Barrier-breakers' influence on full-adoption of digital payment methods

Irina Dimitrova
The Centre for Research on Economic Relations (CER), Mid Sweden University, Sundsvall, Sweden

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Abstract

Purpose – The purpose of this study is to empirically examine the relationships between barrier-breakers and customers' intention to fully adopt digital payment methods (DPMs).

Design/methodology/approach – Survey data were analyzed using statistical methods focusing on hypothesis testing with an ordinal regression model and moderation analysis using the PROCESS macro extension. Participants were divided into two groups of customers in Sweden: adopters-accepters, i.e. young bank customers and adopters-resisters, i.e. members of a formally organized group opposed to a cashless society.

Findings – The findings revealed that only the credibility barrier-breaker could increase the adopters-accepters' intention to fully adopt DPMs. Credibility also seemed to be an important barrier-breaker for the adopters-resisters, as were perceived usefulness and social influence. Additional analyses showed that the impersonalization barrier reduces the impact of the barrier-breakers on DPM adoption.

Practical implications – Retail banks and merchants can use these results as a guide to what barrier-breakers might affect various customers' intention to fully adopt DPMs, and to act accordingly. The impersonalization barrier also merits attention when creating an emotional connection to customers who use DPMs.

Originality/value – This study provides empirically based knowledge of the influence of barrier-breakers on the intention of customers, categorized as adopters-accepters and adopters-resisters, to fully adopt DPMs, and highlights the importance of maintaining a human touch in the post-COVID-19 digital era.

Keywords Digital banking, Digital payment methods, Full-adoption, Barrier-breakers

Paper type Research paper

Introduction

Societal developments have made citizens more technology dependent (Priporas *et al.*, 2017), rapidly challenging their behavior (Yang *et al.*, 2015). These developments have influenced the banking and commerce industries as well as customers' readiness to adopt new digital services (Thomas *et al.*, 2016). In fact, the adoption of digital payment methods (DPMs) has increased worldwide, and cash usage has further decreased due to the COVID-19 pandemic, forcing a move from traditional to digital services (Leong *et al.*, 2022; Santo and Marques, 2022). For example, 95% of companies plan to employ artificial intelligence (AI) by 2025 (Mozafari *et al.*, 2022).

Digital service adoption should be convenient in order to reinforce the impression that new technologies are better than current ones (Laukkanen, 2016; Sivathanu, 2019). However, technological developments often encounter barriers on the way to being adopted. Privacy,

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security, access, and impersonalization concerns are potential barriers to DPM adoption (Dimitrova *et al.*, 2022; Laukkanen, 2016; Yang *et al.*, 2015). Invasion of privacy, system breakdowns, and lack of personal service are examples of problems that could affect the banking and commerce industries. Such problems can decrease the readiness for DPM adoption and even lead to customers' distrust of the whole financial system (Shin *et al.*, 2020).

The literature has identified various factors positively influencing customers' intention to use new digital services. In this study, these determinants are called barrier-breakers – in order to relate them to the barrier concept – illustrating how the aversion to full-adoption can be reduced. Results (e.g. Lee, 2009; Mun *et al.*, 2017; Oertzen and Odekerken-Schröder, 2019) showed that perceived ease-of-use and perceived usefulness are positively related to adoption intention. The literature also considered social influence (e.g. Martins *et al.*, 2014; Tan and Leby Lau, 2016; Venkatesh *et al.*, 2003) as a barrier-breaker. Moreover, the 2008 global financial crisis is still having a negative impact on customers' trust in banks (Rajaobelina *et al.*, 2019). This may distort the credibility of banking services, and some studies (e.g. Luarn and Lin, 2005; Rajaobelina *et al.*, 2019) suggested that perceived credibility is related to customers' intention to change their behavior.

In relation to the four barrier-breakers mentioned, the impersonalization barrier could be considered. This concept was first presented by Singh (2004) to describe a lack of personal contact, and later referred to dehumanization, i.e. lack of human characteristics such as empathy (Mozafari *et al.*, 2022). The lack of face-to-face service, i.e. human-to-human interaction, appears to be highly visible in situations such as the COVID-19 pandemic (Santo and Marques, 2022), because bank customers have been encouraged to handle their bank services digitally, i.e. through human-to-machine interaction (Dimitrova and Öhman, 2021).

Customers' perceptions of digital services are at the center of many of the above-mentioned studies, and background characteristics can affect customers' intention to use these services (Priporas *et al.*, 2017). For example, young bank customers (YBCs) are much more willing to adopt digital technologies than are older ones (Loh *et al.*, 2022; Rehncrona, 2018). As drivers of digital services, YBCs are considered a powerful group of customers who challenge the market (Nourallah *et al.*, 2021). For example, 95% of YBCs in Sweden used mobile applications (Sveriges Riksbank, 2021) giving them rich previous experience of using DPMs. Therefore, this study uses YBCs as a proxy for adopters-accepters (AAs), i.e. individuals who have started using DPMs, and are willing to continue and even increase their use of DPMs (cf. Planing, 2014). Considering past experience, a formally organized social media group of customers in Sweden opposed to a cashless society, known as Kontantupproret (KU), has expressed negative perceptions of DPMs (Arvidsson, 2019). This study categorizes this group as adopters-resisters (ARs), i.e. individuals who have started using an innovation but hesitate to increase its use, stating that adoption and resistance may coexist (cf. Dimitrova *et al.*, 2022; Ram, 1987).

Numerous banking studies have focused on technology acceptance in various adoption phases. Laukkanen (2016), and Yang *et al.* (2015), among others, studied technology adoption in the initial phase, while Chawla and Joshi (2019), Oertzen and Odekerken-Schröder (2019), and Poromatikul *et al.* (2019) focused on the post-adoption phases. Few studies (e.g. Akana and Ke, 2020; Lee *et al.*, 2005) paid some attention to the full-adoption phase. This phase can be described as the end of the post-adoption phase, i.e. when customers have no possibility of replacing DPMs with non-digital payment alternatives such as cash. Such a scenario is of interest considering that Sweden is on its way toward being a cashless society (Dimitrova *et al.*, 2022), and that Thomas *et al.* (2016) found that Sweden's infrastructure and technological readiness for the full-adoption of DPMs was ranked third among 90 countries worldwide.

Previous research has often focused on a specific technology or payment method, but not on combinations of various factors, such as ease-of-use, usefulness, social influence, and

credibility, regarding all common DPMs. This study also emphasizes the fact that little research has examined the full-adoption phase, highlighting the impact of human-to-human interaction on human-to-machine payment solutions.

To address the abovementioned research gaps, this study empirically examines the relationships between a number of barrier-breakers and two categories of customers' intention to fully adopt DPMs. An additional analysis is conducted to investigate the moderating effect of the impersonalization barrier.

The results revealed the importance of credibility as a barrier-breaker toward the full-adoption of DPMs. For the adopters-resisters, usefulness and social influence were also significantly related to the intention to fully adopt DPMs. Moreover, the impersonalization barrier weakened the significant relationships under study. These results could be used to improve customers' experiences in using DPMs in terms of concrete actions to strengthen the credibility barrier-breaker and minimize the impersonalization barrier.

The next section presents the theoretical framework, including the hypothesis development. The third section outlines the research methods used, followed by a presentation of the empirical results. The final section starts with a discussion, and presents implications, limitations, and suggestions for future studies.

Theoretical background and hypotheses

Digital payment methods and full-adoption

Terms such as online payments (Yang *et al.*, 2015), e-payments (Martins *et al.*, 2014), cashless payments (Pizzol *et al.*, 2018), payment instruments (van der Cruijsen *et al.*, 2017), and electronic money (Singh, 2004) have been used to describe DPMs. Despite the richness of different terms, a common denominator is that all these descriptions exclude cash as a payment method (Rehncrona, 2018). Pizzol *et al.* (2018, p. 634) proposed an umbrella definition of DPMs: "payments made using electronic devices and channels". Based on that, this study defines DPMs as methods for monetary transactions using digital devices and channels. The study embraces only publicly accepted DPMs regulated by the government, i.e. bank cards (particularly debit and credit cards), Internet banking, and mobile banking. Blockchain-related DPMs are still currencies outside the control of regulatory authorities (Sveriges Riksbank, 2021) and are outside the scope of this study.

Different payment methods are preferred by customers in different countries. In Sweden, for example, less than 10% of all transactions are made with cash (Sveriges Riksbank, 2021), whereas in other developed countries with similar economic conditions and infrastructure, such as Germany, cash dominates among payment methods (Arvidsson, 2019). Among developing countries, China, known for its rapid digitalization (Yang *et al.*, 2015), is ranked just 40th in DPM adoption readiness (Thomas *et al.*, 2016). Regardless of whether a country is developed or developing, adoption of DPMs seems to depend on customers' perceptions (Oertzen and Odekerken-Schröder, 2019).

The pre-adoption (i.e. initial adoption) phase is when users consider whether to adopt or reject an innovation, while the post-adoption phase is when users consider whether to continue or discontinue using the service (Montazemi and Qahri-Saremi, 2015). When deciding whether to continue using the service, the adoption decision can include adoption acceptance or adoption resistance. Such differences in the customers' mental state may become particularly crucial when alternatives to the service in question no longer exist. Lee *et al.* (2005) emphasized the time gap between initial adoption and full-adoption, and Akana and Ke (2020) noted that paying with existing bank cards is not onerous enough for consumers to fully adopt the mobile banking alternative. In the scenario given in this study, the full-adoption of DPMs precludes the use of non-digital payment alternatives.

Technology acceptance model and intention to adopt

The technology acceptance model (TAM) is essentially based on the theory of reasoned action (TRA) and the theory of planned behavior (TPB). The basis of the TAM was the possibility of predicting and explaining how different variables will affect the intention to use a specific technology or system (Davis *et al.*, 1989). Two main constructs, i.e. ease-of-use and usefulness, are found to be important factors in relation to intention. Moreover, the TAM is among the most popular models in the investigation of technology acceptance due to its broad application to various innovations and populations (Davis *et al.*, 1989). Payment innovation adoption research (e.g. Martins *et al.*, 2014; Sivathanu, 2019; Zhang *et al.*, 2018) is no exception in applying different modifications of the TAM. Framing this study, the TAM2 extension proposed by Venkatesh and Davis (2000) – by adding, for example, social influence – has been implemented successfully in both mandatory and voluntary environments (Lai, 2017) and in the post-adoption phase (Yang *et al.*, 2015). Besides various TAM-modifications, Luarn and Lin (2005) extended the model by including credibility.

The empirical results of numerous studies (e.g. Martins *et al.*, 2014; Yang *et al.*, 2015) are evidence of the robustness of the model. Since the focus of this study is a system in which the only available payments are digital, the TAM2 was considered a suitable theoretical basis (Venkatesh *et al.*, 2003).

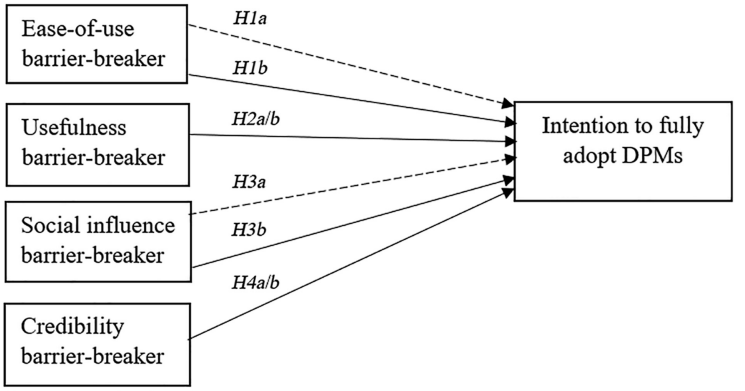
As an integrated part of the original TAM, studies (e.g. Lee, 2009; Mun *et al.*, 2017; Yang *et al.*, 2015; Zhang *et al.*, 2018) have investigated the intention to adopt innovations based on consumers' perceptions. Chawla and Joshi (2019) found that intention had a significant direct relationship to actual behavior. Considering that DPMs have not been fully adopted yet, the focus is accordingly on bank customers' intention to fully adopt DPMs.

Barrier-breakers and hypothesis development

As indicated, a set of barrier-breakers (i.e. ease-of-use, usefulness, social influence, and credibility) was applied to two different groups of customers. Based on previous studies, some differences in perceptions between the two groups could be found. The direct relationships between the barrier-breakers under study and the intention to fully adopt DPMs are illustrated in Figure 1.

Ease-of-use barrier-breaker

As a major part of the original TAM, ease-of-use is defined as the degree of effort that a user perceives when using a technology (Davis *et al.*, 1989). Thus, ease-of-use can be a significant



Source(s): Authors' own creation/work

Figure 1.
Conceptual model: hypothesis analysis

determinant of customers' intention to use new payment methods (Johnson *et al.*, 2018; Laukkanen, 2016; Lim *et al.*, 2022). For example, a smart innovation such as the newest smartphone with its small screen or many features can be perceived as too complex (Mun *et al.*, 2017), decreasing the willingness to use it. The development of most technologies is largely driven by customers' desire for more convenience (Sivathanu, 2019). DPMs, for example, require no effort: all payments can be executed around the clock, no matter where (Rehncrona, 2018).

It must be noted that ease-of-use is most crucial in an early stage of the adoption process (Šumak *et al.*, 2017). Although young ones seem to have more experience in using digital services than do their peers (Koenig-Lewis *et al.*, 2010), Mun *et al.* (2017) found that ease-of-use still plays a role in their adoption of new technologies. At the same time, Garrouch (2021) found that ease-of-use is no longer significant in the post-adoption phase for those who have more experience, which was supported by Venkatesh *et al.* (2003). However, those who show resistance are expected to have less experience in digital technology. This means that ease-of-use seems to be important for their intention to use new payment methods (Johnson *et al.*, 2018). Taken together, the following hypotheses are developed:

H1a. The ease-of-use barrier-breaker is unrelated to adopters-accepters' intention to fully adopt DPMs.

H1b. The stronger the ease-of-use barrier-breaker, the higher the intention of adopters-resisters to fully adopt DPMs.

Usefulness barrier-breaker

The perception of usefulness is the level of expectations relative to real performance (Davis *et al.*, 1989) regarding tasks being conducted more efficiently and effectively (Lim *et al.*, 2022). In practice, DPMs' usefulness is related to convenience, faster transactions, more transparency, and 24/7 access (Zhang *et al.*, 2018). In comparison to ease-of-use, in which the effort of using DPMs is most important, Davis *et al.* (1989) argued that perceived usefulness is related mostly to the accuracy of a technology. Thus, DPMs will be considered more useful if they are more accurate.

For full-adoption, customers should perceive DPMs as useful enough (Humbani and Wiese, 2019). Moreover, system issues such as disruptions also define the level of perceived usefulness (Lee, 2009). For example, AAs are more likely to adopt DPMs, which offer more advantages than do other alternatives (Mun *et al.*, 2017), while ARs value the functionality of DPMs (Berraies *et al.*, 2017). Although not investigating the full-adoption phase, Lee (2009) and Oertzen and Odekerken-Schröder (2019) highlighted that perceived usefulness is directly and positively related to the intention to adopt an innovation, leading to the next hypotheses:

H2a,b. The stronger the usefulness barrier-breaker, the higher the intention of adopters-accepters (a) and adopters-resisters (b) to fully adopt DPMs.

Social influence barrier-breaker

Davis *et al.* (1989) described social influence (first known as subjective norms) as customer perceptions in the decision to use a certain technology based on the influence of people important to the customer. Social influence was later described as "the effect of environmental factors such as the opinions of user's friends, relatives, and superiors" on consumer intention (Martins *et al.*, 2014, p. 4).

However, customers can be affected by different referent groups in their environment regarding the way they pay. In Sweden, for example, use of a popular mobile payment application at university/work can be an obstacle to students/employees who lack DPM experience, which can lead to financial exclusion (Sveriges Riksbank, 2021). Individuals with

no or poor past experience of technology are more likely to be influenced by others (Tan and Leby Lau, 2016). Members of groups with common interests may influence one another regarding services such as DPM use, especially if they feel uncertainty (Montazemi and Qahri-Saremi, 2015). Studies conducted empirical tests (e.g. Martins *et al.*, 2014; Tan and Leby Lau, 2016) and found a positive relationship between social influence and customer intention. However, Swedish YBCs have rich past experience of technology and are less likely to be influenced by others (Eriksson *et al.*, 2020). The fact that AAs and ARs seem to have different views leads to the following hypotheses:

H3a. The social influence barrier-breaker is unrelated to adopters-accepters' intention to fully adopt DPMs.

H3b. The stronger the social influence barrier-breaker, the higher the intention of adopters-resisters to fully adopt DPMs.

Credibility barrier-breaker

Credibility, related to trust and defined as "the extent to which a person believes that the use of mobile banking will have no security or privacy threat" (Luarn and Lin, 2005, p. 880), applies to all kinds of DPMs. The perceived credibility of financial services is often omitted in most TAM-related research. However, some studies emphasized the importance of credibility for DPMs (e.g. Luarn and Lin, 2005; Mun *et al.*, 2017). Moreover, credibility has the power to increase customers' confidence in DPMs (Rajaobelina *et al.*, 2019), especially among Internet-friendly customers, for whom the stability of payments is crucial (Yang *et al.*, 2015).

According to Shin *et al.* (2020), digital financial services such as DPMs are normally perceived as highly credible. Credibility may decrease the perceived risk (Rajaobelina *et al.*, 2019; Santo and Marques, 2022), reduce the perceived barriers (Luarn and Lin, 2005), and increase customers' intention to fully adopt DPMs. Perceived credibility was also highlighted by Rajaobelina *et al.* (2019) as a more powerful factor than ease-of-use and usefulness in the digital banking context. The following hypotheses are developed:

H4a,b. The stronger the credibility barrier-breaker, the higher the intention of adopters-accepters (a) and adopters-resisters (b) to fully adopt DPMs.

Research methodology

Questionnaire design

Previous studies in the digital banking context (e.g. Mun *et al.*, 2017; Shin *et al.*, 2020) adapted questionnaire items to be answered based on respondents' own perceptions, and online surveying was considered appropriate for collecting customers' opinions.

All constructs were adopted from previous studies. The ease-of-use barrier-breaker items (EBB1–2) and the usefulness barrier-breaker items (UBB1–2) were modified from Yang *et al.* (2015), while UBB3 was based on Thomas *et al.* (2016). Following Drolet and Morrison (2001) and the argument that similar questions may have "high costs", this study focused on the two best-established and most relevant items of the ease-of-use construct to avoid redundancy issues. Three items capturing the social influence barrier-breaker (SIBB1–3) were adopted from Venkatesh *et al.* (2003), while SIBB4 was based on Rivera (2019). All three credibility barrier-breaker items were modified from Pennington *et al.* (2003). The dependent variable, i.e. intention to fully adopt DPMs, was modified from Venkatesh and Davis (2000) as a single item. This is in line with Diamantopoulos *et al.* (2012), who emphasized the benefits of multi-item scales, but suggested advisable application of the single item regarding concrete global questions to avoid redundancy.

Questionnaires can be revised to limit potential bias, for example, by rephrasing questions using less abstract language (Podsakoff *et al.*, 2003). A pilot study was therefore conducted by

sending a preliminary version of the questionnaire to 51 respondents, from whom 31 completed questionnaires were obtained. The feedback from the pilot testing was used to make the questions simple and comprehensible for various kinds of respondents. Some of the preliminary items were modified and a few were withdrawn after consideration.

The first section of the questionnaire consisted of a short cover letter and an explanation of the aim of the study, while the second section contained background and demographic questions. This was followed by three core sections containing statements on the barrier-breakers and the intention to fully adopt, using four-point Likert scales anchored at 1 (strongly disagree) and 4 (strongly agree). This is in line with previous studies using four-point Likert scales in the banking context (e.g. Poon, 2008). Likert scales without midpoints were considered appropriate (cf. Nadler *et al.*, 2015), to avoid the potential misuse of "neither" options.

Sample and data collection

The first category of respondents (i.e. AAs) comprised experienced youngsters 18–29 years old, an age range common in young customer research (e.g. Lachance, 2012). Moreover, to open a bank account in Sweden, one must be of legal age, i.e. 18 years or older. Specifically, the sampled YBCs were students at Mid Sweden University. The demographic characteristics and homogeneous behavior of young university students (cf. Tan and Leby Lau, 2016; Yang *et al.*, 2015) characterized this frame of YBCs. Teachers responsible for nine randomly selected educational programs were contacted to deliver the online questionnaire to students in their programs via the university course platform or email. Reaching 913 students, 105 completed questionnaires were gathered after three reminders in the spring of 2020. The response rate was 11.5%. Considering that online surveys typically have low response rates (Baltar and Brunet, 2012), an analysis of non-response bias among the AAs was conducted following Armstrong and Overton (1977) and Levene's test of equality of variances. There were no significant differences ($p > 0.05$) between the first wave and the last wave of respondents regarding the key variables.

The questionnaire was also posted on the KU social media page, which, at the time of data collection, was followed by over 13,000 users; judging from their activity, around 1600 of these were considered potential questionnaire respondents. The KU group (i.e. ARs) comprised individuals with varied demographic characteristics but with a common interest in keeping cash as a publicly acceptable payment method (Arvidsson, 2019). Over a period of three weeks in the spring of 2020, 388 completed questionnaires were collected. The response rate for this second category of respondents was 24.2% (i.e. 388/1600), above the usually acceptable range of 11–15% for online platform surveys (Baltar and Brunet, 2012).

Data analysis

Internal consistency was measured using composite reliability based on the Fornell and Larcker (1981) approach. As recommended by Shevlin *et al.* (1997), factor analysis was used to justify the aggregation of items into factors. Based on the results, purified item scores were summated for each construct to create a new factor variable for each, as is standard in social sciences research (e.g. Shevlin *et al.*, 1997). However, Spearman correlation analysis was conducted beforehand to evaluate the correlation coefficients of the previous items, followed by a discriminant validity test based on the Fornell and Larcker (1981) criteria. Descriptive analysis was conducted, giving an overview of the demographic and background profiles of the respondents. Additionally, variance inflation factor (VIF) testing was conducted to check for potential multi-collinearity between summated items.

Ordinal logistic regression (OLR) was used to test the four hypotheses; this seems to be a practical method for measuring ordinal dependent variables in the social sciences, and when

testing hypotheses in a financial services context (Shin *et al.*, 2020). Dittrich *et al.* (2007) suggested the possibility of using summed Likert scale data as parametric data. The independent variables based on summed item scores were therefore analyzed as covariates in OLR for each sample, i.e. AAs and ARs. Due to empty cells with zero frequencies, the results of goodness-of-fit testing can be uncertain; however, according to Smith and McKenna (2012), this issue does not affect the other types of OLR tests, so they can be analyzed and taken into consideration.

The specification of OLR for both samples is as follows:

$$Y = \beta_0 + \sum_{j,1}^{k} \beta_j x_{i,j} + \mu_j$$

where

Y = dependent variable

β_0 = constant

β_j = parameter to be estimated

$X_{i,\,j}$ = the independent variables

μ_j = random error

Impersonalization barrier

As indicated, the lack of face-to-face services could be considered a barrier to the full-adoption of DPMs. Impersonalization refers to digital services such as chatbots, robo-advisors, virtual assistants, and payment self-services (Dimitrova and Öhman, 2021). The rapid digitalization forced by the COVID-19 pandemic has directed attention to how the lack of human connections affects customers. For example, Mozafari *et al.* (2022) noted that chatbots are perceived negatively when their bot identity is disclosed to customers, distinguishing them from chatbots perceived as humans. Due to the existence of the impersonalization barrier may reduce the positive effects of barrier-breakers, a moderating analysis was conducted using the SPSS software PROCESS macro, as suggested by Hayes and Preacher (2014). The analysis was conducted by employing an ordinary least squares regression, model 1, with a 5,000 bootstrapping sample procedure.

The moderating role of the impersonalization barrier was tested for the whole sample for the significant barrier-breakers (i.e. usefulness, social influence, and credibility), on one hand, and the intention to fully adopt DPMs, on the other.

Control variables

As one of the basic demographic factors, gender was found to be significant (Rajaobelina *et al.*, 2019), with the genders differing in their use of DPMs. Age was of interest given the two researched groups of customers. Income (Johnson *et al.*, 2018; Martins *et al.*, 2014) and location (Yang *et al.*, 2015) were also found to be important factors in the digital banking context. The relationships among the main concepts were also controlled by past experience, since both AAs and ARs have already used DPMs. Moreover, past experience has the power to increase or decrease the intention to adopt DPMs (Laukkanen and Kiviniemi, 2010).

Empirical results

Considering the importance of result robustness, the constructs were tested for reliability, validity and common method bias. Table 1 presents the constructs, followed by items and descriptions, and the factor loading per item based on factor analysis and sources. Table 2 shows the discriminant validity, composite reliability and VIF tests results.

Construct	Item	Item description	Factor loadings $n = 105/388$	Source
Ease-of-use barrier-breaker				
	EBB1	Digital transactions are easy to conduct	0.932/0.924	Modified from Yang *et al.* (2015)
	EBB2	It is easy to learn to use DPMs	0.932/0.924	Modified from Yang *et al.* (2015)
Usefulness barrier-breaker				
	UBB1	DPMs are more convenient to use than cash	0.844/0.838	Modified from Yang *et al.* (2015)
	UBB2	Digital transactions can be made quickly	0.844/0.838	Modified from Yang *et al.* (2015)
	UBB3	I will not regret if cash disappears as payment method	n/a*	Based on Thomas *et al.* (2016)
Social influence barrier-breaker				
	SIBB1	People in my environment believe I should use only DPMs	n/a*	Venkatesh *et al.* (2003)
	SIBB2	Using DPMs gives me higher status than cash	0.769/0.709	Venkatesh *et al.* (2003)
	SIBB3	I pay with DPMs if my friends also do that	0.728/0.796	Modified from Venkatesh *et al.* (2003)
	SIBB4	Public opinion affects my choice of payment methods	0.692/0.726	Based on Rivera (2019)
Credibility barrier-breaker				
	CBB1	I rely on DPMs	0.831/0.886	Pennington *et al.* (2003)
	CBB2	Applied security measures are good enough to allow me to make digital transactions in a desired way	0.868/0.885	Pennington *et al.* (2003)
	CBB3	DPMs are officially (i.e. publicly) accepted	0.777/0.620	Pennington *et al.* (2003)
Impersonalization barrier				
	IB1	Waiting time is long in tele- or chat queues	0.637/0.720	Modified from Yang *et al.* (2015)
	IB2	I find personal customer service more pleasant than self-service alternatives	0.588/0.793	Modified (reversed) from Laukkanen (2016)
	IB3	Chatbots give better service than do bank employees	n/a*	Modified from Yang *et al.* (2015)
	IB4	The lack of personal contact is an obstacle to relying on DPMs	0.774/0.756	Modified from Yang *et al.* (2015)
	IB5	I buy more when paying with DPMs	n/a*	Modified from Lachance (2012)
	IB6	I want to have the possibility to choose between bank employees and chatbots if in need of support	0.707/0.642	Modified from van der Cruijsen *et al.* (2017)
Intention to fully adopt DPMs	INT1	I plan to use only DPMs in the future	n/a	Modified from Chaouali *et al.* (2017)

Note(s): n/a = not applicable; *Items with weak correlations were removed; Factor loadings: Adopters-accepters (AA), $n = 105$, Adopters-resisters (AR), $n = 388$; DPMs = Digital payment methods
Source(s): The author's own creation/work

Table 1. Constructs, reliability and validity tests

Construct	EBB	UBB	SIBB	CBB	AVE	CR	VIF
		Correlation AA					
EBB	*0.932*				0.869	0.930	1.180
UBB	0.692**	*0.844*			0.713	0.832	1.216
SIBB	−0.108	−0.157	*0.730*		0.533	0.774	2.001
CBB	0.468**	0.427**	0.024	*0.826*	0.683	0.866	1.885
		Correlation AR					
Construct	EBB	UBB	SIBB	CBB	AVE	CR	VIF
EBB	*0.924*				0.854	0.921	1.287
UBB	0.624**	*0.838*			0.702	0.825	1.184
SIBB	0.051	0.201**	*0.744*		0.554	0.788	1.650
CBB	0.446**	0.520**	0.163**	*0.846*	0.639	0.839	1.452

Note(s): Spearman's rho correlation analysis; diagonal in italics shows square roots of AVE; the rest of the values show correlation coefficients between constructs; AA = Adopters-accepters, $n = 105$; AR = Adopters-resisters, $n = 388$; AVE = Average variance extracted; CR = Composite reliability; VIF = Variance inflation factor; $^{**}p < 0.01$

Source(s): The author's own creation/work

Table 2.
Discriminant validity and reliability tests

Almost all of the constructs' items had factor loadings above 0.7, except for one social influence barrier-breaker item (SIBB4) for AAs and one credibility barrier-breaker item (CBB3) for ARs. Since lower values can be assumed for four-point Likert scales (Nadler *et al.*, 2015), this study followed Laukkanen and Kiviniemi (2010), and Eriksson *et al.* (2020), among others, in accepting factor loadings above 0.5. Notably, all items of the moderating variable (i.e. the impersonalization barrier) were above this threshold.

Based on the Fornell and Larcker (1981) criteria, square roots of average variance extracted (AVE) for every construct, compared with correlation estimates, indicated discriminant validity and that composite reliability was higher than 0.7, confirming the internal consistency of items. The additional Spearman-Brown test, proposed by Eisinga *et al.* (2013) regarding the two-item scale, indicated the high reliability of both samples (0.84 for the AA group and 0.82 for the AR group). VIF coefficients indicated no risk of multi-collinearity, with all items far below the acceptable 10 according to the rule of thumb (Hair *et al.*, 2014). Harman's first factor test was also applied, explaining 35.1% of the total variances, which was far below the cut-off of 50% (cf. Podsakoff *et al.*, 2003). In addition to preliminary measures such as assuring anonymity of respondents and physical separation of items in the questionnaire, the Harman's first factor test confirmed the lack of common method bias in this study.

The demographic profile of the respondents is presented in Table 3. All respondents had a bank account in at least one Swedish bank. Females and males were equally represented in both groups of customers. In accordance with the research frame, 100% of the AA respondents were 18–29 years old, while different age groups were included in the AR group. Note that most AAs were in the lowest monthly income range, and that the respondents in both groups had various locations. Past experience of DPMs differed significantly, with AAs often or very often using bank cards, Internet banking, and mobile banking applications, and over half of ARs never or very rarely using mobile applications. Regarding the frequency of cash usage, 42.9% of AAs and just 2.6% of ARs reported never paying with cash. The descriptive results of the frequency analysis of all four barrier-breakers together with the intention to fully adopt DPMs are presented at the bottom of Table 3. All mean values were higher for the AA group than for the AR group.

Tables 4 and 5 present Spearman correlation coefficient matrices for each group. Results according to AA perceptions highlighted the significant positive correlation between the

Variable	Value	AA	AR
Swedish bank account	Yes	105 (100%)	388 (100%)
	No	0 (0%)	0 (0%)
Gender	Male	49 (46.7%)	205 (52.8%)
	Female	55 (52.4%)	181 (46.6%)
	Other	1 (1%)	2 (0.5%)
Age (years)	18–29	105 (100%)	23 (5.9%)
	30–53	n/a	155 (39.9%)
	54–65	n/a	129 (33.2%)
	>65	n/a	81 (20.9%)
Monthly income (SEK)	<20,000	89 (84.8%)	104 (26.8%)
	20,000–39,999	13 (12.4%)	196 (50.5%)
	40,000–59,999	0 (0%)	36 (9.3%)
	>59,999	0 (0%)	13 (3.4%)
	Do not want to share	3 (2.9%)	39 (10.1%)
Location	Big city	10 (9.5%)	113 (29.1%)
	City	68 (64.8%)	79 (20.4%)
	Small city	15 (14.3%)	71 (18.3%)
	Village	12 (11.4%)	125 (32.2%)
Payment experience:			
Bank card	Never	0 (0%)	21 (5.4%)
	Rarely	4 (3.8%)	138 (35.6%)
	Often	33 (31.4%)	174 (44.8%)
	Very often	68 (64.8%)	55 (14.2%)
Cash	Never	45 (42.9%)	10 (2.6%)
	Rarely	56 (53.3%)	71 (18.3%)
	Often	3 (2.9%)	170 (43.8%)
	Very often	1 (1.0%)	137 (35.3%)
Internet banking	Never	6 (5.7%)	35 (9.0%)
	Rarely	24 (22.9%)	133 (34.3%)
	Often	44 (41.9%)	187 (48.2%)
	Very often	31 (29.5%)	33 (8.5%)
Mobile app	Never	2 (1.9%)	112 (28.9%)
	Rarely	13 (12.4%)	183 (47.2%)
	Often	42 (40.0%)	84 (21.6%)
	Very often	48 (45.7%)	9 (2.3%)

Interval (Likert scale)	Min	Max	Mean (SD) AA	Mean (SD) AR
EBB1–2	2	8	7.05 (1.212)	5.10 (1.716)
UBB1–2	2	8	6.85 (1.433)	4.26 (1.542)
SIBB2–4	3	12	5.91 (2.296)	4.44 (1.899)
CBB1–3	3	12	9.65 (1.641)	6.89 (2.008)
INT1	1	4	2.98 (0.930)	1.18 (0.552)

Note(s): AA = Adopters-accepters; AR = Adopters-resisters; n/a = not applicable; SD = Standard deviation
Source(s): The author's own creation/work

Table 3. Demographic and descriptive statistics

dependent variable and the following independent variables: ease-of-use (EBB1–2), usefulness (UBB1–2), and credibility (CBB1–3). The results for the ARs were almost the same as for the AAs, except that social influence (SIBB2–4) was also significantly and positively correlated to the intention to fully adopt DPMs.

The summarized results based on OLR analysis are presented in two sections in Table 6. Section A applies to AA perceptions, and the only significant independent variable ($p < 0.001$)

Table 4.
Spearman correlation matrix for AA

Item	EBB1	EBB2	UBB1	UBB2	SIBB2	SIBB3	SIBB4	CBB1	CBB2	CBB3	INT1
EBB1	1.000										
EBB2	0.698**	1.000									
UBB1	0.577**	0.646**	1.000								
UBB2	0.655**	0.522**	0.497**	1.000							
SIBB2	−0.103	0.001	−0.037	−0.109	1.000						
SIBB3	−0.130	−0.012	0.004	−0.220*	0.391**	1.000					
SIBB4	−0.230*	−0.196*	−0.243*	−0.217*	0.336**	0.274**	1.000				
CBB1	0.364**	0.356**	0.442**	0.240*	0.088	0.119	−0.114	1.000			
CBB2	0.398**	0.354**	0.393**	0.182	0.073	0.012	−0.120	0.650**	1.000		
CBB3	0.343**	0.369**	0.429**	0.228*	0.084	−0.021	−0.015	0.407**	0.483**	1.000	
INT1	0.290**	0.461**	0.581**	0.248*	0.129	0.159	−0.225*	0.541**	0.611**	0.411**	1.000

Note(s): $n = 105$; AA = Adopters-accepters; EBB1–2 = Ease-of-use barrier-breaker; UBB1–2 = Usefulness barrier-breaker; SIBB2–4 = Social influence barrier-breaker; CBB1–3 = Credibility barrier-breaker; INT1 = Intention to fully adopt DPMs; **$p < 0.01$ (two-tailed), *$p < 0.05$ (two-tailed)
Source(s): The author's own creation/work

Table 5. Spearman correlation matrix for AR

Item	EBB1	EBB2	UBB1	UBB2	SIBB2	SIBB3	SIBB4	CBB1	CBB2	CBB3	INT1
EBB1	1.000										
EBB2	0.693**	1.000									
UBB1	0.390**	0.328**	1.000								
UBB2	0.677**	0.481**	0.403**	1.000							
SIBB2	0.028	0.006	0.205**	0.077	1.000						
SIBB3	0.097	0.059	0.174**	0.095	0.345**	1.000					
SIBB4	0.036	0.030	0.175**	0.091	0.258**	0.337**	1.000				
CBB1	0.414**	0.363**	0.408**	0.417**	0.096	0.105*	0.073	1.000			
CBB2	0.414**	0.323**	0.315**	0.410**	0.080	0.109*	0.068	0.722**	1.000		
CBB3	0.217**	0.243**	0.239**	0.285**	0.208**	0.039	0.100*	0.297**	0.304**	1.000	
INT1	0.190**	0.136**	0.338**	0.173**	0.141**	0.181**	0.150**	0.260**	0.245**	0.065	1.000

Note(s): n = 388; AR = Adopters-resisters; EBB1–2 = Ease-of-use barrier-breaker; UBB1–2 = Usefulness barrier-breaker; SIBB2–4 = Social influence barrier-breaker; CBB1–3 = Credibility barrier-breaker; INT1 = Intention to fully adopt DPMs; $^{**}p < 0.01$ (two-tailed), $^{*}p < 0.05$ (two-tailed)
Source(s): The author's own creation/work

Section A	OLR for AA (dependent variable: intention to fully adopt DPMs) Estimate	Std. error	Wald	df	*p*-value	Hypothesis	Result
Ease-of-use barrier-breaker	0.073	0.268	0.075	1	0.784	H1a	Supported
Usefulness barrier-breaker	0.295	0.231	1.633	1	0.201	H2a	Rejected
Social influence barrier-breaker	0.047	0.101	0.213	1	0.644	H3a	Supported
Credibility barrier-breaker	0.942	0.179	27.687	1	0.000	H4a	Supported

Note(s): Section A: link function, Logit; Model fitting information, $p = 0.000$; Goodness of fit, $p = 0.831$; Pseudo-R^2: Cox and Snell 0.500, Nagelkerke 0.545; Test of parallel lines, $p = 0.337$; AA = Adopters-accepters

Section B	OLR for AR (dependent variable: intention to fully adopt DPMs) Estimate	Std. error	Wald	df	*p*-value	Hypothesis	Result
Ease-of-use barrier-breaker	−0.020	0.157	0.016	1	0.900	H1b	Rejected
Usefulness barrier-breaker	0.655	0.160	16.704	1	0.000	H2b	Supported
Social influence barrier-breaker	0.263	0.088	8.881	1	0.003	H3b	Supported
Credibility barrier-breaker	0.348	0.126	7.650	1	0.006	H4b	Supported

Note(s): Section B: link function, Logit; model fitting information, $p = 0.000$; goodness of fit, $p = 0.000$; pseudo-R^2: Cox and Snell 0.225, Nagelkerke 0.375; Test of parallel lines, $p = 1.000$; AR = Adopters-resisters
Source(s): The author's own creation/work

Table 6.
OLR and hypothesis results

was the credibility barrier-breaker. The probability of using DPMs increased if the credibility barrier-breaker increased. Accordingly, H4a was supported. The rest of the independent variables were not significantly related to the intention to fully adopt DPMs, meaning that H2a was rejected, while H1a and H3a were supported.

OLR results for ARs are shown in section B. The hypotheses regarding usefulness (H2b), social influence (H3b), and credibility (H4b) were supported. However, H1b was rejected because of the lack of relationship between the ease-of-use barrier-breaker and the dependent variable.

The values of pseudo-R^2 for AAs (ARs) were 0.500 (0.225) Cox and Snell, and 0.545 (0.375) Nagelkerke indicating that 50.0% (22.5%) and 54.5% (37.5%) of the variation in the dependent variable (i.e. intention to fully adopt DPMs) was explained by the independent variables. According to the test of parallel lines ($p = 0.337$ for the AA group and $p = 1.000$ for the AR group), proportional odds assumption was not violated.

The moderating effect of the impersonalization barrier was tested for the whole sample but only between the significant barrier-breakers (i.e. usefulness, social influence, and credibility), on one hand, and the intention to fully adopt DPMs, on the other. The ease-of-use barrier-breaker was not included in this additional test due to the insignificant relationship with the intention to fully adopt DPMs. This additional analysis is presented in Table 7, showing significantly negative moderating effects. The results indicated that the impact of

Moderator: impersonalization barrier Direct relationship	Effect	*t*-value	*p*-value
UBB – Intention	−0.0363	−7.0560	0.0000
SIBB – Intention	−0.0161	−3.5551	0.0004
CBB – Intention	−0.0330	−8.3312	0.0000

Note(s): UBB = Usefulness barrier-breaker; SIBB = Social influence barrier-breaker; CBB = Credibility barrier-breaker; Effect = Interaction terms; $n = 493$; Model $p = 0.0000$
Source(s): The author's own creation/work

Table 7.
Moderation analysis results

usefulness, social influence, and credibility, respectively, on the intention to fully adopt DPMs was weaker for those bank customers who perceived a higher impersonalization barrier.

Concluding remarks

Discussion and conclusion

The influence of a set of barrier-breakers on the intention to fully adopt DPMs was investigated in two groups of customers called adopters-accepters and adopters-resisters. Hypotheses were developed based on the literature, and the results give empirical evidence on a topic of importance for society in relation to the COVID-19 pandemic. In particular, the results indicated which factors can help break existing barriers to the full-adoption of DPMs and that the impersonalization barrier is crucial for eventually achieving a cashless society.

Contrary to previous research (Poromatikul *et al.*, 2019; Tan and Leby Lau, 2016; Yang *et al.*, 2015), the present results indicated no significant relationship between ease-of-use and intention to fully adopt DPMs among adopters-accepters and adopters-resisters. This is interesting, because ease-of-use is fundamental to the TAM. However, the result is consistent with the findings of Garrouch (2021) and Šumak *et al.* (2017), that adopters-accepters appear to have high expectations and require advanced features. Adopters-resisters also seem to have ample experience of DPMs. In other words, both groups of customers are used to paying digitally. A possible reason for this result is that Sweden is among the top-ranked countries regarding digital infrastructure (Thomas *et al.*, 2016). An additional possible explanation is that ease-of-use varies among different adoption phases, and that it is more important for a technology to be easy to use in the initial adoption phase than in the post-adoption phases.

The usefulness of DPMs was perceived as an important positive factor by adopters-resisters, confirming Berraies *et al.*'s (2017) and Oertzen and Odekerken-Schröder's (2019) findings. This could be because cognitive resisters expect DPM performance to be free of technical errors (Chaouali and Souiden, 2019). Adopters-accepters, however, did not perceive the usefulness barrier-breaker as significant, which differs from the results of previous studies (e.g. Mun *et al.*, 2017). This may be because usefulness is perceived as a basic mandatory feature of DPMs, and this particularly concerns those who are less knowledgeable and have less past experience than do adopters-accepters.

Regarding the social influence barrier-breaker, the present results confirmed Tan and Leby Lau's (2016) finding that those with less experience are more likely to be influenced by people in their environment, which seems to be the case with adopters-resisters. The results for this group confirmed the suggestion that social influence is positively related to the intention to fully adopt DPMs, consistent with Martins *et al.* (2014). For members of a group with common interests and shared opinions, positive social influence could lead to increased intention to fully adopt DPMs, even though this group seems to resist doing so. In contrast, and as hypothesized, adopters-accepters were more used to DPM technologies, and appeared to be more independent in the adoption process.

The present results indicated that the only significant barrier-breaker for adopters-accepters is DPM credibility. Koenig-Lewis *et al.* (2010) assumed that credibility does not significantly affect the use of DPMs because of the inability to evaluate security and privacy issues. However, more than ten years later, DPM developments seem to be making at least some customers aware of such barriers. Thus, the credibility barrier-breaker positively affected the intention of both adopters-accepters and adopters-resisters to fully adopt DPMs, corroborating the findings of Luarn and Lin (2005) and Mun *et al.* (2017).

The additional analysis indicated the importance of the impersonalization barrier in times when the COVID-19 pandemic has forced customers to use new digital service marketplaces. The lack of human-to-human interactions and emotions such as empathy reduced the positive effects of usefulness, social influence, and credibility on the intention to use DPMs.

This confirmed the importance of offering personal services in the digital banking context (Dimitrova and Öhman, 2021; van Pinxteren *et al.*, 2020), indicating that human-to-human assistance may help bank customers in the human-to-machine payment context.

Implications, limitations, and suggestions for further research

Previous research has suggested that barriers such as privacy concerns, access limitations, and lack of face-to-face services seem to have a negative impact on customers' intention to adopt DPMs (Yang *et al.*, 2015). The present results indicated that certain barrier-breakers deserve further attention, not only from scholars but also from retail banks, financial companies, merchants, central banks, related IT professionals, and customers.

The theoretical contribution concerns the testing of a set of barrier-breakers as a TAM-extension. Luarn and Lin (2005) and Mun *et al.* (2017) suggested that the TAM seems applicable in the digital banking context but previous research has seldom used credibility as a TAM-determinant. This study suggests that the credibility barrier-breaker is important in this particular context, calling for more attention in further research. The study further suggests that the impersonalization barrier can be highlighted as a moderator indicating the need for the TAM to be modified to the digital world.

An interesting result was that both groups of adopters perceive existing DPMs as sufficiently easy to use. It seems that banks, financial companies, and IT professionals have successfully developed devices and systems that help customers overcome the ease-of-use problem (Laukkanen, 2016). This allows them to focus on addressing the other barrier-breakers to further improve DPMs. The importance of DPM credibility suggests that various customers still need to be convinced that DPMs are free of unnecessary technical errors and privacy and security issues (Shin *et al.*, 2020). Retail banks and merchants, therefore, have to maintain DPM credibility and seek to increase customers' confidence when paying digitally.

Adopters-resisters seem to perceive DPM usefulness and social influence as possible barrier-breakers, indicating that they may need more time to get used to making transactions digitally. This can be useful for retail banks and merchants in increasing DPM usefulness, allowing better everyday payment performance. Concerning the social influence barrier-breaker, marketers and communication managers can further develop social activities and networking events where customers can share their knowledge and experience.

Of interest for the success of barrier-breaker implementation is how the impersonalization barrier is handled. This barrier needs attention when creating an emotional connection to customers who use DPMs (Dimitrova and Öhman, 2021). In particular, vulnerable customers may suffer from financial exclusion. Therefore, a desirable balance between digital and human services requires new service marketplace solutions such as omni-channel services and the creation of bots that are as human-like as possible to make the digital payment process smoother.

Like all research, this study has limitations. As the use of a convenience sample decreases the possibility of generalization (Chaouali and Souiden, 2019), further investigations of panel data covering thousands of participants is recommended. The present study is geographically restricted, so cross-cultural research could give better insights into the topic of interest. In relation to the adoption process, innovation diffusion theory (IDT) could also be considered. A number of studies (e.g. Laukkanen and Kiviniemi, 2010) argued that perceived ease-of-use in the TAM corresponds to complexity in IDT and perceived usefulness in the TAM to relative advantage in IDT. To make stronger theoretical contributions, future work could compare and integrate the TAM and IDT. Further studies investigating a number of barrier-breakers are also encouraged. Single- and two-item scales are recommended when a risk of redundancy exists; otherwise, multi-item scales are preferred to increase content validity. Comparison between various categories of customers based on a more advanced

sample than that used here is recommended, as are studies investigating various DPMs in various adoption phases.

Although research (and business) treats customer perceptions as important, such research is limited due to the dynamic nature of perceptions (Hauff, 2019). Experimental methods would address this issue in future studies of relevant subject matter related to DPMs in the post-corona era from different perspectives.

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About the author

Irina Dimitrova is Doctoral Student in Business Administration at Mid Sweden University and the Centre for Research on Economic Relations. Her research focuses on financial issues. Irina Dimitrova can be contacted at: irina.dimitrova@miun.se