Paying in a blink of an eye

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Research Paper

Paying in a blink of an eye: it hurts less, but you spend more ☆

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ABSTRACT

The key objective of this research is to gain a deeper understanding of the factors associated with pain of paying and to extend knowledge of the consequences. Using rich consumer survey data on the Netherlands, we find that electronic payments – both online and offline – hurt less than cash payments. This holds especially for contactless payments and iDEAL payments, a frequently used online payment method in the Netherlands, and for older people in particular but not for teenagers. Furthermore, the perceived pain of paying is positively related to the price of the product or service and slightly lower for an outing compared to grocery shopping. In addition, the pain is relatively high for individuals that are likely to value money more, such as people who find it hard to make ends meet with their income. On average, cash is perceived to be most helpful in preventing overspending, whereas contactless payments are the least helpful. The lower the perceived pain of paying contactless is in comparison to the pain associated with other payment methods, the lower its perceived usefulness in preventing overspending. Moreover, the intensity of use of contactless payments is negatively correlated with the relative pain of paying contactless, which suggests that people try to avoid the pain of paying. As the usage of cash is declining, it is important that policymakers develop tools that help consumers in averting overspending when utilizing electronic payment methods, particularly contactless ones.

1. Introduction

Paying is part of everyday life. It is something we – unfortunately – all have to do. The way people pay varies. Whereas some people like to pay with banknotes and coins, others prefer cashless payments, such as contactless payments by mobile phone or debit card, or credit card payments. Consumers have been switching from cash to electronic payment methods. Banks and retailers have promoted these instruments. This trend has been accelerated by the COVID-19 pandemic. Fear of infection has induced a shift to contactless payment instruments in many countries (e.g. ECB, 2020; Jonker et al., 2022; Chen et al., 2020; Wisniewski et al., 2021). In various countries the limits for contactless payments were increased (Mastercard, 2020). Contactless payments are faster than cash payments.

When you pay contactless, you can pay in a blink of an eye. For instance, a recent study shows that Dutch consumers perceive contactless payments as the fastest method of payment at the point of sale (POS) and cash payments as the slowest (van der Cruijsen and Broekhoff, 2024). Also, in the Study on the Payment Attitudes of Consumers in the Euro area (ECB, 2022) it is shown that 19 % of the respondents prefer cash because it is faster, while that is 40 % for card payments.

What this shift towards contactless payments implies for the pain of paying that consumers experience is a topic that has barely been studied. As pain of paying can help prevent overspending, it is important to research this topic. Overspending may lead to over-indebtedness, debts that cannot be repaid or only with extreme hardship. Financial hardship is detrimental for peoples' life satisfaction, well-being, health and child development and correlates with violence (Achtziger, 2022). As a result, it harms individual consumers, their households and society. Many organisations try to improve peoples' financial fitness. For example, the Dutch Money Wise Platform – a collaboration between partners from government, financial services industry, NGO's and academia – was launched by the Ministry of Finance to improve the financial fitness of Dutch citizens.

Pain of paying is defined as the negative emotions people experience while paying for goods or services (Zellermayer, 1996; Prelec and Loewenstein, 1998). The concept differs from standard economic theory, that assumes that a purchase decision is made without emotion and only in terms of opportunity costs – the best alternative products that can be bought with the same amount of money (Mazar et al., 2016). This psychological pain can be felt immediately after purchasing a product or anticipated for future purchases. Reshadi and Fitzgerald (2023, p.1) have reviewed the pain of payment literature and define pain of payment as follows: "Pain of payment is the negative psychological affect consumers experience when they become cognizant that they have lost a certain amount of their financial resources (immediate pain) or when they become aware that they will or may lose a certain amount of their financial resources in the future (anticipated pain)."

The literature offers two explanations as to why consumers feel pain while paying. Most research is based on the mental accounting theory by Thaler (1980), which states that consumers track their expenses in mental accounts. The costs and benefits are tracked during an accounting period: a certain time frame in which consumers evaluate financial decisions and outcomes (Prelec and Loewenstein, 1998). If the mental account is negative at the end of the accounting period the costs do not outweigh the benefits and consumers will experience pain of paying. Prelec and Loewenstein (1998) researched pain of paying in the context of cumulative payments over a certain period. Sheehan and van Ittersum (2018) argue that pain of paying is experienced with every spending decision, rather than only cumulative. More recent research is based on the value of money (Reshadi and Fitzgerald, 2023). Money provides a source of protection and security (Zhou and Gao, 2008). As money is not an unlimited resource for most people, this source of protection and security diminishes when they spent money. Therefore people experience pain of paying (Pomerance et al., 2018; Xu et al., 2015). Our research follows the definition of Reshadi and Fitzgerald (2023). This pain of paying construct differs from Thaler's (1985, 2008) definition of transaction utility. The experience of the pain of payment does not depend on whether the price is perceived as fair or unfair, as both fair and unfair prices can diminish financial resources and elicit the pain of payment. Additionally, the pain of paying is only negatively valanced, whereas transaction utility can be negative or positive.

An important consequence of feeling anticipated pain of paying is a decrease in spending (Reshadi and Fitzgerald, 2023). The anticipated pain makes the consumer adjust his or her spending behaviour in order to prevent feeling this pain (Prelec and Loewenstein, 1998). Higher levels of anticipated pain of payment lead to lower willingness to purchase (e.g. Sheehan and van Ittersum, 2018; Liu and Dewitte, 2021) and willingness to pay (Thunström et al., 2018). They also lead to an overall lower amount spent during a shopping trip (Liu and Dewitte, 2021). Most importantly, consumers with high levels of pain are less likely to overspend their budget (Choe and Kan, 2021). As the pain of paying is influenced by the type of payment instrument, a payment instrument that leads to higher payment pain can help respondents to stay within their budget better. Moreover, Soster et al. (2014) find that consumers experience a higher level of pain of payment when they spend a certain amount of money that is close to the cap of their budget or will deplete it, compared to a situation where the same amount of money is spent but they stay within their budget.

The key objective of our research is to gain a deeper understanding of the factors associated with the pain of paying and to extend knowledge of the consequences of the pain of paying. In their study, Reshadi and Fitzgerald (2023) conducted a systematic literature review on the topic and identified research questions that could enhance our knowledge in this area. Our research makes several contributions to the existing literature on the pain of paying. Firstly, we investigate the pain of paying across a wide range of payment instruments, including non-traditional methods (contactless payments via debit card and smartphone), as well as online payment methods. Previous studies primarily focused on the pain of paying associated with conventional payment methods like cash, debit cards, and credit cards. Secondly, we explore how demographic variables (such as age) and other individual level characteristics such as financial scarcity influence the pain of paying, thereby expanding our understanding of its underlying dynamics. Valuing money is the root cause of experiencing pain of paying (Xu et al., 2015). As a result it is expected that individual characteristics that increase the valuation of money exacerbate pain of paying (Reshadi and Fitzgerald, 2023). Previous studies have primarily relied on small-scale experiments, whereas we utilize survey data collected from a large representative group of Dutch consumers, providing us with comprehensive information on personal characteristics. Thirdly, we examine how the context influences the pain of paying. To test how the pain of paying relates to the payment instrument used, the type of expenditure and the amount paid respondents were represented with hypothetical situations ('vignettes'). We distinguish between paying for groceries at the supermarket and paying for an outing. Little is known yet about the relationship between the type of expenditures and the pain of paying, although it is expected that higher involvement with a product is associated with a lower pain of paying (Reshadi and Fitzgerald, 2023). Lastly, we extend knowledge of the consequences of the pain of paying. Specifically, we examine the relative perceived pain of paying of contactless payments in relation to the relative intensity of use of contactless payments and the relative perceived usefulness of contactless payments in preventing overspending. This knowledge is valuable for policymakers, as understanding the pain of paying and its consequences can inform the design of interventions that promote better decision-making. If individuals exhibit wiser decision-making

when experiencing significant pain of paying, policymakers can leverage this insight to develop interventions that encourage improved decision-making (Reshadi and Fitzgerald, 2023). The pain of paying can be considered a beneficial phenomenon for several reasons. It prompts people to be more mindful and deliberate in their spending decisions, to avoid impulsive spending and stay within their budgetary limits. Policymakers who develop policies aimed at preventing financial problems, may find it useful to know the characteristics of people who experience relatively low levels of pain of paying. This allows for more targeted policy development.

Foreshadowing our main results, we find that when you pay in the blink of an eye (so contactless) it hurts less, but you spend more. The pain of paying depends on the payment method, the type of expenditure and the amount paid. In general, electronic payments methods – both online and offline – hurt less than cash payments. This holds especially for contactless payments and iDEAL payments, a frequently used online payment method in the Netherlands. We find this for older people in particular but not for teenagers. As the transaction amount increases, the difference in the perceived pain of paying between cash payments and other payment methods also grows larger. Men experience lower levels of pain compared to women and there is a negative correlation between age and pain of paying, implying that older people experience less pain. Moreover, the harder people find it to make ends meet with their income, the more pain they experience while paying. The pain of paying is also relatively high for people with lower levels of financial literacy and for tightwads, i.e. those who are excessively frugal or even miserly. The intensity of use of contactless payments is negatively correlated with the relative pain of paying contactless, which is the pain measured in comparison to the pain associated with other payment methods. This suggests that people try to avoid the pain of paying. Lastly, we find that the lower the perceived relative pain of paying contactless is, the lower the relative perceived usefulness in preventing overspending. On average, respondents find cash most helpful to prevent overspending and to track their expenditures, whereas contactless payments – especially via a mobile phone – are least helpful. Given the declining use of cash, it is crucial for policymakers to devise tools that aid consumers in averting overspending when utilizing electronic payment methods, particularly contactless ones.

Consumer payments research is a multidisciplinary area that researchers from different fields tackle. These fields include economics, psychology and marketing and consumer research. For example, whereas some researchers focus on the impact of sociological or psychological factors (Khan et al., 2015; van der Cruijsen and van der Horst, 2019; van der Cruijsen and Knoben, 2021), others are particularly interested in how external shocks affect payment behaviour (e.g. Auer et al., 2023; Jonker et al., 2022; Kotkowski and Polasik, 2021; Kraenzlin et al., 2020). Many studies have shown that payment behaviour relates to personal characteristics, payment instrument characteristics, the acceptance of payment instruments and price incentives (e.g. Kosse, 2014). Our research relates most strongly to marketing and consumer research on the relationship between payment choice and spending behaviour (e.g. Soman, 2001).

The pain of paying is positively related to the transparency of the payment instrument (Raghubir and Srivastava, 2008; Soman, 2001, 2003; Thomas et al., 2011). This is the transparency with which people can feel the outflow of money. Soman (2003, p. 175) defines it as follows: "*We define payment transparency of a payment mechanism as the relative salience of the payment, both in terms of physical form and the amount, relative to paying by cash.*". The transparency of cash payments is high. A cash payment is salient in physical form and in amount. It is easy to see that money is being spent and the amount is relatively memorable since cash has to be counted and given. The transparency of electronic payments is lower because of the lower salience of the form and amount compared to cash payments. In the case of cash payments people experience the pain of loss intensely as they need to check the amount, select the right bills and coins, hand these over, receive their change and check whether the amount they have received is correct (Raghubir and Srivastava 2008; Soman, 2003). The pain of paying is lower when using credit cards (Raghubir and Srivastava, 2008; Soman, 2003; Thomas et al., 2011). In this case the sense of parting is temporary and when signing the receipt, consumers check the amount. The transparency of mobile payments is lower than the transparency of cash and credit card payments. It is not necessary to check the amount in the case of mobile payments. People experience a lower pain of paying because they do not necessarily sense a loss when paying with their smartphone (Falk et al., 2016). Ceravolo et al. (2019) conducted a functional magnetic resonance imaging (fMRI) experiment. Participants observed videoclips that varied for the method of payment displayed (cash, card, smartphone). Their findings suggest that cash enhances the salience and negative affective valence of parting with money as there is greater activity in brain areas processing the perceived utility of motor behaviour and individual emotional involvement.

The pain of paying also depends on the price of the product or service bought. There is a positive relationship between the price and the pain of paying (Shah et al., 2016). Shah (2015) finds an interaction effect. When the price is low, the pain of paying is low, and whether people buy the product does not depend on the payment method. However, when the price is high, it matters which payment instrument is used.

Various studies have shown that consumer spending depends on the payment instrument used. Many studies compare credit cards and cash and find that consumers spend more when they use credit cards (Feinberg, 1986). Credit cards and cash not only differ with respect to the representation of money itself, but also because there is a temporal separation between consumption and payment in the case of credit cards (Prelec and Loewenstein, 1998). It is therefore important to research a wider range of payment instruments. Contactless payments by mobile phone or debit card and traditional debit card payments (where the debit card needs to be inserted in the payment terminal and a PIN code needs to be manually entered) are ubiquitous and immediate, making them a suitable substitute for cash. In all cases there is a tight coupling between consumption and payment. The payment instruments differ in the representation of money: physical and visible in the case of cash payments versus digital and invisible in the case of traditional debit card payments and contactless payments. This may result in differences in the pain of paying and therefore spending behaviour. Runnemark et al. (2015) use an experimental approach and find that the willingness to pay (WTP) is much higher for debit cards than cash. The average bid was 22–54 % higher. Studies find a higher WTP for mobile payments than for cash (Falk et al., 2016)) and credit card payments (Boden et al., 2020). Convenience, which is greater for mobile payments than for credit card payments, emerges as a mediator. Trütsch (2014) uses US data from the 2010 Survey of Consumer Payment Choice and finds that the adoption of contactless debit and credit cards leads to an increase of the spending ratio at the POS by 10 % for debit cards and 8 % for credit cards. Meyll and Walter (2019) find

that the use of mobile payment technology is associated with increases in individuals' overall spending by credit card. Ahn and Nam (2022) show that financial knowledge has a moderating effect on the positive association between mobile payment use and overspending. Financial knowledge helps to lower the extent to which mobile payments exacerbate overspending.

The remainder of this paper is structured as follows. Section 2 describes the Dutch payment landscape and our consumer survey. The descriptive results are in Section 3. Section 4 describes our empirical approach to gain a deeper understanding of the factors associated with the pain of paying. Section 5 presents the regression results on the pain of paying. Section 6 focuses on the implications of the pain of paying. We end with a discussion and conclusion in Section 7.

2. Data

2.1. Dutch payment landscape

The Dutch payment landscape is renowned for its advanced and efficient systems, which prioritise convenience, security, and innovation. Various forms of contactless payment have gained increasing popularity as shown by De Nederlandsche Bank (DNB) and Dutch Payments Association (DPA) (DNB and DPA, 2022). In 2021, contactless payments by debit card, smartphone or wearable accounted for 68 % of POS transactions, while contact-based debit card payments represented 11 %. Cash was used for one in five payments, whereas credit card payments only constituted 0.5 %. Because of the popularity of the advanced debit card system the usage of credit cards is limited. Most Dutch consumers prefer not to defer payments, with only a small share of credit card holders using revolving credit cards that carry a balance. A large majority of Dutch credit card users are required to pay their bills in full at the end of each month, without any interest rate being charged on credit card expenditures. Among Dutch consumers, nearly everyone possesses a debit card and has access to cash. In 2021, there were 31.7 million debit cards and 6.3 million credit cards (DPA, 2022). Comparatively, the population of the Netherlands during that period was 17.5 million. The acceptance of both cash and electronic payments is widespread. In 2020, 92 % of the retailers accepted debit cards, 96 % accepted cash and 44 % accepted credit cards (DNB, 2020).

In online transactions, consumers prefer using the debit system iDEAL over credit card payments. In 2021, there were 1.14 billion iDEAL transactions and 122 million online credit card payments in e-commerce (DPA, 2022). iDEAL enables customers to make direct payments from their payments accounts by using a bank app or online banking environment, ensuring quick and seamless transactions between buyers and sellers. It is supported by all Dutch consumer banks and has gained widespread acceptance among businesses and consumers.

Moreover, instant payments is the norm for credit transfers within the Netherlands when paying with a debit card at POS or iDEAL online. This does not hold for credit card payments. Instant payments take no longer than 10 seconds to confirm a payment between payment service providers (PSPs), for example between the PSP of the consumer and the merchant's PSP. In other European countries, instant payments is often seen as a premium product for which consumers pay extra. In the Netherlands, most banks offer it and it is free of charge. This illustrates that Dutch consumers are used to quick settlements. When they pay, the amount paid is quickly deducted from their bank account.

Unlike in countries like Canada or the US, Dutch banks and merchants do not employ financial incentives to encourage the use of debit or credit card payments. Cashback rewards for cardholders are not prevalent in the Dutch payment landscape. European regulations prohibit retailers from applying surcharges to the most commonly used debit and credit card schemes used by Dutch account holders.

2.2. Data collection

We designed a detailed consumer survey to measure: (1) payment behaviour and preferences, (2) pain of paying, and (3) spending behaviour in relation to payment instrument usage. The main survey questions are in Appendix A. The data was collected through the Centerpanel, an online panel managed by Centerdata. This is a research institute affiliated with Tilburg University. The Centerpanel is an accurate representation of the Dutch-speaking population in the Netherlands, aged 16 years and older. For our research, an online panel possibly creates a selection bias in the results, as people who take part in an online survey are more likely to have digital skills and therefore also use digital payment methods more. To address this issue, Centerdata provides a simple computer, an ADSL connection and technical assistance to people without the facilities needed to participate in an online survey. This limits the selection bias as people who have low digital skills are able to participate in the panel. We encourage research that employs offline survey methods, placing a particular emphasis on groups with limited digital skills. These individuals are more inclined to rely on cash, as highlighted by van der Cruijsen and Reijerink (2023).

The survey was distributed among 3,241 members of the panel between 29 October and 16 November 2021. The survey was completed by 2,497 respondents (77.0 %) and partially by thirteen panel members (0.4 %). In addition to the data collected in the survey, we use data of the annual DNB Household Survey on demographic characteristics of the panel members, such as age, gender and income.

Alternatively, we could have measured the pain of paying of payments reported in consumer payment diary surveys. An advantage of our approach is that we measure the pain of paying of multiple payment methods for all respondents. On average there is only one POS payment per respondent in the Dutch payment diary data. Moreover, we can keep the context fixed across and within respondents. For example, we make sure that the expenditure is for the respondent themselves and not for someone else. Lastly, a separate consumer survey provides more opportunities to ask additional questions without burdening the respondent with a too lengthy questionnaire.

2.3. Survey design

The survey is built up in three parts: payment preferences and behaviour, the pain of paying and spending behaviour. The first part of the survey includes questions to gain insights into Dutch consumers' payment preferences and behaviour. Then, we ask questions to measure respondents' pain of paying in twelve different payment scenarios. Table 1 gives an overview of these scenarios.

The pain of paying is measured on a scale from 1 'absolutely no pain of paying' to 7 'a lot of pain of paying'. For each category (POS or online), there is one transaction in a supermarket, to cover the pain while paying for basic needs, and the other transaction considers paying for an outing, to capture the pain while paying for a non-essential service. In the case of the POS questions, respondents reported their pain of paying for four different payment methods: cash, debit card traditional, contactless by debit card and contactless by mobile phone. As regards the questions about online payments, we measure the pain of paying for an iDEAL payment and when using a credit card. For each scenario, we randomise the amount respondents had to pay, which ranges from 5 to 500 euros. The scenarios only include rounded amounts, potentially leading us to underestimate the pain of paying associated with paying in cash. A rounded amount can be paid more quickly than a non-rounded amount. However, if individuals have the exact bill(s) required, they must still verify the amount, choose the correct bill(s), and hand them over, thereby increasing the transparency of cash payments compared to electronic transactions. In the case of non-rounded amounts, people spend additional time selecting the appropriate bills and coins, as well as receiving and verifying the change.

Lastly, the survey includes several additional questions that help gain insight into the link between the payment method used and financial difficulties. For example, we ask questions to measure the extent to which different payment methods help prevent over-spending and the degree to which they help consumers gain insight into their spending patterns.

3. Survey outcomes: descriptive statistics

3.1. Payment preferences and behaviour

A majority of respondents prefer to pay contactless at the POS. Our survey starts by asking the respondents their payment preferences at a physical POS, for example in a restaurant or shop (see Appendix A, question 1). As possible answers we list the most commonly used methods in the Netherlands: cash, debit card traditional, contactless by debit card, contactless via mobile phone, and include the answer option 'other'. 57 % of the respondents have a preference for contactless payment with a debit card. An additional 11 % state that contactless payment with a mobile phone is their preferred method. Cash is preferred by 14 % of the respondents, and the traditional debit card payment by 17 %.

Next, we focus on actual payment behaviour and find that contactless payments are used a lot. We specifically ask how many times respondents paid contactless in the month prior to the survey (Appendix A, question 2). 70 % states that over half of their POS payments were contactless (either with a debit card or a mobile phone), while 10 % never paid contactless. The COVID-19 pandemic has drastically changed payment behaviour in the Netherlands. Contactless payments by debit card clearly gained ground during the pandemic. This finding is in line with data on payment behaviour of Dutch consumers published by DNB (DNB, 2022). In the first phase of the pandemic there was a fear of infection via payment instruments as little was known about the virus. Some merchants requested card payments as this lowers the likelihood of hand contact. In addition, Dutch banks took measures to simplify contactless payments. The transaction and cumulative limits were increased. These factors have resulted in a change in payment behaviour, which did not revert back to pre-pandemic patterns. A possible explanation is that the pandemic has resulted in a better match between payment preferences and payment behaviour (Jonker et al., 2022). The pandemic might have helped expedite the alignment of people's payment behaviour to their payment preferences. An earlier study conducted in the Netherlands before the pandemic finds that cash was used more frequently than one would expect based on stated payment preferences due to persistent habits (van der Cruijsen et al., 2017). Lastly, the COVID-19 pandemic has increased the popularity of online shopping. This underlines the importance of investigating not only payment behaviour and pain of paying at the POS, but also online.

Experience with different payment instruments varies between respondents (Table 2). Almost all respondents (97 %) have made

Table 1
Respondents self-report their pain of paying in twelve different payment scenarios.

POS or online	Type of expenditure	Payment method	Amount in euros (randomly assigned)
POS	Groceries at the supermarket	Cash Debit card traditional Contactless – debit card Contactless – mobile phone	5, 20, 50, 100, 500
POS	Outing	Cash Debit card – traditional Contactless – debit card Contactless – mobile phone	5, 20, 50, 100, 500
Online	Groceries at the supermarket	iDEAL Credit card	5, 20, 50, 100, 500
Online	Outing	iDEAL Credit card	5, 20, 50, 100, 500

traditional debit card payments and cash payments. The share of people that have experience with paying contactless by debit card is also high (90 %), as well as the share of people that have experience with iDEAL (92 %). More than half of the respondents have used a credit card (56 %). Only 27 % have experience with contactless payments by mobile phone. This method is relatively new in the Netherlands. There are significant differences between age groups. The proportion of people under the age of 20 with experience using a credit card is only 7 %, and the use of contactless payments with mobile phones is only 6 % among people who are 80 years old or older.

3.2. Pain of paying

The pain of paying depends on the payment instrument, the amount paid, the type of expenditure (groceries at the supermarket or an outing) and whether it is an POS or online payment. Fig. 1 shows the average pain of paying in the different payment scenarios described in Table 1. Recall that the pain of paying is measured on a scale from 1 'absolutely no pain of paying' to 7 'a lot of pain of paying'.

There is a positive correlation between amount and the self-reported level of pain: the higher the purchase amount, the higher the pain of paying. There are several explanations for this positive correlation. The larger the amount of money being spent, the higher the perceived loss of wealth. Higher amounts become more salient and capture greater attention, which draws focus to the cost and reinforce the pain associated with the purchase. Larger payments often involve sacrificing other potential uses of money. People become more aware of the trade-offs they are making, which can increase the perceiving pain of paying. Lastly, the larger the amount is, the more likely it is to exceed an individual's budgetary limits or financial comfort zone. This may lead to greater financial strain and discomfort. We find the increase in pain with transaction value to be steepest for cash.

In general, cash and contactless payment with a mobile phone are the POS payment methods with the highest average pain of paying for both types of expenditures.[1] For example, in the 500 euros POS grocery shopping case the perceived pain of a cash payment is 4.1 and the perceived pain of a contactless payment by debit card is 3.4, which is a difference of 0.7. Credit card payments are considered to be more painful than iDEAL payments. For example, in the 5 euros online grocery shopping case the perceived pain of a credit card payment is 2.7 and the perceived pain of an iDEAL payment is 1.8. The highest perceived pain of paying observed is 4.3, in the 500 euros POS outing case. To compare, in 2014 van der Cruijsen and Plooij (2018) measured Dutch consumers' perceptions of safety, acceptance, user-friendliness, costs and speed of cash, debit cards and credit cards on a 7-point scale from 1 'very negative' to 7 'very positive'. The lowest perception score was 4.1 for the perceived costs of credit cards, and the highest perception score was 6.3 for the perceived acceptance of debit cards. The highest perception gap was observed for acceptance; debit cards scored 1.4 higher than credit cards.

20 % of the respondents answered 1 'absolutely no pain of paying' in all situations. Compared to other respondents, they are somewhat older and more likely to be male, have a high income, have a partner, be homeowners and live in urban areas. Additionally, they find it somewhat easier to make ends meet with their income, have slightly more difficulty limiting spending and possess a slightly higher level of financial literacy.

3.3. Spending behaviour

Table 3 shows that, on average, respondents state that cash is the most useful payment method to prevent overspending and to understand their own spending behaviour. Both aspects are measured on a scale from 1 'helps not at all' to 7 'helps very well'. Cash gets a score of 4.2 for preventing overspending and a 4.0 for gaining insights into how much one spends and on what. Cash is especially in the lead when it comes to its helpfulness in preventing overspending. Overall, contactless payments by mobile phone are the least useful in preventing overspending and tracking expenditures, with scores of 2.4 and 3.1, respectively. The helpfulness of the four different payment instruments to prevent overspending and gain insight into spending behaviour significantly differs (t-tests, p-values < 0.001). For all age groups it holds that cash is most helpful in preventing overspending. When it comes to gaining insights into spending habits, cash is considered the most useful among respondents aged 40 to 79. On the other hand, electronic payment instruments are perceived to be more helpful for understanding spending behaviour among individuals under the age of 30. Respondents aged between 30 and 39 give similar importance to both cash and debit cards in terms of gaining insights into their expenses.

We find that, on average, consumers tend to check the exact amount before they pay most often when paying with cash and the least when paying contactless with a mobile phone. The frequency of checking the exact amount significantly differs between payment methods (t-tests, p-values < 0.001). The scale is 1 'never', 2 'sometimes', 3 'half of the time', 4 'often' and 5 'always'. Respondents could also chose the answer 'I do not use this payment method'. For cash the average is 4.3 – between 'often' and 'always' – and for contactless payments with mobile phone 3.5, which is in the middle between 'half of the time' and 'often'. The average frequency of checking the exact amount is 4.1 for traditional debit card payments and 4.0 for contactless payments by debit card. We get the same ranking of the payment instruments when we only consider those people who have experience with all four payment methods.

Most respondents use the bank application on their mobile phone to check the balance of their main payments account (72 %), 38 % use their bank's website and only 11 % make use of a paper statement. Compared to younger people, people aged 80 or above are less likely to use their banking app and more likely to use their bank's website or a paper statement. The frequency of checking the balance

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[1] A possible explanation is that people may lack experience with contactless payment with a mobile phone. A regression based on experience-based cases shows a higher pain of paying with cash than when paying contactless by mobile phone (Table 4, column 2).

Table 2

Experience with different payment methods varies between respondents.

Share of respondents with experience									
	(1) All	(2) Age: <20	(3) Age: 20–29	(4) Age: 30–39	(5) Age: 40–49	(6) Age: 50–59	(7) Age: 60–69	(8) Age: 70–79	(9) Age: ≥80
Cash	96.6 %	96.3 %	96.0 %	97.9 %	97.4 %	97.8 %	97.0 %	96.3 %	89.0 %
Debit card traditional	96.8 %	96.3 %	94.9 %	98.2 %	97.4 %	98.2 %	96.1 %	96.5 %	93.8 %
Contactless – debit card	90.1 %	96.3 %	95.4 %	95.4 %	94.8 %	89.8 %	89.5 %	85.8 %	78.6 %
Contactless – mobile phone	27.1 %	44.4 %	52.6 %	44.6 %	39.4 %	28.0 %	19.3 %	13.2 %	6.2 %
iDEAL	91.6 %	96.3 %	97.1 %	98.6 %	98.3 %	94.5 %	90.6 %	84.1 %	76.6 %
Credit card	55.6 %	7.4 %	53.1 %	62.9 %	66.7 %	61.4 %	53.5 %	48.2 %	42.1 %

Source: Centerpanel, 2021.

Note: See Appendix A for the survey question (Q16).
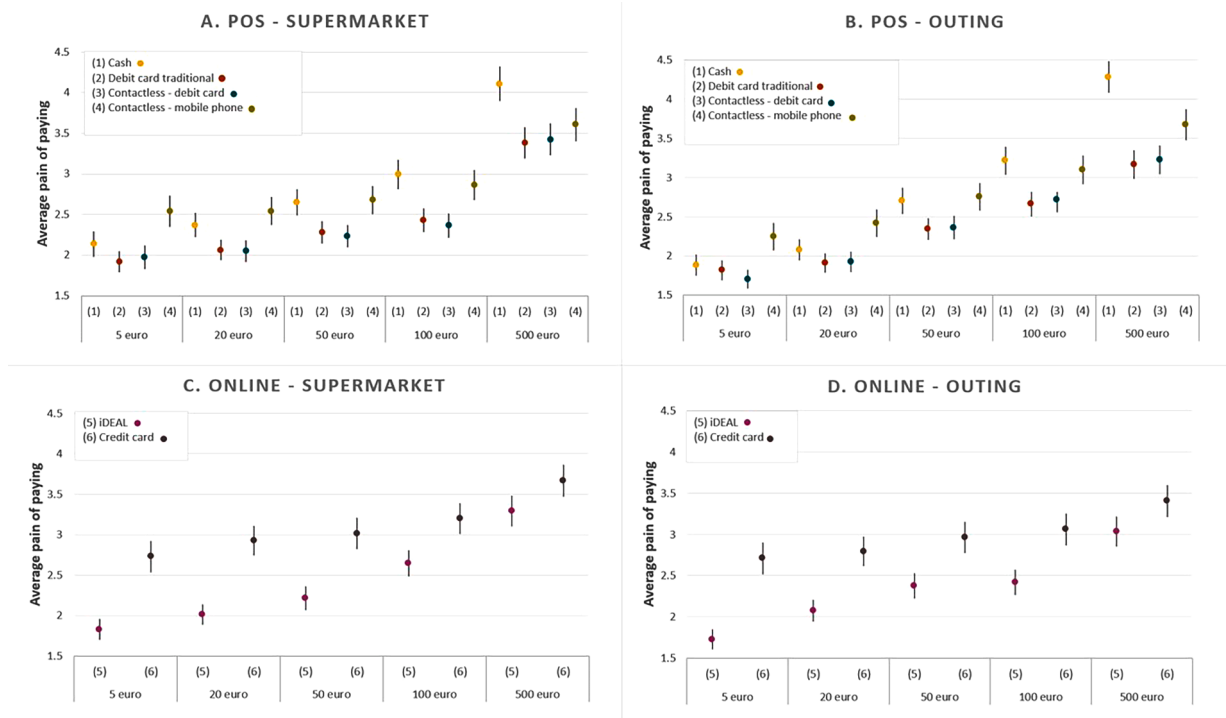
Fig 1. Average pain of paying.
Source: Centerpanel, 2021.
Note: The figure shows the average pain of paying with 95 % confidence intervals. The pain of paying is measured on a scale from 1 'absolutely no pain of paying' to 7 'a lot of pain of paying'.

is measured on the following scale: 1 'once a month or less often', 2 '2 or 3 times a month', 3 '1 to 6 times a week', 4 'once a day' and 5 'multiple times a day'. The average frequency is 2.7. Younger respondents check their balance more often than older respondents.

We asked respondents whether they consider themselves to be a tightwad or a spendthrift (i.e. an individual who spends money extravagantly) on a scale of 1 'I have trouble spending money' to 11 'I have trouble limiting my expenses' (see Appendix A, Q13). This question is similar to one of the questions that form the basis for the *spendthrift-tightwad scale* introduced by Rick et al. (2008). Their *spendthrift-tightwad* measure is known to be useful in trying to explain the difference in the pain of paying between consumers. The average answer is 5.9. Most respondents (58 %) list themselves as a 6 on the spendthrift-tightwad scale, which is the middle point of the scale. More people consider themselves on the tightwad end of the scale (1–5) (24 %) compared to the spendthrift end of the scale (7–13) (18 %). Moreover, we asked respondents to what extent they are able to make ends meet with their income on a scale of 1 'very hard' to 5 'very easy'. The average answer is 3.6. Most respondents are able to make ends meet easily or very easily (56 %). About 8 % has difficulties making ends meet.

4. Empirical approach

To gain insights into the factors that play a role in the pain of paying that consumers experience, we conduct several regressions.

Table 3
Spending behaviour and related factors.

	(1) All	(2) Age: <20	(3) Age: 20–29	(4) Age: 30–39	(5) Age: 40–49	(6) Age: 50–59	(7) Age: 60–69	(8) Age: 70–79	(9) Age: ≥80
Prevent overspending (Q10) (scale: 1 'does not help at all' to 7 'helps very well')									
Cash	4.2	3.7	4.1	4.3	4.4	4.5	4.2	3.9	3.7
Debit card traditional	2.8	3.5	3.1	2.9	2.8	2.8	2.7	2.7	2.9
Contactless – debit card	2.6	3.2	2.8	2.7	2.6	2.5	2.5	2.4	2.6
Contactless – mobile phone	2.4	3.3	2.7	2.5	2.5	2.5	2.3	2.2	2.6
Gain insights into how much is spent and on what (Q11) (scale: 1 'does not help at all' to 7 'helps very well')									
Cash	4.0	3.6	3.3	3.8	4.1	4.3	4.2	4.1	3.6
Debit card traditional	3.7	4.0	4.3	3.9	3.7	3.8	3.5	3.6	3.9
Contactless – debit card	3.5	4.5	4.3	3.8	3.6	3.5	3.4	3.3	3.4
Contactless – mobile phone	3.1	4.0	4.2	3.5	3.3	3.2	2.8	2.6	2.6
Frequency of checking the exact amount before paying (Q12)* (scale: 1 'never' to 5 'always')									
Cash	4.3	3.8	4.2	4.1	4.3	4.3	4.4	4.4	4.3
Debit card traditional	4.1	3.8	3.9	3.9	4.0	4.1	4.2	4.3	4.3
Contactless – debit card	4.0	3.4	3.8	3.8	4.1	4.0	4.2	4.2	4.0
Contactless – mobile phone	3.5	3.6	3.5	3.5	3.7	3.5	3.5	3.3	2.7
Spender (Q13) (scale: 1 'I have trouble spending money' to 11 'I have trouble limiting my expenses')	5.9	5.2	6.0	6.1	5.8	5.8	5.7	5.9	5.8
Method to check the main payments account balance (Q14) (share yes)									
The banking app on a mobile phone	71.6 %	92.6 %	93.1 %	92.1 %	87.6 %	77.3 %	67.9 %	50.8 %	33.8 %
The website of my bank	37.6 %	7.4 %	21.1 %	16.1 %	22.1 %	35.1 %	43.4 %	54.9 %	65.5 %
Paper statement	10.5 %	7.4 %	1.7 %	2.1 %	3.2 %	8.4 %	11.7 %	18.7 %	29.0 %
Frequency of checking the main payments account balance (Q15) (scale: 1 'once a month or less often' to 5 'multiple times a day')	2.7	3.2	3.1	3.0	2.8	2.7	2.6	2.6	2.6
Ease of making ends meet with income (Q17) (scale: 1 'very hard' to 5 'very easy')	3.6	3.8	3.7	3.7	3.7	3.6	3.6	3.6	3.5

Source: Centerpanel, 2021.

Note: See Appendix A for the survey questions. *We excluded respondents who answered 'I do not use this payment method.' in response to this question (Q12).

First, we estimate the following linear model:

$$pain\ of\ paying_{i,j} = f\left(payment\ method_{i,j},\ type\ of\ expenditure_{i,j},\ transaction\ amount_{i,j}\right) + u_i + e_{i,j} \qquad (1)$$

With this model we can learn about the effect on the pain of paying of the type of payment method, the type of expenditure and the amount paid, while controlling for individual fixed effects. This model is useful for a within-subject experiment, where the same respondents respond to multiple scenarios, which is the case in our survey. The subscript i indicates the individual and j denotes the scenario (the 'time' dimension). Our baseline regressions are linear models, as the estimates of these models are easier to interpret than the estimates of ordered logit models. As a robustness analysis, we estimate ordered logit models, which yield very similar results. The dependent variable *pain of paying* captures the pain of paying. It is measured on a scale from 1 'absolutely no pain of paying' to 7 'a lot of pain of paying'. *Payment method* refers to the first set of explanatory variables, binary dummy variables capturing the payment method: debit card traditional, contactless – debit card, contactless – mobile phone, iDEAL or credit card. Cash is the reference category. *Type of expenditure* is a binary dummy that captures the type of expenditure in the scenario (0 = groceries at the supermarket, 1 = outing). The last set of explanatory variables is indicated by *transaction amount*. These are binary dummy variables that capture the amount in euros: 20, 50, 100 or 500. The reference category is 5 euros. Standard errors are clustered at the individual level. The error term is composed of an idiosyncratic error $e_{i,j}$ and an individual fixed component u_i which controls for unobserved heterogeneity at the individual level. Hence, we obtain coefficients that purely show the effect of the payment method, type of expenditure and amount paid.

In our analysis, we take into account that the amount of experience of the respondents with certain payment instruments varies. Recall that in the survey we asked whether the respondent actually had experience with each of the payment instruments (see Table 2). This enabled us to run the model for three different levels of experience. The first regression includes all responses. The second regression includes only the responses for the payment methods that the respondent has experience with, while the third regression only includes respondents who have experience with all six payment methods presented.

We estimate model (1) for different groups to examine whether the relationship between the variables is equal over groups. We expect that the patterns in the pain of paying may vary across groups. For example, pain of paying may be related to the age as older people grew up with cash, whereas teenagers grew up surrounded with electronic payment methods. In addition, we examine the role of gender, education and income. As we find that experience matters, this part of our empirical analysis is based on regressions with the data of the respondents who have experience with the given payment method.

Second, we run the following linear regression model to examine how the pain of paying relates to personal characteristics.

$$pain\ of\ paying_{i,j} = f\left(payment\ method_{i,j},\ type\ of\ expenditure_{i,j},\ transaction\ amount_{i,j},\ X_i\right) + e_{i,j} \tag{2}$$

This model also relates the pain of paying to the payment method, the type of expenditure and the transaction amount. Instead of the individual level fixed effects (see model (1)), we now include X_i, a vector that includes a wide range of variables capturing characteristics of individual i. The idiosyncratic error is denoted by $e_{i,j}$. Standard errors are clustered at the individual level. Our baseline regressions are linear models. As a robustness analysis, we estimate ordered logit models, which yield very similar results. The results are available upon request.

First, we run model (2) with a set of variables capturing standard personal characteristics. Policymakers who develop policies aimed at preventing financial problems, may find it useful to know the characteristics of people who experience relatively low pain of paying. This will allow for a more targeted policy development. We briefly explain each variable. *Male* is a binary dummy that is 1 for males and 0 for females. The age of the respondent is captured by the continuous variable *age. Education: high* is a binary dummy that is 1 for respondents who successfully completed higher vocational or university education and 0 for lower-educated respondents. Three income dummies are constructed to control for differences in the net monthly household income: *income: EUR 1851–2800, income: EUR 2801–3990* and *income: > EUR 3990*. These variables are 1 for respondents who have a net monthly household income that falls in the income category mentioned and 0 otherwise. Respondents in the reference category have an income of EUR 1850 or below. *Partner* a binary dummy variable capturing whether the head of a household lives together with a partner (1 = partner, 0 = no partner). *Homeowner* is included as a proxy for wealth. It is 1 for homeowners and 0 otherwise. The variable *urban area* captures the degree of urbanisation of the respondent's residence. It is 1 if the degree of urbanisation is high or very high, and 0 otherwise.

Second, we add non-standard personal characteristics to deepen our understanding of the underlying dynamics how personal characteristics influence pain of paying. *Ease of making ends meet with household income* captures the answer to "How hard or easy is it for you to make ends meet with your income?". This variable can take five different values: 1 = very hard, 2 = hard, 3 = nor hard, nor easy, 4 = easy and 5 = very easy. We anticipate that individuals who struggle to make ends meet will experience a relatively high level of pain when making payments because they place a higher value on their money. Valuing money is the root cause of experiencing pain of paying (Xu et al., 2015). The experience of financial scarcity can also increase the salience of opportunity costs (Shah et al., 2015; Spiller, 2011) and thereby result in a higher pain of paying. *Spender* captures whether the respondent is a tightwad or spendthrift. It is the answer to "Which description best fits you?", which is measured on a scale from 1 'I have trouble spending money' (tightwad) to 11 'I have trouble limiting my expenses' (spendthrift), with 6 'About the same or neither'. This question is similar to one of the questions that form the basis for the spendthrift-tightwad scale introduced by Rick et al. (2008). Their spendthrift-tightwad measure is known to be useful in trying to explain the difference in the pain of paying between consumers. The authors argue that pain of paying depends on how sensitive an individual is to this type of pain. Spendthrifts have difficulty limiting their expenses, while tightwads have trouble spending money. Spendthrifts have a low sensitivity to this pain, while tightwads have a high sensitivity. This scale captures these differences. Thunström and Ritten (2019) showed that this level of sensitivity influences the intensity of anticipated pain of payment. People experience a pain of paying when they become cognizant that they have lost a certain amount of their financial resources. Therefore, we also include the frequency of checking the balance. *Frequency of checking the balance* is an ordered variable measuring the answer to "On average, how often do you check the amount of money in your main payments account?" This variable can take five different values: 1 = once a month or less often, 2 = 2 or 3 times a month, 3 = 1 to 6 times a week, 4 = once a day, or 5 = multiple times a day. Last, *financial literacy* is the answer to "How knowledgeable do you consider yourself with respect to financial matters?". This self-assessed financial knowledge variable can take four different values: 1 = not knowledgeable, 2 = more or less knowledgeable, 3 = knowledgeable, or 4 = very knowledgeable. Financial literacy plays a crucial role in promoting financial well-being, preventing financial difficulties and fostering a financially responsible society. It is valuable to learn how it relates to the perceived pain of paying. Table B.1 in Appendix B summarises the descriptive statistics of all variables used in the empirical analysis.

5. Regression results

5.1. The pain of paying depends on the payment method, the type of expenditure and the amount paid

The pain of paying depends on the payment method; it is higher for cash payments than electronic payments. The first column of Table 4 shows the result of the regression that uses the complete data set, where all individuals and cases are included. Recall that the pain of paying is measured on a scale from 1 'absolutely no pain of paying' to 7 'a lot of pain of paying'. The pain of paying with a debit

card is 0.4 lower than the pain of paying with cash. This holds for both traditional and contactless debit card payments. We do not find a difference between paying contactless with a mobile phone and paying with cash. Credit card payments hurt the most; the pain of paying is 0.2 higher than when using cash. iDEAL payments hurt the least. However, the picture that arises is blurred as most respondents do not have experience with all six payment methods.

The second column of Table 4 is based on a regression that only contains cases for which it holds that the respondent has experience with that particular payment method. Now, we find that the pain of paying in cash is higher than the pain of paying with any other payment method. Based on experience, the usage of credit cards hurts less than the usage of cash. The pain of paying with a debit card in a traditional way is again 0.4 less than the pain of paying by cash. Contactless payments and iDEAL payments hurt the least: 0.5 less than cash payments. An explanation for our finding that cash payments elicit the highest pain of paying is that the transparency of cash payments is higher than that of electronic payments. A cash payment is salient in physical form and in amount. This is likely to make people more cognizant that they have lost a certain amount of money, so experience pain of paying.

The last column of Table 4 shows the results of a regression based only on the data of those respondents that have experience with all six different payment methods. Again, cash hurts the most. The pain of paying online is 0.4 lower for credit card payments and 0.6 lower when using iDEAL. Contactless payments hurt the least. This regression includes 469 respondents, which is about one fifth of all respondents. Among people who are younger than 20 or who are 80 or above, the adoption of all six payment methods is the lowest (see also Table 2). There are only two respondents younger than 20 who have experience with all payment methods and four respondents aged 80 or above for which this holds. For the younger age group this is caused by relatively low experience with the credit card (7 %), while for the oldest age group this is caused mostly by the lack of experience with contactless payments through mobile phone (6 %). This illustrates that some groups may be underrepresented when we would only use the answers of respondents who have experience with all payment methods. Therefore, in the remainder of the paper, we use only experience-based responses in the analysis. Moreover, it emphasises the importance of researching how pain of paying patterns vary across age groups (see Section 5.2).

The pain of paying is slightly smaller when paying for an outing than when paying for groceries at the supermarket. Given the circumstances – a pandemic without much fun – this finding is plausible. The effect is significant in column 1 and 3 of Table 4. A possible explanation for our finding is that people feel more involved with an outing compared to groceries. Reshadi and Fitzgerald (2023) mention that the level of pain may depend on a consumer's involvement with a product or product category at the time of payment, which is the degree to which a product is perceived to be relevant to their needs, values and goals (Park and Mittal, 1985; Zaichkowsky, 1985). The more involved they feel, the higher the perceived benefits (Celsi and Olson, 1988), which may result in a lower pain of paying.

The higher the transaction amount, the higher the pain of paying. This makes sense as higher amounts imply larger losses of financial resources (see also Section 3.2). Based on column 2, we find that paying 20 euros hurts 0.2 more than paying 5 euros (the reference category). In the case of 50 euros, 100 euros and 500 euros the pain of paying is respectively 0.5, 0.7 and 1.5 higher than for a transaction amount of 5 euros.

In sum, the pain of paying depends on the payment method, the type of expenditure and the amount paid. Experience clearly matters. In the rest of the paper, we use experience-based responses.

Our findings are robust to the use of a different estimation technique. As a robustness analysis, we estimate ordered logit models. The results are shown in Table C.1 of Appendix C. The results are very similar; the signs of all coefficient estimates are the same and all coefficients that are significant in Table 4 are also significant in Table C.1. There is one additional significant effect in column 1 of Table C.1, which is based on all responses. For this regression it also holds that the pain of paying contactless by mobile phone is lower than the pain of paying with cash.

5.2. Pain of paying patterns vary across age groups

The pain of paying patterns vary across age groups. Table 5 shows the regression results for the different age groups that we created. There are some noteworthy observations. For people younger than 20 we do not find that cash hurts the most. The pain of paying by debit card in a traditional way hurts 0.7 more than paying with cash. The coefficients of other electronic payment instruments are also positive. However, they are insignificant. For older people in particular we find that cash hurts more than electronic payment instruments. For example, for people aged 80 or above the pain of paying with cash is 0.9 higher than the pain of paying by debit card or iDEAL. People between 20 and 29 say they experience relatively little pain from paying by credit card.

These findings suggest that pain of paying patterns depend on experience.[2] While teenagers have grown up in an era of electronic payments, older generations have been accustomed to using cash. The younger population is closely connected to their smartphones and extensively utilizes banking apps. As a result they may be more cognizant of electronic payments and less of cash payments. Recall that the pain of paying is the negative psychological affect people experience when they become cognizant of a loss of financial resources (Reshadi and Fitzgerald, 2023).

People in the oldest age class in particular indicate that the pain of paying is smaller when paying for an outing than when paying for groceries at the supermarket. Although we also find negative effects on the pain of paying for other age groups, these effects are insignificant. A possible explanation is that older people are especially likely to look forward to an outing and perceive it as personally relevant and useful and therefore feel more involved with the outing than with the groceries.

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[2] Prior research has shown that perceptions of payment instrument characteristics (such as safety, costs, speed and ease of use) also vary across age groups (e.g. Jonker, 2007).

Table 4
The pain of paying depends on the payment method, the type of expenditure and the amount paid.

	(1) All cases	(2) Experience-based cases	(3) Cases of respondents who have experience with all payment instruments
Payment method (reference category: cash)			
Debit card traditional	−0.44***	−0.43***	−0.49***
	(0.03)	(0.03)	(0.06)
Contactless – debit card	−0.44***	−0.53***	−0.68***
	(0.03)	(0.03)	(0.07)
Contactless – mobile phone	0.00	−0.53***	−0.65***
	(0.04)	(0.04)	(0.07)
iDEAL	−0.47***	−0.53***	−0.59***
	(0.04)	(0.03)	(0.07)
Credit card	0.21***	−0.20***	−0.35***
	(0.05)	(0.05)	(0.09)
Type of expenditure (reference category: groceries at the supermarket)			
Outing	−0.05**	−0.05**	−0.05
	(0.02)	(0.02)	(0.05)
Amount in euros (reference category: 5)			
20	0.22***	0.19***	0.13*
	(0.04)	(0.04)	(0.08)
50	0.47***	0.47***	0.51***
	(0.04)	(0.04)	(0.08)
100	0.70***	0.71***	0.67***
	(0.04)	(0.04)	(0.09)
500	1.43***	1.52***	1.54***
	(0.05)	(0.06)	(0.12)
Constant	2.30***	2.26***	2.40***
	(0.04)	(0.04)	(0.08)
Number of observations	30,080	22,888	5,628
Number of respondents	2,508	2,496	469
R-squared	0.08	0.10	0.10

Note: The table reports estimates of model (1). The dependent variable is *pain of paying*, which is measured on a scale from 1 'absolutely no pain of paying' to 7 'a lot of pain of paying'. Standard errors are clustered at the individual level and shown in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

The sensitivity of the pain of paying to the transaction amount varies across age groups. The pain of paying of people aged between 20 and 29 is most sensitive to the transaction amount. The pain of paying for this group is 2.1 higher when paying 500 euros compared to a transaction of 5 euros. For people aged 80 or above, transactions of 500 euro only hurt 1.1 more than transactions of 5 euros. The pain of paying of these people is least affected by the transaction amount. For all age groups it holds that the pain of paying is positively related to the transaction amount.

5.3. Pain of paying patterns vary across gender, education and income groups

Pain of paying patterns vary across gender, education and income groups. Table 6 shows the regression results for different groups of respondents. For all groups we find that electronic means of paying hurt less than cash payments. This holds especially for contactless payments and iDEAL payments. The difference in pain of paying between cash and electronic payments is lower for people with a low level of education than for people with a high level of education. This difference is also relatively low for people with a low income and high for people with a high income. Credit card payments generally cause less pain of paying than cash payments, except for the low-income group, which shows no significant difference in the pain of paying between these payment methods. One possible explanation for this finding is the low credit card usage among this group. When individuals do not frequently use a specific payment instrument, they tend to pay closer attention to the payment process and carefully check the amount paid. This heightened awareness likely makes them more cognizant of the financial resources being depleted. For all groups we find that the pain of paying is smaller when paying for an outing than when paying for groceries at the supermarket. However, this effect is only significant for males and people with a low level of education. Compared to the pain of paying that males experience, the pain of paying that females experience is more strongly related to the transaction amount. For women, a transaction of 500 euros hurts 1.8 more than a transaction of 5 euros. For men this effect is almost one third smaller. The pain of paying experienced by people with a low income is more sensitive to the transaction amount than the pain of paying experienced by people with a high income. Finally, people with a high level of education are more sensitive to the transaction amount than people with a low level of education.

Table 5
Pain of paying patterns vary across age groups.

	(1) All	(2) Age: <20	(3) Age: 20–29	(4) Age: 30–39	(5) Age: 40–49	(6) Age: 50–59	(7) Age: 60–69	(8) Age: 70–79	(9) Age: ≥80
Payment method (reference category: cash)									
Debit card traditional	−0.43***	0.69**	−0.31***	−0.44***	−0.41***	−0.38***	−0.38***	−0.53***	−0.89***
	(0.03)	(0.29)	(0.10)	(0.07)	(0.06)	(0.06)	(0.06)	(0.07)	(0.16)
Contactless – debit card	−0.53***	0.52	−0.52***	−0.57***	−0.54***	−0.51***	−0.46***	−0.57***	−0.90***
	(0.03)	(0.31)	(0.11)	(0.08)	(0.07)	(0.07)	(0.07)	(0.08)	(0.20)
Contactless – mobile phone	−0.53***	0.52	−0.51***	−0.55***	−0.59***	−0.48***	−0.48***	−0.65***	0.11
	(0.04)	(0.42)	(0.13)	(0.10)	(0.08)	(0.08)	(0.11)	(0.17)	(0.51)
iDEAL	−0.53***	0.41	−0.40***	−0.35***	−0.57***	−0.45***	−0.54***	−0.69***	−0.90***
	(0.03)	(0.42)	(0.11)	(0.09)	(0.08)	(0.07)	(0.08)	(0.09)	(0.19)
Credit card	−0.20***	0.64	−0.64***	−0.30**	−0.20*	−0.12	−0.17*	−0.12	−0.25
	(0.05)	(0.38)	(0.14)	(0.13)	(0.11)	(0.09)	(0.10)	(0.12)	(0.24)
Type of expenditure (reference category: groceries at the supermarket)									
Outing	−0.05**	−0.03	−0.07	−0.01	−0.03	−0.06	−0.00	−0.07	−0.14*
	(0.02)	(0.23)	(0.08)	(0.06)	(0.05)	(0.04)	(0.04)	(0.05)	(0.08)
Amount in euros (reference category: 5)									
20	0.19***	0.43	0.41***	0.36***	0.13	0.15*	0.22***	0.16*	−0.11
	(0.04)	(0.34)	(0.14)	(0.11)	(0.09)	(0.08)	(0.08)	(0.09)	(0.15)
50	0.47***	0.38	1.02***	0.76***	0.46***	0.35***	0.43***	0.35***	0.14
	(0.04)	(0.40)	(0.15)	(0.12)	(0.09)	(0.08)	(0.07)	(0.09)	(0.14)
100	0.71***	1.06***	1.18***	1.03***	0.74***	0.68***	0.60***	0.58***	0.23
	(0.04)	(0.36)	(0.16)	(0.12)	(0.12)	(0.09)	(0.08)	(0.09)	(0.16)
500	1.52***	1.55**	2.06***	1.81***	1.75***	1.27***	1.45***	1.44***	1.03***
	(0.06)	(0.63)	(0.20)	(0.17)	(0.15)	(0.11)	(0.11)	(0.14)	(0.20)
Constant	2.26***	2.65***	2.50***	2.35***	2.48***	2.20***	2.01***	2.14***	2.55***
	(0.04)	(0.41)	(0.13)	(0.11)	(0.09)	(0.08)	(0.08)	(0.08)	(0.19)
Number of observations	22,888	236	1,712	2,786	3,438	4,256	5,032	4,308	1,120
Number of respondents	2,496	27	174	280	347	453	563	508	144
R-squared	0.10	0.12	0.18	0.10	0.13	0.10	0.10	0.10	0.10

Note: The table reports estimates of model (1). The dependent variable is *pain of paying*, which is measured on a scale from 1 'absolutely no pain of paying' to 7 'a lot of pain of paying'. Cases with a particular payment method are only included for those respondents who have experience with that payment method. Standard errors are clustered at the individual level and shown in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

5.4. Pain of paying patterns by transaction amount

For all transaction amounts we find that the perceived pain of paying of cash payments is larger than that of other payment methods. Table 7 shows the regression results for different transaction amounts. As the amount increases, the difference in the perceived pain of paying between cash payments and other payment methods also grows larger. There is only one situation in which another payment instrument hurts more than cash. The perceived pain of paying with a credit card is larger than the perceived pain of paying with cash in case of a payment of 5 euros. Dutch consumers are not used to using a credit card in such a situation and it may take them more time than a cash payment, which is likely to make them more cognizant of the loss of financial resources.

5.5. The pain of paying is correlated with personal characteristics

The pain of paying depends on personal characteristics. We ran additional regressions to gain insight into the relationship between personal characteristics and the pain of paying, see Table 8, column 1. The pain of paying among males is 0.2 lower than the pain among females. One possible explanation for this difference is the disparity in income. On average, females earn less than males, which may lead them to place a higher value on money, thereby exacerbating the pain of paying. Recall that valuing money is the root cause of experiencing pain of paying (Xu et al., 2015). Building upon this notion, Reshadi and Fitzgerald (2023) highlight that individual characteristics that intensify the valuation of money consequently amplify the experience of the pain of paying. The pain of paying decreases with age. For example, someone aged 60 experiences 0.8 lower pain of paying than someone aged 20. A possible explanation for the higher pain among young people is that they have a lower budget at their disposal and therefore value money more. People with a high level of education experience more pain of paying than people with a low level of education. People in the lowest income category experience the highest pain of paying. For example, their pain of paying is 0.4 higher than the pain of paying among people in the highest income category. People with a low income are likely to value money more, which amplifies the pain of paying. People who live together with a partner experience less pain of paying than others. A possible explanation is that one experiences less pain when the bill is being shared with other household members. The pain of paying is unrelated to homeownership (our proxy for wealth) nor to

Table 6
Pain of paying patterns vary across gender, education and income groups.

	(1) All	(2) Female	(3) Male	(4) Low education	(5) High education	(6) Income: ≤1850 euros	(7) Income: 1851–2800 euros	(8) Income: 2801–3990 euros	(9) Income: >3990 euros
Payment method (reference category: cash)									
Debit card traditional	−0.43***	−0.42***	−0.44***	−0.39***	−0.51***	−0.22***	−0.49***	−0.52***	−0.49***
	(0.03)	(0.04)	(0.04)	(0.04)	(0.04)	(0.06)	(0.06)	(0.06)	(0.05)
Contactless – debit card	−0.53***	−0.52***	−0.54***	−0.46***	−0.63***	−0.32***	−0.53***	−0.66***	−0.60***
	(0.03)	(0.05)	(0.04)	(0.04)	(0.05)	(0.06)	(0.06)	(0.06)	(0.06)
Contactless – mobile phone	−0.53***	−0.45***	−0.58***	−0.47***	−0.61***	−0.37***	−0.53***	−0.62***	−0.57***
	(0.04)	(0.07)	(0.06)	(0.06)	(0.06)	(0.10)	(0.08)	(0.08)	(0.08)
iDEAL	−0.53***	−0.55***	−0.51***	−0.51***	−0.57***	−0.45***	−0.53***	−0.60***	−0.54***
	(0.03)	(0.05)	(0.05)	(0.05)	(0.05)	(0.07)	(0.07)	(0.07)	(0.07)
Credit card	−0.20***	−0.22***	−0.19***	−0.19***	−0.24***	−0.04	−0.19*	−0.28***	−0.28***
	(0.05)	(0.07)	(0.06)	(0.07)	(0.06)	(0.11)	(0.10)	(0.09)	(0.08)
Type of expenditure (reference category: groceries at the supermarket)									
Outing	−0.05**	−0.03	−0.05**	−0.06**	−0.03	−0.04	−0.06	−0.06	−0.03
	(0.02)	(0.03)	(0.03)	(0.03)	(0.03)	(0.04)	(0.04)	(0.04)	(0.04)
Amount in euros (reference category: 5)									
20	0.19***	0.24***	0.16***	0.18***	0.21***	0.27***	0.14*	0.30***	0.08
	(0.04)	(0.06)	(0.05)	(0.05)	(0.06)	(0.08)	(0.08)	(0.07)	(0.07)
50	0.47***	0.62***	0.35***	0.44***	0.51***	0.62***	0.42***	0.42***	0.44***
	(0.04)	(0.06)	(0.05)	(0.05)	(0.06)	(0.08)	(0.08)	(0.07)	(0.07)
100	0.71***	0.92***	0.53***	0.64***	0.79***	0.85***	0.62***	0.77***	0.61***
	(0.04)	(0.06)	(0.05)	(0.05)	(0.06)	(0.09)	(0.08)	(0.08)	(0.08)
500	1.52***	1.84***	1.26***	1.46***	1.62***	1.64***	1.55***	1.57***	1.37***
	(0.06)	(0.08)	(0.07)	(0.07)	(0.08)	(0.12)	(0.11)	(0.11)	(0.10)
Constant	2.26***	2.25***	2.25***	2.23***	2.30***	2.29***	2.24***	2.27***	2.24***
	(0.04)	(0.06)	(0.05)	(0.05)	(0.06)	(0.08)	(0.07)	(0.07)	(0.07)
Number of observations	22,888	10,750	12,138	13,128	9,726	5,304	5,608	5,748	6,228
Number of respondents	2,496	1,209	1,287	1,498	994	627	621	626	622
R-squared	0.10	0.13	0.08	0.09	0.12	0.09	0.11	0.11	0.10

Note: The table reports estimates of model (1). The dependent variable is *pain of paying*, which is measured on a scale from 1 'absolutely no pain of paying' to 7 'a lot of pain of paying'. Cases with a particular payment method are only included for those respondents who have experience with that payment method. Standard errors are clustered at the individual level and shown in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

whether people live in an urban area.

The pain of paying is also related to other, non-standard, personal characteristics. The results of a regression with these variables are shown in Table 8, column 2. The easier it is for someone to make ends meet with their income, the lower the pain of paying. For example, if it is very hard to make ends meet, the pain of paying is 1.4 (0.36×4) higher than for people who find it very easy to make ends meet with their income. Spendthrifts experience lower pain of paying than tightwads. Recall that the spendthrift-tightwad scale runs from 1 'I have trouble spending money' (tightwad) to 11 'I have trouble limiting my expenses' (spendthrift). People with a score of 11 experience 0.9 (10×0.09) lower pain of paying than people with a score of 1. The higher the frequency of checking the balance on the payments account, the higher the pain of paying. For example, the pain of paying is 0.2 higher for people who check their balance multiple times a day (*frequency of checking the balance* = 5) compared to people who do this only once a month or even less often (*frequency of checking the balance* = 1). The pain of paying is also related to financial literacy. The higher the financial literacy, the lower the pain of paying. For example, people who state that they are very knowledgeable with respect to financial matters (*financial literacy* = 4) report a pain of paying that is 0.2 (3 × 0.08) lower compared to the pain of paying among people who state that they are not knowledgeable (*financial literacy* = 1). When we include these non-standard variables, we no longer find significant income effects. Gender, age, education and partner effects are robust to the inclusion of these variables, the signs of the coefficients do not change and the effects remain significant. Both specifications confirm the results discussed in Section 5.1: cash payments hurt more than electronic payments, paying for an outing hurts less than paying for groceries, and the pain of paying is positively related to the price of the product or service.

Table 7
Pain of paying patterns by transaction amount.

	(1) All	(2) 5 euros	(3) 20 euros	(4) 50 euros	(5) 100 euros	(6) 500 euros
Payment method (reference category: cash)	−0.43***	−0.17***	−0.22***	−0.38***	−0.56***	−0.86***
Debit card traditional	(0.03)	(0.05)	(0.05)	(0.05)	(0.06)	(0.06)
	−0.53***	−0.33***	−0.32***	−0.49***	−0.66***	−0.91***
Contactless – debit card	(0.03)	(0.05)	(0.05)	(0.06)	(0.06)	(0.07)
	−0.53***	−0.35***	−0.29***	−0.50***	−0.68***	−0.89***
Contactless – mobile phone	(0.04)	(0.07)	(0.07)	(0.07)	(0.08)	(0.09)
	−0.52***	−0.27***	−0.28***	−0.46***	−0.64***	−1.09***
iDEAL	(0.04)	(0.08)	(0.07)	(0.08)	(0.08)	(0.10)
	−0.20***	0.42***	0.13	−0.15	−0.37***	−1.05***
Credit card	(0.05)	(0.11)	(0.09)	(0.09)	(0.09)	(0.11)
	−0.43***	−0.17***	−0.22***	−0.38***	−0.56***	−0.86***
Type of expenditure (reference category: groceries at the supermarket)						
Outing	−0.05**	−0.09	−0.11*	0.00	0.07	0.00
	(0.02)	(0.06)	(0.06)	(0.05)	(0.06)	(0.07)
Constant	2.83***	2.05***	2.25***	2.65***	3.06***	4.16***
	(0.03)	(0.06)	(0.05)	(0.05)	(0.06)	(0.06)
Number of observations	22,888	4,440	4,782	4,663	4,554	4,449
Number of respondents	2,496	1,407	1,494	1,453	1,435	1,423
R-squared	0.01	0.02	0.01	0.01	0.02	0.03

Note: The table reports estimates of model (1). The dependent variable is *pain of paying*, which is measured on a scale from 1 'absolutely no pain of paying' to 7 'a lot of pain of paying'. Cases with a particular payment method are only included for those respondents who have experience with that payment method. Standard errors are clustered at the individual level and shown in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

6. The consequences of the pain of paying

6.1. Pain of paying and payment behaviour

The next step is to examine whether payment behaviour is associated with the experienced pain of paying.[3] We relate the intensity of use of contactless payments to the perceived relative pain of paying contactless. Our survey includes the following question to measure the intensity of use of contactless payments relative to the use of other payment methods: "How often did you pay contactless at the cash register in the past month? Please try to make an estimation." Fig. 2 shows the responses. We construct the variable *intensity of use contactless payments* with values 1 '0 times', 2 'At least 1 time, but less than half of my payments', 3 'Half of my payments', 4 'More than half of my payments, but not all of them', and 5 'Every time'. The mean intensity of use of contactless payments is 3.9, which is close to 4 'More than half of my payments, but not all of them'. We estimate ordered logit models to relate the intensity of use of contactless payments to the perceived relative pain of paying contactless. We control for personal characteristics. Unfortunately, we do not have information on perceptions of payment method characteristics, such as speed and user-friendliness. Prior studies have shown that these matter for payment behaviour (e.g. Schuh and Stavins, 2010; van der Cruijsen and Plooij, 2018).

The relative pain of paying contactless is determined based on the POS supermarket scenarios. Recall that the amounts in these four POS supermarket scenarios (cash, debit card traditional, contactless with debit card, and contactless with mobile phone) are the same for a specific respondent but vary across respondents. We calculate the relative pain of paying contactless as follows: *relative pain of paying contactless = pain of paying contactless - pain of paying other payment methods*. We exclusively consider the responses pertaining to the payment methods that the respondent has experience with. For example, when the respondent has both experience with paying contactless by debit card and paying contactless by mobile phone, *pain of paying contactless* is the mean of the pain of paying experienced in these two cases. When a respondent only has experience with one of the two contactless payment types, *pain of paying contactless* is solely based on the specific contactless payment method the respondent has experience with. Similarly, *pain of paying other payment methods* is the mean of the pain of paying experienced when using the debit card in a traditional manner and the pain of paying when using cash. In case the respondent only has experience with one of these two payment methods, *pain of paying other payment methods* is solely based on the perceived pain of paying of that specific payment method. The mean relative pain of paying contactless is −0.3, which means that on average other payment methods hurt more.

We take into account that the amount in the scenarios varies among respondents. This may affect the relative pain of paying contactless. Therefore we estimate a separate model for each amount, next to a model based on all observations. Table 9 shows the results.

The intensity of use of contactless payments is negatively correlated with the relative pain of paying contactless. This holds for all models in Table 9. We focus the discussion of the results on the model based on the total group of respondents with experience (see column (1)) and discuss average marginal effects. A one point lower relative pain of paying contactless goes along with a 6 percentage

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[3] Table B.2 in Appendix B summarises the descriptive statistics of the key variables used in Section 6.

Table 8
The pain of paying is correlated with personal characteristics.

	(1)	(2)
Payment method (reference category: cash)		
Debit card traditional	−0.44***	−0.46***
	(0.03)	(0.03)
Contactless – debit card	−0.54***	−0.54***
	(0.03)	(0.04)
Contactless – mobile phone	−0.54***	−0.53***
	(0.06)	(0.06)
iDEAL	−0.55***	−0.57***
	(0.04)	(0.04)
Credit card	−0.25***	−0.25***
	(0.05)	(0.05)
Type of expenditure (reference category: groceries at the supermarket)		
Outing	−0.04**	−0.04*
	(0.02)	(0.02)
Amount in euros (reference category: 5)		
20	0.12***	0.09*
	(0.04)	(0.05)
50	0.45***	0.43***
	(0.05)	(0.05)
100	0.74***	0.70***
	(0.05)	(0.06)
500	1.52***	1.52***
	(0.06)	(0.07)
Personal characteristics		
Male	−0.16***	−0.12**
	(0.05)	(0.06)
Age	−0.02***	−0.02***
	(0.00)	(0.00)
High education	0.10*	0.15***
	(0.06)	(0.06)
Income: EUR 1851–2800	−0.22***	0.02
	(0.08)	(0.08)
Income: EUR 2801–3990	−0.15*	0.10
	(0.09)	(0.09)
Income: > EUR 3990	−0.37***	−0.01
	(0.09)	(0.10)
Partner	−0.13*	−0.21***
	(0.07)	(0.07)
Homeowner	−0.09	0.05
	(0.06)	(0.07)
Urban area	−0.04	−0.02
	(0.05)	(0.06)
Ease of making ends meet with income		−0.36***
		(0.04)
Spender		−0.09***
		(0.02)
Frequency of checking balance		0.05*
		(0.03)
Financial literacy		−0.08**
		(0.04)
Constant	3.67***	5.31***
	(0.12)	(0.23)
Observations	22,646	19,574
R-squared	0.14	0.17

Note: The table reports estimates of model (2). The dependent variable is *pain of paying*, which is measured on a scale from 1 'absolutely no pain of paying' to 7 'a lot of pain of paying'. Cases with a particular payment method are only included for those respondents who have experience with that payment method. Standard errors are clustered at the individual level and shown in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

points higher likelihood of always paying contactless at the POS. This finding suggests that people try to avoid the pain of paying. The intensity of use of contactless payments is also related to personal characteristics. It decreases with age. For example, the effect on the likelihood of paying contactless all the time is −3 percentage points for an age increase of 10 years. The intensity of use of contactless payments increases with income. For instance, people whose net monthly household income exceeds EUR 3900 are 14 percentage points more likely to always pay contactless compared to those with incomes below EUR 1850. The easier it is to make ends meet with income, the higher the intensity of use of contactless payments. A one point higher value of *ease of making ends meet with income* corresponds to a 4 percentage point higher likelihood of always paying contactless.
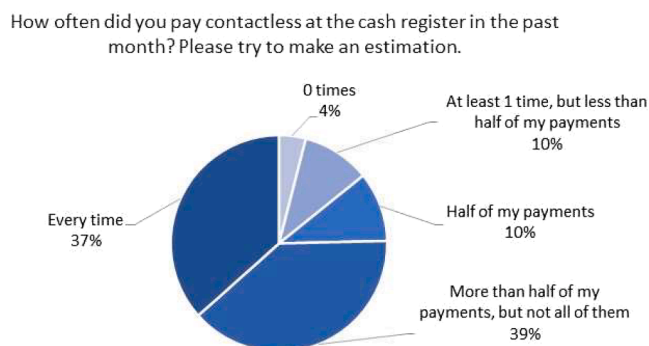
How often did you pay contactless at the cash register in the past month? Please try to make an estimation.

Fig. 2. The intensity of use of contactless payments
Note: The sample includes the 2,176 respondents for which we have estimated the intensity of use of contactless payments models.

Table 9
The intensity of use of contactless payments is negatively correlated with the relative perceived pain of paying contactless.

	(1) All groups	(2) 5 euros group	(3) 20 euros group	(4) 50 euros group	(5) 100 euros group	(6) 500 euros group
Relative pain of paying contactless	−0.25***	−0.40***	−0.32***	−0.47***	−0.18**	−0.12*
	(0.040)	(0.107)	(0.122)	(0.091)	(0.087)	(0.067)
Male	−0.08	−0.16	0.16	0.02	−0.11	−0.29
	(0.083)	(0.196)	(0.192)	(0.180)	(0.190)	(0.187)
Age	−0.02***	−0.02***	−0.01**	−0.01**	−0.02***	−0.02***
	(0.003)	(0.006)	(0.005)	(0.006)	(0.006)	(0.006)
High education	0.11	0.16	−0.03	0.16	0.01	0.16
	(0.088)	(0.198)	(0.213)	(0.195)	(0.203)	(0.204)
Income: EUR 1850–2800	0.37***	0.66**	0.28	−0.06	0.61**	0.41
	(0.126)	(0.304)	(0.337)	(0.273)	(0.263)	(0.279)
Income: EUR 2800–3990	0.47***	0.84**	0.48	0.39	0.65**	0.11
	(0.138)	(0.333)	(0.384)	(0.300)	(0.288)	(0.290)
Income: > EUR 3990	0.68***	0.57	1.05**	0.69**	0.89***	0.24
	(0.154)	(0.361)	(0.449)	(0.333)	(0.331)	(0.330)
Partner	−0.07	−0.12	−0.16	0.11	−0.32	0.19
	(0.106)	(0.248)	(0.295)	(0.221)	(0.228)	(0.252)
Homeowner	−0.05	−0.08	0.19	−0.26	−0.13	−0.02
	(0.101)	(0.251)	(0.226)	(0.232)	(0.225)	(0.227)
Urban area	0.10	0.14	0.27	−0.20	0.35*	−0.07
	(0.086)	(0.204)	(0.194)	(0.193)	(0.196)	(0.195)
Ease of making ends meet with income	0.20***	0.27**	0.21	0.07	0.31**	0.12
	(0.055)	(0.118)	(0.153)	(0.109)	(0.135)	(0.133)
Model significance: Wald Chi-squared	203.28***	55.81***	54.25***	50.50***	59.77***	32.41***
Observations	2,176	413	454	462	432	415

Note: The table reports estimates of ordered logit models. The dependent variable is *intensity of use of contactless payments*, which captures the use of contactless payments at the cash register in the past month and is measured on a scale from 1 '0 times' to 5 'Every time'. Robust standard errors are shown in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

6.2. Pain of paying and preventing overspending

Last, we relate the relatively pain of paying contactless to its relative perceived usefulness in preventing overspending. We calculate the relative perceived useful of contactless payments in preventing overspending as follows: *relative usefulness of contactless payments in preventing overspending = ½ * (usefulness of contactless payments with a debit card in preventing overspending + usefulness of contactless payments with a mobile phone in preventing overspending) - ½ * (usefulness of the traditional usage of the debit card in preventing overspending + usefulness of cash in preventing overspending)*. The usefulness of a specific payment method in preventing overspending is the answer to the question "To what extent do the following payment methods help you to avoid spending too much money?" (see Appendix A, Q10a-Q10d). The answers range from 1 'Does not help at all' to 7 'Helps very well'. On average respondents perceive contactless payments to be worse in preventing overspending than cash payments and the traditional usage of the debit card (see also Table 3). The average relative usefulness of contactless payments in preventing overspending is −1. Table 10 shows the results of linear regressions with *relative usefulness of contactless payments in preventing overspending* as dependent variable. In line with our approach in Section 6.1, we estimate a separate model for each pain of paying scenario amount, next to a model based on all observations.

The relative perceived usefulness of contactless payments in preventing overspending is positively correlated with the relative perceived pain of paying contactless. The lower the perceived relative pain of paying contactless is, the lower the relative perceived

Table 10

The relative perceived usefulness of contactless payments in preventing overspending is positively correlated with the perceived pain of paying contactless.

	(1) All groups	(2) 5 euros group	(3) 20 euros group	(4) 50 euros group	(5) 100 euros group	(6) 500 euros group
Relative pain of paying contactless	0.16***	0.19*	0.06	0.13	0.31***	0.13*
	(0.038)	(0.103)	(0.087)	(0.084)	(0.076)	(0.071)
Male	0.17***	0.32**	−0.04	0.34**	−0.02	0.20
	(0.062)	(0.143)	(0.138)	(0.139)	(0.133)	(0.151)
Age	0.00	−0.00	0.00	−0.01	0.01*	−0.00
	(0.002)	(0.005)	(0.004)	(0.004)	(0.004)	(0.005)
High education	0.04	−0.05	0.11	0.08	−0.04	0.07
	(0.066)	(0.159)	(0.139)	(0.142)	(0.143)	(0.157)
Income: EUR 1850–2800	−0.03	0.11	−0.26	0.11	−0.11	−0.07
	(0.091)	(0.205)	(0.213)	(0.196)	(0.204)	(0.211)
Income: EUR 2800–3990	0.04	0.20	0.01	0.07	−0.05	−0.01
	(0.103)	(0.244)	(0.253)	(0.226)	(0.202)	(0.233)
Income: > EUR 3990	−0.06	−0.28	−0.16	−0.19	0.22	0.02
	(0.107)	(0.259)	(0.255)	(0.236)	(0.231)	(0.237)
Partner	0.07	−0.05	0.19	0.17	0.09	−0.03
	(0.082)	(0.206)	(0.201)	(0.166)	(0.175)	(0.179)
Homeowner	−0.04	−0.03	0.27*	0.16	−0.32*	−0.29
	(0.079)	(0.186)	(0.167)	(0.169)	(0.169)	(0.196)
Urban area	−0.00	−0.11	0.06	0.08	0.22	−0.23
	(0.064)	(0.151)	(0.137)	(0.143)	(0.145)	(0.150)
Ease of making ends meet with income	0.23***	0.33***	0.08	0.17*	0.23***	0.31***
	(0.041)	(0.087)	(0.085)	(0.087)	(0.090)	(0.102)
Constant	−1.91***	−2.10***	−1.68***	−1.77***	−2.04***	−1.71***
Number of observations	2,176	413	454	462	432	415
R-squared	0.04	0.08	0.03	0.05	0.11	0.05

Note: The table reports estimates of linear models. The dependent variable is the *relative usefulness of contactless payments in preventing overspending*. Robust standard errors are shown in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

usefulness in preventing overspending. A one point lower relative pain of paying contactless is associated with a 0.16 lower perceived relative usefulness of contactless payments in preventing overspending. The perceived relative usefulness of contactless payments in preventing overspending is a bit higher for males than females. Lastly, it is positively related to the ease of getting by with income.

7. Concluding remarks

In sum, we find that when people pay in a blink of an eye by paying contactless it hurts less, but they spend more. Consumers' shift from cash to fast electronic payments therefore comes at a risk of increased overspending, which in turn may lead to more difficulties to make ends meet or debt increase.

There are certainly advantages to electronic payment instruments. For example, many people find it faster and easier to pay electronically compared to paying with banknotes and coins. However, our research shows that there are not only benefits. The pain of paying is higher for cash than for electronic payments. It is lowest for contactless payments and iDEAL payments, a popular online payment method used in the Netherlands. As the transaction amount increases, the difference in the perceived pain of paying between cash payments and other payment methods also grows larger. On average, respondents find cash more helpful to prevent overspending and track their expenditures than electronic, and especially contactless, payment methods. When paying with cash, respondents are more aware of the exact amount that they pay. Interestingly, people with a high level of education, a high level of income and older people are particularly likely to experience a higher pain of paying when paying with cash compared to paying electronically at the POS.

For teenagers, the picture that arises is completely different: traditional debit card payments hurt more than cash payments. This finding suggests that the pain of paying patterns depend on experience. Recall that the pain of paying is the negative psychological affect people experience when they become cognizant of a loss of financial resources (Reshadi and Fitzgerald, 2023). An individual's experience with various payment methods may influence the extent to which the individual becomes cognizant of the loss of money when using a particular payment method. This offers an explanation for generational differences in the perceived pain of paying. Whereas teenagers grew up with electronic money, older age groups were raised with banknotes and coins. Young people are inter-twined with their smartphone and use their banking app extensively. A plausible explanation for our finding is that spending money causes them pain when they see a drop in their payments account balance on their smartphone – in other words in the case of an electronic payment – or when they withdraw cash, but less so when they spend the cash in their pocket. Cash is generally associated with higher levels of pain of payment, which can help reduce overspending. If this association does not hold true across generations, it can have significant policy implications, such as for budget control programs.

We also find that the pain of paying is positively related to the price of the goods or service. This is in line with prior research. Moreover, we have found that the sensitivity of the pain of paying to the transaction amount is relatively large for individuals with low

incomes, young people, and females. Given that these groups generally have lower earnings, it is likely that they place a higher value on money, which amplifies the pain of paying and the sensitivity of the pain of paying to the transaction amount. Additionally, the sensitivity of the pain of paying to the transaction amount is also relatively high for individuals with a high level of education. One possible explanation for this finding is that they are more aware of the fact that they are depleting a portion of their financial resources.

The pain of paying is slightly smaller when paying for an outing than when paying for groceries at the supermarket. This effect is significant for respondents in the oldest age category, men and low-educated respondents. A possible explanation for the lower pain of paying for the outing is the higher pleasure associated with it, especially during the pandemic.

Finally, we contribute to the existing body of knowledge regarding the implications of the pain of paying. Our study specifically focuses on the intensity of use of contactless payments and the perceived usefulness of contactless payments in preventing overspending in comparison to other payment methods. The intensity of use of contactless payments is negatively correlated with the pain of paying contactless in comparison to the pain associated with other payment methods. This finding suggests that people try to avoid the pain of paying. The relative perceived usefulness of contactless payments in preventing overspending is positively correlated with the relative perceived pain of paying contactless. The lower the perceived relative pain of paying contactless is, the lower the relative perceived usefulness in preventing overspending.

Our research underscores the importance of tools that help prevent overspending when using electronic payment instruments. Given the declining use of cash, it is crucial for policymakers to devise tools that aid consumers in averting overspending when utilizing electronic payment methods, particularly contactless ones. For example, tools that provide immediate and salient feedback during the payment process. This can include visual or auditory cues that highlight the amount spent or remaining balance, reminding individuals of the financial impact of their transaction in real-time. We strongly encourage research on this topic to explore innovative tools and comprehensively assess the advantages and disadvantages associated with each option. This will enable informed policy decisions regarding the implementation of the most effective tools. To make electronic payment methods more attractive it is key that their ability to prevent overspending improves. This will be especially helpful for those people who experience a relatively low level of pain of paying such as low-educated people and people who have trouble limiting their spending. We also encourage future research that utilizes payment diary data. We believe that such studies could provide significant value in gaining deeper insights into the relationship between pain of paying and payment behaviour.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Data availability

Data will be made available on request.

Appendix A. Survey questions

The purpose of this questionnaire is to learn more about your payment behaviour.

Q1
First of all, we are interested in your payments at physical points of sale, for example at a checkout in a shop or in a restaurant. We call these payments at the cash register.
How do you prefer to pay at the cash register?

○ Cash (coins and/or banknotes)
○ By inserting a debit card into the payment terminal
○ Contactless by debit card
○ Contactless by mobile phone
○ Other

Q2
How often did you pay contactless at the cash register in the past month? Please try to make an estimation.

○ 0 times
○ At least 1 time, but less than half of my payments
○ Half of my payments
○ More than half of my payments, but not all of them
○ Every time

Q3a-Q3d

Is your payment behaviour at the cash register different now compared to before the COVID-19 pandemic?

Q3a Portion of my cash register purchases that I pay with cash

Q3b Portion of my cash register purchases that I pay by inserting a debit card into the payment terminal

Q3c Portion of my cash register purchases that I pay contactless with a debit card

Q3d Portion of my cash register purchases that I pay contactless with a mobile phone

○ Decreased
○ Stayed the same
○ Increased

Q4

We are also interested in your online shopping payments. How often did you shop online before the COVID-19 pandemic started?

○ Never
○ Less than once a month
○ Once a month
○ 2–4 times a month
○ 5 times a month or more

Q5

How often do you shop online now?

○ Never
○ Less than once a month
○ Once a month
○ 2–4 times a month
○ 5 times a month or more

You can only spend money once. Therefore, we can experience pain of paying when we pay.

Next, we sketch four different situations. For each situation we ask you to estimate how much pain of paying you expect to experience.

Q6a – Q6d

Suppose you go to the supermarket for grocery shopping. At the checkout you need to pay [5 / 20 / 50 / 100 / 500][4] euros. The groceries are for yourself.

How much pain of paying would you then experience when using below payment methods?

Q6a Cash (coins and/or banknotes)

Q6b By inserting a debit card into the payment terminal

Q6c Contactless by debit card

Q6d Contactless by mobile phone

1. Absolutely no pain of paying

2.

3.

4.

5.

6.

7. A lot of pain of paying

Q7a – Q7d

Suppose you go on a outing and have to pay for yourself [5 / 20 / 50 / 100 / 500] euros at the end of the outing.

How much pain of paying would you then experience when using below payment methods?

Q7a Cash (coins and/or banknotes)

Q7b By inserting a debit card into the payment terminal

Q7c Contactless by debit card

Q7d Contactless by mobile phone

1. Absolutely no pain of paying

2.

---

[4] For each scenario, we randomised the amount respondents had to pay.

3.
4.
5.
6.
7. A lot of pain of paying

Q8a – Q8b
Suppose you order groceries of [5 / 20 / 50 / 100 / 500] euros online and have to pay for these immediately online. The groceries are for yourself.
How much pain of paying would you then experience when using below payment methods?
Q8a iDEAL
Q8b Credit card
1. Absolutely no pain of paying
2.
3.
4.
5.
6.
7. A lot of pain of paying

Q9a – Q9b
Suppose you make an online reservation for an outing of [5 / 20 / 50 / 100 / 500] euros and you have to pay for this outing immediately. The outing is for yourself.
How much pain of paying would you then experience when using below payment methods?
Q9a iDEAL
Q9b Credit card
1. Absolutely no pain of paying
2.
3.
4.
5.
6.
7. A lot of pain of paying

Q10a-Q10b
To what extent do the following payment methods help you to avoid spending too much money?
Q10a Cash (coins and/or banknotes)
Q10b By inserting a debit card into the payment terminal
Q10c Contactless with a debit card
Q10d Contactless with a mobile phone
1. Helps not at all
2.
3.
4.
5.
6.
7. Helps very well

Q11a-Q11d
To what extent do the following payment methods help you gain insight into how much money you spend and on what?
Q11a Cash (coins and/or banknotes)
Q11b By inserting a debit card into the payment terminal
Q11c Contactless with a debit card
Q11d Contactless with a mobile phone
1. Does not help at all
2.
3.
4.
5.
6.
7. Helps very well

Q12a-Q12d
Do you look at the exact amount before you pay?
Q12a Cash (coins and/or banknotes)
Q12b By inserting a debit card into the payment terminal
Q12c Contactless with a debit card
Q12d Contactless with a mobile phone

○ Never
○ Sometimes
○ Half of the time
○ Often
○ Always
○ I don't use this payment method

Q13
Which description best fits you?
1. I have trouble spending money.
2.
3.
4.
5.
6. About the same or neither of both.
7.
8.
9.
10.
11. I have trouble limiting my expenses.

Q14a – Q14c
What method do you use to check the balance of your main payments account? Multiple answers are possible.
Q14a The banking app on a mobile phone.
Q14b The website of my bank.
Q14c Paper statement

○ No
○ Yes

Q15
On average, how often do you check the amount of money in your main payments account?

○ Once a month or less often
○ 2 or 3 times a month
○ 1 to 6 times a week
○ Once a day
○ Multiple times a day

Q16a—Q16f
In what ways have you ever made payments?
Q16a Cash (coins and/or banknotes)
Q16b By inserting a debit card into the payment terminal
Q16d Contactless with a debit card
Q16d Contactless with a mobile phone
Q16e iDEAL
Q16f Credit card

○ Yes
○ No

Q17
How hard or easy is it for you to make ends meet with your income?

- ○ Very hard
- ○ Hard
- ○ Nor hard, nor easy
- ○ Easy
- ○ Very easy

Appendix B. Summary statistics

Table B1
Summary statistics of variables used the pain of paying analysis.

Variable	Mean	Sd	Min	Max	N
Dependent variable					
Pain of paying	2.64	1.99	1	7	30,080
Key explanatory variables					
Payment method					
Cash (reference category)	0.17	0.37	0	1	30,080
Debit card traditional	0.17	0.37	0	1	30,080
Contactless – debit card	0.17	0.37	0	1	30,080
Contactless – mobile phone	0.17	0.37	0	1	30,080
iDEAL	0.17	0.37	0	1	30,080
Credit card	0.17	0.37	0	1	30,080
Type of expenditure					
Groceries at the supermarket (reference category)	0.50	0.50	0	1	30,080
Outing	0.50	0.50	0	1	30,080
Amount in euros					
5 (reference category)	0.19	0.39	0	1	30,080
20	0.21	0.41	0	1	30,080
50	0.21	0.40	0	1	30,080
100	0.20	0.40	0	1	30,080
500	0.20	0.40	0	1	30,080
Personal characteristics					
Male	0.53	0.50	0	1	22,646
Age	55.43	16.91	16	96	22,646
High education	0.42	0.49	0	1	22,646
Income: EUR 1850 or less (reference category)	0.23	0.42	0	1	22,646
Income: EUR 1851–2800	0.24	0.43	0	1	22,646
Income: EUR 2801–3990	0.25	0.43	0	1	22,646
Income: > EUR 3990	0.27	0.44	0	1	22,646
Partner	0.69	0.46	0	1	22,646
Homeowner	0.72	0.45	0	1	22,646
Urban area	0.42	0.49	0	1	22,646
Ease of making ends meet with income	3.66	0.84	1	5	19,574
Spender	5.90	1.64	1	11	19,574
Frequency of checking the balance	2.78	0.97	1	5	19,574
Financial literacy	2.25	0.75	1	4	19,574

Note: This table describes the variables used in the regressions reported in Table 4, 5, 6, 7 and 8. The mean, standard deviation (sd), minimum (min), maximum (max) and number of observations (N) are reported.

Table B2
Summary statistics of key variables used in Section 6.

Variable	Mean	Sd	Min	Max	N
Intensity of use of contactless payments	3.94	1.11	1	5	2,176
Relative usefulness of contactless payments in preventing overspending	−0.99	1.44	−6	5	2,176
Relative pain of paying contactless	−0.34	1.12	−6	6	2,176

Note: This table describes the key variables used in the regressions reported in Table 9 and 10. The mean, standard deviation (sd), minimum (min), maximum (max) and number of observations (N) are reported.

Appendix C. Additional results

Table C1
The pain of paying depends on the payment method, the type of expenditure and the amount paid: ordered logit models.

	(1) All cases	(2) Experience-based cases	(3) Cases of respondents who have experience with all payment instruments
Payment method (reference category: cash)			
Debit card traditional	−0.60***	−0.72***	−0.84***
	(0.04)	(0.05)	(0.09)
Contactless – debit card	−0.64***	−0.92***	−1.20***
	(0.05)	(0.05)	(0.11)
Contactless – mobile phone	−0.13**	−0.91***	−1.19***
	(0.06)	(0.07)	(0.12)
iDEAL	−0.66***	−0.90***	−0.95***
	(0.05)	(0.06)	(0.12)
Credit card	0.20***	−0.38***	−0.70***
	(0.06)	(0.08)	(0.15)
Type of expenditure (reference category: groceries at the *supermarket)*			
Outing	−0.08***	−0.09**	−0.09
	(0.03)	(0.04)	(0.09)
Amount in euros (reference category: 5)			
20	0.47***	0.55***	0.42**
	(0.06)	(0.08)	(0.17)
50	0.91***	1.17***	1.24***
	(0.06)	(0.08)	(0.17)
100	1.28***	1.63***	1.55***
	(0.07)	(0.09)	(0.19)
500	2.27***	2.98***	3.03***
	(0.08)	(0.11)	(0.24)
Number of observations	30,080	22,888	5,628
Number of respondents	2,508	2,496	469
Wald $\chi 2$	1752.4***	1352.9***	374.0***

Note: Regression results of ordered logit models. The dependent variable is *pain of paying*, which is measured on a scale from 1 'absolutely no pain of paying' to 7 'a lot of pain of paying'. Standard errors are clustered at the individual level and shown in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

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