

Article

Precautionary Demand for Cash and Perceived Risk of Electronic Payments

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Received: 1 September 2020; Accepted: 20 September 2020; Published: 26 September 2020



Abstract: We have recently seen two conflicting trends in the use of cash. The share of e-payments in retail transactions is steadily increasing, but the same upward trend is true for the share of cash in circulation or at least the cash share remained unchanged. This paper shows the significance of perceived risk for consumers' precautionary demand for cash after they make a decision to use e-payments. We use data from a study involving Polish consumers. The main conclusions are as follows: surveyed consumers perceive a level of risk associated with card and mobile payments and continue to carry cash for precautionary reasons. Factors such as the consumer's mental state, lack of trust in e-payments, and attitude to risk influence the decision to maintain cash reserves, while the consumer's income and age may be considered the main determinants of the value of the cash reserve. Consequently, the decision to use e-payments does not necessarily mean that the demand for cash drops to zero. A degree of difficult-to-reduce, autonomous demand for cash may exist independent of the traditionally studied determinants, in particular, those related to the transaction demand.

Keywords: precautionary demand for cash; electronic payments; consumer behaviour; perceived uncertainty; perceived risk; sustainable use of resources

1. Introduction

Recent developments in the use of cash and electronic payments are difficult to explain. On the one hand, the share of e-payments in retail transactions is steadily increasing [1]. The spread of various forms of e-payments, as well as technological innovations, fill existing gaps in infrastructure (e.g., payments with low amounts, peer to peer—P2P) and allow for more convenient use of electronic payments and contribute to more and more consumers opting out of making cash payments.

At the same time, however, cash still remains a significant means of payment. Its significance varies between countries, but often maintains its basic importance when paying at a point of sale (POS) [1–3]. What is more, in recent years, a new phenomenon has emerged, i.e., an upward trend in the volume of cash in circulation or at least the cash share has remained unchanged. This trend is visible both when analysing the share of cash in gross domestic product (GDP) and the share of cash in broad monetary aggregates [4,5]. The share of cash in GDP has been increasing in most countries since at least the beginning of the 2007+ crisis, but in many cases, the trend changed even before the crisis (e.g., in the Euro area). Sweden is among the few countries where the share of cash in GDP is decreasing.

Recent data confirm these trends. For example, in the euro area, the currency in circulation to GDP ratio amounted to 10% in 2015 and 10.3% in 2019; in Poland, it was 8.2% in 2015 and 9.9% in 2019 [6]. The final effect of the pandemic on the handling of cash is unknown and adequate data are lacking.

It is true that sanitary considerations may result in increased interest in electronic payments, but it does not necessarily affect the demand for cash. The first period of the pandemic saw a significant temporary increase in demand for cash in many countries amid concerns over the functioning of payment systems [7]. This precautionary behavior of consumers proves that the problem we are addressing in the article is still relevant. Current data do not indicate a decrease in the amount of cash in circulation, e.g., in the euro area, there was EUR 1270 billion in December 2019 and EUR 1311 billion in July 2020 [8] and in Poland, it rose from PLN 224 billion in December 2019 to PLN 285 billion in July 2020 [9].

Jobst and Stix [4] analysed the determinants of current trends in the use of cash and found no satisfactory explanation when taking into account traditional research approaches. Determinants of using cash and e-payments are therefore still an open and interesting area of research.

In our approach, we aim to show the significance of risk perception for consumers' precautionary demand for cash after they have made a decision to use e-payments (card or mobile payments—CMP). In most discussions to date, full substitutability of the use of various forms of money has been assumed, i.e., the assumption is that the decision to choose one form of money in a given transaction means abandoning another form of money (consequently, the decision to choose a non-cash payment means a decline in the demand for cash). Therefore, the spread of non-cash payments should gradually lead to the disappearance of cash from circulation. Less attention has been given so far to the precautionary demand, which constitutes a rather small portion of the total demand in terms of value, but at the same time, may show a significant inertia.

The demand for money due to the precautionary motive is traditionally defined as the part of the demand for money that does not result from planned payments, but from the uncertainty concerning the size of the payment that will have to be made. From the perspective of the subject of our research, it can also be interpreted as the part of the demand for money that (when faced with a choice between several forms of payment) results from holding additional balances of money as a reserve in a contingency, i.e., in the event that using the preferred method of payment is not possible. It can be assumed that the decision on the amount of such balance held for this reason depends, *inter alia*, on the perception of the risk of being unable to make the payment using the preferred method. It is significant to note that this refers to the perceived risk and not the objective risk (which, in reality, is relatively low). According to our best knowledge, this issue has not been researched yet. There have been limited studies that have tackled this problem indirectly, including Karoubi et al. [10] and Oney et al. [11]. In this paper, we describe the determinants of the decision to maintain cash reserves despite having made a decision to use e-payments and we also note the factors determining the value of such reserves.

This issue is also extremely interesting in the context of sustainable development. There is an ongoing discussion in the literature about which payment system—cash or non-cash—generates higher social costs and requires the involvement of a larger pool of resources [12,13]. Both systems have advantages and disadvantages regarding social inclusion and environmental impact. For example, electronic payments can help overcome free-riding in the economy and support the collection of taxes [14], but they may also increase social exclusion for those without access to technical infrastructure (e.g., the internet). The conclusions are not clear-cut, but regardless of which system is more expensive (in economic, social, and environmental terms), the use of both generates higher social costs and requires a greater use of resources. Therefore, a decision to opt out of one of these systems would have a positive impact on the sustainable use of resources.

The aim of the paper is to investigate whether and why consumers maintain cash reserves, understood as cash held due to a precautionary motive, despite having made a decision to use e-payments. We also want to understand what determinants underlie the decision to maintain the reserves and dictate their value.

We asked the following research questions (RQ):

RQ1: Do consumers perceive a risk associated with card and mobile payments (CMP), what type of concerns does it cause, and what are consumers' prevention strategies to eliminate this risk or at least reduce it to an acceptable level?

RQ2: Do consumers maintain cash reserves despite having made a decision to use CMP? If so, what is the value of such reserves?

RQ3: What determinants underlie the decision to maintain cash reserves after having made a decision to use CMP?

RQ4: What determinants dictate the value of the cash reserves maintained, despite having made a decision to use CMP?

The paper is organized as follows: after a review of the literature on the choice of payment method, we present our research approach, including the research methods and data used, then we discuss the results and present our final conclusions.

2. Literature Review

As noted by Boumie et al., "Despite the growing importance of the debit card in most developed countries, there are relatively few academic studies that analyze the impact of such evolution on the demand for cash" [15]. Moreover, research in this area focuses on the transaction motive and the choice between cash and electronic payment instruments, which means that it is only partially relevant to our paper. However, the literature review presented below presents state-of-the-art research on the determinants of the spread of e-payments and their impact on the demand for cash.

Traditionally, research on the choice between cash and electronic payment instruments has focused on objective determinants relating to the cost–benefit analysis concerning the selection of a payment method, the nature of a transaction, conditions prevailing in the environment, and the characteristics of the decision maker. Initially, most studies were aimed at investigating relative costs and benefits [16–18], both individual and social.

In terms of individual costs and benefits, researchers usually list the following:

- Relative costs of using cash and e-payments [19,20], including fees [21,22] and price incentives [23,24].
- Interest rate as an alternative cost of maintaining cash reserves. According to theory and empirical research, this impact is generally negative for cash, especially for large notes. However, the impact may still be positive for small notes [1,4].
- Speed and convenience [21,25,26]. Convenience is cited overwhelmingly as the main reason for using debit cards [22]; still, it must be noted that the research results are ambiguous when it comes to the relative prevalence of cash or e-payments or the consequences of payment innovations [27,28].
- Safety of payments [25,29].
- Privacy. While there are partial social benefits associated with the loss of anonymity of a transaction [14], in recent years, the issue of privacy has become crucial in individual decision-making. Concerns in this respect cannot be confined solely to issues related to illegal and socially unacceptable activities.

The second group contains transaction-related factors. The first and most obvious factor is the availability and quality of the e-payment infrastructure at the POS. A higher usage of cash is associated with lower levels of card acceptance at the POS [30,31]. The type and place of purchase also matters. Cash usage varies widely across types of purchases and venues [25,30]. The next key determinant is the value of the payment. Estimation results confirm that the probability of using cash decreases homogeneously with the transaction value quartile [30].

The third group covers demography-related factors. The probability of using e-payments decreases with age and increases with education and income [32]. Recent research approaches the role of age in a more nuanced way. Von Kalckreuth et al. found some differences in the behavioural equations of younger and older consumers. However, these are not overly important in terms of explaining the

differences in the observed behaviour. The higher prevalence of cash payments among older consumers can largely be explained by differences in their personal characteristics [20]. Research conducted by Bagnall shows that this does not have any significance, except for the United States, where younger individuals use more cash than older individuals. However, when controlling other determinants, age becomes significant, i.e., cash usage increases homogeneously with age: people aged 60 and older are more likely to use cash than people between the ages of 36 and 59 [30]. Therefore, age is still normally indicated as the key determinant [15]. The role of age is confirmed by cross-sectional studies [1]. The role of education and the level of income are also relatively well confirmed [30]. The level of income (understood as GDP per capita) is also important in cross-sectional studies [1,33].

The fourth group includes variables that describe the conditions prevailing in the environment in which the transaction takes place. Key factors here are economic development and advancements in information and communication technologies (ICT) [34]. Another commonly indicated determinant is the shadow economy [5,35,36], while Goczek and Witkowski point out the importance of trust for the choice of e-payments [33]. Some papers mention macroeconomic stability as another relevant factor. Bech et al. prove that macroeconomic uncertainty has a positive impact on the demand for cash, especially in the case of small notes, but a negative impact for large notes [1]. The impact of high inflation, banking crises, and political instability has been discussed in several studies, but only banking crises that have a negative impact on consumers' trust in banks seem to be important for the choice between cash and e-payments. Jobst and Stix investigate the effects of banking crises linked to the 2007+ crisis and show an increase in the demand for cash in studied countries, but they remark that only a small number of economies survived the banking crisis in 2008 and that the change in the trend in cash demand is relatively common. Looking into crises before 2008 and investigating a group of economies with a banking crisis before 2007/08 (but not in 2007/08), a significant level shift in cash demand has been found. In the group of economies without a systemic banking crisis, no unexplained level shift was found [4].

The fifth group covers psychological and social factors. Payment habits are among the most frequently investigated factors. Kahn et al. analyse whether social influence affects consumer' perception of the security of payment instruments and conclude that the security perceptions of others have a positive effect on people's own security perceptions [37]. Van der Crujisen and Knoben show that people copy the payment behaviour they observe in their environment, especially if the environment is characterised by strong social cohesion. If social cohesion is very strong, people copy the payment behaviour of others in their environment almost to the letter [38]. Van der Crujisen and van der Horst discuss a broad range of socio-psychological factors such as injunctive norms, descriptive norms, roles, personal norms, feelings, and perceived control [39].

It is also worth taking a closer look at research on perceptions of cash, i.e., attitudes and feelings towards cash. Cash is generally valued highly by consumers for its perceived acceptance, costs, and ease of use [30]. Von Kalckreuth, Schmidt, and Stix [20] show that cash is used by some consumers because it helps them monitor their expenditure. In her research commissioned by the National Bank of Poland, Maison indicates that some consumers worship cash, i.e., have a "Love for Cash". In the study, respondents attributed positive features to cash, e.g., when they cannot physically see the money, they feel as though they do not have any at all; cash is the only real money; when they have cash, they can control their expenditure more easily. They experience negative emotions towards e-payments, calling them false, fake, plastic, and dead money [40,41].

The above considerations regarding the determinants underlying the choice between cash or e-payments are only indirectly related to the key problem investigated in the paper. The decision about whether to choose cash or e-payments is not the same as the decision to hold cash despite having made a decision to use e-payments. It can be assumed that some of the above determinants are also relevant in this case, but so far, there has been no systematic research in this area. In our paper, we argue that perceived risk is an important factor in maintaining cash reserves despite having made a decision to use e-payments.

The discussion on risk perception when making card or mobile payments has been thus far dominated with issues related to theft, robbery, or the loss of monetary units [29,42,43]. The broader spectrum of perceived risk has rarely been studied. Among a few exceptions, the following papers should be mentioned: Karoubi et al., Oney et al., Ho and Ng, Liébana-Cabanillas et al., and Nguyen and Huynh [10,11,44–47]. The broader spectrum of risk may include: performance risk or functional risk, financial risk, temporary risk, psychological risk, social risk, and privacy risk. Ho and Ng research five dimensions of risk: physical, performance, psychological, financial, and time loss risks [44]. Karoubi et al. investigate loss risk, theft risk, discomfort risk, unavailability risk, fraud risk, anonymity risk, unacceptance risk, and time risk. Not every purchase situation might entail all types of risk. The kind of product purchased and the various situations described, e.g., by Simcock, Sudbury, and Wright [48], play a fundamental role here.

Jiang & Shao [49] consider increased perceived uncertainty and distrust in the financial system, which induces agents to hold cash for precautionary motives or as a store of value, however they see macroeconomic issues (crisis) as a source of disturbance. They conclude that the increased uncertainty and distrust in the financial system are unlikely to be the main forces behind the robust cash demand before the financial crisis.

According to our best knowledge, the perception of risk associated with the acceptance of CMP has rarely been studied. A rare exception is research conducted by Karoubi et al. who among the broad spectrum of risk, also list unavailability risk (difficulty in concluding a transaction in the absence of the instrument) and unacceptance risk (impossibility to perform a transaction either because the instrument is not accepted by the seller or because the payment is unsuccessful for technical reasons) [10]. Oney et al. research whether past experience with electronic payments systems has a significant and positive effect on consumers' perceived security of e-payments [11].

These determinants have not yet been analysed in the context of precautionary demand. This term refers to the standard economic division of motives underlying the demand for money, i.e., the transaction motive, the precautionary motive, and the speculative motive. Those three reasons for holding money have been distinguished by J.M. Keynes who when coining the definition of the precautionary motive, emphasized the importance of the existence of uncertainty and focused on factors such as confidence and the role of money as a protective device against unpredictable adverse events [50,51]. In the end, he defined the precautionary demand as follows: "to provide for contingencies requiring sudden expenditure and for unforeseen opportunities of advantageous purchases" [52].

Keynes himself, and later also representatives of "hydraulic" Keynesianism, however, began to combine the precautionary motive with the transaction one (and made both types of demand dependent on income), thus the precautionary motive became an unattractive sister of the transaction demand and was often overlooked in mainstream analyses. As de Carvalho notes, "the precautionary motive became a variation of the transaction motive, and disappeared from the model as an independent form of behaviour! The demand for money explained by uncertainty as such, by the degree of disquietude of the public, by the lack of confidence on one's own expectation, which Keynes proposed one year after the publication of the G[eneral] T[h]eory as being one of the two revolutionary innovations of the book was in fact subsumed in the most traditional of motives: the transaction motive to hold money" [51]. Recently, however, interest in the role of risk and uncertainty in the economy has increased again and thus, also the demand for money due to the precautionary motive [53,54]. Gan [44] shows that the precautionary motive, in addition to the transaction motive and the speculative motive, is an important basis for the demand for money.

We believe that investigating the decision to choose between cash or electronic payment instruments only from the perspective of the transaction demand and thus, the perfect substitutability of the forms of money, is insufficient and leads to the omission of a significant phenomenon underlying the existing demand for cash despite the growing importance of e-payments. In our paper, we aim to examine the maintenance of cash reserves in the context of the spread of e-payments. We believe that maintaining

such reserves is dependent on risk perception because cash is valued highly by consumers for its perceived acceptance and ease of use [30] and can be treated as a strategy for dealing with perceived risk [55].

3. Materials and Methods

3.1. Sample and Data Collection

In order to answer the research questions (RQ), a standardized survey was designed and conducted. The research was quantitative. The research was completed in January 2020, i.e., before the outbreak of the COVID-19 epidemic in Poland. Prior to the research, the survey was tested (pilot run) to eliminate possible errors of the research tool and to assess its correctness and suitability to achieve the objectives of the study.

An 18-item paper-and-pencil questionnaire was used to collect data. The questions in the survey were formulated in the form of open, closed, and semi-closed questions and seven-point Likert scales. The reliability of the scales used in the study was confirmed by Cronbach's alpha test. The test values obtained for all applied scales ranged from 0.7 to 0.9. If we assume that the acceptable coefficient level is $\alpha > 0.7$, as suggested by Nunally and Bernstein [56] or Henson [57], then all scales may be regarded as reliable.

The research was conducted among non-randomly selected individual consumers. The decision to non-randomly select the sample group was mostly made due to the lack of a relevant selection report and the necessity to limit research costs. In the case described, we looked for adults, males, and females who declared that they were regularly shopping and using consumer services (regular shopping was assumed to be done in commercial and service institutions at least once a month).

The research was conducted in the Silesian province. This region was chosen because it is the most industrialised and urbanised and has the largest network of shops, service institutions, and banks in Poland. It is also, after the Masovian province, the most densely populated province in Poland. In 2018, its population was 4.5 million inhabitants, which amounts to 11.8% of the population of Poland [58].

The size of the test sample was set at 600. This sample size provided results with a measurement error of no more than 3%, with a confidence level of 0.95 and estimated fraction size of 0.8. This assumption was met; a total of 600 filled out questionnaires were received, of which 65 were considered incomplete or incorrect. Therefore, for further analysis, 535 responses were used. At the same time, it should be remembered that the size of the sample was not determined by the size of the population but on the degree of its homogeneity. The more homogeneous the population (in terms of selected features), the smaller the sample can be (Table 1).

Table 1. Characteristics of the research sample (N = 535).

	Specification	Absolute Number	Percentage of the Tested Sample
Gender	Female	239	44.7
	Male	296	55.3
Age	Under 30	190	35.5
	30–45	166	31.0
	Over 45	179	33.5
Place of residence	Rural areas	97	18.1
	Town with up to 50,000 residents	118	22.1
	Town with 50,000–200,000 residents	208	38.9
	Town with over 200,000 residents	112	20.9
Education	Primary/lower secondary	18	3.4
	Vocational	85	15.9
	Secondary	225	42.1
	Higher	207	38.7

Table 1. Cont.

	Specification	Absolute Number	Percentage of the Tested Sample
Subjective assessment of the financial situation of own household	Very bad	5	0.9
	Bad	6	1.1
	Rather bad	24	4.5
	Average	141	26.4
	Rather good	149	27.9
	Good	168	31.4
	Very good	42	7.9
Attitude to risk	I dislike it very much	39	7.3
	I dislike it	75	14.0
	I rather dislike it	124	23.2
	I neither like it nor dislike it	122	22.8
	I rather like it	95	17.8
	I like it	59	11.0
	I like it very much	21	3.9
Payment method for shopping	Only by card/phone	49	9.2
	Definitely more often by card/phone than in cash	246	46.0
	As often in cash as by card/phone	121	22.6
	Definitely more often in cash than by card/phone	60	11.2
	Only in cash	59	11.0

Data source: Collected during this research.

As a result, it involved 239 women and 296 men, which accounted for 44.7% and 55.3% of the sample, respectively. These were most often people living in towns of various sizes (81.9%) with secondary (42.1%) or higher education (38.7%). The average respondent was 39 years old. Nearly 90% of respondents used electronic payments (cards or phones) to pay for purchases. The sample was dominated by people assessing their financial situation as good, with a positive attitude to risk (Table 1).

3.2. Measures

We aimed to investigate consumers' precautionary demand for cash, i.e., maintaining a cash reserve by consumers despite using e-payments (understood as CMP). Therefore, we were interested in those consumers who make e-payments and not those who pay only in cash. Additionally, we were interested in those consumers who perceived a risk associated with the possibility that an e-payment may not go through successfully. Therefore, our research strategy was as follows. In our questionnaire, we included two branching questions on how consumers make payments and whether they perceive the possibility that an e-transaction may not be effective despite having sufficient funds in their account. We then focused our research solely on the group of people who declared that they made e-payments (exclusively or partially) and who have perceived an associated risk.

In order to find the answers to our RQs, we used some of the questions in the questionnaire and used the following scales (see Appendix A):

- A scale measuring the level of importance attached to the inability to make a CMP despite having sufficient funds;
- A scale measuring the level of likelihood of the inability to make a CMP despite having sufficient funds;
- A scale measuring the determinants of concerns related to a purchase situation when making a CMP;
- A scale measuring the level of safety in the social space.

The first two scales need to be discussed in detail as in the end, they formed one research construct. These scales include a set of 10 statements each, which relate to different types of consumer risk. We prepared the statements on the basis of earlier similar studies described in literature on the subject, as well as on the basis of our own research (e.g., [59–64]). Using the first scale, we measured the importance attached to consequences related to the scenarios of events listed in each statement and the second scale was used to assess the likelihood of their occurrence. Both scales were ordinal, seven-step scales, where 1 meant consequences that were not important at all or that were not at all likely to arise and 7 meant consequences that were very important or that were very likely to arise. When it comes to consumer risk when making card or mobile payments, the main consideration is the possibility for the consumer to incur a loss (negative consequences). Hence, it is obvious that the magnitude of such a type of risk should be assessed, taking into account the severity of the possible loss. However, this is not a complete measure of the risk associated with a consumer using a card or phone when making a payment. It is commonly believed that if a plane engine explodes during a flight, all the passengers and crew members will die; nevertheless, the likelihood of this happening is significantly lower than the likelihood of having a car accident. Therefore, what is important here is not only the severity of the loss but, in line with the two-dimensional concept of perceived risk of R.A. Bauer [65], also the likelihood of incurring the loss. Therefore, a combination of the severity of the possible loss (the first scale) and the likelihood of incurring the loss (the second scale) may be considered a measure of the risk. The greater the potential loss and the greater the likelihood of incurring the loss, the riskier a given event or activity becomes [66] (p. 59). This means, *inter alia*, that the risk a consumer is taking when making a card or mobile payment may be measured quantitatively and it increases depending on how severe and likely the potential loss is.

Since measuring the risk perceived by consumers is difficult, researchers undertaking this task should approach it in a thorough and systematic manner, relying on existing scientific evidence and using different measures to describe the investigated phenomenon as intricately as possible. Literature on the subject describes a number of models for measuring the magnitude of perceived risk, of which simple two-component models measuring the significance of adverse consequences and the likelihood of their occurrence [60] are considered to be the most common and recommended. Such risk models can be multiplicative (MRM) or additive (ARM). For the MRM, the component related to the significance of negative consequences is multiplied by the component related to the likelihood of their occurrence; for the ARM, instead of multiplication, the sum of the two model components is calculated. The MRM was first applied by J.P. Peter and M.J. Ryan [67]. The researchers justified their approach by referring to probability theory, in which the probability is multiplied by monetary value in order to determine the expected value of games of chance. As a result, they measured the significance and likelihood of losses (negative consequences) and correlated them with consumer preferences in product brands [67]. Although many researchers have used and developed the concepts of the multiplicative model, there were also those who have taken a firm position and claimed that such mathematical representations of the consumer decision-making process are too complex. The dispute between supporters of the multiplicative and the additive model lasted for more than three decades, until the superiority of the ARM was proven by J.R. Bettman, as well as J.T. Lanzetta and J.M. Driscoll [68]. Therefore, taking into account the results of many studies, it can be considered that the ARM should, in most cases, reflect the risk perceived by consumers better than the MRM, mainly due to its simplicity. Consumers perceive the possible negative consequences of their choice and then assess the likelihood of their occurrence. It is rather hard to imagine that consumers would multiply these components in their heads [69] (p. 89, 141–145). Therefore, after much consideration, we decided to use the ARM in our research.

The use of both scales and the additive approach in our research allowed us to identify which types of risk consumers are most concerned about when making card or mobile payments. As a result, both scales combined produce a new scale of the perceived risk associated with card and mobile payments in relation to concerns about the possibility of a transaction not being technically feasible, taking into account 10 types of risk (see “Results”).

In order to reduce the number of variables and minimize the risk of a collinearity problem, we performed exploratory factor analyses (EFA). EFAs produce fewer variables, which in turn makes it possible to focus further analyses only on those obtained, mutually independent factors (principal components) which have a different conceptual interpretation, but which retain a significant part of the information contained in the original variables [69–72]. Each EFA was performed on a pre-determined group of variables regarding: 1. perceived risk associated with card and mobile payments; 2. determinants of concerns related to a purchase situation when making a card and mobile payment; 3. level of safety in the social space.

Then, we examined the adequacy of performing the factor analysis. To do this, we analysed the correlation matrices and ran the Kaiser-Meyer-Olkin Test for sampling adequacy, of which their values for the analysed data sets were: 1. KMO = 0.841; 2. KMO = 0.870; 3. KMO = 0.710 (Table 2). Hence, we were able to confirm the adequacy of performing the factor analysis.

Table 2. Kaiser–Meyer–Olkin (KMO) Test for Sampling Adequacy and Bartlett’s Test of Sphericity values.

Test/Group of Variables	1	2	3	
KMO	0.841	0.870	0.710	
Bartlett’s Test of Sphericity	Approximately Chi-Square	1477.787	2460.226	1111.076
	df	45	66	45
	<i>p</i> -value	0.000	0.000	0.000

Data source: Collected during this research.

We identified the factors using the principal component analysis. Unfortunately, there are many criteria for selecting the number of factors. The following criteria are mentioned in the literature: explained variation (e.g., 75%), scree plot criterion, and Kaiser criterion (eigenvalues greater than 1) [70]. The last criterion is often modified when the number of variables is small (eigenvalues greater than a 0.7 threshold). It is worth noting that the Kaiser criterion, often used by default in many statistical packages (as SPSS), is only one of many possible criteria and, as sometimes indicated, its usage leads to selecting too many factors [73]. The final decision is up to the researcher and may depend on the possibility of interpreting the results. In our case, all these methods produced relatively coherent results, but we assumed that we would analyse the results obtained by using the Kaiser and the scree plot criteria and then we would select those that were conceptually interpretable. We used a normalized varimax rotation (results upon request) and also other types of rotation, but they did not produce significantly different results.

All identified factors have been presented in Table 3.

There are many methods that can be used to calculate the values of the new variables, each with its own advantages. As our baseline, we adopted Bartlett’s method. Bartlett factor scores are computed by multiplying the row vector of observed variables by the inverse of the diagonal matrix of variations of the unique factor scores and the factor pattern matrix of loads [74]. In order to investigate the sensitivity of the results to the choice of the method, we also calculated variables using sum scores above a cut-off value—the sum of raw scores but only including items with leading values above a cut-off value in the calculations. The results were not significantly different. The values of the variables can be supplied upon request.

As our next step, we conducted a descriptive analysis of the perceived risk associated with card and mobile payments and then a descriptive analysis of the decision to maintain a cash reserve and the value of such a reserve. Finally, in order to assess the determinants of cash reserves, we ran a binary logistic regression [75]. We examined the determinants of the decision to maintain cash reserves despite having made a decision to use card and mobile payments. We assumed that the response variable is dichotomous (1—the reserve is maintained, 0—the reserve is not maintained) and we used logistic regression. As potential determinants, we considered a group of variables, including those

that result from the factor analysis as well as those which, according to the literature, may underlie decisions about payment methods. We then analysed the determinants of the value of the maintained reserve. Since we identified three classes of values, we used ordinal regression [75].

Table 3. Identified coherent principal (artificial) component groups.

Specification	Identified Factors	Components	Interpretation
Perceived risk associated with card and mobile payments (CMP)	1PC1	1 to 4	perceived risk of technical problems with the terminal
	1PC2	5 to 7	perceived risk associated with how the consumer handles a transaction
	1PC3	8 to 10	perceived risk of other technical problems
Determinants of concerns related to a purchase situation when making a CMP	2PC1	4 to 7	unusual purchase situation (commute, high value, new card)
	2PC2	1 to 3	perception of lack of mental comfort during payment
	2PC3	10 to 12	sales channel considered risky (internet, abroad)
	2PC4	8 to 9	low level of trust, e.g., due to making a purchase for the first time
Level of safety in the social space	3PC1	3,4,6,8,10	trust in the state and its actions, e.g., in the economy and in the scope of cybersecurity
	3PC2	1 and 2	trust in the payment system, understood as a product of trust in the state and technology
	3PC3	5 and 9	risk of armed conflict
	3PC4	7	perception of corruption

Data source: Collected by this research.

4. Results

4.1. Perceived Risk Associated with Card and Mobile Payments

In order for the theory of consumer risk to have any explanatory power, it is necessary to exceed a certain minimum threshold of perceived risk, i.e., the consumer must be aware of the possibility of an event that might be unfavourable. At the same time, this is a necessary condition to analyse risk in terms of the determinants of consumer behaviour.

Our research shows that respondents were aware that something might go wrong during a card or mobile payment and that the payment might not be effective despite having sufficient funds in their account. Certainly, this was not true for all respondents, but for a vast majority—nearly 80% of respondents said they perceived a risk of not being able to pay by card or phone.

Those respondents who perceived a level of risk associated with CMP were presented with the scales described above, i.e., the scale showing the level of importance attached to the inability to make a CMP despite having sufficient funds, and the level of likelihood of the inability to make a card or mobile payment despite having sufficient funds. The results are presented in Table 4.

Table 4. Types of perceived risk associated with card and mobile payments and their level (N = 377).

Specification	Importance of a Negative Consequence				Opinion on the Likelihood of Risk Occurrence				Additive Risk Model
	Me	Mo	M	SD	Me	Mo	M	SD	
1. The payment terminal might fail	5	7	4.47	1.899	4	4	4.48	1.763	8.95
2. I might only learn of the absence of a payment terminal at the point of sale (POS) at the checkout	5	7	4.53	1.943	4	5	4.26	1.900	8.79
3. The Internet connection might be cut off	4	5	4.05	1.902	4	4	4.14	1.750	8.19
4. The payment terminal might be faulty	4	5	4.04	1.820	4	3	3.96	1.797	8.00
5. My bank might have a maintenance break	4	4	4.05	1.849	4	4	3.89	1.814	7.94
6. Other unpredictable problems might occur when making a card payment	4	4	3.88	1.733	4	4	3.64	1.683	7.52
7. The power might be cut off	4	1	3.74	1.977	3	3	3.53	1.728	7.27
8. My card might get blocked	4	1	3.70	2.043	3	2	3.26	1.806	6.96
9. I might enter the incorrect PIN	3	1	3.16	1.987	3	1	3.23	1.961	6.39
10. My card might be damaged when inserted into the payment terminal	2	1	2.92	1.994	2	1	2.60	1.600	5.52

Where: Me—median, Mo—modal value, M—arithmetic average, SD—standard deviation. Additive Risk Model: the arithmetic average of the opinions regarding the importance of negative consequences of card and mobile payments + the arithmetic average of the opinions regarding the likelihood of occurrence of negative consequences of card and mobile payments. Data source: Collected by this research.

In the context of making card or mobile payments, the surveyed consumers were mostly concerned about only learning of the absence of a payment terminal at a given POS at the register, as well as about a possible failure of the terminal. These consequences were also considered most likely, although the possibility of terminal failure was considered more likely. The data contained in Table 4 also show that the surveyed consumers have different attitudes towards negative consequences and the likelihood of their occurrence in real life. They also attach more importance to the significance of negative consequences than to the likelihood of their occurrence, which has already been observed in previous studies [62].

Then, using the ARM to measure the magnitude of the perceived risk associated with CMP, we determined that the greatest risk identified in our research is the risk of payment terminal failure (value 8.95). Also noteworthy are the relatively high values attributed to the risk associated with only learning of the absence of a payment terminal at the POS at the register (value 8.79) and the risk of the internet connection being cut off (value 8.19). In contrast, the lowest values were attributed by the respondents to the risk of damaging the card when inserting it into a payment terminal (value 5.52) and the risk of entering an incorrect PIN (value 6.39)—see Table 4.

Analysing the magnitude and types of consumer risk when making a card or mobile payment, we considered it useful to also draw attention to the measures taken by consumers to reduce the risks that they do not accept. Therefore, those respondents who declared making payments by card or phone and who perceived the risk associated with the possibility that the payment might not be effective despite having sufficient funds in their account were asked about how they deal with such potential threat.

The responses show that consumers use many different methods of reducing risk, depending on the consumer's degree of involvement in the purchasing process (active and passive prevention strategies) and the magnitude of risk being reduced (strategies to reduce uncertainty and strategies to reduce the likelihood of negative consequences)—see Figure 1.

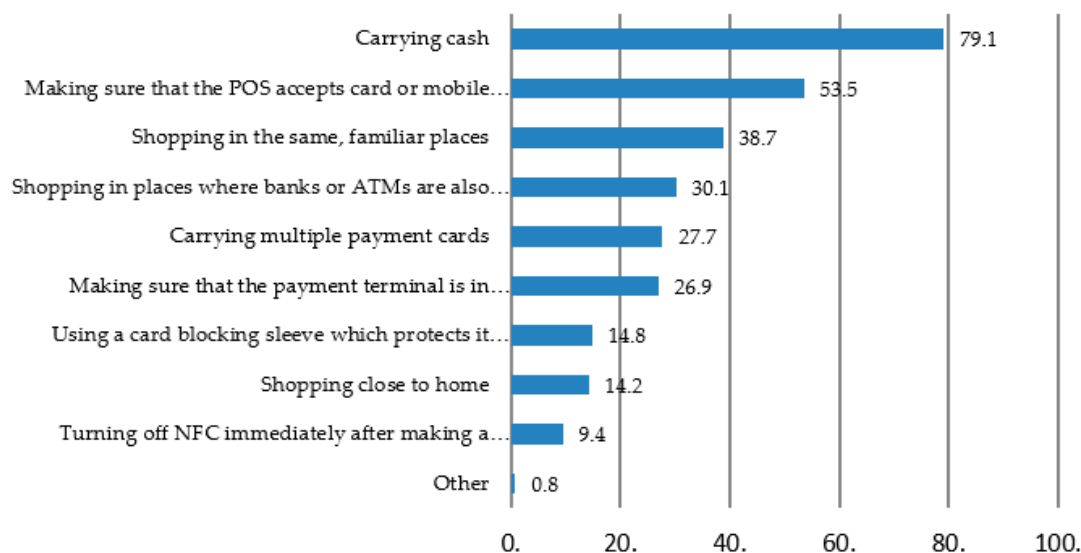


Figure 1. Strategies used by respondents to deal with the risk of being unable to pay by card or phone (N = 385, in %). Note: The percentage of responses does not add up to 100% because respondents could indicate more than one prevention strategy. Data source: Collected by the authors.

According to respondents, the most effective strategy for reducing the risk associated with card and mobile payments is carrying a certain amount of cash, as indicated by almost 8 out of 10 respondents. More than half of the respondents make sure that a given POS accepts e-payments before shopping and 1 in 3 always shop in the same familiar places (Figure 1).

The strategy of carrying a certain amount of cash is assessed by respondents as the most effective prevention strategy. Nearly 60% of respondents gave this strategy the highest rank among all strategies aimed at reducing the risk associated with card and mobile payments (Table 5).

The fact that respondents use prevention strategies might prove that they are extremely prudent, but it might also mean that they do not trust e-payments due to their perceived unreliability. The question is whether the perceived unreliability is linked to problems that they have actually experienced in the past. To answer this, respondents were also asked to indicate how many times in the last three years they had encountered problems when making a card or mobile payment despite having sufficient funds in their account. These responses indicated that 39.0% of respondents could not recall any such situation, 32.3% admitted that they encountered such a situation not more than once or twice, and 28.7% indicated that they had problems with e-payments at least three times. The most common reasons for the payment not being effective were: payment terminal failure (49.8%), internet connection being cut off and a related problem with data transfer (23.4%), or a failure/maintenance break at the bank (14.7%).

The collected research results do not justify such a high level of respondents' prudence. However, as indicated earlier, nearly 80% of respondents perceive a risk associated with card and mobile payments and have worked out ways to deal with it. These results are the same as those obtained in the regression analysis (model 1.5).

Table 5. Effectiveness of used strategies to reduce the risk associated with card and mobile payments—respondents' assessment (N = 385, in %).

Strategy	Rank I	Strategy	Rank II	Strategy	Rank III
Carrying cash	58.9	Making sure that the POS accepts card or mobile payments before shopping	26.4	Shopping in the same familiar places	20.6
Making sure that the POS accepts card or mobile payments before shopping	11.1	Carrying multiple payment cards	13.4	Carrying cash	15.0
Shopping in the same familiar places	7.3	Making sure that the payment terminal is in working order at the POS before shopping	13.4	Shopping in places where banks or ATMs are also located	13.9
Carrying multiple payment cards	6.8	Shopping in the same familiar places	13.1	Making sure that the POS accepts card or mobile payments before shopping	13.1
Shopping in places where banks or ATMs are also located	5.1	Shopping in places where banks or ATMs are also located	12.8	Making sure that the payment terminal is in working order at the POS before shopping	12.0
Using a card blocking sleeve, which protects it against contactless theft	5.1	Carrying cash	9.5	Shopping close to home	7.5
Turning off Near Field Communication (NFC) immediately after making a mobile contactless payment	3.0	Shopping close to home	5.9	Using a card blocking sleeve, which protects it against contactless theft	7.1
Making sure that the payment terminal is in working order at the POS before shopping	1.9	Using a card blocking sleeve, which protects it against contactless theft	3.0	Carrying multiple payment cards	6.0
Shopping close to home	0.8	Turning off NFC immediately after making a mobile contactless payment	2.4	Turning off NFC immediately after making a mobile contactless payment	4.5

Where: Rank I—the strategy that is the most effective in the respondents' opinion; Rank II and Rank III—the highest ranked strategies in terms of effectiveness, in the respondents opinion. Data source: Collected by the authors.

4.2. Cash Reserves of Surveyed Consumers

Those respondents who declared making payments by card or phone and who perceived a risk associated with the possibility that the payment might not be effective despite having sufficient funds in their account were asked whether they also carried cash apart from their card/phone since they were aware of such risk. Respondents confirmed this, with 9 out of 10 (89.9%) answering “yes, always” (37.7%) or “yes, sometimes” (52.2%). Then, we asked them about the amount of cash they were carrying. The responses were in the range between PLN 10 (approximately EUR 2, ca. 0.42% of the modal and 0.24% of the median monthly salary in Poland before tax) and PLN 2000 (approximately EUR 400, ca. 84% of the modal and 49% of the median salary in Poland before tax) [76]. The median and the modal value amounted to PLN 100 (approximately EUR 20). We observed that the responses were clearly linked to the denominations of notes in circulation. Consequently, a cash reserve of PLN 20 was declared by 5.0% of the respondents, PLN 50—21.9%, PLN 100—32.7%, and PLN 200—14.9%. Therefore, the amounts corresponding to the values of the individual denominations represented almost $\frac{3}{4}$ of all variants of the responses.

4.3. Determinants of Cash Reserves of Surveyed Consumers

We then examined the determinants of cash reserves maintained by consumers who declared making payments by card or phone and who perceived a level of risk associated with the possibility that the payment might not be effective despite having sufficient funds in their account.

We started with investigating the determinants of the decision to maintain a cash reserve. The response variable was an event in the form of making a decision on maintaining the cash reserve. We studied the significance of the variables obtained in the EFA as well as variables such as past experiences with technical problems; declared attitude to risk, age, and education; and declared level of income. Definitions of the variables are presented in Table 6.

Table 6. Definitions of variables.

Variable	Definition
PDC	precautionary demand for cash; an event consisting of maintaining a cash reserve despite having made a decision to use CMP, 1—yes or sometimes yes; 0—no
PDC_v	volume of precautionary demand for cash; the range of the value of the cash reserve 1. PLN 50 and less; 2. PLN 51-100; 3. PLN 101 and more
1PC1	risk of technical problems with the terminal
1PC2	risk associated with how the consumer handles a transaction
1PC3	risk of other technical problems
2PC1	unusual purchase situation (commute, high value, new card)
2PC2	perception of lack of mental comfort during payment
2PC3	sales channel considered risky (internet, abroad)
2PC4	low level of trust, e.g., due to making a purchase for the first time
3PC1	trust in the state and its actions, e.g., in the economy and in the scope of cybersecurity
3PC2	trust in the payment system, understood as a product of trust in the state and technology
3PC3	risk of armed conflict
3PC4	perception of corruption
tech_prob	technical problem with the payment
unac_risk	risk of the transaction not being accepted despite having sufficient funds; 1PC1 + 1PC2 + 1PC3
att_risk	attitude to risk
gender	gender of respondents
age	age of respondents
income	subjective assessment of respondents' own financial situation
education	declared higher education

Data source: Collected by this research.

Unfortunately, the selection of variables for the model is hindered by the fact that there is no commonly accepted theory of which its conclusions could be tested during the research. Our research is mostly exploratory. Therefore, our strategy was to test the significance of those groups of variables that were interesting to us, either on account of relations described in literature or due to their usefulness in achieving our research objectives. We then built a model through a backward stepwise regression (other methods of variable selection produced identical or similar results). Both model building strategies led us to the baseline model, which was subject to final interpretation. All models have undergone basic testing (including the Hosmer–Lemeshow test).

The results of the logistic regression have been presented in Table 7. Models 1.1–1.6 show the results of testing individual groups of variables. Model 1.7 is our final model. In each case, age, education, and declared income level were used as control variables. However, these were not statistically significant in any model.

Table 7. Logistic regression results.

Variable	Model 1.1				Model 1.2				Model 1.3				Model 1.4				Model 1.5				Model 1.6				Model 1.7					
	β	se	p	OR	β	se	p	OR	β	se	p	OR	β	se	p	OR	β	se	p	OR	β	se	p	OR	β	se	p	OR		
1PC1	-0.039	0.190	0.839	0.962																										
1PC2	0.652	0.221	0.003	1.920																										
1PC3	0.189	0.181	0.297	1.208																										
2PC1					0.402	0.200	0.044	1.495					0.385	0.194	0.047	1.470														
2PC2					0.504	0.200	0.012	1.655					0.484	0.198	0.014	1.622									0.420	0.203	0.038	1.522		
2PC3					0.310	0.173	0.073	1.363																						
2PC4					0.025	0.192	0.897	1.025																						
3PC1									0.165	0.180	0.360	1.179																		
3PC2									-0.484	0.201	0.016	0.616	-0.473	0.207	0.022	0.623														
3PC3									0.131	0.178	0.463	1.140																		
3PC4									-0.409	0.191	0.033	0.664	-0.523	0.204	0.010	0.593														
Technical problem with the payment																	0.254	0.397	0.523	1.289										
Unacceptance risk																	0.242	0.114	0.033	1.274	0.193	0.116	0.098	1.212						
Attitude to risk																					-0.289	0.138	0.037	0.749	-0.347	0.129	0.007	0.707		

Data source: Collected by this research.

Models taking into account individual groups of variables identified during the factor analysis show that when making a decision to maintain cash reserves, considerable significance is attached to concerns related to handling e-payments (model 1.1), the perception of mental distress during e-payments, and unusual purchase situations (model 1.2), as well as trust in the e-payment system, understood as a product of trust in the banking system and technology (model 1.3). The perception of corruption in model 1.3 is also quite surprising. Model 1.4 shows the results of the backward stepwise regression for all variables identified during the factor analysis.

It is worth noting that maintaining cash reserves is not a result of past experiences with the unreliability of payment systems (model 1.5), but rather of the perception of associated risk (such perception does not necessarily have to result from past experiences). However, it is the level of acceptance of the risk from this group of variables that determines whether one maintains cash reserves (model 1.6). Those consumers who accept higher risk levels are less likely to do so.

Finally, model 1.7, which we treat as a baseline, takes into account all the tested variables which, in a statistically significant way, determine the decision to maintain a cash reserve despite having made the decision to use e-payments.

The most important results can be summarized as follows. Assuming the standard significance level at $p < 0.05$, the decision to maintain a cash reserve despite having made a decision to use e-payments depends on the:

- mental state of the respondent, i.e., mental reaction to the purchase situation (stress, haste, bad mood); the higher the perception of this phenomenon, the more likely the consumer is to make the decision to maintain a cash reserve;
- trust in electronic payment systems (this trust is the result of both trust in the banking system and in technology); this dependence is negative, i.e., the higher the trust, the less likely the consumer is to make the decision to maintain a cash reserve;
- attitude to risk; consumers declaring a higher level of risk acceptance maintain a cash reserve less frequently.

Some results indicate the role of the perception of corruption (the higher this perception, the less likely the consumer is to make the decision to maintain a cash reserve). This surprising result is interpreted under "Discussion".

The results show that the decision to maintain a cash reserve is not dependent on the perception of the magnitude of the various types of risk associated with e-payments (payment terminal failure etc.) and consumer's past experiences. It is worth noting that although the perception of specific types of risk has no significance, the very fact that such risk exists is the cause of maintaining a cash reserve, as indicated in our research. Age, education, and declared level of income are also insignificant.

As the second step, we analysed the determinants of the value of the maintained reserve. We divided the reserve values declared by the respondents into three ranges, organized by the value of the reserve, from smallest to largest (Table 8). Then, we calculated the ordinal regression. In principle, the research strategy was the same as in the first step; however, since the results were not dependent on the selection of variables for the model, we have only published two intermediate models and the final model. Models 2.1 and 2.3 have undergone basic testing (including the Test of Parallel Lines). Model 2.2., which does not pass some of the tests, was published for information only and it has not been the subject of further interpretation. The results are presented in Table 8.

The most important results can be summarized as follows. Assuming a standard significance level at $p < 0.05$, the decision on the value of the cash reserve maintained despite having made a decision to use CMP does not depend on the assessment of the magnitude of risk (except for problems due to consumer's mistakes), past experiences, and attitude to risk. The main determinants are income (higher income increases the likelihood of maintaining larger reserves) and age (the likelihood of maintaining larger reserves increases with age).

Table 8. Ordinal regression results.

Variable	Model 2.1				Model 2.2				Model 2.3			
	β	se	p	OR	β	se	p	OR	β	se	p	OR
1PC1	−0.164	0.116	0.156	0.848								
1PC2	0.354	0.128	0.006	1.425					0.224	0.107	0.036	1.244
1PC3	−0.120	0.121	0.320	0.887								
2PC1	0.048	0.116	0.680	1.049								
2PC2	−0.064	0.120	0.594	0.938								
2PC3	−0.156	0.115	0.176	0.855								
2PC4	−0.037	0.114	0.744	0.964								
3PC1	−0.114	0.111	0.305	0.892								
3PC2	0.018	0.123	0.882	1.018								
3PC3	−0.151	0.111	0.172	0.860								
3PC4	−0.090	0.113	0.426	0.914								
technical problem with the payment						0.228	0.084	0.674				
Unacceptance risk						0.063	0.683	0.975				
Attitude to risk						0.078	0.918	0.992				
age	0.038	0.008	0.000	1.038	0.036	0.009	0.000	1.037	0.036	0.008	0.000	1.036
income	0.291	0.107	0.006	1.338	0.300	0.105	0.004	1.350	0.283	0.103	0.006	1.335
education	0.144	0.230	0.532	1.155	0.025	0.214	0.907	1.025				

Data source: Collected by this research.

5. Discussion

Our research shows that respondents are well aware of the possibility that a CMP might not be effective despite having sufficient funds in their account (79.4%). The risk of not being able to pay by card or phone is perceived to be higher than the risk of making an incorrect purchase decision in many consumer goods and services markets. An example of this is the food market—49.2%, the tourism market—58.9%, or the household appliances market—62.9% [77]. The respondents are mostly concerned about technical problems, such as a payment terminal failure, or their own wrong assumptions about the fact that payment terminals should be used in all POS [78]. Although problems with making card or mobile payments due to a failure or deficiency in infrastructure occur relatively rarely, more than 80% of the surveyed consumers are prepared for them. The most common and, in the opinion of the respondents, the most effective prevention strategy is carrying cash. This behaviour affects the existence and the level of the precautionary demand for cash.

We consider the observation that consumers maintain a cash reserve despite making e-payments to be the most important result of our research. We interpret such reserves in terms of the precautionary demand for money. According to our best knowledge, such an approach has not yet been investigated. In line with a standard economic approach, the precautionary demand for money is defined as the part of the demand for money (which, according to the selected definition, also includes cash) that results neither from the transaction motive nor from reasons related to the assessment of future returns on alternative assets. People hold precautionary balances due to uncertainty regarding transactions [51–53]. However, according to the standard theory of the demand for money, the value of the precautionary demand is dependent on the level of income.

In our research, we applied the concept of the precautionary demand to the case of maintaining a cash reserve despite having made a decision to make payments using alternative methods, i.e., electronic payments. Both determinants of the precautionary demand, which are highlighted in the literature on the subject, have been reflected in our research. The decision to maintain a cash reserve despite making e-payments is influenced in particular by the perception of the risk of technical problems, the perception of stress associated with a purchase situation, and the perception of uncertainty associated with the payment system, as well as the degree of risk acceptance. Past experiences with e-payments or even the magnitude of the perceived risk are insignificant in contrast to allowing for the possibility that the risk may occur. The value of the held cash depends, in turn, on income, which is consistent with the standard theory of the demand for money.

Some papers on the substitutability of e-payments and cash point out that at present, cash holdings by consumers/households are closely linked to the payment function [79–81]. The consequence of this assumption is that the decrease in the significance of cash payments should result in a reduced demand for cash. It is worth noting, however, that most often, these studies ignore the existence of the precautionary demand. We have taken a different research approach. We were only interested in those consumers who make e-payments and hold cash and not those who only pay in cash. Hence, we go beyond the simple dilemma of whether to choose cash or electronic payment. This widely researched dilemma has not been our area of interest, which bears mentioning in case our results are to be interpreted within the context of the literature on the subject to date.

What also needs to be discussed is the clear difference between the actual scale of negative experiences with e-payments and the perception of risk of CMP. Perhaps this results from the respondents' behaviour and the fact that they employ the heuristics of making judgements and decisions and in particular, the heuristic of availability [82]. Single, incidental situations where the terminal has failed or the card has been damaged, which meant that the consumer had to, for example, leave their goods-filled shopping cart in a supermarket, are very memorable and more emotional than dozens of transactions without any adversity. This phenomenon of consumers' perception that "it's always like this" applies not only to card or mobile payments, but also to many other purchase situations. For example, it is a rather common mistake to overestimate the risk of air travel and to underestimate the risk associated with driving a passenger car [83,84]. Plane accidents are more spectacular and cause more anxiety than road accidents and therefore, information about the former is more easily recalled and the risk assessment made on its basis becomes more extreme [85].

The results relating to the role of corruption (e.g., model 1.7), which are surprising when interpreted briefly, require explanation. In the standard approach to interpreting corruption, it is considered to be an indicator of limited trust in the state or at least regulatory weaknesses of public authorities [86]. Taking such a definition into account, it would have been difficult to interpret our results in a reasonable way. However, what is crucial is the distinction between corruption and the perception of corruption, which becomes important, particularly in the case of research such as ours (which did not address corruption directly). As noted by Rose and Mishler, "Perception of corruption has no significant influence on the payment of bribes (. . .). These findings are endorsed by further analysis, which finds that neither the payment of bribes nor the number of contacts with public officials has a significant effect on the perception of corruption. Perceptions are principally influenced by the circulation of information locally and through the media and by the perceived fairness of public officials." [87].

In our case, this means that people who have a high level of perception of corruption do not participate in corruption. Rather, these are people who are sensitive to corruption or who have a more critical approach to life. Therefore, the principle that cash (as an anonymous instrument) is preferred in the case of corruption does not apply here. A different correlation is to be expected, i.e., that people who are not involved in corruption, but are sensitive to this act, will show a higher level of perception. Moreover, even though such interpretation might be far-fetched, it can be expected that people who are more sensitive to corruption, with a negative attitude to this act, will prefer e-payments as a tool for combating corruption [14].

To summarize our research, it can be argued that the decision to use CMP does not necessarily have to mean that the demand for cash drops to zero. There may exist a degree of a difficult-to-reduce level of demand for cash which is independent of the traditionally studied determinants, in particular, those related to the transaction demand (in this sense, it could be called an autonomous demand), which shows a certain degree of inertia. In other words, even if someone makes a decision to use e-payments as their preferred method of payment and even if the existing infrastructure fully allows it, there may be a parallel demand for cash resulting from the precautionary motive. Consumers may use cash as a protective device against unpredictable adverse events (to quote Keynes). At the level of the economy as a whole, this will mean that statistical data will simultaneously show an increase in the importance of electronic payments and a steady demand for cash.

6. Conclusions

Thanks to our research and the statistical analysis of our results, we were able to answer our research questions, thus contributing to the literature on the subject and offering a number of practical and social implications.

The surveyed consumers perceive a risk associated with CMP (RQ1). This risk is evident in a number of areas which, through the use of the exploratory factor analysis (EFA), have been limited to three main risks: the risk of technical problems with a terminal, the risk associated with how the consumer handles a transaction, and the risk of other technical problems. Since consumers are aware of these risks, despite rarely experiencing any problems with e-payments, they use proper prevention strategies in order to reduce this perceived risk. The most common and in the opinion of the respondents, the most effective prevention strategy, is carrying cash. This leads to the answer to the next research question, RQ2. Yes, the surveyed consumers maintain cash reserves despite having made a decision to use e-payments, thus contributing to the increase in the demand for money due to the precautionary motive. Although these reserves should be considered insignificant on an individual scale, they become significant on a global scale. The main determinants underlying the decision to maintain cash reserves (RQ3) are: the consumer's mental state, i.e., reaction to stress, haste, etc.; then, the consumer's trust or rather, lack of trust in electronic payment systems; and finally, the consumer's attitude to risk—the lower the level of acceptable risk, the less likely a consumer is to maintain a cash reserve. In turn, the consumer's income and age should be viewed as the main determinants of the value of the maintained cash reserves (RQ4).

There are also practical implications, which are important for managers of enterprises and financial institutions, from the obtained answers. In the first place, consumers must be informed about the possibility of making payments by card or telephone as soon as they approach a commercial or service outlet (e.g., by appropriate markings on the door or shop window). Consumers should be provided information about systems that enable card or telephone payments, even in the absence of electricity or an internet connection. Finally, consumers should be able to use deferred payments in the event of a terminal failure or other events preventing the use of card or telephone payments, e.g., by issuing a transfer order form or an invoice. The issues we have raised are also important in the context of sustainable development. The presented results of our research show that it is unlikely that in the near future consumers will completely part with cash. Even though e-payment infrastructure is becoming more and more advanced and problems with card or mobile payments are less common [88], a very large percentage of consumers still need cash. Therefore, it will be necessary to continue to maintain both cash and electronic payment systems, which will generate higher social costs and require greater use of resources.

The authors of the paper are aware of the limitations of their research, which cannot be regarded as representative of the entire population of consumers. However, its conclusions and observations can be used as an argument in the debate on the development of electronic payment systems; further education of consumers; prevention of digital exclusion of the old, the poor, and the less educated; and sustainable use of resources. An important research task would be to confirm the results obtained in this research by using a representative sample of consumers and to conduct similar research among consumers from other countries. The authors of the paper thus encourage other researchers to use the proposed scales (Appendix A) and to discuss the obtained results. It is also worth noting that the research was carried out before the outbreak of the COVID-19 pandemic and therefore, does not include its effects on the perception of the risk of using cash in connection with the risk of transmission of the disease.

Author Contributions: Conceptualization, J.P.; methodology, G.M. and J.P.; software, J.P. and G.M.; validation, G.M. and J.P.; formal analysis, J.P. and G.M.; investigation, G.M. and J.P.; resources, J.P. and G.M.; data curation, G.M. and J.P.; writing—original draft preparation, J.P. and G.M.; writing—review and editing, G.M. and J.P.; visualization, G.M.; supervision, J.P.; project administration, G.M.; funding acquisition, J.P. and G.M. All authors have read and agreed to the published version of the manuscript.

Funding: This research received no external funding.

Conflicts of Interest: The authors declare no conflict of interest.

Appendix A

Scale showing the level of importance attached to the inability to make a card or mobile payment despite having sufficient funds

Which of these concerns do you consider the most important when making a card or mobile payment? (For each of the following statements, please indicate a suitable rating on the seven-step scale, where 1 means a risk that is not at all important and 7 means a risk that is very important).

Specification	Not at all Important				Very Important		
	1	2	3	4	5	6	7
1. The payment terminal might fail							
2. The power might be cut off							
3. The Internet connection might be cut off							
4. My bank might have a maintenance break							
5. I might enter the incorrect PIN							
6. My card might be damaged when inserted into a payment terminal							
7. My card might get blocked							
8. The payment terminal might be faulty							
9. I might only learn of the absence of a payment terminal at the POS at the checkout							
10. Other unpredictable problems might occur when making a card payment							

Scale showing the level of likelihood of the inability to make a card or mobile payment despite having sufficient funds

Which of these concerns do you consider the most likely when making a card or mobile payment? (For each of the following statements, please indicate a suitable rating on the seven-step scale, where 1 means a risk that is not at all likely and 7 means a risk that is very likely).

Specification	Not at all Likely						Very Likely
	1	2	3	4	5	6	7
1. The payment terminal might fail							
2. The power might be cut off							
3. The Internet connection might be cut off							
4. My bank might have a maintenance break							
5. I might enter the incorrect PIN							
6. My card might be damaged when inserted into a payment terminal							
7. My card might get blocked							
8. The payment terminal might be faulty							
9. I might only learn of the absence of a payment terminal at the POS at the checkout							
10. Other unpredictable problems might occur when making a card payment							

Scale showing the determinants of concerns related to a purchase situation when making a card or mobile payment

To what extent do the factors listed below increase your concerns when making a card or mobile payment? (For each of the following statements, please indicate a suitable rating on the seven-step scale, where 1 means a factor that does not increase your concerns at all and 7 means a factor that significantly increases your concerns).

Specification	Not at all Important							Very Important
	1	2	3	4	5	6	7	
1. Haste								
2. Stress								
3. Bad mood								
4. New card/phone								
5. High product price								
6. Large single purchase volume								
7. High cost of getting to the product (e.g., long commute)								
8. Low level of trust in a trader/service provider								
9. First-time purchase								
10. Purchase made abroad								
11. Purchase made online								
12. Purchase made by phone								

Scale showing the level of safety in the social space

When making payments, I use cash because: (For each of the following statements, please indicate a suitable rating on the seven-step scale, where 1 means I strongly disagree and 7 means I strongly agree.)

Specification	I Strongly Disagree					I Strongly Agree	
	1	2	3	4	5	6	7
1. Nowadays, we can trust banks							
2. New technologies are safe for humans							
3. The state deserves our trust							
4. The economy is developing in the right direction							
5. There is a real risk of armed conflict							
6. Our pensions are safe							
7. Corruption is still a problem							
8. I feel safe in our country							
9. There is a real risk of a terrorist attack							
10. The current legal and judicial system provides effective protection against unauthorized use of our personal data by companies or government							

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