A Factor Analysis of the Impact of Digitalisation on the Banking Industry

Analiza czynnikowa wpływu cyfryzacji na sektor bankowy

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ABSTRACT

Objective: This paper examines the impact of digitalisation on the banking industry. Research done to date in the field has led to conclusions mainly in favour of digitalisation. Foremost among the positive arguments is that the quality of banking is improved, with customer service sped up; internal business processes are optimised; and the profitability and efficiency of banking are both boosted. We questioned these arguments and used factor analysis to examine the relationship between profitability, the share of problem bank loans and online payments in 87 countries.

Research Design & Methods: Factor analysis, used to determine the correlation between different variables; retrospective analysis, which made it possible to analyse the data taking into account the factor of time; a systematic approach to identifying problem areas and drawing conclusions from the study.

Findings: The results of the study showed digitalisation to have a negative impact on the indicators of banking activity analysed. Countries with a higher level of Internet use for payments have lower returns on banking assets and have a higher share of problem assets in their portfolios. Analysing data from 2014, we found the year to be somewhat of a turning point for banking. Banks were not as fully engaged with digital technologies and innovations. As a result, fintech companies quickly competed with banks and gained market share. Data from 2017 show a decrease in the impact of the share of payments made via the Internet on the return on bank assets. However, a comparison of 2014 and 2017 showed, on the contrary, a worsening of the impact of the relationships between the share of online payments and the quality of banks' loan portfolios. Thus, in countries with a higher level of Internet use for payments, the riskiness of the banking business increases.

Implications/Recommendations: It is therefore appropriate for banks to use digital technologies not only to increase sales and improve the quality of customer service but also to improve scoring and financial monitoring systems. Innovative AI and big data systems and customer identification allow for a better assessment of the borrower's creditworthiness and potential risks. Attention should likewise be paid to improving the population's financial literacy. Banks must also take responsibility for educating their customers through digital technology. Chatbots, which are now used primarily to increase sales and advise customers, can serve as a training format and draw attention to customers' typical financial mistakes. In addition, chatbots can provide advice to customers on the profitable investment of free funds.

Contribution: Digitalisation provides banks with considerable opportunities, while at the same time creating risks banks have not yet learned to deal with.

Article type: original article.

Keywords: digitalisation, digital technologies, banking system, innovations, fintech.

JEL Classification: E58, G18, G21, C10.

STRESZCZENIE

Cel: W artykule dokonano analizy wpływu cyfryzacji na branżę bankową. Przeprowadzone dotychczas badania wskazują, że wpływ ten jest zazwyczaj pozytywny. Cyfryzacja przyczynia się przede wszystkim do: poprawy jakości usług bankowych i przyspieszenia obsługi klienta, optymalizacji wewnętrznych procesów biznesowych oraz zwiększenia rentowności i wydajności branży bankowej. Ustalenia te zakwestionowano i, wykorzystując analizę czynnikową, zbadano relacje między rentownością, udziałem pożyczek bankowych obarczonych ryzykiem i płatnościami online w 87 krajach.

Metodyka badań: W badaniach zastosowano analizę czynnikową do określenia korelacji między różnymi zmiennymi, analizę retrospektywną, która umożliwiła analizę danych z uwzględnieniem czynnika czasu, oraz systematyczne podejście do identyfikacji obszarów problemowych i wyciągania wniosków z badań.

Wyniki badań: Wykazano, że cyfryzacja ma negatywny wpływ na analizowane wskaźniki działalności bankowej. Kraje, które w większym stopniu wykorzystują internet w obsłudze płatności, mają niższe zwroty z aktywów bankowych i wyższy udział aktywów problematycznych w swoich portfelach. Analizując dane z 2014 r., stwierdzono, że rok ten stanowił dla branży

bankowej punkt zwrotny. Banki nie wykorzystywały w pełni technologii cyfrowych i innowacji. W efekcie firmy fintechowe zaczęły konkurować z bankami i zdobywały udział w rynku. Dane z 2017 r. pokazują spadek w zakresie wpływu udziału płatności dokonywanych przez internet na rentowność aktywów bankowych. Porównanie danych z lat 2014 i 2017 prowadzi jednak do odmiennego wniosku dotyczącego relacji między udziałem płatności internetowych a jakością portfeli kredytowych banków. W krajach, które w większym stopniu wykorzystują internet do obsługi płatności, rośnie ryzyko banków.

Wnioski: Banki powinny wykorzystywać technologie cyfrowe nie tylko do zwiększania sprzedaży i poprawy jakości obsługi klienta, ale także do ulepszania systemów scoringowych i monitoringu finansowego. Innowacyjne systemy AI i *big data* oraz identyfikacja klientów pozwalają na lepszą ocenę zdolności kredytowej i ryzyka. Należy również zwrócić uwagę na konieczność poszerzania wiedzy społeczeństwa o finansach. Banki muszą także wziąć odpowiedzialność za edukację swoich klientów za pomocą technologii cyfrowych. Chatboty, które obecnie wykorzystywane są przede wszystkim do zwiększania sprzedaży i doradztwa, mogą być stosowane w celach szkoleniowych i wskazywać na typowe błędy finansowe popełniane przez klientów. Ponadto chatboty mogą udzielać klientom porad dotyczących inwestowania z zyskiem wolnych środków.

Wkład w rozwój dyscypliny: Cyfryzacja daje bankom duże możliwości, ale jednocześnie stwarza ryzyko, z którym nie nauczyły się one jeszcze sobie radzić.

Typ artykułu: oryginalny artykuł naukowy.

Słowa kluczowe: cyfryzacja, technologie cyfrowe, system bankowy, innowacje, fintech.

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1. Introduction

The COVID-19 forced quarantine, introduced by most countries to curb the spread of the disease, further illustrated the importance of developing and implementing modern digital technologies. During quarantine, most businesses were forced to suspend their operations, and only digital technology allowed them to continue to operate online. Such changes sometimes led to shifts in the business model, sales directions, organisational structures, and communication within the company.

In a few months, digitalisation as an evolutionary stage in the development of the country's economy, at one point, revolutionised it completely. Having shown that in the face of dangerous challenges, this is the only way to function.

The banking sector is no exception. While we see a lack of alternatives to digital technologies for banks, there is some question surrounding the impact of digitalisation on banks' economic performance. Is it always a positive phenomenon that brings only benefits to the bank? If not, what should be done to increase the maximum efficiency of this process in terms of its non-alternative.

The purpose of this article is to study the impact of digitalisation on the activities of banks by identifying the relationship between profitability, the share of problem

loans banks hold, and the volume of payments via the internet to pay bills or online purchase in the past 12 months.

In the course of the research we used various methods: statistical, to determine the correlation between different variables; retrospective analysis, to analyse the data while accounting for the factor of time; and a systematic approach to identifying problem areas and draw conclusions from the study.

2. Digitalisation in Banking Industry

Digitalisation is revolutionising the way we do business through industrial value chains using the Internet of Things, intensive data exchange, and analytics forecasting. Digitisation is of vital importance to data processing, storage and transmission, because it "allows information of all kinds in all formats to be carried with the same efficiency and also intermingled". Unlike analog data, which typically suffers some loss of quality each time it is copied or transmitted, digital data can be transmitted with absolutely no deprivation (Harchekar 2018).

Digital transformation is much more than investment. It is a commitment to implementing new technologies and to the adjustment process across the whole organisation (Hyatt 2018). Banks of all sizes and across all regions are making huge investments in digital initiatives in order to maintain a competitive edge and deliver maximum value to their customers. Digitalisation leads to data analytics and intelligence, which helps banks develop closer relationships with customers (Deshpande 2018).

Most researchers are positive about the impact of digitalisation, noting that automating and optimising internal business processes in a bank can increase productivity and profitability, save costs, speed up production and significantly reduce errors (Parida, Sjödin & Reim 2019, Grubic & Jennions 2018, Hasselblatt *et al*. 2018, Schmidt, Drews & Schirmer 2017, Sjödin *et al*. 2018, Rodin, Ganiev & Orazov 2019, Musina 2020, Ebrahim, Kumaraswamy & Abdulla 2021). However, it is not enough just to introduce technological innovations. A bank's digital transformation does not revolve merely around purchasing new technologies, but rests on finding new opportunities and markets, and new ways of conducting operations (Mirković, Lukić & Martin 2019).

In order to make a profit from digitalisation, a bank's existing business model must be turned into to an innovative one, by overhauling customer service. One of the greatest challenges for banks in doing this is to translate the bulk of their data into meaningful information (Mirković, Lukić & Martin 2019).

Digitalisation is the driving force that promotes business development and radically changes it. Companies spend millions of dollars to innovate.

According to the Global Banking Outlook 2018, banks see opportunities for further growth by embracing the IT sector, using it not only to expand the customer base but also to increase efficiency (Fig. 1).
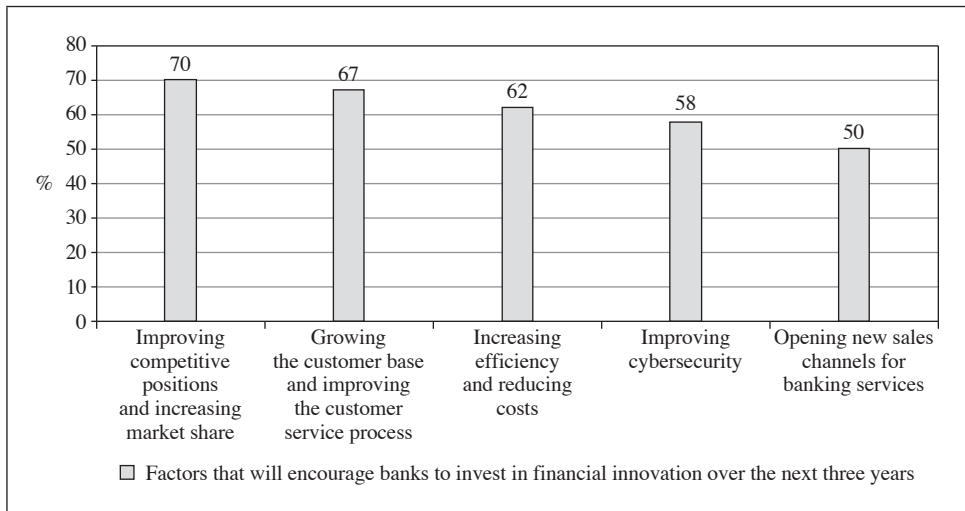
Fig. 1. The Main Factors That Encourage Banks to Invest in Financial Innovation over the Next Three Years

Source: built on Global Banking Outlook data for 2018, https://www2.deloitte.com/ro/en/pages/financial-services/articles/2018-banking-outlook.html (accessed: 14.07.2020).
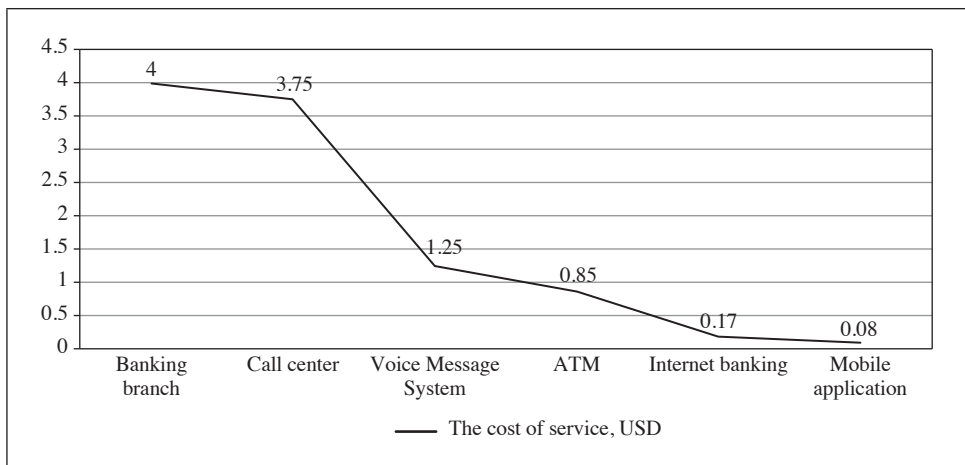

Fig. 2. The Cost of Banking Customer Service Channels, in USD

Source: built on Financial Conduct Authority data for 2018, https://www.fca.org.uk/ (accessed: 14.07.2020).

As Figure 1 shows, the quantitative factor, which involves increasing profitability and cost optimisation, was only in third place. Other factors will affect the quality

of the bank and its services. We shall now try to determine how profitable fintech innovations are for banks.

Figure 2 shows that online channels are the most effective means to selling banking products and services online (Internet banking and mobile applications). In addition, a study conducted by the Financial Conduct Authority (FCA) found that users of mobile applications interact with their bank 20 times more often than those who carry out their financial transactions in person. Barclays was the first bank to use Internet banking. As the results of an internal study showed, customers visit the branches of this bank on average twice a month, and the bank's mobile services 18 times.

3. The Methodology of Factor Analysis of the Impact of Digitalisation on Bank Activity

For our study, to assess the impact of digitalisation on bank activity, we set out to identify the relationship between profitability and the share of problem banking loans, capitalisation and the volume of online payments.

The last available report from the Global Findex Database, which is widely used by scholars and practitioners, was prepared by the Development Research Group of the World Bank and with the financial support from the Bill & Melinda Gates Foundation. It is based on surveys carried out among more than 150,000 adults in over 140 economies in 2014 and 2017 (Global Findex Database 2017).

At the intersection of the International Monetary Fund databases and the Global Findex Database, we formed a sample of data from 87 countries for 2014 and 2017 with indicators including:

– return on assets, % (*ROA*) (International Monetary Fund 2020);

– bank non-performing loans to total loans (International Monetary Fund 2020), % (*NpL*);

– bank regulatory capital to risk-weighted assets (International Monetary Fund 2020), % (*CAP*);

– the percentage of respondents (employees aged 15+) who reported using the internet to pay bills or buy something online in the past 12 months (Global Findex Database 2017) was chosen as a proxy for the use of modern information technologies in the banking services market, % (*FL*).

4. The Results of Factor Analysis of the Impact of Digitalisation on Bank Activity

Graphical and statistical analysis of the sample shows a decrease in the scattering of ROA and an increase in the scattering of distressed assets, capital, and

payments on the Internet. For all four indicators, there is a shift towards an increase over the period 2014–2017 (Table 1).

Table 1. Statistical Characteristics of the Sample

Valid N = 90	Mean	Minimum	Maximum	Lower Quartile	Median	Upper Quartile	Std.Dev.
2014ROA	1.379	−4.243	6.435	0.672	1.228	1.990	1.485
2017ROA	1.416	−1.761	4.294	0.865	1.303	1.972	0.991
2014NPL	6.333	0.510	44.972	2.060	3.981	7.781	7.161
2017NPL	6.698	0.480	54.541	2.053	3.257	9.980	8.631
2014CAP	16.988	9.368	35.653	14.743	16.642	17.948	3.634
2017CAP	18.529	10.482	31.031	16.100	18.087	20.397	3.708
2014FL	0.262	0.007	0.896	0.039	0.137	0.444	0.273
2017FL	0.398	0.009	0.973	0.124	0.295	0.696	0.305

Source: the authors.

We selected regression models to assess the structural relationship between the selected indicators in the sample in 2014 and 2017 and then compare them.
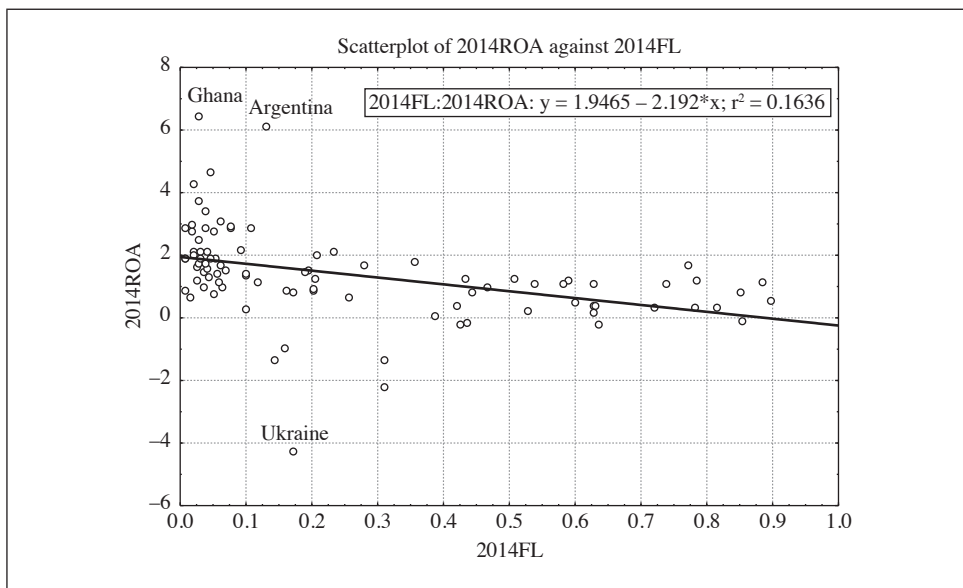

Fig. 3. Dependence of Return on Assets and Use of the Internet for Payments in 2014
Source: the authors.

Figures 3 and 4 show the structural relationship between ROA and the use of the Internet for payments in 2014 and 2017. The most atypical countries with extremely high ROA values were Ghana and Argentina, where the percentage of Internet use for payments was low, at 3–9% (sample quarters I–II) and 13–23% (sample quartiles II), respectively.

In both cases, there is an inverse relationship between the indicators: on average, countries with a higher level of Internet use for payments have lower returns on banking assets.

The main reason for this paradox is likely the emergence of fintech companies on the banking market. Thus, a larger share of online payments may be associated with a greater loss of bank customers to the fintechs. If a few years ago the main competition for customers was between the banks themselves, fintechs are now becoming full players in the banking market. Innovative, dynamic, ready for the most loyal customer service with a minimum margin, these companies are gradually increasing their share in the banking retail market. For example, in 2014 fintechs' share in conducting money transfers and payments was 15%, but by 2017 had increased to 50%. 65% of consumers who have made payment transactions through a fintech are satisfied and plan to continue working with them in the future.
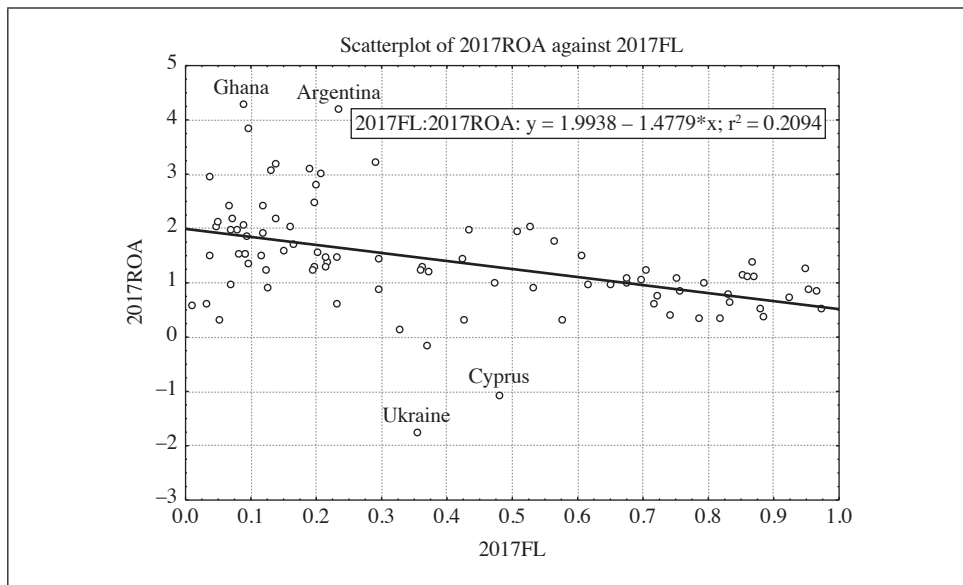

Fig. 4. Dependence of Return on Assets and Use of the Internet for Payments in 2017
Source: the authors.

A retrospective analysis shows that since 2014, many banks have started launching their own online payment and web banking systems, while reducing the number of bank branches and employees. Accordingly, in 2017 profitability jumped over 2014 levels.

On the other hand, the good news is that the banking industry is adapting to financial services being run online and is less affected by increasing usage of online payments on its return. This is illustrated by the decrease in the regression coefficient of the 2017 model relative to the 2014 model. For the countries sampled, a one-percent increase in the number of employees using online payments was accompanied by an average decrease of 0.022% of bank ROA in 2014. In 2017, meanwhile, the reverse link between the online payments and return on bank assets was still preserved, though to a lesser extent. A comparison of Cyprus and Ukraine for 2017 reveals that more online payments on average had 0.015% less return on bank assets per 1% difference. This indicates that the growth of the use of the Internet for payments is accompanied, among other things, by improved profitability in the banking sector.

We compare the impact of the introduction of financial technologies on the effectiveness of the banking business with such determinants as capital and the share of problem loans, building structural regression models for the sample for 2014 and 2017:

$$ROA = b_0 + b_1\, NpL + b_2\, CAP + b_3\, FL + \varepsilon. \qquad (1)$$

The regression models we obtained for bank non-performing loans to total loans have satisfactory statistical characteristics (Tables 2 and 3) with residues close to the normal distribution (Fig. 5 and 6).

Table 2. Estimates and Statistical Characteristics of Regression Equation (1) according to 2014 Data

Specification	Beta	Std.Err. of Beta	B	Std.Err. of B	$t(86)$	p-level
Intercept	–	–	0.995	0.630	1.58	0.12
2014NPL	−0.37	0.09	−0.077	0.018	−4.28	0.00
2014FL	−0.47	0.09	−2.530	0.478	−5.29	0.00
2014CAP	0.22	0.09	0.090	0.036	2.53	0.01

Regression summary for dependent variable: 2014ROA $R^2 = 0.35$, adjusted $R^2 = 0.33$, $F(3.86) = 15.4$.

Source: the authors.

Table 3. Estimates and Statistical Characteristics of Regression Equation (1)
according to 2017 Data

Specification	Beta	Std.Err. of Beta	B	Std.Err. of B	$t(86)$	p-level
Intercept	–	–	2.35	0.467	5.041	0.00
2017NPL	−0.38	0.089	−0.04	0.010	−4.306	0.00
2017FL	−0.55	0.089	−1.77	0.288	−6.164	0.00
2017CAP	0.01	0.088	0.00	0.024	0.148	0.88

Regression summary for dependent variable: 2017ROA $R^2 = 0.36$, adjusted $R^2 = 0.34$, $F(3.86) = 16.2$.
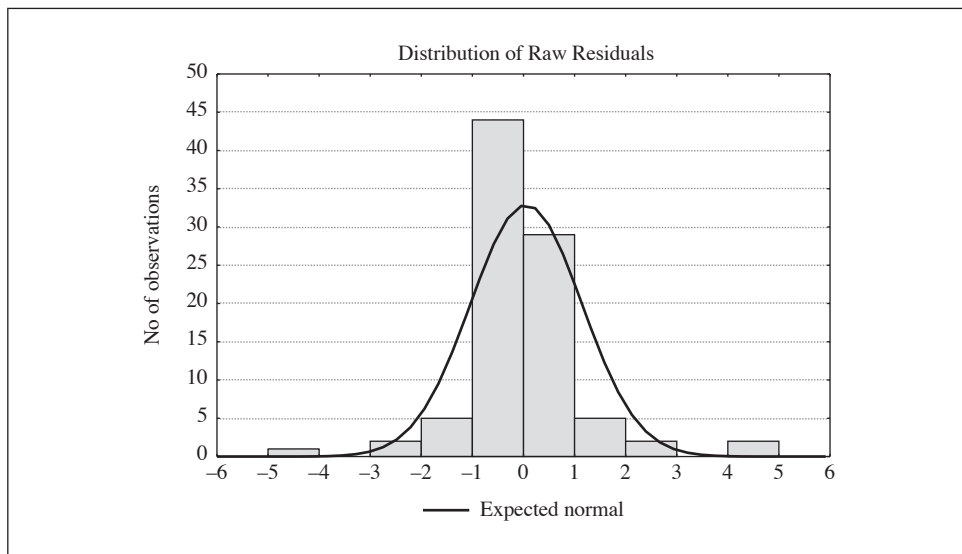
Source: the authors.

Fig. 5. Comparison with the Normal Distribution of the Regression Model Residues
according to 2014 Data

Source: the authors.

Beta odds show that online payments are most closely linked to ROA, with the effect growing over time. Instead, the statistical insignificance of the regression models for the capital factor proved an unexpected result.

Another important indicator is the interdependence between the share of problem loans in the structure of bank assets and the use of the Internet. Consider a similar relationship with the risk index in the banking market – the share of problem loans.
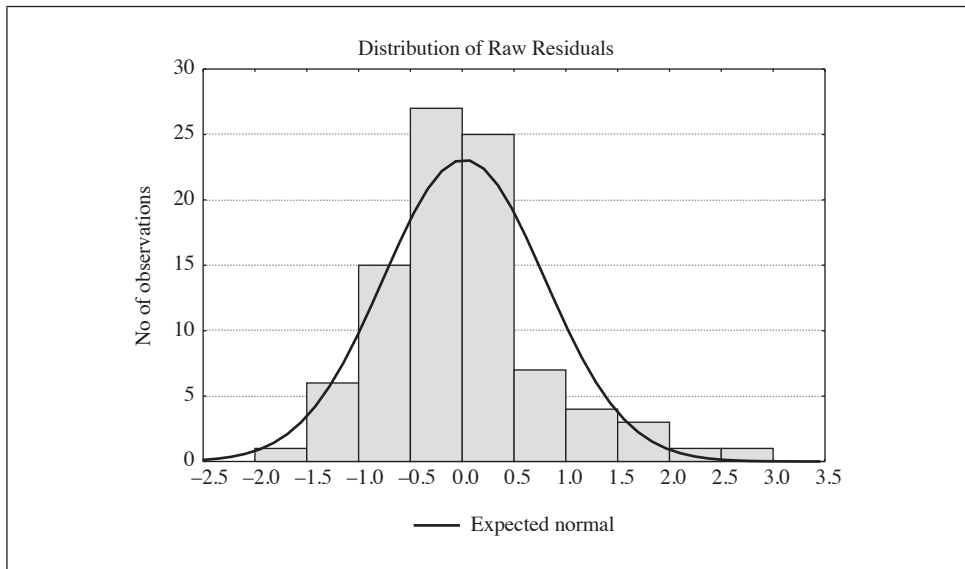
Fig. 6. Comparison with the Normal Distribution of the Remnants of the Regression Model according to 2017 Data

Source: the authors.

The relationship between the share of problem assets and the level of Internet use for payments is also inverse: on average, countries with a higher level of Internet use for payments have a smaller share of problem bank loans. A comparison of these structural relationships for 2014 and 2017 shows that over time, the inverse relationship deepens. 2014 is characterised by the following average estimates: if one country had 1% more users who used the Internet for payments, its share of problem bank loans was on average 0.03% lower. In 2017, the difference in the share of non-performing loans doubled to 0.06%. Thus, in countries with a higher level of Internet use for payments, the riskiness of the banking business increases.

Here are the results of another study that shows potential negative trends in the behaviour of consumers of banking services. Bank customers aged 19 to 35 were interviewed. They revealed that the banking services customers were most interested in using included opening a bank account (60% of customers), payments and money transfers (86%), personal loans (68%), and online mortgage services (62%). An interesting development in this study is the significant proportion of young people willing to borrow money online. Security, speed, and convenience are all impressive benefits, but a mortgage that involves a financial commitment for decades requires a more prudent approach.

The results of both studies show the dilemma banks are facing. On the one hand, the younger generation is creating demand for online lending. However, according to the results of our study, this has a negative impact on the quality of bank loan portfolios and at some point may have a "soap bubble" effect. The crisis of 2008–2009, caused at root by the significant share of problem loans in banks' assets, is a clear example of all the potential consequences and threats of a reckless approach to the formation of loan portfolios.

5. Conclusions and Recommendations

Based on the results of the study, the following conclusions can be drawn:

– in 2014–2017, on average, banks enjoyed a higher rate of online payments but lower profitability. Competition with fintech companies, which can offer more attractive online payments and lower fees, is also forcing banks to reduce the cost of payments, reducing profitability;

– to remedy this situation and boost profitability, banks have in recent years begun in earnest to reduce operating costs for bank branches and staff. By implementing these measures and at the same time invest in the development and improvement of web banking systems, banks are improving their profitability. The results of the study show that further growth of online payments reduces the negative effect on bank profitability;

– the increase in online payments is commonly accompanied by an increase in the share of problem loans a bank makes. At the moment, convenience, ease and affordability, the advantages of online payments, do not always benefit the lender, but do in fact deteriorate the quality of a bank's loan portfolio. However, in this case, the fault lies not only with customers who may recklessly incur long-term financial obligations, but also with banks willing to finance the pursuit of short-term profits;

– the use of online payments is a determinant of bank performance, as evidenced by their closer relationship to profitability relative to capitalisation and the share of problem loans.

We therefore believe it is appropriate for banks to use digital technologies not only to increase sales and improve the quality of customer service but also to improve scoring and financial monitoring systems. Innovative AI and big data systems and customer identification improve the assessment of a borrower's creditworthiness and potential risks. For example, big data technologies provide information about typical purchases over the Internet, search queries, as well as the potential borrower's income and expenses. This is more informative than the data from official documents submitted to the bank with the loan application.

Attention should also be paid to improving financial literacy. The ease of making online payments and the convenience of getting online loans can provoke serious problems when not accompanied by an appropriate level of financial literacy.

The introduction of compulsory specialised courses in the school curriculum in order to educate adolescents will allow them to form a more responsible attitude to spending money. Banks must also take responsibility for educating their customers through digital technology. Chatbots, now used primarily to increase sales and advise customers, can serve as a training format and draw attention to the financial mistakes customers typically make. In addition, chatbots can provide advice to customers on the profitable investment of a customer's free funds.

In conclusion, digitalisation provides banks with considerable opportunities, but also creates risks that banks have not yet learned to address.

References

Deshpande B. (2018), *Digitalization in Banking Sector*, "International Journal of Trend in Scientific Research and Development", Special Issue, October, https://doi.org/10.31142/ijtsrd18677.

Ebrahim R., Kumaraswamy S., Abdulla Y. (2021), *Fintech in Banks: Opportunities and Challenges* (in:) *Innovative Strategies for Implementing FinTech in Banking*, eds Y.A. Albastaki, A. Razzaque, A.M. Sarea, IGI Global, Hershey PA, https://doi.org/10.4018/978-1-7998-3257-7.ch006.

Global Findex Database 2017, Retrieved from https://globalfindex.worldbank.org/#data_sec_focus (accessed: 14.07.2020).

Grubic T., Jennions I. (2018), *Remote Monitoring Technology and Servitised Strategies – Factors Characterising the Organisational Application*, "International Journal of Production Research", vol. 56(6), https://doi.org/10.1080/00207543.2017.1332791.

Harchekar J. (2018), *Digitalization in Banking Sector*, "International Journal of Trend in Scientific Research and Development", Special Issue, October, https://doi.org/10.31142/ijtsrd18681.

Hasselblatt M., Huikkola T., Kohtamäki M., Nickell D. (2018), *Modeling Manufacturer's Capabilities for the Internet of Things*, "Journal of Business & Industrial Marketing", vol. 33(6), https://doi.org/10.1108/jbim-11-2015-0225.

Hyatt J. (2018), *The Revolution Will Be Digitized, Perspectives from CFO Research. Field Notes: CFO*, April/May, https://www.cfo.com/applications/2018/05/digital-investments-revolution/.

International Monetary Fund (2020), Retrieved from https://data.imf.org/ (accessed: 14.06.2020).

Mirković V., Lukić J., Martin V. (2019), *Reshaping Banking Industry through Digital Transformation*. Paper presented at FINIZ 2019 – Digitization and Smart Financial Reporting, https://doi.org/10.15308/finiz-2019-31-36.

Musina A.A. (2020), *Digitalization of Banking – the Way to Create a «Bank of the Future»*, "Intelligence. Innovations. Investment", no 6, https://doi.org/10.25198/2077-7175-2019-6-10.

Parida V., Sjödin D., Reim W. (2019), *Reviewing Literature on Digitalization, Business Model Innovation, and Sustainable Industry: Past Achievements and Future Promises*, "Sustainability", vol. 11(2), https://doi.org/10.3390/su11020391.

Rodin B.K., Ganiev R.G., Orazov S.T. (2019), *«Fintech» in Digitalization of Banking Services* (in:) *Proceedings of the International Scientific and Practical Conference on Digital Economy* (*ISCDE 2019*), Atlantis Press, https://doi.org/10.2991/iscde-19.2019.31.

Schmidt J., Drews P., Schirmer I. (2017), *Digitalization of the Banking Industry: A Multiple Stakeholder Analysis on Strategic Alignment*. Presented at Americas Conference on Information Systems (AMCIS), Boston.

Sjödin D., Parida V., Leksell M., Petrovic A. (2018), *Smart Factory Implementation and Process Innovation*. *A Preliminary Maturity Model for Leveraging Digitalization in Manufacturing*, "Research-Technology Management", vol. 61(5), https://doi.org/10.1080/08956308.2018.1471277.