

## Assessment of Electronic Banking Service's Impact on the Economic Parameters of the Bank Activity

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### ABSTRACT

The relevance of the study: The relevance of the research problem is conditioned by the intensification of innovative processes in modern economy and in the banking sector, in particular, as one of the most sensitive areas for innovation and innovative types of services and information and communication innovations today is one of the major conditions for ensuring the required level of competitiveness of banks. The purpose of the study: the Aim of this research is to develop methodical approaches to assess the impact of electronic banking service on the economic parameters of the Bank activity. Research methods: The main methods of research are methods of factor analysis, pair correlation, multiple correlation analysis, matrix models, and mathematical modeling. The results of the study: The paper proposes a synthesized variant of the method for assessing the impact of electronic banking services on the basis of the Internet technologies on the parameters of economic development of banking structure, which is based on a mathematical model of the technology of remote banking services. Practical significance: The paper is intended for researchers studying the problems of assessing of electronic banking services' impact, in particular the development of remote banking services, as well as professionals of the banking sector, dealing with investments and project implementation in its development.

### KEYWORDS

On-line banking, correlations, economic parameters, Internet technologies, mathematical modeling, synergy, convergence.

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## Introduction

The innovative character of the modern economy shows its reflection in the activities and the banking sector as one of the most sensitive areas for innovation and innovative types of services (Murav'eva, 2004). Managerial and

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financial innovations is today one of the main conditions to ensure the required level of competitiveness of banks in the market of actively developing and improving banking services' kinds (Gracheva, 2002; Alimbetov et al., 2016).

In this regard, of particular relevance is the assessment of the impact of electronic banking on the economic parameters of activity of the Bank (Yudenkov, 2010; Petrovskaya et al., 2016). Therefore, the use of economic-mathematical models for assessing of the impact of electronic banking on the economic parameters of the Bank activity based on the synthesized approach (Grigoryan, 2008), using cluster analysis (Mendel, 2008) and agglomerative-hierarchical method (Skripkin, 2002) provide the most adequate results, taking into account all peculiarities in the application of information and communication technology in banking (Dostov & Shust, 2013).

## **Methodological Framework**

### ***Objectives of the study***

Objective of the study is a methodical justification of the assessment of electronic banking's impact on the economic parameters of the Bank's activities, including:

- extensive statistical analysis of the data for constructing of economic and mathematical models for assessing of the impact of electronic banking on the economic parameters of the Bank activity;
- identified factors forming the revenue and expenditure components of the project:
  - a model of pair correlations of the studied parameters of the project;
  - the formed zone map of parameters' connection of the study and the scheme for construction of linear spline;
  - based on the construction of economic and mathematical models the nature of the variables' dependencies adopted in the method is revealed.

## **Results**

### ***Based on extensive statistical analysis of the data the matrix of pair correlations' coefficients of the economic-mathematical model's variables is formed for evaluation of electronic banking impact on the economic parameters of the Bank activity***

Analysis of the results of the high level of correlation between the studied variables (Murav'eva, 2004) allows drawing of the following conclusions:

- value parameters of the net profit (loss) variable highly depend on savings on collection through the use of technologies of remote banking services (RBS), the correlation coefficient which is 0.98; of the amount of a fee for payments through the system of RBS, the correlation coefficient which is also 0.98; the magnitude of gross sales, correlation coefficient which is also equal to 1; of the magnitude of marketing costs, the correlation coefficient of which is also equal to 1; of the amount of wages of production personnel, the correlation coefficient of which is also equal to (0,91).

It should be noted that the relations between these variables are expressed as strong one, while this relationship is positive when the growth of one



variable's parameter leads to similar growth of parameters of another variable. So, the parameters of the profit (loss) before income taxes highly depend on the following variables:

- the magnitude of savings on collection through the use of technologies of remote banking service, the correlation coefficient of which is equal to 0.99;
- the amount of the fee for payments through the system of RBS, the correlation coefficient of which is equal to 0.99;
- the magnitude of gross sales, correlation coefficient of which is equal to 1;
- the magnitude of marketing costs, the correlation coefficient of which is also equal to 1;
- gross profit's value, the correlation coefficient of which is also equal to 1;
- the amount of the net profit, correlation coefficient of which is also equal to 1.

The above enumerated relationships have expressed durable nature and differ for positive interdependencies.

Parameters of total fixed costs' values have a significant dependence only on the value of wages of production personnel, the correlation coefficient of which is equal to 0,99. In other words, in the process of RBS project implementation, there is a stable relationship between growth in wages of production staff and value of the total fixed costs. The most important result of the analysis is the conclusion that all significant coefficients have positive nature of relations, are close enough to 1 that suggests a direct relationship between changes in these variables that is important for the formation of the proposed methodic.

### ***The formed zone map of parameters' connection of the study and the scheme of the linear spline of the main parameters of the Bank's activities***

To continue the analysis and search of levels of dependencies between variables it is necessary to use methods of multivariate classification of objects, including cluster analysis and non-parametric classification (Mandel, 2008). As the experience of large data analysis shows, the number of objects can reach many tens and hundreds, but the number of features also can be expressed in tens. Obviously, the direct (visual) analysis of a data matrix with a large number of objects and features is almost ineffective. It is only possible to identify individual features of the studied structure, to derive illustrative examples. There are different ways to define distances between clusters. Usually the proximity of two clusters is defined as the average value of the distances between all such pairs of objects where one object of the pair belongs to one cluster and the other to another. In other words, the hierarchical method of cluster analysis involves  $n - 1$  of similar steps. Thus after each step the number of clusters decreases by one and the distance matrix is reduced by one row and one column. At the end of this procedure will be one cluster which contains all  $n$  objects (Mandel, 2008).

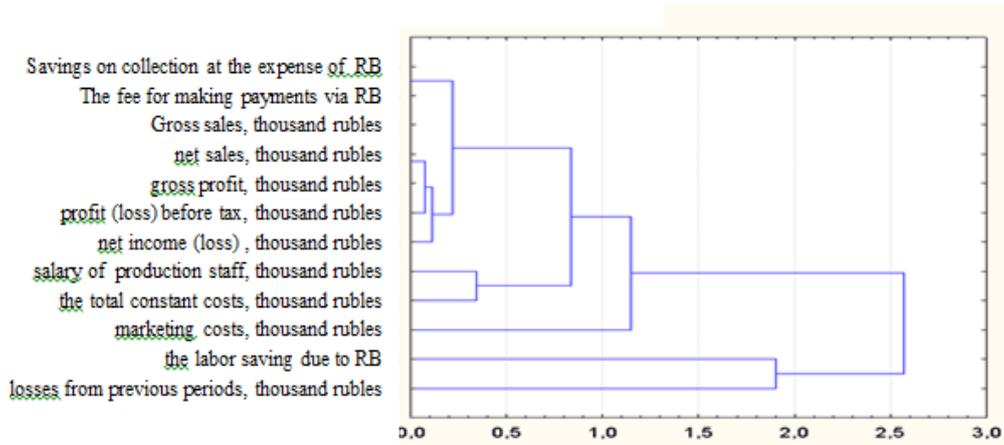


Figure 1. A dendrogram of parameters' relationship of study

The results of such classification can be represented as a dendrogram (hierarchical structure tree) that contains  $n$  levels, each of which corresponds to one of the steps of the process of successive aggregation of clusters. Based on agglomerative - hierarchical method the dendrogram (Fig. 1) and zone map (Fig. 2) are built. As it is evidenced by the results of the analysis of the information in these two figures, the closest ones in the cluster are the variables "gross profit" and "net sales", and then the "net profit" is adjoined, later in the cluster the "magnitude of fee payment" is adjoined. On a more distant level, "the wages of staff" and "total costs" are adjoined (they are very close in a neighboring cluster).

Then to all the above enumerated variables the variables of marketing costs are adjoined, and at the late stage the cluster that contains the variables of settings saving labor costs and losses from previous periods joins. At the next stage of the study, it is logical the formation of a linear interpolation in the spline of the first order.

With linear interpolation it is assumed that the function  $f(x)$  between the interpolation nodes varies linearly (see Fig. 3.). Based on the geometry of the equation of the line passing through the points  $(x_{i-1}, y_{i-1})$  and  $(x_i, y_i)$  dependence has the following form:

$$\frac{y - y_{i-1}}{y_i - y_{i-1}} = \frac{x - x_{i-1}}{x_i - x_{i-1}}$$

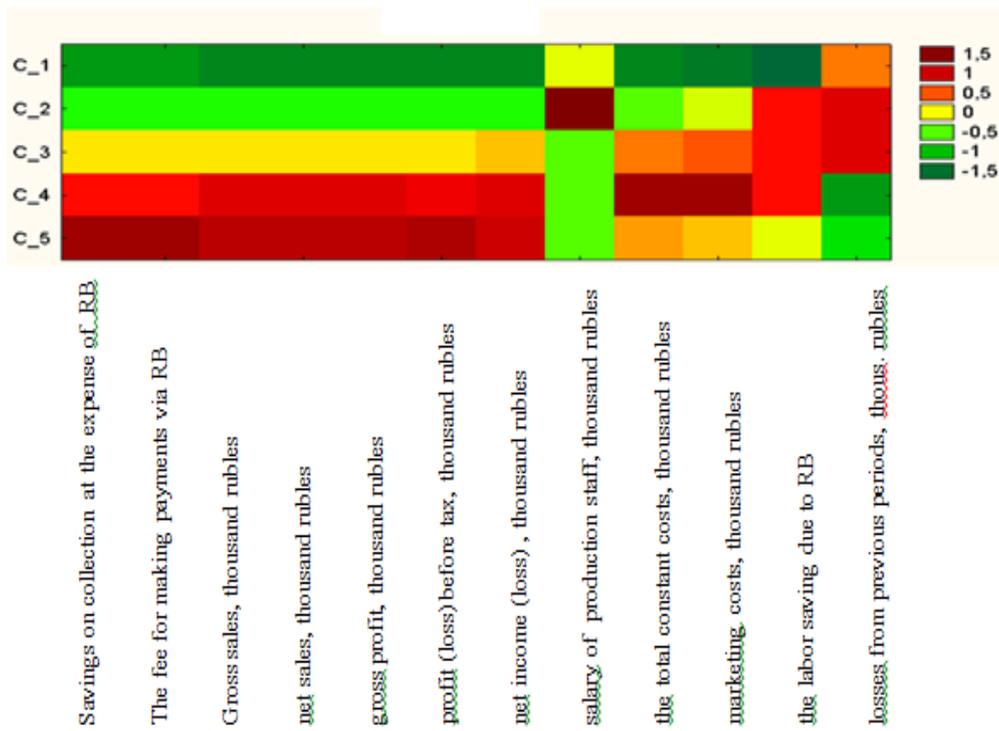


Figure 2. Zone map of relationship of the study parameters

Hence for each value of x lying in the interval [xi-1 xi ] the corresponding y value can be found according to the following formula:

$$y = y_{i-1} + \frac{y_i - y_{i-1}}{x_i - x_{i-1}}(x - x_{i-1})$$

Thus, we can find any f(x) = y at any point along the interpolation.

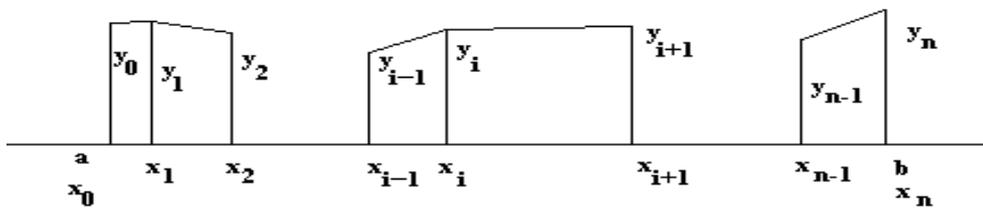


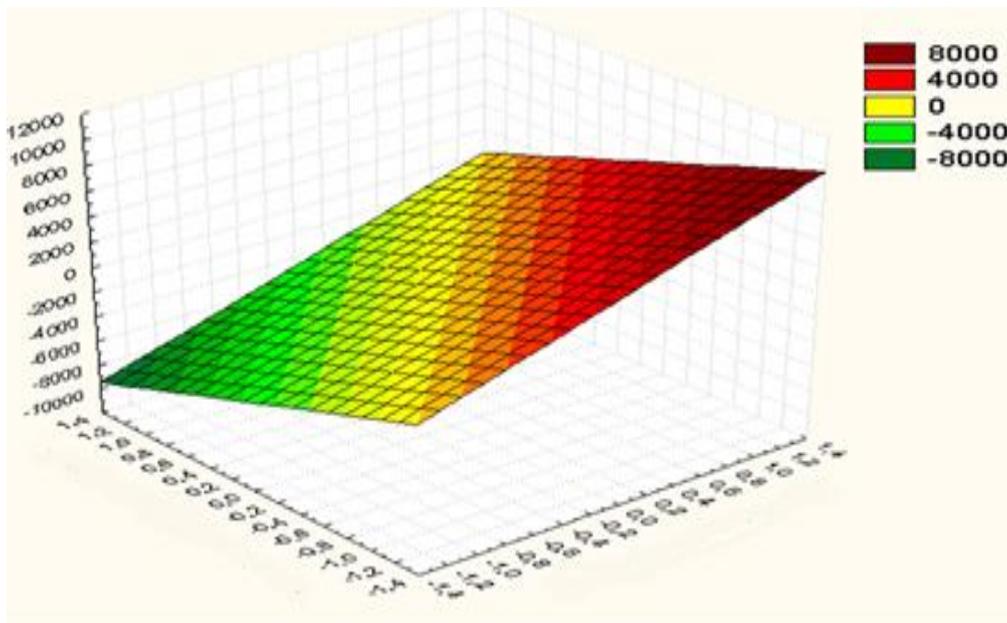
Figure 3. Diagram of the construction of linear spline

Carried out by methods of multivariate classification of objects, including cluster analysis and non-parametric classification the analysis allowed constructing not only a dendrogram of communication, but also zone map of

parameters. This helped to identify the closeness of connections between variables and to build a system of linear spline testifying that between the interpolation nodes the changes are subjected to the linear law (Skripkin, 2002).

***Based on the construction of economic and mathematical models the nature of the dependencies adopted in the methodic of variables is revealed***

For the greatest clarity and ability to visualize tendencies and regularities of interaction and interdependence between the main variables a series of graphs reflecting these relationships consistently is constructed.



**Figure 4.** A graph of the dependences of "net profit" (AxisX) parameters and the parameters of "save to collection" (Axis Y) and "commissions for payments through RBS" (Axis Z)

The graph (Fig. 4) shows dynamic dependence between the variables of "net profit", "saving on cash collection through the implementation of RBS" on the basis of Internet banking and "Commission payment through the system". The positive dynamics of either of the last two parameters leads to an increase in the variable of "net profit".

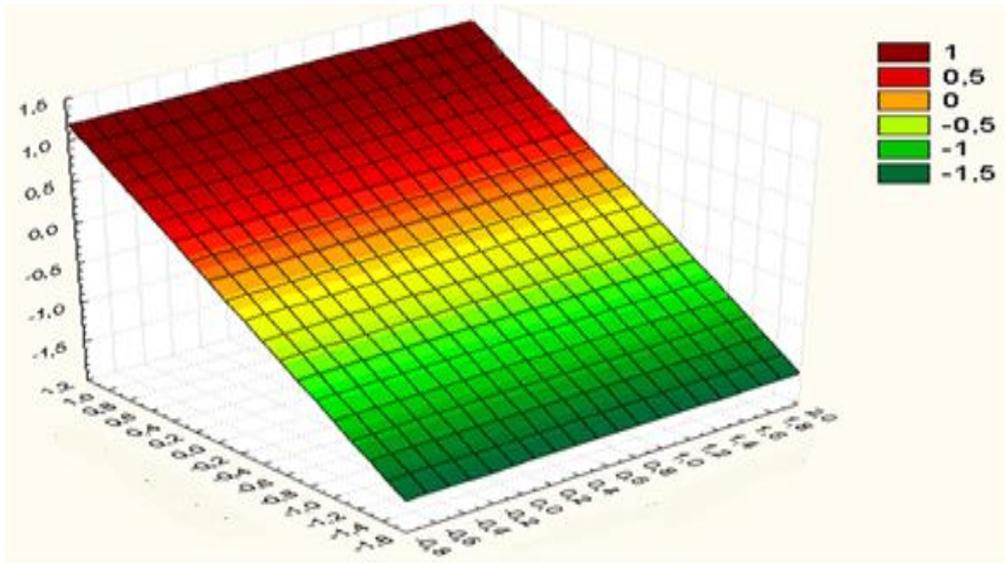


Figure 5. Graph of the parameters of the "net profit" (Axis X) and parameters of "economy of labor" (Axis Y) and "gross sales" (Axis Z)

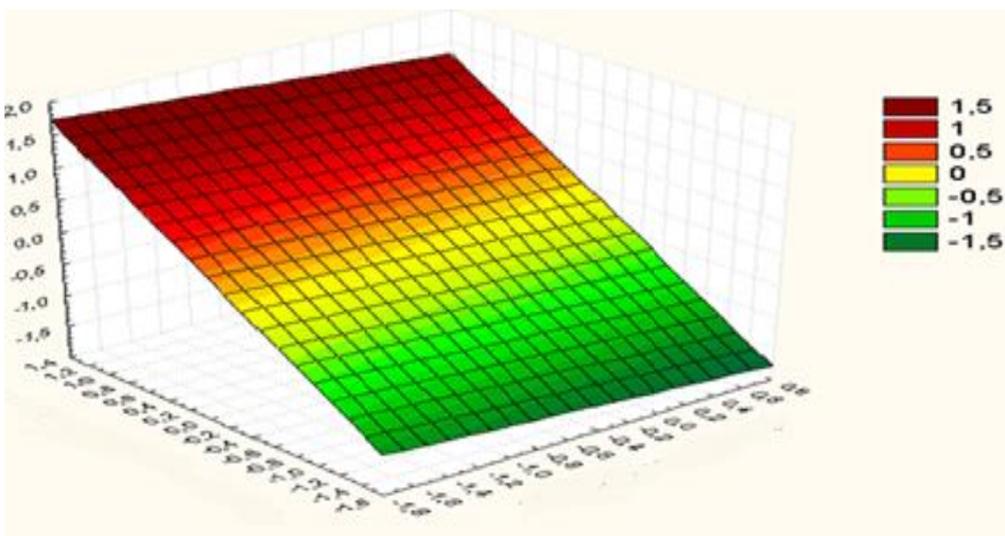
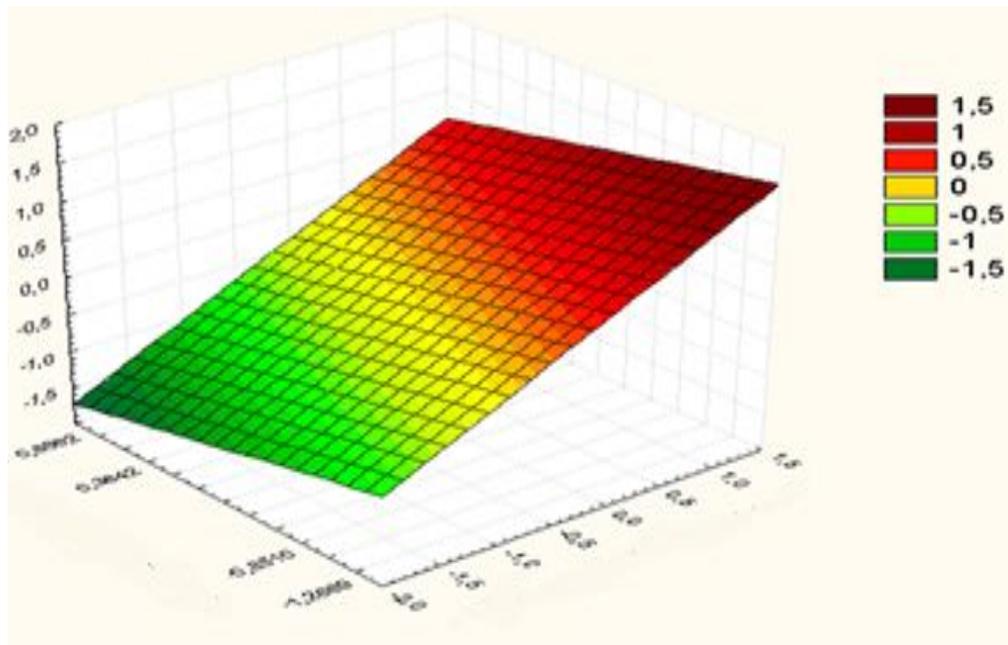


Figure 6. Graph of the parameters of the "net profit" (Axis X) and parameters of "marketing costs" (Axis Y) and "wages of production staff" (Axis Z)

As the data of the above illustrated Fig. 5 and 6 shows, describing the dynamic dependence between the variables of the net profit on the values of the factor variables, the positive dynamics any of the last two parameters leads to an increase in the variable of "net profit". In turn, the direct dependence of the parameter's growth "wages of production personnel and increase of the "net profit" can only be explained by the fact that the increase in wages is not due to the absolute increment of size from personnel but the opening of new branches of the bank and recruitment of new employees.



**Figure 7.** A graph of the parameters' dependence of "net profit" (Axis X) and of the "losses from previous periods" (Axis Y) and "total fixed costs" (Axis Z)

The Graph (Fig. 7.) shows dynamic dependence between the variables of net profit and losses of previous periods, as well as total fixed costs

Thus, the nature of the variables' dependencies adopted in the methodic can be identified as follows:

- it is quite obvious, as it is confirmed by economic and mathematical models that most accurately the behavior of the variable of "net profit" is characterized by the parameters of "gross profit" and "profit before taxes";
- to a lesser extent about the value of "variable gross profit" and "profit before tax" can judge the behavior of the magnitude "of fee payment through RBS";
- even less on the behavior of the parameters of the variable "net profit" influences "wages of production staff" and "total fixed charges";
- even too less in descending order on the behavior of the parameters of the variable "net profit" influences "marketing costs";
- finally, in the most lesser extent in descending order on the behavior of the parameters of the variable "net profit" influences "save labor costs" and "losses from previous periods".

Analysis of economic-mathematical modeling to build the proposed methodic allows to conclude that information and communication technologies include the synergistic mechanism of interaction of all components of the variables and factors of the study (Kochergin, 2011) when changing one of the parameters of one or another factor, there are corresponding changes in the parameters of the other factors adopted in the research. So, as a general conclusion it should be noted that any of the parameters entails a particular parameter growth in net profit. This phenomenon is observed everywhere, in



spite of the fact that we ranked the degree of influence on the behavior of net profit, these degrees are close enough and to judge about the net profit is possible by any of the options. Also according to any one of the selected number of parameters it is possible to judge on the behavior of remaining, as the calculations and studies have shown that the growth of one of the parameters leads to the increase of all parameters, which indicates on the surge of synergy effect (Leonovich, 2007).

Thus, the proposed methodic proves that information and communication technologies when they are embedded in the institutional system of the banking organizations have systemic effects (Martynova, 2006) which is expressed in the intensification of processes of convergence, innovation activity, and manifestation of the synergy effect almost at the level of all factors, which influence significantly the economic and functional parameters of the banking organization's activity in the whole.

### Discussion

Problems of formation of methodology and tools of virtual technology in the development of e-banking, prospects and risks of Internet technologies in the banking business are explored in the works of M.V. Gracheva (2002), T.I. Leonovich (2007), T. Martynova (2006), D.A. Kochergin (2011), Yu. N. Yudenkov (2010).

Modern tendencies of development and regulation of Russian market of electronic banking services, as well as problems in the process of organization of electronic money transactions are considered in works of S.A. Grigoryan (2008), V.L. Dostov & P.M. Shust (2013).

To the problems of the specifics of banking innovations, as well as to the factorial and structural analysis of information technology in banking sphere the works of A.V. Murav'eva (2004) are devoted.

Economic efficiency of functioning of the electronic information systems is considered in the works of K.G. Skripkin (2002).

To the study of peculiarities of application of structural-typological features and their classification, to cluster analysis in different sectors of the economy the works of I.D. Mandel (2008) are devoted.

### Conclusion

Presented methodic for assessing of the impact of electronic banking service on the economic parameters of the Bank activity proves that information and communication technologies when they are embedded in the institutional system of the banking organizations have a systemic effect on it, expressed in the intensification of processes of convergence, innovation activity, and manifestation of the synergy effect almost at the level of all factors, which influence significantly the economic and functional parameters of the banking organization activities in the whole.

### Recommendations

The obtained results allow expanding of the methodical basis of the service economy, the tools for assessing of the impact of electronic banking service on the economic parameters of the Bank's activity. In addition, the obtained results can be useful to public administrations in the field of Informatization of the

banking sector in making managerial decisions in sphere of investment policy and Bank specialists when assessing the impact of RBS projects, their efficiency and commercialization in the market of electronic banking services.

### Disclosure statement

No potential conflict of interest was reported by the authors.

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