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An Empirical Study of Payment Technologies, the Psychology of Consumption and Spending Behavior in a Retailing Context

Abstract

Our study investigates differences in spending behavior among consumers using three alternative payment technologies: cash, credit cards, and stored value contactless smart cards. We provide a deeper understanding of how different payment mechanisms directly impact consumer spending behavior in a retailing context, their influences on customers' psychology of consumption, and perceptions of payment technologies. We show that the payment process can do so by significantly affecting subjective awareness of spending only. In contrast, the source of money can affect perceived payment security only. Both perceived security and convenience have little effect on spending behavior.

Keywords: Payment mechanism, Payment technology, Psychology of Consumption, Pain of paying, Spending behavior

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1. Introduction

How does consumer payment choice influence spending behavior? Recent advances in information systems (IS) and consumer research have shown that payment mechanisms significantly affect consumer decisions and consumption patterns [See-To & Ho, 2016; Chau & Poon, 2003; Poon & Chau, 2001]. This issue is not only of strategic importance to both payment service vendors and merchants, who concern about facilitating consumers' service experience by providing a better designed payment systems and technology [McKenna et al., 2013; See-To & Ho, 2016], but is also of interest to consumers, who should be aware of such psychological effects to avoid losing control of their spending [Haws et al., 2012].

Technology, as a customer interface, influences consumer behaviors significantly [Ho, See-To & Chiu, 2013; Burke, 2002]. Payment technology is one such interface facilitating the transfer of money between retailers and consumers. The ability of payment methods to moderate spending behavior lies largely in the psychological effects they have on consumers by influencing consumer decision processes [Hawes, 1987]. These psychological effects are caused by payment mechanisms, the psychology of consumption, and user perceptions about the payment technology concerned.

One of the hottest focuses in the above research area is the study of factors that influence the adoption of information technology [Cui & Pan, 2015; See-To & Ho, 2016], which is an IS issue. Payment technologies and mechanisms, as one of the most important implementations of information technology, have attracted attention from scholars for more than two decades. This research domain not only relates to the information technology perspective, but also involves psychological studies. For example, Plouffe et al. [2001] tried to understand merchant adoption of a smart card-based payment system through consumer

psychological perspective. More recently, See-To and Ho [2016] reported their findings on showing how consumer perception of the design attributes of an E-payment service, as well as the source of funding in topping up the RFID-based payment card may affect the adoption and the usage of such service. These results suggest that payment mechanisms are characterized by the source of money and the payment process, and both have been shown to influence spending [Arkes et al., 1994; Soman, 2001; 2003; See-To, 2007; Trump et al., 2014]. The effects of payment methods on spending are complicated by their underlying mechanisms. For instance, it is not clear whether the effect of credit cards on spending is itself affected by the credit card payment process (in the absence of cash), or the source of credit card money (on the credit factor) [Khan & Craig-Lees, 2009].

The psychology of consumption is predicated on the fact that most rational consumers dislike making payments – not just because it reduces their wealth, but also due to the process of paying itself, which is technology related. Zellermyer [1996] called this as the “pain of paying” and found that it varies with the payment technology. Soman [2001] showed that the pain of paying was modified by perceived payment timing and the forgettability of the transaction, for which further supports had been found by other studies in the past few years [Kamleitner & Erki, 2013; Soster et al., 2014].

User perceptions of payment technologies center on the perceived security and convenience of the payment. Security and convenience perceptions are central factors in consumer payment choice [Westland, 2002]. Studies have shown that these are the two major payment technology-related user perception factors frequently cited in the literature [Chau & Poon, 2003; Poon & Chau, 2001]. People will base the decision on whether or not to use a particular payment method on these perceptions [Humphrey et al., 1996; Paynter & Law, 2001].

To further probe into the research issues that we have mentioned, we design this study

to investigate the differences in the spending behavior of consumers using three alternative payment technologies: cash, credit cards, and stored value contactless smart cards. We empirically investigate the inter-relationship of the payment mechanism, the psychology of consumption, and user perceptions of payment technologies. The effects of these three constructs on spending behavior, as characterized by transaction amount and shopping frequency, are studied. Real transaction and survey data were collected through a field study of six large supermarkets in a large city, i.e., Hong Kong, to empirically test our hypotheses developed.

Extant research on the psychological effects of card payments has been focused on debit cards. Research on credit cards only has discussed the topic from a theoretical perspective based on behavioral economics assumptions (for example, Thaler [1999]). Their study lacks empirical evidence of the effects card payments have on spending, especially at a real transaction level. Plus, while some studies (for example, Bronnenberg et al., [2008] and Klee [2008]) use transaction data, but the analyses are limited in scope to payment choice only. In order to remedy this research gap, our study empirically compared the psychological effects of paying by cash, credit card, and stored-value contactless smart card, and provided detailed quantitative evidence to uncover their inter-relationship.

For practical consideration, we contribute to the literature and reality by providing a deeper understanding of how different payment mechanisms impact consumer spending behavior in a retailing context, either directly or by influencing customers' psychology of consumption, and perceptions of the payment technologies. The evidence of real-world data has shown that the mere expectation of a specific payment by credit card can elicit significantly higher spending compared to expected cash payment. Raghubir and Srivastava [2008] found that when given the same restaurant menu without prices, those who expected the payment would be made by credit card gave a significantly higher cost estimation than

those who expected the payment would be made by cash. The “overspending” condition is supported by substantial evidence [Tokunaga, 1993]. However, what the role of payment mechanism is playing in influencing future spending behavior is still waiting for further exploration. Our results have practical implications for banks and other issuers of new payment technologies who typically share a common risk – insufficient usage – and for merchants choosing which payment technology to apply. Consumers will find the results useful in developing a better understanding of their innate psychological bias. This will help aware consumers avoid unintentional overspending that would otherwise put them in a relatively disadvantageous position.

Our study also contributes to the measurement of transaction forgettability. We measure transaction forgettability from both a subjective and an objective perspective. The subjective perspective is captured by “preciseness”. Preciseness measures a consumer’s subjective awareness of a transaction. It is determined by the number of decimal places recorded when a consumer is asked to estimate the actual transaction amount. The consumer determines the number of decimal places to record without any interference. Even if the transaction is for a whole amount, it is still possible that a consumer will record decimal places. “Memory error”, which is the difference between the real transaction amount and the amount estimated by a consumer, measures the objective accuracy of the consumer’s memory of the transaction. The findings of our study show that this is a valuable distinction as the two variables were affected differently by payment mechanisms and exerted differential effects on spending.

This study also provides a deeper understanding of how the sources of money and the payment processes have different impacts on spending. Our analysis shows that the payment mechanism (the source of money and the payment process) cannot moderate the objective ability of a consumer to remember a transaction (memory error). However, the payment

process can have a significant influence on the consumer's subjective awareness of a transaction (preciseness). This is true in the context we examine – supermarket shopping – where most transactions are for smaller amounts and purchases are normally low involvement items. The results may differ in other contexts such as department stores, which would be an interesting area for future research.

While preciseness is related to people's awareness of spending, the memory error is concerned with people's ability to remember their spending. A lower level of either preciseness or memory error can decrease payment pain. We show that although the payment process can moderate payment pain, the source of money cannot. However, the influence of the payment process is seen only in the awareness of spending (preciseness) and not in the ability to remember the spending (memory error). In combination with the finding that the effect of a consumer's objective ability to remember a transaction on the amount the consumer spends is greater than the effect of the consumer's subjective ability to remember a transaction, this overall result carries significant managerial implications for the use of payment schemes as a strategic tool to moderate payment pain. Nevertheless, the result could be due to the specific context of supermarket shopping examined here. The question of whether both preciseness and memory error are affected when consumers buy high-involvement items is a key issue for future research.

Previous research suggests that the source of money has a psychological impact on consumption [Arkes et al., 1994]. However, discussion about the nature of this effect is limited to theoretical predictions. Khan and Craig-Less [2009] pointed out that it is not clear whether the effect of credit cards on consumer behavior is based on the credit card payment process (the absence of cash) or the source of credit card money. Our study furthers the understanding of this issue by providing empirical evidence to explain the reasons behind. We show that the source of money is related to perceptions of the payment technology

through perceived payment security only. The source of money does not have any effect on perceived payment convenience and is not related to payment pain or spending behavior. The source of money and the payment process may have opposite effects on the perceived security of a payment method. In the case of a stored value card loaded with cash, the source of money (cash) is positively associated with perceived payment security, while the payment process has a negative effect on security perceptions.

The last but not least, our study also shows that the physical payment process moderates the user perceptions of the associated payment method. With cash as the benchmark case, the stored value card payment process, which does not involve a signature or password, has a positive effect on perceived payment convenience and a negative effect on perceived payment security. Similarly, the credit card payment process, which requires either a signature or a password, is positively associated with perceived payment security. Surprisingly, it has nothing to do with perceived payment convenience. This may show that a mature payment method, such as credit cards, is perceived as similar to cash in terms of ease of use. User perceptions of the associated payment method, on the other hand, have little effect on spending behavior. Only perceived payment security has a slightly positive effect on single transaction value.

The rest of this paper is structured as follows. Section 2 presents our theoretical background and development of hypotheses. Then, we outline our methodology and data collection in Section 3. Afterward, we describe our findings in Section 4. Section 5 presents our discussion on the findings, as well as the theoretical contributions, managerial implications, limitations, and future research directions related to this research. Then, we conclude our paper in Section 6.

2. Research model and development of hypotheses

2.1 Payment mechanisms and transaction forgettability

The psychological effects a mechanism underlying a payment method on consumers are complicated by the fact that the mechanism consists of two aspects: the source of money and the physical payment process. Following prior research, we differentiate between sources of money according to whether or not they are credit-bearing and divide payment processes into cash and non-cash processes. The source of money thus refers to whether the transaction is conducted using credit (i.e., through a credit card or a stored value card linked to a credit card account), a non-credit bearing source such as a bank account (i.e., through a stored value card linked to a bank account), or cash (cash or a stored value card topped up with cash). Khan and Craig-Lees [2009] raised the question of whether the effect of credit cards on consumer behavior is affected by the credit card payment process (the absence of cash) or the source of credit card money. In practice, the psychological effects of the source of money and the payment process have different mechanisms. When the source of money is a credit-bearing account, it may influence spending through the credit factor. The influence of the source of money may also be explained by the mental accounting theory [Thaler, 1999], which suggests that consumers place spending into different “mental accounts” and that their willingness to pay for a particular product depends on the balance of the mental account to which the product belongs. Consumers’ decisions on which product belongs to which mental account may change, when they source money from different accounts. Thus, we hypothesize separately on the effects the source of money and the payment process have on transaction forgettability. Because there is only a limited amount of research involving separate investigations of these two effects, we assume where appropriate that a credit-bearing source of money and a non-cash payment process have similar effects unless there is evidence to the contrary.

H1a: When the source of money used for payment is cash, the level of precision with which the payment is recalled will be higher than when the source of money used for payment is

credit.

H1b: When the source of money used for payment method is a bank account, the level of precision with which the payment is recalled will be lower than when the source of money used for payment is credit.

H1c: When the source of money used for payment is cash, the memory error of the consumer will be lower than when the source of money used for payment is credit.

H1d: When the source of money used for payment is a bank account, the memory error of the consumer will be higher than when the source of money used for payment is credit.

In this study, we would also like to investigate the impact of a new type of payment methods, i.e., the stored value contactless smart cards, which is a popular type of payment method used in the Pacific Asia, such as Hong Kong, Taiwan and Japan [See-To & Ho, 2016]. One of the most famous models of the smart card is the Octopus card, which has been used in Hong Kong for nearly two decades and is a popular smart card payment system in Hong Kong. As we collect our data from subjects recruited from Hong Kong, therefore, it is a natural choice for us to include Octopus card in our analysis, as this will provide us with an opportunity to compare the use of stored value contactless smart card for payment with other payment methods. Therefore, the following hypotheses in respect of Octopus card are developed.

H2a: When the payment process used is Octopus card, the level of precision with which the payment is recalled will be lower than when the payment process used is cash.

H2b: When the payment process used is credit card, the level of precision with which the payment is recalled will be lower than when the payment process used is cash.

H2c: When the payment process used is Octopus card, the memory error of the consumer will be higher than when the payment process used is cash.

H2d: When the payment process used is credit card, the memory error of the consumer will

be higher than when the payment process used is cash.

The strength of consumer memory about purchases is moderated by different payment mechanisms [Soman, 2001] and has important effects on consumer spending. Weaker memory of transactions is observed in card payments, which are simpler to use as they involve fewer steps in the payment transaction (less rehearsal) than cash. Consumption is higher when purchases are settled by cards. Merchants, of course, make this assumption and this explains why they are willing to incur the overhead costs associated with credit card payments (typically 1-3% of the purchase price). In addition, it has been shown that prior payment has an adverse impact on future consumption [Thaler, 1980], a phenomenon called the sunk cost effect [Health, 1995; Kahneman & Tversky, 1984]. There is evidence that consumers will eventually forget and ignore these sunk costs [Arkes & Blumer, 1985]. The gradual reduction of the sunk cost effect is called payment depreciation [Gourville & Soman, 1998] and is enhanced by weaker transaction memory. We thus have the following hypotheses:

H3a: The preciseness of the payment method will negatively affect the amount consumers spend in transactions.

H3b: The preciseness of the payment method will negatively affect the frequency of consumers' transactions.

H3c: Consumers' memory error will positively affect their transaction amount.

H3d: Consumers' memory error will positively affect their transaction frequency.

2.2 *Perceived security*

Past research has shown that credit cards are considered to offer a more secure payment process than cash [Hirschman, 1982; Carow & Staten, 1999]. Moreover, people tend to use other payment methods than cash because the loss incurred when a credit card is stolen is limited to a fixed amount of money [Humphrey et al., 1996]. For example, if a person in

Hong Kong loses his or her credit card and reports the matter to the card issuer within a reasonable period, the maximum liability of the cardholder for card losses incurred before the reporting time is only HK\$500, i.e., around US\$64 [The Hong Kong Association of Banks & The DTC Association, 2009]. We expect that credit cards will be considered to be more secure than cash given that people can expect to recover the bulk of any loss suffered when their credit card is stolen.

A previous study has revealed that people consider security to be the most essential aspect requiring improvement in Octopus card [Paynter & Law 2001]. The same study shows that a large proportion of respondents refuse to use Octopus card for all of their purchases because of security concerns, implying that users of Octopus card are skeptical about its security standards. Moreover, Octopus card is technologically less secure than its competitors, Mondex and Visa cash card [Chau & Poon, 2003; Poon & Chau, 2001]. Therefore, Octopus card is considered to have a low degree of relative salience in both actual physical form and the amount paid [Soman, 2003]. These attributes make it difficult for consumers to notice errors that occur during transactions. Thus, it is reasonable to predict that Octopus card is perceived as the payment process with the lowest level of security.

However, in contrast to the findings of the research studies previously mentioned, Arango and Taylor [2009] and Jonker (2007) showed that cash is perceived to be more secure than credit cards. Khan and Craig-Lees [2009] raised the issue of whether the effect credit cards have on consumer behavior is affected by the credit card payment process (the absence of cash) or the source of credit card money (the credit factor). We thus propose that the perceived security of a means of payment may be affected by both the source of money and the payment process. Because the source of money and the payment process may have opposite effects on the perceived security of credit cards, the contradictory results in the extant literature on the perceived security of credit cards may be attributable to the different

emphases consumers place on each of these aspects. As a source of money, cash is likely to be perceived as more secure than credit and bank accounts because one of its properties is anonymity [Kahn et al., 2005]. Consumers are thus more likely to lose their privacy when they use a means of payment for which the source of money is a bank deposit or credit than when they use a means of payment for which the source of money is cash. A loss of privacy may expose the consumer to the risk of identity theft, which can seriously harm the victim [Milne, 2003]. Moreover, people who acquire a bad credit record after having their credit card stolen by identity thieves can find it a very costly experience [Arango & Taylor, 2009]. We thus predict that bank accounts are considered a more secure source of money than credit.

H4a: When the source of money for the payment method is cash, the perceived security of the transaction will be higher than when the source of money for the payment method is credit.

H4b: When the source of money for the payment method is a bank account, the perceived security of the transaction will be higher than when the source of money for the payment method is credit.

H5a: When the payment process used is Octopus card, the perceived security of the transaction will be lower than when the payment process used is cash.

H5b: When the payment process used is credit card, the perceived security of the transaction will be higher than when the payment process used is cash.

Consumers using debit cards or checks tend to spend more per transaction than do consumers using cash [Bounie & François 2006; Caskey & Sellon, 1994]. One of the possible reasons for this is that people feel insecure when they handle a large amount of cash [Boeschoten, 1998]. Consumers who plan to make a large purchase, therefore, tend to use a more secure means of payment. We predict that the transaction amount is higher when the means of payment is perceived to be more secure. Therefore, we have the following

hypotheses:

H6a: Consumers' perceived security of the payment method will positively affect their transaction amount.

H6b: Consumers' perceived security of the payment method will positively affect their transaction frequency.

2.3 *Perceived convenience*

Plummer [1971] showed that credit cards are considered to be more convenient than cash. Canner and Luckett [1992] also revealed that credit cards have a convenience advantage over cash and checks. Credit cards are also convenient in that the consumer does not have to worry about having the funds available to complete the purchase [Zywicki, 2000]. On the other hand, smart card technology is designed to provide consumers with a payment option that is more convenient than cash [Truman et al., 2003]. This convenience is one of the factors, which makes Octopus card successful [Paynter & Law, 2001]. Jonker [2007] also found that smart cards are perceived to have a higher transaction speed than cash. We thus predict that Octopus card is perceived to be a more convenient payment process than cash.

Bank accounts should also be considered to offer a more convenient source of money than credit. This is because a consumer does not need to clear the balance of his/her credit account regularly when using a means of payment for which the source of money is a bank [Caskey & Sellon, 1994]. Credit should be considered to be a more convenient source of money than cash because the user of a payment method for which the source of money is credit does not need to worry about whether funds are available to complete the purchase [Zywicki, 2000], while it would be inconvenient for consumers to withdraw cash from an ATM [Caskey & Sellon, 1994] or reload their Octopus card. Thus, we have the following hypotheses.

H7a: When the source of money for the payment method is cash, the perceived convenience

of the transaction will be lower than when the source of money for the payment method is credit.

H7b: When the source of money for the payment method is a bank account, the perceived convenience of the transaction will be higher than when the source of money for the payment method is credit.

H8a: When the payment process used is Octopus card, the perceived convenience of the transaction will be higher than when the payment process used is cash.

H8b: When the payment process used is credit card, the perceived convenience of the transaction will be higher than when the payment process used is cash.

Salient payment methods should also be perceived to be less convenient than other payment methods. This is because a salient payment method involves rehearsal steps that make the payment more memorable [Soman, 2001], and these steps make the payment method less convenient. A convenient payment method will, therefore, make the transaction less memorable. As the pain of paying experienced by a consumer will be less severe when the transaction is less memorable and the pain of paying has a negative effect on the amount a consumer spends [Prelec & Loewenstein, 1998; Raghurir & Srivastava, 2008], consumers are likely to spend more per transaction when the payment method used is perceived to be more convenient. The following propositions summarize the preceding discussion:

H9a: Consumers' perceived convenience of the payment method will positively affect their transaction amount.

H9b: Consumers' perceived convenience of the payment method will positively affect their transaction frequency.

2.4 *Source of money*

Credit-bearing sources of money may encourage spending. Soman [2001] found that credit card users tend to experience less pain than those who pay by check and are, therefore,

more willing to spend. Prelec and Simester [2001] found similar results in an experimental auction setting. Subjects who were told to pay by credit card bid a significantly higher amount for the same good than those who were told to pay by cash. Hirschman [1979] employed actual consumer transaction data to show that credit card payers spend significantly more than consumers who use cash or checks. Arkes et al. [1994] showed that the source of money has a significant impact on spending decisions. See-To [2007] conducted an online survey to demonstrate the effects of the source of money. Given our measures of spending behavior (transaction amount and transaction frequency) and payment timing, we have following hypotheses:

H10a: When the source of money for the payment method is cash, the consumer's transaction amount will be lower than when the source of money for the payment method is credit.

H10b: When the source of money for the payment method is cash, the customer's transaction frequency will be lower than when the source of money for the payment method is credit.

H10c: When the source of money for the payment method is a bank account, the consumer's transaction amount will be lower than when the source of money for the payment method is credit.

H10d: When the source of money for the payment method is a bank account, the consumer's transaction frequency will be lower than when the source of money for the payment method is credit.

2.5 Payment timing

Payment technology moderates the psychological effect of the "pain of paying" through the deferral of payment and the forgettability of a transaction [See-To, 2007; Soman, 2001, 2003; Soman & Lam 2002; Heath & Soll, 1996]. When payment has been deferred in prior purchases, e.g., by buying on credit, then the consumer subsequently purchases more

than he would have if he had previously used cash [See-To, 2007; Soman 2001]. Payment timing is important as payment means are mainly classified according to timing and it has a significant impact on consumer spending decisions. This is evidenced by the saying “pay in advance by prepaid (or stored value) card, pay now by debit card, or pay later by credit card”, which is a slogan from www.visa.com. Soman [2001] showed that payment timing affects consumption decisions.

Loewenstein and O’Donoghue [2006] suggested that the pain of paying is a negative emotion experienced by consumers when they make a purchase and that credit cards are a payment method that reduces the pain of paying by delaying the payment into the future. Given that this type of negative emotion is a mechanism through which consumers control themselves, credit cards enable consumers to suspend their self-control in spending. Inman et al. [2009] showed that paying by cash instead of by credit card reduces the likelihood of making unplanned purchases because credit cards, by deferring payment, decouple the pain of paying. We thus have the following hypotheses:

H11a: When the timing of the payment method is pay later, the consumer’s transaction amount will be larger than when the timing of the payment method is pay now.

H11b: When the timing of the payment method is pay later, the consumer’s transaction frequency will be higher than when the timing of the payment method is pay now.

3. Methodology and data collection

3.1 Octopus card

Recent advances in payment card technology have seen the emergence of a new type of payment card: the personalized Octopus card, which is available in Hong Kong. The ordinary Octopus card was originally a stored value smart card used for making micro-payments. Octopus card is the market leader of stored value card in Hong Kong. By November 2016, about 33 million Octopus cards were in circulation in Hong Kong

(Company website of Octopus, 2017). With Hong Kong's population estimated at about 7.4 million, the average was more than four cards per person. As of November 2016, more than 99% of citizens in Hong Kong possessed at least one Octopus card. The popularity of Octopus card ensured the generality of the analysis result, and also, practical implications retrieved from this study are more valuable for card stakeholders. In Hong Kong, the Octopus card has been very successful as a medium for micro-payments for transportation and small purchases at most convenience stores, supermarkets, parking meters, vending machines. This stored value card has become a necessity of local people. Consumers in Hong Kong understand well on how it works in the payment process and are familiar with the mechanism behind this card. This is an important factor for us to investigate consumer perception and psychology on "stored value card".

The personalized Octopus card is an advanced version of the original card which offers an innovative function: consumers can choose to load money manually by cash, automatically from a bank account, or automatically from a credit card account. In other words, this innovative function enables consumers to use the settlement methods of stored value cards, debit cards, and credit cards via their personalized Octopus card. This recent advance in smart card payment technology enables us to study the differential effects of the source of money and the payment process on consumer behavior. The source of money for the same Octopus card payment process may vary from cash to a bank account or credit card. This variation in the source of money within the same payment process is not available via cash or credit cards, the latter of which are always linked to a credit account.

In this study, we choose Hong Kong as the study region as its mercantile environment is an optimal setting for analyzing the consumer psychology of payment systems because many of Hong Kong's economic parameters are controlled by government policy and historical precedent. Nowadays, Hong Kong has constructed mature and diverse payment

mechanisms including cash, debit, credit cards, and the Octopus card. These four payment mechanisms are also highly adopted in other developed countries such as North America and Europe. In addition, Hong Kong's currency is stable (pegged to the US dollar under a currency board arrangement, the current rate is 1US\$ = 7.8HK\$) and the population has a broad middle class whose levels of literacy and economic sophistication are among the highest in the world. With the exception of Australia, Hong Kong's credit card and the market have a longer history than any other countries of the Asia Pacific region [Chan, 1997]. The developed credit-bearing payment mechanism in Hong Kong leads to the higher adoption of credit card or related products. The results in Hong Kong would be somewhat typical of many other industrialized countries. The choices made by Hong Kong consumers can be presumed, within the context of this study, to be informed, consistent over time, and more dependent on cash product characteristics than perhaps is possible in any other market in the world. The consumer psychologies associated with the three payment methods examined in this paper are thus most strongly influenced by their underlying payment characteristics.

3.2 Data collection

We conducted a three-week field study to collect the data. Four researchers were recruited and six supermarkets from different regions were used as data collection points. During the field study, the researchers waited outside the supermarkets and when a consumer came out with his/her purchases, the researcher would approach the consumer. The researcher would identify him/herself and explain that s/he was conducting a consumer study for a local university. The consumer participated in the study by giving his/her transaction receipt to the researcher. Once the consumer had provided the receipt, the researcher filled in a questionnaire for the consumer. The respondents were assured that their identity would not be revealed by the data collected and that their privacy would not be infringed. All data collected

were used for this study only. To encourage their participation, consumers were given a HK\$20 (roughly US\$2.60) cash coupon for the supermarket after the questionnaire had been completed. The details of data obtained via the questionnaire and the participants' receipts are discussed in the next section. A total of 1,200 consumers participated in the study.

3.3 *Constructs included in the survey*

There are four main constructs in our proposed model including spending behavior, psychology of consumption, perceptions of payment technology and payment mechanism. In this section we elaborate more on how these constructs are operationalized.

3.3.1 Spending behavior

We measured spending behavior through two distinct facets – transaction amount and the frequency of transactions – which together can be considered to provide an objective measure of consumer spending behavior. Transaction amount is determined by the total value of the transaction as a whole and transaction frequency is determined by the average number of supermarket visits per week.

3.3.2 Psychology of consumption

The psychology of consumption refers to factors moderating the pain of paying. The two factors under investigation are transaction forgettability and payment timing. We measure transaction forgettability by both a subjective (“preciseness”) and an objective (“memory error”) perspectives.

(i) **Preciseness:** It is measured as the number of decimal places used in recalling the total transaction amount, and is a measure of the consumer's subjective awareness of a transaction. Consumers were asked to write down the total transaction amount after shopping in the supermarket. The more aware a consumer is about a transaction, the less forgettable the transaction is. The forgettability of a transaction affects spending. Raghurir and Srivastava [2009] conducted a series of studies showing that consumer purchasing behavior is affected

by the denomination of money. A consumer is less likely to spend money when he is holding a single large denomination than when he is holding several small denominations of money. A large denomination makes a transaction less salient and hence makes the consumer subjectively less aware of the transaction. This results in the consumer experiencing a lower level of pain in paying.

(ii) **Memory Error:** It measures the objective accuracy of the memory of a consumer about a transaction. It is measured by the difference between the “total transaction amount recalled” and the “actual total value of the whole transaction”.

(iii) **Payment Timing:** Payment timing for each transaction is measured as pay now (cash, Octopus card linked to a bank account, and Octopus card with no automatic money reload function) or pay later (credit card and Octopus card linked to a credit card account).

3.3.3 Perceptions of payment technology

The measures for perceptions of payment technology are user perceptions of the payment technology in terms of its security and convenience, criteria which are commonly used in the literature. In this study, security and convenience are measured as follows:

(i) **Security:** One of the concerns with electronic payments is the level of security. We asked the respondents to assess the perceived security of the payment mechanism by ranking the payment method used.

(ii) **Convenience:** It refers to the ease with which consumers can spend and complete transactions. Respondents’ perceptions of the convenience of the payment method used were measured by asking them to rank it.

3.3.4 Payment mechanism

The construct payment mechanism is characterized by the source of money and the payment process.

(i) **Source of Money:** It refers to whether the transaction is conducted by using credit (a

credit card or an Octopus card linked to a credit card account), a bank account (an Octopus card linked to a bank account), or cash (cash or an Octopus card with no automatic money reload function).

(ii) Payment Process: It refers to whether the respondent uses cash, an Octopus card (all three types), or a credit card.

Figure 1 summarizes our research model.

< Insert Figure 1 here. >

3.3.5 Control variables

We also include the following control variables in this study. Income was measured by annual income level, instead of disposal income. We use the annual income as a control variable because it is easier for our subjects to provide us with this figure. One of the major reasons is that Hong Kong does not have the arrangement of tax withholds, which makes our subjects difficult to estimate their income after tax and use it to estimate their disposable income. Family size was measured by the number of family members the respondent had (including the respondent), as family size is a known factor in affecting family spending pattern [Forsyth, 1960]. Education is another factor that has an impact on spending [Rha et al. 2006], which was measured on a 5-point scale based on the level of formal educational attainment (1 = primary, 2 = secondary, 3 = post-secondary, 4 = college degree, 5 = postgraduate degree). The age and gender of the respondents was also included as the control variables. Table 1 presents the demographic information.

< Insert Table 1 here >

4. Results and Analysis

Tables 2 to 4 present our findings. Since all the variables are single-item objective variables, the traditional indices for validity and reliability, such as Cronbach's Alpha and

average variance extracted (AVE), cannot be obtained, as they are designed for multi-item construct. However, this does not imply that the measurement lacks validity and reliability. Bergkvist and Rossiter [2007] found that marketing variables consisting of a concrete singular object and a concrete attribute should be measured by single-item measurement, as single-item measurement in that situation generate predictive validity which is equivalence to that of multi-item measurements. Since all the research variables in this study are either a concrete singular object, single-item objective measurements should be reliable and valid.

< Insert Tables 2 to 4 here. >

Table 2 presents the means, standard deviations, and intercorrelations of the variables included in the research model. Although the intercorrelations among variables are within a reasonable range, which shows that collinearity that magnify or obscure relationships between constructs may not be a problem, a formal test for collinearity's present is also conducted. To formally test for the existence of multi-collinearity, we calculated the variable inflation factor (VIF) for each variable in our models. Table 3 presents the VIF of each variable in our models. Since none of the VIFs does exceed 10, the threshold set by Tabachnick and Fidell [1996], multi-collinearity is not a concern in our study. To test for the heteroscedasticity, we conducted the Levene's Test for equality of variance across different income groups [Parker & Schrift, 2011]. These results do not show significant evidence for heteroscedasticity on the reported transaction amount ($p > 0.308$) and frequency ($p > 0.336$) across different income groups. Therefore, we conclude that heteroscedasticity should not be a serious concern in this study.

Hierarchical multiple regression analysis is used to test the hypotheses. The results are shown in Table 4. We first tested the hypotheses that the independent variables influence consumers' transaction amounts and transaction frequency (Hypotheses 3, 6, 9, 10 and 11) and then tested the hypotheses that the precision of transaction recall is predicted by the

source of money and the payment process employed (Hypotheses 1a, 1b, 2a and 2b). We next tested the hypotheses that the source of money and the payment process employed influence consumers' memory error (Hypotheses 1c, 1d, 2c and 2d). Finally, we tested the hypotheses that the source of money and the payment process adopted influence consumers' perceived security and perceived convenience (Hypotheses 4, 5, 7 and 8).

To test the variance in the transaction amount explained by the control variables, we first entered the respondents' education, age, gender, family size and income into regression Model 1a. As shown by the Model 1a results in Table 4, 0.015 of the variance in the transaction amount is explained by the control variables. The size of a respondent's family affected the transaction amount ($\beta=0.066$ $p < 0.050$). The education level of a respondent was also found to affect the transaction amount: those with a college degree ($\beta = 0.106$, $p < 0.010$) and secondary school qualification ($\beta=0.080$ $p < 0.050$) had a significantly different transaction frequency to those with a primary education. Income, age and gender was found to be non-significant.

In Model 1b, we first entered the control variables before entering the six independent variables to test for the effect of the source of money, payment timing, memory error, security, convenience, and preciseness on the transaction amount (Hypotheses 3a, 3c, 6a, 9a, 10a, 10c & 11a). The inclusion of these independent variables explains an additional 12.1% of the variance in the transaction amount. The preciseness of the payment method ($\beta = -0.071$, $p < 0.050$) was found to be negatively related to the transaction amount, thus supported support for Hypothesis 3a. As predicted by Hypothesis 3c, memory error ($\beta = 0.138$, $p < 0.001$) was found to have a significant effect on the transaction amount. Hypothesis 6a was supported given that security ($\beta = 0.070$, $p < 0.050$) was positively related to the transaction amount. Because there was no significant relation between convenience ($\beta = -0.026$, $p > 0.050$) and the transaction amount, Hypothesis 9a was not supported. Neither

was Hypothesis 10a, as the dummy variable for cash as the source of money is excluded due to the tolerance being too low [Brace et al., 2000]. It was found that when the source of money was a bank account, the transaction amount did not significantly differ to what it was when the source of money is credit ($\beta = 0.006$, $p > 0.050$). Hypothesis 10c was thus rejected. Hypothesis 11a was supported as when the payment timing was pay later, the transaction amount was significantly different to what it was when the payment timing was pay now ($\beta = 0.312$, $p < 0.001$).

To account for the variance in transaction frequency affected by the control variables, respondents' education, age, gender, family size and income are entered into regression Model 2a. The Model 2a results in Table 4 show that 0.115 of the total variance in transaction frequency was explained by the control variables. Income ($\beta = -0.101$, $p < 0.001$) was found to have an effect on transaction frequency, although family size was found to be unrelated to transaction frequency ($\beta = 0.052$, $p > 0.050$). Education was not significantly associated with transaction frequency. However, the age and gender were found to have significant effects on the transaction frequency ($\beta = 0.220$, $p < 0.001$; $\beta = 0.165$, $p < 0.001$).

In Model 2b, the independent variables – preciseness, memory error, security and convenience, source of money and payment timing – were entered following the control variables to test for their influence on transaction frequency (Hypotheses 3b, 3d, 6b, 9b, 10b, 10d & 11b). The Model 2b regression results in Table 4 show that only an extra 0.005 of the total variance in transaction frequency was explained by the inclusion of the independent variables. The preciseness of the payment method ($\beta = 0.023$, $p > 0.050$) was not significantly related to transaction frequency. Thus, Hypothesis 3b was not supported. Hypothesis 3d also lacked support, as memory error ($\beta = 0.006$, $p > 0.050$) did not significantly affect transaction frequency. Security was found to be not significantly affect transaction frequency ($\beta = -0.003$, $p > 0.050$), and convenience was found to be negatively related to transaction frequency ($\beta =$

-0.067, $p < 0.050$). Therefore, Hypotheses 6b and 9b were not supported. There was no support for Hypothesis 10b as the dummy variable for cash as the source of money was excluded due to the tolerance level being too low. Neither was there support for the hypothesis predicting that the consumer's transaction frequency would be lower when the source of money is a bank account ($\beta = 0.014$, $p > 0.050$) than when the source of money is credit (Hypothesis 10d). Hypothesis 11b also lacked support as there was no significant transaction frequency differential between pay later payment timing ($\beta = -0.012$, $p > 0.050$) and pay now payment timing. None of the independent variables were significantly associated with transaction frequency.

As shown in Model 3, we next tested the hypotheses that the preciseness is predicted by the source of money and the payment process adopted (Hypotheses 1a, 1b, 2a and 2b). To account for the variance in the degree of preciseness explained by the source of money and the payment process, we estimated a model that incorporated the three groups of control variables along with the source of money and the payment process. The variables explained 0.063 of the variance in preciseness. Hypothesis 1a was not supported as there was no significant preciseness differential between cash as source of money ($\beta = 0.068$, $p > 0.050$) and credit as source of money. However, Hypothesis 1b was supported given the significant preciseness differential between "bank" (an Octopus card linked to a bank account) as source of money ($\beta = -0.083$, $p < 0.050$) and credit as source of money. Credit cards ($\beta = -0.195$, $p < 0.005$) as a payment process had a significant preciseness differential compared with cash as a payment process. Moreover, Octopus ($\beta = -0.097$, $p < 0.010$) as a payment process also had a significant preciseness differential in comparison with cash. Both Hypothesis 2a and Hypothesis 2b were thus supported.

Hypotheses 1c, 1d, 2c and 2d indicate that the memory error of a consumer will be predicted by the source of money and the payment process adopted. The results for Model 4

show that only 0.010 of the variance in memory error was explained by the control variables, the source of money and the payment process. Both Hypotheses 1c and 1d lacked support as cash ($\beta = 0.000, p > 0.050$) and bank account ($\beta = 0.032, p > 0.050$) as sources of money had no significant memory error differential in comparison with credit as a source of money. Octopus as a payment process ($\beta = 0.036, p > 0.050$) had no significant memory error differential in comparison with cash as a payment process. Thus, Hypothesis 2c was not supported. Hypothesis 2d was also not supported because credit cards as a payment process ($\beta = 0.086, p > 0.050$) had no significant memory error differential in comparison with cash as a payment process.

We now test the hypotheses which predict that the perceived security of the transaction will be affected by the source of money and the payment process (Hypotheses 4-5). As shown in Model 5, 0.161 of the variance in security was accounted for by the control variables together with the source of money and the payment process. Both Hypotheses 4a and 4b were supported as cash ($\beta = 0.534, p < 0.001$) and bank account ($\beta = 0.150, p < 0.001$) as sources of money had significant security differentials in comparison with credit. The hypothesis which predicts that the perceived security of the transaction will be higher when the payment process is Octopus ($\beta = -0.148, p < 0.001$) than when the payment process is cash was supported (Hypothesis 5a). Credit card as a payment process ($\beta = 0.126, p < 0.050$) also had a significant security differential in comparison with cash, lending support to Hypothesis 5b.

Finally, we tested the hypotheses which predict that the perceived convenience of the payment method will be affected by the source of money and the payment process (Hypotheses 7-8). Model 6 shows that 0.061 of the variance in convenience is explained by the control variables together with the source of money and the payment process. Both Hypotheses 7a and 7b lack support as both cash ($\beta = 0.017, p > 0.050$) and “bank” ($\beta = 0.050,$

$p > 0.050$) as sources of money have no significant convenience differential in comparison with credit. Octopus as a payment process ($\beta = 0.188$, $p < 0.001$) has a significant convenience differential with cash, giving support to Hypothesis 8a. However, Hypothesis 8b was rejected as there was no significant convenience differential between credit cards ($\beta = -0.040$, $p > 0.050$) and cash as payment processes. Table 5 summarizes the results of our hypotheses. Twelve of the results for our 30 sub-hypotheses are statistically significant. All analyses include controls for income, family size and education.

< Insert Table 5 here >

5. Findings and Discussion

5.1 Findings

We first establish how the attributes of the means of payment examined here are related to the amount spent by consumers. Consumers tend to spend more in a transaction when they use a payment method which allows them to postpone payment (a credit card or an Octopus card linked to a credit account) than they do when they use a payment method that requires the consumer to pay immediately (cash, an Octopus card without an automatic money reload function, or an Octopus card linked to a bank account). The amount a consumer spends is also affected by his/her memory error in relation to the amount spent. When a consumer cannot accurately recall the amount spent, he or she is likely to spend more in a transaction and vice versa. Given that the pain of paying experienced by a consumer should be less severe when she is not able to recall accurately the amount she has spent and the pain of paying negatively affects the consumer's amount of spending [Prelec & Loewenstein, 1998; Raghubir & Srivastava, 2008], the consumer should spend more in a transaction when she is not able to recall accurately the amount spent. The results also reveal that preciseness has a slight relation to the amount a consumer spends in each transaction.

According to our definition, preciseness is the consumer's subjective awareness of a transaction. The results imply that an increase in a consumer's confidence in her ability to recall the amount of spending accurately will have a slightly negative effect on the amount the consumer spends. We can conclude that the amount spent by consumers is affected by both their objective ability and subjective ability to remember a transaction. However, the effect of a consumer's objective ability to remember a transaction on the amount the consumer spends is greater than the effect of the consumer's subjective ability to remember a transaction. Perceived security is positively related to transaction amount, although the effect is relatively small. The perceived security of a transaction is found to be positively related to the frequency with which consumers shop through the Internet [Miyazaki & Fernandez, 2001; Swaminathan et al., 1999] and the perceived risk of payment has been found to be negatively related to the frequency with which consumers shop in the Internet [Koyuncu & Bhattacharya, 2004]. Swaminathan et al. (1999) also find that the perceived security of a transaction does not affect the total amount spent by the consumer online. Similar logic should be applicable to the payment method, whereby the perceived security of the means of payment should have a greater effect on the frequency or total value of transactions executed by a consumer within a period using a particular means of payment than does the total amount spent in one transaction. Further investigations are necessary to examine the relationship between perceived security and the frequency of or total amount of transactions executed by a consumer within a period using a particular means of payment. The perceived convenience of a means of payment is found to be unrelated to the total amount spent by a consumer in one transaction.

While the memory error of a consumer is positively related to her amount of spending, it is not affected by the payment process employed in the transaction. Octopus card is considered to be a means of payment with low payment transparency because of its low

salience and vividness [Soman, 2003]. However, although a means of payment with low salience and vividness is likely to result in weaker memory track, an Octopus card transaction does not generate larger memory error than a cash transaction when a consumer recalls the amount spent. Likewise, a credit card transaction does not generate larger memory error than a cash transaction when a consumer recalls the amount spent. Cash was not included in past research studies of how well consumers who use credit cards and other means of payment can recall the amounts of their past transactions [Soman, 2001; Soman & Lam, 2002]. Some of these studies indicate that consumers tend to be more forgetful of the amounts spent in past credit card transactions than they do of those in which they use checks, because checks require consumers to rehearse the price paid given that they have to write it down [Soman, 2001]. Because consumers who use checks “learn” the exact price to be paid and reinforce their memory by writing the check, they should be able to recall their past expenses more accurately. Using cash should also involve a learning and rehearsal process as consumers will count the amount of cash to be paid. A cash transaction should therefore generate less memory error than an Octopus card or credit card transaction when a consumer recalls the amount spent. Nevertheless, cash transactions may not always involve a learning-and-rehearsal process in practice because the consumer can pay the cashier an amount of money approximately equal to the exact price, and the cashier will give the consumer change. Consumers who receive change after paying cash will have a very hazy memory of the transaction amount and this will hinder them from recalling the exact amount of the transaction. This may partially explain the observation that a cash transaction does not generate a larger memory error than a credit card or Octopus transaction when the consumer is asked to recall the amount spent. The source of money is also irrelevant in determining the extent of memory error among consumers in relation to their transactions.

A cash transaction will induce a higher degree of preciseness than a credit transaction

in terms of memory of the amount spent. This implies that a consumer who uses a credit card will tend to be less confident in her ability to recall the amount spent than will a consumer who uses cash. This is consistent with the results of a survey conducted by Soman [2001] in which some of the participants who used credit cards confessed that they had no idea of how much they had spent in their latest transaction. At the same time, all of the participants who used cash could recall the amount spent in the latest transaction, although some of them failed to recall the amount accurately. An Octopus card transaction generates a lower degree of preciseness than a cash transaction does. However, the effect is relatively small. This is an area that requires further investigation as Octopus cards have not been studied in depth in past literature. As a source of money, bank accounts induce a slightly lower level of preciseness than credit, while cash induces a level of preciseness that is neither higher nor lower than that induced by credit.

We show that the physical payment process moderates user perceptions of the associated payment method. With cash as the benchmark case, the Octopus card payment process, which involves no signature or password, has a positive effect on perceived payment convenience and a negative effect on perceived payment security. Similarly, the credit card payment process, which requires either a signature or a password, is positively associated with perceived payment security. Surprisingly, the same payment process has no relation to perceived payment convenience. This may show that those mature payment methods such as credit cards are perceived to be similar to cash in terms of ease of use.

User perceptions of associated payment methods, on the other hand, have little effect on spending behavior, with only perceived payment security having a slightly positive effect on single transaction value. The source of money and the payment process may have opposite effects on the perceived security of a payment method. In the case of an Octopus card loaded with cash, the source of money (cash) is positively associated with perceived payment

security, while the Octopus payment process has a negative effect on security perceptions.

It is not surprising that transaction frequency is not affected by the source of money, the payment process, or the security, convenience and preciseness of a payment method.

Transaction frequency refers to the frequency with which a consumer visits a supermarket or convenience store, while the source of money, the payment process, and security, convenience and preciseness are treated as the attributes of the payment method a consumer uses in a particular transaction. Given that a consumer may use different payment methods in different transactions, the attributes of the payment method used in one particular transaction should not affect the frequency with which a consumer visits supermarkets and convenience stores.

The payment mechanism (source of money and payment process) does not moderate the objective ability of a consumer to remember a transaction (memory error). However, the payment process can have a significant influence on a consumer's subjective awareness of a transaction (preciseness). This is true in the context we examine – supermarket shopping – where most transactions are for smaller amounts and the articles purchased are normally low involvement items. The supermarket context allows us to bypass transaction amount-related confounding factors. A lower level of either preciseness or memory error can reduce the amount of payment pain.

Given that the survey conducted for this study was conducted in a supermarket, most of the items purchased by consumers are likely to have been low-price essentials rather than luxuries. Luxury purchases are likely to induce more severe paying pain than are essential purchases [Kivetz, 1999]. We thus expect that making a purchase in a supermarket will induce rather less paying pain than purchases made in other consumer venues. Given that the pain of paying is expected to affect both memory error and the amount of money spent in a transaction, the supermarket shopping context employed in this study may be one of the

reasons why a rather small proportion of both the total amount of money spent in a transaction and memory error are explained.

5.2 *Theoretical contributions*

As our literature review shows, the effects of payment mechanisms on spending behavior have not only been discussed on a conceptual level, but have been tested in experimental studies, some of the results of which support the conceptual predictions made. However, there remains a need for large-scale studies to understand how different payment mechanisms impact customers' psychology of consumption, perceptions of payment technologies, and consumer spending behaviour. To the best of our knowledge, this study is the first to examine the relationships among these constructs on an empirical basis.

Particularly, prior studies of how the attributes of means of payment affect consumption behavior have shown that only payment transparency, payment coupling and the physical form of the means of payment are related to the total amount consumers spend per transaction [Raghubir & Srivastava, 2008; Soman, 2003]. Our study shows that four attributes of payment methods (payment timing, memory error, security and preciseness) are related to the amount consumers spend per transaction. These findings are important because they provide further support for the view that the attributes of means of payment affect consumers' spending behavior.

Although previous research suggested that the source of money has a psychological impact on consumption [Arkes et al., 1994], only theoretical conjectures about the effect of the source of money have been put forward. A recent study raised the issue that it is not clear whether the effect of credit cards on consumer behavior is derived from the credit card payment process (the absence of cash) or the source of credit card money [Khan & Craig-Lees, 2009]. Our study furthers this understanding by providing empirical evidence. We show that the source of money is related to payment technology perceptions through

perceived payment security only. The source of money has no effect on perceived payment convenience and is not related to payment pain or spending behavior. We find that the source of money is irrelevant in determining the extent of memory error among consumers in relation to the transaction amount and the perceived convenience of a payment method. One of the possible reasons for this finding is that the source of money does not directly affect the payment process when a consumer directly experiences the payment process. For example, the process experienced by a consumer is the same regardless of whether an Octopus card linked to bank account or an Octopus card linked to credit card is used. The source of money therefore has no effect on the consumer's perceived convenience of a payment method or the extent of memory error in relation to the transaction amount.

5.3 *Practical implications*

We show that the payment process, but not the source of money, can moderate payment pain and hence willingness to pay (value, not volume). However, this effect is achieved only by influencing the awareness of spending (preciseness) and not by influencing the ability to remember the spending (memory error). In combination with the finding that the effect of consumers' objective ability to remember a transaction is greater than the effect of consumers' subjective ability to remember the transaction on their recall of the amount spent, this result has significant managerial implications for the use of payment schemes as a strategic tool to moderate payment pain.

For government, the finding that payment process has significant impact on willingness to pay can also raise some valuable implications. If government would like to stimulate consumption for driving GDP growth, encouraging consumers to use stored value smart card or credit card instead of using cash should be a feasible way to achieve the target. In addition, as the payment mechanism has been proved to have significant impact on consumer spending behavior, government could consider investing more on payment

technologies. Particularly, the new payment technology should not involve signature or password and it should be designed to avoid cash transactions.

Also, our study provides a deeper understanding of how different payment mechanisms impact both consumer spending behavior in a retailing context, either directly or by influencing customers' psychology of consumption, and perceptions of the payment technologies examined. The results have practical implications for banks and other issuers of new payment technologies who typically share a common risk – insufficient usage – and for merchants choosing which payment technology to apply. Consumers will find the results useful in developing a better understanding of their innate psychological bias. This will help aware consumers avoid unintentional overspending that would otherwise put them into a relatively disadvantageous position.

5.4 Limitations

Similar to other research, this study also has some limitations. First, the data collection is collected through a field study context, which we have limited control of the background and other demographic background of our subjects. As a result, we put down these demographics as control variables in our study. Second, as saving rates in Hong Kong is relatively high, it would be possible that the consumers in Hong Kong are less sensitive to payment timing compared with other parts of the world.

5.5 Future research directions

There are two areas for our further investigation. First, in this study, we employed no variable affecting consumers' memory error. This is an issue that requires further investigation in an effort to establish the factors that affect such memory error. Second, in this study, the payment context is supermarket, which only provides daily necessities for consumers. Most transactions in supermarkets are for smaller amounts and purchases are normally low involvement items. The results may differ in other contexts. Further

investigation should be conducted in other contexts that offer both luxury items and essentials, such as department stores, to yield further insights in this field.

6. Conclusion

This study investigates differences in spending behavior among consumers using three alternative payment technologies: cash, credit cards, and stored value contactless smart cards. Particularly, the inter-relationship of the payment mechanism, the psychology of consumption, and user perceptions of payment technologies is empirically examined. The effects of these three constructs on spending behavior, as characterized by transaction amount and shopping frequency, are studied. The results show that the payment process can significantly affect subjective awareness of spending. In contrast, the source of money can affect perceived payment security. Both perceived security and convenience have little effect on spending behavior. This study contributes conceptually to the current literature by providing a deeper understanding of how different payment mechanisms impact both consumer spending behavior in a retailing context, either directly or by influencing customers' psychology of consumption, and perceptions of the payment technologies examined. The result carries significant managerial implications for the use of payment schemes as a strategic tool to moderate payment pain, and it will help aware consumers avoid unintentional overspending that would otherwise put them in a relatively disadvantageous position.

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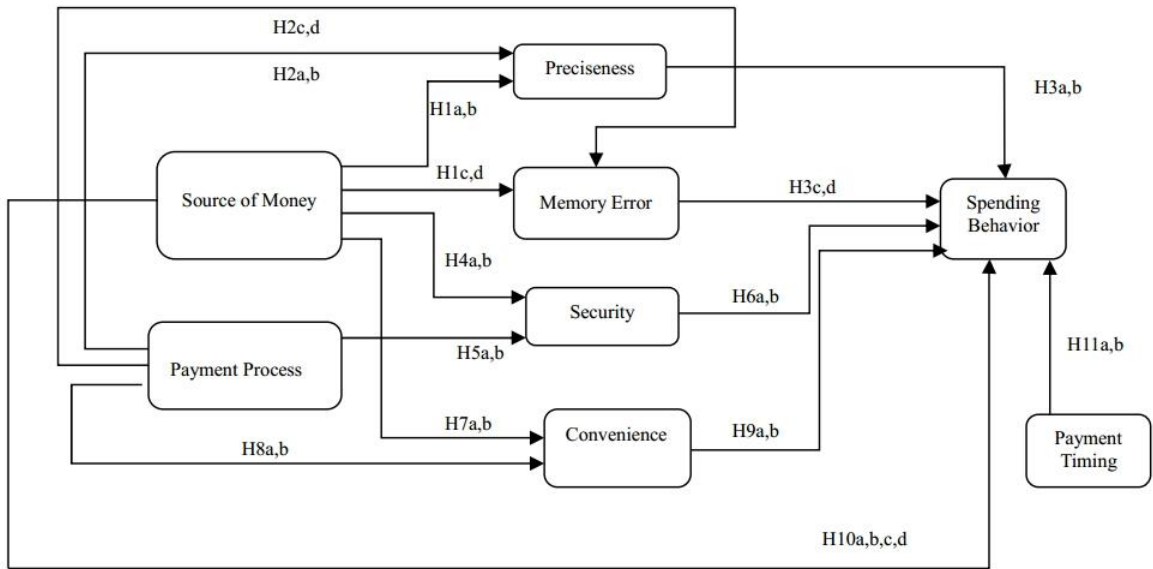


Fig. 1 Research model.

Table 1

Demographic Information of Respondents

Demographic Characteristics		Number	Percentage
Gender	Male	362	31%
	Female	797	69%
Education	Primary	231	20%
	Secondary	531	46%
	Post-secondary	201	17%
	College Degree	173	15%
	Postgraduate Degree	23	2%
Income	Below 80000	28	2%
	80001 – 100000	117	10%
	100001 – 150000	33	3%
	150001 – 200000	75	6%
	200001 – 250000	40	3%
	250001 – 300000	74	6%
	300001 – 350000	32	3%
	350001 – 400000	129	11%
	400001 – 450000	50	4%
	450001 – 500000	141	12%
	500001 – 550000	128	11%
	550001 or above	312	27%
Family Size	1	53	5%
	2	146	13%
	3	324	28%
	4	418	36%
	5	168	14%
	6	30	3%
	7	17	1%
	8 or above	3	0%
Age	Below 16	30	3%
	16 – 20	59	5%
	21 – 25	72	6%
	26 – 30	63	5%
	31 – 35	145	13%
	36 – 40	203	18%
	41 – 45	182	16%
	46 – 50	155	13%
	51 – 55	115	10%
	56 – 60	64	6%
	61 – 65	33	3%
	Above 65	38	3%

Table 2
Means, standard deviations and intercorrelations of study variables (n = 1159)

Variable	M	SD	Income	Gender	Age	Family Size	College Degree	Education			Source of Money		Payment Process		Payment Timing	Memory Error	Security	Convenience	Preciseness	Transaction amount	Transaction frequency
								Secondary	Postgraduate Degree	Post Secondary	Bank	Cash	Octopus	Credit card	Post-pay						
Income	8.26	3.596	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Gender	1.69	0.464	-0.034	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Age	40.81	13.228	-0.024	0.043	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Family Size	3.58	1.206	0.086**	0.110**	-0.095**	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Education	College Degree ^a	0.15	0.357	0.175**	-0.078**	-0.036	-0.172**	---	---	---	---	---	---	---	---	---	---	---	---	---	---
	Secondary ^b	0.46	0.498	-0.052	0.108**	0.090**	0.064*	-0.385**	---	---	---	---	---	---	---	---	---	---	---	---	---
	Postgraduate Degree ^c	0.02	0.140	0.093**	-0.078**	-0.036	-0.094**	-0.060*	-0.131**	---	---	---	---	---	---	---	---	---	---	---	---
	Post Secondary Degree ^d	0.17	0.379	0.002	-0.109**	-0.219**	0.027	-0.192**	-0.421**	-0.065*	---	---	---	---	---	---	---	---	---	---	---
Source of Money	Bank ^e	0.03	0.176	0.070*	0.016	0.024	-0.059*	0.048	0.000	0.045	-0.018	---	---	---	---	---	---	---	---	---	---
	Cash ^f	0.63	0.483	-0.141**	-0.089**	-0.042	0.048	-0.160**	-0.009	-0.057	0.030	-0.237**	---	---	---	---	---	---	---	---	---
Payment Process	Octopus ^g	0.47	0.499	0.037	-0.065*	-0.006	0.022	-0.071*	0.015	0.051	0.033	0.192**	0.284**	---	---	---	---	---	---	---	---
	Credit Card ^h	0.26	0.441	0.053	0.125**	0.073*	-0.008	0.106**	0.019	-0.015	-0.047	-0.109**	-0.781**	-0.566**	---	---	---	---	---	---	---
Payment Timing	Post-pay ⁱ	0.34	0.473	0.118**	0.084**	0.034	-0.027	0.146**	0.009	0.042	-0.024	-0.130**	-0.933**	-0.362**	0.838**	---	---	---	---	---	---
Memory Error		5.604	23.5666	-0.005	0.052	-0.011	0.028	-0.021	0.030	-0.028	0.003	0.026	-0.061*	-0.007	0.064*	0.053	---	---	---	---	---
Security		3.88	1.312	-0.083**	0.030	0.014	0.008	-0.067*	0.024	-0.020	-0.035	-0.017	0.354**	-0.042	-0.217**	-0.355**	0.033	---	---	---	---
Convenience		3.79	1.432	-0.035	0.014	0.057	0.017	-0.041	0.026	0.030	-0.027	0.085**	0.090**	0.220**	-0.159**	-0.124**	0.010	0.330**	---	---	---
Preciseness		0.37	0.484	-0.037	0.055	0.013	0.000	-0.027	-0.034	-0.033	0.025	-0.099**	0.220**	0.016	-0.190**	-0.188**	-0.139**	0.134**	0.063*	---	---
Transaction amount		59.755	81.9779	0.056	0.046	0.021	0.055	0.049	0.016	0.009	0.000	-0.028	-0.300**	-0.323**	0.365**	0.316**	0.168**	-0.058*	-0.043	---	---
Transaction frequency		3.94	2.322	-0.122**	0.197**	0.242**	0.053	-0.099**	0.093**	-0.060*	-0.109**	0.003	0.009	0.076**	0.022	-0.010	0.012	0.006	-0.041	0.012	-0.095**

^aCollege degree vs. Primary (Education: College degree = 1; Primary = 0)

^bSecondary vs. Primary (Education: Secondary = 1; Primary = 0)

^cPostgraduate degree vs. Primary (Education: Postgraduate degree = 1; Primary = 0)

^dPost secondary degree vs. Primary (Education: Post secondary degree = 1; Primary = 0)

^eBank vs. Credit (Source of money: Bank = 1; Credit = 0)

^fCash vs. Credit (Source of money: Cash = 1; Credit = 0)

^gOctopus vs. Cash (Payment process: Octopus = 1; Cash = 0)

^hCredit card vs. Cash (Payment process: Credit card = 1; Cash = 0)

ⁱPost-pay vs. Pay-now (Payment timing: Post-pay = 1; Pay-now = 0)

*p < 0.05 **p < 0.01

Table 3

Test for the existence of multi-collinearity.

	Model 1-2	Model 3-6
	VIF	VIF
Control Variable		
Income	1.087	1.093
Age	1.098	1.098
Gender	1.061	1.062
Family Size	1.094	1.094
Education (Dummy Variables)		
Primary	***	***
College Degree	1.713	1.716
Secondary	1.841	1.842
Postgraduate Degree	1.144	1.149
Post Secondary	1.694	1.696
Independent Variable		
Source of Money (Dummy Variables)		
Credit	***	***
Bank	1.069	1.394
Cash	###	3.962
Payment Process (Dummy Variables)		
Cash	---	***
Octopus	---	1.637
Credit Card	---	4.731
Payment Timing (Dummy Variables)		
Pay-now	***	---
Post-pay	1.274	---
Memoryerror	1.030	---
Security	1.292	---
Convenience	1.140	---
Preciseness	1.082	---

Notes:

*** Dummy variable used as reference group.

Excluded due to low tolerance of the variable.

Table 4
Results of hierarchical regression analysis.

Variable	Model 1 DV = transaction amount				Model 2 DV = transaction frequency				Model 3 DV = preciseness		Model 4 DV = memoryerror		Model 5 DV = security		Model 6 DV = convenience	
	Model 1a		Model 1b		Model 2a		Model 2b		β	p	β	p	β	p	β	p
	β	p	β	p	β	p	β	p								
Control Variable																
Income	0.035	0.246	0.011	0.709	-0.101	0.000	-0.103	0.000	-0.003	0.920	-0.008	0.782	-0.017	0.544	-0.042	0.160
Age	0.041	0.179	0.026	0.375	0.220	0.000	0.225	0.000	0.000	0.991	-0.017	0.583	0.005	0.859	0.068	0.023
Gender	0.048	0.106	0.003	0.905	0.165	0.000	0.168	0.000	-0.029	0.324	0.037	0.219	0.048	0.086	0.022	0.459
Family Size	0.066	0.032	0.066	0.022	0.052	0.070	0.055	0.060	-0.008	0.781	0.019	0.536	-0.007	0.808	0.024	0.415
Education (Dummy Variables)																
Primary	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***
College Degree	0.106	0.005	0.039	0.275	-0.065	0.070	-0.063	0.082	-0.022	0.557	-0.014	0.707	-0.007	0.849	-0.003	0.941
Secondary Degree	0.080	0.044	0.032	0.394	-0.009	0.805	-0.006	0.886	-0.043	0.274	0.020	0.624	0.011	0.761	0.009	0.809
Postgraduate Degree	0.038	0.217	0.015	0.620	-0.034	0.246	-0.030	0.309	-0.033	0.275	-0.022	0.426	0.018	0.543	0.029	0.344
Post Secondary	0.069	0.070	0.037	0.307	-0.062	0.084	-0.062	0.087	-0.012	0.746	0.011	0.782	-0.026	0.451	-0.012	0.738
Independent Variable																
Source of Money (Dummy Variables)																
Credit Bank	---	---	***	***	---	---	***	***	***	***	***	***	***	***	***	***
Cash	---	---	###	###	---	---	###	###	0.068	0.233	0.000	0.997	0.534	0.000	0.017	0.764
Payment Process (Dummy Variables)																
Cash	---	---	---	---	---	---	---	---	***	***	***	***	***	***	***	***
Octopus	---	---	---	---	---	---	---	---	-0.097	0.008	0.036	0.332	-0.148	0.000	0.188	0.000
Credit Card	---	---	---	---	---	---	---	---	-0.195	0.002	0.086	0.178	0.126	0.031	-0.040	0.525
Payment																

Timing (Dummy Variables)																
Pay-now	---	---	***	***	---	---	***	***	---	---	---	---	---	---	---	---
Post-pay	---	---	0.312	0.000	---	---	-0.012	0.694	---	---	---	---	---	---	---	---
Memoryerror	---	---	0.138	0.000	---	---	0.006	0.882	---	---	---	---	---	---	---	---
Security	---	---	0.070	0.025	---	---	-0.003	0.927	---	---	---	---	---	---	---	---
Convenience	---	---	-0.026	0.378	---	---	-0.067	0.024	---	---	---	---	---	---	---	---
Preciseness	---	---	-0.071	0.013	---	---	0.023	0.422	---	---	---	---	---	---	---	---
R-square	0.015		0.136		0.115		0.120		0.063		0.010		0.161		0.061	

Notes:

*** Dummy variable used as reference group

Excluded due to low tolerance of the variable

Table 5
Summary of Hypotheses and Findings

Hypotheses	Results
H1a When the source of money used for payment is cash, the level of precision with which the payment is recalled will be higher than when the source of money used for payment is credit	Reject
H1b When the source of money used for payment method is a bank account, the level of precision with which the payment is recalled will be lower than when the source of money used for payment is credit	Accept
H1c When the source of money used for payment is cash, the memory error of the consumer will be lower than when the source of money used for payment is credit	Reject
H1d When the source of money used for payment is a bank account, the memory error of the consumer will be higher than when the source of money used for payment is credit	Reject
H2a When the payment process used is Octopus, the level of precision with which the payment is recalled will be lower than when the payment process used is cash	Accept
H2b When the payment process used is credit card, the level of precision with which the payment is recalled will be lower than when the payment process used is cash	Accept
H2c When the payment process used is Octopus, the memory error of the consumer will be higher than when the payment process used is cash	Reject
H2d When the payment process used is credit card, the memory error of the consumer will be higher than when the payment process used is cash	Reject
H3a The preciseness of the payment method will negatively affect the amount consumers spend in transactions	Accept
H3b The preciseness of the payment method will negatively affect the frequency of consumers' transactions	Reject
H3c Consumers' memory error will positively affect their transaction amount	Accept
H3d Consumers' memory error will positively affect their transaction frequency	Reject
H4a When the source of money for the payment method is cash, the perceived security of the transaction will be higher than when the source of money for the payment method is credit	Accept
H4b When the source of money for the payment method is a bank account, the perceived security of the transaction will be higher than when the source of money for the payment method is credit	Accept
H5a When the payment process used is Octopus, the perceived security of the transaction will be lower than when the payment process used is cash	Accept
H5b When the payment process used is credit card, the perceived security of the transaction will be higher than when the	Accept

	payment process used is cash	
H6a	Consumers' perceived security of the payment method will positively affect their transaction amount	Accept
H6b	Consumers' perceived security of the payment method will positively affect their transaction frequency	Reject
H7a	When the source of money for the payment method is cash, the perceived convenience of the transaction will be lower than when the source of money for the payment method is credit	Reject
H7b	When the source of money for the payment method is a bank account, the perceived convenience of the transaction will be higher than when the source of money for the payment method is credit	Reject
H8a	When the payment process used is Octopus, the perceived convenience of the transaction will be higher than when the payment process used is cash	Accept
H8b	When the payment process used is credit card, the perceived convenience of the transaction will be higher than when the payment process used is cash	Reject
H9a	Consumers' perceived convenience of the payment method will positively affect their transaction amount	Reject
H9b	Consumers' perceived convenience of the payment method will positively affect their transaction frequency	Reject
H10a	When the source of money for the payment method is cash, the consumer's transaction amount will be lower than when the source of money for the payment method is credit	Reject
H10b	When the source of money for the payment method is cash, the customer's transaction frequency will be lower than when the source of money for the payment method is credit	Reject
H10c	When the source of money for the payment method is a bank account, the consumer's transaction amount will be lower than when the source of money for the payment method is credit	Reject
H10d	When the source of money for the payment method is a bank account, the consumer's transaction frequency will be lower than when the source of money for the payment method is credit	Reject
H11a	When the timing of the payment method is pay later, the consumer's transaction amount will be larger than when the timing of the payment method is pay now	Accept
H11b	When the timing of the payment method is pay later, the consumer's transaction frequency will be higher than when the timing of the payment method is pay now	Reject
