

Varazdin Development and Entrepreneurship Agency and University North
in cooperation with
Azerbaijan State University of Economics (UNEC)
Faculty of Management University of Warsaw
Faculty of Law, Economics and Social Sciences Sale - Mohammed V University in Rabat
Polytechnic of Medimurje in Cakovec



Economic and Social Development

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Editors:

Altay Ismayilov, Khatai Aliyev, Manuel Benazic



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LINKING BETWEEN FINANCIAL LITERACY AND EXTENDING OF FINTECH SERVICES

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ABSTRACT

Extending of financial services in every country depends on many factors, one of which is the level of financial literacy. The modern development of the financial services market is characterized by increased levels of digitization and expansion of the FinTech segment. The article aims to determine the linking between the level of financial literacy and the spread of FinTech services. The methodological basis of the study is the methods of correlation and cluster analysis. The study is based on statistical data for 138 countries. Given that payments and transfers occupy a dominant share in the structure of types of FinTech services, the indicator of the expansion of FinTech services is the share of population aged 15 years and over, which made digital payments in the past year. The correlation analysis between the proportion of adults who are financially literate and the percentage of people aged 15 and over who made digital payments in the past year, showed a direct link between financial literacy and the prevalence of FinTech services worldwide. The paper provides cluster analysis by the k-means method, which allowed to divide countries into 4 clusters, each of which is characterized by a different correlation between the levels of financial literacy, the spread of FinTech services, and the Internet activity of individuals. For cluster analysis, we used indicators of the proportion of adults who are financially literate, the percentage of the population aged 15 and over that made digital payments in the past year, and the percentage of individuals using the Internet. The results of the study made it possible to confirm the hypothesis that there is a direct link between the level of financial literacy of the population and the demand for FinTech services.

Keywords: *Financial literacy, Financial services, FinTech, Digitization, Cluster analysis*

1. INTRODUCTION

The importance of financial literacy is going to increase Post Coronavirus period considering the impact of it on the world economy, The authors of this article used their experience of financial consultancy and its application in different regions and analysed the world experience in this area. The importance of financial literacy for Azerbaijan, Ukraine and other countries with the same type of economy will be increasing in particular as there is direct interdependence between identifying the financial potential of different regions of the country and financial literacy of the population. Financial literacy is about understanding the nature of financial services by individuals, their ability to compare both types of financial services and different financial

institutions, and to choose the best option rationally. The level of financial literacy also determines whether people are aware of the benefits of using financial services, whether they have trust in particular financial institutions and state financial system in general, and, accordingly, whether they are in demand for these financial services (Bilan, Brychko et al., 2019; Didenko et al., 2018; Leonov et al., 2018). The emergence of new types of financial intermediaries and financial services, especially innovative ones, needs to inform consumers accordingly. It is important not only to familiarize consumers with financial products through the marketing strategy of banks and other financial intermediaries, but also to conduct information campaigns on the part of the state or public organizations about both the advantages, disadvantages and potential risks of financial services (Peresadko, Nikolaieva, 2012; Tiutiunyk, 2018; Vasylieva, Didenko, 2016). The mentioned is not only a component of financial literacy, but also a policy of protecting the rights of consumers of financial services (Palienko, Lyulyov, 2018; Poliakh, 2018; Vasilieva et al., 2017). Among the most notable innovations in the financial services market is the development of FinTech. Compared to the services of traditional financial intermediaries, FinTech services have their specific features. First, they can be provided not only by specialized financial institutions but also by other market entities. Among them are technology companies, software developers, who create mobile applications or web resources that mediate certain financial services or perform certain financial transactions (such as making payments, transfers, receiving credits through peer-to-peer or crowdfunding platforms) (Druhov et al., 2019; Bilan, Rubanov et al., 2019). Unlike traditional financial intermediaries, such platforms do not carry out credit assessments, neither provide risk-sharing. Besides, they do not have the same guarantees from the state, the same level of capitalization, or the same risk management system as traditional financial intermediaries (Alikariev, Poliakh, 2018, Berzin et al., 2018). This creates issues that need to be solved both at the micro and macro levels. The macro level of problems is related to information and cyber security, the use of new technologies in shadow and illegal operations (Lebid et al., 2018; Levchenko et al., 2019; Lyeonov et al., 2019; Vasylieva et al., 2018). For households, irrational financial behavior often results in financial losses. Therefore, financial literacy of financial services users is crucial in understanding the additional risks posed by non-financial intermediaries and the use of FinTech services (Buriak et al., 2019; Njegovanović, 2018). On the other hand, FinTech creates additional opportunities for increasing financial inclusion by making services available to SMEs and the poor (Grenčíková et al., 2019; Adeyinka et al., 2018; Kyrychenko et al., 2018; Weldeslassie, Vermaak, 2019). Another peculiar feature of FinTech services is that receiving and providing them requires the use of special tools for accessing mobile applications, web resources (smartphones, laptops, personal computers, etc.), and often requires Internet access. Accordingly, if there is no internet access or no mobile coverage in the country or certain non-urban areas, then the person will not have access to such FinTech services (Bardy, Rubens, 2019; Beyi, 2018; Milon et al., 2018). Thus, when analyzing the impact of financial literacy on demand for FinTech services, there are three components to consider:

- The level of financial literacy of the population;
- The prevalence of FinTech services (or the level of digitization of financial services);
- ICT development in the country (Internet usage by the community).

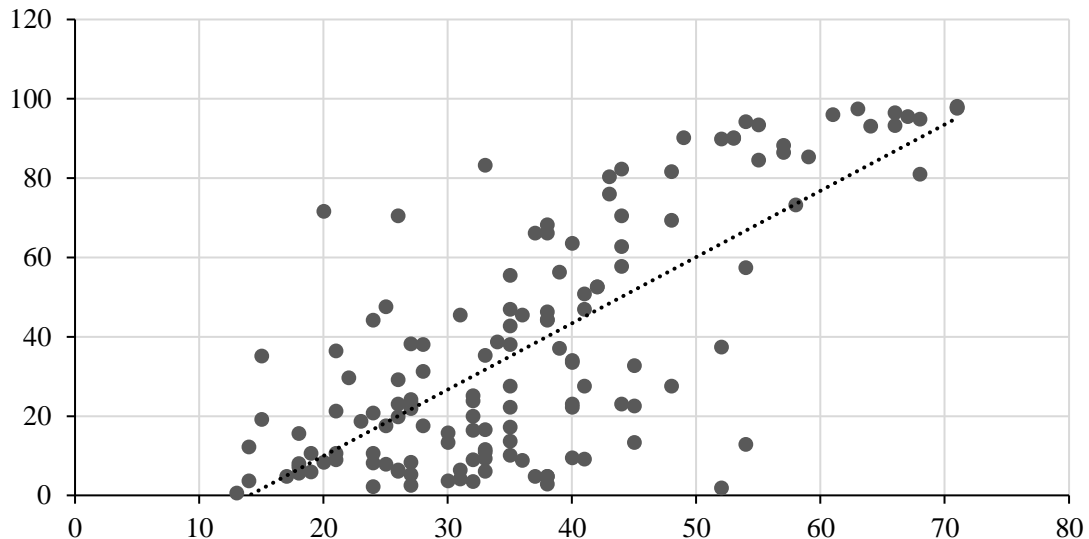
Thus, when conducting a cross-country analysis of the relationship between the identified indicators, we must simultaneously analyze all three components. The most commonly used indicators for assessing financial literacy are indicators that summarize the population's understanding of basic economic categories and patterns, such as the value of money, interest, risk, and inflation (Atkinson, Messy, 2012). Such surveys cannot technically be conducted very often.

Gathering information takes a lot of effort and time, especially when comparing data across countries. Therefore, the problem of assessing financial literacy is that statistics are irregular, limited to individual countries or regions (World Bank, 2010), and are insufficient to track the dynamics of the indicators over time. Among the most extensive global studies of financial literacy is the survey conducted by Standard & Poor's Ratings Services in 2014 (Klapper et al., 2015). As for the statistical basis for analyzing the spread of FinTech services, it is formed mainly by the type of FinTech services or their directions (payments, savings, crediting, etc.). At the same time, country-by-country statistics are virtually non-existent. That is objectively conditioned by the essential characteristics of the FinTech services themselves because when using digital technologies in financial, as in other spheres, interior features are erased (Shevliuga, Olefirenko, 2011; Vasylieva, Leonov et al., 2017). For example, mobile financial applications, regardless of their originator, can be used by users from different countries. Similarly, crowdfunding and peer-to-peer platforms, established in the US or UK, often allow you to raise resources or provide funding to citizens from other countries through access to online technology (Lin, Viswanathan, 2016). Similar conclusions can be drawn regarding trading on cryptocurrency exchanges and the like (Zekeri, Kadiri, 2018). At the same time, FinTech services have the highest share of payments, cards, and transfers (mobile wallets, online payments) (Capgemini, Efma, 2016). Therefore, it is possible to estimate the level of digitalization of financial services as a whole by the proportion of the population that conducts digital financial transactions (payments, transfers). Such data are collected annually by the World Bank. To analyze the level of ICT development in the country in terms of their accessibility to households, we use the indicator of the proportion of the population using the Internet. The source is also the World Bank database. Given that sufficient financial literacy statistics for all countries are only available for 2014, we, therefore, build a study based on a comparison of the three indicators we identified for the 2014 period: financial literacy, Internet usage, and digital payments. Correlation and cluster analysis methods are used to analyze the relationship between these parameters.

2. CORRELATION ANALYSIS RESULTS

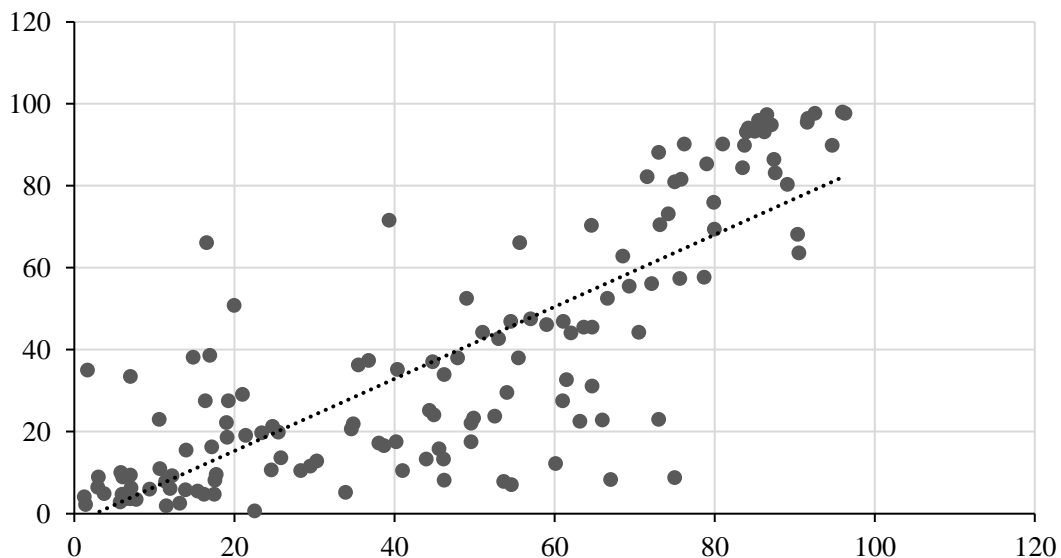
Correlation analysis of the link between the financial literacy of the population and the extending of FinTech services, expressed by the share of the population making digital payments, showed that there is a strong direct relationship between these parameters. The corresponding value of the correlation coefficient between the studied indicators is 0.7453. Figure 1 shows the scatterplot of the analyzed indicators for 138 countries in 2014. The appearance of the chart indicates the correlation between analyzed variables. There is a possibility of establishing a linear functional relationship between them. At the same time, there is a significant deviation from the trend line in some countries. Iran, Portugal, and the Korea Republic have high rates of the share of the population, making digital payments with relatively low levels of financial literacy. Vice versa, in such countries as Myanmar and Bhutan, the level of financial literacy is above average (52-54%), but the share of digital payments does not exceed 13%. Denmark, Norway, and Sweden have the highest levels of financial literacy (71%), and the highest rates of digital payments share (98%). The lowest values of both indicators are in Yemen and Afghanistan.

Figure following on the next page



*Figure 1: Scatter chart between the financial literacy of the population and the share of the population making digital payments
(Source: Authors' calculations based on the World Bank data; Klapper et al., 2015)*

An analysis of the correlation between the share of the population using the Internet and the share of the population making digital payments showed an even closer relationship than the previous pair of indicators (Figure 2). The corresponding value of the correlation coefficient is 0.8163, i.e., almost 82% change in the values of the studied indicators is described by the same functional dependence. On the one hand, this close linkage of indicators is justified since the Internet is directly used to implement the technological component of digital payments and transfers.



*Figure 2: Scatter chart between the proportion of the population using the Internet and the share of the population making digital payments
(Source: Authors' calculations based on the World Bank data)*

At the same time, digital payments can be made using smartphones, including special mobile applications, while an individual may not be a user of the Internet. In particular, country-by-country data analysis shows that even with low Internet penetration (16-20%), the proportion

of users of digital financial services is relatively high (50-66%) in some countries. Examples of such countries are Kenya and Mongolia, where mobile banking prevails. On the other hand, Azerbaijan, Albania, Armenia, Moldova are examples of countries where, despite sufficient internet access (60-75%), the proportion of users of digital financial services is negligible (7-12%).

3. CLUSTER ANALYSIS RESULTS

In the next phase of the study, we apply cluster analysis methods, in particular tree clustering and k-means clustering. Cluster analysis allows dividing the analyzed countries into homogeneous groups (clusters) at once with three selected parameters. The cluster analysis was performed using Statistica 10. The Euclidean distance calculation was used to measure distances between the objects being studied. In the first step of cluster analysis, we build a cluster tree that allows us to visually represent the estimated Euclidean distances for each country and the stages of clustering (Rubanov et al., 2019). The appearance of the constructed cluster tree demonstrates the following conclusions. First, the inability to accurately determine the number of clusters to delineate countries, which is explained by the large sample of study objects and the presence of specific features in each country that may make it close to one or the other cluster. Second, the analysis of the clustering sequence revealed both geographical communities (Denmark, Norway, Sweden) and countries from different geographic regions (Georgia and Ecuador, Germany, and Canada). In the next step of cluster analysis, the k-means clustering method makes a clear division of countries into clusters and allows us to investigate the statistical significance of the distribution. All countries were divided into 4 clusters. The smaller number of clusters does not allow to take into account all significant differences between the studied countries on the selected traits, the values of distances to the center of each cluster are large. Increasing the number of clusters to 5 or more causes a further division of the fourth cluster by less significant features. Thus, it is determined that the division into four clusters is optimal. The results of the k-means clustering are as follows. The plot of means (Figure 3) shows that each of the clusters formed has a different relationship between the average levels of the share of financially literate adults, adults who made digital payments, and individuals using the Internet. The countries in the first cluster have the highest scores for each of the studied parameters. In particular, the level of financial literacy of the population in the countries of this cluster is 55% on average, and the shares of the population using the Internet and making digital payments are higher than 80%.

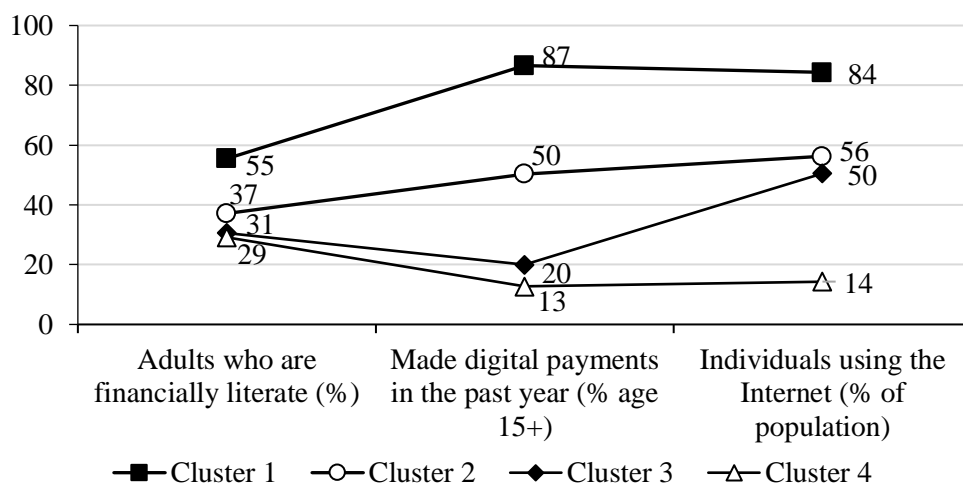


Figure 3: Plot of means for each cluster
(Source: Authors' calculations)

The second cluster countries are characterized by average levels of all the analyzed indicators, in particular, the proportion of the financially literate population in these countries is about 37% on average, while the Internet surfing and digital payments are made by nearly half of the population – 56% and 50% respectively. It should be noted that the third cluster countries have similar values of Internet usage as the second cluster countries. Still, they have lower values of other indicators. In essence, the financial literacy rate of the population is 31% on average, and the share of the population making digital payments is also low and averages 20%. A significant factor that differentiates between third and fourth cluster countries is the level of Internet usage. The fourth cluster countries have the lowest values of this indicator, which averages 14%. Thus, the fourth cluster includes countries that have the most moderate values of all studied indicators. From the plot of means, we can also conclude that despite the higher values of Internet usage in the third cluster countries, the share of digital payments made by the population in these countries remains low, which correlates with the low level of financial literacy of the population. The members of each cluster formed are presented in Table 1. By the number of countries, the first, second, and third clusters are balanced (include 27 to 31 countries), while the fourth cluster is the most numerous and unites 50 countries. The first cluster consists of the most developed countries of the world – the USA, Canada, Japan, Australia, as well as the most developed European countries. The most significant geographical diversity characterizes the countries of the second and third clusters. In particular, the 27 countries of the second cluster include less developed European countries, specifically Eastern European countries (Poland, Bulgaria, Belarus, Hungary, Russia), partly South American countries (Brazil, Chile, etc.), as well as some Asian countries (China and others). The third cluster unites the rest of the least developed countries in Europe (Moldova, Romania, Ukraine, and others), South America (Argentina, Peru, and others), as well as a large part of Asian countries (Azerbaijan, Kazakhstan, Georgia, Armenia, Vietnam, and others). Most of the fourth cluster countries are African countries, as well as the least developed Asian countries.

Cluster	Features		Members of cluster
1	Level of financial literacy	High	31 countries including Australia, Austria, Belgium, Canada, Czech Republic, Denmark, Estonia, Finland, France, Germany, Israel, Japan, Latvia, Netherlands, Norway, Singapore, Slovenia, Spain, Sweden, Switzerland, United Kingdom, United States
	Demand for FinTech services	High	
	Level of internet usage	High	
2	Level of financial literacy	Medium	27 countries including Belarus, Brazil, Bulgaria, Chile, China, Croatia, Hungary, Italy, Lithuania, Malaysia, Poland, Portugal, Russian Federation, Serbia
	Demand for FinTech services	Medium	
	Level of internet usage	Medium	
3	Level of financial literacy	Low	30 countries including Albania, Argentina, Armenia, Azerbaijan, Colombia, Georgia, Greece, Kazakhstan, Mexico, Moldova, Montenegro, Panama, Peru, Romania, Thailand, Tunisia, Ukraine, Uzbekistan
	Demand for FinTech services	Low	
	Level of internet usage	Medium	
4	Level of financial literacy	Low	50 countries including Algeria, Angola, Benin, Bhutan, Cambodia, Cameroon, Chad, Egypt, Ethiopia, Ghana, Indonesia, Iraq, Myanmar, Nepal, Nigeria, Pakistan
	Demand for FinTech services	Low	
	Level of internet usage	Low	

*Table 1: K-means clustering results
(Source: Developed by the authors)*

It should be noted that the data in Table 1 reflect the average level of financial literacy, Internet usage, and demand for FinTech services. Because the clustering was performed on three indicators at a time, in some countries of these samples, the actual values of the analyzed

indicators may be higher or lower than the cluster average. Notably, such deviations are inherent in countries in the second and third clusters. However, the overall trend found remains.

4. CONCLUSION

Overall, the analysis confirmed the relationship between financial literacy and the demand for FinTech services. The nature of correlation is straightforward; meaning a higher level of financial literacy contributes to greater demand for FinTech services. At the same time, there is a significant impact of the availability of online access and the level of Internet use on the prevalence of FinTech services in the country. According to the results of cluster analysis, the countries of the world were divided into 4 clusters. In most cases, the values of all three indicators for the countries of a particular cluster belong to the same level (the first cluster is the high level of all indicators, the second cluster is medium, and the fourth cluster is low). Countries in the third cluster already have an average level of Internet usage, but financial literacy remains low, and therefore, demand for FinTech services is small as well. In order to increase the level of technological development of the financial sector and the extending of FinTech, it is advisable to take measures to increase the level of financial literacy of the population. That is especially true for countries of the third cluster (Albania, Argentina, Armenia, Azerbaijan, Colombia, Georgia, Greece, Kazakhstan, Mexico, Moldova, Montenegro, Panama, Peru, Romania, Thailand, Tunisia, Ukraine, Uzbekistan, and others). Financial literacy covers many components, such as financial literacy of the consumer of financial services, financial literacy of business owners, financial literacy of managing personal finance (Korcsmaros et al., 2019). Among the components listed are those that remain relevant permanently, regardless of the economic development of the state: the ability to plan the expenses, knowledge about varieties of financial services, and the possibilities of their use. The latter is especially significant, given the active development of new types of financial services and the use of information technology opportunities in the financial sector (including FinTech). Other components (tax literacy, ability to use essential financial services, knowledge of investment, and savings options) are more relevant for developing or transitional economies (Vasylieva, Lieonov et al., 2017; Vorontsova et al., 2018). The general increase of financial literacy of the population contributes to the growth of public confidence in the financial sector, the increase in the volume of financial transactions, the expansion of the range of financial services, including the services of the FinTech segment.

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