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FINANCIAL INNOVATIONS ROLE IN CONSUMER BEHAVIOR AT RUSSIAN RETAIL PAYMENTS MARKET

Abstract:

This study estimates the effect of contactless payment and various financial innovations on the frequency of payments in terms of number of transactions for different individuals at the Russian retail payments market. Using the representative nation-wide survey of 1500 individuals, it was found that various types of financial innovations promote activity of consumers at the retail payments market. This paper contributes to the existing literature in payment economics by empirically analyzing the effects of emerging and existing retail financial innovations on the consumers' behavior at Russian retail payments market. The results of the paper provide important implications for both consumers and merchants, as well as help to overcome barriers that prevent spread and use various financial innovations in the future.

Keywords:

Retail payments; payment cards; customers' behavior; financial services; benefits; financial innovation

JEL Classification: G21, D53, E42

1   Introduction

Over the past decades, cash has been one of the main payment methods (Arango et al, 2014). Before, in a barter economy, people exchanged one commodity directly for another without using money. However, people have different preferences regarding goods and that makes a pure barter difficult (Kiyotaki & Wright, 1991). This served as a ground for appearance of money with their exchange role (Kiyotaki & Wright, 1991). For a long time, money had the leading positions. Then, during the first half 1900s, cash and checks appeared and became the most common payment instruments that enabled to make purchases and perform financial transactions between people and firms (Runnemark et al, 2015). Credit and debit cards became available during the second half of 1900s for purchases and later became used for withdrawal of cash from Automatic Teller Machines (ATMs) (Runnemark et al, 2015; Slawsky & Zafar, 2005). Later in the 1990s, electronic commerce was introduced as an additional method of performing financial transactions with the help of the Internet (Runnemark et al, 2015). Electronic commerce has made a large impact on the business environment at a global level, but some time passed and technologies and applications also have started to be more oriented on mobile computing, web connection, and mobile commerce (Shaikh & Karjaluoto, 2014). Against the background of all these events, mobile banking (m-banking) has been developed and the «the focus has shifted to the mobile phone and its capabilities of being a payment device» (Runnemark et al, p. 2, 2015). It is possible to make a prediction that in some time, cash will probably die out and a cashless society will be established (Arvidsson and Markendahl, 2014; Carton and Hedman, 2013; Hedman, 2012).

Globalization has increased the speed of free movement of capital and, as a result, the profitability of different activities in financial markets. Advances in information technology have made possible the financial design, online trading. Moreover, due to the continually growing volume of payments and various specific requests of market participants and the increase in the number of technical capabilities, the steady development of various non-cash payment mechanisms may be observed (Goczek & Witkowski, 2015; Bonn et al., 1999). Among the non-cash instruments currently available are debit and credit cards, prepaid instruments, electronic and mobile money, as well as various mobile payment systems and others (Arango et al, 2015).

There are several other reasons can be named to explain the activation of the innovation process in the financial markets. Among them are:

- the signs of market inefficiency and the imperfections of functioning of markets;

- the necessity to reduce transaction costs and improve profits;

- tightening of financial regulation and tax regime;

- the need for hedging operations;

- increased risks (Razhabbaev & Akhmedov, 2014).

In general, as a result of increasing competitive pressure, several significant changes occurred in the financial industry. This led to the acceleration of consolidation processes, market division and

the occurrence of a number of international large operators as well as new payment instruments (Trachuk & Kornilov, 2013).

In most economies nowadays, the growing process of cash and non-cash payment mechanisms goes in parallel. The importance of growth of non-cash methods of payments along with increase in the number of financial innovations lies in the fact that it leads to significant changes to a country's economy. There are several studies that confirm that the development of different financial innovations along with the system of noncash facilities positively affects economic growth (Hasan, 2012). Another important contribution that is particularly important for the whole financial system on a state level is the decrease in the shadow economy which occurs because noncash transactions are much more transparent compared to cash transactions (Goczek & Witkowski, 2015).

The individual's acceptance of various payment instruments can be seen as the process that depends on a number of benefits and costs arising from the adoption and use of a particular financial payment method. The factors that create the value of a payment instrument from a user's point of view determine the success of payment innovations along with the influence of financial innovations on the payment behavior are the main points of interest of this study.

Despite the fact that today financial innovations and cashless payments attract a lot of attention, there is not much analysis considering the factors that have a real impact on the trends and development processes of cashless payment mechanisms at retail level (Goczek & Witkowski, 2015). The number of empirical researches in this sphere is insufficient and such researches can be said to have a more analytical nature of the study (Saaksjarvi, 2003; Lassar et al, 2004; Claudy et al, 2014; Arango et al, 2016). A great proportion of literature on this topic analyses primarily the network effect property of retail payments, however this effect can hardly be measured using econometric techniques (Claessens, 2003; Milne, 2006; Au & Kauffman, 2008). The main novelty of this study is to assess determinants of different financial innovations on an empirical level and analyze their significance for the individuals' behavior. This work is also relevant from an economic point of view since it provides the insights about how the supply of financial innovations and contactless payments can stimulate the payment behavior of individuals, and therefore explains how interesting and profitable it is for providers of financial innovation to offer and develop various financial innovations.

The main objective of this work is to empirically evaluate influence of cashless payments and emerging and existing financial innovations on consumers' payment behavior at Russian retail payments. Besides the study attempts to identify the main determinants of the frequency of usage of noncash techniques and financial innovations, and, in general, the factors that influence the individual's decision whether to use or not a particular financial technology. Determination of such factors will enable to forecast how successful will be the introduction of a particular innovation, as well as it will provide a deeper understanding of the processes that help or, on the contrary, prevent the greatest spread of contactless payments and various financial innovations. It is crucial for firms that develop and market new products and services to understand whether and why

consumers will adopt innovations (Claudy et al, 2014). In practice, managers, when making a market research, often rely on consumers' attitudes towards characteristics of a particular product to anticipate whether a particular innovation will be accepted by individuals. Also, such empirical investigation will help to overcome barriers that make it difficult to spread and use various financial innovations (Claudy et al, 2014).

The structure of the work reflects the goal and objectives of the research. The study includes an introduction in which the aim of the research is stated, the relevance and the problem of the work are formulated, the research objectives are described; theoretical framework in which mechanisms through which financial innovations and contactless payment options may affect payment behavior are explained; empirical set-up which gives information about the data and variables used for analysis, as well as about the model implemented to draw empirical conclusions; results which give the insights about the main findings of the work; and list of references which demonstrate the scale of the study in terms of the analysis of available theoretical and practical material.

2   Theoretical Framework

Nowadays a lot of attention is given to the growing use of noncash instruments in retail payment markets (Goczek & Witkowski, 2015). During the last years there was a significant improvement in computer technology. As a result, the past decade has been characterized by the quick growth of different financial innovations, that has led to the expansion of use of various payment instruments other than cash. For example, credit and debit cards, various contactless payment technologies have significantly increased in their popularity during the last decade.

When it comes to analysis of a choice of a payment instrument, it should be noted that there is a number of factors that affect the prevalence and use of payment instruments by different consumers. It is necessary to mention, however, that there are factors that favor both the use of financial innovations and, on the contrary, more traditional methods of payment, such as cash. These factors may not necessarily be economical, but also may have sociological nature: for example, level of trust to financial institutions, perceived safety of a particular product, how easy it is to enforce private contracts of overdue payments and some others (Goczek & Witkowski, 2015). As was mentioned before, unfortunately, most of works on this topic provide solely a descriptive statistics and are based on analytical or case study analysis.

Arkady Trachuk and Georgy Kornilov (2013) conditionally divided factors that influence the decision concerning the method of payment into three groups: basic economic factors (for example, the amount of money in circulation or the Ratio of GDP to the amount of money in circulation), economic and technological factors («factors of convenience» such as ease of use or fraud resistance) and socio-cultural factors (age structure of the population, culture of using money and others). In the light of our analysis we will mainly focus on the, so called, factors of convenience and with reference to the paper we will explain what specific factors fall into these groups. We can also divide these factors into two categories, characterized by their effect either on usage or the frequency of usage of different financial innovation. That is there are factors that influence mostly the choice of a payment instrument, and in particular the intention to use various

financial innovations and also factors that determine how often will a particular innovation or a contactless payment method be used, that is they provide motivations to employ them more frequently.

2.1 Effect on usage of financial innovations

In the work of Arkady Trachuk and Georgy Kornilov (2013), the ease of use factor was identified among factors that affect the spread and expansion of the use of various financial innovations (Anguelov et al. 2004). The "ease of use" appears when there is no need for special knowledge and technology to use a payment instrument. At first glance, we can say that the ease of use is more characteristic of cash, but in our days, we can see that the young and middle generations do not have a need in acquiring special skills and abilities to use financial innovations since from their early age they interact with various financial technologies (Siu & Cheng, 2001, Hayhoe et al, 1999). It can be noticed that at a present the younger generation already easily uses non-cash payment methods in their everyday life, for example, they often make purchases using a phone or plastic card (Trachuk & Kornilov, 2013).

However, in the paper of F. Munoz-Leiva et al (2016), where individuals had to examine a mobile application of the largest European bank, it was not found that there exists a positive effect of usefulness on the intention to use the mobile application.

Apart from the age, other socio-demographic factors play a role in determining the acceptance and use of different financial innovations. For example, in the work of Howard Tokunaga it is argued that credit cards are used mostly by individuals with a sufficient level of education (Schuh & Stavins, 2010) and relatively high income (Hogarth & Anguelov 2004). These consumers are said to care more about the fashion and, therefore, less about prices of products, and to be more risk oriented (Howard Tokunaga, 1993).

Another crucial factor influencing the consumer payment choice refers to how secure and safe payment instruments are (Trutsch, 2017). In last years it has become an important topic for state banks and financial institutions because of the growth of electronic payments (Trutsch, 2017). In the paper of Arkady Trachuk and Georgy Kornilov a relating factor is identified more narrowly and is called the resistance to fraud (Murphy, 1998). It should, firstly, be noted that different payment instruments are subject to different types of fraud. The type of the fraud is subject to the characteristics of a particular instrument, as well as the conditions under which it is used. In the case of cash, the main types of fraud will be theft and counterfeiting (Trachuk & Kornilov, 2013). However, the fraud cases happen in the sphere of the financial innovations: methods that are used in contactless systems, make available the flow of personal information, duplication of payments and a copy of a Bank card information. Moreover, there exist high-tech methods of fraud that allow to thief funds from personal banking accounts or e-wallets.

For example, Arango and Taylor (2009) indicate that payment cards are used more frequently if individuals perceive them less risky in terms of potential fraud or theft compared to cash. In the work of Marc Anthony Fusaro it is argued that individuals report "safety" as one of the motivations for using a card, therefore considering this financial innovation as a safer one compared to cash

(Fusaro, 2013). However, in the study of Schuh and Stavins (2010) there was no evidence that security motives play a significant role in the choice of a payment instrument.

Another factor related to the previous one is the level of trust to either a financial institution (for example, a bank that issues a card, or a particular financial technology and those who stand behind it). An average user of financial innovations has concerns about the access to and use of his personal information. Financial companies are aware of this and try to produce new software and technologies that help to solve this problem by ensuring anonymity of consumers, keeping the numbers of their credit cards safe and making cautions about web sites that are unsecured (Godwin J. Udo, 2001). Moreover, for a large number of individuals' cooperation with financial institutions, such as banks, is limited due to bad credit histories, unstable and unsteady cash flows, and a low level of financial literacy (Servon & Kaestner, 2008). Large investments are made by governments and commercial organizations to ensure that the methods of transferring data over the Internet are safe. Yet numerous steps are taken to ensure the safety of identification of participants in financial transactions, there is still a great demand for privacy in the area of financial activity (Trachuk & Kornilov, 2013).

The next important factor is negotiability (Trachuk & Kornilov, 2013). By the negotiability is meant the ability to use a given financial innovation with the absence of special confirmation by the existing agents. Today we may argue that only cash can be said to have full marketability.

Among convenience factors universality may also be named (Trachuk & Kornilov, 2013). By the universality it is meant that payment instruments should possess such qualities as fewer restrictions regarding its use and large number of agents that willing to accept a particular means of payment. Obviously, it is crucial for any payment method, before it will actually be widely used, to be accepted by individuals. However, taking into an account the nature of retail payment markets, individuals will be ready to accept a new payment instrument solely if there is already a sufficient number of other individuals that use it, because the value of a payment instrument grows accordingly with the number of other individuals using it (Trutsch, 2017). At the same time, a particular payment method should be accepted by merchants as well. In this regard, the most universal payment instrument will be the one that is a legal means of payment and thus is required to be accepted in any territory. Today cash still has the leading position in these terms (Trachuk & Kornilov, 2013).

Also, autonomy can be considered as an important factor (Trachuk & Kornilov, 2013). It should be possible to use the means of payment in case of unavailability of communication channels (offline). For example, some individuals are afraid of losing the connection during the time they perform an online banking transaction (Kuisma et al., 2007). If autonomy is defined as an opportunity to make transactions offline, then it is possible to say that today some non-cash payment instruments have a significant autonomy. However, if looking in a broader sense and explain autonomy as dependence on the availability of information channels or power, the cash today is the only one instrument that has full autonomy (Trachuk & Kornilov, 2013).

Apart from a possibility of losing a connection, there exist other perceived risks that are implicitly incorporated in different types of innovations. For example, cellphones have a limited battery,

which is essential for using the cellphone and its services. Other consumers worry about a possibility of making mistakes in their banking processes when using a laptop (Kuisma et al., 2007). There are also risks associated with people having a list of their pin codes and passwords that make access to their personal data and finance easy (Kuisma et al., 2007). However, in the analysis of F. Munoz-Leiva et al (2016) only weak relationship was found between perceived risks and intention of using a financial application.

2.2 Effect on frequency of usage of financial innovations

There are other factors that also may be thought of as determinants of a payment instrument choice and frequency of its usage. Among them are cost savings from using a particular instrument, switching costs and the increased speed of performing a transaction (Borzekowski & Kiser, 2008; Borzekowski, Kiser, and Ahmed, 2008). Banks and other financial institutions try to offer and consistently develop different technologies because they can improve efficiency, decrease costs, and increase the number of consumers using them (Servon & Kaestner, 2008).

Electronic banking can be given as an example of a financial innovation, that has increased in its popularity a lot during the last years. Electronic banking has several advantages, among which are the ability to see account balances of an individual and easier transfer of funds among various accounts (Goldfield, 1998). It is also argued that electronic banking has lower cost of usage and it is more convenient because financial services are available for individual at any time at any place. Moreover, an individual's financial management improves and risks associated with carrying cash tend to be lower (Hogarth & Anguelov, 2004). In recent papers is has also been stated that "increased use of online banking and bill paying can actually decrease the occurrence of identity theft by taking personal information outside the mailbox and eliminating a paper trail" (Stafford & Royne, 2004, p.201).

Different sources of additional income that provide financial innovations also play a big role in the choice of a payment instrument. Intuitively, if a particular financial innovation provides some form of benefits in terms of cash back, miles for airplanes or discounts in a partner stores, the individual will be more motivated to use this technology and will use it more frequently. The supporting evidence is found in Carlos Arango, Kim P. Huynh et all (2011), where they indicated that higher levels of rewards and various bonuses lead to higher volume of credit card purchases relative to cases with the absence of rewards.

There are 2 main hypothesis that are needed to be stated for the further analysis implemented in this work.

Hypothesis 1. Benefits that do provide different types of financial innovations are positive and significant for the cardholders.

Hypothesis 2. Cashless payments and emerging and existing financial innovations positively influence consumers' payment behavior.

3   Empirical set-up

3.1 Data and sample

The main data source that we use for our analysis is the survey of the retail payments performed by Moscow School of Management SKOLKOVO Financial Innovations and Cashless Economy Centre in 2017. The data is representative for the Russian retail payments market and include the surveys of 1,500 individuals and 800 merchants from all federal regions of Russia. The total sample of 1500 people gives reliable information with a statistical error of 3.4% (Krejcie & Morgan, 1970; Grafström & Schelin, 2013). In our work, the focus is on the individuals from all cities in Russia. The study uses three-stage probability sampling technique and quotas for age and gender to guarantee that the proportion of each separate group of individuals (sorted by gender, income, age and geographical position) corresponds to the Russian demography.

The sample implementation scheme provides a multi-stage stratified territorial random sample of respondents. The sample of respondents implemented in accordance with the scheme represents the adult (over 18 years) population of the Russian Federation by sex, age, labor status (employment) and type of settlement in which the Respondent lives using three stage probability sampling and relevant quotas. Separate Federal districts of the Russian Federation are also represented in the study. All cities are included in the sample.

Face-to-face interviews were conducted with individuals and used to collect the dataset. In the study of individuals, which are the focus of our work, 1500 people were interviewed, among the respondents the proportion of women (54% vs. 46%) is slightly higher than the proportion of men, which goes in line with the results of the all-Russian census conducted by the Federal state statistics service in 2010 of distribution of the population by sex. The survey involved respondents aged 18 to 99 years. The highest percentage of respondents (29%) are aged 55+. About a half of the respondents (45%) have specialized secondary education, 25% have higher education.

Among the respondents, employees predominate (64%), another 18% of respondents are pensioners. The sample is dominated by middle-income respondents: for example, 48% indicated that they have enough money for food and clothing, but the purchase of household facilities is difficult. Another 27% indicated that, if necessary, can afford to buy household facilities.

It was shown in the study that 73.5% of individuals surveyed in 2014 hold at least one payment card, 75% of which uses it for payments. In 2017, 75% of individuals had at least one payment card, while 88% of them used it to pay for goods and services. In the period of last 8 years the share of non-cash transactions in total number of transactions increased from 21% to 71% (Moscow school of management SKOLKOVO, Market research of retail payment services in Russia, 2017).

3.2 Variables

All of the variables used in the further analysis of this research are available in table 1. In this table, it is shown what question from the survey was taken to estimate each particular variable, the name of the variable employed while performing the empirical analysis, type of the variable and additional comments along with description.

Table 1. Description of all of the variables used in paper's analysis

Question in the questionnaire	Variable name in the model	Type of variable	Description or/and commentaries
Q40. If the cashier accepts cards, how often do You pay with a card?	Frequency	Categorical	Estimation of frequency of payments with credit card. Values: 1 = if never of almost never 2 = Sometimes or rarely 3 = Always or almost always 0 = Difficult to answer / fail to answer
QD4. Do You personally have a valid Bank card?	Hold	Binomial	Values: 1 = yes 0 = no
Q61. What services do You use for financial transactions? - Mobile banking applications - Internet banking - E-wallets, for example, Yandex.Money, Qiwi Wallet - Personal Finance management Applications - Social networks, for example, money transfers in Vkontakte	mob_app_use	Binomial	1 = if a person uses a particular service for performing financial transactions 0 = if a person doesn't use a particular service for performing financial transactions
	internet_bank_use	Binomial	
	e_wallet_use	Binomial	
	financial_app_use	Binomial	
	soc_networks_use	Binomial	

	usage_at_least_one	Binomial	1 = if a person uses at least one service from the list above
			0 = if a person does not use any service from the list above
	av_use	Continuous	PCA variable on the basis of use variables
Q63. How often do You use these technologies? - Mobile banking applications - Internet banking - E-wallets, for example, Yandex.Money, Qiwi Wallet - Personal Finance management Applications - Social networks, for example, money transfers in Vkontakte	frequency mob_app_frequency	Categorical	Values: 5 = Every day 4 = Two/three times a week 3 = Every two weeks 2 = Once a month 1 = Less than once a month 0 = if a person doesn't use a particular service for performing financial transactions
	internet_bank_frequency	Categorical	
	e_wallet_frequency	Categorical	
	financial_app_frequency	Categorical	
	soc_networks_frequency	Categorical	
	av_frequency	Continuous	PCA variable on the basis of frequency variables
Q57. Do You trust financial innovations / technologies provided by different services (mobile app developers, social networks)?	Level_of_trust	Categorical	Values: 4 = Yes, I do. 3 = Rather Yes than no 2 = Rather no than Yes 1 = No, I don't. 0 = Difficult to answer / fail to answer

Q44. Do You participate in bonus programs of banks (do you get bonuses (points, airline miles, etc.) or discounts when paying for goods by credit card?	Participation_loyalties_progr	Binomial	Values: 0 = No 1 = Yes
Q66.Which of the following contactless payment options do You have? - ApplePay - SamsungPay - AndroidPay - Bank cards with contactless Mastercard technology - Bank cards with Visa contactless technology	availability_ApplePay	Binomial	Values: 0 = No 1 = Yes
	availability_SamsungPay	Binomial	
	availability_AndroidPay	Binomial	
	availability_Mastercard	Binomial	
	availability_Visa	Binomial	
	availability_Visa_and_Mastercard	Binomial	Values: 1 = if a person has a payment option of bank cards with contactless Mastercard or Visa technology 0 = if a person doesn't have a payment option of bank cards with contactless Mastercard or Visa technology

Q49. What will change if the bonus programs become more profitable (for example, the number of bonuses will double)? How often will You use the card to pay for goods and services?	improvement_of_bonuses	Categorical	Values: 4 = Open the card and will actively use it to pay for goods and services 3 = Open the card and will actively use it, but mainly for cash withdrawals at an ATM 2 = I'll open the map, so it was in case of need 1 = I'll still use the cash
Q71. How important it is for you to interact with Your Bank channels listed below? - Bank branch - Call center - Internet bank - Mobile application	importance_interaction_bank	Categorical	Values: 1– absolutely not important = 1 2 = 2 3 = 3 4 = 4 5 = 5 6 = 6 7– very important = 7
	importance_interaction_callc	Categorical	
	importance_interaction_internetb	Categorical	
	importance_interaction_mobapp	Categorical	
Q58. Do you use any electronic devices for financial transactions? - I use a computer (laptop) - I use the tablet - I use a mobile phone	computer_use_for_finop	Binomial	Values: 1 = if a person uses one of the particular devices listed for financial transactions 0 = if a person doesn't use one of the particular devices listed for financial transactions
	tablet_use_for_finop	Binomial	
	mobile_use_for_finop	Binomial	

	mobile_and_tabl et_use_for_finop	Binomial	This variable is comprised on the basis of variables about usage of tablets or mobile phone for financial transactions. Values: 1 = if a person uses tablet or mobile phone devices for financial transactions 0 = if a person doesn't use tablet or mobile phone devices for financial transactions
QD3. Your education? - Lower secondary education or lower - Secondary education (school or vocational school) - Secondary special education (technical school) - Incomplete higher education (from the 3rd year of University) - Higher education - Difficult to answer / fail to answer	beg_prof	Binomial	Lower secondary education or lower Secondary education (school or vocational school)
	mid_prof	Binomial	Incomplete higher education (from the 3rd year of University)
	high_prof	Binomial	Higher education
QD11. Look at the card. Tell me, if we consider all types of payments – salaries, pensions, allowances, scholarships, what was about your family income per family member last month?	low_income	Categorical	Up to 3000 rubles 3000-5999 rubles 6 000 – 9 999 rubles 10 000 – 14 999 rubles 15 000 – 24 999 rubles

	high_income	Categorical	45 000 – 54 999 rubles 55 000 – 64 999 rubles 65 000 – 74 999 rubles 75 000 rubles and above
QD7. Are You married? Yes / No	mar	Binomial	Values: 1 = yes 0 = no
QD2. How old are You now?	y_18	Binomial	If a person is from 18 to 25 y.o
	y_2535	Binomial	If a person is from 26 to 35 y.o.
	y_3545	Binomial	If a person is from 36 to 45 y.o.
	y_5565	Binomial	If a person is from 55 to 65 y.o.
	y_65m	Binomial	If a person is from 66 y.o. or older
Q15. What is the type of your Bank card? Debit/ Credit	credit	Binomial	Values: 1 = credit 0 = debit
Q23. In addition to the card's annual service fee, do You have any other regular payments related to the card service (for example, mobile banking fee)?	No_pay	Binomial	Values: 1 = yes 0 = no

3.2.1 Dependent variables

There are two dependent variables used in the analysis. The first one is the card usage dummy. This variable used on the first stage of the two-step Heckman selection model is a binomial variable on holding a valid bank card by an individual. It is estimated by the answer from the questionnaire and takes the value of 1 if a person has a valid bank card and 0 if they don't have one.

The second dependent variable in our analysis is the payment behavior of individuals at Russian retail payments markets, which is estimated by the frequency of payments with a card. This variable is categorical and takes values from 0 to 3. A variable is equal to 1 if a person uses a particular service never of almost never, 2 if sometimes or rarely, 3 if always or almost always and 0 if a person does not use payment card at all, finds it difficult to answer or fails to answer. The data for estimating this variable is also available from the answers in the survey because the questionnaire asked those respondents, who owned at least one payment card, how frequently they use their card for purchases of goods and services. Due to the fact that only those individuals, who possess at least one payment card, were asked the question about the frequency of its usage, the data on potential frequency of payments of those individuals that do not own a payment card yet, but potentially could become card users, is not available.

3.2.2 Explanatory variables

There are several explanatory variables used to evaluate the influence of cashless payments and emerging and existing financial innovations on consumers' payment behavior.

The first variable is the individuals' usage of different services for performing financial transactions. Among these services are mobile banking applications, internet banking, e-wallets (for example, Yandex.Money, Qiwi wallet), personal finance management applications and social networks (for example, money transfers in Vkontakte). There are 5 variables related to the frequency of usage, each related to one of the technologies. These variables are binomial. A variable is equal to 1 if a person uses a given service and 0 otherwise.

Virtual electronic services make it possible for people to make various payments using a credit card or an account in the electronic system. Internet transactions are usually associated with simplicity, speed of transfer of funds and safety regarding personal data. Online payment systems may be divided into three categories: electronic currency, online banking and instant payment services.

Internet banking is a system that allows people to receive bank services via the Internet. For example, transfer money, pay bills or repay a loan. People can access the Internet Bank from a computer, tablet, smartphone simply through a browser. Also, mobile gadgets allow installing special financial management applications or mobile banking applications — they are sometimes considered to be more convenient to use.

A simple example of instant payment system is Qiwi wallet, which appeared in 2007. Services like Qiwi are associated with the ease of use and variety of components. These are the terminals, own bank cards and a set of online tools that allow you to make numerous transactions. Use of

social networks (for example, money transfers in Vkontakte) for financial operations is also increasing in popularity.

The second variable is the frequency of usage of all of the technologies listed below for financial transactions. There are 5 variables related to the frequency of usage, each is concerned with one of the technologies. These variables are also categorical and take values from 1 to 5. A variable is equal to 1 if a person uses a particular service less than once a month, 2 if once a month, 3 if every two weeks, 4 if a person uses a technology from two to three times a week and 5 if he uses it every day.

In a number of robustness checks we have also used Principal Component Analysis (PCA) with the aim to standardize the range of the continuous initial variables so that each one of them contributes equally to the analysis. Two new variables, namely average usage of different services and average frequency of usage of all of the different technologies for performing financial transactions, were created. PCA allows calculating weighted average components of given factors, where weights are based on the correlations among the variables. This approach outperforms naïve arithmetic average approach and accounts for the fact that some innovations might not be used by people as frequently as the others.

To test robustness of the results to the changes in measures, the access to contactless payment options, which evaluates the accessibility of an individual to financial innovations, is used. Access device innovations can make payments more convenient for cardholders. The aim is to assess the impact of contactless payment on transaction frequency. To estimate this variable, answers to the question about contactless payment options of an individual available directly from the surveys are used. Among different options presented are ApplePay, SamsungPay, AndroidPay, bank cards with contactless Mastercard technology and bank cards with Visa contactless technology. These variables are binomial and take value of 1 if a person uses one of the particular contactless payment options for financial transactions and 0 if a person doesn't use any.

Due to the limited data on usage of bank cards with contactless Mastercard and Visa technology, we have created another variable to catch the effects of both of these contactless payment options. It is binomial and takes a value of 1 if a person has a payment option of bank cards with contactless Mastercard or Visa technology and 0 otherwise.

The final variable is the usage of electronic devices for payment purposes. This variable is estimated by the answers from the survey and includes answers to the question about the usage of electronic devices for financial transactions. Electronic devices include computer (laptop), the tablet and a mobile phone. These variables are binomial and take value of 1 if a person uses one of the particular devices listed for financial transactions and 0 if a person doesn't use any one of the particular devices listed for financial transactions.

Due to limited data on usage of tablets and mobile phones for financial operations, a new variable was created to catch the effects of usage of both of these electronic devices. The new variable is binomial and is equal to 1 if a person uses one of the particular devices for financial transactions and 0 if he doesn't use one of the particular devices listed.

3.2.3 Control variables

Among control variables, several groups can be identified: socio-economic factors, transaction and contract-specific. Socio-economic factors of the individuals that include the age, income level and education level. All of these variables are treated as dummy variables that correspond to particular interval (e.g., level of education or income or age groups). Moreover, the study controls for the marital status of an individual. Age group from 46 to 54 is a reference category, while for the income level it is the individuals with middle income.

Marital status may have an effect on the probability to hold and frequency of payments with a card since partners can have numerous instruments for making payment linked to one bank account balance. This improves the transfer of income between family members (Bounie et al., 2016; Schuh & Stavins, 2010; Krivosheya & Korolev, 2016).

The income level represents whether an individual is able to cover fees and expenses that are related to the process of issuing a payment card and purchase a certain amount of goods and services (Krivosheya & Korolev, 2016). It also can be supposed that people with lower level of income will not be highly interested in any novelties including card payments, while people with high income are more likely to engage with contemporary payment options (Goczek & Witkowski, 2015).

Other control variables include level of trust to bank services, consideration of an imaginary situation of bonus programs becoming more profitable and individuals' reaction towards it and importance of interaction with bank's channels (bank branch, call center, internet bank and mobile application). All of these variables are categorical and are available from the survey questionnaire. Most of these variables are introduced in the robustness checks, while main analysis focuses on controls described in the existing literature.

There was a survey among Dutch credit card owners performed by Kosse (2010). It was indicated that the level of confidence in financial institutions plays one of the most important roles in determining the willingness to pay cashless, therefore the willingness to use financial innovations.

Different bank rewards and loyalties programs motivate individuals to use hold a card and use more frequently due to additional benefits associated with cashless instruments. (Agarwal, Chakravorti et al, 2010; Krivosheya & Korolev, 2016).

Finally, the details of the contract with the issuers such as the absence of fees for certain payment products (e.g., salary card), the type of card (credit or debit card) and participation of individuals in bonus programs of banks (bonuses as airline miles or discounts when paying for goods and services by credit card) are taken into consideration. All of these variables are dummy variables.

3.3 Estimation methods

This study uses the two-step Heckman selection model to estimate the proposed models of cashless payments usage frequency. The main advantage of this model is that it allows to mitigate the potential selection and survivorship biases resulting from the fact that the data on usage of a card is available only in case an individual is already has a card. These biases are

common in empirical analyses and in order to correct them, we need to treat the second model as dependent on the first one.

In the first stage, there is a probit model by which it is estimated the probability a person possesses a card. In the second stage the probability that a person who possesses at least one card uses it to pay for goods and services is estimated. In order to control for selection bias, the inverse Mills ratio is used. The results for probability of holding a card that are estimated by the probit model are also used as a selection equation probability modeling of a card usage.

Similar method was used in the analysis of Schuh and Stavins (2010) or Krivosheya & Korolev (2016, 2018), where they explored the behavior of individuals at the retail payments market such as the probability of using the card for payments for goods and services or the frequency of cashless instruments usage. Krivosheya and Korolev (2016), who based their analysis on the similar dataset, highlighted that the Heckman two stage model is better than the alternatives, when used to estimate the individual's payment behavior in Russia. However, there are also some drawbacks during the second stage of this model that need to be addressed. Potential problems include multicollinearity of explanatory variables in the second stage which may lead to inconsistency of standard errors estimates.

The probit model is a special case of the binary choice model in which the normal distribution is used. This model addresses several issues that can be found in OLS (linear probability model) regressions. Firstly, the probit model guarantees that predicted probability falls in the range of [0,1]. Secondly, it permits the change of marginal effect of factors across sample. However, probit has some limitations as well. For example, probit estimates are consistent only when the error term is normal. Moreover, it is more difficult to compute.

Generalized model looks as follows:

$$\begin{cases} Holding_{kt} = \alpha + \beta * I_{kt} + \varepsilon_{kt} \\ Frequency_{kt} = \tilde{\alpha} + \tilde{\omega} * Det_{kt} + \tilde{\beta} * SE_{kt} + \tilde{\gamma} TC_{kt} + \tilde{\varphi} IC_{kt} + \tilde{\varepsilon}_{kt} \end{cases}, \text{ where}$$

$Holding_{kt}$ is the binary dummy variable, which takes the value of 1 in case the individual k from that participate in survey in the year t holds a payment card and 0 if he does not. I_{kt} reflects the vector of individual characteristics, while ε_{kt} is the vector of error terms.

$Frequency_{kt}$ is the vector of cardholders' frequency of usage of a financial innovation, here a payment card. Det_{kt} stands for different determinants of financial innovations, SE_{kt} reflects socio-economic characteristics, TC_{kt} corresponds to transaction characteristics, IC_{kt} stands for the details of the issuing contract. $\tilde{\varepsilon}_{kt}$ is again the vector of error terms.

Table 2 provides cross-correlations of the main variables used in the further analysis. Correlation coefficients show no evidence of multicollinearity as the correlations are less than 50% for most of the variables, except for the relationship between Usage of at least one of services, Average Frequency and Average Usage variables. However, these variables are not used in most of the regression specifications simultaneously. Specifications that include Average Usage and

Frequency of usage variables use the aggregated factors obtained from the results of the principal component analysis (PCA) to avoid the multicollinearity problem.

Table 2. Cross-correlations of main variables used in paper's analysis

		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1	Usage of at least one of services	1.00															
2	Average frequency	0.73	1.00														
3	Average usage	0.74	0.93	1.00													
4	Credit card	0.08	0.08	0.05	1.00												
5	No fees	0.18	0.08	0.13	-0.07	1.00											
6	18-25	0.15	0.16	0.14	0.02	-0.04	1.00										
7	26-35	0.18	0.18	0.17	-0.01	0.09	-0.18	1.00									
8	36-45	0.08	0.04	0.05	-0.01	0.08	-0.17	-0.25	1.00								
9	55-65	-0.18	-0.16	-0.17	-0.05	-0.02	-0.15	-0.23	-0.22	1.00							
10	65 and older	-0.22	-0.15	-0.15	-0.02	-0.12	-0.11	-0.17	-0.16	-0.14	1.00						
11	Beginning professional	-0.17	-0.13	-0.11	-0.01	0.09	-0.15	0.07	-0.03	0.00	0.07	1.00					
12	Medium professional	0.04	-0.01	-0.02	-0.00	0.03	-0.04	-0.04	-0.01	0.03	-0.07	-0.53	1.00				
13	Higher professional	0.16	0.18	0.16	-0.01	0.08	-0.12	0.14	0.06	-0.04	-0.05	-0.32	-0.56	1.00			
14	Marital status	0.04	0.03	0.03	-0.06	0.08	-0.30	0.02	0.14	-0.06	-0.09	0.12	0.03	0.12	1.00		
15	Low Income	-0.16	-0.15	-0.15	-0.04	-0.04	-0.12	-0.02	-0.02	0.06	0.13	-0.07	-0.03	-0.08	0.02	1.00	
16	High Income	0.15	0.19	0.15	0.01	0.00	0.01	0.02	0.01	-0.06	-0.05	-0.06	-0.02	0.11	0.08	-0.30	1.00

4   Results

Overall, this work aims to evaluate the role of determinants of financial innovations in explaining the frequency of payments at the retail payments market, specifically, those of the cardholders. Most of the findings in this study allow to draw the link between different financial innovations available and to underline their importance for the individuals' frequency of payments and, overall, payment behavior.

This study attempts to design a method to empirically evaluate the importance of financial innovations for cardholders' behavior. The empirical links derived in this work can be regarded as a valuable tool for both individuals and merchants to address the development of the retail payments market by analyzing the effect of various financial innovations introduced to the market.

However, this research has certain limitations that open opportunities for further research in this area. Firstly, the analysis of the influence of financial innovations on the payment behavior of merchants could be explored, since potential benefits from financial innovations could be different for merchants and therefore the overall effect may change, moreover the merchants have a different type of behavior and other considerations in terms of profitability and usefulness. Moreover, research on merchants would be different, since the merchants, in fact, make only one decision regarding cards – whether to accept them or not. Secondly, the determinants of financial innovations are evaluated on the Russian retail market among individuals. Further investigations could be made in other markets taking into an account different nature of markets and their specific characteristics. Thirdly, the analysis can be expanded to a more global level, that is include other countries' and cross-country determinants of financial innovations, their influence on frequency of payments and more sophisticated variables relating to cultural differences may be of interest in the context of the increasing economic integration. Fourthly, it should be exceptionally interesting to look at the dynamics of acceptance and use of various financial innovations through years, however, unfortunately, the data is unavailable at the moment. Lastly comes that deeper mechanisms may become the point of a research's interest: not only the effect on the frequency of usage that arises through use of financial innovations may be explored, but also the role of different specific characteristics of financial innovations in determining individuals' attitude and payment behavior.

This section presents the results for the estimation of the role of financial innovations in promoting activity of consumers at the retail payments market. Significant effect of some determinants of financial innovations such as the usage of different services for financial transactions, frequency of usage of some technologies as well as availability of contactless payment options and others seem to influence frequency of payments.

This work focuses on 3 sets of key models: without regional controls and with simple determinants of financial innovations (tables 3-6), without regional controls and with more complicated measures of financial innovations (table 7) and, the last set, with larger number of different control variables and regional dummy variables to control for unobserved regional heterogeneity (tables 8-9). All models report the results of estimating the two-step Heckman model for the analysis of the determinants of card payment frequency. The value of coefficients in

the first step models may be slightly different for different specifications, however, the significance of the variables does not normally change. The changes in numerical values are small and depend on the amount of data available. More detailed outputs of the first step estimations are available at request.

4.1 Simple financial innovation variables as determinants of financial innovations

Table 3 and 4 present the results for model estimation of the fact of usage and frequency of usage of different devices, respectively. Both of the tables also include the baseline model and its estimations. Baseline models follow Krivosheya and Korolev (2016) and Krivosheya and Semerikova (2018) to estimate the probability of an individual to hold at least one payment card.

Model 1, named the baseline model, presents the results for the simplest model without financial innovation variables. The first step model controls for the age groups, education of an individual (Schuh & Stavins, 2010), level of income (Krivosheya & Korolev, 2016; Goczek & Witkowski, 2015), the marital status (Bounie et al., 2016; Schuh & Stavins, 2010; Krivosheya & Korolev, 2016), type of a card and fees for certain payment products. The second step model controls for participation of individuals in bonus programs of banks.

Table 3 present the results of the estimation of influence of usage of several devices for financial operations on the frequency of payments using a payment card. Models 3-6 present different specifications, each is based on the usage of a particular device.

All models below report the second step of the model, the first step estimation is available at request. All of the models include 1500 individuals with sample reductions based on data availability.

For all tables below ∗ denotes significance at 10% level, ∗∗ at 5% level, ∗∗∗ at 1% level.

Table 3. Model estimation of usage of different devices

Variables	Model 1 Baseline model	Model 2 E-wallets usage	Model 3 Financial Apps usage	Model 4 Internet Bank usage	Model 5 Social Networks usage	Model 6 Mobile Apps usage
Usage of e-walets		0.259** (0.103)				
Usage of financial apps			0.172 (0.105)			
Usage of internet bank				0.345*** (0.0762)		
Usage of social networks					0.323** (0.133)	
Usage of mobile apps						0.376*** (0.0748)
Participation in loyalties programs	0.388*** (0.0739)	0.364*** (0.0742)	0.373*** (0.0743)	0.307*** (0.0754)	0.376*** (0.0738)	0.307*** (0.0748)
Age						
18-25	0.462** (0.207)	0.409** (0.206)	0.451** (0.206)	0.400* (0.207)	0.410** (0.206)	0.387* (0.207)
26-35	0.345* (0.196)	0.315 (0.195)	0.330* (0.196)	0.306 (0.196)	0.319 (0.195)	0.329* (0.196)
36-45	0.104 (0.181)	0.0984 (0.180)	0.0973 (0.181)	0.0825 (0.181)	0.0936 (0.180)	0.105 (0.181)
55-65	0.160 (0.152)	0.165 (0.151)	0.161 (0.152)	0.195 (0.152)	0.169 (0.151)	0.219 (0.153)
65 and older	-0.238 (0.373)	-0.235 (0.370)	-0.239 (0.372)	-0.215 (0.371)	-0.250 (0.371)	-0.203 (0.371)
Education						
Beginning professional	0.572** (0.287)	0.536* (0.286)	0.555* (0.287)	0.448 (0.287)	0.532* (0.286)	0.528* (0.286)
Medium prof.	0.932** (0.379)	0.886** (0.377)	0.914** (0.378)	0.806** (0.378)	0.898** (0.377)	0.881** (0.377)
Higher professional	1.044** (0.495)	0.980** (0.493)	1.019** (0.494)	0.897* (0.494)	0.996** (0.493)	1.016** (0.493)
Married	0.219** (0.0897)	0.207** (0.0889)	0.214** (0.0895)	0.200** (0.0900)	0.213** (0.0890)	0.215** (0.0901)
Low Income	0.0942 (0.0863)	0.0956 (0.0854)	0.105 (0.0862)	0.0937 (0.0865)	0.0934 (0.0856)	0.109 (0.0867)
High Income	0.503** (0.253)	0.471* (0.251)	0.499** (0.253)	0.501** (0.253)	0.483* (0.252)	0.525** (0.253)
Credit Card	0.121 (0.170)	0.116 (0.169)	0.121 (0.170)	0.115 (0.168)	0.102 (0.170)	0.136 (0.167)
No fees	-0.0498 (0.0721)	-0.0469 (0.0718)	-0.0493 (0.0719)	-0.0287 (0.0714)	-0.0497 (0.0718)	-0.0366 (0.0712)
Constant	0.267 (0.783)	0.330 (0.779)	0.278 (0.782)	0.258 (0.779)	0.319 (0.780)	0.0908 (0.779)

In the baseline model control variables including individuals' participation in bonus programs of banks, ages groups of 18-25 and 26-35, level of education, marital status and high level of income are significant at the 5% level. This supports findings of Krivosheya and Korolev (2016), where level of education and high-income level were also found out be significant. The appearance of new significant variables in the baseline model may appear due to the new data available, since the research of Krivosheya and Korolev (2016) was based of provide private data from the survey of Russian cardholders' profiles and their behavior in 2013–2014, while this study is based on the additional data survey performed in 2017.

With the 46-54-year-olds being the reference category, clearly in all the other groups card possession is more probable in the group of the 18-25 and 26-35-year-olds. The results referring to age are not surprising. The negative influence of the variable relating to the age group of 65 years old and higher may be explained by the fact that the people in the oldest group category could probably be more card-averse and have a fear of card transactions (Goczek & Witkowski, 2015).

Most of the determinants of financial innovations, including the usage of e-wallets, internet banking, and mobile banking applications turn out to be significant at 1% level. Usage of social networks is significant at 5% level but not 1% level. It may be due to the limited number of social networks that provide services for conducting financial operations at the moment of survey. Usage of personal finance management applications is not significant even at 10% level, which can be explained by several reasons. Firstly, there are few users of financial applications. Secondly, there are not many financial applications existing, so the sample of such apps is small and is rather unpopular in Russia. Mobile banking apps are dominating the market and are not included in the survey.

Table 4 presents the results of estimation of influence of frequency of usage of the same devices for financial operations, as were used in the previous table, on the frequency of payments using a card. Again, models 8-12 present different specifications of the model, each is based on the frequency of usage of a particular device, while model 7 shows the estimation results of the baseline model. The baseline model is the same as was reported in table 3.

Table 4. Model estimation of frequency of usage of different devices

	Model 7	Model 8	Model 9	Model 10	Model 11	Model 12
Variables	**Baseline model**	**E-wallets frequency of usage**	**Financial Apps frequency of usage**	**Internet Bank frequency of usage**	**Social Networks frequency of usage**	**Mobile Apps frequency of usage**
Frequency E-wallets		0.0954*** (0.0361)				
Frequency Financial Apps			0.0516 (0.0321)			
Frequency Internet Bank				0.118*** (0.0212)		
Frequency Social Networks					0.116** (0.0523)	
Frequency Mobile Apps						0.0952*** (0.0187)
Participation in loyalties programmes	0.388*** (0.0739)	0.365*** (0.0746)	0.372*** (0.0747)	0.286*** (0.0762)	0.380*** (0.0742)	0.288*** (0.0763)
Age						
18-25	0.462** (0.207)	0.418** (0.210)	0.455** (0.207)	0.393* (0.215)	0.397* (0.206)	0.428** (0.217)
26-35	0.345* (0.196)	0.318 (0.195)	0.325* (0.197)	0.283 (0.203)	0.298 (0.193)	0.363* (0.204)
36-45	0.104 (0.181)	0.101 (0.183)	0.0956 (0.182)	0.0609 (0.184)	0.0708 (0.177)	0.150 (0.191)
55-65	0.160 (0.152)	0.163 (0.152)	0.179 (0.153)	0.224 (0.151)	0.177 (0.150)	0.235 (0.154)
65 and older	-0.238 (0.373)	-0.238 (0.371)	-0.153 (0.378)	-0.135 (0.361)	-0.174 (0.379)	-0.170 (0.379)
Education						
Beginning professional	0.572** (0.287)	0.530* (0.287)	0.566** (0.285)	0.446 (0.284)	0.509* (0.285)	0.529* (0.290)
Medium professional	0.932** (0.379)	0.885** (0.378)	0.896** (0.376)	0.757** (0.372)	0.883** (0.377)	0.914** (0.378)
Higher professional	1.044** (0.495)	0.978** (0.497)	0.984** (0.491)	0.808* (0.490)	0.976** (0.493)	1.061** (0.499)
Married	0.219** (0.0897)	0.211** (0.0895)	0.227** (0.0888)	0.200** (0.0905)	0.225** (0.0888)	0.201** (0.0936)
Low Income	0.0942 (0.0863)	0.102 (0.0862)	0.117 (0.0855)	0.127 (0.0850)	0.107 (0.0853)	0.128 (0.0886)
High Income	0.503** (0.253)	0.475* (0.255)	0.482* (0.255)	0.463* (0.257)	0.469* (0.255)	0.600** (0.270)
Credit Card	0.121 (0.170)	0.0940 (0.172)	0.128 (0.170)	0.119 (0.170)	0.0753 (0.173)	0.116 (0.171)
No fees	-0.0498 (0.0721)	-0.0414 (0.0725)	-0.0503 (0.0725)	-0.000236 (0.0726)	-0.0521 (0.0725)	-0.0182 (0.0726)
Constant	0.267 (0.783)	0.314 (0.788)	0.306 (0.786)	0.319 (0.790)	0.356 (0.785)	-0.0129 (0.805)

The results are similar to what we received in the analysis of influence of usage of numerous devices on the frequency of payments using a card. Here, frequency of usage of e-wallets, internet banking, and mobile banking applications turn out to be significant at 1% significance level. Frequency of usage of social networks is significant at 5% level, while frequency of usage of personal finance management applications is, again, not significant even at 10% level. The results are expected since variables indicating the frequency of usage, depend on the usage variables, therefore they should indicate similar results.

Evidence from both tables 3 and 4 indicate that usage and frequency of usage of some of financial innovations have some positive influence on the frequency of payments. Main observed dependent variables are shown to be significant at 1% level. Both specifications, namely usage and frequency of usage (models 2-6 and 8-12), included several important control variables, which helps to draw conclusions on the reliability of the analysis.

In the next set of models influence of availability of various contactless payment options was estimated. Contactless payment options include ApplePay, SamsungPay, AndroidPay Bank cards with contactless Mastercard and Visa technology. Due to the limited number of observations regarding individuals that use Mastercard and Visa contactless technology, a new variable, combining both of these options, was created and its influence was evaluated. The results are shown in the table 5.

Table 5. Model estimation of availability of various contactless payment options

	Model 13	Model 14
Variables	**Inclusion of Availability of AplePay**	**Inclusion of Availability of Mastercard and Visa**
Availability of ApplePay	0.0892	0.0776
	(0.178)	(0.177)
Availability of SamsungPay	0.354**	0.348**
	(0.159)	(0.156)
Availability of AndroidPay	0.362**	0.350**
	(0.168)	(0.168)
Availability of Visa	-0.00801	-0.186
	(0.0908)	(0.139)
Availability of Mastercard	0.0282	
	(0.105)	
Availability of Visa and Mastercard		0.221*
		(0.126)
Participation in loyalties programmes	0.337***	0.331***
	(0.0792)	(0.0788)
Age		
18-25	0.318	0.309
	(0.217)	(0.217)
26-35	0.255	0.233
	(0.207)	(0.205)
36-45	0.0624	0.0441
	(0.188)	(0.186)
55-65	0.159	0.159
	(0.149)	(0.147)
65 and older	-0.0923	-0.0855
	(0.422)	(0.421)
Education		
Beginning professional	0.442	0.456
	(0.287)	(0.285)
Medium professional	0.737**	0.725**
	(0.357)	(0.356)
Higher professional	0.760	0.740
	(0.478)	(0.476)
Married	0.220**	0.223**
	(0.0906)	(0.0899)
Low Income	0.137	0.142*
	(0.0852)	(0.0840)
High Income	0.334	0.304
	(0.276)	(0.274)
Credit Card	0.0793	0.0657
	(0.184)	(0.184)
No fees	-0.0620	-0.0553
	(0.0763)	(0.0760)
Constant	0.688	0.708

Availability of SamsungPay and AndroidPay (in the first specification which treats contactless Mastercard and Visa technology separately) turned out to be significant at 5% level. Availability of ApplePay and contactless Mastercard and Visa technology in the model 13 is insignificant at 10% level, however in the model 14 the variable that includes the combined effect of availability of both Visa and Mastercard payment options, is significant at 10% level. We can conclude that its insignificance even at 10% level in the model 13 was indeed due to limited number of observations overall or insufficient number of users of Mastercard technology. It is possible to say that availability of most of contactless payment options mentioned above indeed plays a role in explaining the frequency of payments.

Insignificance of the availability of ApplePay variable can be explained by the fact that at the date of the research, Android maintains a leading position in the number of users in the world as well in the Russia with a large margin from other market participants. According to analytical research made by StatCounter Global Stats, in 2018 the share of Android accounted for 73.54% of the market in Russia, iOS - 19.91%, the remaining 6.5% is distributed between other systems. Therefore, in Russia there are fewer users of ApplePay than users of AndroidPay, since a higher proportion of individuals own phones running on the Android operating system than on iOS. ApplePay users are also likely to be of similar income, age and lifestyle characteristics, which may result in lower heterogeneity observed in relation to their payment behavior.

In the next set of models, the role of usage of some electronic devices is evaluated. Among devices proposed as possible means for performing financial transactions are a computer (laptop), a tablet and a mobile phone.

Table 6. Model estimation of usage of specific electronic devices

Variables	Model 15 Inclusion of usage of Electronic Devices	Model 16 Inclusion of usage of Mobile and Tablet
Usage of Computer	0.577***	0.577***
	(0.101)	
Usage of Mobile Phone	0.231**	
	(0.0994)	
Usage of Tablet	0.244	
	(0.187)	
Usage of Mobile and Tablet		0.233**
		(0.0741)
Participation in loyalties programmes	0.268***	0.388***
	(0.0768)	(0.0736)
Age		
18-25	0.415*	0.468**
	(0.217)	(0.204)
26-35	0.354*	0.345*
	(0.204)	(0.194)
36-45	0.114	0.0966
	(0.190)	(0.179)
55-65	0.170	0.154
	(0.160)	(0.150)
65 and older	-0.295	-0.225
	(0.382)	(0.369)
Education		
Beginning professional	0.414	0.569**
	(0.297)	(0.284)
Medium professional	0.866**	0.919**
	(0.387)	(0.376)
Higher professional	1.005**	0.999**
	(0.507)	(0.492)
Married	0.219**	0.222**
	(0.0958)	(0.0882)
Low Income	0.0883	0.0968
	(0.0923)	(0.0848)
High Income	0.585**	0.487*
	(0.265)	(0.250)
Credit Card	0.153	0.130
	(0.165)	(0.170)
No fees	-0.0153	-0.0521
	(0.0713)	(0.0719)
Constant	-0.108	0.384
	(0.805)	(0.780)

Two specifications were analyzed. In the model 15, the effects of usage of a tablet and a mobile phone are considered separately, while in the second specification a new variable combines both of these two. In the model 15, the usage of a computer and the usage of a mobile phone variables are significant at 1% and 5% levels respectively. The variable regarding the usage of tablet is insignificant at 10% level, but it may be due to a limited number of observations on individuals holding a tablet or as a result of a poor number of people using it for financial transactions.

In the model 16, usage of computer by individuals for financial transactions remains unchanged, it has a positive coefficient and is significant at 1% level. The combined variable of usage of a mobile or a tablet by a respondent becomes significant at 5% significance level. The new combined variable relied on a larger amount of observations and therefore is estimated more precisely here.

Usage of such electronic devices as a computer, a tablet and a mobile phone seems to have a positive influence on the frequency of payments with a card. Results of modeling of both usage and frequency of usage of different devices suggest that the participation of an individual in the bank's loyalty programs, that is, the programs where consumers receive bonuses that they can later spend at specialized bank platform or partners, cashbacks, special offers or other types of bank loyalty programs are significant at 1% level and have a positive influence on the frequency of payments with a card. The result is intuitive since bank's loyalty programs provide both intangible and material benefits for customers, which induces individual to pay more to receive higher benefits.

4.2 Alternative financial innovation variables as determinants of financial innovations

The next set of models uses more complicated variables in its estimations. Effect of such variables as average usage and average frequency of usage of different services, as well as a dummy variable, that takes the value of 1 if a person uses at least one of the services mentioned before, is assessed.

Table 7. Model estimation of alternative financial innovation variables as determinants of financial innovations

Variables	Model 17 Usage of at least one of services	Model 18 Average usage of services	Model 19 Average frequency of usage of the services
Average Usage of services		0.112***	
		(0.0227)	
Average Frequency			0.122***
			(0.0243)
Usage of at least one of services	0.465***		
	(0.0816)		
Participation in loyalties programmes	0.261***	0.302***	0.281***
	(0.0764)	(0.0751)	(0.0786)
Age			
18-25	0.378*	0.346*	0.378*
	(0.213)	(0.205)	(0.221)
26-35	0.340*	0.277	0.275
	(0.200)	(0.194)	(0.206)
36-45	0.121	0.0807	0.101
	(0.186)	(0.179)	(0.193)
55-65	0.197	0.199	0.258*
	(0.156)	(0.150)	(0.153)
65 and older	-0.246	-0.228	-0.0384
	(0.377)	(0.368)	(0.380)
Education			
Beginning professional	0.482*	0.455	0.440
	(0.292)	(0.285)	(0.285)
Medium professional	0.866**	0.810**	0.778**
	(0.382)	(0.375)	(0.373)
Higher professional	1.016**	0.896*	0.839*
	(0.499)	(0.490)	(0.499)
Married	0.205**	0.197**	0.191**
	(0.0934)	(0.0887)	(0.0908)
Low Income	0.0992	0.110	0.157*
	(0.0898)	(0.0852)	(0.0859)
High Income	0.558**	0.472*	0.491*
	(0.259)	(0.250)	(0.274)
Credit Card	0.103	0.109	0.0920
	(0.166)	(0.168)	(0.176)
No fees	-0.0284	-0.0369	-0.0159
	(0.0710)	(0.0712)	(0.0747)
Constant	-0.0567	0.418	0.423
	(0.790)	(0.774)	(0.823)

The model reports that all of the three variables, namely average usage, average frequency of usage and a variable that catches the effect of using of at least one of the services by an individual, are significant at 1% level. All of the three variables have a positive sign which is consistent with what we could expect since the more people use different financial technology and the more devices and payment options they have, the more frequent they will pay in general.

4.3 Robustness checks

In a number of robustness checks we include further controls and account for unobserved regional heterogeneity to test the possible changes in results. The first set of models (models 20 and 22) controls for the importance of interaction with different bank channels for an individual, hypothetical increase in profitability for an individual of some bonus programs and level of trust to financial innovations and/or technologies provided by different services (for example, mobile app developers, social networks). All other control variables that were used in previous models are included as well. The second set of models (models 21 and 23) includes dummy variables for various regions across Russia to control for unobserved heterogeneity.

The inclusion of more control variables will allow to neutralize the effects on the dependent variable by factors that are not the object of interest, that is, not related to financial innovations, as well as decrease the probability of endogeneity that is possible due to omitted controls relating to other factors that can influence payment frequency. The goal of this part is to demonstrate that the estimates of different determinants of financial innovations is not sensitive to the exact specification used. Consequently, if this is true, the relationships obtained in the final model can be interpreted in terms of the causal relationship between the dependent and main explanatory variables.

In the models 20-21 in table 8 average usage is included as the main explanatory variable, while in models 22-23 (table 9) average frequency of usage is estimated.

Average usage of services remains significant at 1% level even after controlling for importance of interaction through bank channels, hypothetical increase in profitability of some bonus programs, level of trust to financial innovations and/or technologies provided by different services and a dummy for different regions across Russia.

Table 8. Average usage and robustness check

	Model 20	Model 21
Variables	**Average use and all controls**	**Average use and dummy for region**
Average usage of services	0.0987***	0.0856***
	(0.0277)	(0.0231)
Participation in loyalties programmes	0.340***	0.321***
	(0.0866)	(0.0759)
Improvement of bonuses	0.138***	
	(0.0367)	
Importance of interaction with bank	0.00159	
	(0.0278)	
Importance of interaction with call center	0.00374	
	(0.0259)	
Importance of interaction with Internet Bank	0.0346	
	(0.0305)	
Importance of interaction with Mobile Apps	-0.0147	
	(0.0292)	
Level of trust	-0.0176	
	(0.0375)	
Age		
18-25	0.193	0.362*
	(0.230)	(0.192)
26-35	0.0745	0.301*
	(0.204)	(0.181)
36-45	-0.0182	0.0688
	(0.202)	(0.167)
55-65	0.0828	0.249*
	(0.180)	(0.141)
65 and older	-0.241	-0.224
	(0.422)	(0.347)
Education		
Beginning professional	0.294	0.499*
	(0.365)	(0.269)
Medium professional	0.418	0.799**
	(0.507)	(0.355)
Higher professional	0.510	0.842*
	(0.622)	(0.463)
Married	0.152	0.198**
	(0.0952)	(0.0832)
Low Income	0.104	0.0872
	(0.0893)	(0.0854)
High Income	0.311	0.441*
	(0.298)	(0.236)
Credit Card	0.0199	0.0299
	(0.179)	(0.164)
No fees	-0.0233	-0.0810
	(0.0797)	(0.0721)
Region controls included		
Constant	0.582	0.341

Table 9. Average frequency of usage and robustness check

Variables	Model 22 Average Frequency and controls	Model 23 Average Frequency and dummy for region
Average Frequency	0.124***	0.101***
	(0.0293)	(0.0242)
Participation in loyalties programs	0.321***	0.320***
	(0.0904)	(0.0794)
Improvement of bonuses	0.133***	
	(0.0384)	
Importance of interaction with Bank	-0.00382	
	(0.0293)	
Importance of interaction with Call Center	0.0226	
	(0.0271)	
Importance of interaction with Internet Bank	0.00612	
	(0.0323)	
Importance of interaction with Mobile Apps	0.00318	
	(0.0308)	
Level of trust	-0.0172	
	(0.0388)	
Age		
18-25	0.195	0.396*
	(0.246)	(0.208)
26-35	0.0537	0.269
	(0.219)	(0.193)
36-45	-0.0293	0.0681
	(0.215)	(0.179)
55-65	0.147	0.312**
	(0.192)	(0.144)
65 and older	0.00913	-0.0823
	(0.449)	(0.359)
Education		
Beginning professional	0.281	0.489*
	(0.364)	(0.269)
Medium professional	0.341	0.788**
	(0.507)	(0.354)
Higher professional	0.421	0.796*
	(0.628)	(0.473)
Married	0.161	0.206**
	(0.0982)	(0.0853)
Low Income	0.131	0.147*
	(0.0916)	(0.0866)
High Income	0.252	0.443*
	(0.325)	(0.259)
Credit Card	0.00294	0.0312
	(0.186)	(0.171)
No fees	-0.00251	-0.0670
	(0.0835)	(0.0759)
Region controls included		
Constant	0.686	0.487
	(1.037)	(0.810)

Average frequency of usage of services also remains significant at 1% level even after controlling for all the characteristics mentioned above.

All other socio-economic characteristics are insignificant in models that account for various control variables but exclude the dummy variable for a region (models 20 and 22). Overall, there is still some evidence that the socio-economic characteristics are important for frequency of payments since some of them were found to be significant in previous specifications. One of the possible explanations for the disappearance of the effect of the socio-economic characteristics is that the control variables that were included in previous models already caught effects of some of the new control variables added. For example, for people of the age group 65 and older interaction with internet bank or mobile applications may be expected to be not important since individuals of this age group are not frequent users of such technologies and may not be familiar with them at all. Therefore, inclusion of variables that control for age, implicitly incorporated the effect of the variable relating to importance of interaction with different channels.

4.4 Reconciliation of obtained results with the stated hypotheses

Overall, this study finds significant evidence in favor of both hypotheses 1 and 2, stated in the theoretical framework part. There is indeed evidence that, firstly, different benefits that are brought by various types of financial innovations and cashless payment methods are positive and significant for the cardholders, since their coefficients, when estimated, have a positive sign and tend to be significant. Secondly, cashless payments as well as emerging and existing financial innovations tend to positively affect consumers' payment behavior, since their determinants are found to be significant with a positive sign.

5   Conclusion

This study identifies the determinants of the frequency of usage of noncash techniques and various financial innovations, and, in general, the factors that influence the individual's decision whether to use or not a particular financial technology of end-users at the Russian retail payments market. Representative survey of 1500 individuals coming from the national study of retail payments market that covers all Russian regions.

The obtained results correspond to the purpose of the main objective of the study. Empirical evaluation of influence of cashless payments and emerging and existing financial innovations on consumers' payment behavior at Russian retail payments was performed. There is significant evidence that financial innovations promote activity of consumers at the retail payments market.

The research contributes to the existing literature on the analysis of influence of cashless payments and emerging and existing financial innovations on consumers' payment behavior (Laukkanen, 2016; Bounie et al; Guthrie & Wright, 2007; Runnemark et al, 2015). However, the number of empirical researches in this sphere is still insufficient and researches that have been made have of more analytical analysis (Saaksjarvi, 2003; Lassar et al, 2004; Claudy et al, 2014; Arango et al, 2016). Moreover, a great proportion of literature on this topic analyses primarily the network effect property of retail payments, however this effect can hardly be measured using econometric techniques (Claessens, 2003; Milne, 2006; Au & Kauffman, 2008). The main novelty

of this study is to assess determinants of different financial innovations on an empirical level and analyze their significance for the individuals' behavior at the retail payments market. Moreover, the article provides insights from the emerging retail payments market by providing the empirical analysis within Russian payments industry (Krivosheya, 2019). The results derived in this paper are also relevant from an economic point of view and are practically important since they provide the insights about how the supply of financial innovations and contactless payments can stimulate the payment behavior of individuals, and therefore explain, from a providers of financial innovations point of view, how attracting and profitable it is to market and develop various financial innovations.

In addition, understanding the determinants of the frequency of usage of different financial innovations has several important implications. Firstly, determination of such factors will enable to predict the success of a particular innovation, as well as it will help to understand the processes that contribute or, on the contrary, prevent the wider distribution of contactless payments and various financial innovations. Secondly, it is particularly important for firms that develop and sell new products and services to understand the processes which lie behind consumers' adoption of innovations (Claudy et al, 2014). Thirdly, such empirical analysis will help to overcome barriers that make it difficult to spread and use various financial innovations (Claudy et al, 2014).

However, this research has certain limitations that open opportunities for further research in this area. Firstly, the analysis of the influence of financial innovations on the payment behavior of merchants could be explored, since potential benefits from financial innovations could be different for merchants and therefore the overall effect may change, moreover the merchants have a different type of behavior and other considerations in terms of profitability and usefulness. Moreover, research on merchants would be different, since the merchants, in fact, make only one decision regarding cards – whether to accept them or not. Secondly, the determinants of financial innovations are evaluated on the Russian retail market among individuals. Further investigations could be made in other markets taking into an account different nature of markets and their specific characteristics. Thirdly, the analysis can be expanded to a more global level, that is include other countries' and cross-country determinants of financial innovations, their influence on frequency of payments and more sophisticated variables relating to cultural differences may be of interest in the context of the increasing economic integration. Fourthly, it should be exceptionally interesting to look at the dynamics of acceptance and use of various financial innovations through years, however, unfortunately, the data is unavailable at the moment. Lastly comes that deeper mechanisms may become the point of a research's interest: not only the effect on the frequency of usage that arises through use of financial innovations may be explored, but also the role of different specific characteristics of financial innovations in determining individuals' attitude and payment behavior.

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