DOI: 10.31648/pw.6870

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SELECTED COUNTRIES OF EASTERN AND CENTRAL EUROPE IN THE FACE OF CHALLENGES OF MODERN FINANCIAL TECHNOLOGIES (BASED ON THE EXAMPLE OF ROBO-ADVICE)[1]

Abstract: This article aims to diagnose the state of technological advancement in the field of personal finance in Eastern and Central European countries based on the example of automated financial advice. The considerations were based on the literature on the subject. In the empirical part, a critical analysis of secondary data from databases was made and the results of research on robo-advice and determinants that may affect the advancement of the modern use of contemporary tools in personal finance management were published. Based on the data analysis, it was concluded that technological sophistication in personal finance in the studied countries of Eastern and Central Europe was at a high level, as evidenced by the high concentration of assets and the growing number of robo-advice users.

Keywords: personal finance management, modern financial technologies, robo-advice, open banking

1. Introduction

The current market-leading technologies making inroads into the banking sector, such as artificial intelligence, biometrics and robotic process automation systems, are rapidly encroaching into IT architecture and banking services. The available analyses indicate that countries in the Eastern-European region still face a range of challenges, including negative demographic trends, the risk of a reduction in the availability of European funds after 2020 and low work efficiency. The tremendous pressure

[1] The project was financed within the Regional Initiative for Excellence programme of the Minister of Science and Higher Education of Poland, years 2019-2022, grant no. 004/RID/2018/19, financing 3,000,000 PLN.

exerted by competitive economies is forcing the transformation of an employee-oriented market into a highly innovative market based on modern technological solutions and knowledge. In addition, integration of the banking sector with third parties and fintech requires implementing an open banking model, which for many banks in the region is still a vision locked in the future.

This article aims to diagnose the state of technological advancement in the area of personal finances in Eastern and Central European countries based on the example of automatic financial advice. Furthermore, the authors of this study seek to establish which determinants block the implementation of modern financial solutions. In order to achieve the research objective, considerations were based on literature relevant to the subject. A critical analysis of secondary data from databases has been carried out, and the results of studies on career guidance and conditions that may affect the advancement of the use of modern tools in personal finance management have been published.

The authors suggest a hypothesis that there is substantial differentiation among the studied Eastern and Central European countries in developing modern technologies in finance, based on robo-advice, conditioned by economic, demographic, social, regulatory and technological factors. Such differentiation is not a peculiarity of this region of Europe since international research indicates that robo-advice services in the region differ in their development level, rooted in socio-economic factors (Waliszewski/Warchlewska 2020a, 399-420).

This study consists of four main sections. The first part presents the theoretical foundations in the field of personal finance management, financial knowledge and awareness, the implementation of open banking and the development of the fintech industry. The second section contains a description of the research methodology, which presents a research sample looking at the number of users of robo-advisory services. The data was downloaded from the Statista database. In addition, to assess the determinants that block access to modern financial tools, analysis was conducted on existing studies (research found), analyses and reports. The third section presents and analyses the conclusions. A discussion on the existing empirical material is one element of the fourth section. The final part of the paper offers conclusions and thoughts of the authors regarding the opportunities to be had and the challenges faced by users of modern technologies and financial institutions in Central and Eastern Europe. The study closes with a broad list of references arising from an in-depth literature review.

2. Literature review

The technological advancement of institutions offering financial products and services (banks, other banking-related institutions, third parties) is still neither integral nor systemic. On the one hand, services for the management of client assets and liabilities are highly diversified, while, on the other hand, there is a lack of legal solutions that might support financial institutions in implementing modern financial solutions. One of the key elements in the management of personal finances is the collection of data needed to analyse a consumer's financial situation (Alińska 2019). In Europe, the major factors supporting the implementation of APIs include the open banking initiative in Great Britain and – in European Union countries – the PSDII Directive, which is the driving force of open banking. First of all, a regulator imposes legal solutions obliging banks to open up to TPPs (December 2018). Secondly, the market (pressure from customers and competitors) drives the need for change and the perspective of benefits that may result from establishing cooperation with cooperating entities (Fig. 1).

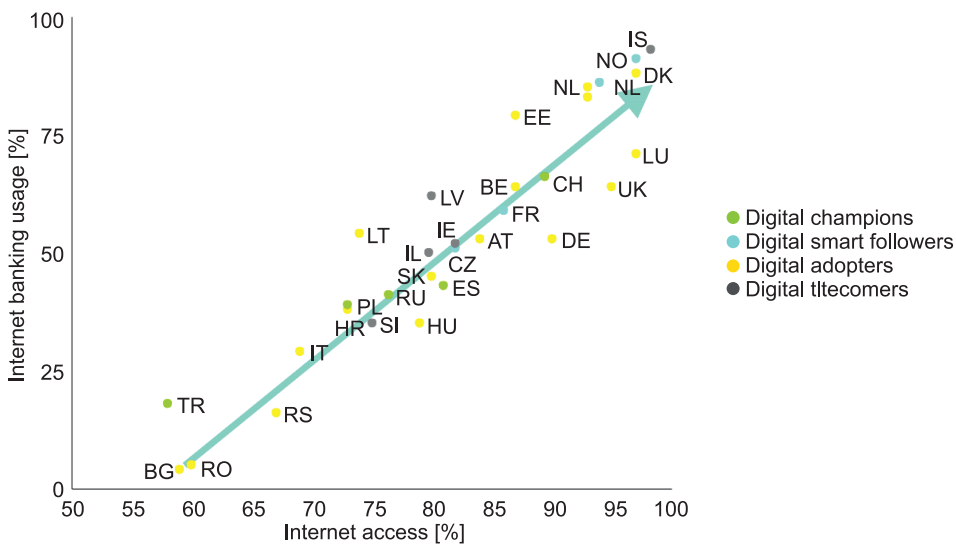

Fig. 1. The digital maturity of Europe and the Middle East
Source: Deloitte 2018, 11

The issue of open banking (Rohan 2017) refers to all services and technologies in finance based on interfaces enabling third parties to use and transfer data provided by institutions, e.g. banks. Additionally, the main characteristic of open banking is transparency in terms of access to financial data and freedom in its management. Considering that few global banks operate in Central and Eastern

Europe and given the lack of operational compliance, one might conclude that the open banking initiative might only be present regionally and nationally. Furthermore, fintech companies are often discouraged from further development by the lack of regulations supporting technological integration (Deloitte 2018). In some countries, the absence of any legal obligation that might be imposed on regional banks to provide access to their infrastructure and customer data hinders data transfer for the purpose of managing customer assets and liabilities outside the strict confines of banking services (PAP 2019a; Cision 2019).

Global trends dictated by the fintech industry and the application of automated financial advice offers the customer faster, individualised financial transactions and financial management. Robo-advice (table 1) is defined as a form of automated financial advice that supports clients' decision-making processes in investment services, loans, and insurance.

Table 1. Selected definitions of robo-advice

Author	Meaning
M. Faloon B. Scherer	Automated asset management advisory firms assign risky portfolios to individual investors based on investment algorithms. These algorithms use investor characteristics such as age, net income, and assessments of individual risk aversion to recommend suitable asset allocations. Client interaction and delivery of portfolio advice are web-based and without human interaction. Robo-advice disintermediates the classical distribution model, which is now widely recognized as expensive, difficult to scale, and unacceptably heterogeneous (i.e., highly dependent on the individual advisor's skill level).
M. W. Uhl P. Rohner	Robo-advisors are digital wealth management platforms that provide automated financial planning services and investment solutions mostly based on passive and cost-efficient instruments while efficiently managing these allocations by rebalancing mechanisms.
L. Brenner, T. Meyll	Robo-advisors ask the clients for information on their financial situation and their investment objectives, subsequently creating an investment portfolio suitable to the clients (risk-)profile often using inexpensive exchange-traded funds (ETFs), and managing the portfolio usually based on an algorithm, which includes, for example, rebalancing activities and the reinvesting of dividends or savings plan inflows
M. L. Fein	The term "robo-advisor" refers to any of a growing number of Internet-based investment advisory services aimed at retail investors that have emerged in the financial marketplace. About a dozen such services or so currently exist with any significant customer base. More robo-advisors are expected to appear in the future.
P. Sironi	Robo-Advisors are automated investment solutions that engage individuals with digital tools featuring advanced customer experience to guide them through a self-assessment process and shape their investment behaviour towards rudimentary goal-based decision-making, conveniently supported by portfolio rebalancing techniques using trading algorithms based on passive investments and diversification strategies

Source: Fein 2015; Sironi 2016; Brenner and Meyll 2020, 1-8; Uhl, Rohner 2018, 44-50; Faloon, Scherer 2017, 30-36

The development of technology in financial markets is undoubtedly shaping a new model (Martínez et al. 2018, 227-238). Observations of the market give the impression that not all social groups have the same availability of products and wide range of banking services. The impact of digital technologies on consumer decisions are currently at the forefront of national and international discourse on consumer policy (Thorun/Diels 2020, 177-191). The impact of modern financial technologies on data transfer and security, consumer privacy, the responsibility of financial service providers using online platforms, and digital consumer education are just some of the issues that have undergone intense discussion. Boosting access to digital financial services and the use of innovative financial services, tools, and applications can open up new opportunities for businesses and consumers, improving the consumers' level of financial integration.

Available literature in the area of behavioural finance (Carpentier 1996; Ricciardi/Simon 2000, 1-9; Smyczek 2010, 375-385; McGoun, Skubic 2010, 135-144; Zhang/Zheng 2015, 1-5; Ewe et al. 2020) states that being aware does not require the making of conscious choices. The development of behavioural finance, which postulates the need to take flaws into account when looking at the behaviour of human investors, is an important factor influencing investors' decisions (Itzkowitz/Itzkowitz 2017, 180-188). In order to guard against the threats posed by the digital world, consumers should have knowledge and experience that will enable them to understand complex processes, such as finance management. This process of perpetual control of financial resources consists of securing income, spending, saving, investing, borrowing, risk management, retirement planning, tax planning, and transfer of assets. In recent years, financial knowledge has become an important resource necessary to function properly in the financial market (Świecka et al. 2020). A low level of financial knowledge (EBA 2020) leads to a relatively small interest in personal financial management (McCannon/Peterson 2015, 199-205; Barembruch 2018), including financial planning (Waliszewski 2014, 204-221). As digitisation progresses, financial education plays a major role in supporting effective forms of consumer protection by raising financial awareness of recipient groups and dealing with threats and prejudices (Musiał 2014, 837-848).

3. Methodology

The methodology is based on analysis of the existing data from the statista.com database and scientific studies in which quantitative and qualitative analysis of the analysed issues was made, especially in the subject of financial knowledge necessary to use modern tools by consumers. The analyses were based on data from the period 2016-2023 (forecasts). The choice of the analysed countries was dictated by the availability of data in the Statista.com database.

According to data available from the global research company Statista.com, the size of the robo-advice market in Eastern European (Armenia, Azerbaijan, Belarus, Bulgaria, Georgia, Moldova, Romania, Russia, Ukraine) in 2020 in terms of assets under management (AUM) was evaluated at USD 788 million, 115.6 thousand users, with an average USD 6.8 thousand worth of assets per user (table 2). By comparison, the entire European robo-advice market is worth USD 49.471 million, with 2.173 thousand users with USD 22.8 thousand worth of assets per user. Individual robo-advice markets in Eastern European countries feature significant disparities in terms of AUM, the number of users and assets per user.

Table 2. Characteristics of the robo-advice market in Eastern Europe (in 2020)

Country	AUM (in million USD)	Number of users (in thousands)	Assets per user (in USD)
Armenia	11	2.3	4,783
Azerbaijan	165	13.2	12,500
Belarus	179	14.4	12,431
Bulgaria	15	11.1	1,351
Georgia	16	3.1	5,161
Moldova	25	4.9	5,102
Romania	103	28.8	3,576
Russia	126	13.3	9,474
Ukraine	148	24.5	6,041
Total	**788**	**115.6**	**6,817**

Source: Authors' own work based on www.statista.com [accessed: 14 IV 2020]

The largest markets for this type of services are Belarus (USD 179 million), Azerbaijan (USD 165 million) and Ukraine (USD 148 million). At the other extreme, the Armenian (USD 11 million), Bulgarian (USD 15 million) and Georgian (USD 16 million) markets have the lowest value. Given the number of users, the highest is in Bulgaria (28.8 thousand), Ukraine (24.5 thousand), with the lowest in Armenia (2.3 thousand) and Georgia (3.1 thousand). Considering user assets, the highest value occurred in Azerbaijan (USD 12.5 thousand), Belarus (USD 12.43 thousand) and the lowest in Bulgaria (USD 1.35 thousand) and Romania (USD 3.6 thousand). The discrepancies indicated in the development of individual robo-advice markets in Eastern Europe mean that four countries – Ukraine, Russia, Belarus and Azerbaijan – account for nearly 80% of the entire market (Fig. 2).

Considering the prognosis for the robo-advice market in Eastern Europe in 2023, the total value of assets under management is estimated at USD 2.2 billion, the total number of users at 265 thousand, and the average assets per user are set to increase to USD 8.1 thousand. In comparison, the value of the entire European

robo-advice market is predicted to stand at USD 122.312 million; the number of users is to increase to 4005.1 thousand people and assets under management per user up to USD 30.5 thousand.

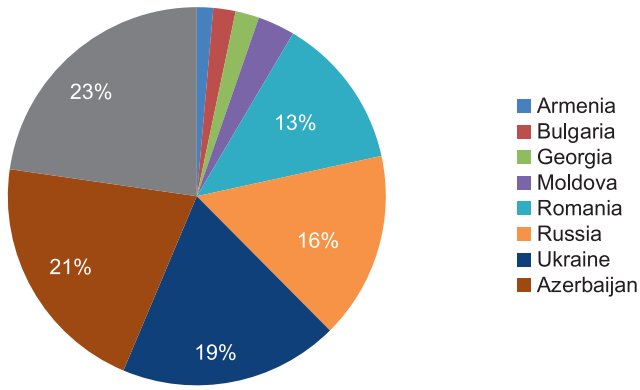

Fig. 2. Robo-advice market share in Eastern European Countries (in 2020)
Source: Authors' own work based on www.statista.com [accessed: 14 IV 2020]

The previously indicated disparities in the development of individual markets are still forecast to continue, although the largest markets for this type of services remain unchanged, albeit in a different order than in 2020 – Belarus (USD 487 million), Ukraine (USD 411 million), Azerbaijan (USD 388 million) and Russia (USD 364 million). An important indicator determining the market development potential is the average annual growth rate (CAGR) for 2020-2023, which is predicted to be 40% for all Eastern European countries, with the highest in Armenia (53%) and the lowest in Azerbaijan (33%). In comparison, the estimated CAGR for the entire

Table 3. Prognosis of the robo-advice market in Eastern Europe (in 2023)

Country	AUM (in million USD)	CAGR (2020-2023)	Number of users (in thousands)	Assets per user (in USD)
Armenia	40	52.90%	6.4	6,250
Azerbaijan	388	33%	26.8	14,478
Belarus	487	39.60%	32.8	14,848
Bulgaria	44	43.30%	26	1,692
Georgia	52	48.60%	8.1	6,420
Moldova	75	44%	11.8	6,356
Romania	293	41.80%	65.4	4,480
Russia	364	42.30%	30.6	11,895
Ukraine	411	40.60%	57.1	7,198
Total	**2154**	**40%**	**265**	**8,128**

Source: Authors' own work based on www.statista.com [accessed: 14 IV 2020]

European market is about 35%. This indicates an approximately 5% higher average annual growth rate for the robo-advice market in Eastern Europe compared to the whole of Europe.

According to Statista.com forecasts, in 2023, the largest number of users will be in Romania (65.4 thousand), Ukraine (57.1%), with the lowest in Armenia (6.4 thousand) and Georgia (8.1 thousand). Projected assets under management per user attain the highest value in Belarus (USD 14.8 thousand), Azerbaijan (USD 14.5 thousand), with the lowest in Bulgaria (USD 1.7 thousand) and Romania (USD 4.5 thousand). The concentration of assets under management in the four countries with the largest markets will remain high, as it was in 2020, and amount to 77% (Fig. 2).

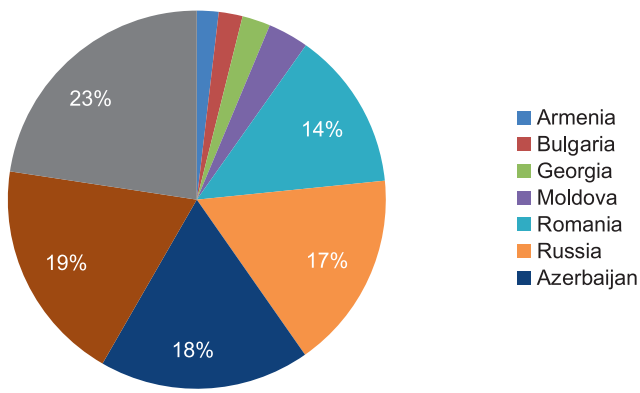

Fig. 3. Prognosis of robo-advice market share in Eastern European Countries (in 2023)
Source: Authors' own work based on www.statista.com [accessed: 14 IV 2020]

Within the scope of market analysis on robo-advice, Poland's first survey was conducted among individual investors who use automatic financial consulting. The empirical material was obtained online (CAWI) via the Slovak company Finax, which provides pioneering services on the Polish market. Qualitative measurement ensured the collection of 114 questionnaires. The survey questionnaire contained questions in the following areas: 1) identification of the robo-advisory solutions used, 2) the type of investment strategy conducted via robo-advice, 3) the amount invested, 4) the number of assets entrusted to be managed by robo-advisors, 5) the level of satisfaction with robo-advice technology, 6) the possible recommendation of such services to friends, 7) how knowledge about robo-advice is acquired, 8) the use of traditional investment consultation, 9) the pros and cons of robo-advice, 10) charges for using robo-advisory services, 11) prospects for the development of robo-advice, 12) the impact of COVID-19 on personal finances, 13) the ethicality of robo-advice, 14) the during of using robo-advisory services. The survey was conducted with a group of N = 114 people (Warchlewska/Waliszewski 2020, 97-114).

Table 4. Duration of using robo-advice in Poland

		N	%
Which statement do you think is true?	Robo-advisors are less ethical than traditional financial advisors	1	0.90%
	Robo-advisors are just as ethical as traditional financial advisors	38	34.23%
	Robo-advisors are more ethical than traditional financial advisors	72	64.86%
How long have you used robo-advisory services (in months)?	1 month	31	27.68%
	2-3 months	68	60.71%
	4-6 months	9	8.04%
	Longer	4	3.57%

Notes: N – number, % – percentage
Source: Authors' own work, N = 114

According to most respondents (64.86%), robo-advisors were more ethical than traditional financial advisors, while 34.23% of respondents believed that robo--advisors are just as ethical as traditional financial advisors. One person was of the opinion that robo-advisors were less ethical than traditional financial advisors. The respondents usually used robo-advice for a period lasting between 2 weeks and 10 months, and the average period was M = 2.33 months. Most people used robo-advice for between 2–3 months (60.71%).

Research conducted on robo-advice users in Poland indicates several statistically significant relationships (Warchlewska/Waliszewski 2020, 97-114):

1. Investors who assessed the prospects of robo-advice in Poland as definitely positive evaluated their own satisfaction with this type of investing higher and would be more willing to recommend this method to their friends.
2. The level of education, age of investors and duration of use all have an impact on the amount of assets entrusted to robo-advisors. The higher the level of education, the higher the age and the longer the period of use, the higher the amount of assets managed by robo-advisors
3. Investors who apply a balanced strategy evaluated the prospects for robo-advisory development the highest.
4. Higher evaluation of the ethicality of robo-advisors compared to traditional financial advisors resulted in this service being recommended to friends. People who were of the opinion that robo-advisors were more ethical than traditional investment advisors were more likely to recommend robo-advice to their friends.
5. Investors who positively assessed the prospects of robo-advice for the future were more satisfied with this investment method and would be more willing to recommend it to their friends.

Another study by Waliszewski and Warchlewska (2020b, 303-317) showed an analysis of data obtained from customer surveys assessing their expectation with the use of modern technologies indicated that the vast majority of respondents would not be happy if a computer program made investment decisions on their behalf. At the same time, the respondents mostly expressed a willingness for a computer program to analyse their spending habits and recommend improvements. The study showed that level of education did not affect the assessment of robo-advice concerning investment decisions, but it did influence the willingness to receive investment proposals. People with higher education would be more likely to use a computer program that would analyse their expenses and suggest improvements.

Most research on users of robo-advice services has been devoted to American investors as this is the largest and oldest market. There is limited information available about European robo-advisory client demographics. For Germany, there are estimates that clients are on average 40 years old, have a monthly net household income of around EUR 4,000 and are university graduates. Somewhat more detailed figures are available for Italian investors. In Italy, male clients outnumber female clients, which is most likely the case in other countries as well. More educated clients use robo-advice more often than less educated investors. The same holds true for financial literacy. Finally, there is a linear correlation between wealth and the use of robo-advice. In general, however, robo-advice investors will probably not be shifting their entire portfolios to accounts like these but will increasingly use these services (Kaya 2017).

According to literature (Smyczek 2016, 24-35), in terms of determinants that may obstruct access to modern financial solutions, the available analyses focus on behavioural factors, financial education, internet infrastructure and bandwidth, as well as legal solutions. Within the scope of a direct survey in Poland, Romania, Slovakia, Ukraine and Hungary, 600 respondents were asked to subjectively assess their financial knowledge and rate it against other consumers in a given country. Based on the conducted research by Smyczek (2016), it was concluded that the objective level of financial knowledge of consumers measured according to the Singapore Monetary Authority scale in the countries of Central and Eastern Europe is low. The level of financial knowledge for Poland, Romania, Slovakia, Ukraine and Hungary amounted to 33.5%, 30.4%, 37.2%, 29.7% and 31.6%, respectively. Significantly, regardless of the country, the level of financial knowledge was independently higher for men than for women. The level of financial knowledge increased proportionally with age, but only until the age of 44. A low level of knowledge was observed among senior citizens. Higher education correlated with greater knowledge and interest in financial topics. It should be emphasised that the consumers' assessment of their material situation did not significantly differentiate their level of financial knowledge. In order to statistically verify the impact of factors on the level of financial knowledge, ANOVA analyses confirmed

differences in the level of financial knowledge depending on the sex, financial activity and educational level of the respondents (Table 5).

The study conducted in Central and Eastern European countries demonstrated that the level of financial knowledge depended primarily on the sex of the consumer, the level of education and professional experience. However, age, type of employment and material situation did not correlate to the level of knowledge. It is worth noting that financial knowledge was perceived as boring and rather unnecessary in the countries analysed. The vast majority of respondents rated themselves as having an intermediate or low level (Smyczek 2016, 24-35). In comparing the respondents' level of knowledge to the rest of the society in a given country, it was perceived at a much higher level.

Table 5. Financial knowledge in selected Central and Eastern European countries with demographic and economic variables – test ANOVA

Variables	χ^2	df	χ^2/df	F	Sig.
Sex	102.3	2	051.2	4.227	0.007
Age	248.9	4	062.2	2.801	0.211
Qualification	147.5	1	147.5	3.904	0.004
Employment	194.1	2	097.1	2.357	0.408
Professional activity	211.7	5	042.3	0.844	0.002
Economic situation	125.6	1	125.6	1.871	0.295

Source: Smyczek 2016, 30

It is difficult to assess the effectiveness of education. In the group of countries selected for the study, this issue was not diagnosed, although studies in the field of financial education indicate that the conclusions are not unequivocal in terms of the effectiveness of education or its absence (Lusardi/Mitchell 2014, 5-44; Willis 2011, 429-434). In addition, Fernandes et al. (2014, 1861-1883) highlight the very spectacular effects of financial education in Miller et al. (2015, 220-246), indicating that financial education can only be effective with specific financial behaviour.

According to the report by Global Business Consulting in Central and Eastern European countries, the technologies most popular with business entities are social media, online cloud services, mobile applications and document flow automation. In countries in this region and the Balkans, executives' opinions are divided on the topic of combating unemployment using modern technologies (PAP 2019a). According to EBA (2020), the ability to use digital technologies requires a basic understanding of digital products and financial services. Consumers should first be made aware of digital channels and then available innovative and non-standard financial products and services.

4. Results and discussion

The diagnosed differences in the development of automated financial advisory services in Eastern and Central European countries are grounded in economic, regulatory, technological and socio-cultural factors. The basic determinant of an economic nature that differentiates individual markets is the affluence of a given society and its level of socio-economic development. Since the analysed services relate to investment advice, their popularity in a given country is determined by levels of economic and financial knowledge as well as interest in forms of investment alternative to bank deposits. The considerations in this study indicate that it is impossible to determine the effectiveness of education in Eastern European countries unequivocally.

5. Conclusion

Based on the data analysis, it should be concluded that the technological advancement in personal finance in the studied Eastern and Central European countries is at a high level, as evidenced by the high concentration of assets and the growing number of robo-advice users. In the analysed countries, financial knowledge is perceived as tedious and unnecessary. In order to fully engage customers in the active use of modern tools that support financial management, it is important to focus on consumer education.

The technological aspects associated with openness to the use of these technologies in financial services and the development of infrastructure related to Internet accessibility and bandwidth are not insignificant. The demographic structure and proportion of Millennials as target customers for robo-advice is also relevant. Regulatory factors play an important role regarding the possibility to legally offer this type of services in a given country as well as the willingness shown by citizens of a given country to use them.

The evaluation of the ethicality of robo-advice was associated statistically significantly with the probability of recommending robo-advice to friends. People who were of the opinion that robo-advisors were more ethical than traditional investment advisors were more likely to recommend robo-advice to their friends. The study indicates that these topics in the field of robo-advice require further research.

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