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Methodological approach to the assessment of the national banking sector transformation under the influence of fintech

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Abstract. Banking sector often acts as the strong driver of innovations, not only due to the financing capital power, but also because of the surging consumption of the digital economy products, for instance, cyber-security platforms, new client's identification methods and predictive analytics for better needs catering. In recent years, many countries witnessed rapid change in financial products delivery methods, however, the experience was not accumulated and structured on the level of the whole banking sector, not on the individual banks' level. The article contributes to the theoretical and methodological summarizing of the main directions of the banking sector transformation under the influence of the fintech industry. The methodological framework of the research includes the fundamental approach to the industry analysis. The review of the dynamic of the basic balance sheet and PL ratios demonstrated that the main directions of the transformation are the surging competition observed by the pricing indicators, larger digital clients share and more sustainable financial model (operational efficiency, income sustainability, retail-based funding). Based on comparative statistical and variation analysis, the rating measuring the overall level of the banking sector transformation was constructed. The rating allowed to distinguish 3 groups of countries with China and Great Britain leading the rating of the most modified banking sectors. Correlation analysis proved the rating relevance.

Keywords: banking sector transformation, fintech industry, pricing competition, digital clients share, operational efficiency, financial model sustainability

Методологический подход к оценке уровня трансформации национального банковского сектора под влиянием финтеха

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Аннотация. Банковский сектор часто выступает в роли драйвера инноваций не только в силу своих финансовых возможностей, но и в связи с ростом объема потребления услуг цифровой экономики, например платформ для кибербезопасности, новых методов идентификации клиентов и предиктивной аналитики для лучшего удовлетворения потребностей. В последние годы во многих странах мира происходило стремительное изменение способов предоставления финансовых услуг, тем не менее опыт не был систематизирован и структурирован ни на уровне банковского сектора, ни на уровне отдельно взятых банков. На теоретическом и методологическом уровнях систематизированы ключевые направления трансформации банковского сектора экономики под влиянием финтеха. Методология исследования заключается в фундаментальном анализе отрасли. Обзор динамики основных коэффициентов, рассчитываемых по балансовым данным и отчету о прибылях и убытках, продемонстрировал, что ключевые направления трансформации — это растущая конкуренция, которую можно измерить с помощью ценовых индикаторов, увеличение доли цифровых клиентов и переход на более устойчивую финансовую модель (за счет роста операционной эффективности, доли устойчивых доходов и величины розничного фондирования). На основе сравнительного статистического и дисперсного анализа был построен рейтинг общего уровня трансформации банковского сектора экономики. Благодаря рейтингу, который возглавили КНР и Великобритания, удалось выделить три группы стран по уровню трансформации банковского сектора. Корреляционный анализ подтвердил релевантность рейтинга.

Ключевые слова: трансформация банковского сектора, финтех-отрасль, ценовая конкуренция, доля цифровых пользователей, операционная эффективность, устойчивость финансовой модели

Introduction

In many countries, banking sectors undergo sufficient transformation due to the proliferation of financial technologies.

Traditional banks are no longer the solitary financial intermediaries for lending, transaction processing, financial advisory and in many countries — for

deposit-taking. Bigtech, retail, social network and telecom companies try to extract additional value from their vast client base by adding banking services to their services ecosystem.

Fintech services give traditional banks extra competitive edge over peers but at the same time make competition between different segments of the financial market tougher (primarily between the banking sector and asset management and brokerage companies).

Apart from institutional transformation of the banking sector, transformation may be observed in the internal environment, primarily, the channels for the banking services distribution. Remote identification, automated routine transactions, proliferation of mobile Internet and higher accessibility of smartphones make remote banking operations possible.

Moreover, digital technologies help traditional institutions to enhance the sustainability of their financial model due to the following factors:
- expenses optimization with regard to office cuts;
- access to the new markets, primarily, unbanked population;
- shifts from savings-and-loan to transactional business model;
- prospects for expanding the number of partnerships.

Overall, fintech transforms banking sectors in several directions, the preponderance of which could be quantified.

Literature review

For the purpose of this research we would refer to fintech as unique technologies that help to create innovative products for the financial markets, primarily, for the banking sector.

We are going to contribute to research on fintech's financial and operational effect on the traditional banking sector which so far covers the experience of individual countries, mainly China (Dong et al., 2020; Liao, Yao, Yang, 2019; Wang, 2021), India (Venkatachalam, 2020) and UAE (Rupeika-Apoga, Thalassinos, 2020; Dwivedi et al., 2021).

There are several approaches to the assessment of the level of an industry or a company transformation under the influence of technological innovation:
1. Through the change in the market value of the companies engaged in innovation development (Kogan et al., 2012; Nicholas, 2008; Chen, Qunxi, Baozhong, 2019).
2. Based on companies' fundamental indicators (balance sheet and profit and loss statement items). The most widespread method is the analysis of the factor productivity based on the Malmquist index (Zhao, Pi, Zhang, 2022; Cao, Cook, Kristal, 2022; Kale, 2022; Paulet, Mavoori, 2020; Luo et al., 2022; Lee et al., 2021). However, some researchers opt for the econometric analysis of basic quantitative industry performance characteristics, such as ROE, ROA, assets turnover, etc. (Murinde, Rizopolous, Zachariadis, 2022; Weqar et al., 2021; Chen, Qunxi, Baozhong, 2019).

The preponderance of approaches is based on individual banks' statistics analysis and, thus, they hinder us from the whole industry transformation assessment.

In addition, the change in the fair value can be well observed only in the informationally efficient markets (based on E. Fama's financial markets classification (Fama, 1970)). At the same time we do not want to limit our research only to developed markets and we are planning to cover emerging markets' banking sectors (China, Brazil, India, South Africa).

The main difference from other studies is that we propose a cross-national research of banking sectors transformation that makes exploration of the fintech — bank interaction more macroeconomic.

Methods

In order to estimate the degree of a banking sector transformation, we suggest constructing an index on the basis of the highlighted directions of banking sector transformation. The principles of the construction:

- Usage of financial data for the estimation of the banking sector transformation (balance sheet and profit & loss statement).
- Preference is given to ratios over absolute figures due to varying accounting standards.
- The preponderance of indicators should be taken in dynamics, that is comparing key indicators in 2014 and 2019. We find 5-year period to be best possible for detecting perceptible shift towards highly competitive financial products supply, besides, 2014 was without the crisis in most economies.
- We rely mostly on the shifts in individual clients' banking servicing as this business stream is developing at markedly different speed in comparison with corporate business.
- We establish three levels of banking sector transformation for each indicator. The scale is common for all indicators: 100 scores for the highly affected banking sectors, 50 scores — for medium influenced sectors and 0 for slightly or unaffected sectors or in the case of the lack of data. While determining the threshold levels, we focus primarily on Chinese or American statistics as these two countries witnessed the highest speed of fintech development (Frost et al., 2019).
- While prioritizing indicators, we will apply variance analysis to indicators' values across all observations of the sample and, in accordance with the best index construction practices,[1] grant the largest weights to indicators with the largest cross-country variance.
- Population-based indicators (industry statistics) are in priority to sample-based one (except for asset-weighted digital clients share and digital transactions share for TOP-5 banks).

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[1] The Pekin University Digital financial inclusion index of China (2011–2018). Institute of Digital Finance, Peking University, 2019. Retrieved September 5, 2022, from https://en.idf.pku.edu.cn/docs/20190610145822397835.pdf

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While analyzing factors, influencing the fintech adoption by traditional banks, we will revert to the Michael Porter's diamond model (Porter, 1990) and the components of the following digital economy indices:

- Digital evolution index by the Fletcher School and Mastercard;
- BCG e-Intensity Index;
- Digital money index by Citibank;
- Global innovation index;
- Digital Russia index by Skolkovo Moscow school of management.

Results and discussion

In our view, there are three directions of the banking sector transformation:

1. Institutional transformation

For incumbents this tendency means tougher competition from fintech startup, as well as bigtech companies, social media networks, retailors and telecom operators, entering the market (Kotliarov, 2019; Barykin, 2020).

Our hypothesis is that despite fintech startups replacing traditional banks, challenger banks' individual market shares are still weak and standard market structure indicators (the Herfindahl-Hirschman index, the Lorenz curve, the concentration ratio) will not record significant shifts. That is why, we propose to revert to indicators reflecting pricing power. However, the Lerner index, the Boone indicator and the Panzar-Rosse H-statistics imply rather subjective assumptions and calculations. Still, we intend to use the principle embedded in the abovementioned indices: higher market concentration leads to an increased market power and, consequently, higher margins. On the contrary, rivalry means lower margins and as some scientific papers state (A. Thakor, 2019, p. 28) fintech companies erode traditional banks' margin. The tendency can be observed with the help of such indicators as:

- Price indicators:
  - Net interest margin (NIM);
  - Net commission margin (NCM);
  - Spread between the Central bank's key interest rate and average liabilities cost;
  - Spread between average return on assets and the Central bank's key interest rate;
- Overall performance of the sector:
  - Dynamics of the assets adjusted for the accumulated inflation:
  - ROA;
  - ROE.

2. Adoption of omni-channel customer service model

The following indicators can keep track of changes to the ways of incumbents' servicing their clients:

- Average share of clients using Internet banking;
- Average digital operations (digital sales) share;
- Average annual bank cyberattacks losses.

3. *Incumbent's business model transformation*

3.1. Due to lowering margins banks have to cut administrative costs. The substitution of digital channels of banking services delivery for physical ones fuels this process and results in higher operational efficiency indicators:
- Declining number of bank outlets per 1 bank;
- Rising average assets per 1 bank outlet;
- Dropping cost-income-ration (CIR) or cost-assets ratio (CAR);

3.2. More resilient retail-funding business model (Orastean, 2018) that means:
- Rising share of retail deposits in total interest-bearing liabilities;
- Rising share of demand deposits in total retail deposits.

3.3. More commission-oriented business model and lighter credit exposure due to new sources of revenue like agent commissions gathered from nonbank ecosystem services presented in the bank's mobile app or Internet bank (clients base monetization) (Turuev, Shashkina, 2022; Stepnov, Kovalchuk, 2018) or monetization of the banks expertise in risk management in crowdfunding platforms. The transformation can be measured by:
- Net commission income to net operational income ratio.

Due to the lack of nation-wide data on the level of digital banking usage we propose taking top-5 banks data as a proxy for the level of the national banking sector transformation in accordance with the following methodology:
- We take TOP-5 banks in each country by assets as of 2019;
- We take their assets as 100 % and calculate the weight of each bank. If statistics of the number of digital clients or digital transactions share is unavailable for some banks, we do not consider these banks, instead of this, we apply a decreasing coefficient to the rest of the banks.
- If more than two banks in a country's sample do not publish data on the level of digital communication with clients, we consider that data is unavailable for the whole sector.
- The value of the decreasing coefficient depends on the number of banks in the sample and level of homogeneity of their results.
- The level of homogeneity is determined as follows:
  - We divide the maximum value in the sample by the minimum one.
  - If the received ratio exceeds 1.5 we consider the sample to be heterogeneous, otherwise, homogeneous.
  - The exact values of the decreasing coefficients are presented in Table 1.

Table 1

Decreasing coefficients for sample-based index indicators

Factors influencing the decreasing coefficient		Number of banks with available data	
		3	4
Level of homogeneity of available data	Homogeneous	0.8	1
	Heterogeneous	0.6	0.8

Source: compiled by the authors.

Sample-based indicators are collected from the top banks annual reports for the shareholding meeting.

The digital transaction share was calculated by dividing the number of Internet bank and mobile application users by the total client base.

The methodology of the digital transaction share statistics collection is as follows:
- Digital transactions share may be calculated on the basis of the number of transactions and their value, however, value-based indicators are in priority to volume-based ones.
- The banking operations value comprises
    - The turnover of debit and credit cards, accounts and deposits;
    - Customer transactions in the stock market and with precious metals, etc.
- Equivalents of the notion "digital transactions share" are digital sales share, internet financial transactions share, e-banking substitution rate.

For better understanding of the principle of the calculation, we would like to give an example (Table 2).

Table 2

**Asset-weighted digital clients share
and digital transaction share for TOP-5 banks in Great Britain**

Bank	Assets in 2019, *mln pound sterling*	Assets share, %	Digital clients share, %	Digital transactions share, %
Barclays capital	876 672	32	48	59
HSBC bank	636 491	23	60	80
Lloyds bank	505 750	18	63	75
Royal bank of Scotland group	723 039	26	73	53
Morgan Stanley international plc	502 508	-	n/d	n/d
Total for banks with available statistics (TOP-4)	**2 741 952**	**100**	-	-
Minimum value	-	-	48	53
Maximum value	-	-	73	80
Maximum value / minimum value	-	-	1.52	1.51

Source: authoring based on the listed banks' annual reports.

For both indicators homogeneity marker turned out to be more than 1.5, that is why we apply 0.8-coefficient while calculating the assets-weighted digital clients share and digital transactions share:

$$Digital\ clients\ share\left(Great\ Britan\right) =$$

$$=\left(0.32\times48\%+0.23\times60\%+0.18\times63\%+0.26\times73\%\right)\times0.8=48\%; \qquad (1)$$

$$Digital\ transactions\ share\left(Great\ Britan\right)=$$

$$=\left(0.32\times59\%+0.23\times80\%+0.18\times75\%+0.26\times53\%\right)\times0.8=52\%; \qquad (2)$$

Indicator's variance depends heavily on the type of indicators: asset-related indicators (ROA, NCM, NIM, CAR) are prone to less variation due to small amounts in comparison with other indicators (CIR, price indicators, assets dynamics, etc.) (Table 3).

Table 3

Detecting indicators' weights in the index based on the level of indicators' variation, %

Types of variation	Weights granted, %	Asset-related indicators, %	Other indicators, %
High variation	2–3	>0.01	>1
Medium variation	3–7	0.001–0.01	0.1–1
Slight variation	5–10	<0.001	<0.1

Source: compiled by the author.

All criteria and indicators are summarized in Appendix A.

For calculating rating scores we construct a sample of 15 national banking sectors, from both developed (the USA, some EU-countries, Canada) and developing countries (BRICS). We suggest dividing the bulk of countries into three group based on their results (Table 4).

Table 4

Threshold levels for the overall rating

Level of banking sector transformation	Scores	Country examples
High	70–100	China, Great Britain
Medium	50–69	The Netherlands, USA, Canada, Sweden, Switzerland, Germany, Russia, South Africa
Slight	0–49	India, Japan, Brazil, Spain, Italy

Source: compiled by the author.

Individual results are presented in Appendix B.

The threshold levels for the overall rating are determined in accordance with the following principles:
- 50 points is the threshold between slight and medium levels of the banking sector transformation for both individual indicators and the overall rating.

- High intensity of results in the range [51; 64] followed by a lag means that two cohorts of results [51; 64] and [70; 73] should be noticeably separated into distinct levels of transformation.

Countries with the highest scores have much in common, because they all are leaders in:

- digital transformation of the whole economy (based on the Global innovation index ratings,[2] Digital Intelligence Index from the Fletcher School at Tufts University and Mastercard[3]);
- accumulated investments in fintech (Figure 1);
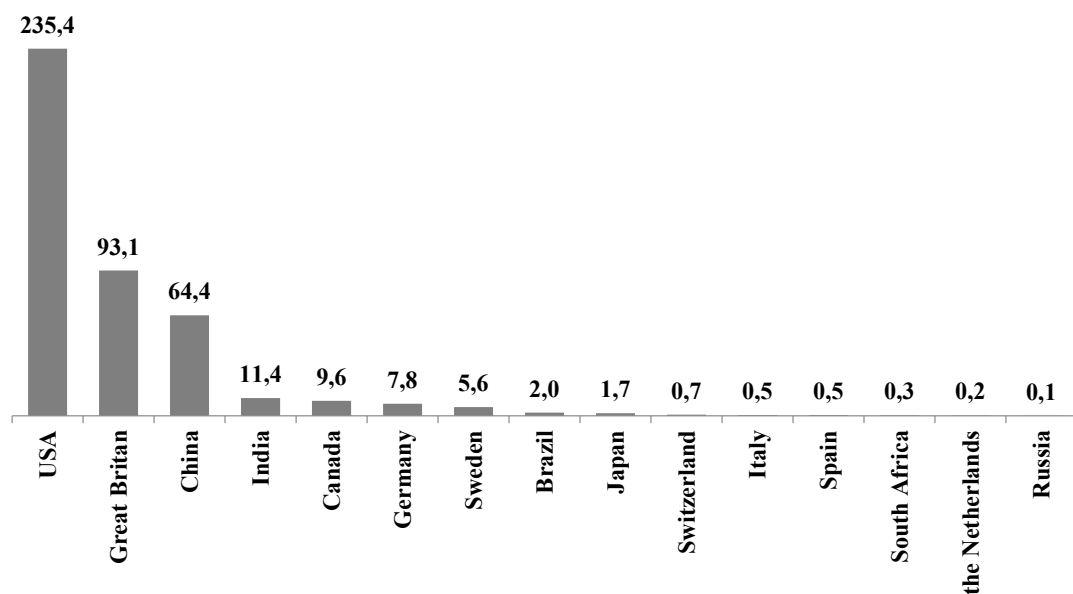- fintech industry regulation agenda.

Figure 1. Accumulated venture capital investments in fintech in 2015–2019, bln US dollars
Source: authoring based on KPMG,[4] PWC,[5] SEFO,[6] Startupticker,[7] Dealroom,[8] VEC,[9] Partech[10] data.

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[2] Global innovation index. Retrieved August 24, 2022, from https://www.globalinnovationindex.org/Home

[3] Digital Intelligence Index. Retrieved August 24, 2022, from https://digitalintelligence.fletcher.tufts.edu/dei

[4] Pulse of fintech. Biannual analysis of global fintech investments. Retrieved August 24, 2022, from https://home.kpmg/xx/en/home/industries/financial-services/pulse-of-fintech.html

[5] Fintech calls for fuel. Retrieved August 24, 2022, from https://www.pwc.com/it/it/industries/fintech/docs/PwC-FinTech-2020.pdf

[6] Snapshot of the fintech sector in Spain. Retrieved August 24, 2022, from https://www.sefofuncas.com/pdf/Carb%C3 %B3 %209-1.pdf

[7] Swiss venture capital report. Retrieved August 24, 2022, from https://www.startupticker.ch/en/swiss-venture-capital-report

[8] Venture capital & tech in Amsterdam: one year into the pandemic. Retrieved August 24, 2022, from https://dealroom.co/uploaded/2021/04/Amsterdam-Funding-q121--1617372947.pdf

[9] Venture enterprise center, Japan. Retrieved August 24, 2022, from https://www.vec.or.jp/

[10] Partech. Retrieved August 24, 2022, from https://cdn-website.partechpartners.com/

To check the rating for relevance and sustainability, we will conduct a pairwise correlation analysis of the scores and some of the factors of the fintech industry development.

In accordance with the Michael Porter's diamond model, there are 5 groups of factors, influencing fintech adoption by banks — factor conditions, demand conditions, firm strategy, related and supporting industries, and government.

The key factor for the banking industry fintech adoption is developed IT-infrastructure (that can be measured by Internet penetration rate, number of smartphones per capita) and financial resources (venture capital market volume).

Client's demand for banking services delivered through digital channels is predetermined by their level of trust and loyalty to cashless money transfers as digital payment services tend to form customer attitudes (Kowalewski, Pisany, Slazar, 2022, p. 9). We propose to assess these behavioral parameters through share of banked population, number of cards per inhabitant, volume of cashless payments per inhabitant, value of cashless payments per inhabitant and fintech adoption index, issued by EY.

For the purpose of this study, the fintech industry (defined as the sum of fintech startups) will be considered a related and supporting industry. The odds for the success of start-ups that are micro- or small enterprises are higher in countries with favorable environment for business (Doing business rating by the World bank) and enough investment resources.

We can indirectly determine whether a bank adheres to an active fintech adoption strategy by the existence of corporate venture funds.

The Central bank or another banking industry regulation body acting on behalf of the government can impact fintech development and adoption by:
- Direct regulation of the new market entrants (mandatory licensing and capital adequacy ratios, etc.);
- Money and administrative support of fintech projects;
- Creating indirect incentives for financial technologies products consumption by end users through restrictions on cash money circulation and introduction of central bank digital currencies.

The pairwise correlation analysis result are presented in Table 5. Our supposition in regard to the correlation analysis is that with high probability countries with the most favorable conditions for the fintech industry development witness tougher competition between traditional banks and between incumbent and challenger banks that contributes to the transformation of the banking sector measured by the rating score.

More than 30 % correlation coefficients signals that there is significant interdependence between the rating and factors' indicators.

The rating proved to be relevant to the estimation of banking sector transformation under the influence of the fintech industry based on the relatively high correlation coefficients for smartphones per capita, number of cashless payments per capita, value of cashless payments to GDP, easiness of doing business scores and level of regulation.

Table 5

Correlation analysis of rating scores and factors of the fintech industry development

Factor of the fintech industry development	Factor's indicator	Correlation coefficient, %
Factor conditions	**Smartphones per capita**	**45**
	Internet coverage	22
Demand conditions	Cards per inhabitant	−4
	Number of cashless payments per capita	**64**
	Value of cashless payments to GDP	**77**
	Fintech adoption index	29
Related and supporting industries	**Accumulated venture capital investments in fintech companies**	**36**
	Doing business rating score	**51**
Strategy and rivalry	Existence of banks' corporate venture funds (expert assessment)	16
Regulation	**Regulation score by Deloitte**	**43**
	Banknotes to GDP	**−40**

Source: authoring based on World bank, Bank for international settlements, EY, Deloitee, Newzoo and InternetWorldStats statistics.

Conclusion

We worked out the author's method of the assessment of the banking sector transformation, influenced by the financial technologies development. The approach is based on the fundamental financial analysis of the banking industry that is suffering external and internal structural shifts.

The change in the external environment of the banking sector leads to lowering profit margins due to increasing competition with challenger banks and niche fintech start-ups. Another direction of the sector transformation is the shift to digital channel distribution, especially in the retail banking segment. The fintech industry also enhances the sustainability of the business model: more cost-efficient services delivery (mainly thanks to offices cuts), retail-deposits funding and commission-oriented monetization model.

We constructed an index estimating the overall level of national banking sector transformation under the influence of the fintech industry based on the abovementioned general directions of transformation. The assessment conducted with the help of 20 indicators, each contributing from 2 to 10 % to the overall rating result. The criteria levels were determined on the basis of the results for the world leaders in fintech development (China and the USA) and our assumptions concerning trends in the banking industry. The indicators were taken in dynamics to reflect the structural shifts in the banking sectors in 2019 in comparison with 2014.

The constructed index revealed that apart from China and the USA that tend to be leaders in financial technologies adoption, the leading European banking sectors as well as Canada had also underwent serious banking sector transformation.

Although the index is constructed and tested on the industry level, the analysis tools may be used on the level of individual banks.

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Appendix A

List of criteria for estimation of the fintech development influence on the banking sector transformation

Criteria, indicators	Formula	Weight, %	100 scores (highly affected)	50 scores (medium affected)	0 scores (slightly or unaffected)
1	2	3	4	5	6
Criterion 1. Level of competition in the banking sector		40			
Sub-criterion 1.1. Usage of pricing strategies for attracting and maintaining clients		20			
Indicator 1.1.1. Dynamics of key interest rate – cost of liabilities spread	$\left(Key\ interest\ rate\ 2019 - \dfrac{Interest\ expense\ 2019}{Average\ \%-Bearing\ liabilities\ 2019}\right) -$ $\left(Key\ Interest\ Rate\ 2014 - \dfrac{Interest\ expense\ 2014}{Average\ \%-Bearing\ liabilities\ 2014}\right)$	3	≤ -0.8 p.p	-0.8–0 p.p	> 0 p.p
Indicator 1.1.2. Number sign of key interest rate – cost liabilities spread in 2019	"–" in highly influenced banking sectors, "+" – in slightly affected sectors	2	"–"	-	"+"
Indicator 1.1.3. Dynamics of return on assets – key interest rate spread	$\left(\dfrac{Interest\ income\ 2019}{Average\ \%-Earning\ assets\ 2019} - Key\ interest\ rate\ 2019\right) -$ $\left(\dfrac{Interest\ income\ 2014}{Average\ \%-Earning\ assets\ 2014} - Key\ interest\ rate\ 2014\right)$	3	≤ -1.2 p.p	-1.2–0 p.p	> 0 p.p
Indicator 1.1.4. Number sign of return on assets – key interest rate spread in 2019	"–" in highly influenced banking sectors, "+" – in slightly affected sectors	2	"–"	-	"+"
Indicator 1.1.5. Net interest margin (NIM) dynamics	$\dfrac{Net\ interest\ income\ 2019}{Average\ \%-Earning\ assets\ 2019} - \dfrac{Net\ interest\ income\ 2014}{Average\ \%-Earning\ assets\ 2014}$	7	≤ -0.5 p.p.	-0.5–0 p.p.	> 0 p.p.
Indicator 1.1.6. Net commission margin (NCM) dynamics	$\dfrac{Net\ commission\ income\ 2019}{Average\ \%-Earning\ assets\ 2019} - \dfrac{Net\ commission\ income\ 2014}{Average\ \%-Earning\ assets\ 2014}$	3	≤ -0.12 p.p.	-0.12–0 p.p.	> 0 p.p.

Continuation of the Appendix A

1	2	3	4	5	6
Sub-criterion 1.2. Banking sector overall performance		20			
Indicator 1.2.1. Banking sector assets growth adjusted for inflation	$$\frac{Banking\ sector\ assets\ 2019}{Banking\ sector\ assets\ 2014} - 1 - Compounded\ inflation\ 2014-2019$$	10	< 0 %	0–11 %	>11 %*
Indicator 1.2.1. ROE dynamics	$$\frac{Net\ profit\ 2019}{Average\ equity\ 2019} - \frac{Net\ profit\ 2014}{Average\ equity\ 2014}$$	5	< –7 p.p.	–7–2 p.p.	> 2 p.p.
Indicator 1.2.2. ROA dynamics	$$\frac{Net\ profit\ 2019}{Average\ assets\ 2019} - \frac{Net\ profit\ 2014}{Average\ assets\ 2014}$$	5	≤ –0.4 p.p	–0.4–0 p.p.	> 0 p.p.
Criterion 2. Level of clients' digital servicing		16			
Sub-criterion 2.1. Level of digital services penetration into the banking activities		14			
Indicator 2.1.1. Asset – weighted digital clients share for TOP-5 banks	$$\left(\sum_{i=1}^{3-5} W_i * Digital\ clients\ share_i\right) * Decreasing\ coefficient$$ where i is the number of the bank in the sample	2	> 46 %	23–46%	< 23%
Indicator 2.1.2. Asset – weighted digital transactions share for TOP-5 banks	$$\left(\sum_{i=1}^{3-5} W_i * Digital\ transactions\ share_i\right) * Decreasing\ coefficient$$ where i is the number of the bank in the sample	2	> 95%	48 – 95%	< 48%
Indicator 2.1.3. Share of individuals using Internet / mobile banking	$$\frac{Internet\ or\ mobile\ bank\ users\ in\ a\ country}{Total\ adult\ population\ in\ a\ country}$$	10	> 61%	31–61%	< 31%
Sub-criterion 2.2. Digital security		2			
Indicator 2.2.1. Annual losses from cyberattacks to banking assets ratio	$$\frac{Annual\ losses\ from\ banks'\ cyberattacks\ 2019}{Total\ banking\ assets\ 2019}$$	2	< 0.13%	0.13–0.26%	> 0.26% or no data

Ending of the Appendix A

1	2	3	4	5	6
Criterion 3. Banking sector financial resilience		44			
Sub-criterion 3.1. Operational efficiency		29			
Indicator 3.1.1. Dynamics of average number of offices per 1 bank	$\dfrac{Number\ of\ bank\ offices\ 2019}{Number\ of\ banks\ 2019} - \dfrac{Number\ of\ bank\ offices\ 2014}{Number\ of\ banks\ 2014}$	10	<100%	100–119%	>119%
Indicator 3.1.2. Dynamics of average assets per 1 bank office	$\dfrac{Banking\ sector\ assets\ 2019}{Number\ of\ bank\ offices\ 2019} - \dfrac{Banking\ sector\ assets\ 2014}{Number\ of\ bank\ offices\ 2014}$	10	>128%	100–128%	<100%
Indicator 3.1.3. Cost-income ratio (CIR) dynamics	$\dfrac{Administrative\ expenses\ 2019}{Net\ operating\ income\ 2019} - \dfrac{Administrative\ expenses\ 2014}{Net\ operating\ income\ 2014}$	7	< –2 p.p.	–2–0 p.p.	> 0 p.p.
Indicator 3.1.4. Cost-assets ratio (CAR) dynamics	$\dfrac{Administrative\ expenses\ 2019}{Average\ banking\ sector\ assets\ 2019} - \dfrac{Administrative\ expenses\ 2014}{Average\ banking\ sector\ assets\ 2014}$	2	<–0.08 p.p.	–0,08–0 p.p.	> 0 p.p.
Sub-criterion 3.2. Banking sector resource base sustainability		12			
Indicator 3.2.1. Dynamics of personal deposits share in total interest-bearing liabilities	$\dfrac{Personal\ deposits\ 2019}{\%-Bearing\ liabilities\ 2019} - \dfrac{Personal\ deposits\ 2014}{\%-Bearing\ liabilities\ 2014}$	5	> 0 p.p.	–1.9–0 p.p.	< –1.9 p.p. or no data
Indicator 3.2.2. Dynamics of demand deposits in total individuals' deposits	$\dfrac{Demand\ personal\ deposits\ 2019}{Personal\ deposits\ 2019} - \dfrac{Demand\ personal\ deposits\ 2014}{Personal\ deposits\ 2014}$	7	> 1.3 p.p.	0–1.3 p.p.	< 0 p.p.
Sub-criterion 3.3. Revenue streams sustainability		**3**			
Indicator 3.3.1. NCM to net operating profit ratio dynamics	$\dfrac{Net\ commission\ income\ 2019}{Net\ operating\ profit\ 2019} - \dfrac{Net\ commission\ income\ 2014}{Net\ operating\ profit\ 2014}$	3	> 0 p.p.	–1.6–0 p.p.	< –1.6 p.p.

* — In countries with rapid growth of the banked population share in 2011–2017, an observation (country) is assigned 50 scores (medium banking sector transformation level) if Source: Lecture notes in Network.

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Country results for the banking sector transformation rating

Country	Total score	Criteria 1	Criteria 2	Criteria 3
China	73	29	11	33
Great Britain	70	19	15	37
The Netherlands	64	16	12	36
Sweden	62	24	10	28
Germany	61	19	12	30
Canada	61	15	12	34
USA	58	16	14	28
Switzerland	56	22	10	25
South Africa	54	19	3	32
Russia	51	17	9	25
Italy	48	14	9	25
Brazil	48	15	14	19
Japan	47	15	12	20
India	47	18	11	18
Spain	46	22	6	18
Maximum possible value	100	40	16	44

Source: authoring based on countries' Central bank report, National statistical bureaus, and banks' annual reports.