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The impact of financial inclusion on digital payment solution uptake within the Gulf Cooperation Council Economies

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ABSTRACT

Recognizing the role of society in the sustainability of payment system innovation through the quadruple helix framework, this study analyzes the causal influence of demand-side financial inclusion indicators on society's uptake of digital payment solutions (DPS) within the regional economy of the Gulf Cooperation Council. To this end, the present study relies on data extracted from Global Findex surveys (in 2014 and 2017), as well as the economic theory of random utility maximization, to model individuals' DPS uptake decisions "ceteris paribus." The maximum likelihood estimation revealed no gender-based gradient in DPS uptake behaviors; additionally, financial inclusion indicators such as transaction account ownership and debit card ownership did not significantly influence endogenous or exogenous DPS uptake decisions between 2013 and 2017. However, all remaining financial inclusion indicators did significantly influence DPS uptake. Assessing these findings through the lens of open innovation and the ongoing efforts from the Arab Regional Payment System project, which seeks to expand financial inclusion by facilitating access to transaction accounts, there is reasonable evidence to suggest that complementary financial inclusion policies addressing the use dimension of DPS (i.e., extending access to saving and borrowing, along with digital payroll practices for both private and public enterprises) would contribute to more effective policy on financial inclusion in the region.

1. Introduction

The Helical Framework Theory characterizes innovation infrastructure as the interplay between institutional actors with specialized and interdependent functions (Cai and Etzkowitz, 2020). These actors operate within interactive helical spaces to foster economic and social development (Carayannis et al., 2018). As illustrated in Fig. 1, the theory recognizes four institutional actors: academia, industry, government, and society (Höglund and Linton, 2018; Yun and Liu, 2019). These actors interact in terms of knowledge, innovation, consensus, and consumption spaces, while still assuming the respective functions of novelty production, wealth generation, normative control, and utility/needs satisfaction (Schütz et al., 2019).

Concerning payment system innovation, the role of the fourth institutional actor (society) is often overlooked (Borkowska and Osborne, 2018; Bengtsson and Edquist, 2022). However, various stages of this innovation, including the development, diffusion, and adoption of digital payment solutions (DPS), result from the interplay between novelty production in academia, wealth generation within the industry, normative policy control by the government, and utility maximization among

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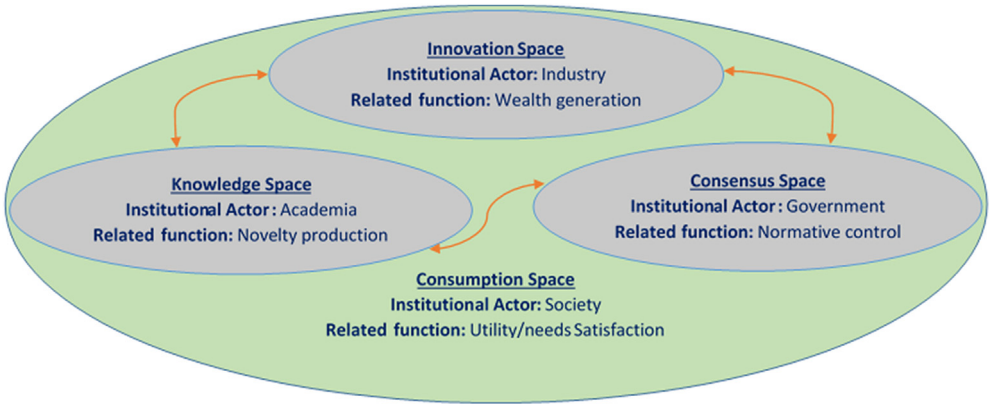

Fig. 1. Innovation Helical framework in the Consumption Space.

members of society. The important role of society within the Helical Theory Framework was initially recognized by Carayannis and Campbell (2012), who formulated the quadruple helix typological modality.

Despite the theoretical recognition that society's demand for technological innovations, including DPS, may help stimulate their sustained development (since the successful adoption of an innovative payment instrument requires acceptance by both businesses and consumers), there is a lack of empirical evidence on demand-driven payment systems. Instead, the majority of the existing literature has focused on the supply of such innovations (Ligon et al., 2019; Lee et al., 2020; Shi and Sun, 2020; Wang, 2020) rather than society's demand (Ohlan and Rani, 2019; Bengtsson and Edquist, 2022).

As well as fostering financial inclusion (generally defined as both access to and usage of appropriate, affordable, and accessible financial services), payment system innovation in the form of DPS uptake has been found to bring significant benefits to stakeholders in modern economic systems (Al-Khouri, 2014; Bakšys and Sakalauskas, 2009; Taylor, 2016). The reported benefits to financial institutions include financial market development (Žvirblis and Buračas, 2010), increased credit history, and fewer risky loans (Giné et al., 2012). Governments also play an important role in increasing transparency in public transfers (Masino and Niño-Zarazúa, 2020); this contributes to reducing leakages and fake recipients' issues (Gupta and Pal, 2020) while providing cost savings in the long run (Klapper and Singer, 2017a, 2017b). Furthermore, the benefits for digital payment recipients include lower costs due to reduced travel time and expenses (Aker et al., 2020), increased convenience (Ky et al., 2021), timely delivery and security, and better control of financial transactions (Alqudah, 2018). Other documented benefits to society include increased resilience (Afawubo et al., 2020), incentives to save (Batista and Vicente, 2020; Niankara, 2020), increased connectivity to the broader economy (beyond geographical boundaries) (Kos and Kloppenburg, 2019), women's economic empowerment (Islam, 2020), and overall social inclusion (Lal, 2021).

As a result, financial inclusion has become an important policy goal in the global development arena. One of the first steps toward this is gaining access to a deposit account at a formally regulated financial institution (Demirgüç-Kunt et al., 2020). However, cumulative evidence also suggests that policy efforts addressing only the supply side of payment system innovation within economic systems often fail to deliver the full benefits to society (Bengtsson and Edquist, 2022).

In the context of the Middle East, following the 2015 downturn in oil prices and the concerted efforts of monetary authorities, financial institutions, and payment service providers, the Gulf Cooperation Council (GCC) countries have endeavored to diversify their regional economy by expanding DPS to facilitate tax revenue collection, in addition to ensuring greater transparency and security (Alshubiri, 2019). However, Srouji (2020) reported limited DPS uptake within GCC countries, with cash still dominating payment transactions. This suggests the need for more research on the demand-side drivers of DPS adoption within the GCC regional economy. Based on this context, this study aims to analyze the causal influence of demand-side drivers of DPS uptake decisions by members of society within the GCC regional economic system.

To this end, the remainder of the paper is structured as follows. Section 2 provides a succinct background on financial inclusion initiatives within the GCC regional economy, culminating in the formulation of the research hypothesis and the conceptual framework; Section 3 presents the adopted methodology, which describes not only the mathematical operationalization of the conceptual framework but also the data sample used in the analysis; Section 4 presents the research findings, which are then discussed further in Section 5; Finally, Section 6 addresses the conclusions, along with suggestions for future lines of research.

2. Literature review, research framework, and hypotheses

In order to support regional financial inclusion initiatives in the Middle East and North Africa (MENA), the Arab Monetary Fund was established in 2012 under the purview of the Council of the Arab Central Bank Governors (Attia and Benson, 2018).

The subsequent actions undertaken by the Arab Monetary Fund were guided by its 2015–2020 Strategic Plan, which set out to help member countries improve access to financial services, as well as broaden and deepen financial systems across the region. In light of these needs, a regional initiative on financial inclusion named "Financial inclusion for the Arab Region Initiative" was established in Egypt in September 2017; This was constructed under the auspices of the Council of the Arab Central Banks Governors and sponsored by the Arab Monetary Fund in partnership with the World Bank Group (Arab Monetary Fund, 2019).

The initiative's objective was to facilitate scale-ups in support of financial inclusion development, in accordance with other initiatives such as the G20 Agenda on financial inclusion and the 2030 Agenda for Sustainable Development Goals (SDGs) (Attia and Benson, 2018). Within this framework, its scope encompassed a range of relevant financial inclusion policy domains, including (i) the collection of financial inclusion data for evidence-based policymaking; (ii) supporting gender parity in financial inclusion outcomes; and (iii) expanding digital financial service provision and institutional innovation in the MENA region.

Due to varying degrees of financial infrastructural readiness and political and social stability, countries require different financial inclusion policy initiatives (Santos-Arteaga et al., 2020; Alkhowaiter, 2020). The issue of coverage (i.e., access extension) through digital financial services and institutional innovation remains relevant for many countries, including the MENA region. For some countries, such as members of the GCC, which are among the wealthiest emerging economies in the world (Ben Ltaifa et al., 2018), the supply side of financial inclusion receives significant coverage (Khatoon et al., 2020). Therefore, in this case, a more relevant policy question is whether financial inclusion significantly affects well-being through society members' use of digital financial services, including DPS, to satisfy their consumption needs.

The relevance of the above question is rooted in "the inactive users' problems," which has emerged as an important topic of debate in the field of financial inclusion policy (Ozili, 2020). From a regulatory standpoint, inactive users create a new kind of financial inclusion dilemma for policymakers because scarce infrastructural resources are often mobilized to extend financial coverage. Therefore, by reducing the volume of financial transactions, financial inactivity also reduces the revenues of financial institutions, resulting in reduced tax revenues for governments; this, in turn, affects public service provision and overall economic output.

Owing to the potential adverse effect of users' inactivity on economic growth, the issue deserves attention from all four institutional actors in the quadruple helix system, including academic scholars (Amry et al., 2021). Therefore, this study relies on data from four of the six GCC countries (collected through the latest two waves of the Global Findex survey in 2014 and 2017) to analyze the causal influence of financial inclusion (in terms of access to a formal account, as well as financial products and services such as savings, borrowings, debit cards, credit cards, and emergency funds) on DPS uptake decisions by individuals within the GCC regional economy.

Although policy efforts usually aim to correct or improve market outcomes, financial inclusion policies within the GCC regional economy also aim to extend the financial coverage and services needed to help people meet their consumption needs, thereby improving standards of living. Given the limited prior evidence on this matter, this study adopts a rather conservative view, under which "financial inclusion policies in the GCC regional economy are fully binding" and "efforts to extend financial inclusion in GCC countries on the supply side are matched with significant account usage by the demand side." As such, the associated null and alternative hypotheses are as follows:

Ho: *The ongoing state of financial inclusion in the GCC regional economy positively influences members of society's DPS uptake decisions.*

Ha: *The ongoing state of financial inclusion in the GCC regional economy has no bearing on members of society's DPS uptake decisions.*

The framework adopted for studying individual members of society's DPS uptake decisions in the GCC regional economy is derived from the economic theory of random utility maximization (RUM) (Ben-Akiva et al., 2019). Based on the importance of using behavioral economics tools to analyze decision-making (Neto et al., 2019), and in accordance with McFadden's subjective interpretation of utility (McFadden, 2001), as well as the random utility model of behavioral optimization presented in Niankara (2022), the framework stipulates that each individual's DPS uptake decision is driven by the subjective utility they derive from such uptake. As such, an individual will choose to rely on DPS for purchase purposes if and only if the utility derived from such an uptake exceeds that of not uptaking. In other cases, they will choose not to rely on DPS. The framework further assumes that the subjective utility derived by each individual member of society depends on observed (exogenous and endogenous) financial inclusion indicators, as well as random influences that are not observed. These factors are depicted in a random utility-based conceptual framework, as shown in Fig. 2.

Among the included financial inclusion indicators, formal "account" ownership is assumed to endogenously determine individuals' DPS preferences, while the remaining indicators are exogenous determinants, along with socio-economic and demographic indicators. Together, observed factors combine with unobserved/latent factors to determine the subjective utility of DPS uptake for each member of society, as illustrated in Fig. 2. For each individual, the relative level of derived utility determined whether they decided to adopt DPS through Internet-based payments/purchases in the 12 months prior to data collection.

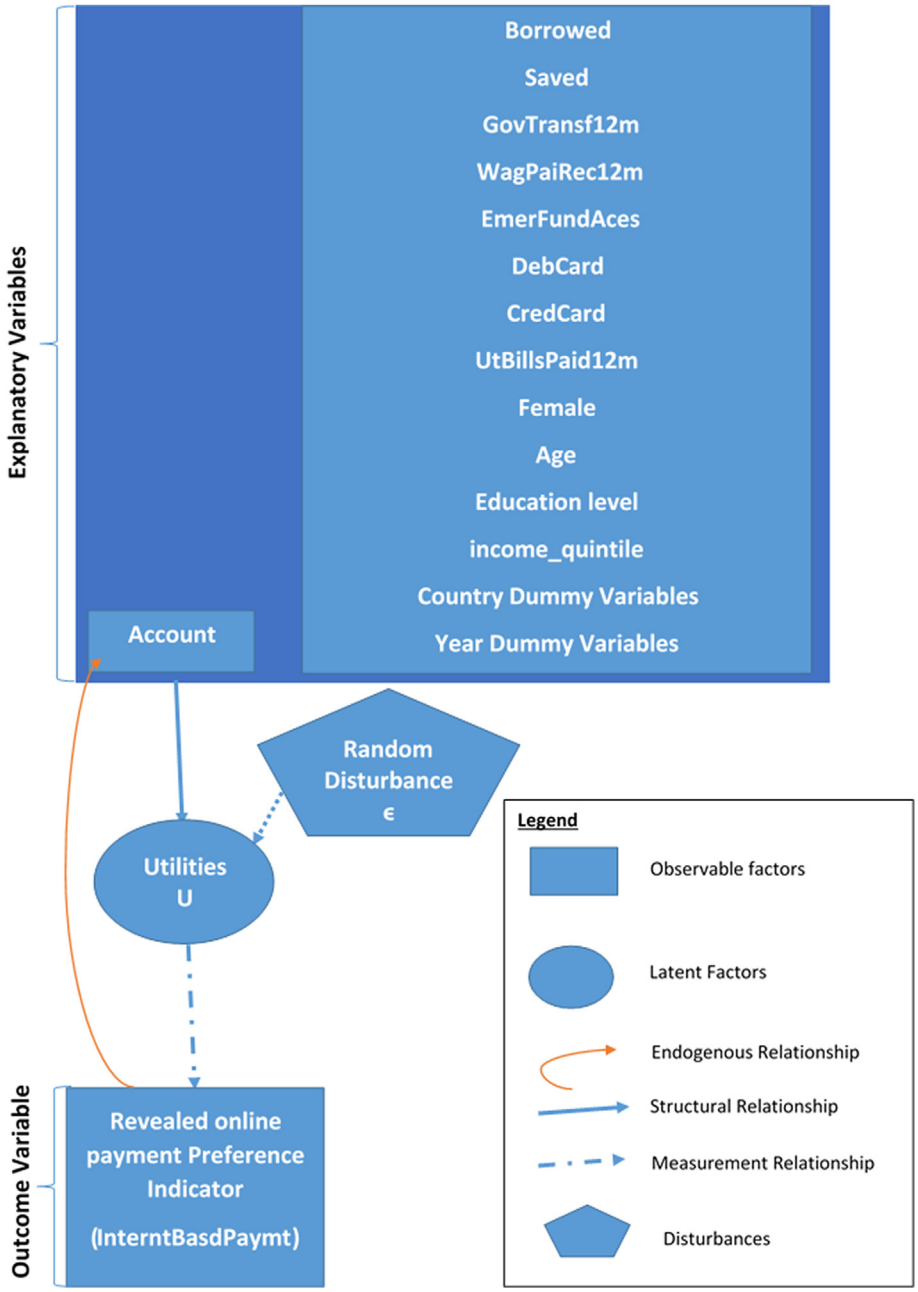

Fig. 2. Random Utility Based Conceptual Framework of DPS uptake.

3. Methodology

3.1. The behavioral economics model

To operationalize the random utility-based conceptual framework, the behavioral economics model of DPS uptake within the GCC region was developed by assuming that each member of society wants to maximize utility. As such, DPS uptake decisions can be characterized using the following random utility representations:

$$\begin{cases} U_A^* = V_A + \varepsilon_A \\ U_{\overline{A}}{}^* = V_{\overline{A}} + \varepsilon_{\overline{A}} \end{cases} \begin{cases} U_I^* = V_I + \varepsilon_I \\ U_{\overline{I}}{}^* = V_{\overline{I}} + \varepsilon_{\overline{I}} \end{cases} \tag{1}$$

where.

A characterizes the choice to « own an account » while $\overline{A}$ represents its complement;

I denotes the individual's choice to « uptake DPS» and $\overline{I}$ represents its complement event.

V_A , $V_{\overline{A}}$, V_I , $V_{\overline{I}}$ represent the observed component parts of the utility functions, whereas ε_A, $\varepsilon_{\overline{A}}$, ε_I , $\varepsilon_{\overline{I}}$ represent the random parts of utility. Considering the latency of utility, the indicators revealing each individual's account ownership and DPS uptake outcomes are observable here. As such, the relationships between the latent utilities and observed indicators are expressed as follows:

$$D_1 = \begin{cases} A & if \quad U_A^* - U_{\overline{A}}{}^* > 0 \\ \overline{A} & otherwise \end{cases} \quad D_2 = \begin{cases} I & if \quad U_I^* - U_{\overline{I}}^* > 0 \\ \overline{I} & Otherwise \end{cases} \tag{2}$$

Due to the binary nature of each of the two decisions (which can be understood as choosing whether or not to engage with the corresponding financial service during the year), the uptake of each financial service (A, I) can be defined as "1," while their non-uptake ($\overline{A}$,$\overline{I}$) can be defined as "0". In such contexts, the binary choice process in Equation (2) can also be expressed as:

$$D_1 = \begin{cases} 1 & if \quad U_A^* - U_{\overline{A}}{}^* > 0 \\ 0 & otherwise \end{cases} \quad D_2 = \begin{cases} 1 & if \quad U_I^* - U_{\overline{I}}^* > 0 \\ 0 & Otherwise \end{cases} \tag{3}$$

The corresponding marginal probabilities of DPS uptake and account ownership are:

$$P[D_1 = 1] = P\left[U_A^* - U_{\overline{A}}{}^* > 0\right] \quad P[D_2 = 1] = P\left[U_I^* - U_{\overline{I}}^* > 0\right] \tag{4}$$

Taking as a starting point the process characterizing account ownership choice, we get:

$$\begin{aligned} P\left[U_A^* - U_{\overline{A}}{}^* > 0\right] &= P[(V_A + \varepsilon_A) - (V_{\overline{A}} + \varepsilon_{\overline{A}}) > 0] = P[(\varepsilon_A - \varepsilon_{\overline{A}}) > (V_{\overline{A}} - V_A)] \\ &= P[(\varepsilon_{\overline{A}} - \varepsilon_A) < -(V_{\overline{A}} - V_A)] \end{aligned} \tag{5}$$

Similarly, the Internet-based purchase (or DPS uptake) equation gives:

$$P\left[U_I^* - U_{\overline{I}}^* > 0\right] = P[(\varepsilon_{\overline{I}} - \varepsilon_I) < -(V_{\overline{I}} - V_I)] \tag{6}$$

with further notational simplifications:

$$V_{\overline{A}} - V_A = \tilde{V}_A \quad \text{and} \quad \varepsilon_{\overline{A}} - \varepsilon_A = \tilde{\varepsilon}_A \quad V_{\overline{I}} - V_I = \tilde{V}_I \quad \text{and} \quad \varepsilon_{\overline{I}} - \varepsilon_I = \tilde{\varepsilon}_I \tag{7}$$

here, $\tilde{V}_A$ and $\tilde{V}_I$ represent the observed marginal utilities, whereas $\tilde{\varepsilon}_A$ and $\tilde{\varepsilon}_I$ represent their unobserved marginal components, respectively. Therefore, the marginal probabilities of account ownership and DPS uptake in Equations (5) and (6) become:

$$P[D_1 = 1] = P[\tilde{\varepsilon}_A < -\tilde{V}_A] = \int_{-\infty}^{-\tilde{V}_A} f(\tilde{\varepsilon}_A)\, \mathrm{d}\, \tilde{\varepsilon}_A \tag{8}$$

$$P[D_2 = 1] = P[\tilde{\varepsilon}_I < -\tilde{V}_I] = \int_{-\infty}^{-\tilde{V}_S} f(\tilde{\varepsilon}_I) \mathrm{d}\, \tilde{\varepsilon}_I \tag{9}$$

Thus, the endogeneity of account ownership in Internet-based purchase (or DPS uptake) decisions can be tested using their joint probability distribution density:

$$P[D_1 = 1\ , D_2 = 1\ ] = \int_{-\infty}^{-\tilde{V}_A} \int_{-\infty}^{-\tilde{V}_I} f(\tilde{\varepsilon}_A\ , \tilde{\varepsilon}_I\ )\ \mathrm{d}\tilde{\varepsilon}_I \mathrm{d}\tilde{\varepsilon}_A \tag{10}$$

where $f(\tilde{\varepsilon}_A, \tilde{\varepsilon}_I)$ represents the joint bivariate density functions of the differences in the unobserved marginal utility components. The bivariate logit model was obtained under the assumption of a logistic probability distribution for $f(.)$, with $f(\tilde{\varepsilon}_A, \tilde{\varepsilon}_I) = \Lambda_2(\tilde{\varepsilon}_A, \tilde{\varepsilon}_I)$. Conversely, the bivariate probit model assumes a standard normal probability distribution with $f(\tilde{\varepsilon}_A, \tilde{\varepsilon}_I) = \Phi_2(\tilde{\varepsilon}_A, \tilde{\varepsilon}_I)$. The resulting variance-covariance matrix of the bivariate model is:

$$\sum = \begin{bmatrix} \theta_{11} & \theta_{12} \\ \theta_{21} & \theta_{22} \end{bmatrix} \tag{11}$$

where θ_{11} and θ_{22} represent the variances of the two processes of account ownership and Internet-based purchases (or DPS uptake); and $\theta_{12} = \theta_{21}$ represent the covariance between the two processes, respectively. In this recursive bivariate RUM framework, the deterministic component of the utility function is expressed as follows:

$$\begin{aligned} \tilde{V}_A = {} & \beta_{10} + \beta_{11}\text{borrowed} + \beta_{12}\text{govTransf12m} + \beta_{13}\text{wagPaiRec12m} + \beta_{14}\text{EmerFundAces} \\ & + \beta_{15}\text{DebCard} + \beta_{16}\text{CredCard} + \beta_{17}\text{UtBillsPaid12m} + \beta_{18}\text{female} + \beta_{19}\,\text{age} \\ & + \beta_{110}\text{educ} + \beta_{111}\text{icome}_q + \beta_{112}\text{country} \end{aligned} \tag{12}$$

$$\begin{aligned} \tilde{V}_I = {} & \beta_{20} + \beta_{21}\text{borrowed} + \beta_{22}\text{govTransf12m} + \beta_{23}\text{wagPaiRec12m} + \beta_{24}\text{EmerFundAces} \\ & + \beta_{25}\text{DebCard} + \beta_{26}\text{CredCard} + \beta_{27}\text{UtBillsPaid12m} + \beta_{28}\text{female} + \beta_{29}\,\text{age} \\ & + \beta_{210}\text{educ} + \beta_{211}\text{icome}_q + \beta_{212}\text{country} + \beta_{213}\text{account} \end{aligned} \tag{13}$$

β_{ij} represents the coefficients capturing the relative influence of the explanatory variables on the marginal utility of account ownership ($\tilde{V}_A$) and the marginal utility of DPS uptake ($\tilde{V}_I$). These coefficients are estimated based on the data and parameters of the variance-covariance matrix. This is achieved using the bivariate (probit and logit) estimator described in the *R* library "SemiParBIVProbit" (Wojtys et al., 2016) for joint conditional effects. For explanatory purposes, marginal effects and odds ratios are produced using the "mfx" library (Fernihough, 2014). Furthermore, though not the direct focus of this study, the predictive accuracy of the final probability model is assessed through the numerical AUC (i.e., the area under the receiver operating characteristics-ROC curve) and confusion matrix analysis, using the "ROCit" and "caret" libraries in the *R* statistical package, respectively (R Core Team, 2015).

3.2. Test of account ownership endogeneity

An individual society member's choice to own a formal account may affect their DPS preferences, while also the desire to use DPS for online shopping and e-payments might push an individual to open a formal account or hold a mobile money account. Given this, there is a potential bidirectional relationship between "account ownership" and "DPS uptake" decisions. This potential reversed causality, if confirmed, renders account ownership statistically endogenous in the equation that represents individuals' DPS uptake decisions.

Accounting for such endogeneity biases provides us with the estimated effects of account ownership. To solve this endogeneity problem, one may rely on instrumental variable (IV) methods (Ky et al., 2021) or endogenous switching methods (Lee and Porter, 1984) that are implemented through recursive bivariate modeling, as highlighted in Eqs (10)–(13). Given the difficulty of finding suitable instruments, especially with observational studies relying on secondary data sources, and considering the relative straightforwardness of implementing the endogeneity switching regression approach in cases of discrete outcome modeling (see Niankara, 2022), the latter approach is adopted here.

After estimating the recursive bivariate model, the estimated correlation coefficient θ_{12} between account ownership and DPS uptake is tested for statistical significance. If confirmed, its significance would suggest that the unobserved factors influencing the two choice processes are significantly interdependent, hence confirming the presence of endogeneity. In this case, by accounting for such a correlation, the recursive bivariate system would be more appropriate for correcting such an endogeneity bias. However, if the correlation coefficient is not statistically significant, then account ownership would be an exogenous driver of DPS uptake, such that a single index functional representation of Equation (9), coupled with explicit specifications in Equation (13), would be sufficient to characterize the DPS uptake process within the GCC regional economy.

3.3. Data source and description of the variables

3.3.1. The data

The GCC data sample used in this analysis was extracted from the latest two waves of the Global Findex survey (2014 and 2017) conducted by the World Bank. A recent account of the sampling design was provided by Niankara (2022). For additional survey methodology and procedural details, see also Demirguc-Kunt et al. (2015) and Demirguc-Kunt et al. (2018) for the 2014 and 2017 waves, respectively. The raw survey data for 2014 and 2017 only covered respondents from four of the six GCC

members. Therefore, excluding Oman and Qatar, the characteristics of the data covering Bahrain, Kuwait, Saudi Arabia, and the United Arab Emirates (UAE) are shown in Table 1, with an overall average retention rate of 76.98%.

3.3.2. Variables description

Given that the study aims to evaluate the impact of financial inclusion indicators that correspond to the demand-side (including account ownership) of DPS uptake decisions within the GCC regional economy, the socio-economic and demographic factors, along with the indicators of financial inclusion, described in Table 2, are used for econometric modeling and analysis.

3.3.3. Model validation

To validate the model specifications, the chi-squared dependence test was used to ascertain the link between the qualitative explanatory variables (including the financial inclusion indicators) and the binary indicator of the DPS uptake status (dependent variable). For the quantitative explanatory variable "age," we applied Levine's test of variance equality along with Welch's independent "*t*-test" procedure to determine whether the average age of individuals who adopt DPS differs significantly from those who do not. If the average age is found to be significantly different, it will be considered a determinant of DPS uptake within the GCC regional economy. The results of these validation tests are summarized in Tables A3-A5.

4. Results

4.1. Descriptive findings

4.1.1. Univariate descriptive findings

The univariate descriptive findings in Table A3 indicate that the proportion of society members with bank account ownership within the GCC regional economy remained stable at approximately 84% between 2014 and 2017. At the same time, the proportion of individuals with Internet-based payments (DPS uptake) in the region rose from 35.95% to 49.48%. During the same period, the financial indicators of emergency fund access, ATM debit card ownership, and borrowings increased by 12.18%, 1.23%, and 18.79%, respectively. Conversely, a percentage decrease of 7.12% and 25.09% was observed for individuals' credit card ownership and savings in the region, respectively.

However, notable increases were observed in public sector (government) financial transfers, private sector direct wage deposits, and utility bill payments, which increased by 36.73%, 55.04%, and 5.35%, respectively. Similarly, the proportion of female respondents increased by 2.9%, that of individuals with primary education or less increased by 41.06%, and that of individuals with secondary education increased by 3.10%. Conversely, a 5.89% decrease in the proportion of individuals with tertiary education or higher was recorded between 2014 and 2017.

The income distribution results for the same period suggest a rising proportion of people in the lowest three income quintiles by 24.82% (for the poorest 20%), 9.93% (for the second poorest 20%), and 12.38% (for the middle 20%). These increases are also accompanied by a 10.05% and 16.86% decrease in the proportion of people in the highest two income quintiles during the same period.

The binary indicators, which index each of the four GCC countries in the study sample, show that while the proportion of respondents from the UAE decreased by 14.59% (from 28.10% in 2014 to 24% in 2017), respondents from Bahrain, Kuwait, and Saudi Arabia increased by 4.76%, 5.32%, and 7.09%, respectively.

4.1.2. Bivariate descriptive findings

The bivariate descriptive findings presented in Table A4 assess the statistical dependence of the nominal explanatory factors and the DPS uptake outcome variable. The results for the quantitative explanatory variable "age" are summarized in

Table 1
Characteristics of the data sample.

Countries	Initially Collected Data			Final Data	
	Collection Period	Collection method (language)	Sample Size	Sample Size	Retention Rate
Bahrain	May 7 - May 20, 2017		1,060	1,029	97.08%
	Jun 1 - June 26, 2014		1,005	580	57.71%
Kuwait	May 18 -June 8, 2017		1,000	972	97.20%
	May 30 – June 28, 2014	Cellular phone and Landline (English and Arabic)	1,013	545	53.80%
Saudi Arabia	April 30-May 20, 2017		1,009	985	97.62%
	May 18 – June 30, 2014		1,018	543	53.34%
United Arab Emirates	July 2- July 30, 2017		1,003	943	94.02%
	May 21 – June 26, 2014		1,002	652	65.07%
Total			**8110**	**6249**	**76.98%**

Source: Author's own, using GCC data extracted from Global Findex surveys (2014, 2017).

Table 2
Study variables' description.

Variable	Description
InterntBasdPaymt	1 if a respondent has made online payments (through a computer, mobile phone, or any other electronic device) in the previous 12 months, and 0 otherwise
Account	1 if a respondent owns a formal account, a mobile money account, or both, and 0 otherwise
Saved	1 if a respondent has set aside savings in the 12 months prior to data collection, and 0 otherwise
Borrowed	1 if a respondent borrowed money from any source in the 12 months prior to data collection, and 0 otherwise
DebCard	1 if a respondent has an ATM debit card, and 0 otherwise
CredCard	1 if a respondent has a credit card, and 0 otherwise
EmerFundAces	1 if a respondent is able to come up with emergency funds (i.e. 5% of per-capita gross national income) within a month, and 0 otherwise
GovTransf12 m	1 if a respondent reports receiving any government assistance (in the form of education, medication, or unemployment benefits) in the previous 12 months, and 0 otherwise
WagPaiRec12 m	1 if a respondent reports receiving any salary or wage payment from an employer in the previous 12 months, and 0 otherwise
UtBillsPaid12 m	1 if a respondent paid utility bills in the previous 12 months, and 0 otherwise
Educ	Respondent's ordinal level of Education: 1 if respondents only completed primary education, 2 if they completed secondary education, and 3 if they completed tertiary education
inc_q	Respondent's ordinal income quintile, using pre-tax household income (including not only farming income but also salaries, wages, and remittances).
Female	1 for female respondents and 0 for male respondents.
Age	Respondent's age in years.
year	The year during which the data was collected (2014 or 2017).
economy2	The country in which the respondent resides (has 4 modalities, one for each economy)
Wgt	Respondents' country-level final weight in the study sample

Source: Author's own, using GCC data extracted from Global Findex surveys (2014, 2017).

Tables A5 and A6 in the form of Levine's test of variances homogeneity and Welch's two-samples *t*-test of mean differences; which are combined to evaluate the dependence of "age" with the DPS uptake outcome variable.

Table A4 shows that except for public sector (government) transfers, which have statistical significance at the 1% level, all remaining explanatory factors, including financial inclusion indicators, show statistical dependence with the DPS uptake status at the 0.1% level. These findings suggest a strong dependence between the explanatory factors and our DPS uptake outcome of interest, further suggesting the high relevance of the random utility-based conceptual framework in Fig. 1.

Using the *p*-value produced by Levine's test (see Table A5), we have sufficient evidence to conclude that there is unequal variance in the "age" of respondents with Internet-based payments (DPS adopters) and those without such payments (non-adopters) between 2014 and 2017 within the GCC regional economy. Taking this unequal variance result into account, the implemented Welch *t*-test of the mean age difference (see Table A6) shows that the average age of individuals with prior Internet-based payments (DPS adopters) statistically differs from those without such payments, thereby suggesting that DPS uptake depends significantly upon "age."

4.1.3. Endogeneity test result for account ownership

To test for the statistical endogeneity of "account ownership," as described in Section 3.2, we relied on the endogeneity switching regression approach to specify the two processes of account ownership and DPS uptake, therefore allowing for the potential correlation of their error terms. The results of this bivariate model are summarized in Table A7, which highlights a correlation coefficient of $\theta_{12} = 0.149$, with a corresponding 95% confidence interval $(-0.081; 0.354)$. Since zero is included in this interval, we have enough evidence to conclude that the correlation coefficient is not statistically significant. This implies the absence of statistical endogeneity for "account ownership" in the process of DPS uptake by members of society within the GCC regional economy; hence, the use of a bivariate model representation is not necessary. The univariate representation through the single index function in Equation (9), coupled with its explicit form in Equation (13), is sufficient to characterize the process of DPS uptake by members of society within the GCC's quadruple helix economic system.

4.2. Econometric findings

To compare the statistical model performances while assessing sensitivity to misspecifications, the probit and logit specifications are adopted for the above-mentioned univariate representation of the process of DPS uptake by consumers within the GCC regional economy. The results of these two specifications are estimated through maximum likelihood methods, as shown in Table A8, which highlights the signs and significance of the explanatory factors to be consistent across the two (probit and logit) models, hence suggesting no misspecification issue. Moreover, the two model specifications show fairly close performances based on the Akaike information criteria (AIC) and Bayesian information criterion (BIC) measures; however, the logit model performed marginally better and was therefore chosen as the base specification on the probability scale, from which the marginal effects (see Table A9 and odds ratios (see Table A10) are obtained due to the explanatory focus of the analysis. Nonetheless, the predictive accuracy assessment using the area under the curve (AUC) and confusion matrix analyses suggested that the selected logistic model specification is reasonable.

Although both marginal effects and odds ratios (OR) are provided, they convey parallel information on the likely impact of the explanatory factors on the actual observed outcome of GCC consumers' DPS uptake. Therefore, our econometric results can be presented on either scale (marginal or OR) without loss of generalizability. For the sake of convenience and in accordance with the standard practices of presenting logit model results in the literature, we chose to discuss the results of the marginal effects.

4.2.1. The relative influence of financial inclusion indicators on DPS uptake

As summarized in Table A9, the marginal effect results suggest that financial inclusion indicators such as account ownership and debit card ownership do not significantly affect the marginal likelihood of DPS uptake by consumers in the GCC regional economy. However, compared with those that are financially excluded, GCC consumers that are financially included by having savings, borrowings, and credit cards are 12.2%, 11.4%, and 25.4% more likely to have marginal DPS uptake, respectively. Similarly, individuals included in the public and private sectors' transfer receipts record 5.4% and 6.5% higher marginal likelihoods of DPS uptake, respectively. Furthermore, members of society that can access emergency funds and past utility bill payments also had 7.65% and 15.1% higher marginal likelihoods of DPS uptake in the GCC's quadruple helix economic system, respectively.

4.2.2. The relative influence of demographic and socio-economic control factors

The statistically insignificant coefficient value of the female indicator variable suggests the absence of a gender-based gradient in DPS uptake by consumers in this context. The estimated relative influence of education highlights that compared to respondents with primary education or less, those with secondary education and respondents with at least a tertiary education show 17% and 28% higher marginal likelihoods of DPS uptake, respectively. The estimated relative influence of income highlights the increasing nonlinear marginal likelihood of GCC consumers' DPS uptake. Indeed, compared to individuals in the first income quintile, respondents in the 2nd, middle, 4th, and top income quintiles have 5.9%, 7.5%, 9.4%, and 14.9% higher marginal likelihood of DPS uptake, respectively. The estimated average change in GCC consumers' DPS uptake between 2014 and 2017, as captured by the binary indicator (YEAR), shows an 18.18% average increase over the three-year period. Moreover, the estimated effect of age suggests a 0.7% average reduction in the marginal likelihood of DPS uptake for every yearly increase in age between 2014 and 2017.

However, national-level changes in DPS uptake for each country, which are captured by the binary indicators (country fixed effects), suggest that, compared with consumers in the UAE, those from Bahrain, Kuwait, and Saudi Arabia had 4.2%, 5.2%, and 4.7% lower marginal likelihoods of DPS uptake between 2014 and 2017, respectively. Therefore, our study results suggest an overall regional average increase of 37.64% (from 35.95% to 49.48%; see Table A3) between 2014 and 2017 for individual DPS adopters. Yet, cross-country heterogeneity in the DPS uptake rate remains significant between the four economies in the studied region. Additionally, significant within-country socio-economic inequalities due to different populations' structural compositions are reported to be at the root of the low national-level uptake of DPS in the region (Ben Ltaifa et al., 2018). Indeed, much of the working population in the region consists of transient workers, most of whom are unskilled and unbanked and are thus unplugged from the formal financial system.

For example, although the UAE led the way in DPS uptake among the four GCC countries between 2013 and 2017, Alqudah (2018) attributed its strong mobile payment growth to its large youth demographic and high rate of mobile phone penetration. Studies show that UAE nationals accounted for only 11% of the total population of 9.6 million in 2018 and were mostly at the upper end of the income distribution, with access to generous social safety nets. However, 32% (17 million individuals) of the total working population remained unbanked, mainly consisting of blue-collar foreign workers and migrant laborers earning less than $679 per month (Srouji, 2020). Members of this latter group typically rely on formal or informal networks of money exchanges to receive wages and send remittance savings home. This contributed to the limited DPS uptake across the entire region.

5. Discussion

Regional heterogeneity in payment infrastructure capabilities across countries often translates into significant within- and-between-country inequalities in financial inclusion outcomes (Santos-Arteaga et al., 2020). Policymakers in the MENA region have taken important steps to identify and address the significant challenges they face in the quest for financial inclusion (Attia and Benson, 2018). One key example was the launch of the Arab Regional Payment System project (Arab Monetary Fund, 2018), which aims to provide a new platform for clearing and settling payments, including cross-border payments, while also reducing the cost and duration of remittances and payments in the MENA region and beyond.

This initiative has been guided by the global consensus on the value of digital payment infrastructure for realizing inclusive economic growth (Litsareva, 2017) at the national and regional levels. With growing evidence pointing toward the limited effectiveness of only using supply-side policies (Srouji, 2020) in bringing about real market changes and financial inclusion outcomes, studies have recently focused on the drivers of digital financial solution usage. For example, using 600 cases collected through online survey questionnaires, Gerlach and Lutz (2021) built a partial least squares structural equation model incorporating a comprehensive set of variables to expand respondents' future use intention of digital financial advice solutions. Their findings revealed the great potential of financial service digitization (i.e., service innovation) for traditional

banks. Similarly, this study analyzed the relative influence of demand-side financial inclusion indicators on DPS uptake decisions within the GCC regional economy.

5.1. Financial inclusion in the GCC quadruple helix system

Taking a "general-to-specific" approach with the quadruple helix framework as its starting point, a partial equilibrium behavioral economics model relying on the economic theory of RUM was adopted to zoom in on society members' preferences for DPS "ceteris paribus" (i.e., by keeping the contributing influences of academia, industry, and government constant).

The initial model validation procedure based on the chi-squared test (for the qualitative explanatory factors), along with the Welch *t*-test of differences in mean age across adopters and non-adopters of DPS, pointed toward the significance of the included financial inclusion indicators in the model. After formal estimation of the model using maximum likelihood methods, the results revealed that both (i) transaction account ownership and (ii) debit card ownership did not endogenously nor exogenously influence the likelihood of DPS uptake in the GCC regional economy between 2014 and 2017. However, all remaining financial inclusion indicators in the adopted conceptual framework were found to significantly influence this likelihood.

Assessing these results in accordance with ongoing efforts by the Arab Regional Payment System project to expand financial inclusion by extending access to transaction accounts as formerly supported by the "Universal Financial Access 2020" (UFA 2020) initiative (World Bank, 2016), the findings seem to indicate that simply extending access will not be sufficient for the full materialization of the intended benefits of DPS within the GCC regional economy. For this to be achieved, complementary financial inclusion policies that address the "usage dimension" of DPS by end consumers will be necessary.

Based on the study's findings, such complementary policies may include financial inclusion strategies, such as providing consumers with an incentive to save, borrow, and pay their utility bills digitally. Complementary policies may also include extending consumer credit to members of society through credit cards or mandating fully digital payroll practices for both private and public enterprises in the region (Niankara, 2020). By implementing such policies, financial policymakers in the GCC region could also draw from the best practices used elsewhere, including those by the "Global Partnership for Financial Inclusion," particularly the "Market and Payment Systems" subgroup (The G20 Research Group, 2018).

Furthermore, the fact that account and debit card ownership did not significantly affect DPS uptake decisions highlights the need for more attention to be paid to the usefulness or suitability of digital financial services and products in fulfilling society members' needs for Sharia compliance in the GCC region. This is especially important in Islamic culture, where a lack of Sharia-compliant features could render digital financial services inappropriate and underused by members of the society.

Moreover, in addition to the above effects of financial inclusion indicators, no significant gender-based gradient was found in terms of DPS uptake within the GCC regional economy. This suggests that, overall, the GCC region has succeeded in closing any gender-based disparity in accessing or using DPS, which signals an important advancement in gender equality as a key dimension of financial inclusion. This regional-level finding corroborates the recently reported moderating effect of gender on electronic payment technology acceptance in the UAE (Alshurideh et al., 2021). This also has important implications for the financial inclusion of the Arab Region Initiative (Arab Monetary Fund, 2019), as this may allow non-GCC members with similar cultural and structural characteristics to capitalize on cross-border learnings and achieve greater gender equity in financial inclusion.

5.2. Recent trends and open innovation in the GCC

Since the data used in this analysis were collected, policymakers in the GCC region have undertaken numerous other initiatives. For example, in 2017, new payment system regulations were launched by the UAE's central bank to allow retail players and peer-to-peer participation in the country's payment ecosystem; additional payment strategies were subsequently announced in 2018, which reduced transaction costs while strengthening the security and efficiency of national payments. Additionally, the Arab Monetary Fund (headquartered in the UAE) announced a Memorandum of Understanding with MasterCard on December 13, 2021, to help facilitate the growth of payments activities across the MENA region and beyond (MasterCard Engagement bureau, 2021). This was subsequently followed by the joint signing of an official pledge between MasterCard and the UAE Gender Balance Council on January 18, 2022, to improve gender balance within the country (MasterCard Engagement bureau, 2022a, 2022b, 2022c).

On January 20, 2022, MasterCard (via "tap on the phone technology") also launched an initiative in partnership with Network International that aims to allow over 500,000 SMEs in the region to use mobile phones as payment terminals (MasterCard Engagement bureau, 2022b). Finally, in commemoration of the UAE's Golden Jubilee and to further incentivize DPS uptake by end users over the next 50 years, MasterCard introduced a limited edition worldwide credit card in collaboration with UAE-based financial investment firm "Deem Finance," which offers wide-ranging benefits on exclusive services and experiences (MasterCard Engagement bureau, 2022c). Similar measures have been considered in other GCC countries.

By creating the kind of technological innovation environment described in Baierle et al. (2021), the above-mentioned efforts are consistent with open innovation (Bašić, 2021), which requires open collaboration between multiple players to ensure technological innovation and diffusion (Awadh, 2022). These efforts also point toward a growing culture of open innovation dynamics (Yun et al., 2020), which should at least theoretically contribute to improving DPS uptake outcomes over

and beyond the status of things depicted in this study. This is supported by evidence from the European Union (Lopes et al., 2021) and the Asia-Pacific region (Litsareva, 2017), both of which have strong regional innovation systems.

6. Conclusion

Relying on a "general-to-specific" or "deductive logical" reasoning order, this study embraced a transdisciplinary view to analyze the causal influence of demand-side factors on DPS uptake decisions within the GCC region, which was conceptualized as a quadruple helix economic system.

The findings revealed that financial inclusion in the form of extending access to a transaction account with an attached debit card did not significantly impact social well-being in terms of its members' use of DPS to meet their consumption needs from 2013 to 2017. Seemingly, for this to occur, other financial inclusion strategies such as the facilitation of borrowings, savings, credit card ownership, emergency funds access, and electronic payment processing in public and private sectors, as well as the digitalization of utility services' payments, were more effective in driving DPS uptake in the GCC region during the period covered in this study.

Overall, the findings and suggestions presented herein showcase the need for dynamic collaborations between academia, society, industry, and government/policymakers to ensure continuous payment system innovations and regional economic sustainability. Although the study provides key methodological contributions with equally significant practical implications for optimizing the benefits of financial inclusion in the GCC regional economy, it still has some limitations that hinder the generalizability of the results.

For example, given its retrospective nature (i.e., covering the period from 2013 to 2017), the reported findings do not necessarily reflect the recent (post-2017) policy efforts by GCC countries to diversify the regional economy through open collaborations and digital payment innovations. In addition, they do not reflect the recent (post-2019) structural shifts imposed on the world's economy (inclusive of the GCC) by the Coronavirus Disease 2019 (COVID-19) pandemic and the consequent mitigation measures (World Bank, 2020). However, it is reasonable to expect important changes in DPS uptake propensities in this new economic environment due to accelerated process digitalization from businesses (Pandey and Pal, 2020) and consumers' substitution of crowded in-store shopping experiences with online ones. The joint interplay of these COVID-19-triggered changes should theoretically stimulate DPS adoption and the growth of the digital economy. As the global economy recovers and markets settle into the new normal, conducting a prospective study that revisits the factors influencing financial inclusion and DPS uptake within the GCC regional economy and beyond would be valuable.

Declaration of competing interest

The author(s) declare no conflict of interest.

Appendix A

Table A3
Summary statistics for the study variables

Quantitative Factors	**Units**	**2014 Sample ($N = 2320$)**		**2017 Sample ($N = 3929$)**	
		Mean	**Standard Deviation**	**Mean**	**Standard Deviation**
Sampling Weight (wgt)	- - - - -	0.96	0.70	0.99	0.60
AGE	(in years)	34.26	11.81	36.01	11.72
Qualitative Factors	**Categories**	**Absolute Frequency**	**Relative Frequency (%)**	**Absolute Frequency**	**Relative Frequency (%)**
InterntBasdPaymt	1: Yes	834	35.95	1944	49.48
	0: No	1486	64.05	1985	50.52
ACCOUNT	1: Yes	1955	84.27	3307	84.17
	0: No	365	15.73	622	15.83
SAVED	1: Yes	1686	72.67	2139	54.44
	0: No	634	27.33	1790	45.56
BORROWED	1: Yes	1175	50.65	2364	60.17
	0: No	1145	49.35	1565	39.83
DEBITCARD	1: Yes	1852	79.83	3175	80.81
	0: No	468	20.17	754	19.19
CREDITCARD	1: Yes	827	35.65	2628	33.11
	0: No	1493	64.35	1301	66.89
EmerFundAcess	1: Yes	1147	49.44	2179	55.46
	0: No	1173	50.56	1750	44.54
GovTransf12 M	1: Yes	180	7.76	417	10.61
	0: No	2140	92.24	3512	89.39
WagPaiRec12 M	1: Yes	916	39.48	2405	61.21

	0: No	1404	60.52	1524	38.79
UtBillsPaid12 M	1: Yes	941	40.56	1679	42.73
	0: No	1379	59.44	2250	57.27
FEMALE	1: Yes	1522	65.6	2652	67.5
	0: No	798	34.4	1277	32.5
EDUCATION	1: At least Primary	79	3.41	189	4.81
	2: Secondary	1106	47.67	1931	49.15
	3: At most Tertiary	1135	48.92	1809	46.04
INCOME QUINTILE	1: Lowest 20%	316	13.62	668	17.00
	2: Second 20%	388	16.72	722	18.38
	3: Middle 20%	403	17.37	767	19.52
	4: Fourth 20%	554	23.88	844	21.48
	5: Highest 20%	659	28.41	928	23.62
Country	1: UAE	652	28.10	943	24.00
	2: Bahrain	580	25.00	1029	26.19
	3: Kuwait	545	23.49	972	24.74
	4: Saudi Arabia	543	23.41	985	25.07

Source: Author's own, using GCC data extracted from Global Findex surveys (2014, 2017).

Table A4
Conditional percent frequency distributions with chi-squared tests for the nominal explanatory variables

Whole Sample (N = 6249)	Categories	InterntBasdPaymt		Chi^2 Test		
		Relative Frequency (%)		X-stat	df	*p*-value
		Yes	No			
account	1: Yes	48.71	51.29	242.91***	1	$<2.2 \times 10^{-16}$
	0: No	21.78	78.22			
Saved	1: Yes	52.58	47.42	262.46***	1	$<2.2 \times 10^{-16}$
	0: No	31.64	68.36			
borrowed	1: Yes	54.28	45.72	318.15***	1	$<2.2 \times 10^{-16}$
	0: No	31.62	68.38			
DEBITCARD	1: Yes	49.27	50.73	240.75***	1	$<2.2 \times 10^{-16}$
	0: No	24.63	75.37			
CREDITCARD	1: Yes	68.19	31.81	734.49***	1	$<2.2 \times 10^{-16}$
	0: No	32.20	67.80			
EmerFundAcess	1: Yes	53.73	46.27	246.82***	1	$<2.2 \times 10^{-16}$
	0: No	33.90	66.10			
GovTransf12 M	1: Yes	50.59	49.41	9.7758***	1	0.001768
	0: No	43.81	56.19			
WagPaiRec12 M	1: Yes	53.12	46.88	214.59***	1	$<2.2 \times 10^{-16}$
	0: No	34.63	65.37			
UtBillsPaid12 M	1: Yes	56.95	43.05	284.22***	1	$<2.2 \times 10^{-16}$
	0: No	35.44	64.56			
FEMALE	1: Yes	47.15	52.85	36.616***	1	1.44×10^{-09}
	0: No	39.04	60.96			
EDUCATION	1: At most Primary	13.81	86.19	368.23***	2	$<2.2 \times 10^{-16}$
	2: Secondary	35.59	64.41			
	3: At least Tertiary	43.61	56.39			
INCOME QUINTILE	1: Lowest 20%	30.18	69.82	179.36***	4	$<2.2 \times 10^{-16}$
	2: Second 20%	39.01	60.99			
	3: Middle 20%	43.33	56.67			
	4: Fourth 20%	47.07	52.93			
	5: Highest 20%	55.64	44.36			
Country	1: UAE	53.42	46.58	88.782***	3	$<2.2 \times 10^{-16}$
	2: Bahrain	45.74	54.26			
	3: Kuwait	39.49	60.51			
	4: Saudi Arabia	38.68	61.32			
Year	2014	35.95	64.05	107.59***	1	$<2.2 \times 10^{-16}$
	2017	49.48	50.52			

* This implies a 0.05 level of significance; ** represents a level of 0.01; and *** represents a level of 0.001 level.
Source: Author's own, using GCC data extracted from Global Findex surveys (2014, 2017).

Table A5
Levine's variance homogeneity test

		Age
ACCOUNT	Degree of freedom	1
	F-statistic	4.267
	p-value	0.039 *
InterntBasdPaymt	Degree of freedom	1
	F-statistic	29.495
	p-value	5.817e-08 ***

Ho: Equal age variance assumption holds between owners and non-owners of formal accounts, V.S. **Ha**: the null hypothesis does not hold.
Ho: Equal age variance assumption holds between those with those and without Internet-based payment, V.S. **Ha**: the null hypothesis does not hold.
Source: Author's own, using GCC data extracted from Global Findex surveys (2014, 2017).

Table A6
Welch's mean difference test, with a 95% confidence interval (C.I)

			Age
ACCOUNT	Group Mean Values	No	31.247
		Yes	36.127
	C.I. on the group means difference		(-5.672, −4.088)
InterntBasdPaymt	Group Mean Values	No	35.876
		Yes	34.708
	C. I. on the group means difference		(0.586, 1.750)

Source: Author's own, using GCC data extracted from Global Findex surveys (2014, 2017).

Table A7
Estimated conditional effects from the joint probability model of DPS uptake and account ownership

			InterntBasdPaymt	Account
(INTERCEPT)			−1.381*** (0.148)	−1.462*** (0.225)
Saved	1: Yes		0.307*** (0.039)	0.291*** (0.078)
borrowed	1: Yes		0.290*** (0.037)	0.105 (0.076)
DEBITCARD	1: Yes		0.251 (0.164)	3.062*** (0.084)
CREDITCARD	1: Yes		0.634*** (0.041)	0.539*** (0.145)
EmerFundAcess	1: Yes		0.192*** (0.037)	0.770 (0.166)
GovTransf12 M	1: Yes		0.142* (0.061)	0.770*** (0.166)
WagPaiRec12 M	1: Yes		0.168*** (0.039)	0.526*** (0.087)
UtBillsPaid12 M	1: Yes		0.377*** (0.040)	0.814*** (0.095)
FEMALE	1: Yes		−0.026 (0.040)	0.037 (0.080)
EDUCATION	2: Secondary		0.376*** (0.106)	0.053 (0.144)
	3: At least Tertiary		0.660*** (0.108)	.224 (0.157)
INCOME QUINTILE	2: Second 20%		0.140* (0.061)	−0.051 (0.111)
	3: Middle 20%		0.171** (0.060)	0.001 (0.115)
	4: Fourth 20%		0.223*** (0.059)	0.177 (0.114)
	5: Highest 20%		0.356*** (0.059)	0.037 (0.119)
AGE			−0.018*** (0.001)	0.003 (0.003)
Country Fixed Effects		Bahrain	−0.107* (0.050)	−0.172 (0.114)
		Kuwait	−0.135** (0.051)	−0.176 (0.113)
		Saudi Arabia	−0.121* (0.052)	−0.289** (0.104)
Year		2017	0.468*** (0.038)	−0.085 (0.079)
N			6249	
$\widehat{\theta}_{12}$			0.149 (−0.081, 0.354)	
$\widehat{\theta}_{22}$			0.0949 (−0.052, 0.231)	
AIC			8467.342	
BIC			8763.909	
Largest Absolute Gradient			4.733413e-06	
Eigenvalue Range			[10.107, 4510693]	

The information in parentheses represents the standard error of the coefficients and the 95% C.I. on $\widehat{\theta}_{12}$ and $\widehat{\theta}_{22}$.
* This implies a 0.05 level of significance; ** represents a level of 0.01; and *** represents a level of 0.001.
Source: Author's own, using GCC data extracted from Global Findex surveys (2014, 2017).

Table A8
Maximum likelihood estimation of the probit and logit models of DPS uptake

			Probit	Logit
(INTERCEPT)			−1.441*** (0.138)	−2.471*** (0.248)
account		1: Yes	0.082 (0.090)	0.164 (0.153)
saved		1: Yes	0.303*** (0.039)	0.506*** (0.065)
borrowed		1: Yes	0.288*** (0.037)	0.471*** (0.062)
DEBITCARD		1: Yes	0.081 (0.081)	0.127 (0.137)
CREDITCARD		1: Yes	0.634*** (0.042)	1.046*** (0.069)
EmerFundAcess		1: Yes	0.190*** (0.037)	0.313*** (0.062)
GovTransf12 M		1: Yes	0.133* (0.061)	0.222* (0.103)
WagPaiRec12 M		1: Yes	0.161*** (0.039)	0.269*** (0.065)
UtBillsPaid12 M		1: Yes	0.368*** (0.040)	0.617*** (0.066)
FEMALE		1: Yes	−0.027 (0.040)	−0.044 (0.068)
EDUCATION		2: Secondary	0.378*** (0.107)	0.703*** (0.197)
		3: At least Tertiary	0.662*** (0.109)	1.171*** (0.199)
INCOME QUINTILE		2: Second 20%	0.142* (0.061)	0.240* (0.104)
		3: Middle 20%	0.173** (0.061)	0.303** (0.103)
		4: Fourth 20%	0.222*** (0.059)	0.384*** (0.100)
		5: Highest 20%	0.358*** (0.059)	0.606*** (0.100)
AGE			−0.019*** (0.002)	−0.032*** (0.003)
Country fixed effects	Bahrain		−0.103* (0.051)	−0.176* (0.085)
	Kuwait		−0.132** (0.051)	−0.215* (0.086)
	Saudi Arabia		−0.117* (0.052)	−0.195* (0.088)
year	2017		0.472*** (0.039)	0.789*** (0.066)
N			6249	6249
Likelihood-ratio			1650.019	1649.570
Deviance			6935.924	6933.373
AIC			6980.373	6979.924
BIC			7128.656	7128.208

The information in parenthesis represents the standard error of the estimated coefficients.
* This implies a 0.05 level of significance; ** represents a level of 0.01; and *** represents a level of 0.001.
Source: Author's own, using GCC data extracted from Global Findex surveys (2014, 2017).

Table A9
Marginal effects estimated from the logistic model of DPS uptake

			InterntBasdPaymt
account		1: Yes	0.039 (0.036)
saved		1: Yes	0.122*** (0.015)
borrowed		1: Yes	0.114*** (0.014)
WagPaiRec12 M		1: Yes	0.065*** (0.015)
GovTransf12 M		1: Yes	0.054* (0.025)
EmerFundAcess		1: Yes	0.0765*** (0.015)
DEBITCARD		1: Yes	0.030 (0.033)
CREDITCARD		1: Yes	0.254*** (0.016)
UtBillsPaid12 M		1: Yes	0.151*** (0.016)
FEMALE		1: Yes	−0.010 (0.016)
EDUCATION		2: Secondary	0.170*** (0.046)
		3: At least Tertiary	0.280*** (0.045)
INCOME QUINTILE		2: Second 20%	0.059* (0.025)
		3: Middle 20%	0.075** (0.025)
		4: Fourth 20%	0.094*** (0.024)
		5: Highest 20%	0.149*** (0.024)
AGE			−0.007*** (0.000)
Country Fixed Effects	Bahrain		−0.042* (0.020)
	Kuwait		−0.052* (0.020)
	Saudi Arabia		−0.047* (0.021)
Year	2017		0.188* (0.015)
N			6249

The information in parenthesis represents the standard error of the estimated coefficients.
* This implies a 0.05 level of significance; ** represents a level of 0.01; and *** represents a level of 0.001.
Source: Author's own, using GCC data extracted from Global Findex surveys (2014, 2017).

Table A10
Estimated odds ratios of the logistic model of DPS uptake

			InterntBasdPaymt
Account		1: Yes	1.178 (0.180)
Saved		1: Yes	1.658*** (0.107)
Borrowed		1: Yes	1.602*** (0.099)
DEBITCARD		1: Yes	1.134 (0.155)
CREDITCARD		1: Yes	2.847*** (0.197)
EmerFundAcess		1: Yes	1.368*** (0.084)
GovTransf12 M		1: Yes	1.248* (0.128)
WagPaiRec12 M		1: Yes	1.308*** (0.084)
UtBillsPaid12 M		1: Yes	1.853*** (0.122)
FEMALE		1: Yes	0.956 (0.064)
EDUCATION		2: Secondary	2.019*** (0.397)
		3: At least Tertiary	3.225*** (0.641)
INCOME QUINTILE		2: Second 20%	1.271* (0.132)
		3: Middle 20%	1.354** (0.139)
		4: Fourth 20%	1.468*** (0.146)
		5: Highest 20%	1.832*** (0.183)
AGE			0.968*** (0.002)
Country fixed effects	Bahrain		0.838* (0.071)
	Kuwait		0.806* (0.069)
	Saudi Arabia		0.822* (0.072)
Year	2017		2.201*** (0.144)
N			6249

The information in parenthesis represents the standard error of the estimated coefficients.
* This implies a 0.05 level of significance; ** represents a level of 0.01; and *** represents a level of 0.001.
Source: Author's own, using GCC data extracted from Global Findex surveys (2014, 2017).

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