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The Problem of Unauthorized Transactions of Using Bank Cards as a Payment Instrument

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***Abstract*—The bank card market continues to develop and the capacity of this segment of banking services has not yet been exhausted in Russia. The development of the payment card market is facilitated by several factors, such as a development of technologies used to ensure transactions with cards and a change of bank clients' generations. The most part of Generation Y (Millennials) and Generation Z has more confidence in card payments than previous generations. However, the technology development, the customers' activity and, sometimes, the awareness lack of cardholders about the protecting possibilities of banking data let fraudsters steal money from the accounts of bank customers. The relevance of the article topic is due to the fact that there is no significant reduction in transactions made with bank cards without the consent of clients of financial institutions despite the constant development of technologies, including in the field of cashless payments. An increase in the payment cards numbers, the number of payment cards transactions and the volume of payment cards transactions themselves shows the adoption of measures to prevent unauthorized access to these payment instruments. The article analyzes the dynamics of transactions with bank cards in their relationship with unauthorized transactions. As a result of the study, it is proposed to develop and implement software to identify and prevent unauthorized transactions with payment cards. Also, the authors consider it is necessary to develop a legislation to stimulate banks to develop payment card protection software, and to toughen punishment for the considered unauthorized write-offs of clients' money.**

Keywords—bank card, payment card, unauthorized transaction, payment card transaction

I. INTRODUCTION

The active spread of bank cards as a non-cash payment instrument in world practice can be observed since the 1980s of the 20th century. In Russia, this tool was developed to a greater extent in the 2000s. But the transition from using cash to bank cards in settlements could be observed in the 2010s in the United States, when employers abandoned the use of checks in favor of payment cards in settlements with their employees (Angel et al., 2015).

E-commerce systems as part of the digital economy include various elements, including debit and credit cards, digital checks, stored value cards, and others (Batten et al., 2019; Hove et al., 2016). In some studies we can find comments on the increasing possibility of jointly solving

problems in the financial sphere between the public and private sectors in the development of the digital technologies using and ensuring financial stability (Eaton et al., 2018; Ozili, 2018) or the significant development of digital technologies in the financial sector (Gomber et al., 2017; Puschmann, 2017).

The bank card using for making payments and transfers has advantages and disadvantages for banking institutions, the government and cardholders. Among the advantages for banks, we can say about the availability of access to accounts tied to cards and the ability to carry out their activities, reducing the cost of supporting operational activities, and among the disadvantages - the presence of reputational risks due to the possibility of using cards of a particular bank to carry out fraudulent schemes. An increase in the share of non-cash payments with bank cards reduces the shadow sector of the economy by growing the transparency of transactions. However, in some studies we can find data on the functioning of the digital shadow economy (Gaspareniene et al., 2016). As a disadvantage for government we can say about decrease in the ability to control money aggregates (in particular, M0 in the Russian Federation) and the money supply as instruments for the implementation of monetary policy by the central bank. The advantages for cardholders are the possibility of obtaining additional benefits in the form of bonuses and cashbacks, instant transfers and payments using remote forms of banking services (personal accounts and mobile applications), control and manage of money at card accounts 24/7. A disadvantage is worth noting the additional costs of issuing and servicing bank cards, as well as the possibility of losing money as a result of unauthorized transactions.

The formation and expansion of the digital economy is accompanied by the development of payment systems and non-cash forms of payments. For example, Sweden has abandoned the use of cash for payments, while other Scandinavian countries are showing an increase in the share of digital payments (Pizzola et al., 2018). Some scholars study cashless economy models as an option to reduce the share of the shadow sector, hinder tax evasion, etc. (Cohen et al., 2020). Others study the impact of a cashless economy on increasing financial inclusion (Bayero, 2015; Diniz et al., 2016). Some researchers associate the development of the cashless economy with a change in the institutional environment (Shekhar et al., 2020). These changes, in our opinion, can be accompanied by the transformation not only of formal institutions of the monetary system functioning (development of legislation of the cashless economy functioning), but also influence the informal institutions prevalent in the state as a whole or in its regions (change in habitual patterns of behavior in payment transactions). The development of digital technologies allows the creation of new interaction instruments in the monetary system, in addition to the previously existing traditional instruments and methods of non-cash payments and remote banking services (Khanboubi et al., 2019; Kumar et al., 2020; Lee et al., 2020). At the same time, it is worth noting the need to develop a management system for interaction with banks' clients, including in the field of issuing and servicing bank cards, as a fairly common product, in addition to other banking products - deposits, loans, valuable papers, etc. (Konovalov et al., 2020).

The need to study the bank cards using for payments is also due to the significant penetration of digital technologies into consumer behavior and the impact on their choices (See-To et al., 2014; Fritze et al., 2018), which will increase in the future.

II. MATERIALS AND METHODS

Our study was based on data from surveys on unauthorized money transfers (2015-2018), a review of transactions conducted without the consent of clients of financial institutions (for 2019) and statistical reports on the number and volume of transactions and cards, issued by the Bank of Russia. The reports contain statistical data of the number of unauthorized money write-offs from bank cards, the number of actual transactions performed using bank cards, and the number of issued payment cards.

As a research tool we used the correlation coefficient, formed on the basis of variables (Table 1).

TABLE I. VARIABLES USED TO CALCULATE THE CORRELATION COEFFICIENT

Variables	Description of the variable
Q_{unauth}	quantity of unauthorized card transactions (units)
Q_{total}	quantity of card transactions (units)
Q_{oth}	volume of transactions carried out on the territory of Russia and abroad using payment and credit cards issued by credit institutions and the Bank of Russia - other transactions (units)
V_{unauth}	volume of unauthorized card transactions (mln rubles)
V_{total}	volume of card transactions (mln rubles)
$V_{unauth-Int/mob}$	volume of unauthorized transactions carried out via the Internet and mobile devices (mln rubles)
V_{oth}	volume of transactions carried out on the territory of Russia and abroad using payment and credit cards issued by credit institutions and the Bank of Russia - other transactions (mln rubles)
Q_{card}	quantity of payment cards issued by credit institutions and the Bank of Russia, thousand units
$r_{\frac{Qunauth}{Qtotal}year}$	Coefficient of correlation between the quantity of unauthorized card transactions (units) with the quantity of card transactions (units), annual data
$r_{\frac{Qunauth}{Qoth}year}$	Coefficient of correlation between the quantity of unauthorized card transactions (units) with the quantity of other transactions with cards (units), annual data
$r_{\frac{Qunauth}{Qtotal}quart}$	Correlation coefficient of the quantity of unauthorized transactions with cards (units) with the quantity of transactions with cards (units), quarterly data
$r_{\frac{Qunauth}{Qoth}quart}$	Correlation coefficient of the quantity of unauthorized transactions with cards (units) with the quantity of other transactions with cards (units), quarterly data
$r_{\frac{Vunauth}{Vtotal}year}$ $r_{\frac{Vunauth}{Vunauth-Int/mob}year}$ $r_{\frac{Vunauth}{Voth}year}$	Correlation coefficient of the volume of unauthorized card transactions (mln rubles) with: the volume of transactions with cards (mln rubles), annual data the volume of unauthorized transactions carried out via the Internet and mobile devices (mln rubles), annual data other transactions with cards (mln rubles), annual data
$r_{\frac{Vunauth}{Vtotal}quart}$ $r_{\frac{Vunauth}{Vunauth-Int/mob}quart}$ $r_{\frac{Vunauth}{Voth}quart}$	Correlation coefficient of the volume of unauthorized card transactions (mln rubles) with: the volume of transactions with cards (mln rubles), quarterly data the volume of unauthorized transactions carried out via the Internet and mobile devices (mln rubles), quarterly data other transactions with cards (mln rubles), quarterly data

The correlation coefficients were calculated using the classical formula:

$$r_{x/y} = \frac{\sum(x_i - \bar{x}) \times (y_i - \bar{y})}{\sqrt{\sum(x_i - \bar{x})^2 \times \sum(y_i - \bar{y})^2}} \quad (1)$$

III. RESULTS

In our research we analyzed the dynamics of changes in the volume and quantity of transactions carried out using bank cards in their relationship with the dynamics of volumes and the quantity of unauthorized transactions with cards. Analyzing quarterly data from 2014 to 2018, we found a direct relationship between the quantity of unauthorized transactions with the total quantity of transactions with cards and the quantity of unauthorized transactions with the quantity of other transactions with cards - the correlation coefficients are 0.7401 and 0.7671, respectively (Table 2).

At the same time, there is no strong correlation between the dynamics of the volume of unauthorized transactions and the volume of total transactions with bank cards. This correlation coefficient has a negative value and is equal to -0.1192 (Table 2). A similar correlation is showed by the correlation coefficient between the volume of unauthorized transactions using bank cards and the volume of other transactions (not related to payment for goods, works and services and cash withdrawals), which has a value of -0.0757 (Table 2).

A weak correlation is showed by the correlation coefficient of the volume of unauthorized transactions using bank cards and the volume of unauthorized transactions performed via the Internet and mobile devices - the coefficient value is 0.2689 (Table 2).

However, if we analyze annual data, we can observe a strong correlation between almost all indicators. The correlation coefficients of the quantity of unauthorized transactions with cards with the quantity of transactions with cards and the quantity of unauthorized transactions with the quantity of other transactions with cards have the highest value - 0.9303 and 0.9472, respectively.

TABLE II. VALUE OF CORRELATION COEFFICIENTS - QUARTERLY AND ANNUAL VALUES

	Quarterly data	**Annual data**
Coefficient of correlation between the quantity of unauthorized card transactions (units) with the quantity of card transactions (units)	0.740186574	0.930370649
Correlation coefficient of the volume of unauthorized card transactions (mln rubles) with the volume of transactions with cards (mln rubles)	-0.11924847	0.706521118
Correlation coefficient of the volume of unauthorized card transactions (mln rubles) with the volume of unauthorized transactions carried out via the Internet and mobile devices (mln rubles)	0.26890696	0.138715776
Correlation coefficient of the quantity of unauthorized transactions with cards (units) with the quantity of other transactions with cards (units)	0.767186069	0.947217804
Correlation coefficient of the volume of unauthorized card transactions (mln rubles) with other transactions with cards (mln rubles)	-0.07577284	0.710099919

At the same time, the correlation coefficients of the volume of unauthorized card transactions with the volume of card transactions and the volume of unauthorized card transactions with the volume of other transactions also have a strong correlation between the analyzed indicators - the value of the coefficients is 0.7065 and 0.71, respectively (Table 2). There is no correlation between the volume of unauthorized card transactions with the volume of unauthorized transactions performed via the Internet and mobile devices - the correlation coefficient is 0.1387.

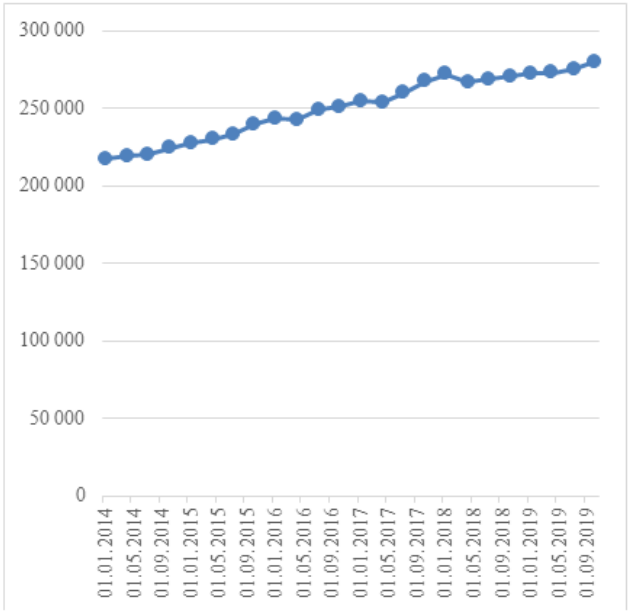

Fig. 1. Quantity of payment cards issued by credit institutions and the Bank of Russia, thous. units

The data in Figure 1 shows an increase in the quantity of issued cards, which exceeds 1 billion pieces on an annualized basis, starting in 2017, which allows us to talk about the stable spread of such an element of the digital economy as non-cash payments through bank cards. Considering the fact that the cards are valid for 2-5 years, the quantity of cards used during the year significantly exceeds the quantity of cards issued during the same period.

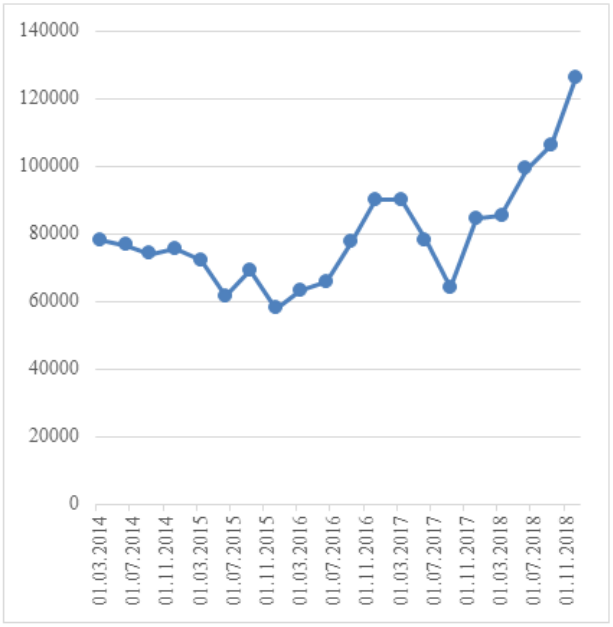

Fig. 2. Quantity of unauthorized transactions with cards carried out on the territory of the Russian Federation (units)

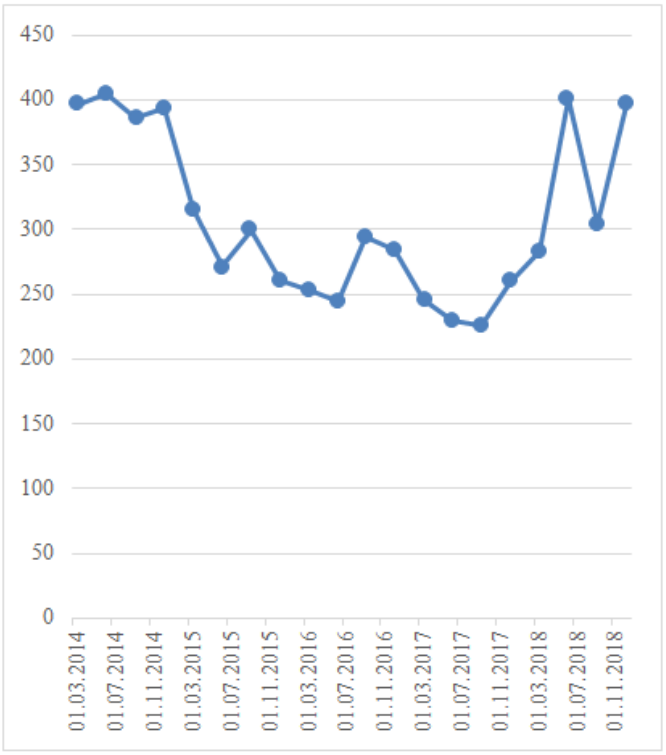

Fig. 3. Volume of unauthorized transactions with cards carried out on the territory of the Russian Federation (mln rubles)

It is an interesting fact that despite the presence of a strong correlation between the quantity of unauthorized card transactions (units) and the quantity of card transactions (units) based on quarterly data and a rather weak correlation between the volume of unauthorized card transactions (million rubles) with the total volume of card transactions (mln rubles) also according to quarterly data, we can observe multidirectional dynamics of changes in the quantity of unauthorized card transactions (units) and the volume of unauthorized card transactions (mln rubles) if we analyze quarterly data values in 2014 -2018 (Fig. 2 and 3).

At the same time, the correlation coefficients of the annual values of these indicators show a strong correlation between these indicators (Table 2).

Analysis of the dynamics of average values of the volume of unauthorized card transactions also does not reflect a similar trend. In the period from 2014 to 2017, we can observe a stable downward trend in the average value of the volume of unauthorized transactions, despite the general trend of an increase in the quantity of unauthorized transactions (Table 3). Since 2018, there has been an increase in the average values of the volume of unauthorized transactions, while in 2019 there was a jump - an increase of more than 3.3 times.

We would like to pay attention that only registered facts of unauthorized operations with cards were used in the analysis. It is not possible to estimate the volume of unauthorized transactions for which no applications were received from the banks' clients.

TABLE III. DYNAMICS OF THE NUMBER AND VOLUME OF UNAUTHORIZED TRANSACTIONS WITH CARDS

	2014	2015	2016	2017	2018	2019
Quantity of unauthorized card transactions (units)	304154	260922	296698	317178	416933	576,566
Volume of unauthorized card transactions (mln rubles)	1581.4	1147	1075.4	961.3	1384.7	6426.5
Average value of an unauthorized card transaction, thousand rubles	5.199	4.395	3.624	3.03	3.321	11.146

IV. DISCUSSION

The observed growth in the bank card using in transactions is accompanied by an increase in unauthorized transactions with bank cards, which leads to various losses of cardholders. The Review of Transactions Conducted without the Consent of Clients of Financial Institutions for 2019, published by the Bank of Russia, provides data on 85% of unreimbursed money to bank clients. This fact reflects the need to develop and implement software aimed at identifying and preventing unauthorized transactions with cards due to the further spread of the use of cashless payments by all participants in the development of the digital economy.

We also consider a necessary to develop and adopt specialized legislation that will toughen measures against entities performing unauthorized transactions with cards and will provide for the simplification of the procedure for filing an application by the injured party when revealing the facts of unauthorized transactions.

V. CONCLUSION

It can be concluded that there is a direct correlation between the quantity of issued cards, transactions carried out with them and the quantity of unauthorized transactions with cards recorded.

Despite the fact that there is no stable growth in the volume of unauthorized transactions in money, carried out with cards, there is a need to tighten legislation in the field of regulation of illegal actions with cards and money on the accounts of cardholders in order to ensure the safety of money of financial institutions' clients and increase the degree of confidence in the use of bank cards in the implementation of all money transactions, primarily by individuals for the development and further spread of the system of cashless payments.

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