

Keywords: information asymmetry, capital structure, market value of the company, WACC.

1. INTRODUCTION

The appropriate choice of financing sources is one of the dominant problems of corporate finance. Despite many theoretical considerations and empirical studies in the literature, no consensus has been reached. Modigliani and Miller (1963) were precursors in this field. They pointed out that thanks to the debt tax shield, the company's value increases as the share of interest-bearing debt in the capital structure increases. In turn, considerations of Miller (1958, 1963) on the existence of bankruptcy costs and corporate income tax (CIT) and personal income

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tax (PIT) led to the conclusion that the relationship between leverage and company value depends on tax benefits. This implies that the tax benefits of debt are limited. The value of a company using debt increases as the degree of indebtedness increases, but only until the interest tax shield from reducing the income tax base by the interest paid on the interest on the debt is used.

Moreover, non-debt tax shields, e.g. depreciation deductions, the amount restrictions on the deductibility of interest on the debt (introduced in 2018 by an EU directive) and the possibility to deduct tax losses from future income for no more than five years, mean that increasing the debt share in the capital structure does not give the company unlimited opportunities to increase its market value (Leszczyłowska, 2018).

The paper aims to examine the influence of capital structure and information asymmetry on the equity value of companies listed on the main trading floor of the Warsaw Stock Exchange.

The research problem undertaken in this paper is still relevant because the results of previous studies are not unambiguous due to the difficulty of measuring the phenomenon of information asymmetry. Drobetz (2010), Fauver and Naranjo (2010) and Fosu, Danso, Ahmad and Coffie (2016) explain the negative correlation between information asymmetry and equity value by the presence of agency costs, adverse selection and moral hazard.

Huynh, Wu and Duong (2020) point out the ambiguous effect of the information asymmetry phenomenon on equity value, while Botosan (1997), Dierkens (1991) and Bharath, Pasquariello and Wu (2009) argue that the relationship between these variables may be strongly influenced by capital structure.

The study was conducted using the ordinary least squares (OLS) method on a sample of 273 companies listed on the primary market of the Warsaw Stock Exchange. The companies' financial data refer to 2017 and are taken from the Notoria database, and information asymmetry measures are retrieved from the Bloomberg database. For the robustness check, we retrieved panel stock data from the Orbis database for 2007–2021 and applied GMM with instrumental variables. We contribute to the literature on asymmetry information impact on the capital structure due to the limited studies for companies listed on the Polish stock exchange (Jerzemowska, 1999; Gajdka, 2002; Czekaj, 2015; Białek-Jaworska and Nehrebecka, 2016; Koralun-Bereźnicka, 2016; Pawlonka and Franc-Dabrowska, 2018; Szomko, 2020). Additionally, there is a particular lack of studies linking the use of companies' debt with the common phenomenon of information asymmetry. Stereńczak (2020) suggests that on the Polish stock market, there exists a stock liquidity premium, which constitutes only a tiny fraction of returns and does not increase during periods of a bearish market. This is because of the lengthening of the average holding period when market liquidity decreases.

The remainder of the paper is as follows. Section 2 reviews the literature and empirical studies on the factors that influence the value of a company. The control variables used in the empirical study were selected based on this. Section 3 describes the data and the research design methodology. Section 4 shows the results. First of all, it starts with the verification of the research hypotheses. Then, it answers whether leverage negatively correlates with equity value due to the limited tax benefits of debt. Furthermore, it verifies how information asymmetry and control variables used in the study, such as firm size, the tangibility of assets, amount of cash flow, and profitability of the company and its business profile, correlate with equity value. Finally, section 5 considers the robustness of the results by applying additional information asymmetry measures to OLS models and a dynamic panel-data approach (GMM) to check how information asymmetry affects percentage change in equity value. Section 6 concludes.

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2. LITERATURE REVIEW

The literature reveals that the impact of capital structure on enterprise value differs. Myers (1984) and Stulz (1990) show a negative correlation between these variables. Higher leverage increases the underinvestment or overinvestment problem. According to King and Santor (2008), Fama and French (1998), Brigham and Houston (2012), the negative relationship between the increase in debt and enterprise value is due to the presence of additional costs (agency costs, bankruptcy, among others) and financial risks to which shareholders are exposed. However, Modigliani and Miller (1963), Jensen (1986) and Robb and Robinson (2014) point out that the use of (interest-bearing) debt has a significant positive impact on the enterprise value, as the returns achieved in this way exceed the average interest cost. Furthermore, Jensen (1986) and Gul and Tsui (2010) argue that leverage reduces agency costs, positively impacting equity value. Miller (1989), Ibhagui and Olokoyo (2018), Lin and Chang (2011), Fosu, Danso, Ahmad and Coffie (2016) also indicate an ambiguous relationship between leverage and equity value, which may be due to the threshold relationship between these variables, among others. Based on the literature cited and research, we formulate **hypothesis H1**: *Long-term leverage negatively correlates with equity value*.

Information asymmetry increases the incentives to use short-term debt among risky borrowers (Diamond 1991; Flannery 1986) to signal that they have favourable private information about future outcomes, resulting in lower borrowing costs. Shorter maturities are associated with more substantial information asymmetries. In the presence of information asymmetry, borrowers use short-term debt to signal their quality and commitment to repayment. Smaller firms with less tangible assets are more opaque. Therefore, they prefer shorter maturity debt (Berger et al., 2005; Custódio et al., 2013; Demirgüç-Kunt et al., 2015; Magri, 2010; Ortiz-Molina and Penas, 2008). Distinguishing short-term and long-term debt, we state supportive **hypothesis H1A**: Short-term leverage positively correlates with equity value.

According to Huynh, Wu and Duong (2020), the phenomenon of information asymmetry and the appropriate capital structure choice should be looked at together due to their possible correlation. Indeed, the strength with which information asymmetry affects the equity value may depend intensely on leverage. For example, according to Botosan (1997), the cost of equity is lower for companies with higher levels of information asymmetry. Similarly, Dierkens (1991) observed that companies announce share issues when their information asymmetry is relatively low. On the other hand, He, Lepone and Leung (2013) find that the dispersion of analysts' forecasts increases the ex-ante cost of capital. Moreover, Shen's (2014) research indicates that companies replace equity with debt when information asymmetry increases. Bharath, Pasquariello and Wu (2012) suggest that information asymmetry can directly impact the capital structure, determining investment decisions and shaping the enterprise value.

Based on a study conducted on American companies, they found that debt financing increases with information asymmetry. Similarly, Gao and Zhu's (2015) study found that companies with big information asymmetry use more debt in their capital structure but less long-term debt. Krishnaswami, Spindt and Subramaniam (1999) argue that companies with favorable information about their value and future earnings prefer to issue debt securities (corporate bonds), which are relatively less sensitive to information asymmetry. This inference is consistent with the pecking order theory.

The agency theory (e.g., Myers and Majluf, 1984) concerns the conflict of interests and information asymmetries between corporate insiders (e.g., managers) and outsiders (e.g., existing and prospective shareholders), while the market microstructure theory concerns information asymmetries between informed and uninformed traders. Diamond (1985) shows that smaller information asymmetries between corporate insiders and outsiders result in smaller information asymmetries between traders because the public release of inside information to

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outsiders makes traders' beliefs more uniform and reduces information asymmetries between informed and uninformed traders. Next, Chung et al. (2010) confirm that bigger information asymmetry between corporate insiders and outsiders results in bigger information asymmetry among traders.

Information asymmetry measures commonly found in the market microstructure literature include the price impact of trade, the adverse selection component of the spread, and the probability of information-based trading (Bharath et al., 2009; Easley, Kiefer, O'Hara, & Paperman, 1996). The former assesses the extent to which a trade alters share price and captures the value of private information held by informed traders. Moreover, Chung et al. (2015) use also the dispersion of financial analysts' earnings forecasts, the number of analysts following a firm, an aggregate (composite) metric, and the principal component of these information asymmetry measures.

One of the main problems in researching information asymmetry is the difficulty of measuring it since it is not a directly observable and easily measurable phenomenon. For this reason, this study uses several indicators to approximate information asymmetry. One of the ways of measuring information asymmetry is a group of methods based on observing market transactions concerning a given company. This group includes market microstructure indicators such as the bid-ask spread (the difference between the selling price and the buying price of an asset) and the beta coefficient (the correlation coefficient between the return on an investment in a given company's stock and a hypothetical investment in a market index). The precursor to using the bid-ask spread as a measure of information asymmetry was Demsetz (1968), followed by subsequent researchers, including Kyle (1985) and Glosten and Milgrom (1985). They demonstrated that information asymmetry increases the risk of adverse selection of market participants, which in turn increases the spread. The use of the beta coefficient as an indirect measure of information asymmetry was supported by Easley and O'Hara (2005). They argue that outside investors' varying access to information affects the price of securities. However, the above methods do not guarantee the complete effectiveness of measuring information asymmetry. Studies show that information asymmetry can have different effects on the difference in the bid and ask prices of securities – according to Madhavan, Richardson and Roomans (1997), the contribution of adverse selection costs to the spread is about 40%, while in a study by Kaul and Nimalendran (1990), it is only about 10%.

Furthermore, methods that identify firms that require specialized knowledge involve the risk that their value may be driven by economic factors other than information asymmetry. A market-to-book ratio, which is also often used as a measure of information asymmetry, may only indirectly indicate the level of information asymmetry and mainly relates to their monopoly power, for example (Clarke, 2000). Accounting-based indicators of the earnings quality or the share of intangible assets in assets are also used to measure information asymmetry. The former is mainly based on estimating the quality of accruals by discretionary accruals. Measurement errors of asymmetry, in this case, may result from industry diversity of the structure of accruals and business risk. The latter helps determine the extent to which some assets are more difficult to value for outside investors and determine the expected growth opportunities of the business. Asset intangibility ratios and ratios indicating growth opportunities (i.e., market-to-book ratio) can also reflect the risks associated with investing in a company (Kubiak, 2013). The cited research results indicate that information asymmetry is an essential factor determining equity value. Its occurrence may negatively influence investment decisions which ruin the equity value. Moreover, its influence may be intensely dependent on leverage. The above considerations based on the literature lead to **hypothesis H2**: *Information asymmetry measured by bid-ask spread is negatively correlated with equity value.*

H2A: *Applied beta is negatively correlated with equity value.*

H2B: *Market-to-book ratio is positively correlated with equity value.*

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H2C: *Information asymmetry measured by discretionary accruals negatively correlates with equity value.*

H2D: *Information asymmetry measured by intangibility is negatively correlated with equity value.*

Among the factors influencing the equity value and the phenomenon of asymmetric information and capital structure, studies distinguish, among other things, the firm size, the tangibility of assets, cash flows, and the company's profitability and business profile.

The larger the company is, the easier it is to obtain internal and external financing, which translates into equity value. However, contrary to initial assumptions, studies by Yang and Chen (2009) and Martínez-Sola (2013) show a negative correlation between these variables. As an explanation, they point out that small companies are less exposed to the agency problem and have a more flexible organizational structure, making it easier for them to adapt quickly to change. A negative correlation between company size and firm value is confirmed by Maury and Pajuste (1999) and Fosu, Danso, Ahmad and Coffie (2016), who point out that larger companies are likely to be mature companies for which valuation tends to be low.

Asset tangibility, or the share of fixed assets in a firm's asset structure, can also determine its value. However, this correlation is not straightforward, according to Fosu, Danso, Ahmad and Coffie (2016). On the one hand, companies with a higher share of fixed assets in total assets have fewer intangible assets such as know-how, patents, trademarks, which suggests a negative correlation between tangibility and company value (Maury & Pajuste, 2005). But on the other hand, companies with higher tangibility have less information asymmetry. They hence are less exposed to its negative consequences, which positively affects their value through the structure and cost of capital. Gassen and Fülbier (2014) examined the impact of debt financing on earnings smoothing. When assessing its financial health, investors obtaining information about a company focus on its reported earnings and stability (a measure of the risk of not meeting credit covenants). The results indicate that as the share of external financing in the capital structure increases, the propensity to smooth profits increases. In contrast, according to Boulland, Filip, Ghio and Paugam (2018), investors pay more attention to a firm's ability to generate cash surplus (cash flow from operations) than the profits reported in the income statement. This means that investors are aware of the earnings smoothing by companies (reducing their volatility), so they attach more importance to cash flow, which is not subject to distortion (active shaping). Therefore, a positive relationship is expected between generated operating cash flows and the market value of a company (equity value).

Investors pay less attention to a company's profitability determined on the basis of profit calculated on an accrual basis (in the income statement). However, given investor distrust and suspicion that the income has been actively shaped (using earnings management tools), it is expected that there is a negative correlation between operating margin (a measure of profitability) and the equity value (Grabiński & Wójtowicz, 2019). This implies that the more profitable a company is "on paper", the lower its equity value.

Research by Rodríguez and Molina (2013) indicates that cash holdings vary across companies in different sectors. This implies, therefore, that equity value varies between industries.

3. METHODOLOGY AND DATA

The study included 273 companies out of the 482 listed on the primary market of the Warsaw Stock Exchange. The banking, insurance and finance sectors were excluded from the sample as their activities include collecting and storing or investing cash, debt trading and lending. Therefore, including them could distort the estimation results. Companies whose financial statements did not contain complete data needed to define the variables used in the model were

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also removed from the sample. In addition, companies for which the Bloomberg database did not contain data on applied beta and bid/ask spread were excluded. We analyze a separate total sample and subsample, excluding those that reported negative cash flows in 2017. Table 1 presents the characteristics and composition of the research sample. The data refer to 2017 and come from the Notoria and Bloomberg databases.

Table 1
Characteristics and composition of the research sample

Criteria	No. of firms
Companies and institutions listed on the Warsaw Stock Exchange	**482**
Banks	15
financial and insurance companies	47
non-financial companies	**420**
Exclusion from the sample due to:	**147**
no data on applied beta and bid/ask spread (information asymmetry measures)	133
no financial data	14
Composition of the research sample by sector:	**273**
Trade	37
Services	37
Manufacturing	112
ICT	30
Others (construction, real estate, paper & packaging, advertising, publishing, leisure & recreation, recycling)	57
Total number of observations	**273**

Source: Own elaboration based on data from the Notoria database using Stata/IC 16.0 programme.

The ordinary least squares (OLS) method was used to perform the linear regression estimation.

The dependent variable in the model is the equity value, defined as the natural logarithm of the market capitalization, i.e. *ln*(*number of shares* × *share price*).

Quotation data were taken from the Bloomberg database as of 29/12/2017. Thus, our research is a pilot study. However, it is essential to notice that time specificity could impact conclusions. Therefore, we expand our analysis for several years (2007–2021) for robustness check. According to the literature review, the explanatory variables are the determinants of equity value. The primary test variable is long-term leverage used as a measure of capital structure to verify hypothesis H1, according to which we expect leverage to be negatively correlated with equity value. Following the studies of Danso and Adomako (2014), Fosu (2013) and Opler and Titman (1994), leverage is calculated as the ratio of long-term liabilities (interest-bearing debt) to total assets. We consider short-term leverage as the second test variable to verify hypothesis H1A related to its mitigating role in lowering information asymmetry. The following five test variables are the information asymmetry measures, i.e. applied beta, average bid-ask spread, market-to-book ratio, discretionary accruals and intangibility. These variables were chosen to verify the H2 and H2A–H2D hypotheses formulated based on the literature analysis, according to which we

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expect information asymmetry to negatively correlate with equity value except for the market-to-book ratio. In addition to information asymmetry and leverage measures, control variables suspected to be correlated with equity value were introduced into the model.

The tangibility of assets is a variable measuring the share of fixed assets in the company's total assets. The correlation between the tangibility of assets and equity value is not clear. However, according to Mauri and Pajust (2005), companies with a higher share of tangibles in assets have fewer intangible assets (i.e. patents, trademarks, know-how related to inventions and growth opportunity), which indicates a negative correlation between tangibility of assets and company value.

On the other hand, Fosu, Danso, Ahmad and Coffie (2016) indicate that the higher the level of tangible assets in a company's asset structure, the lower the level of information asymmetry due to the higher collateral role of assets in the case of debt. This implies a positive correlation between the tangibility of assets and equity value. Another control variable is firm size, measured as the natural logarithm of sales revenues generated by the company in the year under review after deducting returns, discounts, rebates and sales taxes. According to Kemper and Rao's (2013) and Dasilas and Papasyriopoulos' (2015) studies, total sales are considered a measure of company size. Mauri and Pajust's (2005) research indicates that larger companies tend to be mature, for which valuation tends to be lower. Therefore, a negative correlation between a firm size (sales) and equity value is expected. Studies by Boulland, Filip, Ghio and Paugam (2018), Walters (1999) and Rappaport (1999) indicate that a company's ability to generate cash surplus from operations is also crucial in the context of equity value formation. Based on the above studies, the cash flow variable measured as the natural logarithm of the operating cash flow generated by the company was introduced into the model. The last continuous variable is the return on assets (ROA), measured as operating profit to total assets. Profitable companies are valued higher by investors because they can generate higher returns on investment and higher dividends, so the ROA variable is expected to correlate with equity value positively. Based on Rappaport's (1999) considerations, an alternative profitability measure was also applied in the model – operating profit margin, measured as a quotient of operating profit and sales revenue in the examined year. This indicator informs about real possibilities of profit from the company's primary activity.

In the case of the long-term valuation of a company, the operating margin should have non-decreasing values. A decrease in the ratio value may signal an incorrect pricing policy or an uncontrolled cost increase. If the operating profit margin falls to a certain limit, the value of cash flows decreases to such an extent that the value added to shareholders will be zero. Thus, if the company achieves a margin value below the limit value, the increase in sales does not cause an increase in shareholder value but its "destruction" (Jakowska-Sulwalska, 2013). This implies a negative correlation between the operating profit margin and equity value. The research of Rodríguez and Molina (2013) and the considerations of Borowski (2014) and Jajuga (2015) indicate that the formation of equity value may depend on industry affiliation. Thus, the discrete variable *sector_factor* was introduced into the model.

Table 2 presents the definitions of the dependent and independent test and control variables and their expected direction of influence on the explained variable, distinguishing the explanatory variables used as measures of information asymmetry. Due to observations with negative values in some variables, the Box-Cox transformation was not used to choose the model's best functional form. Still, the best-fitting model was selected for the functional form used in the study by Fosu et al. (2016), the analysis of histograms and the method from general to specific.

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The base model has the following form:

$$y_i = \beta_0 + \beta_1 lt\_lever_i + \beta_2 appliedbeta_i + \beta_3 bidaskspread_i + \beta_4 markettobookratio_i + \\ + \beta_5 tang_i + \beta_6 sales_i \beta_7 cf_i + \beta_8 profitability_i + \sum_{j=2}^{5} \beta_9 sector\_factor_i + \varepsilon_i \quad (1)$$

where: profitability means ROA or margin, the indices j of the discrete variable result from their decoding, is a constant, ε_i is the random error, and $i = 1, 2, \ldots, 210$ (considering observations with positive cash flow) and 273 in the case of the total sample (in the robustness check section).

Table 2
Definition of variables and the expected direction of influence on the dependent variable

Variable	definition	expected sign
	Dependent variables	
Marketcap	*ln*(*equity value*) = *ln*(*number of shares* × *share price*)	
Changemarketcap	percentage change in market capitalisation measured as follows $\frac{marketcap_t - marketcap_{t-1}}{marketcap_t}$	
	Test variables	
st_lever	short-term debt / total assets	
lt_lever	long-term debt / total assets	–
Information asymmetry measures:		
bid-ask spread	variable measuring information asymmetry – variable representing the average of all bid/ask spreads taken as a percentage of the average price	–
applied beta	variable measuring information asymmetry – a statistical coefficient that measures the percentage change in a share's price, taking into account the change by one per cent of its benchmark index	–
refindex1beta1year refindex1correlcoeff1year refindex2beta1year refindex2correlcoeff1year refindex3beta1year refindex3correlcoeff1year refindex4beta1year refindex4correlcoeff1year	Betas provided by Bureau van Dijk in the Orbis database, calculated for one month, three months, one year, and three years periods, with each reference index and the correlation coefficient for each period clearly noted. The beta is calculated on a weekly basis and considers the daily prices. For the calculations, a gliding system is used. Beta is obtained by the relationship between two statistics: (1) the covariance of the returns of the stock and the returns of an index and (2) the variance of the returns of the index. The correlation coefficient allows measuring the intensity of the existing correlation between the returns of the stock and the returns of the related index.	–
stocksplitratio	A stock split is when a company's board of directors issues more shares of stock to its current shareholders without diluting the value of their stakes. As a result, a stock split increases the number of shares outstanding and lowers the individual value of each share.	
DAC	discretionary accruals equal residuals estimated by Dechow's model (the modified Jones's model), extended by the ROA, described in equation (2)	–
intangibility	intangible assets / total assets	–
market-to-book ratio	the variable measuring information asymmetry *ln*[(*book value of assets – book value of equity + market value of equity*)/ *non-cash assets*], where *the market value of equity = number of shares* × *share price*	+

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Variable	definition	expected sign
	Control variables	
Changesales	percentage change in sales measured as follows $\frac{sales_t - sales_{t-1}}{sales_t}$	
Changecf	percentage change in cash flow measured as follows $\frac{cash\ flow_t - cash\ flow_{t-1}}{cash\ flow_t}$	
tangibility (*tang*)	tangible assets/total assets	?
sales – firm size	ln(sales revenues in the year under review 2017)	–
cash flow (*cf*)	ln(cash flows from operations)	+
ROA (renturn on assets)	operating profit/total assets in panel models – ROA using profit or loss before tax	+
Margin	operating profit/revenue from sales	–
sector_factor	Discrete variable assigning the company's sector of activity: 1. Trade, 2. Services, 3. Manufacturing, 4. ICT, 5. Others	?
nace	Nace codes – binary variables equal one for the NACE code of a firm activity in a decile of EKD codes, and 0 otherwise. For example, nace0 equals 1 for two digits EKD code higher than 0 and lower than 10, nace1 equals 1 for two digits EKD code higher than ten and lower than 20 etc.	

Source: Own elaboration based on definitions from the Bloomberg, Notoria and Orbis database and discussed literature.

$$\frac{TA_{it}}{A_{it-1}} = \alpha \frac{1}{A_{it-1}} + \alpha_2 \frac{\Delta REV_{it} - \Delta REC_{it}}{A_{it-1}} + \alpha_3 \frac{PPE_{it}}{A_{it-1}} + \alpha_4 ROA_{it} + \varepsilon_{it} \quad (2)$$

where:

TA_t – total accruals in year t, described in equation (2);
A_{t-1} – total assets in year $t-1$;
ΔREV_t – revenues in year t minus revenues in year $t-1$;
ΔREC_t – net receivables in year t less net receivables in year $t-1$;
PPE_t – gross property, plant and equipment in year t;
ROA_t – return on assets in year t;
ε_{it} – a random error.

$$TA_{it} = \frac{(\Delta CA_{it} - \Delta CL_{it} - \Delta RMK_{it} - \Delta CASH_{it} \Delta DEP_{it})}{A_{it-1}} \quad (3)$$

where:

ΔCA_t – change in current assets in year t;
A_{t-1} – lagged total assets (in year $t-1$);
ΔCL_t – change in current liabilities (without debt) in year t;
ΔRMK_t – change in prepaid expenses in year t;
$\Delta CASH_t$ – change in cash and cash equivalents in year t;
DEP_t – depreciation and amortization expense in year t.

Table 3 shows the descriptive statistics of continuous variables.

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Table 3
Descriptive statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
marketcap	273	12.4439	1.684	9.2017	17.6296
st_lever	273	0.06023	0.1061	0	0.74
applied_beta	273	0.5224	0.2155	-0.3503	1.4097
bid_ask_spreed	273	0.3479	0.4689	0.0107	1.8
markettobookratio	273	2.2471	5.259	0.235	77.729
lt_lever	273	0.133	0.128	0	0.74
size	273	11.6894	2.7198	0	18.1328
cf	273	5.3831	8.1721	-12.265	17.124
ROA	273	2.985	12.525	-70.213	39.228
margin	273	0.1465	5.227	-60.909	9.252
tangibility	273	0.6014	0.241	0.00075	0.9978
intangibility	273	0.0717	0.1375	0	0.7811
nda_teo_reg	273	-0.0073	0.0914	-0.5077	0.4952
nace0	273	0.0143	0.1189	0	1
nace1	273	0.0929	0.2908	0	1
nace2	273	0.2429	0.4296	0	1
nace3	273	0.0679	0.2519	0	1
nace4	273	0.2286	0.4207	0	1
nace5	273	0.0643	0.2457	0	1
nace6	273	0.1214	0.3272	0	1
nace7	273	0.1464	0.3541	0	1
nace8	273	0.0214	0.145	0	1

Source: Own elaboration based on Bloomberg and the Notoria database data using Stata/IC 16.0 programme.

The discrete variable used in the model is the company's sector_factor variable, which distinguishes five levels: 1. trade, 2. services, 3. manufacturing, 4. ICT and 5. others. Table 4 shows the statistical summary of the dependent variable within each company's sectors of activity considered in the model.

The equality of the distributions in each sector was also tested using the Kruskal-Wallis test. The value was 2.080, and the p-value was 0.7210, so the test is not statistically significant at any level of significance. There is no basis for rejecting the null hypothesis that there are no differences in the distribution of populations in the sectors studied. Therefore, it can be expected that the use of the sector_factor variable in the regression may be insignificant. Thus, we disaggregated sectors based on NACE codes into nine groups.

Before estimating the model, correlations between all variables were examined. The highest correlation was found between the firm size and cash flow (later logarithmic transformation). These variables measure different economic quantities: (1) sales revenue on an accrual basis (taking into account when receivables arise) and (2) cash surplus from operating activities (receipts (inflows) minus expenditures (outflows)) determined on a cash basis, and both are necessary to estimate the equity value correctly. Therefore, all the variables discussed above are included in the model.

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Table 4
Descriptive statistics of the dependent variable by sector_factor

Variable	N	Mean	Standard deviation	Min	Max
1. Trade	38	12.5688	1.6710	9.8469	16.6120
2. Services	37	12.2306	1.4557	9.9822	15.3435
3. Manufacturing	115	12.5716	1.8709	9.878	17.629
4. ICT	31	12.623	2.0397	9.5771	16.5817
5. Others	52	12.2156	1.449	9.2017	15.5042
nace0	6	12.98	1.008	12.11355	14.9564
nace1	40	11.934	1.518	9.577	15.343
nace2	33	12.6845	1.718	10.158	16.581
nace3	18	12.734	2.037	9.202	16.278
nace4	63	12.5764	1.752	9.847	17.602
nace5	19	12.976	1.799	9.877	16.930
nace6	65	12.4584	1.553	9.929	17.629
nace7	25	11.419	0.962	10.4133	14.288
nace8	4	15.1817	1.779	12.929	16.917

Source: Own elaboration based on data from Stata/IC 16.0.

4. RESULTS

Six regression equations were estimated using the OLS method differing in terms of modifying the definition of explanatory variables and considering the significance of coefficients at the variables taken into account. All regressions were conducted on the sample of 210 companies listed on the Warsaw Stock Exchange with positive cash flow. The baseline level of the discrete variable *sector_factor* was assumed to be level *1. trade*. Table 5. presents the results of conducted estimations and diagnostic tests.

Table 5
Determinants of equity value

	variable	model 1	model 2	model 3	model 4	model 5	model 6
H1	lt_lever	-0.3825	-0.6995	-0.8417	-0.9289*	-0.9159*	-0.9665*
		(0.8632)	(0.8119)	(0.6351)	(0.5492)	(0.5459)	(0.5416)
H2	appliedbeta	3.1676***	3.2361***	2.2521***	1.5668***	1.5657***	1.5279***
		(0.5204)	(0.4882)	(0.3882)	(0.3460)	(0.3452)	(0.3422)
H2	bidaskspread	0.0528**	0.0294	0.0084	-0.0044		-0.0021
		(0.0242)	(0.0232)	(0.0183)	(0.0159)		(0.0157)
H2	marketto bookratio (ln)	0.1279*** (0.0466)	0.9745*** (0.1637)	0.9917*** (0.1289)	1.2181*** (0.1148)	1.2100*** (0.1107)	1.1393*** (0.0997)
	tang	1.8335***	1.9212***	1.8842***	3.0187***	3.0074***	3.1098***
		(0.4675)	(0.4369)	(0.3441)	(0.3253)	(0.3220)	(0.3203)

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Table 5 – continued

variable	model 1	model 2	model 3	model 4	model 5	model 6
sales	9.58e-08 ***	9.29e-08 ***	3.15e-08***			
	(2.22e-08)	(2.08e-08)	(1.06e-08)			
ln_sales				0.4882***	0.4873***	0.4861***
				(0.0555)	(0.0552)	(0.0548)
cf	-8.58e-08	-6.56e-08				
	(8.27e-08)	(7.76e-08)				
ln_cf			0.4646***	0.2032***	0.2030***	0.2078***
			(0.0421)	(0.0487)	(0.0486)	(0.0481)
ROA (margin)	1.9342	0.1967	-1.4031	-1.6013**	-1.5863**	-0.6542***
	(1.1961)	(1.1267)	(0.8990)	(0.041)	(0.7740)	(0.0481)
_Isector_fa_2	-0.5746	-0.6342*	-0.2728	0.2777	0.2834	0.2415
	(0.3778)	(0.3545)	-0.2811	(0.2517)	(0.2503)	(0.2479)
_Isector_fa_3	-0.4105	-0.3879	-0.3566*	-0.1714	-0.1648	-0.1529
	(0.2909)	(0.2789)	-0.2144	(0.1868)	(0.2454)	(0.1846)
_Isector_fa_4	-0.4432	-0.6134*	-0.4102	-0.1392	-0.1288	-0.1090
	(0.3920)	-0.3622	-0.2854	(0.2488)	(0.2454)	(0.2459)
_Isector_fa_5	-0.6519*	-0.6553**	-0.3891	-0.0162	-0.01135	-0.0158
	(0.3341)	-0.3132	0.2476	(0.2189)	0.2177	(0.2166)
_cons	9.7024 ***	9.7021***	5.7573***	1.8061***	1.8206***	1.7286***
	(0.3822)	(0.3541)	(0.4530)	(0.5282)	(0.5109)	(0.5224)
No. observations	210	210	210	210	210	210
R2	0.4718	0.5353	0.7116	0.7838	0.7837	0.7892
R2_adjusted	0.4388	0.5070	0.6941	0.7706	0.7717	0.7764
F Statistics	14.66***	18.91***	40.51***	59.51***	65.21***	61,47***
RESET Test	13.21***	14.02***	12.29***	2.86**	2.77**	3,7**
Breusch-Pagan Test	6.08**	7.75***	6.87***	2.62	2.58	2.48
White Test	120.52***	126.29***	138.51***	135.41***	120.61***	138.95***
Jarque-Bera Test	9.95***	9.95***	9.95***	9.95***	9.95***	9.95***

* p < 0.1, ** p < 0.05, *** p < 0.01, the deviations of the estimators (standard errors) are given in brackets
Source: Own elaboration based on regression performed in Stata/IC 16.0.

Model 5 shows that long-term leverage is negatively correlated with equity value. The obtained results are consistent with the theory of Myers (1984) and Stulz (1990) and the results of studies by King and Santor for Canadian companies (2008) and Fama and French (1998) for companies listed on the New York Stock Exchange (NYSE). Therefore, the obtained results do not give grounds to reject hypothesis H1, according to which long-term leverage is negatively correlated with equity value. This means that as the share of interest-bearing debt increases in the company's capital structure, the equity value (determined by the market and reflected in its market capitalization) decreases, in line with hypothesis H1. Such a correlation may result from underinvestment or overinvestment in the company's stock. Alternatively, it can be explained by agency costs, bankruptcy or increasing risk.

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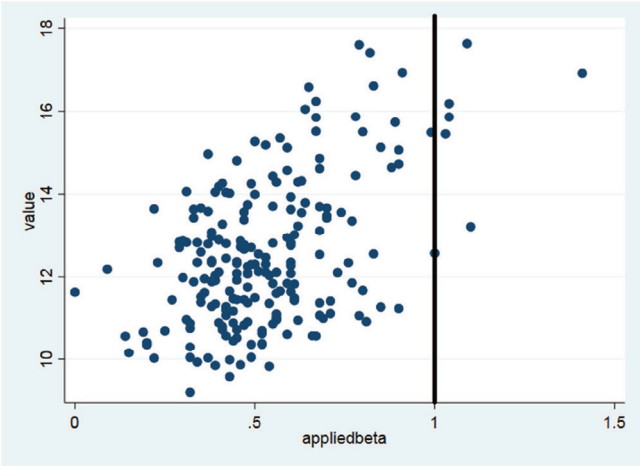
Moreover, a negative correlation between leverage and equity value may be due to the limited benefits of the interest tax shield, which are much lower than the nominal tax rate. According to the pecking order theory, companies with high profits maintain a relatively low debt ratio. This implies that the low-profitable companies have to borrow to finance investments. On the other hand, however, due to the non-high income tax, low-profitable enterprises are close to exhausting their ability to use tax deductions (Leszczyłowska, 2018). In such a situation, companies lose the ability to (immediately) deduct interest so that foreign capital ceases to be relatively more attractive (cheaper due to the tax shield) than equity.

In the final model 5, coefficients at two of the three variables measuring the information asymmetry are statistically significant (applied beta and logarithm of the market-to-book ratio), both of which positively correlate with equity value. Thus, we reject hypothesis H2A based on the positive coefficient at the applied beta variable. The higher the market-to-book ratio, the higher the level of information asymmetry. However, this study shows that the higher the market-to-book ratio, the higher the equity value. It is in accordance with H2B. This implies that information asymmetry does not necessarily hurt equity value. Similar results were obtained with another measure of information asymmetry – applied beta, which measures the volatility of share prices compared to the market. A beta ratio below 1 means that the company's share price is less volatile than the market. This implies less information asymmetry and less risk for potential investors. This means that below one, the lower the beta, the higher the equity value. In Figure 1, we can see that for most companies in the sample, applied beta oscillates around the value of 0.5. This means that the share prices of these companies are, on average, 50% less volatile than the market index (WIG) and less correlated with the WIG indicator.

Meanwhile, at the end of 2017, the equity value of companies with a higher beta was higher (positive correlation), which contradicts our expectations expressed in the H2A hypothesis. On the one hand, in a pilot cross-sectional study, the period specificity could be a factor. On the other hand, it is consistent with the theoretical approach that the equity value (fundamental, long-term) differs from the market price at a given time. This is because the estimation of the value in the valuation process is made based on individual criteria of external investors. This means that the equity value may be different for different parties. Furthermore, the difference between the equity value and the share price, in addition to the information asymmetry, consists of many other factors, including a limited number of buyers, uneconomic motivations, negotiating skills, and the need to act under duress.

Figure 1
Point plot of the equity value and applied beta variables



Source: Own elaboration in Stata/IC 16.0.

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These results lead to rejecting the H2A hypothesis, according to which we expected that information asymmetry proxied by applied beta is negatively correlated with equity value. This means, therefore, that the negative consequences of information asymmetry on the equity value have not been demonstrated. The obtained results are in line with the studies by Huynh et al. (2020), Botosan (1997), Dierkens (1991) and Bharath et al. (2009). These researchers indicated that the negative influence of information asymmetry on equity value could not be unambiguously confirmed because it may depend on the examined sample, time and individual choices of investors, who, despite information asymmetry, may value a given company higher. These studies also indicate that leverage may strongly influence the impact of information asymmetry on equity value. Information asymmetry may directly impact the company's capital structure, which determines investment decisions. The latter, in turn, shapes the equity value. This implies that the above study results could change depending on the sample studied and the leverage applied by companies.

On the other hand, tangibility positively affects equity value, meaning that as the share of fixed assets in total assets increases, the equity value increases. These results align with Fosu et al. (2016), who argue that companies with higher tangible assets may be less exposed to the information asymmetry problem, which positively affects their value through the capital structure and cost of capital.

Contrary to initial expectations, the study results showed that larger companies (*ln_sales*) have a higher value on average. In addition, the study also shows that cash flow (*cf*) positively impacts the equity value. This result confirms that investors pay more attention to a company's ability to generate cash surplus from operating activities than the profits shown in the income statement, which can be actively shaped (earnings management).

Contrary to expectations, the ROA variable, which measures the profitability of assets, negatively correlates with equity value. This means that the more profitable a company is, the lower its equity value. This means that investors find the cash flows shown in the cash flow statement (prepared on a cash basis) more valuable than the "on paper" profitability shown in the income statement (prepared on an accrual basis). The latter may be subject to manipulation in the company's financial statements, e.g. as a result of accounting policies regarding the creation and release of provisions and write-downs (so-called silent provisions), fair value measurement or active selection of depreciation methods.

We check robustness by estimating a regression in which an alternative measure of the company's profitability was used – the operating margin (*margin*). The results are presented in model 6. After replacing the ROA variable with the *margin* variable, determination coefficients $R2$ and adjusted R2 marginally increased from 0.7837 to 0.7892 and 0.7717 to 0.7764, respectively. There was also a decrease in the deviation of estimators of individual variables, which indicates a slight improvement in model fitting. The coefficient at the *margin* variable is statistically significant, in line with the assumptions formulated by Rappaport (1999), who lists it among the main factors shaping equity value.

Moreover, the results indicate a negative correlation between operating profit margin and equity value, which may seem surprising. However, comparing the sign of the coefficient at the cash flow variable and ROA or profit margin, it can be concluded that investors react positively to information about higher cash flow and are skeptical about the information on accrual profitability (ROA, margin). The latter may not be reflected in liquidity (cash). Therefore, it is presumed that investors are risk-averse and do not trust accrual measures of profitability. Regardless of the profitability measure used in models 5 and 6 (ROA or operating profit margin), the statistical inference regarding the relationship between individual explanatory variables and equity value is similar in both models. In particular, the results indicate that both accrual profitability measures hurt the equity value. This means that more profitable companies are less valued.

None of the coefficients at the sector_factors discrete variables turned out to be statistically significant, but the variable sector_factor was left in the model because of the cross-sector analysis.

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An ANOVA test was also conducted to verify whether the mean equity values in the groups designated by sector of activity differ and whether this difference is statistically significant. As a result of the ANOVA test with an F statistic equal to 0.88 and a p-value of 0.4763, it was found that there is no basis to reject the null hypothesis of equality of mean equity values in groups designated by sector of activity. It is possible that given a wider data set, the regression results would support the hypothesis of differentiation of equity values between sectors of activity.

5. ROBUSTNESS CHECKS

Section 5 considers the robustness of the results by applying additional information asymmetry measures to OLS models and a dynamic panel-data approach (GMM) to check how information asymmetry affects percentage change in equity value. To check the reliability of the estimates obtained, we present additional estimates below.

5.1. OLS method

First, we add models estimated on the entire sample without excluding observations with negative cash flow, considering the short-term leverage role in mitigating the negative impact of information symmetry. It allows us to compare models estimated on the total sample with models estimated on the subsample limited to observations with positive cash flow. We notice that in model 1 on the entire sample, including observations with negative cash flows, neither coefficient at cash flow nor margin variables are statistically significant. In both models (1) and (2) in Table 6, the coefficient at the short-term leverage variable is statistically insignificant. That does not allow us to verify the H1A hypothesis. The results in Table 6 reject H2 for the entire sample and a subsample of observations limited to positive cash flows. It is because information asymmetry measured by bid-ask spread positively correlates with equity value.

Table 6
Determinants of equity value by a balance of cash flow

marketcap	**MODEL 1** entire sample	**MODEL 2** positive_cf = 1
st_lever	-0.695	-1.08
	(0.6576)	(0.8929)
applied_beta	1.391***	1.766***
	(0.3809)	(0.4199)
bid_ask_spread	0.6623***	0.6799***
	(0.1537)	(0.1485)
size	0.4631***	0.3129***
	(0.0434)	(0.0628)
cf	0.0071	0.3205***
	(0.0096)	(0.0575)
margin	-0.023	-0.481*
	(0.0207)	(0.2794)
tangibility	1.979***	1.810***
	(0.3446)	(0.3688)

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Table 6 – continued

marketcap	**MODEL 1** entire sample	**MODEL 2** positive_cf = 1
nace1	-0.956*	-0.770
	(0.5350)	(0.5250)
nace2	-0.277	-0.107
	(0.5014)	(0.4900)
nace3	0.0412	0.1827
	(0.5574)	(0.5403)
nace4	0.0105	0.0139
	(0.5066)	(0.4939)
nace5	0.3031	0.3291
	(0.5576)	(0.5458)
nace6	0.5537	0.6415
	(0.5237)	(0.5177)
nace7	-0.017	0.2418
	(0.5158)	(0.5142)
nace0	1.217	-0.044
	(0.7629)	(0.7868)
_cons	4.795***	3.354***
	(0.7629)	(0.7757)
No. observations	273	212
R2	0.5504	0.6876
R2_adjusted	0.5242	0.6637
F Statistics	20.98***	28.76***
Breusch-Pagan Test	5.85*	5.04**
White Test	137.45***	128.99**
Jarque-Bera Test	13.26**	13.26**

* p < 0.1, ** p < 0.05, *** p < 0.01, the deviations of the estimators (standard errors) are given in brackets
Source: Own elaboration based on regression performed in Stata/IC 16.0.

Table 7 presents the outcomes of models' estimations separate for manufacturing and the other sectors considering alternative measures of information asymmetry – discretionary accruals (DAC) and intangibility, and distinguishing short-term and long-term leverage. The results in Table 7 reject hypothesis H1 because long-term leverage increases the equity value, controlling for DAC. The results of model (4) for manufacturing firms do not support H1A. Thus, we do not find evidence of a mitigating role of short-term debt in limiting the negative impact of information asymmetry on equity value. However, we reject the H2 hypothesis based on positive coefficients at the bid-ask spread variables. Similarly, we reject hypotheses H2A for applied beta and H2C for the non-manufacturing subsample (based on positive coefficients at the applied beta and DAC variables). We cannot verify the H2D hypothesis due to the statistically insignificant coefficient at the intangibility variable in all models in Table 7.

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Table 7
Determinants of equity value by sectors

marketcap	MODEL 1 entire sample	MODEL 2 entire sample	MODEL 3 non-manufac-turing	MODEL 4 manufactu-ring	MODEL 5 non-manufac-turing	MODEL 6 manufactu-ring
st_lever	-0.6677		-0.4259	-2.695**		
	(1.0097)		(1.4532)	(1.2185)		
lt_lever		1.1079***			0.81653*	0.88689
		(0.40275)			(0.45461)	(1.0103)
applied_beta	2.1516***	1.9831***	2.7721***	2.0172***	2.5213***	1.9484***
	(0.50929)	(0.50296)	(0.80967)	(0.62391)	(0.80140)	(0.64436)
bid_ask_spread	0.56208***	0.59103***	0.87001***	0.60259***	0.85193***	0.68073***
	(0.18973)	(0.18557)	(0.32205)	(0.21485)	(0.31598)	(0.22242)
size	0.33934***	0.35035***	0.15660**	0.64598***	0.17004**	0.63196***
	(0.05274)	(0.05178)	(0.06920)	(0.07183)	(0.06805)	(0.07339)
cf	0.02252*	0.02287**	0.02064	0.00432	0.02178	0.00534
	(0.01187)	(0.01148)	(0.01648)	(0.01675)	(0.01579)	(0.01719)
margin	0.02198	0.02488	-0.0086	0.14627***	-0.0040	0.14919***
	(0.02290)	(0.02247)	(0.02856)	(0.03396)	(0.02821)	(0.03479)
intangibility	0.39427	-0.0637	0.93760	10.2623	0.63882	0.42070
	(0.70836)	(0.67532)	(0.88470)	(1.1516)	(0.85174)	(1.1547)
DAC	1.7544*	1.4861	4.1369**	0.23917	3.7245**	0.24023
	(1.0041)	(0.98763)	(1.7742)	(1.0908)	(1.7610)	(1.1183)
nace1	-2.419***	-2.589***				
	(0.80948)	(0.78940)				
nace2	-1.729**	-1.777**				
	(0.77439)	(0.7587)				
nace3	-1.110	-1.222				
	(0.83806)	(0.8214)				
nace4	-1.722**	-1.832**				
	(0.77667)	(0.7609)				
nace5	-1.207	-1.632**				
	(0.84431)	(0.8320)				
nace6	-0.7174	-0.8062				
	(0.81644)	(0.8010)				
nace7	-1.443*	-1.540**				
	(0.78891)	(0.7739)				
nace8	-1.132	-1.172				
	(0.91085)	(0.8934)				
_cons	8.5029***	8.4294***	8.7758***	3.1862***	8.6218***	3.1897***
	(1.0007)	(0.9815)	(0.78045)	(0.84139)	(0.76938)	(0.8626)

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Table 7 – continued

marketcap	MODEL 1 entire sample	MODEL 2 entire sample	MODEL 3 non-manufac-turing	MODEL 4 manufactu-ring	MODEL 5 non-manufac-turing	MODEL 6 manufactu-ring
No. observations	194	194	105	89	105	89
R2	0.5074	0.5264	0.3259	0.6848	0.3473	0.6687
R2_adjusted	0.4628	0.4836	0.2697	0.6532	0.2929	0.6355
F Statistics	11.39***	12.30***	5.80***	21.72***	6.38***	20.18***
Breusch-Pagan Test	0.28	0.01	1.77	1.77	2.01	2.01
White Test	134.86**	147.28***	54.04	54.04	55.17	55.17
Jarque-Bera Test	4.51*	4.51*	4.51*	4.51*	4.51*	4.51*

* p < 0.1, ** p < 0.05, *** p < 0.01, the deviations of the estimators (standard errors) are given in brackets
Source: Own elaboration based on regression performed in Stata/IC 16.0.

5.2. Panel data

For the robustness check, we retrieved panel stock data from the Orbis database for 2007-2021. Then, we applied a two-stage Arellano-Bond estimator of the Generalized Method of Moments (GMM) with instrumental variables for dynamic panel data. The results for the sensitivity of equity value to leverage and information asymmetry, i.e., determinants of percentage change in equity value, are presented in Table 8.

The results do not confirm equity value sensitivity to short-term debt. Similarly, only model 1 provides evidence that equity value is sensitive to long-term debt. However, our findings confirm the H2 hypothesis for a long-time horizon. Thus, information asymmetry measured by bid-ask spread negatively influences the percentage change in equity value. For most information asymmetry measures related to market microstructure measured by various betas and correlation coefficients, we have no basis for rejecting the H2A hypothesis (except for the *refindex1correlcoeff1year* and *refindex1beta1year*).

Furthermore, based on the positive coefficient at the market-to-book ratio, there is no reason to reject the H2B hypothesis. Besides, the stock split ratio negatively influences the dependent variable. Finally, equity value is more sensitive to cash flow changes than standard profitability measures on an accrual basis – ROA or profit margin.

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Table 8
Sensitivity of equity value to leverage and information asymmetry

	MODEL 1	MODEL 2	MODEL 3	MODEL 4	MODEL 5	MODEL 6	MODEL 7	MODEL 8	MODEL 9	MODEL 10	MODEL 11
L1.changemarketcap	-0.3603***	-0.3368***	-0.3321***	-0.3298***	-0.3539***	-0.3539***	-0.3539***	-0.3539***	-0.3539***	-0.3539***	-0.4007***
	(0.09036)	(0.09348)	(0.09211)	(0.09256)	(0.08967)	(0.08967)	(0.08967)	(0.08967)	(0.08967)	(0.08967)	(0.08794)
L2.changemarketcap	-0.1956**	-0.1416*	-0.1164*	-0.1207*	-0.1497**	-0.1497**	-0.1497**	-0.1497**	-0.1497**	-0.1497**	-0.2605***
	(0.08155)	(0.08332)	(0.07921)	(0.07987)	(0.07443)	(0.07443)	(0.07443)	(0.07443)	(0.07443)	(0.07443)	(0.07715)
L3.changemarketcap	-0.1536**	-0.0917	-0.0996	-0.1043	-0.1023*	-0.1023*	-0.1023*	-0.1023*	-0.1023*	-0.1023*	-0.1426**
	(0.05738)	(0.05716)	(0.05648)	(0.05653)	(0.05507)	(0.05507)	(0.05507)	(0.05507)	(0.05507)	(0.05507)	(0.05405)
st_leverage	-0.4960	-0.4109	-0.5706	-0.4811	-0.7780	-0.7780	-0.7780	-0.7780	-0.7780	-0.7780	-1.071
	(0.96586)	(1.0011)	(0.99015)	(0.99024)	(0.98394)	(0.98394)	(0.98394)	(0.98394)	(0.98394)	(0.98394)	(0.95459)
lt_leverage	1.3605*	1.1768	1.0650	1.1476	0.22998	0.22998	0.22998	0.22998	0.22998	0.22998	0.20141
	(0.74960)	(0.77562)	(0.75615)	(0.77696)	(0.75299)	(0.75299)	(0.75299)	(0.75299)	(0.75299)	(0.75299)	(0.70932)
bid_ask_spread	-1.451***	-1.522***	-1.237***	-1.239***	-1.440***	-1.440***	-1.440***	-1.440***	-1.440***	-1.440***	-1.199***
	(0.41393)	(0.42873)	(0.42001)	(0.42232)	(0.40746)	(0.40746)	(0.40746)	(0.40746)	(0.40746)	(0.40746)	(0.39442)
refindex1correlcoeff1year	-1.175	1.9313*	1.8541**								
	(1.1411)	(0.84721)	(0.82801)								
refindex1beta1year				0.48621*							
				(0.2520)							
refindex2beta1year					-37.65**						
					(18.742)						
refindex2correlcoeff1year						-77.53**					
						(38.595)					
refindex3beta1year							-32.34**				
							(16.099)				

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Table 8 – continued

	MODEL 1	MODEL 2	MODEL 3	MODEL 4	MODEL 5	MODEL 6	MODEL 7	MODEL 8	MODEL 9	MODEL 10	MODEL 11
refindex3correlcoeff1year								-74.68**			
								(37.177)			
refindex4beta1year									-34.18**		
									(17.015)		
refindex4correlcoeff1year										-76.67**	
										(38.165)	
stocksplitratio											-0.0162***
											(0.00538)
changesales	-0.0677	-0.1703	-0.1322	-0.1272	-0.1266	-0.1266	-0.1266	-0.1266	-0.1266	-0.1266	-0.0512
	(0.12582)	(0.12757)	(0.12089)	(0.1211)	(0.11784)	(0.11784)	(0.11784)	(0.11784)	(0.11784)	(0.11784)	(0.11504)
changecf	0.05690**	0.05513***	0.04650**	0.04545**	0.05009**	0.05009**	0.05009**	0.05009**	0.05009**	0.05009	0.04500**
	(0.02040)	(0.02115)	(0.02087)	(0.02100)	(0.02030)	(0.02030)	(0.02030)	(0.02030)	(0.02030)	(0.02030)	(0.01960)
profitmargin	0.00750*	0.00966**									
	(0.00370)	(0.00379)									
ROA			0.02031***	0.02042***	0.01892***	0.01892***	0.01892***	0.01892***	0.01892***	0.01892***	0.01789***
			(0.00657)	(0.00661)	(0.00638)	(0.00638)	(0.00638)	(0.00638)	(0.00638)	(0.00638)	(0.00614)
tangibility	-0.7924	-10.352**	-10.243**	-10.389**	-0.2298	-0.2298	-0.2298	-0.2298	-0.2298	-0.2298	-0.9807
	(0.53032)	(0.52926)	(0.51766)	(0.56398)	(0.56219)	(0.56219)	(0.56219)	(0.56219)	(0.56219)	(0.56219)	(0.45785)
markettobook	0.18307***										
	(0.04693)										
industry effects	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
time effects	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
_cons	1.8452	3.0059**	3.3957***	3.7568***	2.0940*	2.0940*	2.0940*	2.0940*	2.0940*	2.0940*	2.3324**
	(1.2511)	(1.2598)	(1.2621)	(1.3867)	(1.1454)	(1.1454)	(1.1454)	(1.1454)	(1.1454)	(1.1454)	(1.0963)

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Table 8 – continued

	MODEL 1	MODEL 2	MODEL 3	MODEL 4	MODEL 5	MODEL 6	MODEL 7	MODEL 8	MODEL 9	MODEL 10	MODEL 11
No. observations	1204	1204	1204	1204	1204	1204	1204	1204	1204	1204	1204
No. groups	168	168	168	168	168	168	168	168	168	168	168
No. instruments	102	102	102	102	102	102	102	102	102	102	102
Test Walda	316.50	280.30	291.78	289.02	305.12	305.12	305.12	305.12	305.12	305.12	334.55
p-value	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Test Arellano-Bonda											
AR(1)	-4.66	-4.06	-3.89	-3.93	-3.83	-3.83	-3.83	-3.83	-3.83	-3.83	-4.23
p-value	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
AR(2)	-0.79	-1.42	-1.67	-1.60	-1.69	-1.69	-1.69	-1.69	-1.69	-1.69	-0.84
p-value	0.430	0.156	0.095	0.110	0.092	0.092	0.092	0.092	0.092	0.092	0.403
Test Sargana	63.64	73.36	72.77	73.66	77.63	77.63	77.63	77.63	77.63	77.63	79.13
p-value	0.843	0.596	0.615	0.587	0.458	0.458	0.458	0.458	0.458	0.458	0.411
GMM instruments for levels											
Sargan test	52.95	62.37	63.55	63.23	66.73	66.73	66.73	66.73	66.73	66.73	60.51
p-value	0.895	0.670	0.630	0.641	0.521	0.521	0.521	0.521	0.521	0.521	0.729
Difference	10.68	10.99	9.21	10.44	10.90	10.90	10.90	10.90	10.90	10.90	18.62
p-value	0.298	0.276	0.418	0.316	0.282	0.282	0.282	0.282	0.282	0.282	0.029
iv											
Sargan test	53.27	63.21	64.91	65.87	67.04	67.04	67.04	67.04	67.04	67.04	69.80
p-value	0.905	0.674	0.617	0.584	0.544	0.544	0.544	0.544	0.544	0.544	0.450
Difference	10.37	10.15	7.86	7.79	10.59	10.59	10.59	10.59	10.59	10.59	9.33
p-value	0.240	0.255	0.447	0.454	0.226	0.226	0.226	0.226	0.226	0.226	0.315

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$, the deviations of the estimators (standard errors) are given in brackets

Source: Own elaboration based on regression performed in Stata/IC 16.0.

6. CONCLUSIONS

The study conducted on the financial data of 273 joint-stock companies listed on the primary market of the Warsaw Stock Exchange in 2017 allowed us to verify the hypotheses. Firstly, based on the regression estimation results using the OLS method, no grounds were found to reject hypothesis H1. Thus, long-term leverage negatively correlates with equity value. It is due to underinvestment or overinvestment problems, agency or default costs. Based on models 5. and 6., with a 1 pp increase in the long-term leverage, the equity value on average will decrease by about 60%.

Second, based on the agency theory, adverse selection costs and moral hazards impede access to external sources of capital. Bigger information asymmetry worsens equity value, implying a negative correlation between these variables. In the conducted study, one of the measures of information asymmetry (bid/ask spread) turned out to be statistically insignificant, but statistically significant measures (applied beta and logarithm of the market to book ratio) show a positive correlation with equity value. According to model 5, an increase in the market-to-book ratio (information asymmetry) of 1% will result in an average increase in the equity value of 1.21%. On the other hand, with an increase in applied beta of 1 pp, the average equity value will increase by over 1.5%. This means that information asymmetry does not have to impact equity value negatively. The study, therefore, provides valuable conclusions in the context of studies by Drobetz (2010), Fauver and Naranjo (2010) and Fosu et al. (2016). They indicate a negative correlation between information asymmetry and equity value due to the existing difficulties in accessing external sources of capital. Therefore, this means that the valuation of a company is made based on many subjective criteria used by investors who, for some reason, despite information asymmetry, may value a given company higher. Based on the results obtained, we reject hypothesis H2 on the negative correlation between information asymmetry and equity value in a short time (i.e., 2017). However, the GMM dynamic panel data analysis shows that information asymmetry limits growth (percentage changes) in equity value.

The influence of control variables on equity value was also verified. The results show that tangibility is positively correlated with the equity value in a short time while negatively in a long time. An increase in tangibility of one percentage point results in an average increase in the equity value of 3%. Cash flows are positively correlated with the equity value; a 1% increase causes an average increase in the equity value of 0.2%. In turn, an increase in sales volume of 1% will result in an average increase in the equity value of 0.48%. A negative correlation with equity value is observed in the case of accrual-based measures of company profitability, i.e. return on assets (ROA) and margin in a short time (i.e., in 2017). With a one percentage point increase in ROA, the equity value will decrease by almost 80% on average. On the other hand, an increase in the margin of one percentage point will result in a 48% drop in equity value. However, in the long-time horizon, both profitability (ROA or margin) and an increase in cash flow add to equity value growth. Equity value is more sensitive to cash flow than profitability measures affected by earnings management practices.

The results of this study should be a guide to investors in the stock market to pay particular attention to the cash flows reported by companies, which is a cash-based measure of profitability (although, in practice, it is used to measure liquidity). In other words, they should give more weight (importance) to liquidity than profitability based on accrual measures. Furthermore, in a short time, companies should control the proportion of interest-bearing debt in the capital structure, knowing that the tax benefits of reducing the income tax base by interest are limited and carry the risk and cost of bankruptcy.

Our study was conducted on companies limited by the availability of applied beta data and only on a selected listing day of the year (29.12.2017). This means that the statistical inference could change if the sample was extended to foreign markets or a panel study conducted over a longer period. A robustness check confirms this limitation and time sensitivity. Furthermore,

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the measures of information asymmetry used in this study could also be questioned. Given the complexity of measuring information asymmetry and the diversity of its measures, it is worth using other measures that could verify the stability of the results (robust check). Indeed, in further research on the relationship between capital structure and equity value taking into account the information asymmetry, it would be worthwhile to address this aspect and use more advanced econometric methods. Our robustness tests support these conclusions and point to directions for future research.

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Decentralization and tax independence in OECD countries: GDP per capita analysis from 1995–2018

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ABSTRACT

The association of local and regional self-government is examined in regard to the decentralization of state administration. This study extrapolated data from 36 Organisation for Economic Co-operation and Development (OECD) countries and analyzed whether decentralization of the state assists in economic growth and development. Administrative decentralization is explored through defining a precedence from the literature. A systematic literature review was conducted and macroeconomic OECD data using nominal gross domestic product was analyzed for the period of 1995–2018. The results confirmed that decentralization does not positively correlate with the level of tax independence of local government and, in effect, is not an advantage. Territorial administration is highlighted throughout the paper as a key factor behind tax autonomy in relation to fiscal decentralization levels.

JEL Classification: E7; F3; O1; O11

Keywords: state administration, self-government, public finance, tax autonomy, general government tax revenue, federal law

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1. INTRODUCTION

The enlargement of local and regional self-governments is associated with the decentralization of state administration. One of the elements of this mechanism is the decentralization of public finance via its transference to the local level. Interdependency, offset by the level of decentralization and tax independence, interrelates with the internal power struggle of state governance and government control fluctuating between central, regional, and local authorities. The decentralization of public administration is, in part, the decentralization of the state—with the other components comprising the political system and financial structure (Adler & Borys, 1996; Christiano, Eichenbaum, & Evans, 2005). To better understand the decentralization of public finance, important system and performance structures must be taken into account, i.e., top-down versus bottom-up processes (Ahuja, 2000; Mokyr, 2018; Zhou, Liu, Chang, & Hong, 2019). Top-down decentralization relates directly to the unitary state in which the central authority is the overriding entity. The makeup of top-down decentralization incorporates three important factors that must be taken into consideration by the local government: dispersion, delegation, and devolution (i.e., the expenditure and income independence of the local government) (Wągrodzka, 2011). Bottom-up decentralization occurs in the federal state where the implementation of local tasks is prioritized. The central government, in this case, has no influence on the local government which independently institutes tasks and responsibilities (Trussel & Patrick, 2009; Wągrodzka, 2011). In summary, government competence between the central level of the state and regional or local self-government is thus the degree of dependence (i.e., the level of independence) on the state—characterized via three administrative systems: federal, regional, and unitary.

In federal states, laws set at the central level prompt certain actions. Such actions include making regions able to implement law and, to the extent agreed, to create supplementary legislation that must not infringe federal law. In this model, there is a certain scope of independence of local self-governance within legal, economic, and administrative bounds (Beer, 1973; Mokyr, 2018; Radin & Boase, 2000). Regionalized countries are like unitary ones in that a relatively high level of decentralized competence exists. Regions can make laws, but their competences are not irremovable, i.e., the powers assigned to them are part of the powers of the central government. In this system, there is a large decentralization of law making at the local level (Fossum & Jachtenfuchs, 2017; Harrison & Heley, 2015; Hudson, Hunter, & Peckham, 2019). As a result, competitive and equivalent competences of central and local authorities are triggered via activities from public authorities, i.e., specifically from territorial and centralized units, overlapping and sharing similar rights and entitlements. In the unitary system of territorial administration of the state, territorial units are subordinated to the state authority (Salder, 2020). The competence of regions or local units is directly filtered down from the powers of the central level of government. Territorial units are subordinated and organized centrally, which shapes the system and jurisdictional structure—both with centralized and decentralized variants (Tomaszewski, 2007).

The research looks at 36 member countries associated with the Organisation for Economic Co-operation and Development (OECD) and examines the relationships between decentralization of state administration and public finance tax independence at the local level using nominal gross domestic product (GDP) as the key indicator. The study is the presentation of the principles that have aided the different types of change and the economic progress of the countries under exemination from 1995 to 2018. Table 1 illustrates the affiliation of OECD (2020b) countries in relation to their administrative system. The unitary administrative system is the dominant model in which local government units have powers subordinated to the central authority. This trend is observed in most countries throughout the world (World Bank, 2020); however, it should be noted that it is sometimes difficult to define the various variants of administrative systems currently in place. The existing elements of autonomy and independence of local government units can vary—especially in unitary states or specific subordinate-like local government units in federal

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states—making the definition of a state's system variable to some extent. First, the paper examines the notion of administrative decentralization and assesses the competitive edge needed by local governments to thrive. Financial independence is then discussed in relation to case research on OECD countries. Finally, a discussion elucidates the relationship between decentralization and economic success.

Table 1
Territorial administration systems in the 36 selected OECD countries*

Federal	Regional	Unitary
Australia, Austria, Belgium, Canada, Germany, Mexico, Switzerland, United States	Spain	Chile, Czech Republic, Denmark, Estonia, Finland, France, Greece, Hungary, Iceland, Ireland, Israel, Italy, Japan, Korea, Latvia, Lithuania, Luxembourg, Netherlands, New Zealand, Norway, Poland, Portugal, Slovakia, Slovenia, Sweden, Turkey, United Kingdom

* based on OECD (2020b) data and information obtained from the respective embassies of each country

2. LITERATURE REVIEW

2.1. Administrative decentralization

Decentralization mechanisms are elements that can contribute to the emergence of competition between varying local governments, potential residents and entrepreneurs alike. This rivalry can create administrative push and pull factors that attract people as well as business investment (i.e., related to public goods and services) by matching the supply of public goods (i.e., in terms of qualitative and quantitative returns) to any proposed group (Tiebout, 1956). Having the ability to better match public goods and services at the local level increases the efficiency of the public sector in terms of transference of decisions, competences, and finances from the central authority to local government units. In a number of cases, this has been shown to improve local economic development and, in effect, help shape infrastructural activity (Baskaran, Feld, & Schnellenbach, 2016; Oates, 1993). Decentralization can engage a focalized view of adjusted public goods and services provided according to socioeconomic circumstances (Oates 1972, 1999). Essentially, effective decentralization must incorporate adequately localized income with favorable conditions such as mobility of production factors (e.g., employability), operational mechanisms to cope with budgetary constraints, and functional and effective institutional stability (Weingast, 2014).

Decentralization favors the mechanisms of competition between local governments. It steers towards improving efficiency in terms of budgetary revenue and expenditure by aiding economic and community development. Some negative effects of competition, however, have shown to reduce tax revenue, which has translated into a lower overall budget, e.g., via less investment. In line with the Pareto principle, private investors are more inclined to do business regardless of community input, which potentially can reduce the provision of public goods and services and decrease local government efficiency (Border, 1983; Chipman, 2006; Sher, 2020). As a result, accumulation of revenue from low tax policies most likely would increase the local budgetary deficit by augmenting scarcity (Edwards & Keen, 1996; Keen & Marchand, 1997; Weingast, 1995; Wilson & Wildasin, 2004; Zodrow, Mieszkowski, Zodrow, & Mieszkowski, 1986). When considering the reduction of public spending, one can expect a decline in the activity of private entrepreneurship, which can cause a decline in economic growth. This idea reflects public expenditure support and supplementation on the part of private entrepreneurship which can improve productivity of private capital, e.g., by funding the development of education (Ozturk, 2008) and designing new infrastructure (Gerson, 1998). Competition between local governments

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usually can improve the quality of the overall governance of a system (de Mello & Barenstein, 2001) since they are more likely to be held directly accountable by local inhabitants. This can motivate self-governance-oriented authorities to regularly evaluate the socioeconomic conditions and veer towards proven policy models that have been successful (Bardhan, 2002; Besley & Case, 2003).

2.2. Finding the competitive edge

Decentralization and the emergence of competition between local or regional units may prevent the market economy from being mismanaged by political entities, in particular, at the central government level. An example is any attempt to take over and subordinate private property or public land owned by local authorities. To counterbalance this, granting more powers and authority at the local or regional level, alongside with strong budgetary restrictions, can aid in preventing excessive market fluctuation ensuing from strong top-down political decisions (Chatry, 2017; Weingast, 1995). Ineffective decentralization may result from deficiencies in democracy, e.g., improper controls during elections, which stand as a type of bedrock for holding local authority action-responsible. Examples of ineffective decentralization include: poor quality of governance, emergence of local or regional interest groups taking advantage of or overly abusing their benefits, and corruption (i.e., connections between individual levels of government, obtaining subsidies, and subsidies by local governments from the central level). As a result of the existence of special interest groups, power is much easier to execute and sustain at the local or regional level than at the central level (Enikolopov & Zhuravskaya, 2007; Weingast, 2014). In terms of political influence, decentralization must also consider the power struggle of political parties. In less developed countries, in conditions of limited democracy, strong political parties have a motivating effect on local or regional politicians and decentralization favors development. In order to gain party power, local or regional politicians try to introduce pro-development measures that can eliminate costs negatively affecting the functionality of the economy. As such, the level of power of political parties (i.e., via the centralization of a country's policy) can influence the effects of decentralization on economic growth (Enikolopov & Zhuravskaya, 2007).

Research in the early 2000s indicated that varying tax levels set by local tax authorities did not correlate with strong economic growth (Stegarescu, 2004; Thornton, 2009). Moreover, subsequent studies identified some impact in selected OECD countries over several decades but revealed income as negatively correlated with economic growth (Espasa, Esteller-Moré, & Mora, 2017). With additional measures, however, such as administrative decentralization added to fiscal decentralization, varying results were found. As a result, these conditions could be conducive to the decision-making process by local governments—signaling them to implement higher levels of administrative decentralization with high levels of fiscal decentralization (Espasa et al., 2017; Filippetti & Sacchi, 2016).

Studies from around the world appear to show country-specific findings that outline some ambiguity about one fixed solution versus preferred top-tier of approaches. In China, Yang (2016) showed a non-linear correlation in which low income consistently increased decentralization and, hence, led to economic development and growth. However, in the case of high decentralization, economic development was limited. Moreover, the impact of decentralization was dependent on regional infrastructure levels (Long, Wu, Wang, & Dong, 2008; Yang, 2016). In Russia, fiscal decentralization was shown to slow the pace of development, especially if an increase in the share of subsidies and subsidies from the state budget (i.e., income exclusive to territorial units) was poorly accounted for (Yushkov, 2015). This can be related to a lack of decision-making and political clout at the Russian local level. Digging deeper in this topic, the interdependence between fiscal decentralization and the rate of economic growth is verified by Bayesian model averaging. According to this model, a large number of regression equations with different independent variables are estimated to confirm or exclude the

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operation of the analyzed variables (Fragoso, Bertoli, & Louzada, 2018; Steel, 2020; Wasserman, 2000). Asatryan and Feld (2015) applied this technique to a selection of OECD countries and found that there was no interdependence between decentralization and the rate of economic growth. Similarly, a Polish study on municipalities nationwide found that no clear positive impact from decentralization was widespread (Kopańska, Kula, & Siwińska-Gorzelak, 2018). Kopańska et al.'s (2018) research did emphasize, however, a positive effect of decentralization when specific complementary conditions were included, i.e., the level of investment expenditure, cost-effectiveness of local governments, the level of education, and the type of municipality (e.g., urban versus rural and rich versus poor). Moreover, Baskaran et al. (2016) conducted a comprehensive review on the subject matter and found a number of other viewpoints relating to decentralization and economic growth. To date, it is important to point out that the advantage (i.e., positive impact) of decentralization to economic growth is not conclusive. This study reexamines this topic by assessing OECD countries—drawing upon much of the state-of-the-art and discipline-specific research—to test this idea. As such, the originality of research lies in determining whether the independence of territorial units (i.e., institutional factors) are a determinant of the economic success and prosperity of the citizenry of a given country. The possibility of using the level of autonomy of local governments and tax independence to confront this argument could also be expanded to include other macroeconomic indicators (e.g., economic growth, unemployment, etc.); this being said, the study acts as a baseline to developing comparative research to better project how countries might develop economic metrics in an out-of-the-ordinary manner.

3. MODEL SPECIFICATION AND DATA

3.1. Method

A systematic literature review was conducted using the following electronic journal databases: Science Direct, Web of Knowledge, Scopus, Science Direct, Directory of Open Access Journals, Google Scholar, and Google. The following English language keywords were used: "decentralization", "tax independence", "tax dependence", "economic autonomy", "economic growth", "self-government", "self-governance", "state administration", "fiscal decentralization", "central government", "federal system", "regional system", "unitary system", political stability", "public financial", "federal law", "economic development", "expenditure", and "OECD". The literature was compiled, and the publications were systematically analyzed so as to identify the methodologies used. As part of the systematic review process, we also identified past and existing terminology relating to decentralization and tax independence and synthesized and updated it so as to provide a way forward with the benchmark research (Paczoski et al., 2019). Microsoft Excel 2021 was used to collate datasets and conduct the analysis.

The study examined the 36 OECD (2020b) member countries that ratified their membership before 2018, using macroeconomic data (i.e., nominal GDP) to create datasets within a twenty-four-year period between 1995 and 2018. Note, Columbia and Costa Rica are not included in the research as they both ratified their membership after the end date of the research period on 28 April 2020 and 25 May 2021, respectively. The following two research hypotheses are considered:

Hypothesis 1 (H1): Increased decentralization of state administration in conjunction with fiscal independence from local governments increases the amount of GDP per capita.

Hypothesis 2 (H2): Increased decentralization of state administration in conjunction with fiscal independence from local governments decreases the amount of GDP per capita.

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3.2. Categorization of taxation

In OECD countries, it is common for the local government budget to include more than one local tax although, most often, one of them is of dominant importance. The exception to this rule is in the United Kingdom, where the budget of local governments is supplied only by revenue from the so-called council tax. It is a tax that combines the features of a classic property value tax and poll tax (Oulasvirta & Turala, 2009). In most other countries, property tax is the responsibility of the varying levels of territorial administration. Local government units most often have a specific scope of tax jurisdiction regarding the tax category. As such, their decisions relate to the amount of tax rates within the limits of statutory maximum rates. Only in countries such as Hungary and Belgium are these rates set centrally. On the other hand, the level of property tax revenue ranges from 2.4% in Sweden to 100%, e.g., in the United Kingdom. The second category of taxes that should be analyzed is income tax. In Poland, for example, local governments have a 100% share in income tax paid in the form of a tax card, shared via personal and corporate income tax, but do not have any tax authority in this respect. As such, personal income tax is a local tax in eleven OECD countries (Semmerling, 2019), including mainly the Scandinavian countries, some Western European countries such as Switzerland, Belgium and Italy, and non-European countries including the United States, South Korea, and Japan.

Apart from the two groups of local taxes mentioned, the budgets of local government units in OECD countries are supplied with revenue from other taxes which are difficult to explicitly classify. Among them, taxes take a variety of forms, including: transport (i.e., Spain, Belgium, Estonia, Greece, Poland, and Portugal), real estate trade (i.e., Slovakia), organization of artistic events (i.e., Czech Republic), gambling (i.e., Czech Republic and Slovenia), advertising (i.e., Estonia), residential (i.e., Finland), disposal of household waste (i.e., France and Italy), increase in the value of real estate due to location in a city (i.e., Spain), tourism (i.e., the Netherlands and Hungary), advertising (i.e., Slovakia) and occupied space in the public domain (i.e., Italy). The revenue from such taxes is generally of negligible fiscal importance. In many cases, local governments have the power to impose taxes until a certain level of decentralization is reached (Semmerling, 2019). The scope of local tax authority is mainly associated with the taxation within geographical limits and detailed regulatory legislation to justify the tax. Since 1995, the OECD has published cyclical lists of indicators of tax autonomy—all the way down to the local level. The update from 2018, i.e., the last year of the period analyzed in this study, is illustrated in Table 2. The classification of taxation, broken down using the OECD's (2020a) five main groups of local government financial independence, formulated the structuring and methodology used in this paper. The categories are as follows:

- category "A" = full authority over tax rates and tax bases;
- category "B" = power over tax rates (i.e., essentially representing a type of "piggy bank" tax);
- category "C" = power over the tax base;
- category "D" = arrangements for tax distribution;
- category "E" = no power on the rates and bases at all; and
- category "F" = represents taxes that cannot be allocated.

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Table 2
Tax autonomy in OECD countries, 2018

	Discretion on rates and reliefs		Discretion on rates		Discretion on reliefs	Tax sharing	Rates and reliefs set by CG	Other
	Full	Restricted	Full	Restricted				
	(A1)	(A2)	(B1)	(B2)	(C)	(D)	(E)	(F)
Australia	100.0	—	—	—	—	—	—	—
Austria	8.9	—	—	14.8	—	1.1	68.1	7.1
Belgium	7.5	—	92.3	—	—	—	0.1	—
Canada	1.4	—	95.5	—	—	—	1.0	2.1
Chile	—	—	15.3	25.3	—	59.3	—	0.1
Czech Republic	—	—	—	99.9	—	0.1	—	—
Denmark	—	—	89.0	11.0	—	—	—	—
Estonia	10.9	—	—	82.0	—	7.1	—	—
Finland	—	—	83.6	8.1	—	8.3	—	—
France	44.2	—	5.6	3.3	0.2	16.2	21.2	11.3
Germany	—	—	12.8	42.1	—	43.6	—	1.5
Greece	—	—	—	93.8	—	—	6.2	—
Hungary	0.1	—	—	96.4	—	3.5	0.0	—
Iceland	—	—	—	96.9	—	—	—	3.1
Ireland	—	—	—	90.1	—	—	9.9	—
Israel	—	4.9	—	—	—	—	95.1	—
Italy	14.3	—	—	52.3	—	32.5	—	0.3
Japan	—	0.2	55.2	26.6	—	—	18.0	—
Korea	—	—	—	85.2	—	—	14.2	0.6
Latvia	—	—	—	13.6	—	86.4	—	—
Lithuania	10.6	—	—	84.0	1.1	—	4.3	—
Luxembourg	8.8	—	—	85.4	—	—	0.9	—
Mexico	100.0	—	—	—	—	—	—	—
Netherlands	—	—	68.0	31.2	—	—	—	0.7
New Zealand	97.1	—	—	2.9	—	—	—	—
Norway	—	—	—	99.2	—	—	0.8	—
Poland	—	—	—	25.6	—	65.1	3.7	5.5
Portugal	—	—	—	68.6	—	11.7	19.0	0.7
Slovakia	8.9	—	—	90.0	—	—	—	1.1
Slovenia	15.7	—	—	—	—	75.9	8.2	0.1
Spain	26.3	—	—	56.2	—	16.7	0.6	0.1
Sweden	—	—	97.6	—	—	—	2.4	—
Switzerland	2.4	—	—	97.6	—	—	—	—
Turkey	—	—	—	—	—	83.2	16.8	—
United Kingdom	—	—	95.8	0.8	—	2.6	—	0.8
United States	—	—	—	—	—	—	—	100.0

Source: based on OECD (2019) data on taxing power of sub-central governments in 2018.

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4. RESULTS

Overall, the results illustrate the assessment of the level of tax independence of local governments in the assessed 36 OECD countries. As part of the tax independence assessment, selected variables for the member countries were analyzed. Data indicating the percentage of local tax revenue in terms of total tax (i.e., for central and local government sectors) for the years 1995–2018 is presented in Appendix 1. Note, since the tax autonomy data for the selected countries is not available after 2018, the results of the research match accordingly. Table 3 illustrates the share of tax revenue of local authorities from general government tax revenue for 1995 and 2018 with the standard deviation and minimum and maximum values between the two years.

Table 3
Share of tax revenue of local authorities from general government tax revenue, 1995 and 2018

	1995	2018	Standard deviation	Minimum value	Maximum value
Australia	3.4	3.4	0.247	2.9	3.6
Austria	4.1	3.0	0.346	3.0	4.1
Belgium	4.8	4.6	0.265	4.1	5.4
Canada	9.8	10.0	0.716	8.1	10.7
Chile	6.5	7.9	0.847	5.2	8.4
Czech Republic	0.9	1.0	0.163	0.8	1.3
Denmark	31.3	27.0	3.041	23.7	33.2
Estonia	0.8	0.8	0.236	0.8	1.6
Finland	22.3	22.7	1.051	20.7	24.3
France	11.0	13.5	1.238	9.8	13.5
Germany	7.4	8.6	0.523	6.8	8.6
Greece	2.0	2.4	0.168	2.0	2.6
Hungary	2.5	5.8	0.993	2.5	6.7
Iceland	20.8	27.6	2.242	18.6	27.6
Ireland	2.7	2.1	0.465	2.0	3.5
Israel	6.4	7.9	0.737	6.4	8.8
Italy	5.4	11.7	3.734	5.4	16.8
Japan	25.2	23.2	1.403	22.7	28.3
Korea	18.7	16.6	0.993	15.1	18.9
Latvia	19.5	18.1	1.217	16.0	20.3
Lithuania	2.3	1.2	0.378	1.2	2.4
Luxembourg	6.5	4.5	1.021	3.3	6.6
Mexico	1.5	1.6	0.280	1.0	1.8
Netherlands	3.1	3.5	0.288	3.0	4.0
New Zealand	5.3	6.6	0.673	5.3	7.2
Norway	20.0	15.3	2.290	11.9	19.6
Poland	8.5	12.7	1.621	8.5	13.5
Portugal	5.4	7.2	0.589	5.4	7.3

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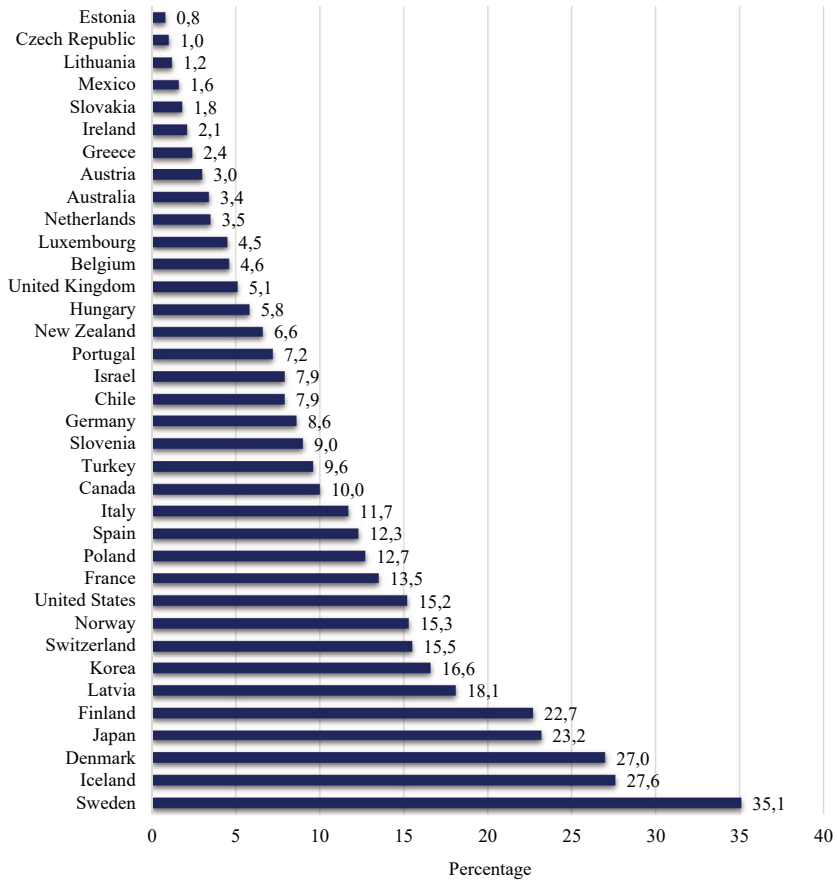
Table 3 – continued

	1995	2018	Standard deviation	Minimum value	Maximum value
Slovakia	1.3	1.8	0.588	1.3	2.9
Slovenia	6.2	9.0	1.605	6.3	11.1
Spain	8.6	12.3	0.893	8.2	12.3
Sweden	30.8	35.1	2.696	28.8	36.9
Switzerland	17.6	15.5	0.797	15.1	17.7
Turkey	12.8	9.6	2.337	5.9	15.7
United Kingdom	3.7	5.1	0.480	3.7	5.3
United States	13.3	15.2	1.376	12.2	17.6

Source: based on the fiscal decentralization database from OECD (2020a).

Three countries, Sweden, Iceland, and Denmark, achieved the highest share of tax revenue at the local level with over 27%, followed by Finland and Japan with over 22%. At the end of the spectrum, there are countries whose local authorities obtained less than 5% of total shared tax: Australia, Austria, Belgium, Czech Republic, Estonia, Greece, Ireland, Lithuania, Luxembourg, the Netherlands, Mexico, and Slovakia. The difference between Sweden, which has the highest share of local tax revenue, and Estonia, i.e., the lowest, is 34.3 percentage points (ppt) in 2018. Figure 1 shows the ranking of the countries, from lowest to highest, whose local governments received tax revenue according to data for 2018.

Figure 1
Local level tax revenue as a percentage from the total general government sector, 2018



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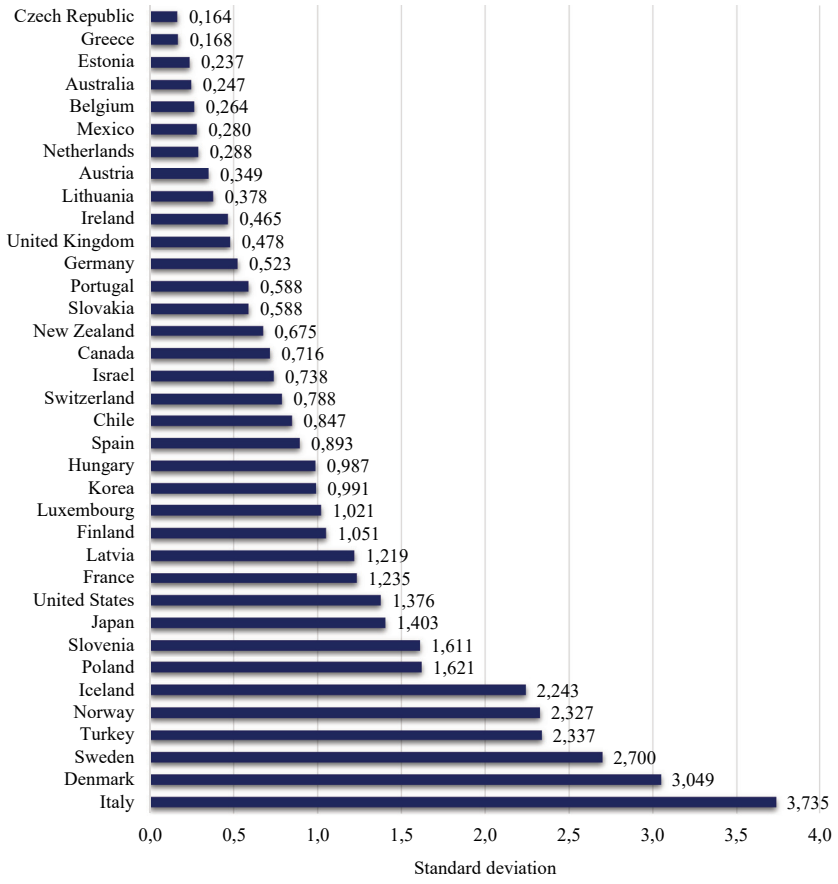
The standard deviation, calculated for the years 1995–2018, is also worth considering (Figure 2). It illustrates that some countries had a high degree of variation in local authorities' share of total income. The highest values of standard deviation, i.e., > 2, were achieved by six countries: Denmark, Iceland, Italy, Norway, Sweden, and Turkey. It can be observed for the analyzed time period that the lowest value of the share in taxes of local authorities in Italy was 5.4% and the highest was 16.8% (i.e., a difference of 11.4 ppt) while in Denmark these values were 23.7% and 33.2% (i.e., 9.5 ppt), respectively. The Czech Republic achieved the lowest standard deviation value of 0.164.

Figure 2
Standard deviation of the share of local government tax revenue from the total general government sector, 1995–2018



According to Table 2, only two states, i.e., Australia and Mexico, have full local authority over tax rates and tax bases. For New Zealand, the autonomy rate for local taxation is 97.1%. France was next with 44.2%. In general, among the member countries, sixteen countries had full tax autonomy over the rates and tax bases in 2018; however, most of them, i.e., seven, achieved this rate at a level lower than 10%. This indicates that 43.75% of these countries, i.e., classified as belonging to countries with the attributed tax authority, have only less than 10% of tax revenue. Moreover, when considering the issues of tax authority in the context of tax independence, the dominance of Scandinavian countries (i.e., Denmark, Finland, and Sweden) is present. Their share from taxes, whose rates are shaped by local authorities, is approximately 90%. This high percentage rate is also shared by Belgium, Canada, and the United Kingdom. Countries in which local authorities have the possibility to shape tax rates with certain limitations (i.e., restricted (B2) discretion on rates above 80%) include the Czech Republic, Estonia, Greece, Hungary, Iceland, Ireland, Korea, Lithuania, Luxembourg, Norway, Slovakia, and Switzerland. Poland is one of the European countries with little tax control over the share of tax revenue as such. Municipalities can

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fully decide on the tax rate within the established framework and the share of such tax revenue, i.e., 25.6%. Moreover, the states recognized as federations were characterized by different levels of power in terms of tax autonomy. These countries include variants with 100% sovereignty in terms of rates and basic tax base (i.e., Australia and Mexico) and those with local authorities that do not play a major role in relation to these taxes (e.g., Austria) (Table 4). The autonomy level of local tax is dominant at level "B", which gives some freedom as to the tax rate implemented. Based on the presented data, the relationship between the administrative system and the level of local tax autonomy cannot be confirmed (Figure 3).

Table 4
System of territorial administration, GDP per capita, and level of local tax autonomy in selected OECD countries, 2018

Country	System	GDP per capita (USD)	ALLT	Country	System	GDP per capita (USD)	ALLT*
Australia	Federation	57,180.78	A	Korea	Unitary	33,436.92	B
Austria	Federation	51,486.58	E	Latvia	Unitary	17,865.03	D
Belgium	Federation	47,549.21	B	Lithuania	Unitary	19,186.18	B
Canada	Federation	46,548.64	B	Luxembourg	Unitary	117,254.74	B
Chile	Unitary	15,772.33	D	Mexico	Federation	9,686.98	A
Czech Republic	Unitary	23,419.74	B	Netherlands	Unitary	53,044.53	B
Denmark	Unitary	61,591.93	B	New Zealand	Unitary	43,250.44	A
Estonia	Unitary	23,063.56	B	Norway	Unitary	82,267.81	B
Finland	Unitary	49,988.91	B	Poland	Unitary	15,468.48	D
France	Unitary	41,592.80	A	Portugal	Unitary	23,562.55	B
Germany	Federation	47,973.61	D	Slovakia	Unitary	19,389.98	B
Greece	Unitary	19,756.99	B	Slovenia	Unitary	26,116.86	D
Hungary	Unitary	16,427.37	B	Spain	Regional	30,364.58	B
Iceland	Unitary	74,469.80	B	Sweden	Unitary	54,589.06	B
Ireland	Unitary	79,107.60	B	Switzerland	Federation	86,388.40	B
Israel	Unitary	42,063.45	E	Turkey	Unitary	9,454.35	D
Italy	Unitary	34,622.17	B	United Kingdom	Unitary	43,646.95	B
Japan	Unitary	39,727.12	B	United States	Federation	62,805.25	F

* ALLT = autonomy level of local tax
Source: GDP per capita, World Bank (2022).

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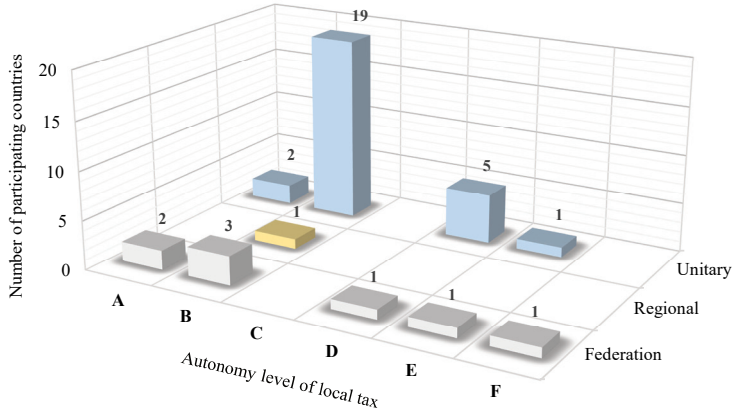
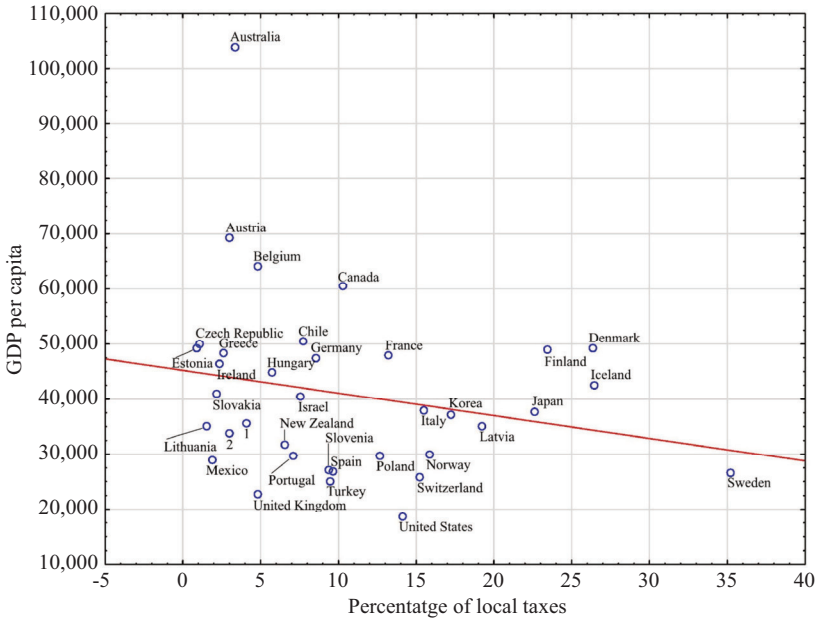
Figure 3
Participation of the selected member countries' administrative systems in relation to the autonomy level of local tax, 2018



When examining the level of correlation between the measure of GDP per capita and the share of local taxes in total taxes, the result is -0.439419 (i.e., $p < 0.05$), which indicates the existence of a negative correlation between the two variables (Figure 4).

Figure 4
Distribution of dependence on GDP per capita and share of local taxes in terms of total tax, 2018



Note: [1] Luxembourg, [2] Netherlands.

As an extension, it would seem that greater tax autonomy of local authorities should lead to an increase in economic development; however, in practice, such a large spatial differentiation shows that it may lead to the opposite effect. It seems that in terms of both tax management at the local level and the dynamics of economic development, the possibilities of territorial units as well as the experience, competences, and knowledge of those responsible for management locally are more important than the legal regulations themselves.

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5. CONCLUSIONS

Financial independence of local governments, in essence, is the starting point at which territorial self-government, i.e., at of the local or regional level, manifests decentralization (Piotrowska-Marczak, 1997). These territorial units have the freedom to set tasks (i.e., make decisions), legal regulations, and political agendas as well as strategies for economic development, organization and community-based planning, and local management schemes (Heller, 2006; Kozera, Głowicka-Wołoszyn, & Wysocki, 2016). A principal issue of territorial units is the ability to utilize localized funds needed to implement established tasks with the highest possible return. As such, financial independence of the local government, both in terms of income and expenditure, can be treated as one of the determinants of independence from the central government. Another example of a determinant is decision-making independence where development priorities are localized and community-oriented. In this study, financial independence of local government units is treated as a desired state that ensures development. Local government authorities identify the development needs of a given territory as better than centralized development since they are closer and usually directly involved and impacted. Moreover, the management of financial resources is usually more effective as a public authority can be directly held accountable for its actions. Local government has also a closer relationship with the local or regional community and can foster social and economic development in a more effective manner (Diaz-Serrano & Rodríguez-Pose, 2015). The scope of this financial freedom is the degree of fiscal independence at the local level.

The decentralization of public finance brings about the need for administrative oversight, including what government authority public finance is used for and what part of those public finances remains at the local and regional governmental level. As part of income independence, the categorization of this income needs to be considered, i.e., tagged as permanent, indefinite in nature, without limitations, or in part state-controlled with proceeds at the disposal of local government units (Dylewski, Filipiak, & Gorzałczyńska-Koczkodaj, 2004; Gonet, 2008). Hence, the competence of local governments to conduct fiscal policy is important. They must consider tax authority, establish local power, and determine the amount of taxation, payment period, rules for collection, enforcement, preferences, and tax remission. In essence, economic independence of local governments is the ability to perform public tasks on their own behalf, under their own responsibility, and to provision their own income (Kozera, 2018). This includes the possibility of conducting localized fiscal policy (Poniatowicz, 2015).

An independent fiscal policy can be interpreted as the freedom local governments have in determining the amount and structure of taxes and local tax rates. The sources of income constitute the basis of local government's finance (i.e., budget) and are key to determining its level of independence—especially in terms of fiscal decentralization. Key factors include the possibility of creating income sources and structuring favorable stability and efficiency on the local income side of the budget (Wyszkowska, 2017). Power struggle governance, in terms of these factors, allows for more effective control of the budget revenue, budget balance, and performance of local government duties (e.g., investment, education, and social policy). Increased sovereignty may be helpful in conducting a more flexible fiscal policy by local governments in the event of changes in the economic situation (e.g., the COVID-19 pandemic) and in budgetary conditions imposed by the central state (Wyszkowska, 2017).

Financial independence of local governments in the selected individual OECD countries varies as regards local and regional units. The notion of "fiscal autonomy" is of fundamental importance, as it covers the various aspects of the freedom that local authorities have over their own taxes. Among OECD countries, only a few have full authority over tax rates and tax bases, i.e., Australia, Mexico, and New Zealand. Most member countries, however, have authority over the rates of some local taxes, while others whose local governments have none to a low level of power (i.e., Israel, the United States, and Austria) illustrate the diversity of the study.

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Hypothesis H2, i.e., increased decentralization does not positively interrelate with the level of tax independence of local government and, in effect, is not an advantage to economic growth and development (i.e., GDP per capita), is corroborated with the analyzed OECD data. Together with the literature (Chipman, 2006; Sher, 2020), it confirms that the system of territorial administration has no influence on the limits of tax autonomy of local governments and no strong correlation exists between the share of local taxes in total taxes and achieved economic benefit or an increase in nominal GDP per capita (Edwards & Keen, 1996; Weingast, 1995; Wilson & Wildasin, 2004). Such observations lead to the conclusion that the legal provisions which determine the scope of tax autonomy are not a sufficient element for dynamic economic development. The share of taxes and the amount of locally-produced income at the disposal of local governments are of course of significant importance for development opportunities; however, other factors may prove to be significant influencers. These may include, e.g., the introduction of rent variability (i.e., in terms of location) as well as the level of experience and autonomy, and the continuity of government since the competence of local authorities for a given region should be strategically-oriented and decision-making should be region-specific.

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Appendix 1
Total percentage of general government sector tax revenue, 1995–2018

	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
Australia	3.4	3.4	3.3	3.1	3.1	3.0	3.1	3.0	3.0	2.9	2.9	2.9	2.9	3.2	3.5	3.5	3.4	3.4	3.4	3.6	3.6	3.6	3.4	3.4
Austria	4.1	4.0	3.8	3.8	3.7	3.5	3.1	3.1	3.1	3.1	3.1	3.1	3.1	3.0	3.1	3.1	3.1	3.1	3.1	3.1	3.0	3.0	3.0	3.0
Belgium	4.8	4.8	4.8	4.5	4.6	4.1	4.5	4.8	5.0	4.8	4.8	4.8	5.0	4.4	5.4	5.1	5.0	4.6	4.7	4.6	4.9	5.0	4.9	4.6
Canada	9.8	9.6	9.2	8.9	8.6	8.1	9.3	9.5	9.4	9.2	9.2	8.9	9.0	9.8	10.4	10.7	10.4	10.5	10.5	10.4	10.4	10.4	10.3	10.0
Chile	6.5	6.7	7.2	7.7	8.4	7.9	7.9	7.9	8.0	6.9	6.5	5.5	5.2	6.3	8.4	6.9	6.6	6.7	7.3	7.6	7.6	7.8	7.8	7.9
Czech Republic	0.9	0.9	0.8	0.9	0.8	0.9	0.8	1.2	1.2	1.1	1.1	1.1	1.0	1.0	1.2	1.3	1.2	1.3	1.3	1.2	1.2	1.1	1.1	1.0
Denmark	31.3	31.0	31.3	31.5	31.4	30.7	32.4	33.0	33.2	31.8	30.4	30.7	23.7	24.7	25.6	26.7	26.7	26.4	26.2	24.6	26.0	26.6	26.4	27.0
Estonia	0.8	1.4	1.4	1.4	1.5	1.6	1.5	1.4	1.3	1.2	1.2	1.0	0.9	1.2	1.2	1.4	1.5	1.3	1.1	1.1	1.0	1.0	0.9	0.8
Finland	22.3	22.8	21.7	21.8	21.7	21.6	22.1	21.4	21.1	20.8	20.7	21.0	21.3	21.9	23.7	24.3	23.2	22.7	23.4	23.5	23.7	23.1	23.5	22.7
France	11.0	11.1	10.9	10.9	10.6	10.0	9.8	10.0	10.2	11.0	11.4	11.4	11.9	12.0	13.0	10.6	12.9	13.0	12.8	12.9	13.1	13.4	13.3	13.5
Germany	7.4	7.3	7.4	7.9	7.9	7.4	7.3	7.0	6.8	7.4	7.8	8.3	8.4	8.5	7.8	7.9	8.0	8.2	8.2	8.2	8.3	8.5	8.6	8.6
Greece	2.0	2.2	2.1	2.0	2.0	2.0	2.1	2.0	2.1	2.2	2.2	2.2	2.2	2.3	2.3	2.3	2.3	2.4	2.6	2.4	2.4	2.4	2.4	2.4
Hungary	2.5	3.7	4.1	4.5	5.3	5.2	5.5	5.4	5.7	6.1	6.2	6.4	6.2	6.4	6.7	6.4	6.6	6.2	5.9	5.6	5.8	5.8	5.8	5.8
Iceland	20.8	20.2	23.9	23.3	22.5	23.3	24.9	24.7	24.2	23.5	22.9	24.2	25.0	25.9	27.3	25.5	26.6	26.3	26.6	24.5	25.6	18.6	26.5	27.6
Ireland	2.7	2.5	2.4	2.2	2.1	2.0	2.1	2.3	2.3	2.2	2.2	2.0	2.2	2.6	3.3	3.3	3.3	3.5	3.1	2.8	2.5	2.3	2.2	2.1
Israel	6.4	6.6	6.7	6.9	6.9	6.7	6.7	7.0	7.2	7.7	7.6	7.5	7.7	8.2	8.8	8.7	8.6	8.5	8.3	8.2	8.1	7.9	7.6	7.9
Italy	5.4	5.6	5.8	11.8	9.4	15.3	15.8	16.3	16.8	16.6	16.6	16.1	16.4	16.2	15.0	15.4	15.6	16.2	16.1	16.6	16.5	15.1	15.5	11.7
Japan	25.2	25.7	25.9	26.6	26.6	26.1	26.4	26.0	25.7	25.6	25.2	25.5	27.5	28.3	27.5	25.9	25.2	24.7	24.2	23.4	23.9	23.9	22.7	23.2
Korea	18.7	18.3	17.9	16.8	16.3	15.1	17.8	18.9	18.0	17.8	17.4	18.1	16.8	16.7	16.5	16.6	16.2	15.8	15.5	16.9	18.0	17.5	17.3	16.6
Latvia	19.5	20.3	16.1	16.3	16.0	16.9	17.4	17.1	17.6	17.7	16.7	16.9	17.8	18.8	17.8	20.0	19.2	18.7	18.6	18.9	18.7	18.9	19.2	18.1
Lithuania	2.3	2.4	2.0	1.8	1.9	2.0	1.9	2.2	1.7	1.7	1.5	1.3	1.2	1.2	1.6	1.7	1.6	1.6	1.2	1.2	1.3	1.3	1.2	1.2
Luxembourg	6.5	6.6	6.2	6.2	5.7	5.8	5.7	6.1	6.0	4.9	4.5	4.4	4.4	4.5	4.5	4.4	4.6	4.0	3.5	3.3	3.5	3.9	4.1	4.5

Appendix 1 – continued

	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
Mexico	1.5	1.3	1.1	1.1	1.0	1.0	1.1	1.2	1.3	1.5	1.6	1.7	1.8	1.7	1.8	1.7	1.7	1.8	1.8	1.8	1.6	1.5	1.6	1.6
Netherlands	3.1	3.4	3.4	3.5	3.3	3.3	3.5	3.6	3.8	4.0	4.0	3.3	3.3	3.3	3.6	3.6	3.8	3.9	3.8	3.8	3.8	3.1	3.0	3.5
New Zealand	5.3	5.6	5.4	5.9	6.2	5.7	5.6	5.5	5.6	5.5	5.3	5.6	5.8	6.4	7.1	7.2	7.2	6.9	6.9	6.9	6.8	6.7	6.6	6.6
Norway	20.0	19.1	18.3	18.3	17.2	15.1	16.4	13.0	14.7	13.7	13.3	12.6	12.6	11.9	13.9	13.6	12.1	12.5	13.3	13.9	15.4	16.2	15.9	15.3
Poland	8.5	9.7	10.1	10.3	9.3	9.2	10.2	10.1	9.6	12.8	12.7	12.9	13.3	13.5	13.1	12.6	12.3	12.6	12.6	13.0	12.9	12.8	12.7	12.7
Portugal	5.4	5.5	5.5	5.8	6.3	6.3	6.1	6.3	6.0	6.7	6.7	6.6	7.1	7.0	7.0	6.7	6.5	6.7	6.9	7.2	7.3	7.3	7.1	7.2
Slovakia	1.3	1.5	1.5	1.4	1.4	1.4	1.4	1.8	1.8	1.8	2.6	2.7	2.6	2.6	2.8	2.9	2.8	2.9	2.8	2.7	2.0	2.0	1.9	1.8
Slovenia	6.2	6.6	6.7	6.5	7.1	7.3	7.4	7.4	7.6	7.6	7.4	7.7	9.1	8.9	10.1	10.9	10.8	11.1	10.9	10.6	9.6	9.5	9.4	9.0
Spain	8.6	8.5	8.8	9.2	9.1	8.9	8.7	8.5	8.2	8.2	8.2	8.3	8.2	8.5	8.8	8.9	9.0	9.3	9.7	9.9	9.8	9.9	9.7	12.3
Sweden	30.8	30.4	29.4	29.1	29.6	28.8	31.0	32.6	33.1	32.8	32.1	31.9	32.3	34.6	36.2	35.3	35.6	36.7	36.9	36.9	36.0	35.4	35.3	35.1
Switzerland	17.6	17.4	17.1	16.6	17.1	16.2	16.9	16.7	16.5	16.3	15.9	15.8	15.8	15.3	15.5	15.2	15.2	15.1	15.2	15.4	15.3	15.6	15.3	15.5
Turkey	12.8	12.5	12.4	15.7	14.1	8.9	8.8	6.5	5.9	7.0	7.6	8.3	8.4	8.7	8.8	9.3	8.8	8.9	8.8	9.4	9.6	9.7	9.5	9.6
United Kingdom	3.7	3.8	3.8	3.9	3.9	4.0	4.2	4.5	4.8	4.7	4.7	4.6	4.6	4.8	5.3	5.1	4.9	4.9	4.9	4.9	4.9	4.9	4.9	5.1
United States	13.3	13.0	12.8	12.4	12.4	12.2	12.7	14.4	14.9	15.0	14.6	14.3	14.6	15.1	17.6	16.7	16.1	15.7	14.6	14.5	14.2	14.6	14.2	15.2

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The Impact of IFRS 9 on the Link Between Lending and the Capital Ratio in Publicly Traded Banks in Poland

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ABSTRACT

This paper aims to determine the role of the expected credit loss approach as defined in IFRS 9 in the effects of capital ratio on loans growth in publicly traded banks in Poland. To resolve this problem, we apply semi-annual data of individual banks in 2012–2018. Using several estimation techniques, we find that in the period of implementation of the expected credit loss approach, the links between loans growth and the capital ratio were enhanced. In particular, lending growth is more sensitive to levels of the capital ratio. These results are important with respect to the goal of bank financial stability and have implications for the conduct of macroprudential policy.

JEL Classification: E32; G2; G28; G32

Keywords: loans growth rate, capital ratio, expected credit loss, IRFS 9

1. INTRODUCTION

Bank lending depends on many factors, including the demand side and supply side of the loans market. Each of them comprises determinants that are internal to the bank – including activity size, business model, capitalization, and external to the bank – covering regulations constraining the activity of the bank. Bank capital is a quantitative supply-side determinant of lending. Insufficient levels of capital ratios are a basic constraint on the bank investment activity and, in particular, on the bank lending activity.

Theory and empirical research shows that the link between bank lending and the capital ratio is diversified (Borio & Zhu, 2012; Berrospide & Edge, 2010; Beatty & Liao, 2011; Kim & Sohn,

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2017; Olszak et al., 2019) and strongly dependent on the level of capital buffers of the bank. These capital buffers constitute excess capital over the amount required by the external regulatory requirements and internal capital assessment by the bank. Banks with large capital buffers are insensitive to losses, and therefore they do not reduce their lending activity, even during turbulent periods. That is why the link between loans growth and the capital ratio should be negative. In contrast, banks with thin capital buffers will be prone to losses depleting capital and, in effect, will be forced to change the structure of their assets by reducing the lending activity.

After the global financial crisis (henceforth GFC) of 2007/8, regulatory and supervisory authorities introduced many standards aimed at increasing the capital levels of banks, whereby banks should be stimulated to keep profits in upturns, to be used in downturns. These new standards include the International Financial Reporting Standard 9 (IFRS 9). Regulators expected that this standard, at least in the early implementation period, would worsen the capitalization of banks by reducing the amount of capital buffers available for the lending activity, particularly considering the new restrictive capital standards (such as leverage ratio, fixed capital buffer, cyclical capital buffer, buffers for systemically significant institutions) (European Systemic Risk Board, 2017, 2019a, 2019b; Basel Committee on Banking Supervision, 2017). Previous research shows that increased restrictiveness of capital regulations is associated with a capital crunch (Peek & Rosengren, 1995; Beatty & Liao, 2011; Kim & Sohn, 2017), which is associated with decreased lending activity due to a reduction in available capital buffers, i.e., excess capital over the regulatory requirements, which is accessible in bank management for capital allocation and capital absorption process.

The aim of this paper is to determine the effect of IFRS 9 on the link between the lending activity and the capital ratio of publicly traded commercial banks in Poland. Considering the fact that IFRS 9 decreased the amount of available capital buffers, we hypothesize that IFRS 9 has increased the sensitivity of loans growth to the capital ratio. We also expect that the implementation of IFRS 9 in 2018 had a negative effect on loans growth.

In this paper, we use individual data of publicly traded banks operating in Poland in 2013–2018 and apply several estimation techniques (generalized least squares, ordinary least squares) usually employed in the analysis of cross-section and time-series data. In our analysis, we also use hand-collected data from annual and financial reports of banks covered in the study. These data are used to construct indices measuring the intensity of steps taken to prepare for the introduction of IFRS 9. The results show an economically significant effect of IRFS 9 on the link between loans growth and the capital ratio.

This rest of the paper is structured as follows. Section 2 covers the review of the literature and presents hypotheses. Section 3 describes the model, methodology and data used in the study. Section 4 interprets the research results. The last section concludes.

2. LITERATURE REVIEW AND HYPOTHESES

Empirical research on the role of capital standards in the bank lending activity has been conducted for over 30 years. Preliminary research in the 1990s focused mostly on the economic effect of capital ratio, as defined in Basel I, on loans growth (Jackson et al., 1999). Its basic goal was to determine whether an external standard affecting the banking sector produces any outcomes for the real economy. This research concludes that bank capital was of huge importance in the bank lending activity, especially in the period of implementation of the new capital adequacy standards.

More recent papers focus on the heterogeneity of effects of the capital ratio on loans growth. These papers analyse several factors including: monetary policy (Kishan & Opiela, 2006); level of the capital ratio (and buffer capital) (Carlson et al., 2013); bank size (Kishan & Opiela, 2000;

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Olszak et al., 2019); timeliness (and potential delay) of loan-loss provisioning (Beatty & Liao, 2011); excess control rights (Lepetit et al., 2015); liquidity of the bank (Kim & Sohn, 2017; Thornton & Tommaso, 2019); macroeconomic environment (Beatty & Liao, 2011; Olszak et al., 2019).

Kim and Sohn (2017) analyse the effect of liquidity on the link between loans growth and the capital ratio of commercial banks in the United States. They show that more liquid banks exhibit stronger positive links between loans growth and the capital ratio. In the same vein, Thornton and Tommaso (2019), in a study covering 521 banks from 21 European countries, show that the effects of capital ratio on lending depend on liquidity. The more liquid the bank is, the stronger the effect of capital ratio on loans growth rate during a crisis.

Lepetit et al. (2015) analyze capital ratio adjustments in 17 European countries in 2002–2010. They show that if control and cash flow rights are identical, banks issue equity without cutting lending in order to boost capital ratios. In contrast, when control rights exceed cash flow rights, banks downsize by reducing lending rather than issue equity. As they suggest, such a finding is mostly prevalent in countries with weak shareholder protection or for family-controlled banks.

Roulet (2018) analyses the impact of the new Basel III capital and liquidity regulation on bank lending following the 2008 financial crisis in commercial banks in Europe. As the paper shows, capital ratios have significant and negative impacts on the expansion of large European banks' retail and other lending activity in the context of deleveraging and "credit crunch". However, the effect is heterogeneous and depends on liquidity indicators, which have positive but perverse effects on bank lending growth.

Altunbas et al. (2016) examine the link between bank capital and earning assets in five European countries in 1989–2012 using panel cointegration techniques. They find that higher bank capital is associated with a higher volume of earning assets, including bank loans. However, they additionally find some evidence that bank capitalization would impact negatively on the growth of bank lending at capital-to-asset ratios above 15%. Similarly, Karmakar and Mok (2015) evaluate the relationship between capital ratios and business lending of commercial banks in the United States in 1996–2010. They find a moderate positive relationship between capital ratios and business lending. As in other papers (Carlson et al., 2013), they show that this relationship is stronger in low-capital-ratio banks. The same inference is made by Fang et al. (2020) for developing countries and by Catalán et al. (2020) for banks in Indonesia. Košak et al. (2015) show a significant effect of Tier 1 capital ratio on lending in 91 countries in 2000–2010.

There is only one paper focusing on the role of accounting standards for the assessment of impairment in lending activity and the links between bank lending and the capital ratio. The study by Alexandre and Clavier (2017) investigates the effects of IAS 39 on both lending and the links between lending and the capital ratio in a sample of 243 banks in 11 European countries in 2002–2008. This paper tests the hypothesis that the adoption of the IAS/IFRS results in an increase in the amount of credit offered by banks with liquidity constraints. Their results are only partly consistent with this hypothesis and depend on the measure of the constraint (liquidity measure versus capital ratio), the bank size, and the enforcement regime. They also show that the adoption (both voluntary and mandatory) of the IAS/IFRS leads to an increase in credit supply only for small and constrained banks. This research shows that in the sample of banks covered by the study, the capital ratio did not exert a significant effect on loans growth. Neither did the IFRS 39 change the link between loans growth and the capital ratio as this link was negative in the period of analysis. Such a result is, however, not surprising, considering the period of analysis associated with buoyant prosperity in the market. In good times, a bank finds it easy to get access to external sources of funding and the quality of credit portfolio improves.

To summarize, the literature shows that the capital ratio is a constraint on bank lending if the association between loans growth and the capital ratio is positive (Beatty & Liao, 2011; Olszak et al., 2019). If the link is negative, the bank is not capital-constrained. However, the research

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highlights the diversity of the links between lending and the capital ratio. This diversity may be explained, intern alia, with regulations, business cycle and bank size. In this paper, we focus on a specific example of regulatory determinants, which is the IFRS 9 accounting standard. In particular, we ask how the IFRS 9 implementation in Poland affected the link between loans growth rate and the capital ratio.

In line with the expectations of experts, i.e., the regulators and supervisors of banks (European Systemic Risk Board, 2017, 2019a, 2019b; Basel Committee on Banking Supervision, 2017), IFRS 9 creates a constraint on bank lending through the reduction of the available capital funds needed to increase lending. More specifically, the expected credit loss model (ECL) is associated with such a reduction in 2018. Therefore, we hypothesize that:

IFRS 9 implementation in 2018 is associated with an increased effect of the capital ratio on lending (hypothesis H1).

However, this effect of IFRS 9 in 2018 may be conditioned by the steps taken by bank management to prepare for the adoption of the standard. In particular, banks which took more steps to better absorb the increased loan losses as defined in the standard could have been less affected by the IFRS 9 implementation. However, this effect may also be reversed if the banks which were preparing for that for longer suffered from capital shortages (in particular, due to internal capital shortages that were difficult to identify). We therefore expect that banks which were preparing longer for the implementation of IRFS 9 suffered from insufficient capital buffers.

3. METHODOLOGY AND DATA

3.1. Model

The first econometric models that define the relationship between the loan growth rate and the capital ratio were developed in the 1990s – mainly for the analysis of the US banking sector (Olszak, 2015, p. 337). Studies from recent years are inspired by these models (Berrospide & Edge, 2010; Beatty & Liao, 2011; Carlson et al., 2013; Kim & Sohn, 2017; Olszak et al., 2018) and these studies were considered when the authors created the necessary model to achieve the purpose of this article. However, unlike previous studies, the econometric model used here additionally includes interactions between qualitative variables (determining the application of the IFRS9 regulation) and the capital ratio:

$$\begin{aligned}\Delta Loan_{i,t} = {} & \alpha_o + \alpha_1 * CAR_{i,t-1} + \alpha_2 * NIM_{i,t-1} + \alpha_3 * DEP_{i,t-1} + \alpha_4 * MFUND_{i,t-1} + \\ & + \alpha_5 * size_{i,t-1} + \alpha_6 * IAS9 + \alpha_7 * CAR_{i,t-1} * IFRS9 + \alpha_8 * MR_{i,t-1} + \alpha_9 * GDPG_{i,t-1} + \\ & \alpha_{10} * UNEMPL_{i,t} + \varepsilon_t + \vartheta_{i,t}\end{aligned} \quad (1)$$

where:

$\Delta Loan_{i,t} = \ln(Loan_{i,t}) - \ln(Loan_{i,t-1})$ – a variable that determines the rate of credit growth;

$CAR_{(t-1)}$ – capital adequacy ratio;

$NIM_{(t-1)}$ – net interest margin ratio expressed as the quotient of the interest margin and loans, which determines the effectiveness of the bank's lending activities;

$DEP_{(t-1)}$ – the share of non-financial sector deposits in the bank's balance sheet, which measures access to stable sources of financing for the bank's lending activities;

$MFUND_{(t-1)}$ – the ratio calculated as the share of the bank's liabilities to entities other than depositors from the non-financial sector in the balance sheet total, which determines access to wholesale and fewer sources of financing the bank's lending activity;

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$Size_{(t-1)}$ – calculated as the natural logarithm of assets. Size(t-1) measures the scale of the bank's operations;

IFRS9 – dummy variable determining whether IFRS 9 was introduced in a given period in the bank;

$CAR_{(t-1)}$ * IFRS9 – the interaction between the capital ratio and IFRS9, which measures the impact of the capital ratio on banks' lending activity after the implementation of the IFRS9 standard at a bank. The regression coefficient for this variable determines whether the implementation of IFRS9 will change the economic relationship between credit activity and the capital ratio;

$MR_{(t-1)}$ – market interest rate – WIBOR6M. This rate determines the impact of market interest rates on lending activity;

$GDPG_{(t-1)}$ – real GDP growth rate, which measures the impact of the business cycle on credit activity;

$UNEMPL_{(t-1)}$ – unemployment rate, which identifies the impact of the demand side of the economy on the bank lending activity.

In order to avoid the problem of incorrect selection of the estimation technique, the study used various methods appropriate to the panel data, i.e., the least squares method, the random effects method and the weighted least squares method. In all estimated models, a single delay of the explanatory variables was used in order to reduce the endogeneity problem.

3.2. Data Description

The study used data of individual listed banks from the semi-annual financial statements (i.e. the balance sheet and profit and loss account) available on the websites of these banks. The analysis covers 12 listed banks[2] from the period 2013–2018. Most of the banks are identified as systemically important institutions, with assets accounting for 77.2% of the assets of the commercial banking sector.

In order to determine the impact of the application of IFRS 9, it is necessary to construct an index that measures the application of IFRS 9 in individual banks. The index used in a study was an index which has had been zero since the implementation of the standard in January 2018, in line with regulatory requirements and accepted international standards aimed at ensuring financial stability in macroprudential terms. We define this variable as IFRS9_1. Considering the fact that all banks applying the International Financial Reporting Standards in their reporting were obliged to implement IFRS9 from January 1, 2018, this variable assumes the value of one in each of the banks in the first and second half of 2018.

The second qualitative aspect of this study was the identification of the banks that informed in their financial statements about preparations for the implementation of this standard. Such preparatory work could have weakened the impact of the capital ratio on the loan growth rate during its implementation in 2018, which could have been the result of banks accumulating additional capital buffers. Two variants of this potential "intensity" of the preparatory work will be considered in the study. First, does the bank inform in its annual and semi-annual financial statements about the preparatory work in at least 2014? Second, does the bank inform about these works at least in 2015? The variable measuring the process of such preparations is the zero-one variable, assuming the value of one for the period in which preparations for implementation of the standard were mentioned in the report for the given reporting period. Thus, in the further part of the study, two such variables will be used, PP1 (variable equal to 1 when the bank mentions preparations for the use of IFRS 9 at least in 2014 (i.e., in 2014 or 2013) and 0 otherwise and PP2

[2] Alior Bank S.A., Bank Handlowy w Warszawie S.A., BNP Paribas Bank Polska S.A., Bank Ochrony Środowiska S.A., Getin Noble Bank S.A., Idea Bank S.A., ING Bank Śląski S.A., mBank S.A., Bank Millennium S.A., Pekao Bank Polski S.A., PKO BP S.A., Santander Bank Polska S.A.

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(variable equal to 1 when the bank mentions preparations for the application of IFRS 9 at least in 2015 (i.e. in 2015 or 2014 or 2013 and 0 otherwise). In the case of PP1, five banks were identified in the sample, and in the case of variable PP2, ten banks. It should be noted that almost all banks mentioned this in 2016 and 2017, and therefore introducing such a criterion as "intensity" of preparations would not identify banks that significantly stand out in this respect.

Table 1 presents descriptive statistics of the variables used in the study. The average loan growth rate is 4.04% with a standard deviation of 8.71%. The minimum value is (–23.39%) – this is the value for Getin Noble Bank. The average value of the loan growth rate in the analysed period for Getin Noble Bank itself is (–3.2%). The average value of the capital ratio is 15.46% with a standard deviation of 2.72%, which indicates the stability of this ratio. The minimum value of the capital adequacy ratio was 2.7% for Idea Bank. Both Getin Noble Bank and Idea Bank experienced financial problems in the analysed period, which is reflected in the indicators.

Table 1
Descriptive statistics of the variables used in the study

	$\Delta Loan_{i,t}$	CAR	DEP	MFUND	size	NIM	MR	UNEMPL	GDPG
Average	4.045	15.460	67.250	22.080	25.010	2.790	1.982	8.982	3.918
Median	2.963	15.160	69.190	20.270	24.980	2.670	1.810	8.700	3.700
Std Dev	8.719	2.727	9.554	8.560	0.810	0.772	0.348	2.478	0.859
Min.	–23.390	2.700	33.550	8.939	22.720	1.342	1.770	5.800	2.200
Max.	47.890	23.370	80.830	53.520	26.500	4.755	2.710	13.400	5.400
No of observations	132	122	131	131	131	131	132	132	132

Source: own study based on data from banks' financial statements and Eurostat; $CAR_{(t-1)}$ – capital adequacy ratio; $NIM_{(t-1)}$ – net interest margin ratio; $DEP_{(t-1)}$ – share of non-financial sector deposits in the bank's balance sheet; $MFUND_{(t-1)}$ – ratio calculated as the share of the bank's liabilities to entities other than depositors from the non-financial sector in the balance sheet total; $size_{(t-1)}$ – calculated as the natural logarithm of assets; $MR_{(t-1)}$ – market interest rate – WIBOR6M; $GDPG_{(t-1)}$ – real GDP growth rate; $UNEMPL_{(t-1)}$ – unemployment rate.

Table 2
Correlation matrix

	$\Delta Loan_{i,t}$	CAR	DEP	MFUND	size	NIM	WIBOR6M	UNEMPL	GDPG
	1								
CAR	0.14	1							
DEP	0.01	–0.29*	1						
MFUND	–0.05	0.19*	–0.97*	1					
size	0.20*	0.34*	0.14	–0.25*	1				
NIM	0.22*	–0.08	0.29*	–0.42*	0.14	1			
WIBOR6M	0.01	–0.24*	–0.08	0.07	–0.09	0.04	1		
UNEMPL	0.15	–0.31*	–0.09	0.09	–0.12	–0.04	0.77*	1	
GDPG	–0.12	0.27*	0.08	–0.08	0.1	0.05	–0.69*	–0.87*	1

Source: own study based on data from banks' financial statements and Eurostat; $CAR_{(t-1)}$ – capital adequacy ratio; $NIM_{(t-1)}$ – net interest margin ratio; $DEP_{(t-1)}$ – share of non-financial sector deposits in the bank's balance sheet; $MFUND_{(t-1)}$ – ratio calculated as the share of the bank's liabilities to entities other than depositors from the non-financial sector in the balance sheet total; $size_{(t-1)}$ – calculated as the natural logarithm of assets; $MR_{(t-1)}$ – market interest rate – WIBOR6M; $GDPG_{(t-1)}$ – real GDP growth rate; $UNEMPL_{(t-1)}$ – unemployment rate; * – statistical significance.

Table 2 presents the correlations of the analysed variables. The loan growth rate is most strongly correlated with the NIM variable, size and the capital ratio. It is worth noting that the correlation between the loan growth rate and the capital ratio is positive, which initially

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indicates that only banks with a higher level of this ratio grant more loans. This is in line with the expectation that better capitalized banks provide more funding to the non-financial sector.

There is also a negative correlation with the ratio of the bank's liabilities to entities other than depositors from the non-financial sector in the balance sheet total. The loan growth rate is also correlated with market variables – a positive correlation with the unemployment rate and a negative correlation with the real GDP growth rate. There is no correlation between the loan growth rate and the share of deposits from the non-financial sector in the bank's balance sheet total.

4. RESEARCH RESULTS

In Table 3, we include baseline research results, without interaction terms. We present three models, one without macroeconomic determinants and the other two applying such determinants. As can be seen from the regressions, the link between the capital ratio and loans growth was positive, but not significant statistically. However, in economic terms, a positive association suggests that banks aiming at increased lending need to have higher levels of the capital ratio. Such a result is in line with other research (Beatty & Liao, 2011; Carlson et al., 2013; Kim & Sohn, 2017; Olszak et al., 2019).

Liquidity of banks, proxied with DEP (funds obtained from non-financial borrowers) and MFUND (funds accessed on the interbank market), is negatively associated with loans growth and mostly insignificantly in statistical terms. Such a result implies that banks with better access to stable funding delivered by non-financial depositors were not increasing their lending. This result suggests that potentially banks were not forced to deal with liquidity shortages in the period of analysis.

As can be seen from the table, bank size did not exert a significant effect on the loans growth rate. A negative regression coefficient for SIZE, however, implies that large banks tend to extend less credit, in line with previous research (Kim & Sohn, 2017; Olszak et al., 2019).

Profitability of the lending activity proxied with the net interest margin ratio (NIM) was positively linked with the loans growth rate, implying that increased efficiency of lending is associated with more credit extension. The interbank market rate is insignificantly –and in an ambiguous way – associated with the loans growth rate in the period of analysis. In that period, banks operated in an environment of very low interest rates. This implies that generally, they were extending loans not due to the level of rates in the interbank market, but rather because of non-interest related incentives covering, e.g., relationship banking or other qualitative aspects of bank lending (Claessens et al., 2018).

The unemployment rate exerted a positive and statistically significant effect on loans growth. Such a result is in contrast with theoretical expectations, suggesting that increased unemployment results in a weakened loans growth rate. There are several explanations for such effects, including, inter alia, a worsened financial condition of borrowers and increased credit risk, weakened incentives for banks to extend loans due to increased levels of non-performing loans, etc. However, in our period of research, average unemployment was relatively low (around 8%), meaning that conditions in the real economy were not necessarily playing a decisive role in the loan extension by banks. This result corroborates the effect of lagged GDPG which is positive, but statistically insignificant. A positive association between GDPG and loans growth is, however, in line with, e.g., Beatty et al. (2015) and Gómez et al., (2020).

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Table 3
Baseline result – determinants of loans growth rate

	GLS	GLS	Weighted OLS
	2	5	6
$CAR_{(t-1)}$	0.001	0.002	0.003***
	(0.002)	(0.002)	(0.002)
$DEP_{(t-1)}$	−0.743	−0.831	−0.106
	(0.512)	(0.538)	(0.349)
$MFUND_{(t-1)}$	−0.944	−1.078*	−0.169
	(0.596)	(0.622)	(0.387)
$size_{(t-1)}$	−0.020	−0.020	−0.007
	(0.014)	(0.015)	(0.007)
$NIM_{(t-1)}$	0.016	0.012	0.0265***
	(0.016)	(0.017)	(0.010)
$WIBOR6M_{(t-1)}$		−4.180	0.017
		(0.034)	(0.023)
UNEMPL		1.274*	0.830*
		(0.736)	(0.470)
$GDPG_{(t-1)}$		2.456	1.083
		(1.704)	(1.084)
R^2			0.188
Sum of squared residuals	0.744	0.719	112.893
adjusted R^2			0.128
Test F p-value			0.003
No of observations	118	118	118
Variance between	0.001	0.001	
Variance within	0.006	0.006	
mean theta	0.283	0.343	
corr(y,yhat)^2	0.117	0.146	

Source: The authors' analysis with the use of data from individual banks' financial statements (bank-specific data) and EUORSTAT (macroeconomic variables).

Table 4 presents the effect of implementation of IFRS 9 on loans growth only (models 1 and 3) and the effect of IFRS 9 on the link between loans growth and the capital ratio (models 2 and 4). The regression coefficients for IFRS 9 in models 1 and 3 are not statically significant, meaning that IFRS 9 did not exert an economic and statistical effect on the loans growth rate of publicly traded banks in Poland. However, the positive and statistically significant coefficient for the interaction term between the capital ratio and IFRS9 suggests that only banks with a higher capital ratio in the group were able to extend more loans in the implementation period. Such a results is in line with the hypothesis of capital crunch (Beatty & Liao, 2011; Carlson et al., 2013).

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Table 4
The effect of implementation of IFRS 9 on the link between lending and capital ratio

	GLS	GLS	GLS	GLS
	1	2	3	4
$CAR_{(t-1)}$	0.001	0.001	0.003	0.002
	(0.002)	(0.002)	(0.002)	(0.002)
$DEP_{(t-1)}$	−0.795	−0.992*	−0.835	−1.021*
	(0.541)	(0.567)	(0.540)	(0.565)
$MFUND_{(t-1)}$	−1.002	−1.232*	−1.085*	−1.309**
	(0.624)	(0.650)	(0.625)	(0.648)
$size_{(t-1)}$	−0.021	−0.025	−0.020	−0.023
	(0.015)	(0.017)	(0.014)	(0.017)
$NIM_{(t-1)}$	0.015	0.011	0.012	0.008
	(0.017)	(0.018)	(0.016)	(0.017)
$WIBOR6M_{(t-1)}$			−0.005	−0.021
			(0.041)	(0.041)
UNEMPL			1.349*	1.392*
			(0.799)	(0.781)
$GDPG_{(t-1)}$			2.235	1.18
			(1.927)	(1.948)
IFRS9	−0.005	−0.035	0.008	−0.010
	(0.019)	(0.024)	(0.031)	(0.031)
$IFRS9xCAR_{(t-1)}$		**0.004****		**0.004****
		(0.002)		(0.002)
R^2				
Sum of squared residuals	0.744	0.724	0.719	0.698
adjusted R^2				
Test F p-value				
No of observations	118	118	118	118
Variance between	0.001	0.001	0.001	0.001
Variance within	0.006	0.006	0.006	0.006
mean theta	0.341	0.417	0.340	0.416
corr(y,yhat)^2	0.116	0.141	0.146	0.171

Source: The authors' analysis with the use of data from individual banks' financial statements (bank-specific data) and EUORSTAT (macroeconomic variables).

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4.2. The Role of "Intensity Of Steps" Taken to Prepare for the Implementation of IFRS

The results for the role of the intensity of steps to get prepared for the implementation of IFRS 9 are presented in Table 5. We differentiate between banks that started this process no later than in 2014 and denote them as PP1 banks (columns 1–5) and banks that started this process no later than in 2015 and mark them as PP2 banks (columns 9–10).

As can be seen from this table, banks that took more steps (in terms of earlier information about the expected implementation of IFRS 9 in financial reporting) did not exhibit a statistically significant change in the loans growth rate. However, there is a significant difference between PP1 and PP2 banks in terms of the average loans growth rate. PP1 banks exhibited on average reduced loans growth as all coefficients for PP1 are negative (see columns 2–5). In contrast, PP2 banks tended to extend more loans as the coefficients for PP2 are positive (see columns 7–10).

Looking now at the loans growth rate in the year of implementation of IFRS 9, i.e. 2018, we find that PP2 banks extended more loans than other banks because the regression coefficient for PP2xIFRS9 is positive and statistically significant (see model 9 in Table 5) and equals 0.00688. The banks which started to inform about the implementation later exhibited reduced average loans growth in the year of implementation of IFRS 9 as the statistically negative coefficient for IFRS9 dummy equals -0.0064. The PP1 banks exhibit a similar pattern of the loans growth rate, but the results are not statistically significant.

The results on the link between the loans growth rate and the capital ratio in the period of implementation of IFRS 9 show that lending of PP1 banks is more capital-constrained than lending of other banks as the regression coefficient for a triple interaction of PP1*IFRS9*$CAR_{(t-1)}$ is positive and statistically significant, equalling 0.0087. We also note a similar pattern of effects for PP2 banks. However, in this group, the estimated coefficients are not statistically significant.

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Table 5
The effect of IFRS 9 on the link between lending and capital ratio – the role of the intensity of steps taken to implement IFRS 9

	1	2	3	4	5	6	7	8	9	10
$CAR_{(t-1)}$	0.0012	0.0008	0.0007	0.0007	0.0010	0.0012	0.0008	0.0010	0.0009	0.0016
	(0.0016)	(0.0016)	(0.0016)	(0.0016)	(0.0016)	(0.0016)	(0.0016)	(0.0016)	(0.0015)	(0.0015)
IFRS9	−0.005	−0.035	−0.035	−0.0701	−0.006	−0.005	−0.035	−0.036	−0.064**	−0.048
	(0.0187)	(0.0235)	(0.0235)	(0.0467)	(0.0583)	(0.0187)	(0.0235)	(0.0237)	(0.0276)	(0.0316)
IFRS9xCAR$_{(t-1)}$		**0.0039****	**0.0040****	**0.0040****	**−0.003**		**0.0039****	**0.0039****	**0.0039****	**0.0015**
		(0.0018)	(0.0018)	(0.0018)	(0.0043)		(0.0018)	(0.0018)	(0.0018)	(0.0025)
PP1			−0.011	−0.021	−0.021					
			(0.0421)	(0.0438)	(0.0321)					
PP1x **IFRS9**				0.0414	−0.038					
				(0.0476)	(0.0635)					
PP1x IFRS9xCAR$_{(t-1)}$					**0.0087***					
					(0.0047)					
PP2								0.0187	0.0043	0.0089
								(0.0235)	(0.0248)	(0.0174)
PP2x **IFRS9**									**0.0688***	**0.0229**
									(0.0354)	(0.0481)
PP2x **IFRS9xCAR$_{(t-1)}$**										**0.0053**
										(0.0038)
Sum squared residuals	0.7441	0.7235	0.7272	0.7255	0.6913	0.7441	0.7235	0.7087	0.6905	0.6685
No of observations	118	118	118	118	118	118	118	118	118	118
Variance between	0.0008	0.0011	0.0016	0.0016	0.0004	0.0008	0.0011	0.0008	0.0008	0
Variance within	0.0061	0.0058	0.0058	0.0058	0.0057	0.0061	0.0058	0.0058	0.0056	0.0055
mean theta	0.34061	0.4171	0.4843	0.4853	0.2544	0.3406	0.4171	0.3579	0.3717	0
corr(y,yhat)^2	0.1161	0.141	0.1372	0.1401	0.1787	0.1161	0.141	0.1583	0.1802	0.2058

Source: The authors' analysis with the use of data from individual banks' financial statements (bank-specific data) and EUORSTAT (macroeconomic variables). This is a shortened presentation of the results obtained with equation Eq. (1) with the use of bank-specific variables only. The estimations are conducted with the random effects technique. IFRS9 is a dummy equal to 1 in the period of implementation of IFRS 9. PP1 – a dummy variable taking the value of 1 for banks that started informing about IFRS 9 in their financial reports at least in 2014 (i.e. in 2013 and 2014) and 0 otherwise. PP2 – a dummy variable taking the value of 1 for banks that started informing about IFRS 9 in their financial reports at least in 2015 (i.e. in 2013, 2014 and 2015) and 0 otherwise.

5. CONCLUSIONS

This paper focuses on the role of the IFRS 9 standard on the loans growth rate and the link between lending and the capital ratio in publicly traded banks in Poland. We use hand-collected individual bank level data from financial statements covering the period of 2012–2018. The analysis with the random effects estimator shows that, on average, in 2018 loans growth was reduced. However, the reduction was not statistically significant.

The implementation of IFRS 9 enhanced the link between loans growth and the capital ratio, thus suggesting that these accounting standards were related with a capital crunch. Our results show that in the year of implementation of IFRS 9, the link between lending and the capital ratio was positive. In effect, only those banks which exhibited higher levels of the capital ratio were able to extend more new loans.

We also find that banks which took more steps to inform in their reporting about the expected introduction on of IFRS 9 extended more loans than other banks.

The results on the link between the loans growth rate and the capital ratio in the period of implementation of IFRS 9 also show that lending of banks which started to include information about the new accounting standard in their financial reporting exhibited a stronger effect of the capital ratio on lending.

The research contributes to the literature because it is the first paper to test the role of IFRS 9 on loans growth and on the link between loans growth and the capital ratio. As this paper shows, the implementation of IFRS 9 did exert a significant effect on the role of the capital ratio for lending in the first year of implementation. This research thus reveals that only better capitalized banks may extend new loans when new regulation on the non-performing loans assessment is introduced.

Our study has several shortcomings. First, it refers only to publicly traded banks, and does not consider other commercial banks or cooperative banks. Second, it is a one-country study. Third, it does not consider other aspects of bank activity, like profitability or risk-taking. Future research should be extended to cover other types of banks, to use a cross-country sample, and to cover other areas of bank activity.

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What determines the quality of remuneration policy in financial holding companies? An analysis based on the example of the UniCredit Group

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ABSTRACT

This study seeks to examine the quality of the remuneration policy (RP) and identify its main determinants within a financial holding company (FHC) – the UniCredit Group. The results show that the quality of remuneration policy in the examined FHC was low. Although the dominant bank is characterized by high remuneration policy standards, the rest of the group is not. The empirical approaches used show that remuneration policy quality was positively related to the size of the bank and the transparency index of the remuneration policy, but negatively affected by the selected corporate governance determinants.

JEL Classification: G2, G34, G38

Keywords: banking and insurance, corporate governance, financial holding company, remuneration policy, quality index of the remuneration policy

INTRODUCTION

Institutions that operate in the financial sector have specific characteristics that distinguish them from corporations that operate in other sectors of the economy. The Cadbury report (1992) drew attention to the need to regulate issues related to corporate governance, such as the work of the board of directors, their independence and remuneration, and the creation of committees. These issues, as well as the corporate scandals of the early 21st century, gave rise to international regulations covering corporate governance that apply to all sectors of the economy, including the financial sector (for example: EU, 2011; OECD, 2015; EBA, 2013). However, it was only

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the outbreak of the financial crisis in 2007 that revealed the problem of the need for stricter regulation of the financial sector, in particular, with regard to remuneration policies (RPs) (for example: FSB, 2018; EU, 2010; EBA, 2015). It was pointed out that an optimally designed managerial compensation scheme should reflect a bank's strategy and give incentives to achieve the institution's goals concerning stakeholder or shareholder value creation (Marcinkowska, 2014, p. 68). This was confirmed by the implementation of individual international recommendations into national legal regulations and best practice codes.

This strict regulation also applies to financial holding companies (FHCs). The lack of regulation relating only to FHCs (mainly in Asian countries) is due to the fact that they are covered by the same regulations as banking holding companies (BHCs)[2]. For example, Swamy (2012, p. 11) outlined the role and the structure of the lead regulator for a financial conglomerate in selected countries.

Although there are many definitions of a holding company in the literature, for this article, a holding company can be defined as a structure that consists of at least two legally independent economic entities, one of which is in a position to influence the decisions made by the other as a result of an agreement between them concerning the entity (the dominant one) acquiring the capital share of the other (the subsidiary) (Gajewski, 2013, p. 76). The advantage of creating an FHC is that it offers a geographically flexible financial product that is beyond the reach of an individual bank (Mayo, 1980). Moreover, it can assume the debt of shareholders on a tax-free basis, borrow money, acquire other banks and non-bank entities more easily, and issue stock with greater regulatory ease (Swamy, 2012, p. 7).

The literature on the subject lacks studies that deal with the relationships within FHCs. There is also a lack of research on the quality of RPs in FHCs. The shortcomings can be perceived as an important empirical gap because the quality of the whole group depends on the quality of all units, not only on the quality of the "leader". It is applied to all aspects of the FHC policy, including corporate governance, remuneration policy, quality of the management, among others. The identification of the cause-effect relationship between all units of the whole group is perceived as a valuable input into the empirical literature, especially in the context of the quality of the aspect of corporate governance which is remuneration policy. Considering these motivations outlined by the identified gaps and existing inconsistencies, this paper aims to fill these research gaps by analyzing the quality of RPs in a particular FHC as well as by indicating the factors that influence their level. The basis for that research is the UniCredit Group, which operates in the financial sector, mainly in the banking sector. Due to the limited access to data for banks making up the UniCredit Group, the time sample covers the period between the years 2005 and 2018. In 2018, it comprised 505 financial institutions. However, due to a lack of access to all necessary information[3], 27 banks that belong to the UniCredit Group from 17 countries, including the parent bank and 26 subsidiary banks (20 banks and seven other financial institutions), were finally qualified for the survey. The size of the group and its international reach mean that the FHC is an excellent example and case study for the research. However, due to data availability, the study covered the period from 2005 to 2018. The time sample allowed us to observe changes in the quality of corporate governance standards regarding remuneration policy and investigate what factors influence the quality of these standards. The research methodology is based on computing a quality index of the remuneration policy (QRI) and applying it in a panel data analysis.

The paper's value and novelty lie in the empirical results. Firstly, QRI is created and explained using an important FHC. To our knowledge, this is the first attempt to translate international guidelines on the quality of remuneration policy into a quantitative measure. This will make it

[2] The FHC is a broader concept than the BHC because it is not only banks that may belong to it. Therefore, everything that refers to the BHC also applies to the FHC.

[3] Most of the group's financial institutions do not have a website. For institutions that do have a website, it is not possible to open it in English. However, in some cases, where it is possible, the financial institutions do not make their annual reports available.

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possible to compare the quality of the remuneration policy not only in banks under FHC, but also in all companies on the market. Secondly, the index is used to proxy the quality of all important aspects of the remuneration policy conducted within an international holding. Thirdly, due to the ambiguous results of existing studies, mainly obtained for individual banks or groups of banks, the paper investigates the relationships between RP quality and its determinants and identifies the most important ones for the analyzed holding. Fourthly, the study offers a set of conclusions based on an existing unit, thereby creating input to the discussion aimed at corporate governance and the quality of remuneration policy. Fifthly, the results of the study are valuable as it gathers and compares the regulations of standards of remuneration policy and recommendations included in national codes of good practice. As stated, the scope of the research is important for further discussions on remuneration policy.

The paper consists of five sections. The first section presents a literature review. Section 2 indicates regulations on the quality of remuneration policy that result from international recommendations and confronts them with national regulations, both laws and codes of best practice. Section 3 emphasizes the research methodology, while section 4 contains the empirical results of the research. The final section presents the discussion and conclusions.

LITERATURE REVIEW

The subject matter of holding companies is widely described in the literature. However, few works are devoted strictly to FHCs (Swamy, 2012; Olszewska, 2015; Stiroh & Rumble, 2006; Cuong, 2021). They treat the FHC as a whole, without paying attention to what is happening within the company. More often, there are studies in which a BHC has been surveyed, focusing on the BHC in terms of the role of capital in BHC decision-making (Barajas et al., 2015) or risk management (Ellul & Yerramilli, 2013; Jiangli & Pritsker, 2008). Equally frequent are comparisons between BHC banks and individual banks (Ashcraft, 2008; Raykov & Silva-Buston, 2020), as well as the BHC itself, given its complexity, geographical coverage, or what its subsidiaries do (Avraham, Selvaggi, & Vickery, 2012; Goetz, Laeven, & Levine 2012; Flood et al., 2020). By contrast, bank channels which have been used to transfer assets and income from the parent bank to its subsidiaries and vice versa are much less frequently studied (Allen, Gu, & Kowalewski, 2013).

Few papers analyze corporate governance standards in BHCs, in particular, their RP, even though irregularities in remuneration policy were identified as one of the causes of the 2007 crisis. Adams and Mehran (2003) compared BHCs and industrial companies in terms of board size, the number of external directors, the board composition, the number of committees, the frequency of board meetings, and the remuneration structure. Fortin, Goldberg and Roth (2010) examined the relationship between the CEO remuneration structure and the risk level of a BHC. They showed that CEOs who earned higher base salaries took less risk. However, BHCs that pay CEOs more in stock options or bonuses exhibit greater risk-taking (Fortin, Goldberg, & Roth, 2010, p. 894). Minnick, Unal, and Yang (2011, p. 440) showed that the more closely a bank CEO's wealth is tied to the bank's stock, the more consistent acquisition decisions are with shareholder value maximization. Specifically, when CEOs are paid for performance, they are less likely to make acquisitions that do not create shareholder value and more likely to seek out value-enhancing investments.

Most of the work is done on banks. For years, the subject matter has been very broad, from capital adequacy issues (Davis, 2012; Klepczarek, 2015) to corporate governance itself (Adams & Mehran, 2003; Becht, Bolton, & Roell, 2011; Gropp & Heider, 2010; de Andrés, Rejg, & Vallelado, 2019; Diaz, García-Ramosand, & Olalla, 2020; Cerasi et al., 2020). The outbreak of the financial crisis caused great interest in RPs in the banking sector. There are two main

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research areas in this field. The first includes studies that attempted to identify the main factors that determine the level of remuneration, e.g., bank size and economic performance. In most studies, the size of the bank (measured by the size of assets) influences the increase in the level of remuneration (Doucouliagos, Haman, & Askary, 2007; Luo & Jackson, 2012; Słomka-Gołębiowska & Urbanek, 2013). However, other works confirm the negative relationship between the size of the bank and the level of remuneration (Aduda, 2011). There are also studies that look for relationships between bank size and the remuneration structure (Demsetz & Saidenberg, 1999) or the level of remuneration transparency (Słomka-Gołębiowska & Urbanek, 2015a). Large banks usually have many years of experience and an established position on the market. In order to retain existing shareholders and attract new investors, these institutions should be characterized by high standards, also in terms of remuneration policy. Since the studies conducted so far confirm the impact of bank size on executive remuneration, it is worth examining whether it impacts remuneration policy quality.

Linking managerial remuneration to financial performance is a way for a bank to communicate with its shareholders and the capital market. The strength of this relationship indicates the importance to the bank of creating shareholder value. The literature contains several papers that examine the relationship between a bank's financial results and the level of remuneration (Słomka-Gołębiowska & Urbanek, 2013; Le, Shan, & Taylor, 2020). They confirm that the rate of return on shares significantly impacts managers' remuneration (Livne, Markarian, & Milne, 2011; Demsetz & Saidenberg, 1999; Luo & Jackson, 2012). Remuneration was also found to depend on fair value accounting (Livne, Markarian, & Milne, 2011), earnings per share (Barro & Barro, 1990), net profit (Laietu & Mellado, 2009), ROE (Doucouliagos, Haman, & Askary, 2007), and ROA (Doucouliagos, Haman, & Askary, 2007; Luo & Jackson, 2012), although this correlation could not always be confirmed (Aduda, 2011).

Nevertheless, the relevance of the bank's financial results to the remuneration level is undeniable. Additionally, some studies confirm a positive correlation between corporate governance standards and financial performance (Vo & Nguyen, 2014; Aktan et al., 2018). Therefore, it can be assumed that financial performance also influences the remuneration policy itself and its quality. Banks with high financial performance, as an example of efficient financial institutions, may feel obliged to apply higher standards, also in terms of remuneration policy, to stand out even more from their competitors.

The literature also focuses on selected standards of corporate governance that determine the level of remuneration. Among these standards is the size of the bank's board[4]. The literature stresses that a large number of board members can make it difficult for the board to have an in-depth, effective discussion. This may result in a passive attitude of the entire board and the free-rider problem (Coles, Daniel, & Naveen, 2005). In such a situation, it is easier for the chief executive to control the behavior of board members. The result is that directors can push through the bank's non-compliance with internationally recommended remuneration policy standards. Large boards may also cause board meetings to be limited to almost 'ritualistic' approval (rejection) of previously prepared decisions (Słomka-Gołębiowska & Urbanek, 2015a, p. 140).

On the other hand, a large bank board may benefit from a greater ability to distribute its tasks among specialized committees, which may translate into effective supervision (Klein 2002; Anderson, Mansi, & Reeb, 2004). However, the benefits of greater experience and knowledge of the members of a larger board (Coles, Daniel, & Naveen, 2005) may outweigh the limitations of slowing down decision-making, greater risk aversion, and communication problems (Hermalin & Weisbach, 2003). Moreover, the effectiveness of the board's activities can be measured by, inter alia, the frequency of meetings. In this context, the more frequent the meetings, the greater the range of issues discussed, and the more effective the monitoring of directors' remuneration.

[4] The bank's board is understood as the supervisory board or the board of directors.

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Another standard of corporate governance is the presence of independent directors on the bank board. It seems that a lack of connections with the bank and its executives and shareholders makes such people willing to objectively assess the effects of the executives' work and effectively oppose the opportunistic behavior of the directors, which may lead to, among other things, setting excessive remuneration. However, existing studies have not clearly confirmed the impact that appointing independent directors to the board has on managers' remuneration (Angbazo & Narayanan, 1997; Słomka-Gołębiowska & Urbanek, 2013).

The second thread in the literature is devoted to the transparency of RPs, mainly determining the factors that influence the scope of disclosures in this area of corporate governance. Such factors include financial results. Banks disclose more detailed information on directors' remuneration when they perform better, meaning that directors may be more inclined to disclose their remuneration when they act more effectively (Burghof & Hofmann, 2000). Sheu et al. (2010) suggested that transparency (the comprehensive disclosure of information on compensation) signals that companies have fewer agency problems and a better governance structure; poor disclosure can be perceived as camouflage for excess compensation and bargaining behavior (Marcinkowska, 2014, p. 67). The literature also emphasizes the importance of transparency regulation (Chu, Lawrence, & Stapledon, 2006), or the relationships between RP transparency and corporate governance standards, such as the size of the board, the number of meetings of the Remuneration Committee (RC), or the participation of independent directors (Słomka-Gołębiowska & Urbanek, 2015a). Research shows that banks are willing to disclose more information when they are certain that it will have a positive impact on their image and will be positively received by potential investors. Taking this into account, it can be assumed that banks that apply international standards recommended by international institutions concerning remuneration policy will disclose more information on remuneration policy.

As presented, the literature review lacks studies that deal with the relationships within FHCs. The studies presented above are not directly and completely associated with the research on the quality of remuneration policies in FHCs. The facts are perceived as an important empirical gap because the quality of the whole group depends on the quality of all units, not only on the quality of the "leader" unit. The stated lack of comparative analysis is an important motivation for the proposed research and allows for studying the relationship between the quality index of the remuneration policy and a set of its determinants including those associated with corporate governance, financial performance or transparency.

ANALYSIS OF INTERNATIONAL LEGAL REGULATIONS AND CODES OF BEST PRACTICE

The banking sector is subject to strict supervision, not only nationally but also internationally. For this reason, international institutions make their own recommendations on banking activities, including remuneration policy standards. A summary of international recommendations on RP standards is presented in Table 1A in Appendix A.

There is almost full convergence in the scope of the recommendations in the case of the European Banking Authority (EBA) and the European Union (EU), and partial convergence in the case of the Basel Committee on Banking Supervision (BCBS) and the Financial Stability Board (FSB). For the first pair, the EBA concludes that banks should apply Directive 2013/36/EU. For the second pair, the BCBS recommends applying the FSB Principles for Sound Compensation Practices in its recommendations. The provisions of the international recommendations indicate certain practices in terms of RP standards. They can be divided into two subgroups (Table 1A): (i) those concerning the quality of the Remuneration Committee, (ii) those concerning the quality of the variable components of RPs.

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For the first sub-group, all international recommendations included a recommendation on establishing an RC. Most international organizations (except the FSB and the BCBS) recommend that non-executive directors or supervisory board members should be members of the committees. Moreover, most of them should meet the independence criteria. The most detailed recommendations connected with the second sub-group were issued by the EU and EBA, followed by the BCBC and FSB. They focused on the process of constructing remuneration and on variable remuneration itself.

Each country has the right to decide which international recommendations it will transpose into national regulations, if any[5]. If a country decides to do so, it has two options. It can either introduce the relevant provisions into the legislation or transfer them into codes of best practice. Table 1 shows which international recommendations on selected corporate governance standards have been transposed into national legislation and those that have been incorporated into legislation despite the lack of recommendations from international institutions[6].

In the case of international recommendations on RP standards, only one provision was not included in any country's legislation (Table 1). The remaining provisions were included in the legal regulations of at least one country.

Table 1. Regulations regarding standards of the remuneration policy in national law based on international recommendations

	YES	NO
Concerning the quality of Remuneration Committee (RC)		
Establishment of the Remuneration Committee	AU, BA, BG, HR, CZ, HU, IR, IT, LU, PL, RO, RU, SK, SI, TR	RS, UA
Remuneration Committee is composed of at least three members	AU, BA, HR, RO, SI, TR[VI]	BG, CZ, HU, IR, IT, LU, PL, RU, RS, SK, UA
A majority of members should be independent	IT	AU, BA, BU, HR, CZ, HU, IR, LU, PL, RO, RU, RS, SK, SI, TR, UA
The chairman of the Remuneration Committee is an independent director	TR	AU, BA, BG, HR, CZ, HU, IR, IT, LU, PL, RO, RU, RS, SK, SI, UA
RC members should have experience in remuneration policies and practices, risk management, and control activities	AU, CZ, RU	BA, BG, HR, HU, IR, IT, LU, PL, RO, RS, SK, SI, TR, UA
Concerning the quality of the variable components of the remuneration policy		
The possibility of using malus	AU, BG, HR, CZ, HU, IR, IT, LU, PL, RO, RU, SK, SI	BA, RS, TR, UA
The possibility of using clawback	AU, BG, HR, CZ, HU, IR, IT, LU, PL, RO, RU, SK, SI	BA, RS, TR, UA
The variable component shall not exceed 100% of the fixed component of the total remuneration[I]	AU, BG, HR, CZ, HU, IR, IT, LU, PL, RO, RU[III], SK, SI	BA, RS, TR, UA
50% of variable compensation should be awarded in shares or share-linked instruments	AU, BG, HR, CZ, HU, IR, IT, LU, PL, RO, RU[IV], SK, SI	BA, RS, TR, UA

[5] The exception are countries belonging to the EU, which are obliged to implement directives and regulations issued by the European Parliament on the domestic market.

[6] The countries surveyed are the 17 countries in which UniCredit subsidiaries are present and for which information was available in English. The data in the table were collected based on regulations that were available in English.

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Table 1 – continued

	YES	NO
40 to 60% of variable compensation should be payable under deferral arrangements over a period of years	AU, BG, HR, CZ, HU, IR, IT, LU, PL, RO, RU, SK, SI	BA, RS, TR, UA
The deferral period should not be less than three to five years	AU[II], BG, HR, CZ, HU, IR, IT, LU, PL, RO, RU[V], SK, SI	BA, RS, TR, UA
During the assessment of the performance, financial criteria are taken into account	AU, BG, HR, CZ, HU, IR, IT, LU, PL, RO, SK, SI	BA, RU, RS, TR, UA
During the assessment of the performance, non-financial criteria are taken into account	AU, BG, HR, CZ, HU, IR, IT, LU, PL, RO, SK, SI	BA, RU, RS, TR, UA
The remuneration is based on a combination of the assessment of the performance of the individual and the business unit concerned	AU, BG, HR, CZ, HU, IR, IT, LU, PL, RO, SK, SI	BA, RU, RS, TR, UA
The variable remuneration components take into account all types of current and future risks	AU, BG, HR, CZ, HU, IR, IT, LU, PL, RO, SK, SI	BA, RU, RS, TR, UA
The assessment of the performance is set in a multi-year framework in order to ensure that the assessment process is based on longer-term performance	AU, BG, HR, CZ, HU, IR, IT, LU, PL, RO, SK, SI	BA, RU, RS, TR, UA
Additional recommendations regarding standards of the remuneration policy in national law		
Minimum number of meetings of Remuneration Committee	AU	BA, BG, HR, CZ, HU, IR, IT, LU, PL, RO, RU, RS, SK, SI, TR, UA

Abbreviations: AU – Austria, BG – Bulgaria, BA – Bosnia and Herzegovina, CZ – Czechia, HR – Croatia, HU – Hungary, IR– Ireland, IT – Italy, LU – Luxembourg, PL – Poland, RO – Romania, RU – Russia, SK – Slovakia, SI – Slovenia, RS – Serbia, TR – Türkiye, UA – Ukraine.

[I] This level can be increased to 200%, provided that some of the conditions are fulfilled; [II] Minimum of five years; [III] The variable part of the remuneration should be no less than 40% of the total remuneration; [IV] No information about which part of the variable remuneration should be awarded in shares or share-linked instruments; [V] Minimum of three years; [VI] Minimum of two members.

Source: own compilation based on national legal regulations.

As regards the provisions on Remuneration Committees, almost all countries (except Serbia and Ukraine) have introduced a provision on establishing Remuneration Committees in their legislation. In the case of countries belonging to the EU, there is an obvious reason for such a high level of implementation of this provision. Directive 2013/36/EU obliges the member states to implement the provisions concerning the necessity to establish a Remuneration Committee. For the other provisions concerning the quality of the Remuneration Committees, their implementation is very low. The reason for this again seems simple. Although the EU has introduced these recommendations, they are not binding. Therefore, these countries, as with countries that do not belong to the EU, were not obliged to implement them into national regulations and, consequently, they did not do so, which is visible in Table 1.

The provisions regarding the quality of the variable components of RPs have been implemented by most of the countries surveyed. Such a high level of transposition of these provisions into national markets may be because those countries belong to the EU (with the exception of Russia). The EU introduced a number of provisions on variable components of RPs in Directive 2013/36/EU. Members of the EU were, therefore, obliged to implement these provisions into legal regulations. Russia, although it does not belong to the EU, also decided to introduce some of these regulations into its legal regulations. Other countries (Bosnia and Herzegovina, Serbia, Türkiye, and Ukraine)

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have not introduced them into their legal regulations. One of the reasons for this may be that these countries focus their legal regulations on other issues, such as capital requirements. The provisions on remuneration policy standards have been introduced into national codes of good practice.

As mentioned above, countries may incorporate international recommendations into national codes of good practice. However, banks are not obliged to comply with these rules. Nevertheless, in order to attract investors, particularly from abroad, banks may have to comply with high standards of corporate governance, which will involve complying with good practice codes. Table 2 shows which countries' domestic good practice codes include standards of corporate governance based on international recommendations and which are not based on international recommendations[7].

Recommendations related to the quality of RCs appeared much more often than the quality of the variable components of RPs. This is likely because most recommendations relating to the quality of the variable components of RPs are included in national legislation. Therefore, there was no need for them to be included in codes of good practice.

In the codes of good practice of two countries (Czechia and Luxembourg), there was a recommendation for a minimum number of meetings of the RC, which was not mentioned by the international institutions. Both codes of good practice recommended that RCs meet at least once a year.

Table 2. Recommendations regarding standards of the remuneration policy in national codes of good practice based on international recommendations

	YES	NO
Concerning the quality of RC		
Establishment of an RC	AU, HR, CZ, HU, IR, IT, LU, PL, RO, RU, RS, SK, SI, UA	BA, BU, TR
RC is composed of at least three members	HR, CZ, HU, IT, LU, PL, RU, SK, SI	AU, BA, BU, IR, RO, RS, TR, UA
A majority of members should be independent	AU, HR, CZ, HU, IR, IT, LU, PL, RO, RU, SK, UA	BA, BU, RS, SI, TR
The chairman of RC is an independent director	IT, LU, RU	AU, BA, BU, HR, CZ, HU, IR, PL, RO, RS, SK, SI, TR, UA
RC members should have experience in remuneration policies and practices, risk management, and control activities	AU, IT, PL, SI	BA, BU, HR, CZ, HU, IR, LU, RO, RU, RS, SK, TR, UA
Concerning the quality of the variable components of the remuneration policy		
The possibility of using malus	IT	AU, BA, BU, HR, CZ, HU, IR, LU, PL, RO, RU, RS, SK, SI, TR, UA
The possibility of using clawback	AU, PL	BA, BU, HR, CZ, HU, IR, IT, LU, RO, RU, RS, SK, SI, TR, UA
50% of variable compensation should be awarded in shares or share-linked instruments	RU	AU, BA, BU, HR, CZ, HU, IR, IT, LU, PL, RO, RS, SK, SI, TR, UA
The deferral period should not be less than three years	AU, IT, PL1, RU, SI	BA, BU, HR, CZ, HU, IR, LU, RO, RS, SK, TR, UA

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Table 2 – continued

	YES	NO
During the assessment of the performance, financial criteria are taken into account	AU, IT	BA, BU, HR, CZ, HU, IR, LU, PL, RO, RU, RS, SK, SI, TR, UA
During the assessment of the performance, non-financial criteria are taken into account	AU, IT	BA, BU, HR, CZ, HU, IR, LU, PL, RO, RU, RS, SK, SI, TR, UA
The remuneration is based on a combination of the assessment of the performance of the individual and the business unit concerned	AU, BA, BU, HR, RU, RS, SI	CZ, HU, IR, IT, LU, PL, RO, SK, TR, UA
The variable remuneration components take into account all types of current and future risks	RU	AU, BA, BU, HR, CZ, HU, IR, IT, LU, PL, RO, RS, SK, SI, TR, UA
The assessment of the performance is set in a multi-year framework in order to ensure that the assessment process is based on longer-term performance	AU, LU	BA, BU, HR, CZ, HU, IR, IT, PL, RO, RU, RS, SK, SI, TR, UA
Additional recommendations regarding standards of the remuneration policy in national good practice codes		
Minimum number of meetings of RC	CZ, LU	AU, BA, BU, CR, HU, IR, IT, PL, RO, RU, RS, SK, SI, TR, UA

[1] 2 years.
Country abbreviations – see Table 1

Source: own compilation based on national codes of good practice.

When comparing Tables 1 and 2, one important detail should be noted. The international recommendation that the RC and the risk committee should work closely together is not found in the legislation or good practice code of any country. This is surprising, as it was mentioned in the recommendations of four international institutions (BCBS, EBA, EU, FSB). For the other international recommendations, the situation is clear. Recommendations that are not included in the legal regulations of individual countries are included in their codes of good practice. This shows that the countries surveyed fully comply with the recommendations issued by international institutions (except for the one mentioned above).

METHODOLOGY

The assessment of the quality of the remuneration policy in the UniCredit Group was based on research conducted on a group of 27 financial institutions that belong to this FHC (see Table 2A in Appendix A). The annual financial statements for the years 2005–2018 were the source of data for the analysis.

For the study, a composite QRI was constructed, consisting of two sub-indices: the quality index of the variable components of the remuneration policies (QVRI) and the quality index of the RC (QRCI). The indices were calculated based on information given in the reports published by the banks. Such information is treated as reliable as these reports are audited by independent,

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external auditors who, by accepting a given report, confirm that all information contained within it is consistent with reality.

Each of the sub-indices is based on information on selected aspects of the RP (see Appendix B). The indices are composed of variables that correspond to the categories of standards for RPs recommended by international institutions or national regulations, as shown in Table 1A. All variables are binary, and they were selected in such a way that in each area, a higher index value means a higher quality RP. As the number of variables that form the individual sub-indices differs, they were standardized using the following formula (Słomka-Gołębiowska & Urbanek, 2015b, p. 11):

$$QRIi_i = \sum_{J=1}^{2} \frac{Jj,i}{\max Tj} \tag{1}$$

where:
$QRIi_i$ – the value of the quality index for the i-th bank,
Jj,i – the value of the j-th sub-index for the i-th bank,
max Tj – the maximum value for the j-th sub-index.

The transformed value of sub-indices for each bank is in the range (0,1). As a result of this approach, the value of the *QRI* is in the range (0,2). The value of each calculated sub-index shows the share of the quality of information disclosed by the analyzed banks in each aspect of RP described by the appropriate sub-index. Generally, the larger the *QRI*, the higher the quality of the remuneration policy in the company.

Next, the *QRI* was used to investigate the determinants of the quality of the remuneration policy in the UniCredit Group. Considering the literature review and the unambiguous results, the set of explanatory variables was chosen, including the importance of the size of the bank, the effects of the corporate governance quality, the banks' financial performance, and the transparency index of the remuneration policy (TI_{it}). As a result, the general, standard equation used is as follows:

$$QRI_{it} = \alpha_0 + \alpha_1 \times lna_{it} + \alpha_2 \times fin\_result_{it} + \alpha_3 \times board_{it} + \alpha_4 \times TI_{it} + \xi_{it} \tag{2}$$

where:
QRI_{it} – the value of the quality index of the remuneration policy for the i-th bank in the t-th year,
lna_{it} – the natural logarithm of the bank's assets for the i-th bank in the t-th year,
fin_result_{it} – the vector of variables that capture the financial condition of the i-th bank in the t-th year (like ROE – roe_{it}, ROA – roa_{it}, earnings per share – eps_{it}),
$board_{it}$ – the vector of variables that capture institutional aspects related to the quality of the bank's corporate governance determinants, like the board size $board\_size_{it}$, the number of the board meetings $board\_meet_{it}$, and the share of independent members in the total members of the board $indep\_dir_{it}$,
TI_{it} – transparency index of the remuneration policy for the i-th bank in the t-th year,
ξ_{it} – error term.

The full list of the variables used and their descriptive statistic is presented in Table 3A in Appendix A. The data used for computing the variables come from the banks' annual reports. However, the data for the full sample (covering years 2005–2018) are not available for all banks. Even if the literature is not conclusive in investigating the relationships between the chosen

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explanatory variables and remuneration policy, the potential and expected signs for those relations are presented in Table 4A in Appendix A.

In order to evaluate the relationship between the composite QRI and its determinants, and to overcome the potential endogeneity, the instrumental variable, the two-stage least squares estimation method, was applied (see, e.g., Wooldridge, 2010; Baltagi, 2008). Moreover, robustness checks were also employed by emphasizing other estimation methods (applying dynamic panel data, or Beck and Katz's panel corrected standard errors procedure) or different sets of control variables.

THE QUALITY INDEX OF THE REMUNERATION POLICY – RESULTS

The empirical part of this study consists of a two-step procedure. The first step relates to computing the appropriate quality index. The quality of the remuneration policy applied in the UniCredit Group was measured using *QRI*, which consists of two sub-indices. Table 3 shows the *QVRI*, *QRCI*, and *QRI*.

Table 3. Quality index and sub-indices of remuneration policy

Name	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	average
QVRI															
UniCredit SPA	0.00	0.00	0.00	0.00	0.64	0.82	0.91	0.91	0.91	1.00	1.00	1.00	1.00	1.00	0.66
UniCredit Group	0.00	0.01	0.02	0.02	0.06	0.07	0.16	0.19	0.28	0.29	0.35	0.40	0.33	0.30	0.18
QRCI															
UniCredit SPA	0.57	0.57	0.71	0.71	0.71	0.71	0.71	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.84
UniCredit Group	0.10	0.16	0.08	0.09	0.08	0.07	0.10	0.10	0.12	0.14	0.16	0.17	0.14	0.15	0.12
QRI															
UniCredit SPA	0.57	0.57	0.71	0.71	1.35	1.53	1.62	1.91	1.91	2.00	2.00	2.00	2.00	2.00	1.50
UniCredit Group	0.11	0.18	0.10	0.11	0.14	0.15	0.25	0.29	0.39	0.42	0.51	0.56	0.47	0.44	0.30

Source: own compilation.

The first thing that is conspicuous when analyzing the data in Table 3 is that UniCredit SPA applied all the international standards on RPs recommended by international institutions, thus obtaining the maximum index value in particular years. The values of the indices of the UniCredit Group as a whole, on the other hand, were very low. These results show that although the dominant bank has fully applied all standards since 2014, it has not required this from its subsidiaries. These results emphasize how little interest these financial institutions show in improving the quality of their RPs. It can be argued that the banks apply the standards without providing information about it in their annual reports. However, it seems unlikely. Applying the variable components of RP standards recommended by international institutions is very well received by investors. Therefore, banks should brag about this, thus encouraging investors to buy their shares. Another argument is that these banks included this information in reports written in their native language. However, this is unlikely because, as a rule, both reports (in English and the native language) should contain the same information.

The results of both the main index and the sub-indices show how large the differences are in the number of standards used within the FHC. Although the dominant bank, often treated as a representative of the group, is characterized by high standards, it should be remembered that the

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group comprises all the financial institutions belonging to it, not just this one. Looking at the FHC through the prism of UniCredit SPA, it would seem that the UniCredit Group has high standards in terms of RP. However, if we take a closer look at the whole group, we can see that it is not so.

Considering the econometric approach, *QRI* is a dependent variable in baseline equation (2). Due to potential endogeneity, the baseline estimation method applies the two-stage least squares method. Before the estimation, the test of endogenous regressors was applied. The tested regressor is earnings per share, instrumented by the net profits (lagged by two periods). The test shows that the regressor can be implemented. At the same time, the Sargan statistic, which is computed in each regression, informs that the instruments used may be treated as valid. Supported by the use of the fixed-effects estimator, the results of the estimates for the baseline and alternative equations are presented in Table 4. *Regressions I* and *II* are the baseline equations, but *regression I* covers the whole sample, while *regression II* covers the period 2010–2018, i.e., after the financial crisis hit and the post-crisis period.

The relationship between earnings per share and the dependent variable is marginal, negative, and not statistically significant. *QRI* was not affected by the level of earnings per share, even though the robustness checks suggest the potential negative effect of the variable on RP quality in the group. The lack of a statistically significant relationship is also applied to the ROA and ROE. The results indicate that all three variables representing the financial performance of the units (ROE, ROA, and earnings per share) were statistically insignificant. Thus, the financial results were not important in creating the quality of the remuneration policy.

On the other hand, the relationship between the size of the bank, measured by the natural logarithm of the level of assets, generally proved to be statistically significant. The estimates showed that the effect of the size of the bank on the quality of the remuneration policy was positive. Therefore, the hypothesis regarding bank performance captured by size and the quality of the remuneration policy was confirmed.

The estimates concerning the relationships between the dependent variable and the quality of the corporate governance (expressed by the size of the board, the number of board meetings, or the number of independent members in the board) were negative. As obtained, the magnitude of the statistically significant effects of the control variables depends on the other explanatory variables applied in the regressions. Generally, the impact of the board size is estimated as ranging between -0.08 to -0.06, the effect of the frequency of board meetings ranges between -0.04 to -0.02, while the share of the independent "outsiders" ranges from -0.004 to -0.006. The analysis of the relationship between the quality of the remuneration policy and the three corporate governance variables (board size, board independence, and frequency of board meetings) proved to be statistically significant in almost every case, except for *regression IV*, which includes the variable lagged by one year, which captures earnings per share, and *regression VII*, with the dummy variable for the implementation of the RC (rc_{it}). The rc_{it} takes a value of 1 if the bank implemented an RC, and 0 otherwise.

However, taking into account the quality of the data, the results confirm only the hypothesis that the larger the board, the lower the quality of the remuneration policy. The effect might also be interpreted by the coefficient for the relationship between $board\_size_{it}$ and QRI_{it}, which was the highest for all three relationships related to variables that include the corporate quality of the board. Although it was expected that board independence and the frequency of the board meetings were positively related to the quality of RP, the results were negative. Considering the results, the more independent the board, the less information on the RP is disclosed, and the lower the quality of the policy. Additionally, more frequent board meetings negatively impacted the quality of the RP.

RP transparency, measured by TI_{it}, was positive and statistically significant. The estimated effect of the variable on QRI_{it} ranged between 0.3 to 0.4, on average. The hypothesis about the positive relationship between TI_{it} and the remuneration policy quality was not rejected; thus, transparency may be treated as an important determinant of the quality of RP in the group.

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Table 4. Coefficient estimates of the regressions for the UniCredit Group units

	I	II	III	IV	V	VI	VII
ln_a_{it}	0.4031* (0.2326)	0.4321* (0.2423)	0.3336** (0.1705)	0.3172 (0.2275)	0.4408* (0.2554)	0.3311* (0.1857)	0.3696* (0.2145)
eps_{it}	-0.0003 (0.0002)	-0.0003 (0.0002)	-0.0003* (0.0002)	-0.0004 (0.0004)	-0.0003 (0.0002)	-0.0002 (0.0002)	-0.0003 (0.0002)
roa_{it}	0.0164 (0.0339)	0.0072 (0.0284)	0.0148 (0.0306)	0.0212 (0.0440)	0.0191 (0.0356)	0.0091 (0.0270)	0.0148 (0.0333)
roe_{it}	-0.0016 (0.0046)	-0.0003 (0.0040)	-0.0006 (0.0044)	-0.0017 (0.0055)	-0.0017 (0.0047)	-0.0002 (0.0037)	-0.0017 (0.0045)
$board\_size_{it}$	-0.0818** (0.0320)	-0.0572** (0.0278)	-0.0798*** (0.0268)	-0.0724** (0.0336)	-0.0857** (0.0343)	-0.0617** (0.0264)	-0.0844** (0.03321)
$board\_meet_{it}$	-0.0367* (0.0221)	-0.0329* (0.0198)	-0.0443** (0.0212)	-0.0303 (0.0233)	-0.0395* (0.0237)	-0.0230* (0.0176)	-0.0330 (0.0205)
$indep\_dir_{it}$	-0.0054* (0.0031)	-0.0055* (0.0033)	-0.0044** (0.0025)	-0.0042 (0.0031)	-0.0058* (0.0034)	-0.0043* (0.0025)	-0.0053* (0.0031)
TI_{it}	0.4035*** (0.0937)	0.3903*** (0.0828)	0.2715** (0.1278)	0.4459*** (0.0871)	0.3949*** (0.0989)	0.2658*** (0.0927)	0.3626*** (0.1195)
TI_{it-1}			0.2034** (0.0988)				
eps_{it-1}				0.0002 (0.0002)			
$eps_{it}x$(2009–2018)					-0.0001 (0.0001)		
$TI_{it}x$(2009–2018)						0.1427** (0.0561)	
rc_{it}							0.1469 (0.1493)
Sargan statistic (p-value)	4.384 (0.2229)	2.347 (0.5036)	3.358 (0.3396)	3.519 (0.3183)	3.925 (0.2697)	3.332 (0.3432)	4.464 (0.2155)
Test statistic of endogenous regressors (p-value)	7.621 (0.0058)	5.567 (0.0183)	9.909 (0.0016)	5.586 (0.0181)	8.328 (0.0039)	4.566 (0.0326)	4.470 (0.0345)
Obs.	175	160	175	175	175	175	175
Years	2005–2018	2010–2018	2005–2018	2005–2018	2005–2018	2005–2018	2005–2018
Objects	26	26	26	26	26	26	26
Centered R^2	0.8055	0.3212	0.3641	0.0041	0.2241	0.5437	0.8055

The values of standard errors presented in parentheses. Signs *, **, *** denote significance at the 10, 5, and 1 percent levels, respectively. Estimates for the two-stage least squares method, supported by the fixed-effects estimator.

Source: own compilation.

Regressions V–VII include additional variables. *Regressions V* and *VI* were extended by variables that emphasize the importance of the post-crisis period (i.e., after 2008). As estimated, after 2008, *QRI* was positively and significantly affected by *TI* while the earnings per share still showed a lack of relationship with the dependent variable. The estimates of the baseline explanatory variables were robust. Finally, *regression VII* includes the dummy variable for the implementation of the RC. The estimate shows a positive but insignificant effect on the dependent

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variable. It is likely due to the fact that in most cases, the Committee was not introduced into the structure of the banks, so the panel regression exhibited a lack of (but a potentially positive) relationship.

The robustness checks for the alternative estimation method are presented in Table 5A in Appendix A. The estimation technique is a panel corrected standard error (PCSE) approach. The estimates confirm the results from Table 4 regarding the signs of the relationships between all variables and the dependent variable in the baseline regressions. However, the statistical significance was only confirmed for variables ln_a_{it}, and TI_{it}, suggesting that the other variables have an ambiguous impact on *QRI*. As presented in Table 4A, the PCSE method confirms the statistical significance of the explanatory variables depending on the set of regressors. Despite this, the effect of financial conditions in terms of ROA was significant, in contrast to the results presented in Table 4. Moreover, the impact of earnings per share was also significant in most of the analyzed regressions. The effect of the dummy variable for the RC was positive and statistically significant; the estimated coefficient was about 0.08 on average. The highest magnitude of coefficients was related to the positive relationship between QRI_{it} and *TI*.

As the *QRI* may depend on its value in the past, the estimates presented in Table 5 show the results of a test for the dynamic panel data approach. The methodology is based on the system-GMM approach. The estimation technique employs the system two-step GMM estimator rather than the one-step estimator. This approach is based on Windmeijer's (2005) inferences, whose correction procedure of the system two-step GMM estimator generates an increase in precision compared to the system one-step GMM estimator. Some of the regressions are presented in Table 5.

Table 5. Robustness checks for the system-GMM estimator

	I	***II***	***III***	***IV***
QRI_{it-1}	0.4521*** (0.0362)	0.4611*** (0.05769)	0.3809*** (0.0317)	0.4433*** (0.0983)
ln_a_{it}	0.0526*** (0.0063)	0.0539*** (0.0046)	0.0575*** (0.0128)	0.0497*** (0.0139)
eps_{it}	-1.88e-06 (2.66e-06)	4.84e-06 (3.81e-0)	-9.45e-08 (2.99e-06)	-1.97e-06 (2.67e-06)
roa_{it}	0.0016 (0.0076)	0.0016 (0.0062)	0.0004 (0.0042)	0.0014 (0.0079)
roe_{it}	-0.0006 (0.0006)	-0.0006 (0.0005)	0.0000 (0.0005)	-0.0006 (0.0007)
$board\_size_{it}$	-0.0138*** (0.0011)	-0.0133*** (0.0014)	-0.0129*** (0.0021)	-0.0137*** (0.0022)
$board\_meet_{it}$	-0.0120*** (0.0006)	-0.0121*** (0.0005)	-0.0120*** (0.0017)	-0.0123*** (0.0009)
$indep\_dir_{it}$	-0.0008*** (0.0002)	-0.0008** (0.0002)	-0.0004 (0.0011)	-0.0007*** (0.0002)
TI_{it}	0.3879*** (0.0121)	0.3942*** (0.0169)	0.40389*** (0.0174)	0.3837*** (0.0213)
eps_{it-1}		6.83e-06* (3.61e-06)		
rpc_{it}				0.0223* (0.0132)

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Table 5 – continued

	I	*II*	*III*	*IV*
cons	-0.8028*** (0.0986)	-0.8585*** (0.0688)	-0.8901*** (0.2079)	-0.7573*** (0.2244)
Obs.	228	228	179	228
Years	2005–2018	2005–2018	2010–2018	2005–2018
Sargan statistic (prob >)	12.8098 (0.9560)	12.3894 (0.9640)	10.5964 (0.8768)	12.4527 (0.9629)
AR(1) statistic (p-value)	-2.4605 (0.0139)	-2.4604 (0.0139)	-2.3839 (0.0171)	-2.524 (0.0116)
AR(2) statistic (p-value)	1.0902 (0.2756)	1.1305 (0.2583)	1.2598 (0.2078)	1.0490 (0.2942)

Standard errors presented in parentheses. Signs *, **, *** denote significance at the 10, 5, and 1 percent levels, respectively. Estimates for system two-step GMM estimator. AR(1) and AR(2) denote the values of the statistic for the Arellano-Bond test for serial correlation. The Sargan statistic denotes the value of the Sargan test of over-identifying conditions.

Source: own compilation.

The estimates confirm the positive and statistically significant effects of lagged denoting the importance of the past effects of the index on the current quality of the remuneration policy. Thus, a better quality of remuneration policy in the past requires high quality in the current period. The estimated coefficients ranged between 0.4 and 0.5, on average.

Generally, the sign and statistical significance of the estimates are similar to those for the baseline estimation method, which was the instrumental variable approach. The coefficients for the relationship between and the dependent variable were positive and ranged between 0.05 and 0.06. The effect of TI was around 0.4, on average. The coefficients for the effects of corporate governance (in the form of board size, board independence, and board meeting frequency) were negative. However, as in the use of the instrumental variable approach, the negative effects of the board size were the highest in their magnitude. However, in contrast to the estimates presented in Table 4, the coefficient for the dummy variable for the RC was statistically significant.

DISCUSSION AND CONCLUSIONS

The financial crisis emphasized the importance of good corporate governance, including RPs, for well-functioning financial institutions. The importance of standards for remuneration policies in this sector has been confirmed by macro-prudential regulations at both international and national levels. Since the most important institutions devote so much attention to this issue, and since national supervisors see the rationale for incorporating these recommendations into legal regulations and codes of good practice, the problem should be considered unquestionably important in shaping appropriate corporate governance mechanisms in financial institutions.

While there is consensus at the macro-prudential level on the need for high RP standards, at the level of individual financial institutions, this issue seems to be marginalized. Therefore, it is necessary to consider the reason why the dominant bank implements the rules but the subsidiary banks underestimate the issue. Is it because the dominant bank is "representative" of the whole group, and based on its assessment, investors form an opinion/build trust in the subsidiary banks? Are subsidiary banks left with such a degree of autonomy that the standards they introduce are not controlled?

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The strength of the dominant bank's influence on its subsidiaries depends on the number of shares and voting power of the authorities of the subsidiary bank. The shares held in a given subsidiary bank give them the right to participate in general meetings and in the work of the bank's board through the possibility of deciding on the composition of this body. Therefore, it can be presumed that the lack of implementation of corporate governance standards, including RPs, is due to weaknesses in the functioning of the supervisory mechanisms.

Taking into account all the issues mentioned above, the low values of QRI for the whole group is quite interesting. It shows that although many banks that belong to UniCredit Group do not meet the international requirements in terms of the remuneration policy, there is no reaction to this behavior by the parent bank. There is also no reaction from the international institutions that created these regulations. Therefore, one may question the point of creating regulations concerning the quality of RP since not applying them has no consequences.

It is worth paying attention here to the growing awareness of social responsibility presented by banks. Increasingly, when making investment decisions, investors take into account the implementation of the Environmental, Social, Governance (ESG) issues into the business strategy of the bank. As one of the elements of ESG is "Governance", which includes RP, it would be worth considering why supervisors do not react to banks' non-compliance with the regulations concerning this area of corporate governance. The results of the research clearly show that the banks belonging to the UniCredit Group do not follow RP requirements in most cases. Such a low quality of RP in the surveyed banks may prove that the supervisory institutions have little importance or that they have little power of influence on the banks.

The research carried out in this study allowed us to positively verify some of the research hypotheses. However, it is not possible to discuss similar research results, as this is the only work of its kind. The empirical part of the study, based on alternative estimation methods, emphasized the positive correlation between the size of the bank and the quality of remuneration policy, thus confirming studies that indicate that larger banks have better supervisory standards (Słomka-Gołębiowska & Urbanek, 2015a; Demsetz & Saidenberg, 1999).

Considering the empirical results, it turned out that weaker quality RPs are found in banks with larger boards. This outcome is consistent with the view that small boards promote critical and intellectual reflection and greater involvement of members. This, in turn, can lead to more effective decision-making, monitoring, and performance improvement (Firstenberg & Malkiel, 1994; Hermalin & Weisbach, 2003). However, the study showed the negative effect of the frequency of bank board meetings on remuneration policy quality. It is surprising as it would seem that the increased frequency of meetings is intended to intensify the activities of the board, to raise more issues, and probably also to demonstrate a more responsible attitude of the council members towards their duties. Considering the ambiguous result of the statistical significance of the relationship, there is a need for future research.

The share of independent directors was generally negatively related to QRI. This is in line with the position presented by Axworthy (1988), who claimed that non-executive directors do not generally exercise effective supervision and that the board of directors itself is a body that approves only the findings of the board of directors.

RP quality was positively and statistically significantly related to transparency index, regardless of the estimation method used. The relationship between these variables is indisputable. Quality and transparency are closely related. By applying all standards regarding the remuneration policy, banks will want to boast about it, which will translate into greater transparency. Therefore, it seems logical that higher transparency means higher quality of the remuneration policy.

In conclusion, some limitations of the study should be mentioned. Firstly, it was not possible to analyze all of the financial institutions that belong to the FHC. Secondly, some imperfections of the computed index itself should be outlined, resulting from all components having equal weights. Thirdly, the time sample is limited, as is the quality of the data. Moreover, there is a wide

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range of missing observations for the units in the whole UniCredit Group. When the data for the COVID-19 pandemic period will be available, then their inclusion may be a valuable input into the analysis. Thus the analysis of the unique situation in the banking sector created by the remote work and lockdowns may deliver some implications. In the context of this study, it is a recommended direction of further research. Nevertheless, the work may be seen as a good start on the road to getting to know groups from within. It also outlines a potential area for further research, mainly focusing on the construction of alternative indices for RP quality and deeper analyses of the robustness of the determinants of the remuneration policy. In the future, as part of an in-depth study, it would also be possible to examine other holdings and, as a result, compare the UniCredit Group with other groups and examine and compare the results with other corporate governance standards.

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APPENDIX

Appendix A

Table 1A. International recommendations regarding standards of remuneration policy

	Basel Committee on Banking Supervision	Committee of European Banking Supervisors	European Banking Authority	European Union[I]	Financial Stability Board	OECD[II]
Concerning the quality of RC						
Establishment of an RC	YES	YES	YES	YES	YES	YES
RC is composed of at least three members			YES[III]	YES[III]		
A majority of members should be independent	YES		YES	YES		YES
The chairman of RC is an independent director	YES		YES			
Work closely with the firm's risk committee in evaluating the incentives created by the compensation system	YES		YES	YES	YES	
RC members should have experience in remuneration policies and practices, risk management, and control activities			YES	YES		
Concerning the quality of the variable components of RP						
The possibility of using malus	YES		YES	YES	YES	YES
The possibility of using clawback	YES	YES	YES	YES	YES	YES

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Table 1A – continued

	Basel Committee on Banking Supervision	Committee of European Banking Supervisors	European Banking Authority	European Union[I]	Financial Stability Board	OECD[II]
The variable component shall not exceed 100% of the fixed component of the total remuneration[IV]			YES	YES		
50% of variable compensation should be awarded in shares or share-linked instruments	YES		YES	YES	YES	
40 to 60% of variable compensation should be payable under deferral arrangements over a period of years	YES		YES	YES	YES	
The deferral period should be not less than three to five years	YES[V]	YES[VI]	YES	YES	YES[V]	
During the assessment of the performance, financial criteria are taken into account	YES	YES	YES	YES		
During the assessment of the performance, non-financial criteria are taken into account	YES	YES	YES	YES		
The remuneration is based on a combination of the assessment of the performance of the individual and of the business unit concerned	YES	YES	YES	YES	YES	
The variable remuneration components take into account all types of current and future risks	YES	YES	YES	YES	YES	
The assessment of the performance is set in a multi-year framework in order to ensure that the assessment process is based on longer-term performance	YES		YES	YES		

I The European Union makes recommendations in the form of recommendations but also in the form of directives and regulations. In the case of directives and regulations, all countries belonging to the EU are obliged to implement them in national law. However, as the survey also involved countries that do not belong to the EU and therefore do not have to comply with EU regulations, the survey does not consider recommendations, regulations, and directives separately.

II The OECD makes recommendations for all companies, not just banks. However, due to the international importance of the OECD, these were taken into account in the study.

III In the case of a small board of directors/supervisory board, the minimum number of directors in RC is two.

IV With the consent of the general meeting, it can be increased to 200%.

V 3 years.

VI In the case of a significant bonus, some of it should be deferred.

Source: own compilation based on regulations issued by Basel Committee on Banking Supervision, Committee of European Banking Supervisors, European Banking Authority, European Union, Financial Stability Board, OECD.

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Table 2A. The surveyed companies that are part of the UniCredit financial holding group

Name	Position in the group	Country of origin	Group membership period
UniCredit SPA (earlier UniCredito Italiano SPA)	dominant bank	Italy	2005–2018
AO UniCredit Bank (earlier ZAO UniCredit Bank)	subsidiary bank	Russia	2007–2018
Bank BPH	subsidiary bank	Poland	2005–2007
Pekao Bank Hipoteczny (earlier BPH Bank Hipoteczny S.A.)	subsidiary bank	Poland	2005–2016
Bank Pekao SA	subsidiary bank	Poland	2005–2016
Public Joint Stock Company Ukrsotsbank	subsidiary financial institution	Ukraine	2009–2015
UniCredit Luxemburg	subsidiary bank	Luxembourg	2009–2017
UniCredit Bank d.d. Mostar	subsidiary bank	Bosnia and Herzegovina	2008–2018
UniCredit Bank Czech Republic and Slovakia, A.S.	subsidiary bank	Czechia and Slovakia	2007–2018
UniCredit Bank Ireland p.l.c. (earlier UniCredito Italiano Bank (Ireland) p.l.c.)	subsidiary bank	Ireland	2005–2018
UniCredit Bank Srbija JSC	subsidiary bank	Serbia	2007–2018
UniCredit Bank Slovenija D.D.	subsidiary bank	Slovenia	2007–2018
UniCredit Hungary Zrt.	subsidiary bank	Hungary	2007–2018
UniCredit Bank Austria AG (earlier Bank Austria Cerditanstalt AG)	subsidiary bank	Austria	2005–2018
UniCredit Bulbank AD (earlier Bulbank AD)	subsidiary bank	Bulgaria	2005–2018
UniCredit Factoring Czech Republic and Slovakia, A.S.	subsidiary financial institution	Czechia and Slovakia	2015–2018
UniCredit Factoring SPA	subsidiary financial institution	Italy	2005–2018
UniCredit Jelzálogbank Zrt. (earlier HVB Jelzálogbank Zrt.)	subsidiary bank	Hungary	2005–2018
UniCredit Leasing Cz., A.S.	subsidiary bank	Czechia	2007–2018
UniCredit Bank S.A. (earlier UniCredit Tiriac Bank SA)	subsidiary bank	Romania	2006–2018
Dom Inwestycyjny Xelion sp. z.o.o. (earlier Xelion Doradcy Finansowi sp.z.o.o.)	subsidiary financial institution	Poland	2005–2016
Zagrebačka banka dd	subsidiary bank	Croatia	2005–2018
UniCredit International Bank (Luxembourg) SA	subsidiary bank	Luxembourg	2005–2018
UniCredit services s.c.p.a. (earlier UniCredit Business Integrated Solutions S.C.p.A.)	subsidiary financial institution	Italy	2012–2018
Yapi Kredi Portfoey Yoenetimi AS	subsidiary financial institution	Türkiye	2005–2018
Yapi Kredi Yatirim Menkul Degerler AS	subsidiary financial institution	Türkiye	2005–2018
Yapi ve Kredi Banka AS	subsidiary bank	Türkiye	2005–2018

Source: own compilation.

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Table 3A. Descriptive statistics

Variable	Obs	Mean	st. dev.	Min	Max
QRI_{it}	255	0.325	0.494	0.000	2.000
TI_{it}	255	0.695	0.834	0.000	2.890
ln_a_{it}	255	17.096	2.384	10.142	22.114
roe_{it}	255	11.193	12.928	-55.619	59.283
roa_{it}	255	2.688	8.252	-6.994	53.113
eps_{it}	255	1668.125	8356.749	-1113.896	91975.040
$board\_size_{it}$	255	8.553	4.119	3.000	24.000
net_profit_{it}	255	676195.300	6444778.000	-59100000.000	23200000.000
$board\_meet_{it}$	255	2.694	4.539	0.000	22.000
$indep\_dir_{it}$	255	13.884	25.664	0.000	94.118

Source: own compilation.

Table 4A. Determinants of the quality of the remuneration policy

Quality determinant	Method of measurement	Predicted nature of the relationship
Bank size	Total assets	+
Financial performance	ROE, ROA, net profit, earnings per share	+
Size of the bank's board	Number of bank board members	–
Activities of the bank's board	Number of bank board meetings	+
Independence of the bank's board	Participation of independent bank board members	+
Transparency of remuneration policy	Transparency index (TI)	+

Source: own compilation.

Table 5A. Estimates based on PCSE method

	I	*II*	*III*	*IV*	*V*
ln_a_{it}	0.0444*** (0.0127)	0.0312*** (0.0091)	0.0271*** (0.0068)	0.0422*** (0.0122)	0.0319*** (0.0097)
eps_{it}	-7.18e-07 (1.01e-06)	-2.32e-06** (8.28e-07)	-2.31e-06*** (5.96e-07)	5.78e-06 (5.53e-06)	-1.10e-06* (5.62e-07)
roa_{it}	0.0040** (0.0015)	0.0031** (0.0013)	0.0025** (0.0011)	0.0040** (0.0019)	0.0028** (0.0013)
roe_{it}	-0.0007 (0.0009)	-0.0002 (0.0007)	-0.0002 (0.0007)	-0.0005 (0.0009)	-0.0004 (0.0007)
$board\_size_{it}$	-0.0043 (0.0064)	0.0002 (0.0061)	0.0007 (0.0060)	0.0015 (0.0068)	-0.0068 (0.0058)
$board\_meet_{it}$	-0.0030 (0.0045)	-0.0064 (0.0040)	-0.0073* (0.0040)	-0.0131** (0.0057)	-0.0051 (0.0039)
$indep\_dir_{it}$	-0.0011 (0.0008)	-0.0014** (0.0007)	-0.0014** (0.0007)	-0.0015 (0.0010)	-0.0011 (0.0007)

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Table 5A – continued

	I	*II*	*III*	*IV*	*V*
ti_{it}	0.5243*** (0.0227)	0.5382*** (0.0185)	0.5186*** (0.0224)	0.5418*** (0.0185)	0.5023*** (0.0233)
ti_{it-1}			0.0335 (0.0243)		
eps_{it-1}		1.30e-06 (8.43e-07)	1.27e-06** (6.25e-07)		
rpc_{it}					0.0805** (0.0409)
cons.	-0.7350*** (0.1811)	-0.5477*** (0.1305)	-0.4723*** (0.1005)	-0.7163*** (0.1896)	-0.5141*** (0.1410)
Obs.	255	228	228	187	255
Years	2005-2018	2005-2018	2005-2018	2010-2018	2005-2018
Objects	27	26	26	27	27
R^2	0.7956	0.8531	0.8872	0.8910	0.8585

Het-corrected standard errors presented in parentheses. Signs *, **, *** denote significance at the 10, 5, and 1 percent levels, respectively. Estimates for panel corrected standard errors method with inclusion the assumptions about panel-level heteroskedastic errors and panel-specific AR1 autocorrelation structure.

Source: own compilation.

APPENDIX B. DEPENDENT VARIABLES USED TO BUILD THE *QRI* – THE QUALITY INDEX OF THE REMUNERATION POLICY

The scope of the *QRI* ranges from 0 to 2. It is obtained by adding up the points obtained in two subcategories: the policy of the variable components of the remuneration (a maximum score of 11) and the RC (a maximum score of 7). In both subcategories, all items have the same weight: 1 if it is met, or 0 if it is not met.

Subcategories of the quality index of the remuneration policy (*QRI*)	
the policy of the variable components of the remuneration	**RC**
1. the possibility of using malus 2. the possibility of using clawback 3. the variable component shall not exceed 100% (200% for approval of GAM) of the fixed component of the total remuneration 4. 50 percent of variable compensation should be awarded in shares or share-linked instruments 5. 40 to 60 percent of variable compensation should be payable under deferral arrangements over a period of years 6. the deferral period should not be less than three to five years 7. during the assessment of the performance, financial criteria are taken into account 8. during the assessment of the performance, non-financial criteria are taken into account	1. establishment an RC 2. the RC is composed of at least three members 3. a majority of members should be independent (at least 51%) 4. the chairman of the RC is an independent director 5. works closely with the firm's risk committee in evaluating the incentives created by the compensation system 6. RC members should have experience in remuneration policies and practices, risk management, and control activities 7. minimum number of meetings

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Appendix B – continued

Subcategories of the quality index of the remuneration policy (*QRI*)	
the policy of the variable components of the remuneration	**RC**
9. the remuneration is based on a combination of the assessment of the performance of the individual and of the business unit concerned	
10. the variable remuneration components take into account all types of current and future risks	
11. the assessment of the performance is set in a multi-year framework in order to ensure that the assessment process is based on longer-term performance	

Source: own compilation.

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Households' Borrowing Intentions During the COVID-19 Crisis: The Role of Financial Literacy

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ABSTRACT

This study aims to determine the role of financial literacy in households' borrowing intentions during the coronavirus pandemic. Employing a survey of 1,300 Polish citizens conducted during the COVID-19 crisis and an instrumental variable analysis, we found that financial literacy significantly increases households' borrowing intentions. This applies to financially sound consumers both in crisis and normal times. In terms of sociodemographic features, young adults and the less educated are less willing to borrow during the pandemic.

JEL Classification: D14, D91, G51, G53

Keywords: borrowing intentions, financial literacy, instrumental variables, quantile regression

1. INTRODUCTION

The coronavirus pandemic is an unprecedented shock for households and, consequently, for the banking sector as well. During this time, the key task of the financial sector (and supervisors) is to maintain the financing of the economy and prevent a credit crunch (many central banks, including Riksbank and the National Bank of Poland, took measures to sustain the economy). However, keeping the economy financed is not only the role of the credit supply. The demand for credit should also demonstrate a counter-cyclical nature, enabling a quick exit from the recession. Looking at the Polish banking sector, the supply of credit during the pandemic was sustained, which did not lead to a credit crunch. However, corporate and household lending declined markedly, driven by low credit demand. At the beginning of 2021, consumer and corporate lending in Poland even reached negative growth rates (National Bank of Poland, 2022). In this

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case, it is important to examine whether financial literacy could have prevented the decline in demand for credit during the pandemic. At the same time, through financial literacy, it is possible to indicate (based on a literature review – e.g. Lusardi & Tufano, 2015) that keeping credit market activity during a crisis period would be associated with healthy financial decisions.

The aim of this article is to determine households' borrowing intentions in the credit market during the coronavirus pandemic and the role that financial literacy plays in these. Financial literacy, understood as the ability to process economic information and make informed financial decisions (Lusardi & Mitchell, 2014), influences consumers' economic behavior throughout their lives. Thus, it is important at the time of both employment and retirement. The outcomes of households' borrowing, saving and investment decisions depend on the level of their financial and numerical abilities (Strömbäck et al., 2017; Smith et al., 2010; Christelis et al., 2010; Lusardi & Mitchell, 2014). Less financially educated individuals are more likely to pay higher transaction costs and fees for financial services (Campbell, 2006; Lusardi & Tufano, 2015), and – according to Mottola (2013) – to engage in a more costly credit card behavior. Therefore, a higher level of financial knowledge is associated with an interest in holding precautionary savings (de Bassa Scheresberg, 2013).

To achieve our research goal, we surveyed a representative sample of 1,300 Polish citizens through June and July 2020 (i.e., during the intensive level of pandemic restrictions). According to statistics from the Bank for International Settlement, credit for the private non-financial sector in Poland amounted to 79.6% of GDP in the first quarter of 2020, which is low compared to the average for advanced economies (164.2%) or even emerging market economies (144.3%). The need to understand customers' decisions in a society with a relatively low credit activity provides additional justification for this study.

Our research contributes to the literature in several areas. Firstly, it verifies the role of financial literacy in managing household finances during the pandemic. Secondly, it identifies the factors influencing consumer intention to borrow, which may be necessary from a prudential policy perspective. Thirdly, it shows that investments in the financial literacy of society play an important role in the context of the rapid recovery of the economy from the crisis.

The paper is organized as follows: in the next section, we review the literature on the household behavior during the economic shock, credit inclusion and the relationship between financial/debt literacy and borrowing willingness. In the third section, we present our research methodology and survey design. Then, we describe our results and discuss our findings; and the last section elucidates the conclusions.

2. LITERATURE REVIEW

Following our research goal (i.e. determining households' borrowing intentions in the credit market during the coronavirus pandemic and the role that financial literacy plays in these), we focused on three areas of the literature review. Firstly, we explore literature on the trend in consumer financial behavior during economic shocks. Our study is conducted during the coronavirus pandemic, hence reviewing existing research on consumer behavior during economic shocks is crucial for a proper understanding of potential consumer decisions. Next, we review the literature on the determinants that encourage households to participate in the credit market. Finally, we examine the importance of financial literacy in shaping "healthy" credit market behavior.

When analyzing household behavior during financial shocks, it is worth referring to the study by Nofsinger (2011). He verified household behavior during two periods – boom and bust economic cycles. His research focuses on the global financial crisis. According to the author, households exhibit pro-cyclical actions. This means that during a boom, households follow trends

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and group-thinking. Such behavior reinforces the threat of speculative bubbles. Conversely, in a downturn, fear of the future leads to selling off assets at low prices. Generally, households in a downturn spend less and repay debts, putting a strain on an already slowing economy. Even if households were willing to borrow, financial institutions would often restrict this possibility during a crisis by tightening credit conditions (Brunnermeier, 2009).

The literature mostly focuses on macroeconomic determinants, and only a few studies consider individuals' characteristics as drivers of the willingness to borrow. Chivakul and Chen (2008) analyzed the determinants of borrowing intentions among households in Bosnia and Herzegovina. Their results highlight that lenders' behavior is influenced by gender (females are more prone to incurring debt), income, and educational qualifications. Moreover, their research confirmed that the borrowing behavior is also determined by the post-conflict and transitional nature of the country. Vissing-Jorgensen (2011) suggests that customers who spend a relatively high portion of their income on luxuries tend to engage in high loss products. Meier and Sprenger (2010) investigated the sources of interest in credit cards (i.e., products that require careful use). According to their findings, present-biased individuals are more likely to use this type of loan. Their survey suggested that the average credit card user is characterized as female with low disposable income, about 36 years old. In our study, from the perspective of household behavior, it is crucial to take into account the period of the analysis. This survey period concerns the first coronavirus pandemic wave and is associated with a shock for the labor market. Therefore, it is critical to look also at the importance of customer expectations regarding their concerns about losing a source of income. At the same time, it is worth emphasizing that greater credit inclusion can strengthen the resilience of the financial system to crises (e.g. López & Winkler, 2019). This is due, inter alia, to diversification effects (Cull et al., 2012) and is often observed in the form of lower Z-score and NPL ratios (Morgan & Pontines, 2014). However, recent studies raise concerns about the relationship between credit inclusion and financial stability. Sahay et al. (2015) find non-linearities and state that the relationship between credit inclusion and financial stability depends on the quality of banking supervision. In our study, in turn, we want to highlight the role of financial and debt literacy.

According to Lusardi and Tufano (2015), debt literacy refers to the ability to make simple decisions regarding debt contracts, applying basic knowledge about compound interest to everyday financial choices. They propose a set of questions specifically aimed at measuring such knowledge and skills. The participants of the survey were asked about interest compounding and credit card debt accumulation, as well as to compare two payment options which dealt with the concept of the time value of money. Lusardi and Tufano (2015) found that the majority of American respondents are debt illiterate, which significantly affects their borrowing and debt behavior. Such individuals pay higher fees and charges, and have problems with assessing their debt position or judge their debt to be excessive. Additionally, literate people are more resilient to economic downturns (Mitchell & Lusardi, 2015), which is more essential than ever in the current pandemic. Moreover, Klapper et al. (2013) used a panel data set from Russia and confirmed that financially literate individuals are significantly less vulnerable to negative income shocks during the global financial crisis. At the same time, the authors suggest that greater activity in the consumer credit market should go hand in hand with financial literacy. Financial literacy also has a secondary mechanism – it makes people less afraid to use credit products because they know how those products operate (Grohmann & Menkhoff, 2020). In our research, we focus on borrowing intention during the pandemic and suggest the following research proposition:

P: *Highly literate and financially sound households are more willing to borrow funds during a pandemic.*

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In this proposition, we combine two mechanisms. Firstly, we point out that financial literacy allows the continuation of credit market activity even during the crisis (which is beneficial for economic growth). Secondly, based on the literature review, we remark that intended credit market activity of highly literate individuals during the crisis is safe from the credit risk perspective.

3. RESEARCH METHODOLOGY AND SURVEY DESIGN

As a first step in addressing our research proposition, we asked respondents three questions to determine their level of financial literacy[2] in three areas: (i) understanding compound interest (FL1); (ii) understanding inflation (FL2); and (iii) understanding risk diversification (FL3). These questions are commonly used in the literature to measure financial literacy (Lusardi & Mitchell, 2011). Moreover, we asked three additional questions to verify the debt literacy of a particular respondent (DLI – DLIII). The content of debt literacy questions is provided by Lusardi and Tufano (2015). The list of three financial and three debt literacy questions, along with possible answers, is presented in Table A1 in the Annex.

The research sample included 1,300 Polish citizens, and the characteristics of the sample were chosen to be as representative of the Polish adult society as possible (see Table 1). Therefore, we applied random sampling with appropriate weights. Compared to the characteristics of the Polish society, the survey sample undercounts the proportion of people over the age of 64. However, from the point of view of the research goal (i.e., borrowing intentions during a pandemic), it is important to focus on people active in the labor market. Moreover, the coronavirus pandemic had the greatest impact on the labor market, which further justifies increased attention to people under the age of retirement. In our research, we use a CAWI method (computer assisted web interview) to collect responses.

Table 1
Respondent profiles

Variable	% (survey)	% (Polish adult society – 2020)
Gender		
Male	49.3%	48.4%
Female	50.7%	51.6%
Age		
18–24	13.8%	8.9%
25–34	26.1%	17.3%
35–44	24.2%	19.7%
45–54	15.2%	15.4%
55–64	12.9%	16.5%
Age > 64	7.8%	22.2%
Degree		
Elementary	10.0%	10.8%
Middle-high	48.3%	61.5%
High	41.7%	27.7%

Note: The table presents the share of a given demographic characteristic in the sample population.

Source: Eurostat database.

[2] Three Questions to Measure Financial Literacy: https://gflec.org/wp-content/uploads/2015/04/3-Questions-Article2.pdf

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The second part of the survey tracked the borrowing intentions (indicated by respondents). We obtained this by asking respondents a question which verified the declared level of monthly loan installment that a given respondent was capable of (C_i) (see descriptive statistics and exact content of the question related to C_i in Table A2 in the Annex). It is worth noting that C_i is based on the possible amount the respondent is able to repay, not the actual amount of installment.

We additionally divided the sample into two groups – the overindebted (i.e. 122 respondents) and those who currently have no problems in settling their debts (i.e. 1,178 respondents). In this way, we will check the asymmetric nature of financial literacy – i.e. depending on the borrower's debt situation. We expect that financial literacy will increase the borrowing intentions of the financially healthy part of the respondents to incur debt during the pandemic. In contrast, for currently overindebted respondents, financial literacy should not further encourage them to incur debt during the pandemic.

We asked respondents to determine the loan installment assuming two levels of net income I_i (i.e., PLN 2,500 and PLN 5,000[3]). The division into two variants is justified by a certain minimum amount spent on the most basic living expenses by a given respondent. Respondents with higher incomes will have a larger income buffer above the minimum cost of living, and their propensity to borrow may be greater. Finally, below, we present the equations explaining the during the pandemic. In the first stage, we use OLS regression.

$$C_{i,\,2500,\,COVID} = \beta DV_i + \delta Income\,fears_i + \theta Savings_i + \upsilon Literacy_i + \varepsilon \quad (1)$$

$$C_{i,\,5000,\,COVID} = \beta DV_i + \delta Income\,fears_i + \theta Savings_i + \upsilon Literacy_i + \varepsilon \quad (2)$$

where DV_i denotes demographic variables (gender, age, and degree) and $Literacy_i$ represents the share of correct answers to the financial and debt literacy questions (see descriptive statistics in Table A3 in the Annex).

Additionally, we included two variables in the regression equation that could potentially affect respondents' credit behavior. The choice of these variables is due to their crucial nature for consumer behavior during the crisis. In the case of savings (see descriptive statistics in Table A4 in the Annex), we expect that a higher level of savings will mean that households will not be afraid of taking a loan (although they do not need it). We added the savings variable mainly due to its role in shaping the broadly understood behavior of households during the crisis (Kostakis, 2012; Finlay & Price, 2015). On the other hand, concerns about losing a source of income in the last months (to some extent, respondent's macroeconomic expectations) may significantly reduce the tendency to take out loans during the coronavirus pandemic (see descriptive statistics in Table A4 in the Annex). Consumer confidence in shaping own borrowing behavior (based on a sample of Polish citizens) was also confirmed by Kłopocka (2017).We also tested possible collinearity; however, no individual VIFs exceed the value of 4, and no median VIF value for each model cross the value of 2.

In our regression, we have to consider the endogeneity issue. The endogeneity of the literacy variable is widely discussed in customer behavior research (e.g., Yeh & Ling, 2021 or Rooij et al., 2012). In our study, the endogeneity issue can be described as a feedback relationship between literacy and the respondent's borrowing intentions. Literacy influences borrowing intentions, but borrowing intentions may also affect financial literacy. We used an instrumental variable analysis to deal with endogeneity. In this analysis, we first estimated $Literacy_i$ with the same explanatory variables as in equations (1) and (2) (we called them $Controls_i$) and then extended the equation by an additional instrument (IV_i).

[3] The average salary in Poland in 2020 amounted to approx. PLN 3,800 net.

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$$\widehat{Literacy}_{\iota} = \widehat{\alpha} Controls_i + \widehat{\gamma} IV_i + \varepsilon_i \quad (3)$$

where $\widehat{\alpha}$ and $\widehat{\gamma}$ are estimated coefficients. If IV_i is uncorrelated with the residuals in equation (1), the $\widehat{Literacy}_{\iota}$ will also not be correlated with residuals. Therefore, in the second stage regression, we can apply $\widehat{Literacy}_{\iota}$ with no endogeneity.

$$C_{i,COVID} = \beta_2 DV_i + \delta_2 Income\ f\ ears_i + \theta_2 Savings_i + \upsilon_2 \widehat{Literacy}_{\iota} + \varepsilon_i \quad (4)$$

The discussion has to be held using an appropriate instrument IV_i. Based on the literature, some authors used instruments such as siblings' education (Van Rooij et al., 2011), numerical skills at the district (Morgan & Trinh, 2019), and respondents' abilities to understand financial questions asked in the survey (Cupák et al., 2019). In our case, we used respondents' experiences in the credit market. We defined experiences as the number of credit types that a respondent had had throughout their life (see descriptive statistics in Table A5 in the Annex). Experience in the credit market clearly influences higher literacy (Lusardi & Tufano, 2015). However, more experiences with repaid credits do not necessarily mean that a given respondent is more inclined to incur debt in the future. It should also be remembered that the C_i variable does not result from the respondent's actual indebtedness, but from their answer about hypothetical willingness to incur debt under certain circumstances during the pandemic. On the one hand, people who used credit extensively in the past may be more cautious about incurring liabilities during the pandemic or they may no longer have the capacity to take out new loans (negative correlation mechanism with C_i). On the other hand, credit skills acquired via experiences can reduce the fear of debt (positive correlation mechanism with C_i). Therefore, recognizing that the correlation between C_i and credit experiences may be bidirectional, we decided to use credit experience as an instrument. We also calculated the correlation coefficient between the experience variable (i.e. the number of credit types that a respondent had had throughout their life) and various variants of C_i presented in the article. The average correlation coefficient is only 0.13. Furthermore, we tested the endogeneity issue and the strength of our instrument with the Wu-Hausmann test and F-statistics for the first-stage regression.

4. RESULTS

When looking at the proportion of correct answers to the financial and debt literacy questions in the research sample, it should be noted that the Polish society is characterized by an average level of financial literacy and a low level of debt literacy. The same questions were asked in different countries and at different times. A summary of the research in this area was presented by Lusardi and Mitchell (2014). The share of respondents who correctly answered all financial literacy questions is 42%, putting Poland behind countries such as Canada, Australia, and Germany. However, this proportion is higher than that observed for Finland, France, or the United States. Nevertheless, it should be noted that these studies were carried out in different years. In terms of debt literacy, the average respondent's score is very low and equals 26.3% (see descriptive statistics in Table A3 in the Annex). Questions about debt literacy were also asked by various researchers (including a sample of Polish citizens). Cwynar (2022), using an internet-based survey on a purposive sample of 1,055 borrowers, obtained very similar results to ours (see Table 2).

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Table 2
Debt literacy questions – different research comparison

Reseach	DLI	DLII	DLIII
Cwynar (2022)	43%	21%	7.5%
Kurowski and Malinowska-Misiąg (2021)	44%	21%	15%

Source: Cwynar (2022).

Comparing the percentage of correct answers by Poles to other international studies (e.g. Lusardi & Tufano, 2015 or Van Ooijen & van Rooij, 2016), it should be noted that Poles score much worse in DL II (the minimum payment question). This may be related to the fact that this questions is more related to mathematical competences, which are challenging for Polish citizens (Cwynar et al., 2019).

In the next step, we checked the importance of financial literacy for the intention to borrow during the pandemic. OLS regression results are presented in Table 3.

Table 3
Regression results for loan installment variable assuming the different levels of income during the pandemic

Reference variable	Variables	(1) Loan PLN 2,500 sound	(2) Loan PLN 2,500 overindebt	(3) Loan PLN 5,000 sound	(4) Loan PLN 5,000 overindebt
Male	Gender (Male)	29.92228 (45.63197)	-105.8954 (140.007)	-146.183 (123.4549)	-472.1427 (459.4724)
Degree Elementary	Middle-high	283.8772*** (59.53164)	184.9255 (152.9491)	260.9087 (161.0597)	507.1173 (501.9455)
	High	365.6988*** (63.35884)	59.1021 (180.9559)	460.5865*** (171.414)	141.6062 (593.8576)
Age 18–34	Age 35–54	135.8758*** (49.60538)	-128.5478 (158.85)	259.1822* (134.2047)	-521.3924 (521.3111)
	Age more 54	-37.34342 (58.85418)	242.7282 (156.1126)	-47.68121 (159.2269)	68.33218 (512.3275)
	Income fears	2.170676 (12.09262)	92.47938*** (31.87419)	-4.975339 (32.71593)	163.3598 (104.6041)
	Savings	7.876928*** (2.118632)	47.07716*** (8.969706)	19.74518*** (5.731846)	51.20116* (29.43661)
	Literacy	534.3928*** (93.18839)	-111.3237 (335.6921)	2523.348*** (252.1163)	1535.188 (1101.668)
	Sample	1178	122	1178	122
	R-square	0.4923	0.4897	0.4666	0.3018

Note: The table presents OLS regression for loan installment during the pandemic that the respondent is willing to pay depending on the level of income (2,500 for columns 1 and 2; 5,000 for columns 2 and 3), with standard error in the brackets. *, **, and *** denote statistical significance at 10%, 5%, and 1%, respectively. The column with models 1 and 3 estimates parameters for respondents who do not have problems with repaying their debts, while columns 2 and 4 estimate parameters for overindebted respondents.

Source: Authors' calculations.

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According to the regression results, debt and financial literacy significantly influence the borrowing intentions, but only for financially sound respondents (see significant positive parameters in the literacy variable in Table 3 and models 1 and 3). The direction is positive – higher literacy is associated with higher borrowing intentions. People with greater financial and debt literacy are possibly financially better prepared for the pandemic period and do not reduce the intentions to borrow. This anticipation is also supported by the positive and significant parameter near savings. A higher level of savings means that respondents could have accepted higher indebtedness. As expected, financial literacy does not play a significant role if we look at the sample of overindebted people (see insignificant parameters in literacy variable in Table 3 and models 2 and 4). According to Lusardi and Tufano (2015), financial literacy by itself reduces overindebtedness. However, our study showed that during the pandemic, financial literacy does not increase the intention to borrow for overindebted individuals (oppositely to financially sound respondents).

Looking at the other variables, it should be emphasized that borrowing intentions during the pandemic are higher among middle-aged and more educated respondents. According to the results, young adults (18–34 years old) are significantly less willing to borrow during the pandemic than people aged 35–54. Faced with lower incomes, young people are reluctant to take on liabilities hence their intentions to borrow are limited. Older people, often of retirement age, are also unwilling to take on debt in times of a pandemic.

In the next stage, we explored the validity of treating the literacy variable as endogenous. According to Wu-Hausmann test results (see Table 4), this variable is endogenous. Therefore, it was reasonable to conduct a second stage regression after estimation of the literacy variable with an appropriate instrument (IV_i). We used credit experience as an instrument (i.e., the respondent's indication of whether they had ever taken out a given type of loan out of eight possible options[4]). The F-statistics presented in Table 4 indicates that our instrument has adequate strength. The level of estimated parameter near the literacy variable and its significance confirms, to even greater extent, that literacy increases a given consumer's intention to borrow during the pandemic (but it is valid only for financially sound respondents).

Table 4
Literacy parameters estimations for 2SLS regression

Variable	Loan PLN 2,500 sound	Loan PLN 2,500 overindebt	Loan PLN 5,000 sound	Loan PLN 5,000 overindebt
Literacy	3003.279** (972.609)	4025.57 (4255.522)	7957.843*** (2441.983)	4977.57 (9553.422)
Wu-Hausmann	11.5947***	2.6482	6.9121**	0.1589
F-statistics	19.4127***	1.6871	19.4127***	1.6871

Note: The table presents the coefficients of literacy variables in 2SLS regression (see equation 4). The dependent variable is indicated in the first row and concerns the pandemic period. The standard error is given in parentheses under the coefficient value. *, **, and *** denote statistical significance at 10%, 5%, and 1%, respectively.

Source: Authors' calculations.

In addition, we verified whether the conclusions regarding the borrowing intentions are also applicable for the pre-crisis periods (during normal times). To accomplish this, we asked respondents a question about the possibility of loan repayment a year before the coronavirus pandemic and re-calculated the dependent variable C_i, which we explained with the same explanatory variables as in previous stages of the analysis. Some descriptive statistics for C_i in

[4] The types of credit that could be selected were car loan, mortgage loan, renovation loan, installment loan, overdraft, credit card loan, cash loan, and loan for students.

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the pre-COVID period are presented in Table A2 in the Annex. Moreover, Table 5 demonstrates OLS regression results for the pre-COVID C_i, while the literacy variable coefficients assuming endogeneity have been shown in Table 6.

Table 5
Regression results for loan installment variable assuming the different levels of income one year before the pandemic

Reference variable	Variables	(1) Loan PLN 2,500 sound	(2) Loan PLN 2,500 overindebt	(3) Loan PLN 5,000 sound	(4) Loan PLN 5,000 overindebt
Male	Gender (Male)	-7.158041 (48.11053)	-163.661 (161.8376)	-292.391** (133.4168)	-630.4376 (415.4251)
Degree Elementary	Middle-high	280.6303*** (62.76518)	285.9632 (176.7977)	397.137** (174.0561)	465.0405 (453.8265)
	High	331.3703*** (66.80025)	144.7581 (209.1714)	600.2362*** (185.2458)	454.235 (536.9275)
Age 18–34	Age 35–54	161.8479*** (52.29976)	-58.49017 (183.6187)	288.4703** (145.0341)	-205.9774 (471.3356)
	Age more 54	-48.02436 (62.05091)	157.3307 (180.4545)	-8.095711 (172.0753)	567.1901 (463.2132)
	Income fears	13.4055 (12.74944)	84.17458** (36.84417)	21.85163 (35.35587)	182.4372* (94.57625)
	Savings	8.828286*** (2.233708)	43.82315*** (10.36831)	20.99245*** (6.194363)	34.6391 (26.61467)
	Literacy	670.5187*** (98.25004)	146.0685 (388.0349)	2609.86*** (272.4602)	1110.327 (996.0567)
	Sample	1178	122	1178	122
	R-square	0.5183	0.4817	0.4773	0.3682

Note: The table presents OLS regression for loan installment one year before the pandemic that the respondent is willing to pay depending on the level of income (2,500 for columns 1 and 2; 5,000 for columns 2 and 3), with standard error in the brackets. *, **, and *** denote a statistical significance at 10%, 5%, and 1%, respectively. The column with models 1 and 3 estimates parameters for respondents who do not have problems with repaying their debts, while columns 2 and 4 estimate parameters for over-indebted respondents.

Source: Authors' calculations.

Table 6
Literacy parameters estimations for 2SLS regression

Variable	Loan PLN 2,500 sound	Loan PLN 2,500 overindebt	Loan PLN 5,000 sound	Loan PLN 5,000 overindebt
Literacy	3660.316*** (1078.982)	3105.998 (3956.213)	9491.827*** (2756.206)	10734.76 (11101.05)
Wu-Hausmann	14.8369***	0.9466	9.3298**	1.3762
F-statistics	19.4127***	1.6871	19.4127***	1.6871

Note: The table presents the coefficients of literacy variables in 2SLS regression (see equation 4). The dependent variable is indicated in the first row and concerns the pre-pandemic period. The standard error is given in parentheses under the coefficient value. *, **, and *** denote statistical significance at 10%, 5%, and 1%, respectively.

Source: Authors' calculations.

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Re-conducted analyzes confirm that our conclusions are also applicable in normal times. From the perspective of our proposition, it has been proven that financial literacy will significantly improve the borrowing intentions for financially sound individuals. Again, for the overindebted, financial literacy proved to be an insignificant variable.

5. DISCUSSION

According to our findings, financial literacy increases borrowing intentions for financially sound individuals. It is probably because financial literacy raises awareness and knowledge of banking products principles, eliminating the fears associated with the use of financial services. In this regard, our results align with other reports on the role of financial literacy in promoting healthy financial behavior.

Our research showed that middle-aged groups are more willing to borrow. Younger age groups have significantly higher debt aversion. This may be due to the fact that the younger generation is more cautious about the future (see the income fears variable in Table A4) and responds to the pandemic by reducing their borrowing intentions (it is also applicable to the pre-pandemic period). In this context, Henry (2017) also confirmed that young adults would increase their savings for unknown future needs. Also, Keese (2012) showed that household heads older than 45 years have a higher debt burden than younger household heads, supporting our conclusions about younger age groups' debt aversion.

Borrowing intentions in our research are not gender dependent. The mechanism of gender influence on credit decisions varies and conflicting results have been proposed in different reports. Chivakul and Chen (2008) highlighted that females are more likely to incur debt. On the other hand, Almenberg et al. (2020) found that women are more likely to be uncomfortable with debt. Considering financial attitudes, females are generally more risk-averse than males (Levin et al., 1988; Pinjisakikool, 2018). Similar to other studies on the sample of Polish citizens (Filipek et al., 2019), we also confirmed the existence of the gender gap in debt literacy.

The impact of education on borrowing intentions is also worth mentioning. According to our findings, the higher the level of education, the greater the willingness to borrow. These results are consistent with previous research. According to Tang and Guo (2017), each additional year of a household's head education would increase the probability of borrowing by 2.5%. The increased likelihood of "healthy" borrowing among educated people is often due to a better understanding of loan applications and debt management (Akram et al., 2008; Chandio et al., 2020).

6. CONCLUSIONS

The restrictions related to the coronavirus pandemic had a significant impact on the situation of households and their behavior in the credit market. The aim of the article was to determine how financial literacy influences household borrowing intentions during the coronavirus pandemic. In the literature, we can find research confirming the positive impact of financial literacy on healthy financial behavior in terms of savings, pension planning, and participation in the financial market and welfare. To a lesser extent, the research investigates the financial behavior of households in crisis times. Conducting a CAWI survey among 1,300 Polish citizens in June and July 2020 (i.e., during the peak of pandemic restrictions) made it possible to assess the role of financial literacy for borrowing intentions during the coronavirus pandemic.

Our study confirms that highly literate households are better prepared for a pandemic period and do not reduce the willingness to borrow. Respondents with a higher level of financial literacy are less hesitant to use credit products during the pandemic. Our findings are applicable to

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normal (non-crisis) times as well. Considering sociodemographic factors, debt aversion (in terms of limited borrowing intentions) is a feature of young adults and low educated people. Our conclusions are supported by OLS regression and an instrumental variable analysis.

During the coronavirus pandemic, the growth rate of loans in Poland (especially in the consumer loan segment) decreased to a level slightly above 0% (from 8% at the end of 2019) (National Bank of Poland, 2020). This research confirms that a financially literate society wants to continue borrowing even during a pandemic. This behavior allows a quick recovery from the recession. Importantly, financial literacy only strengthens the willingness to borrow for those who are financially sound. In the future, it will be intriguing to repeat the survey after the pandemic period. On the one hand, it will allow checking the impact of the coronavirus pandemic, and on the other hand, it will show whether households have drawn the right conclusions about personal finance management.

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ANNEX

Table A1
Literacy questions

Question	Answers
Financial Literacy I (FL I): Suppose you had PLN 100 in a savings account and the interest rate was 2% per year. After 5 years, how much do you think you would have in the account if you left the money to grow?	a) More than PLN 102; b) Exactly PLN 102; c) Less than PLN 102;
Financial Literacy II (FL II): Imagine that the interest rate on your savings account was 1% per year and inflation was 2% per year. After 1 year, how much would you be able to buy with the money in this account?	a) More than today; b) Exactly the same; c) Less than today;
Financial Literacy III (FL III): Please tell me whether this statement is true or false. "Buying a single company's stock usually provides a safer return than a stock mutual fund."	a) True; b) False;
Debt literacy I (DL I): Suppose you owe PLN 1,000 on your credit card and the interest rate you are charged is 20% per year compounded annually. If you didn't pay anything off, at this interest rate, how many years would it take for the amount you owe to double?	a) 2 years; b) Less than 5 years; c) 5 to 10 years; d) More than 10 years;
Debt literacy II (DL II): You owe PLN 3,000 on your credit card. You pay a minimum payment of PLN 30 each month. At an annual percentage rate of 12% (or 1% per month), how many years would it take to eliminate your credit card debt if you made no additional new charges?	a) Less than 5 years; b) Between 5 and 10 years; c) Between 10 and 15 years; d) Never, you will continue to be in debt; e) Do not know;
Debt literacy III (DL III): You purchase an appliance which costs PLN 1,000. To pay for this appliance, you are given the following two options: (a) Pay 12 monthly installments of PLN 100 each; (b) Borrow at a 20% annual interest rate and pay back PLN 1,200 a year from now. Which is the more advantageous offer?	a) Option (a); b) Option (b); c) They are the same; d) Do not know

Source: Own work.

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Table A2
Suppose you do not have any debt but would like to take out a loan. What maximal amount currently (or a year ago, before the coronavirus pandemic) would you be able to spend on monthly loan repayment if the average monthly earnings per person in your household were PLN 2,500 (or PLN 5,000) net?

Variable	Number	Intended monthly loan repayment during COVID-19 (income PLN 2,500)	Intended monthly loan repayment during COVID-19 (income PLN 5,000)	Intended monthly loan repayment pre-COVID-19 (income PLN 2,500)	Intended monthly loan repayment pre-COVID-19 (income PLN 5,000)
Financially sound respondents (n = 1178)					
Gender					
Male	586	666.56	1655.87	748.29	1906.71
Female	592	734.88	1788.52	800.94	1908.84
Age					
18–34	479	662.72	1588.76	729.10	1773.69
35–54	463	788.44	1903.60	878.95	2084.41
Age > 54	236	609.50	1644.41	665.22	1833.50
Degree					
Elementary	110	528.44	1161.25	571.65	1105.03
Middle-high	559	655.50	1599.66	741.47	1802.93
High	509	789.35	1981.38	856.23	2196.46
Overindebt respondents (n = 122)					
Gender					
Male	56	487.78	954.46	590.67	952.71
Female	66	659.45	1632.16	758.93	1782.75
Age					
18–34	40	703.22	1732.65	774.85	1648.00
35–54	48	419.16	1025.00	618.75	1120.58
Age > 54	34	406.50	762.50	535.41	770.83
Degree					
Elementary	20	699.25	1046.00	614.00	1098.00
Middle-high	69	591.37	1431.11	730.49	1420.05
High	33	486.36	1257.75	620.72	1547.57

Source: Own work.

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Table A3
Financial literacy/debt literacy questions: Share of correct answers to a particular question.

Variable	FL I	FL II	FL III	DL I	DL II	DL III
Gender						
Male	75.7%	72.4%	75.9%	48.4%	25.1%	14.8%
Female	68.7%	54.1%	61.6%	39.1%	15.7%	14.3%
Age						
18–34	68.6%	53.6%	58.0%	42.8%	20.8%	15.8%
35–54	72.8%	67.1%	73.6%	44.0%	19.8%	15.7%
Age > 54	77.8%	74.1%	79.6%	44.8%	23.3%	10%
Degree						
Elementary	66.2%	50.8%	59.2%	33.8%	5.4%	12.3%
Middle-high	71.2%	61.1%	67.7%	42.0%	19.9%	12.9%
High	74.7%	68.5%	72.0%	48.0%	25.8%	17.0%

Source: Own work.

Table A4
Income fears question: On a scale of 0 (no worries) to 5, rate how concerned you have been in recent months about losing your source of income. **Savings question**: How many months is your household able to survive based only on its savings?

Variable	Income fears (from 0 to 5)	Savings (in months)
Gender		
Male	2.47	9.30
Female	2.89	6.08
Age		
18–34	2.87	7.23
35–54	2.83	7.89
Age > 54	2.01	7.20
Degree		
Elementary	2.48	5.45
Middle-high	2.70	6.89
High	2.70	8.68

Source: Own work.

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Table A5
What type of loan have you used in your life?

Variable	Car	Mortgage	Installment	Student	Cash	Renovation	Credit card	Overdraft
Gender								
Male	17.3%	23.1%	36.2%	3.9%	38.2%	8.7%	28.7%	17.2%
Female	15.0%	16.8%	30.0%	6.1%	34.3%	10.6%	22.0%	13.1%
Age								
18–34	14.3%	17.9%	26.6%	8.1%	32.4%	9.8%	17.0%	9.6%
35–54	18.2%	26.2%	37.8%	3.3%	38.6%	9.6%	29.7%	17.4%
Age > 54	15.9%	11.9%	36.7%	2.2%	39.3%	9.6%	33.0%	21.1%
Degree								
Elementary	8.5%	10.8%	31.5%	0.8%	31.5%	10.0%	13.8%	12.3%
Middle-high	13.2%	15.4%	31.8%	4.0%	39.5%	8.1%	22.9%	12.7%
High	21.4%	27.3%	34.9%	7.2%	33.6%	11.4%	30.8%	18.5%

Source: Own work.

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