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*Payment Features and Incentives as Drivers for Non-Cash
Payments Usage – the Evidence from Poland*

Keywords: cash usage; payment features; payment choices; discounts and surcharges; price incentives; contactless payments

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Abstract

Theoretical background: There is evidence that sustainable economic growth is strictly connected with non-cash payments' development. Nevertheless, in many countries, cash still remains the dominant means of payment. Cash can be treated as a store of value and a means of payment. The paper focuses on its transactional function and addresses the need to recognise drivers that can shift consumers away from cash.

Purpose of the article: The paper aims to analyse what features of payment instruments and what kind of incentives could convince consumers to switch from cash to non-cash payments.

Research methods: The data analysed were collected during the first survey on this topic conducted in 2018 on a representative sample of Polish consumers. The selected statistical methods were applied to analyse research data. Among them are correlation analysis and Thurstone's method of paired comparisons, to analyse preferences and association (co-occurrence) for exploring consumers' preferences related to their payment choices.

Main findings: The results show that consumers' payment choices in Poland are driven rather by the cost than other payment instrument features such as speed, convenience or security. These results are consistent with the greater sensitivity of Polish consumers to financial incentives than material bonuses or tax benefits. The analysis has also shown a statistically significant correlation between the kind of incentive and the consumer's characteristics.

Introduction

During the last few decades, new technology development and digitalisation impacted almost all spheres of human life, including payments. With the spread of new innovative payment methods, the role of cash in the world is believed to diminish. Still, the data shows that cash remains the most widely used means of payment worldwide. Existing studies claim that there is a relationship between the development of non-cash payments, especially electronic ones, and sustainable economic growth. The results of such studies confirm that migration to efficient electronic retail payments stimulates the overall economy, consumption, and trade (Hasan et al., 2013). Moody's Analytics studies covering five years (2008 to 2012) and 56 countries/regions that cover 93% of the world gross domestic product revealed that increased use of electronic payments added 0.8% to GDP across emerging economies and 0.3% for developed countries (Zandi et al., 2013). Thus, there is more and more evidence that economies which succeeded in switching from cash to non-cash payments grow faster. Adversely cash-based economies tend to grow slowly and miss out on significant financial benefits. Handling cash transactions is expensive and labour-intensive; hence, increasing non-cash payments results in substantial savings for the entire economy and supports sustainable and inclusive economic growth. For this reason, reducing cash usage by supporting the adoption of non-cash payments has been a subject of public authorities as well as central and commercial banks' interest for years across the world.

Cash in the economy is measured using two approaches:

- static, where the cash in circulation (i.e. banknotes and coins) is treated as a stock of value and measured as a percentage of GDP (currency-to-GDP ratio),
- dynamic (a flow measure), where the use of cash for payments is taken into account.

Understandably, the cash in circulation (scaled by GDP) does not equal cash used for payments. However, due to the lack of comparable cross-country data on cash usage, the cash in circulation is commonly used as a proxy for cash demand (Amromin & Chakravorti, 2007; Williams & Wang, 2017; Bech et al., 2018). This study develops research related to the transactional cash function.

It should be underlined that cash has many advantages as a means of payment. They include its simplicity and robustness (protection from cyber-attacks or financial institution failures) as well as privacy protection when doing transactions. On the other hand, banknotes and coins expose their users to loss through misplacement, theft, or accidental destruction. Additionally, in the pandemic era, they are also connected with hygienic concerns (Cevik, 2020). Similarly, non-cash payments have both advantages and disadvantages. Speed, convenience, and cost are usually discussed among the advantages of payments made using currencies issued by central banks. At the same time, cyber-attack threats and security concerns are perceived as disadvantages. In the case of cryptocurrencies issued by non-banking entities, the range of threats differs since their users use them more frequently as alternative investments than a payment method. Based on their preferences, customers should have a choice between different kinds of payment methods. Still, from the macroeconomic point of view, disadvantages of cash outweigh its advantages since cash may generate many risks, such as money laundering, tax avoidance, economic violence or embezzlement.

Nevertheless, when analysing the use of cash for payments, the main macroeconomic problem is its relative inefficiency reflected by the high social cost connected with the cost of resources used to provide payment services. They are computed by summing up the private costs of all market players (commercial banks, a central bank, retailers, cash-in-transit companies, consumers, etc.), excluding transfers between them (to avoid double-counting). According to the EBC study carried out in 2013, the social costs of retail payment instruments were substantial. They amounted to EUR 45 billion, i.e. 0.96% of GDP for the sample of 13 participating EU countries. Due to the relatively high usage of cash, its social costs were nearly half of the total social costs of retail payments (Schmiedel et al., 2012, p. 6; Steward et al., 2014; Kosse et al., 2017).

Thus, answering the question of how to reduce cash usage and make the payment system more efficient is a subject of public authorities, banks (including central banks), and merchants' interest worldwide. For a long time, the migration away from cash has largely been in favour of traditional non-cash instruments. However, given that cash-dominance areas are face-to-face transactions (made at POS) and low-value payments, new alternative payment solutions can play a larger role in replacing cash. Considering the pace of development and the rate of adoption of the basic types of payment innovations (contactless cards, mobile payments, online payments, and digital wallets), the most promising alternative to cash seems to be contactless payments, both based on cards and mobile devices (Harasim, 2016, p. 55).

However, when taking actions aimed at increasing the use of new payment methods instead of cash, the network externalities explained by the two-sided market theory (Rochet & Tirole, 2003) should be considered. The two-sided market theory holds that consumer adoption and merchant acceptance of payment instruments are interrelated. Thus, to let innovation diffuse (i.e. to achieve the critical mass), both sides of the market must adopt it simultaneously. Therefore, along with investment incentives for payment

service providers, usage incentives for consumers are also necessary when searching for efficiency in payment systems (Kemppainen, 2003, p. 15).

Despite the growing number of research on retail payments, due to the limited data on individual payment transactions, explaining the real drivers of consumer payment behaviour remains not an easy task. Most research discusses how consumers pay (Kennickell & Kwast, 1997; Humphrey et al., 2001; Hayashi & Klee, 2003; Bounie & Francois, 2006; Klee, 2006, 2008; De Grauwe et al., 2006; Borzekowski et al., 2008; Chen, 2008; Poussotchi, 2008; Carlos & Taylor, 2009; Zinman, 2009; Schierz et al., 2010; Kosse, 2013; Shaw, 2014; Hoang & Vu, 2020; Karjaluoto et al., 2020; Raman & Aashish, 2020), and only a few try to find the answer to the question of why. Even less, try to find what should be done to motivate consumers to switch from cash to other non-cash payment methods. The literature review led to the conclusion that the hierarchy of features influencing consumers' payment choices changes over time.

For this reason, the purpose of the paper is to show what features of payment instruments and what kind of incentives, such as financial incentives, material bonuses, or tax benefits, may convince consumers to switch from cash to non-cash payments. To answer these questions, a survey of a representative sample of Polish consumers was carried out in 2018. To the authors' best knowledge, it was the first exploratory study on this topic in Poland. The data collected has been analysed using statistical methods, such as correlation analysis and Thurstone's method of paired comparisons, to analyse preferences and association (co-occurrence) for exploring consumers' preferences related to their payment choices.

The remaining part of the paper is organised as follows. The next section presents the literature review on consumer payment behaviour determinants, including payment features and incentives used to motivate consumers to change their payment habits. Then research methodology and the data set are presented, followed by the empirical results and discussion. The last section provides the conclusions and implications for business, society and policymakers, as well as for further research.

Previous research on the determinants of consumer payment behaviour – literature review

As the data on individual payment transactions are still very limited, exploring the real drivers of consumer payment behaviour is a cumbersome task. Nevertheless, there is a growing body of literature analysing how consumers pay, but only a few papers have addressed the question of why consumers pay as they do. Most previous research examining drivers of consumers' payment choices considered only two basic payment instruments: cash and cards (Kennickell & Kwast, 1997; De Grauwe et al., 2006; Humphrey et al., 2001; Bounie & Francois, 2006; Borzekowski et al., 2008; Carlos & Taylor, 2009; Zinman, 2009; Kosse, 2013; Hoang & Vu, 2020). Some early studies also added checks to the list of payment methods (Bounie & Francois, 2006).

The studies carried out in recent years consider additionally innovative payments such as contactless cards, mobile payments, and online payments (Chen, 2008; Klee, 2008; Poussotchi, 2008; Schierz et al., 2010; Shaw, 2014; Karjaluoto et al., 2020; Raman & Aashish, 2020). To date, several demand-side and drivers of consumer payment choice were analysed, namely:

- payment instrument characteristic (Hedman et al., 2017) and features such as cost (Humphrey et al., 2001; Borzekowski et al., 2008; Zinman, 2009; Hoang & Vu, 2020), safety (Rochet & Tirole, 2003; Koulayev et al., 2016; Harasim, 2015; Stavins & Wu, 2017), speed and convenience (Rochet & Tirole, 2003; Klee, 2006; Borzekowski & Kiser, 2008; Arango et al., 2011; Harasim, 2015; Schuh & Stavins, 2015; Stavins & Wu, 2017),
- the necessity to hold a suitable amount/reserve of cash (Kennickell & Kwast, 1997),
- the context of a transaction, including its size, the kind of purchased goods and services, and a place (Bounie & Francois, 2006; Jonker, 2007; Klee, 2006, 2008; Von Kalckreuth et al., 2009; Mester, 2012; Hedman et al., 2017; Koźliński, 2017; Maison, 2017),
- socio-demographic factors such as age, education, income, and gender (Stavins, 2001; Zinman, 2009; Klee, 2006; Borzekowski & Kiser, 2008; Bagnall et al., 2016),
- psychological factors such as social and personal norms, roles, control, and emotions (Vand der Cruijsen & Van der Horst, 2016),
- acceptance network (Wright, 2011; Carbó-Valverde et al., 2012; Kosse, 2013; Arango et al., 2016; Arifovic et al., 2017; Bounie et al., 2017).

The literature review led to the conclusion that the hierarchy of features influencing consumers' payment choices changes over time. It seems that cost and safety have been losing importance in favour of speed and convenience. Knowing how consumers assess those features regarding cash and its substitutes (i.e. contactless/proximity payments made by cards or smartphones) should be the foundation for any action promoting non-cash payments. It was the motivation to carry out such research in Poland. Studies exploring this set of payment instruments features are still limited. Thus, the results of the survey carried out will help to develop knowledge in this field.

Almost all studies conducted so far generally focus on explaining how consumers pay, and aim to analyse the determinants of their payment choices. Fewer studies address measures that should be taken to encourage consumers to switch from cash to non-cash payments, i.e. change their payment patterns. Most previous studies referring to consumer payment patterns use aggregate consumer or household surveys. Thus, they present limited information on attitudes towards cards and cash and the role of incentive-related mechanisms.

Mechanisms that support switching from cash to non-cash payments (mostly cards) may be divided into two main groups: merchant-imposed discounts and/or surcharges and reward or loyalty programs connected with credit cards. In both fields, a limited number of surveys were conducted.

Most research on merchant-imposed discounts and/or surcharges refers to the role of price incentives. For example, Amromin et al. (2007) analysed toll payments on the Illinois Tollway in the United States. They discovered that doubling the toll fees for cash payers made customers rapidly switch to electronic payments. In the Netherlands, Bolt et al. (2010), using consumer and retailer survey data, proved that high surcharges on debit card transactions did steer Dutch consumers away from debit cards to cash. The findings showed that about 22% of Dutch retailers practised card surcharges, while no retailers in the sample practised cash discounts (both cash discounts and card surcharges were legal in this country at this time). In turn, Shy and Stavins (2015) stated that although in 2013 U.S. merchants had been allowed to surcharge certain credit card transactions to recover their credit card processing costs (surcharging is nonetheless still prohibited on any debit card or pre-paid card transactions), they rarely decided to differentiate prices based on the method of payment. They proved that the prevalence of discounts and surcharges related to payment methods was stable from 2012 to 2015. The theoretical reasons for merchants' unwillingness to offer them were discussed in the article by Brilevics and Shy (2014).

The second group of studies focused on the rewards programs' role and took a behavioural perspective. They showed significant positive effects of incentive programs (reward points, discounts, and cash-back) for general purchases (Hsee et al., 2003). It must be pointed out that none of them referred directly to the role of incentive programs in card payments. However, such surveys were a point of interest in the banking literature. According to Gross and Souleles (2002), there is a relationship between the consumers' preferences towards cards and changes in contractual conditions such as interest rates, repayment schemes or rewards programs. Those preferences are not linear and may vary significantly due to those changes. Furthermore, Carbó-Valverde and Liñares-Zegarra (2009), using a unique survey of consumers' preferences for payment instruments in Spain, argued that rewards programs could considerably impact the willingness to use a card payment instead of cash. However, the impact of those programs varied significantly among merchant sectors and the type of payment card (it was higher for holders of debit cards than holders of credit cards). Similarly, Ching and Hayashi (2010) proved the statistically significant impact of payment card rewards on a consumer's payment choice. Arango et al. (2011) also tried to analyse the influence of reward program incentives and merchant acceptance on a consumer payment choice. They suggested that in mature card payment markets like Canada, card users are relatively inflexible with regard to options of incentives. However, the probability of using a credit card increases with transaction value due to the proportionality of credit card reward plans. According to Stavins and Wu (2017), such price incentives are quite rare in the US. Still, cash discounts increased consumers' willingness to use cash for payments. On the contrary, other studies confirmed that reward programs could motivate consumers to greater card usage (Agarwal et al., 2010; Simon et al., 2010).

In Poland, studies on payment instruments and consumers' payment behaviour are being conducted more and more frequently. Their results enabled establishing

the proportion of cash and non-cash retail payments and the scope of their usage referred to transaction size, place, product/service type, and consumer demographics (Koźliński, 2017; Maison, 2017, 2021; Kotkowski et al., 2021). To date, less attention has been paid to consumer payment behaviour and payment pattern determinants such as cost, security, speed, and convenience. Just a few surveys presented the comparison of cash and other payment instruments considering those features. Similarly, there are only a few attempts to assess customers' willingness to change current payment habits. Surprisingly, the results of the first research in this field (Harasim, 2015, pp. 17–30) showed that they perceive cash as the cheapest and simplest payment method. Innovative payment methods were assessed by customers as the fastest, but over 40% of respondents could not imagine replacing cash with innovative payment methods in the nearest future. This research had a regional reach; thus, it was not possible to extrapolate the results to the whole population. To the authors' best knowledge, any research conducted in Poland analysed the customer sensitivity to different types of incentives (financial incentives, material bonuses or tax benefits) that may be used to encourage customers to switch from cash to non-cash payments. Our study contributes to this field of research and to the discussion of how to motivate customers to change their payment habits and reduce the use of cash for payments in the economy. It aims to find the answer to the following research questions:

1. What features of payment instruments are critical for changing customers' payment habits, i.e. switching from cash to non-cash payments?
2. What kind of incentives may change Polish customers' payment habits and induce them to exchange cash for non-cash payments?

The study presented in this paper was carried out on a representative sample of Polish customers, which makes its results more comprehensive.

Research methodology and dataset

The survey's scope corresponded with the research questions and addressed the following issues:

- the use of cash and payment instruments being its alternative and the reasons for using them,
- the assessment of cash and alternative payment instruments in face-to-face transactions in terms of speed, convenience, security, and cost,
- the evaluation of incentives which have the potential to steer customers towards increased usage of non-cash payments.

The choice of the features of the above-mentioned payment methods, as well as the kinds of incentives, were based on an in-depth literature review.

In order to answer the research questions, a randomised survey was designed and conducted. The research was quantitative. The survey was conducted in 2018 in co-operation with the Foundation for Development of Non-Cash Transactions (FROB).

To the authors' best knowledge, it was the first study on this topic in Poland. It was carried out on a representative sample of Polish consumers over 15 years old. To ensure that the survey sample will match the population in terms of age, gender, and education level, the Random Iterative Method (RIM) weighting data technique was used. Data was collected by questionnaire-based interviews using the CAPI method (Computer-Assisted Personal Interview), which is thought to be one of the most effective face-to-face methods to ensure high confidence in the data. The 27-item questionnaire was applied. The questions in the survey were multiple-choice questions (closed and semi-closed), and for some of them, the five-point Likert scale was used. Before carrying out the appropriate research, the pilot study was completed to validate the questionnaire, eliminate possible errors in the research tool, and assess its correctness and suitability to achieve the study's objectives. The sample size was 1,100.

Since the research sample reflected the structure of the population, it included slightly more women than men, and almost 60% of the sample consisted of persons over 40 years old. The respondents were most often people living in towns (61%), and the majority were well educated, i.e. have at least secondary education. The sample was dominated by people assessing their financial situation as rather good, reflected by the statement: "We can afford everything, but we live economically". The respondents presented different attitudes toward cash. Every fourth respondent declared paying only in cash. The next 27% of the respondents claimed that they definitely more often use cash than non-cash payments. However, more than 48% of the respondents use non-cash payments more frequently (Table 1).

Table 1. Characteristics of the research sample ($N = 1,100$)

Characteristics		Number of respondents	Percentage of the sample
Gender	female	572	52.0
	male	528	48.0
Age group	15–24	143	13.0
	25–39	308	28.0
	40–59	341	31.0
	over 60	308	28.0
Place of residence	rural areas	429	39.0
	city with up to 50,000 residents	282	25.6
	city with 50,000–200,000 residents	144	13.1
	city with over 200,000 residents	245	22.3
Household net income (per person)	up to PLN 1,500	217	19.7
	PLN 1,500–1,750	263	23.9
	over PLN 1,750	261	23.7
	refuse to answer	359	32.7
Education	primary/lower secondary	491	44.6
	upper secondary	367	33.4
	higher	242	22.0

Characteristics		Number of respondents	Percentage of the sample
Attitude towards cash	I pay only in cash.	267	24.3
	I pay more often in cash than using non-cash payments (definitely more often and rather often).	302	27.4
	I use more often non-cash payments (definitely more often and rather often or only in non-cash).	531	48.3
Self-assessment of the financial situation of the household	We can afford everything without the necessity to save.	176	16.0
	We can afford everything, but we live economically.	649	59.0
	We have sufficient money to buy the cheapest food and clothes.	231	21.0
	We have sufficient money only to buy the cheapest food but not clothes.	33	3.0
	We do have not enough money neither for the cheapest food nor for buying clothes.	11	1.0

Source: Authors' own study.

The survey analysed the payment instruments deemed to be most cash-competitive in point of sales (POS) transactions, such as contactless cards and mobile proximity payments (Harasim, 2016, p. 55). To assess them in terms of speed, convenience, security, and cost, the 5-point Likert scale was applied (following Amromin et al., 2007, pp. 101–126). To check the strength of the relationship between the respondents' payment habits and sociodemographic variables, i.e. age, gender, education level, and place of residence, a non-parametric Chi-square test of independence was used assuming a statistical significance of $p = 0.05$. Besides, multinomial logistic regression was used to model the nominal outcome variable – attitude towards cash. The log odds of the outcomes are modelled there as a linear combination of the predictor variables – demographic characteristics.

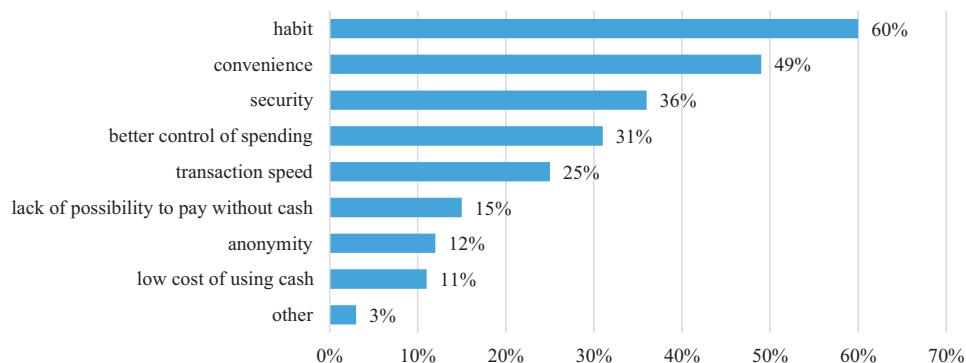
In the second part of the study, consumers who prefer cash over non-cash payments ($N = 569$) were selected to determine their willingness to switch from cash to non-cash payments and vulnerability to different incentive mechanisms. The Thurstone comparative assessment method was applied to establish what incentives may motivate respondents to change their payment behaviour (Thurstone, 1927). The method enables the creation of a one-dimensional metric preference scale based on data on preferences obtained using the pairwise comparison scale.

To discover relationships between the different kinds of financial incentives chosen by the respondents, association (co-occurrence) analysis was used. These relationships are represented in the form of a set of frequent items or association rules (e.g. fixed discounts, progressive discounts). The strength of an association rule can be measured in terms of its support and confidence. The first measure used in this paper determines how often a rule is applicable to a given data set. The Apriori algorithm is adopted to discover the most frequent item sets (Hastie et al., 2001). The same method was used to extract all high-support rules between the financial benefits that would convince a person to use non-cash payments.

Results and discussion

The assessment of payment instruments' features

For answering the first research question, the assessment of payment methods' features was required. First, the general reasons for using cash when doing face-to-face transactions were examined. The outcomes indicate that people who prefer paying in cash (569 respondents out of 1,100) do it habitually and/or because it is convenient. Over one-third of them consider cash payments safe and enable overspending control. Only one-fourth chose cash because of transaction speed (Figure 1). The cost was pointed out as the last feature taken into account what is not in accordance with some previous findings (Kennickal & Kwast, 1997; Humphrey et al., 2001; Borzekowski et al., 2008; Zinman, 2009).



*respondents had to choose three answers, that is why the results do not sum up to 100%

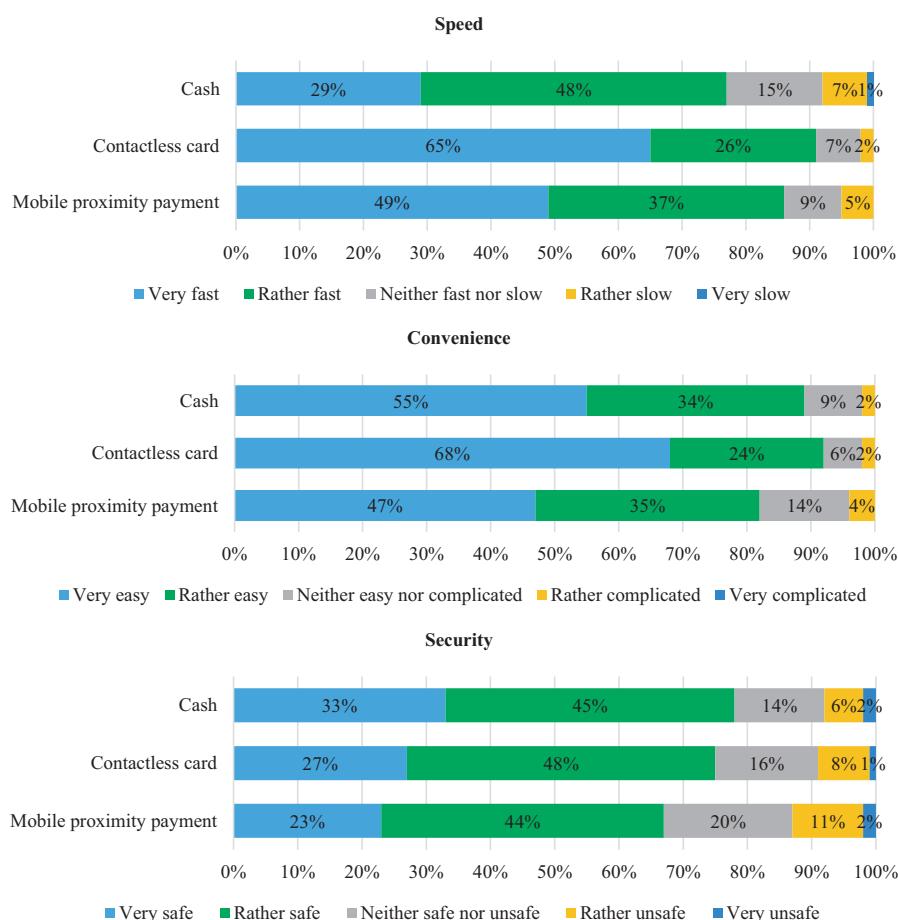
Figure 1. The reasons for using cash as a payment method (N = 569)

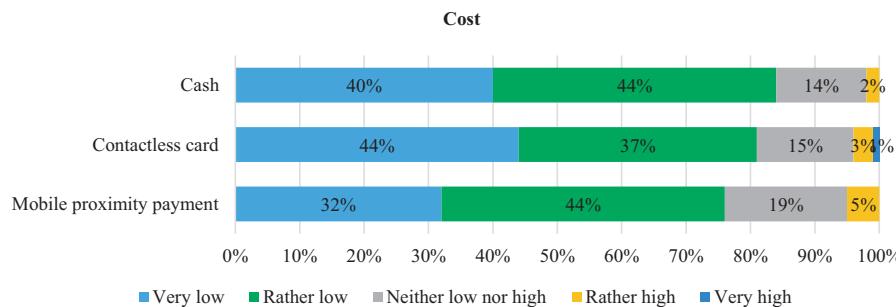
Source: Authors' own study.

The respondents were also asked how frequently they use cash. It depends on the type of transaction (at POS or online), transaction size, and place (the kind of goods and services purchased). The respondents more frequently pay using cash in low-value transactions made at POS. Cash is rather not used in online transactions and payments for durable goods. The respondents willingly pay in cash for services, food and other consumer goods as well as in public administration offices. One-third of them use cash to pay bills. The research results correspond with previous research concluding that consumer payment choice depends to a large extent on the so-called transaction context (Klee, 2006, 2008; Jonker, 2007; Von Kalckreuth et al., 2009; Mester, 2012; Hedman et al., 2017; NBP, 2020, pp. 1–48) and transaction value (Bounie & Francois, 2006; Maison, 2010, 2017; Koźliński, 2017).

The findings support the claim that, generally, paying in cash results from consumers' habits. However, it is worth mentioning that the respondents quite often noted the lack of possibility to pay without cash, which means that the non-cash payment acceptance network is insufficient. Over one-third of respondents pointed out that as a barrier to using payments alternative to cash when paying for services, and one-fourth – in public administration offices. About one-fifth of respondents use cash because they do not have a bank account or card. Even those who more often use non-cash payments tended to use cash in low-value transactions and when speed is a priority.

Then the respondents were asked to assess features of cash-competitive payment instruments used in face-to-face transactions, which are the area of cash dominance. They compared the components of cash, contactless and mobile proximity payments. The characteristics assessed were speed, ease of use (convenience), and cost (Figure 2).



**Figure 2.** Consumers' assessment of payment methods' features (N = 569)

Source: Authors' own study.

Surprisingly, the only cash feature assessed higher than other payment methods was security. Regarding the cost, even though using cash for payments is perceived as free of charge, the respondents considered contactless cards cheaper to use than cash. Most respondents found cash convenient, but not as much as contactless cards. Those cards were also assessed as the fastest payment method among all analysed payment methods. Taking into account speed, cash was evaluated as the worst. The increasing impact of convenience and speed of the payment instrument on consumer payment choice is coherent with other research findings (Klee, 2006; Borzekowski et al., 2008; Arango et al., 2011; Stavins, 2013; Harasim, 2015, 2016; Schuh & Stavins, 2015; Koulayev et al., 2016). The results showed that, despite some security concerns, Polish consumers consider contactless cards a real alternative to cash-in POS transactions. The most probable areas of such substitution are daily payments as well as payments in public administration offices. As the differences in cash and no-cash payment methods' assessment were insignificant, the cash features seem not to be the most critical driver of its usage.

The respondents' payment behaviour (measured as described in Table 1) could depend on age, gender, education level, and place of residence. The findings revealed a statistically significant relationship ($p < 0.05$) between the form of payment and age, level of education, and place of residence. The study found no connection between the form of payment and gender. Results of a non-parametric Chi-square test of independence are presented in Table 2.

Table 2. The relationship between the preferred payment method and demographic variables (N = 569)

The sample features	The p-value for the Chi ² test
gender	$p = .516$
age group	$p = .000$
level of education	$p = .000$
place of residence	$p = .015$

Source: Authors' own study.

The impact of the above demographic variables on the preferred payment method was evaluated based on multinomial logistic regression analysis. To simplify the model, the dependent variable has three levels: "I pay only in cash" (the reference level), "I pay more often in cash than using non-cash payments", and "I use more often non-cash payments". Results are presented in Table 3 and Table 4. The final model did not include interactions between demographic variables due to the lack of meaningful relationships.

Table 3. The relationship between the preferred payment method and demographic variables ($N = 569$)

	I pay more often in cash than using non-cash payments vs I pay only in cash	I use more often non-cash payments vs I pay only in cash
Age group (reference level: 25–39)		
15–24	-1.1***	-1.2***
40–59	-0.4	-1.1***
60+	-1.7***	-3.2***
Education (reference level: primary/lower)		
Secondary	0.3	0.4**
High	0.9***	1.7***
Place of residence (reference level: rural areas)		
City with up to 50,000 residents	-0.2	0.4*
City with 50,000–200,000 residents	0.1	0.4
City with over 200,000 residents	0.4*	1.1***
Constant	0.8***	1.4***
AIC	2,053.5	2,053.5
Goodness-of-fit McFadden: 0.13; Cox-Snell: 0.23; Nagelkerke: 0.27		

* $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$; standard errors are omitted

Source: Authors' own study.

Table 4. Odds ratios from multinomial logistic regression

	I use more often non-cash payments	I pay more often in cash than using non-cash payments
(Intercept)	2.31	3.99
15–24	0.33	0.30
40–59	0.68	0.34
60+	0.19	0.04
high	2.40	5.29
City with up to 50,000 residents	0.80	1.43
City with 50,000–200,000 residents	1.10	1.46
City with over 200,000 residents	1.51	3.05

Source: Authors' own study.

The findings confirm that demographics differentiate payment method choices. Age is the most important variable determining payment methods' usage. Among those who rather use non-cash payments were mainly people aged 25–39. Hence

this group was selected as the reference group. All other age groups are less likely than the reference group to use the “non-cash” option or even “cash more often than the non-cash” option, with the oldest group being the most distinct. The respondents who always pay in cash live in rural areas and have primary education. All else being equal, being aged 15–24 and 40–59 reduces the relative odds of choosing the non-cash option over the only-cash option by 70%, while for age 60+ it is almost 100%. Education above primary increases the chance of selecting non-cash payments. Already having a high school education increases the relative probability of choosing the non-cash option over the only-cash option by 60%. The situation is similar for the place of residence. In most cases, the respondents who always paid in cash lived very economically or were forced to limit their spending. Among people aged 25–39, who rather chose non-cash payments, the percentage of respondents living in large cities was more than double compared to those who more often use cash. The rate of those who were highly educated was three times greater. Their economic situation was also much better. Although most of them live economically, more than one-third declared they could afford everything. The percentage of those who had to limit their spending was two and a half times lower than the respondents who preferred cash. Similarly to previous research (Stavins, 2001; Zinman, 2009; Klee, 2006; Borzekowski et al., 2008; Bounie et al., 2017), the results confirmed that demographic characteristics and income (or household assets) could be good predictors of preferences for different payment instruments.

The respondents were also asked to declare if they were ready to stop paying in cash. Despite the increasing willingness to use non-cash payments, almost one-third of respondents do not want to resign from cash. Only 8% of respondents declared that they could live without cash. One-quarter of respondents are ready to switch from cash to non-cash payment instruments when the acceptance network covers all sales points (Figure 3).

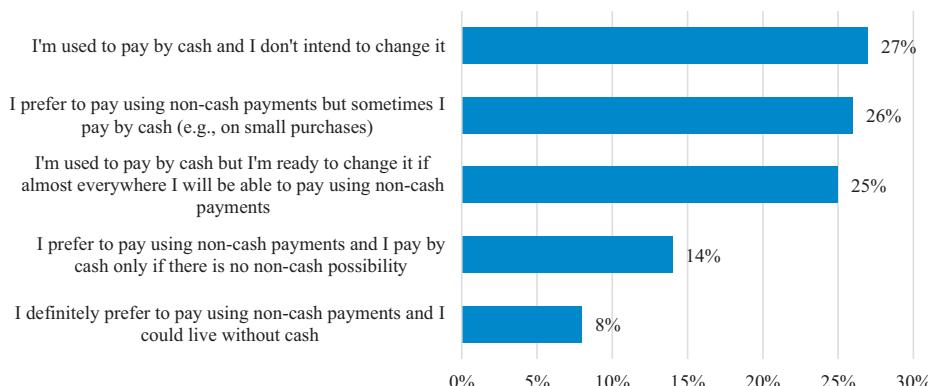


Figure 3. Consumers' assessment of payment methods' features (N = 569)

Source: Authors' own study.

In addition to the analysis of consumers' payment habits, the research aimed at finding what may induce them to migrate away from cash. It is important to find out because 69% of the respondents, who often or very often pay in cash, chose that method even if non-cash payments were accepted. Among the respondents with a banking account, 70% behave like this in the case of low-value transactions, and 21% do it because they think card payments take more time.

Consumers' sensitivity to incentive-related mechanisms

Therefore, to address the second research question in the next part of the investigation, the respondents who prefer cash over non-cash payments were selected. To establish what kind of incentives may convince them to change their payment behaviour, the Thurstone comparative assessment method was applied. This method enables to design a one-dimensional metric preference scale based on data on preferences obtained using the pairwise comparison scale. Four reasons for choosing non-cash payment were presented to the respondents who were asked to rank them from most important to least important (1 to 4, accordingly) (Table 5).

Table 5. Ranking options for preferred reasons for using non-cash payments

Options	Description
1	If the price of goods/services is lower for the non-cash payment
2	If the transaction speed is higher for the non-cash payment
3	If the non-cash payment is as (or more) convenient as (than) a cash payment
4	If the non-cash payment is more secure than the cash payment

Source: Authors' own study.

Table 6 presents the frequency of placing particular options in different positions (from 1 to 4). Lower prices for goods and services, when paid using non-cash instruments, were most often chosen in the first position (41%). One in four people chose speed (option 2) as the most important, and the importance of convenience (option 3) and security (option 4) varies considerably.

Table 6. Ranking options for preferred reasons for using non-cash payments

Position	Option 1	Option 2	Option 3	Option 4
Position 1	41.36	25.64	14.91	18.09
Position 2	16.82	19.64	22.91	17.82
Position 3	11.09	20.36	17.27	19.91
Position 4	11.73	14.91	20.73	19.55

Source: Authors' own study.

Next, the data in the form of a ranking scale was processed into the results of pairwise comparisons of individual objects. Based on the assessments of those comparisons, a table of proportions was created in which a given reason is preferred over another (Table 7).

Table 7. The proportions of respondents preferring one option over each of the others

	Option 1	Option 2	Option 3	Option 4
Option 1	0.00	0.38	0.34	0.35
Option 2	0.62	0.00	0.44	0.45
Option 3	0.66	0.56	0.00	0.51
Option 4	0.65	0.55	0.49	0.00

Source: Authors' own study.

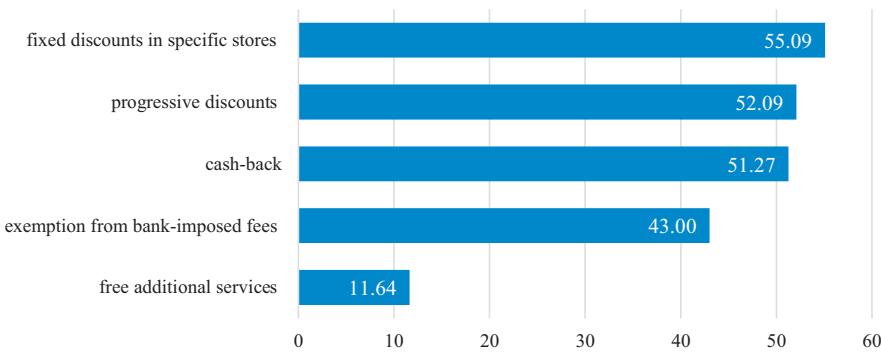
62% of the respondents decided that the first option (lower price) is more important than the second one (speed). The rate (second option) is more important than the convenience (third option) for 55% of the respondents, and 51% of the respondents thought the fourth option (security) to be more important than the third.

The highest sensitivity to price incentives was confirmed in the other part of the study. The respondents were asked what kind of incentive could increase their willingness to use non-cash payments instead of cash. Choosing only one incentive, most of them (almost 60%) decided to select financial benefits (monetary rewards), 21% – tax benefits and 18% – material bonuses. A non-parametric Chi-square test of independence showed a statistically significant relationship between the preferred kind of benefit and both the place of residence and age ($p = .009$). All groups of respondents pointed out financial benefits as the most important, but the group of the elderly over 60 years old was less sensitive. In the case of tax benefits, the less sensitive group was the group aged 15–24, and for material bonuses, the respondents aged 40–59.

Considering that financial benefits were perceived as the most important, they were further explored. Each respondent could choose three of the following benefits:

- exemption from fees (for an account, card, etc.),
- fixed discounts in specific stores (regardless of the volume of purchases),
- progressive discounts (increasing with the size of expenses),
- cash-back (repayment of a part of non-cash paid expenses),
- loyalty programs (points exchanged for prizes, additional discounts, etc.),
- free additional services in shopping centres, cinemas, restaurants, hotels or airports.

The highest percentage of respondents (55.1%) chose fixed discounts in specific stores, while slightly more than half chose progressive discounts or cash-back (Figure 4).

**Figure 4.** Financial benefits preferred by the respondents (%)

Source: Authors' own study.

The association (co-occurrence) analysis was used to discover relationships between the different kinds of financial incentives pointed out by the respondents. These relationships are represented in the form of a set of frequent items or association rules (e.g. fixed discounts, progressive discounts). The strength of an association rule can be measured in terms of its support and confidence. The first measure used in this paper determines how often a rule applies to a given data set. The Apriori algorithm was adopted to discover the most frequent item sets (Hastie et al., 2001). The same method was used to extract all high-support rules between the financial benefits that would steer a consumer to use non-cash payments.

The outcomes of the analysis showed that over 12% of "cash lovers" respondents chose three advantages, while the rest chose only two of three possible. Almost one-third chose one of the forms of price reduction: fixed discounts, progressive discounts or cash-back (Table 8).

Table 8. The proportions of respondents preferring one option over each of the others

The most popular combinations of financial incentives	Number of respondents	Percentage
Fixed discounts + progressive discounts	310	28.18
Fixed discounts + cash-back	295	26.82
Cash-back + progressive discounts	294	26.73
Cash-back + exemption from fees	220	20.00
Progressive discounts + exemption from fees	218	19.82
Fixed discounts + exemption from fees	205	18.64
Fixed discounts + cash-back + progressive discounts	136	12.36

Source: Authors' own study.

Analysis of the incentives supported the claim that the respondents are most sensitive to financial incentives. They are especially sensitive to price reductions such as fixed or progressive discounts, cash-back, etc. Concurrently, they are less interested in indirect financial incentives (e.g. a decrease in or exemption from bank-imposed fees and charges), tax benefits and material bonuses.

Conclusions

Even if Poland is considered a leading country in payment innovations' adoption, the share of cash used in transactions made at POS is still large there. Limiting cash usage in such transactions is of key importance for each economy because of the hidden high social costs of cash and the reduction of the shadow economy. The decrease in cash payments contributes to the economy's growth, the GDP increase, and the reduction in money circulation costs. Discovering consumers' preferences regarding cash payments, the role of cost, speed, convenience, and security of different payment methods/instruments in affecting consumers' payment choices, and factors which can encourage them to switch from cash to non-cash payments may support initiatives taken worldwide aiming at reducing cash usage.

The research results showed that those who pay in cash do it habitually or prefer paying like this for specific reasons. The assessment of payment instruments' features showed that cash was evaluated better than non-cash payments only in terms of security. Regarding convenience and cost, contactless cards were ranked highest overall, and cash was assessed as the worst in transaction speed. Such results lead to the conclusion that, on a rational level, Polish consumers have already realised that contactless cards might be a viable alternative for cash in daily transactions. In Poland, the acceptance network is not a barrier to contactless payments diffusion, as all POS terminals accept them. However, the card acceptance network is relatively less saturated than in developed European countries. Thus, the threat that a particular POS will not accept non-cash payments was mentioned as a reason for switching from non-cash to cash payments. Additionally, some psychological factors, mainly habits, make cash the preferred payment method for face-to-face transactions. The case of the contactless cards' development in Poland showed that if consumers take the opportunity to pay using an innovative payment method, they will adopt it quite easily and quickly. That is why choosing a proper incentive is crucial in switching from cash to non-cash payments.

The analysis of incentives which could induce "cash-lovers" to switch to non-cash payments proved that the respondents are much more sensitive to financial incentives, especially different kinds of price reduction (i.e. fixed or progressive discounts, cash-back, etc.). They are less interested in indirect financial incentives such as reducing or exemption from bank-imposed fees and charges and much less in tax benefits or material bonuses. Recently, however, it turned out that external non-financial and non-economic factors, such as the COVID-19 pandemic, may also be a significant stimulus to switch from cash to non-cash payments.

The research results developed knowledge of how consumers make their payment choices resulting from previously conducted research based on payment diary methodology by explaining the drivers of their payment choices. Moreover, they indicate what should be done to induce them to change their payment patterns. Additionally, contrary to other studies, an in-depth analysis of consumers' payment behaviour who

prefer cash was done. Most previous research, especially those focused on incentives, analysed only cash and card payments. Thus, exploring the contactless cards and mobile proximity payments as having the highest potential to substitute cash also expands research reach and enriches existing knowledge related to cash-competitive solutions. To the authors' best knowledge, it is the first research in Poland analysing customer sensitivity to different types of incentives aimed at encouraging them to switch from cash to non-cash payments.

The research results have practical implications for merchants, public authorities, and banks (including central banks) concerning the choice of incentives that may be used to change consumer payment habits. It should improve the effectiveness of the increasing initiatives aimed at reducing the use of cash to drive greater adoption of non-cash payments. Since the research outcomes indicated that the highest percentage of "cash-lovers" are older people living in rural areas who are relatively less educated, the educational projects addressed to such consumers should be adjusted in their form and content to the level of their financial knowledge and cognitive abilities. The path to change their payment patterns should begin with developing basic money management skills, i.e. they should learn how to budget, avoid scams, apply for benefits, and manage debit cards. Based on other countries' experiences, it is worth noticing that such incentives may not be enough to change payment patterns. The findings showed that age is the main demographic variable influencing payment instrument choice. It revealed a new research question – is it necessary and efficient to take any action to encourage customers to change their behaviour or just enable them to make decisions themselves following their needs characteristics for the stage of the family life cycle?

The research limitations result from its geographical scope and methodology. Even though Poland is somewhat similar to other countries, the results obtained in other countries may differ as socio-demographics influence them. Since in the study, a survey method was used, i.e. we analysed customers' declared willingness to change their payment patterns and not the real behaviour, it would be beneficial to conduct further research using the diary method or retailer data to assess the real scope of applied incentives and their efficiency in the process of changing customer payment patterns. We should also point out that the correlational character of the research data creates some shortcomings as research findings reflect only the relationship between variables which does not equate to causation.

References

Agarwal, S., Chakravorti, S., & Lunn, A. (2010). Why do banks reward their customers for using their credit cards? *FRB of Chicago Working Papers, 2010-19*, 1–46. Retrieved from <https://www.chicagofed.org/publications/working-papers/2010/wp-19>

Amromin, G., & Chakravorti, S. (2007). Debit card and cash usage: A cross-country analysis. *FRB of Chicago Working Papers, 2007-04*. Retrieved from <https://ssrn.com/abstract=981236>; doi:[10.2139/ssrn.981236](https://doi.org/10.2139/ssrn.981236)

Amromin, G., Jankowski C., & Porter, R.D. (2007). Transforming payment choices by doubling fees on the Illinois Tollway. *Economic Perspectives, 31*(2), 22–47. Retrieved from <https://www.chicagofed.org/publications/economic-perspectives/2007/2qtr2007-part2-amromin-etal>

Arango, C., Hyunh, K., & Sabetti, L. (2011). How do you pay? The role of incentives at the point-of-sale. *European Central Bank, Working Paper Series, 1386*, 1–42. Retrieved from <https://www.ecb.europa.eu/pub/pdf/scpwps/ecbwp1386.pdf>

Arango, C., Huynh, K.P., & Sabetti, L. (2016). Consumer payment choice: Merchant card acceptance versus pricing incentives. *Journal of Banking & Finance, 55*, 130–141. doi:[10.1016/j.jbankfin.2015.02.005](https://doi.org/10.1016/j.jbankfin.2015.02.005)

Arifovic, J., Duffy, J., & Hua Jiang, J. (2017). Adoption of a new payment method: Theory and experimental evidence. *Bank of Canada Staff Working Papers, 2017-28*, 17–28. doi:[10.34989/swp-2017-28](https://doi.org/10.34989/swp-2017-28)

Bagnall, J., Bounie, D., Huynh, K.P., Kosse, A., Schmidt, T., Schuh, S., & Stix, H. (2016). Consumer cash usage: A cross-country comparison with payment diary survey data. *European Central Bank, 12*(4), 1–61. Retrieved from <http://www.ijcb.org/journal/ijcb16q4a1.pdf>

Bech, B., Faruqui, U., Ougaard, F., & Picillo, C. (2018). Payments are a-changin', but cash still rules. *BIS Quarterly Review, 67–80*. Retrieved from http://www.bis.org/publ/qtrpdf/r_qt1803g.pdf

Bolt, W., Jonker, N., & van Renselaar, C. (2010). Incentives at the counter: An empirical analysis of surcharging card payments and payment behaviour in the Netherlands. *Journal of Banking & Finance, 34*(8), 1738–1744. doi:[10.1016/j.jbankfin.2009.09.008](https://doi.org/10.1016/j.jbankfin.2009.09.008)

Borzekowski, R., & Kiser, E.K. (2008). The choice at the checkout: Quantifying demand across payment instruments. *International Journal of Industrial Organization, 26*(4), 889–902. doi:[10.1016/j.ijindorg.2007.07.006](https://doi.org/10.1016/j.ijindorg.2007.07.006)

Borzekowski, R., Kiser, E.K., & Ahmed, S. (2008). Consumers' use of debit cards: Patterns, preferences, and price response. *Journal of Money, Credit and Banking, 40*, 149–172. doi:[10.1111/j.1538-4616.2008.00107.x](https://doi.org/10.1111/j.1538-4616.2008.00107.x)

Bounie, D., & Francois, A. (2006). Cash, check or bank card? The effects of transaction characteristics on the use of payment instruments. *Telecom Paris Economics and Social Sciences Working Paper, ESS-06-05*. doi:[10.2139/ssrn.891791](https://doi.org/10.2139/ssrn.891791)

Bounie, D., Abel, F., & Van Hove, L. (2017). Consumer payment preferences, network externalities, and merchant card acceptance: An empirical investigation. *Review of Industrial Organization, 51*, 257–290. doi:[10.1007/s11151-016-9543-y](https://doi.org/10.1007/s11151-016-9543-y)

Briglevics, T., & Shy, O. (2014). Why don't most merchants use price discounts to steer consumer payment choice? *Review of Industrial Organization, 44*(4), 367–392. doi:[10.1007/s11151-014-9419-y](https://doi.org/10.1007/s11151-014-9419-y)

Carbó-Valverde, S., & Liñares-Zegarra, J.M. (2009). How effective are rewards programs in promoting payment card usage? Empirical evidence. *ECB Working Paper Series, 1141*, 1–38. doi:[10.2139/ssrn.1522029](https://doi.org/10.2139/ssrn.1522029)

Carbó-Valverde, S., Liñares-Zegarra, J.M., & Rodríguez-Fernández, F. (2012). Feedback loop effects in payment card markets: Empirical evidence. *Review of Network Economics, 11*(2), 1–24. doi:[10.1515/1446-9022.1268](https://doi.org/10.1515/1446-9022.1268)

Carlos, A., & Taylor, V. (2009). Merchants' costs of accepting means of payment: Is cash the least costly? *Bank of Canada Review, winter 2008–2009*, 15–23. Retrieved from https://www.bankofcanada.ca/wp-content/uploads/2010/06/arango_taylor.pdf

Cevik, S. (2020). Dirty money: Does the risk of infectious disease lower demand for cash? *International Finance*, 23(3), 460–471. doi:10.1111/infi.12383

Chen, L.D. (2008). A model of consumer acceptance of mobile payment. *International Journal of Mobile Communications*, 6(1), 32–52. doi:10.1504/IJMC.2008.015997

Ching, A., & Hayashi, F. (2010). Payment cards reward programs and consumer payment choice. *Journal of Banking & Finance*, 34(8), 1773–1787. doi:10.1016/j.jbankfin.2010.03.015

De Grauwe, P., Rinaldi, L., & Van Cayseele, P. (2006). *Issues of Efficiency in the Use of Cash and Cards*. University of Leuven. Retrieved from <https://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.629.5066&rep=rep1&type=pdf>

Gross, D.B., & Souleles, N.S. (2002). Do liquidity constraints and interest rates matter for consumer behavior? Evidence from credit card data. *The Quarterly Journal of Economics*, 117(1), 27–52. doi:10.1162/003355302753399472

Harasim, J. (2015). Zwyczaje płatnicze konsumentów a możliwości ograniczenia obrotu gotówkowego w Polsce. *Cracow Review of Economics and Management*, 2(938), 17–30. doi:10.15678/ZNUEK.2015.0938.0202

Harasim, J. (2016). Europe: The shift from cash to non-cash transactions. In J. Górką (Ed.), *Transforming Payment Systems in Europe* (pp. 28–69). London: Palgrave Macmillan. Retrieved from https://link.springer.com/chapter/10.1057/9781137541215_2

Hasan, I., De Renzis, T., & Schmiedel, H. (2013). Retail payments and the real economy. *ECB Working Paper Series*, 1572. doi:10.2139/ssrn.2302527

Hastie, T., Tibshirani, R., & Friedman, J. (2001). *The Elements of Statistical Learning. Data Mining, Inference and Prediction*. Springer Verlag. Retrieved from <https://link.springer.com/book/10.1007/978-0-387-84858-7>

Hayashi, F., & Klee, E. (2003). Technology adoption and consumer payments: Evidence from survey data. *Review of Network Economics*, 2(2), 175–190. doi:10.2202/1446-9022.1025

Hedman, J., Tan, F.B., Holst, J., & Kjeldsen, M. (2017). Taxonomy of payments: A repertory grid analysis. *International Journal of Bank Management*, 35(1), 75–96. doi:10.1108/IJBM-12-2015-0187

Hoang, D.P., & Vu, T.H. (2020). A transaction cost explanation of the card-or-cash decision among Vietnamese debit card holders. *International Journal of Bank Management*, 38(7), 1635–1664. doi:10.1108/IJBM-05-2019-0191

Hsee, K., Yu, C.F., Zhang, J., & Yan, Z. (2003). Medium maximization. *Journal of Consumer Research*, 30, 1–14. doi:10.1086/374702

Humphrey, D., Kim, M., & Vale, B. (2001). Realizing the gains from electronic payments: Costs, pricing, and payment choice. *Journal of Money, Credit, and Banking*, 33(2), 216–234. doi:10.2307/2673882

Jonker, N. (2007). Payment instruments as perceived by consumers – results from a household survey. *De Economist*, 155(3), 271–303. doi:10.1007/s10645-007-9062-1

Karjaluoto, H., Shaikh, A.A., Leppäniemi, M., & Luomala, R. (2020). Examining consumers' usage intention of contactless payment systems. *International Journal of Bank Management*, 38(2), 75–96. doi:10.1108/IJBM-04-2019-0155

Kempainen, K. (2003). Competition and regulation in European retail payment systems. *Bank of Finland Discussion Papers*, 16. Retrieved from <https://www.econstor.eu/handle/10419/211949>

Kennickell, A.B., & Kwast, M.L. (1997). Who uses electronic banking? Results from the 1995 survey of consumer finances. *Proceedings of the 33rd Annual Conference on Bank Structure and Competition, Federal Reserve Bank of Chicago*, 56–75. Retrieved from <https://www.federalreserve.gov/pubs/feds/1997/199735/199735pap.pdf>

Klee, E. (2006). Families' use of payment instruments during a decade of change in the US payment system. *Finance and Economics Discussion Series*, 2006-01, 1–54. Retrieved from <https://www.federalreserve.gov/pubs/feds/2006/200601/200601pap.pdf>

Klee, E. (2008). How people pay: Evidence from grocery store data. *Journal of Monetary Economics*, 55(3), 526–541. doi:10.1016/j.jmoneco.2008.01.009

Kosse, A. (2013). The safety of cash and debit cards: A study on the perception and behaviour of Dutch consumers. *International Journal of Central Banking*, 9(4), 77–98. Retrieved from <https://www.ijcb.org/journal/ijcb13q4a3.htm>

Kosse, A., Chen, H., Felt, M.H., Dongmo Jiongo, V., Nield, K., & Welte, A. (2017). The costs of point-of-sale payments in Canada. *Bank of Canada Staff Discussion Papers*, 2017-4. Retrieved from <https://www.bankofcanada.ca/wp-content/uploads/2017/03/sdp2017-4.pdf>

Kotkowski, R., Dulinicz, M., & Maciejewski, K. (2021). *Zwyczaje płatnicze w Polsce w 2020 r.* Warszawa: NBP. Retrieved from https://www.nbp.pl/systemplatniczy/zwyczaje_platnicze/zwyczaje_platnicze_Polakow_2020p.pdf

Koulayev, S., Rysman, M., Schuh, S., & Stavins, J. (2016). Explaining adoption and use of payment instruments by US consumers. *RAND Journal of Economics*, 47(2), 293–325. doi:10.1111/1756-2171.12129

Koźlński, T. (2017). *Wybrane wyniki badania Polaków nt. korzystania z usług bankowych i płatności 2016.* Warszawa: NBP. Retrieved from https://www.nbp.pl/systemplatniczy/obrot_bezgotowkowy/Polacy-na-temat-uslug-bankowych_2016.pdf

Maison, D. (2010). *Postawy Polaków wobec obrotu bezgotówkowego.* Warszawa: NBP. Retrieved from https://www.nbp.pl/systemplatniczy/obrot_bezgotowkowy/postawy_polak%C3%B3w_wobec_obrotu_bezgotowkowego_raport.pdf

Maison, D. (2017). *Postawy Polaków wobec obrotu bezgotówkowego. Raport z badania 2016 i analiza porównawcza z danymi z 2009 i 2013 roku.* Warszawa: NBP. Retrieved from <https://www.nbp.pl/badania/seminaria/8v2017.pdf>

Maison, D. (2021). *Postawy Polaków wobec obrotu bezgotówkowego. Raport z badania 2021 i analiza porównawcza z danymi z 2009, 2013 i 2016 roku.* Warszawa: NBP. Retrieved from https://www.nbp.pl/systemplatniczy/obrot_bezgotowkowy/obrot-bezgotowkowy-2021.pdf

Mester, L.J. (2012). Changes in the use of electronic means of payment: 1995–2010. *FRB of Philadelphia Business Review*, Q3, 25–36. Retrieved from https://www.philadelphiahed.org/-/media/frbp/assets/economy/articles/business-review/2012/q3/brq312_changes-in-use-of-electronic-means-of-payment-1995-2010.pdf

NBP. (2020). *Informacja o kartach płatniczych – I kwartał 2020 r.* Warszawa: NBP. Retrieved from https://www.nbp.pl/systemplatniczy/karty/q_01_2020.pdf

Pousttchi, K. (2008). A modelling approach and reference models for the analysis of mobile payment use cases. *Electronic Commerce Research and Applications*, 7(2), 182–201. doi:10.1016/j.elerap.2007.07.001

Raman, P., & Aashish, K. (2020). To continue or not to continue: A structural analysis of antecedents of mobile payment systems in India. *International Journal of Bank Management*, 39(2), 242–271. Retrieved from <https://www.emerald.com/insight/content/doi/10.1108/IJBM-04-2020-0167/full/html>

Rochet, J.-C., & Tirole, J. (2003). Platform competition in two-sided markets. *Journal of European Economic Association*, 1, 990–1029. doi:10.1162/154247603322493212

Schierz, P.G., Schilke, O., & Wirtz, B.W. (2010). Understanding consumer acceptance of mobile payment services: An empirical analysis. *Electronic Commerce Research and Applications*, 9(3), 209–216. doi:10.1016/j.elerap.2009.07.005

Schmiedel, H., Kostova, G., & Ruttenberg, W. (2012). The social and private costs of retail payment instruments. A European perspective. *European Central Bank Occasional Paper Series*, 137. Retrieved from <https://www.ecb.europa.eu/pub/pdf/scpops/ecbocp137.pdf>

Schuh, S., & Stavins, J. (2015). How do speed and security influence consumers' payment behavior? *Contemporary Economic Policy*, 34(4), 1–33. doi:10.1111/coep.12163

Shaw, N. (2014). The mediating influence of trust in adopting the mobile wallet. *Journal of Retailing and Consumer Services*, 21(4), 449–459. doi:10.1016/j.jretconser.2014.03.008

Shy, O., & Stavins, J. (2015). Merchant steering of consumer payment choice: Evidence from a 2012 diary survey. *Journal of Behavioral and Experimental Economics*, 55, 1–9. doi:10.1016/j.soec.2014.12.006

Simon, J., Smith, K., & West, T. (2010). Price incentives and consumer payment behavior. *Journal of Banking & Finance*, 34(8), 1759–1772. doi:10.1016/j.jbankfin.2010.02.001

Stavins, J. (2001). Effect of consumer characteristics on the use of payment instruments. *New England Economic Review*, 16, 20–33. Retrieved from <https://www.bostonfed.org/publications/new-england-economic-review/2001-issues/issue-number-3-2001/effect-of-consumer-characteristics-on-the-use-of-payment-instruments.aspx>

Stavins, J. (2013). Security of retail payments: The new strategic objective. *FRB of Boston Public Policy Discussion Paper*, 13-9, 1–46. Retrieved from <http://www.bostonfed.org/economic/ppdp/index.htm>

Stavins, J., & Wu, H. (2017). Payment discounts and surcharges: The role of consumer preferences. *FRB of Boston Working Paper*, 17-4, 1–37. Retrieved from <https://www.bostonfed.org/publications/research-department-working-paper/2017/payment-discounts-and-surcharges-the-role-of-consumer-preferences.aspx>

Stewart, C., Chan, I., Ossolinski, C., Halperin, D., & Ryan, P. (2014). The evolution of payment costs in Australia. *Reserve Bank of Australia Research Discussion Papers*, 2014-14. Retrieved from <https://www.rba.gov.au/publications/rdp/2014/pdf/rdp2014-14.pdf>

Thurstone, L. (1927). A law of comparative judgment. *Psychological Review*, 34(4), 273–286.
doi:10.1037/h0070288

Van der Cruijsen, C., & Van der Horst, F. (2016). Payment behaviour: The role of socio-psychological factors. *DNB Working Paper*, 532. Retrieved from <https://www.dnb.nl/media/m4odd4cf/working-paper-532.pdf>

Von Kalckreuth, U., Schmidt, T., & Stix, H. (2009). Choosing and using payment instruments: Evidence from German microdata. *Bundesbank Discussion Papers Series 1: Economic Studies*, 36.
doi:10.1007/s00181-013-0708-3

Williams, J., & Wang, C. (2017). Reports of the death of cash are greatly exaggerated. *FRB of San Francisco*. Retrieved from <https://www.frbsf.org/our-district/about/sf-fed-blog/reports-death-of-cash-greatly-exaggerated/>

Wright, J. (2011). Why do merchants accept payment cards? *Review of Network Economics*, 9(3), 1–8.
doi:10.2202/1446-9022.1221

Zandi, M., Singh, V., & Irving, J. (2013). *The impact of electronic payments on economic growth*. Moody's Analytics. Retrieved from <https://usa.visa.com/dam/VCOM/download/corporate/media/moodys-economy-white-paper-feb-2013.pdf>

Zinman, J. (2009). Debit or credit? *Journal of Banking & Finance*, 33(2), 358–366.
doi:10.1016/j.jbankfin.2008.08.009