Promoting Gender Inclusion in Digital Financial Services: Evidence on Policies and Socio-Economic Factors in Kenya

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Working Paper DFSP-CCS-004

Bringing Rigour and Evidence to Economic Policy Making in Africa

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Published by: The African Economic Research Consortium
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Abstract

This study employs quantitative methods to analyse the results of the 2021 FinAccess Household Survey to identify socio-economic factors that affect gender inclusion in digital financial services (DFS). Key informant interviews were performed to assess the effectiveness of some existing policies on gender inclusion in DFS. Logistic regression model and multivariate probit model were used to identify the socio-economic factors affecting uptake of DFS. To investigate the drivers of gender gaps in digital financial inclusion in Kenya, the Fairlie decomposition technique was applied. Results of the regression models indicated that socio-economic factors such as residence, age, marital status, education, income, telephone ownership, possession of identification documents (ID) and financial literacy are significant for the various DFS indicators. Higher levels of education were associated with increased DFS inclusion. Lower income earners were more likely to be included in the DFS_Credit as they seek for alternative ways of getting more finances. Ownership of telephones and possession of IDs were also associated with higher uptake of DFS across all indicators. Fairlie decomposition of the gender gap for each of the DFS indicators showed that socio-economic factors explained more than 50% of the existing gender gap in the use of DFS in Kenya. Education was the major consistent factor that brings about the gender differences in DFS inclusivity, with its contribution at an average of 16% across all DFS indicators. Telephone ownership is ranked high in the explained differences in DFS_Savings and DFS_Account. Therefore, efforts aimed at bridging the gender gap in employment and education in particular financial literacy and digital skills across all gender groups should be emphasized to ensure inclusivity in DFS. Strengthening the regulatory framework, addressing infrastructural gaps, promoting affordable DFS devices and Internet connectivity and creating DFS products tailored towards a specific gender group will encourage uptake of DFS.

Keywords: *Digital Financial Inclusion, Gender, Digital financial services, Fairlie decomposition*

1. Introduction

Digitization of economies has been regarded as a key innovation strategy to foster development and promote economic growth (Anane and Nie, 2022). The World Bank refers to digital financial services (DFS) as money related services that are provided to consumers of such services through digital technology (Gabor and brooks, 2017). Digital innovations for digital financial services are built up on payments, remittances, savings and credit access. Such innovations include use of digital tools like mobile telephones to carry out transactions digitally at any point in time and place. DFS are convenient because of low costs, greater transaction speed, personalized experience and greater coverage (Pazarbasioglu et al., 2020).

Kenya is one of the countries in Africa where digital financial access has grown tremendously (Kingiri and Fu, 2019). This has been accelerated by more investments by the private sector. The increase in technology adoption has also increased the digitalization of financial access. The digitalization of the financial sector and the recent increase in DFS brings new opportunities to help build inclusive economic infrastructure that offers new services to marginalized populations and underserved communities around the world (Ndung'u, 2018).

It has been widely documented that digital financial solutions have the potential to make a significant difference in bridging the gender gap, by increasing women's financial autonomy and improving their economic participation (Arnold and Gammage, 2019). Digital financial services can help bridge the gap in account ownership, increase women's participation in the financial system and give them the opportunity to save formally or access credit (Hendriks, 2019). These services can lower the risks associated with greater financial autonomy by improving privacy, confidentiality and control, and reducing the time spent travelling to access finances. They can also help women's business by lowering costs and giving access to a diversity of financial services. Previous studies estimate that DFS could turn 1.6 billion of the 2 billion unbanked people in the world into formal customers by 2025 and more than half of these would be women (McKinsey Global Institute, 2015). McKinsey Global Institute (2016) also estimated that widespread use of digital finance could increase annual gross domestic product (GDP) of all emerging economies by US$3.7 trillion by 2025 which represents a 6% increase versus a business-as-usual scenario. However, women are already lagging behind in the digital field and in accessing financial services (Mariscal et al., 2019).

Digitalization of the finance sector in Kenya had increased access to formal financial services to 84% by 2021 (KNBS, 2021). Despite the increase, there is still a 4.2% gender gap in the access to formal financial services. Women have 2.6% higher access to informal financial services than men. Access to formal financial services indicate that 84.1% of males access mobile money compared to 78.9% of females (KNBS, 2021). These statistics show that there is still a gender gap in digital financial access.

Therefore, this study used a mixed method approach to identify the gender gap in DFS in Kenya. Quantitative analysis was applied to identify the socio-economic factors that affect gender inclusion in DFS. Specifically, this study decomposed the degree to which each socio-economic factor contributes to the gender gap in DFS in Kenya. Qualitative analysis was employed to assess the effectiveness of existing policies on gender inclusion in DFS in Kenya. Evidence generated from this study can be used by stakeholders to design policies that will increase inclusion and services that are accessible to women in order to close this gender gap.

The rest of the paper is organized as follows. Section 2 focusses on the literature review. Section 3 introduces the empirical strategy and the data source. Section 4 presents the discussion of results and Section 5 presents the emerging themes from the qualitative study and policy landscape in DFS. Section 6 presents the conclusion and the policy recommendations.

2. Literature review

Gender inclusion in DFS is a key issue in empowering women to realize their full potential and has been documented in many studies (see, for example, Akudugu, 2013; Karpowicz, 2014). Gender inclusivity in DFS brings more advantages to households, women owned businesses and eventually the economy at large (Liu et al., 2021). The current gender gap in financial inclusion and the gender digital divide can be traced to many common factors, ranging from unequal opportunities, structural barriers, policies, social-economic factors, and cultural settings. The overlap of these barriers creates greater risks for women to be excluded from the opportunities associated with the digitalization of finance and to prevent them from bridging the current divide (Arnold and Gammage, 2019).

Previous studies have demonstrated the indicators to consider while measuring financial inclusion. The most basic and common indicator that has been widely used in determining financial inclusion is ownership of a formal account (Allen et al., 2016). According to Zins and Weill (2016), financial inclusion determinants can be shown by looking at ownership of accounts and use of savings and credit services rendered by financial institutions. Although these are indicators of financial inclusion, factors that drive inclusivity may vary accordingly.

The determinants of DFS can be traced to financial services that are offered using digital platforms. For example, in Kenya the most common digital financial service used is M-Pesa which allows consumers to have mobile accounts that can facilitate payment, saving and remittances. M-Shwari is a common DFS that helps consumers access credit digitally (Suri and Jack, 2016). A study by Aker et al. (2016) found that with mobile money there was a greater bargaining power for women and an increase in household consumption due to increased access to cost-effective financial services.

Many regulators find it a challenge to keep an adequate understanding of the implications of evolving business models and the rise of technology in the financial sector. Policy makers struggle with resource and capacity gaps regarding technological developments. As a result, policy makers resort to regulatory frameworks that are restrictive and ill-suited for technology-driven innovation, or that exacerbate pre-existing market gaps that hinder financial inclusion (UN Women1, 2019). Many countries still have laws that discriminate against women and have a direct impact on their ability to access and use digital financial services. Women face barriers in going places, starting a job, getting paid, getting married, having children, running a business, managing assets, and getting a pension (World Bank, 2019). In some countries, husbands can legally prevent their wives from working and other countries have laws which prevent women from inheriting equally as a spouse. In some countries, women cannot be the head of household or family and other countries have laws which prevent women from traveling outside their homes (UN Women2, 2019). Laws on non-discriminatory access to credit,

based on gender and marital status, and the reform of legal barriers to women's access and control over assets by addressing laws affecting marital property, inheritance and the titling of land should be enacted (Robino et al, 2018). Access to property rights and land is essential for women entrepreneurs because property is used as collateral for business credit. Having access to loans or from building credit scores would lower the rates and fees of digital financial services.

Much evidence from literature has broadly looked at individual attitudes towards financial inclusivity. For example, Fungáčová and Weill (2015) showed that attitudes such as the cost that goes into accessing certain financial services and the trust towards the financial service providers mostly drives the choice of an individual to use that financial service. However, this is one way to look at the factors that shape inclusivity.

Socio-economic factors have been classified as demand factors that influence digital financial inclusion (Cheronoh, 2019). Many studies commonly adopt socio-economic characteristics such as age, gender, education levels and income levels. Delechat et al. (2018) demonstrated that there was a strong relationship between such characteristics defining an individual to financial inclusion. In China, for example, the level of education was shown to significantly affect the financial inclusion of an individual (Fungáčová and Weill, 2015). A study by Conrad et al. (2019) showed that geographical location, that is, whether an individual lives in a rural or urban area, had a significant effect on access to information on financial services. They found out that people living in rural areas had a greater gap in information access than people who lived in urban areas.

Although many studies have looked at the effect of socio-economic factors on financial inclusion, many do not look at it from a gender perspective. Social norms like women being less likely to receive education or be employed in specific roles explain why women experience greater barriers to benefiting from the opportunities provided by the digitalization of finance. It can be argued that other socio-economic factors have a role to play in ensuring countries achieve better financial inclusivity. Evidence on socio-economic factors can be a key remedy for shaping policies that promote financial inclusivity.

Theoretical framework

This study adopted the gender inclusive framework to understand and unpack gender inclusivity in DFS in Kenya. The framework provides for the integration of gender analysis into the design of the specific area of interest (Aggestam et al., 2019). The feminist theory on gender issues informed the incorporation of a gender lens into this study. The theory is key to showing the importance of analysing issues and trends that are mostly disregarded due to historical presumptions on gender (Fergurson, 2017). Mistakenly, it is assumed that the theory has a high regard for women and girls and disregards men and boys (Dietz, 2003). However, the underlying concept of the theory is to highlight inequality in social problems by evaluating further the gender component. The gender inequality concept, as shown by feminist theory, recognizes that people have the same capacity therefore should be presented with equal opportunities (Bacchi and Eveline, 2010). Building from these theoretical concepts this research study adopted a gender lens in identifying the socio-economic causes of the gender gap in DFS that inhibits complete gender inclusivity.

Fairlie decomposition

To investigate the drivers of the gender gap in digital financial inclusion in Kenya, the Fairlie decomposition method was applied. This method is an extension of the Blinder–Oaxaca decomposition method (Blinder, 1973; Oaxaca 1973). The Blinder–Oaxaca decomposition method is used to identify and quantify the separate contributions of group differences in measurable characteristics to gender gaps in outcomes. The Blinder–Oaxaca decomposition method cannot be used directly if the outcome is binary, and the coefficients are from a logit or probit model. Fairlie decomposition, based on Fairlie and Meyer (1999), fits binary dependent variables. This technique draws on the coefficient estimates from a logit or probit model and can be used directly in the decomposition specification (Jann, 2008). Based on Fairlie and Meyer (1999), the decomposition for a non-linear equation $y = f\left(X\hat{\beta}\right)$ can be written as:

$$\overline{y}^M - \overline{y}^F = \left(\sum_{i=1}^{N^M} \frac{f\left(X_i^M \hat{\beta}^F\right)}{N^M} - \sum_{i=1}^{N^F} \frac{f\left(X_i^F \hat{\beta}^F\right)}{N^F}\right) + \left(\sum_{i=1}^{N^M} \frac{f\left(X_i^M \hat{\beta}^M\right)}{N^M} - \sum_{i=1}^{N^F} \frac{f\left(X_i^M \hat{\beta}^F\right)}{N^F}\right) \tag{1}$$

where y is the dependent variable representing the digital financial inclusion; N^k is the sample size for gender k; and M and F represent male and female respectively.

The first term in parentheses represents the part of the gender gap that is due to group differences in distributions of X; and the second term represents the part owing to differences in the group processes determining levels of y. The second term also captures the portion of the gender gap owing to group differences in unmeasurable or unobserved endowments. To identify the contribution of group differences in specific variables to the gender gap, we assume that: $N^M = N^F$.

This means that that there exists a natural one to one matching of male and female observations. Using coefficient estimates from a logit regression for a pooled sample, $\hat{\beta}^*$ the independent contribution of X_i to the gender gap can then be expressed as:

$$y = \frac{1}{N^F} \sum_{i=1}^{N^F} f\left(\hat{\alpha}^* + X_{1i}^M \hat{\beta}_1^* + X_{2i}^M \hat{\beta}_2^*\right) - f\left(\hat{\alpha}^* + X_{1i}^F \hat{\beta}_1^* + X_{2i}^M \hat{\beta}_2^*\right) \tag{2}$$

The contribution of each variable to the gap is equal to the change in the average predicted probability of replacing the female distribution with the male distribution of that variable while holding the distributions of the other variable constant. The main property of this technique is that the sum of the contributions of individual variables will be equal to the total contribution of all of the variables evaluated in the sample.

3. Empirical strategy

Data

This study utilized data from the 2021 FinAccess Household Survey to achieve its objectives. The survey is the 6th edition of the survey since 2006 (KNBS, 2021). This survey was carried out at both national and county levels. It was also conducted during the evolving COVID-19 pandemic and reflects some of the impacts of this crisis at household level. The survey used a cross-sectional survey design at household level and targeted individuals aged 16 years and above living within conventional households in Kenya. The sample was drawn from the Kenya Household Master Sample Frame (K-HMSF) developed from the 2019 Kenya Population and Housing Census to provide estimates at national level, rural/urban and across all the 47 counties. The minimum sample size for integrated surveys was computed for each of the survey domains, yielding 1,700 enumeration areas or clusters and 30,600 households. The collected data was weighted and adjusted for non-responses, resulting in representative data at national and county levels. From the sample, 25,724 people were eligible for interviews at the time of data collection, where 22,024 recorded successful interviews. Overall response rate was 85.6%, with rural dwelling response rate at 88.6% and urban at 80.5%. The survey and variables are covered in four dimensions, namely access, quality, usage and impact (KNBS, 2021). To the best of the authors' knowledge, this study provides the first empirical evidence on gender gap in digital financial inclusion at the individual level using 2021 FinAccess Household Survey. FinAccess Household Survey was designed to measure financial inclusion therefore the data captures many aspects of financial inclusion in Kenya (Allen et al., 2021). Given that the adulthood age is Kenya is 18 years, this study restricted itself to those individuals who are above 18 years of age and eligible to have most of the identification documents. Registration to many digital financial services requires one to have identification documents.

In this study key informant interviews (KIIs) were also carried out to understand the policy landscape in digital financial access. The stakeholders were mapped out based on two categories, regulators and digital financial service providers. The grouping of the stakeholders was guided by the level of interest and the level of influence the stakeholders have on digital financial inclusion. The study adopted qualitative techniques for analysis of stakeholder KIIs data. Key informant interviews sought to evaluate the existing policies that promote gender inclusion in digital financial access and the gaps in policies that, if filled, can promote gender inclusion in digital financial services.

Econometric model and estimation

In order to evaluate the effect of the socio-economic variables on the digital financial inclusion indicators, the logit regression model was used as follows:

$$y_i = \mathbf{X}_i' \boldsymbol{\beta}_i + \varepsilon_i; \quad y_i = 0,1; \ i = 1, 2, ..., n \tag{3}$$

where $\mathbf{X}_i'\boldsymbol{\beta} = \beta_0 + \beta_1 x_{i1} + \beta_2 x_{i2} + ... + \beta_k x_{ik}$. In this case the $\mathbf{X}_i'$ represent the independent variables/ socio-economic variables and y_i represents the dependent variable/ digital financial inclusion indicator for the ith individual. If the ith individual chooses to be financially included then $y_i = 1$, otherwise, $y_i = 0$. Equation 3 represents a model with a binary choice involving an estimation of the probability of an individual adult in Kenya being financially included (y_i) given a set of factors ($\mathbf{X}_i'$) which are exogenous to the individual. Since $\Pr(Y_i=1)=p_i$ and $0 \le p_i \le 1$, using the logit transformation we have:

$$\ln\left(\frac{p_i}{1-p_i}\right) = \mathbf{X}_i'\boldsymbol{\beta} \tag{4}$$

and $p_i = E(y_i) = \frac{e^{x_i\beta_i}}{1 + e^{x_i\beta_i}}$ for $y_i = 1$ or 0. Table 1 presents the dependent variables used in the logit regression model described in Equation 1.

The study also used the multivariate probit model to regress a vector of correlated binary DFS indicator variables on a mixture of continuous and discrete predictors. This was specifically important since most DFS inclusion indicators are suspected to be correlated. The multivariate probit model is a generalization of the bivariate probit model. The bivariate probit model has two binary dependent variables y_1 and y_2 so that there are two latent variables: y_1^* and y_2^*. It is assumed that each observed variable takes on the value 1 if and only if its underlying continuous latent variable takes on a positive value: $y_1 = \begin{cases} 1 \ if \ y_1^* > 0 \\ 0 \ if \ y_1^* < 0 \end{cases}$ and $y_2 = \begin{cases} 1 \ if \ y_2^* > 0 \\ 0 \ if \ y_2^* < 0 \end{cases}$ with $\begin{cases} y_1^* = x_1'\beta_1 + \epsilon_1 \\ y_2^* = x_2'\beta_2 + \epsilon_2 \end{cases}$

and $\begin{bmatrix} \epsilon_1 \\ \epsilon_2 \end{bmatrix} | \mathbf{X} \sim \mathbf{N}\left(\begin{bmatrix} 0 \\ 0 \end{bmatrix}, \begin{bmatrix} 1 & \rho \\ \rho & 1 \end{bmatrix}\right)$. Fitting the bivariate probit model involves estimating the values of, $\boldsymbol{\beta_1}, \boldsymbol{\beta_2}$ and ρ. The multivariate probit model has n correlated binary dependent variables (Jeliazkov and Lee, 2010).

Table 1:   Description of digital financial aervices (DFS) inclusion indicators

Variable	Description
DFS_*Account*	Dummy variable is equal to 1 if an individual has either registered:
	i) on mobile money (e.g. M-Pesa, Airtel Money, TCash, Tangaza, MobiKash, Equitel) or
	ii) on mobile bank (e.g., M-Shwari, KCB M-Pesa, MCoop cash, Eazzy Loan, Timiza, HF Whizz)
	in the past12 months
DFS_*Saving*	Dummy variable is equal to 1 if the individual either saved:
	i) through mobile banking or
	ii) through mobile money provider
	in the past 12 months
DFS_*Credit*	Dummy variable is equal to 1 if the individual either borrowed:
	i) from mobile banking or
	ii) from *fuliza*, a digital overdraft facility offered by select banks through mobile money operator, Safaricom or
	iii) from digital loans that one gets through the telephone via downloaded applications (e.g., Branch, Tala, Utunzi, Haraka loans, etc.)
	in the past 12 months
DFS_*Others*	Dummy variable is equal to 1 if in the past 12 months the individual either:
	i) used a debit card (use on ATM, POS to pay in shops and deducts from account immediately) or credit card to make payments, or
	ii) bought or acquired insurance policy by searching online and buying the policy online or through mobile telephone, or
	iii) accessed bank account(s) through either mobile banking or ATM or using Internet banking /online banking or using POS/card machine swipe or
	iv) bought securities (e.g., shares, stocks, mutual funds, T-bills or bonds online (by themselves and **not** through an agent) or mobile applications (e.g., NSE Mobile App, Stockbroker Mobile App, Money Market Fund App)

The descriptions of the independent variables used in the study are presented in Table 2. The independent variables/socio-economic factors considered in this study include age, marital status, education, income, residence area, employment among others.

Table 2: Description of independent variables: Digital financial services (DFS) inclusion

Variable	Description
Marital single	Dummy variable is equal to 1 if respondent is single, 0 elsewise
Marital married	Dummy variable is equal to 1 if respondent is married, 0 elsewise
Marital divorced	Dummy variable is equal to 1 if respondent is divorced, 0 elsewise
Marital widowed	Dummy variable is equal to 1 if respondent is widowed, 0 elsewise
Gender	Dummy variable is equal to 1 if respondent is female, 0 elsewise
Age	Age in number of years
Youth	Dummy variable is equal to 1 if respondent's age (in years) lies in the interval , 0 elsewise
Middle-aged adults	Dummy variable is equal to 1 if respondent's age (in years) lies in the interval , 0 elsewise
Old age	Dummy variable is equal to 1 if respondent's age (in years) is greater than 60, 0 elsewise
No formal education	Dummy variable is equal to 1 if individual has no formal education, 0 elsewise
Primary education	Dummy variable is equal to 1 if individual has some primary education or has completed primary school, 0 elsewise
Secondary education	Dummy variable is equal to 1 if individual has some secondary education or has completed secondary education, 0 elsewise
Technical education	Dummy variable is equal to 1 if individual has some technical training or has completed technical education, 0 elsewise
University education	Dummy variable is equal to 1 if individual has some university education or has completed university education, 0 elsewise
Low income	Dummy variable is equal to 1 if the monthly income is less than Ksh.24000, 0 elsewise
High income	Dummy variable is equal to 1 if the monthly income is more than Ksh. 24000 (minimum monthly taxable income is Ksh. 24,001), 0 elsewise
Occupation: Farming	Dummy variable is equal to 1 if individual earned majorly from farming in the last 12 months, 0 elsewise
Occupation: Waged	Dummy variable is equal to 1 if individual earned majorly from salaried employment in the last 12 months, 0 elsewise
Occupation: Casual Worker	Dummy variable is equal to 1 if individual earned majorly from casual employment in the last 12 months, 0 elsewise
Occupation: Self employed	Dummy variable is equal to 1 if individual earned majorly from self-employment, business and investments in the last 12 months, 0 elsewise
Occupation: Retired	Dummy variable is equal to 1 if individual earned majorly from pension in the last 12 months, 0 elsewise
Occupation: Others	Dummy variable is equal to 1 if individual received support from friends, spouse or money from NGO / Government in the last 12 months, 0 elsewise
Residence	Dummy variable is equal to 1 if individual resides in a rural area, 0 elsewise

Table 2 Continued

Variable	Description
Disability	Dummy variable is equal to 1 if individual has difficulty in seeing, walking, hearing, remembering/concentration, self-care or communicating in your usual language, 0 elsewhere
Financial literacy	Dummy variable is equal to 1 if individual can accurately calculate interest amount repaid on a loan, 0 elsewhere
Phone ownership:	Dummy variable is equal to 1 if individual owns a telephone or tablet, 0 elsewhere
Internet daily	Dummy variable is equal to 1 if individual uses internet daily, 0 elsewhere
Internet weekly	Dummy variable is equal to 1 if individual uses internet weekly, 0 elsewhere
Internet monthly	Dummy variable is equal to 1 if individual uses internet monthly, 0 elsewhere
Internet less often	Dummy variable is equal to 1 if individual uses internet less often, 0 elsewhere
Internet never	Dummy variable is equal to 1 if individual never use internet, 0 elsewhere
Identification documents	Dummy variable is equal to 1 if individual posses' ID, passport or alien ID, 0 elsewhere
Region_Nairobi	Dummy variable is equal to 1 if individual is from Nairobi region, 0 elsewhere
Region_Central	Dummy variable is equal to 1 if individual is from Central region, 0 elsewhere
Region_Coast	Dummy variable is equal to 1 if individual is from Coast region, 0 elsewhere
Region_Eastern	Dummy variable is equal to 1 if individual is from Eastern region, 0 elsewhere
Region_North Eastern	Dummy variable is equal to 1 if individual is from North Eastern region, 0 elsewhere
Region_Nyanza	Dummy variable is equal to 1 if individual is from Nyanza region, 0 elsewhere
Region_Rift Valley	Dummy variable is equal to 1 if individual is from Rift Valley region, 0 elsewhere
Region_Western	Dummy variable is equal to 1 if individual is from Western region, 0 elsewhere

4. Results and discussion

Descriptive Statistics

Table 3 presents descriptive statistics of the digital financial inclusion indicators and gender gap in DFS_Savings, DFS_Credit, DFS_Account and DFS_Others.

Table 3: Descriptive statistics for digital financial inclusion indicators

Sample (n)	Female		Male		Total		Gender gap
	12,159 (58.2%)		8,732 (41.8%)		20,891		
	Size	%	Size	%	Size	%	% point
DFS_Savings	7,052	58.00	5,565	63.73	12,617	60.39	-5.80
DFS_Credit	2,779	22.86	2,676	30.65	5,455	26.11	-7.79
DFS_Account	9,447	77.70	7,262	83.17	16,709	79.98	-5.47
DFS_Others	2,197	18.07	2,257	25.85	4,454	21.32	-7.78

Out of a sample of size 20,891 considered in the study, 58.2% were female and 41.8% were male. Most respondents (79.98%) had DFS_Account with either a mobile bank or mobile money, 60.39% saved through mobile banking or a mobile money provider but only 26.11% accessed credit through digital financial services. In addition, 21.32% performed other transactions through digital financial services. These transactions included use of a debit card, credit card, acquiring an insurance policy by searching online and buying the policy, access to bank account, and buying securities using digital channels.

There exists a gender gap across all the four DFS indicators. First, a gender gap of -5.47% points exist in DFS_Accounts implying fewer women have DFS account than men. Though the gap has been reducing over the years (KNBS, 2021) it still exists and should be bridged. This gender disparity in usage of mobile money and mobile bank services reflects the existence of barriers in access to mobile telephones and Internet for women compared to men. Consistent with DFS accounts, a gender gap of -5.80% points exist in access to DFS savings, implying that more women are excluded in access to DFS savings. A gender gap exists in access to DFS credit (−7.79% points) where women have lower access to DFS credit than men, 22.86% versus 30.65%, respectively. Fewer women than men (18.07% versus 25.85% respectively) conduct

other transactions (payments, access to bank accounts, investment, and insurance) through digital channels. This gap may be due to fewer women participating in some of these services such as insurance and investment in financial securities. Additionally, more women may not be formally banked. Women in Kenya mostly run their business in the informal economy and have more access to informal financial services than men (Kim, 2022). This increases their chances of being excluded in the access to digital financial services.

Table 4 shows the descriptive statistics for the socio-economic factors considered in this study. The statistics are further disintegrated by gender whereby for each factor the proportion of male to female was evaluated.

Table 4: Descriptive statistics of determinants of digital financial inclusion

Sample (n)	Female		Male		Total	
	Size	%	Size	%	Size	%
	12,159	**58.20**	**8,732**	**41.80**	**20,891**	**100**
Marital Status						
Single	2,378	19.58	2,326	26.67	4,704	22.54
Married	6,563	54.04	5,418	62.13	11,981	57.42
Divorced	964	7.94	647	7.42	1,611	7.72
Widowed	2,240	18.44	330	3.78	2,570	12.32
Total respondents	12,145	59.20	8,721	41.80	20,866	99.88
Age						
Youths (18–35 years)	6,251	51.41	4,153	47.56	9,596	45.93
Middle-aged adults (36–60 years)	4,041	33.23	3,458	39.60	8,307	39.76
Older adults (Above 60 years)	1,867	15.35	1,121	12.83	2,988	14.30
Total respondents	12,159	58.20	8,732	41.80	20,891	100
Level of education						
No formal education	2,769	22.79	1,172	13.44	3,941	18.88
Primary education	4,865	40.05	3,553	40.74	8,418	40.34
Secondary education	3,206	26.39	2,774	31.80	5,980	28.65
Technical education	856	7.05	699	8.01	1,555	7.45
Tertiary education	452	3.72	524	6.01	976	4.68
Total respondents	12,148	58.21	8,722	41.79	20,870	99.90
Levels of income						
Low income	10,362	95.63	7,200	90.14	17,562	93.30
High income	473	4.37	788	9.86	1,261	6.70
Total respondents	10,835	58.20	7,988	41.80	18,823	90.10

Table 4 Continued

Sample (n)	Female		Male		Total	
	Size	%	Size	%	Size	%
	12,159	**58.20**	**8,732**	**41.80**	**20,891**	**100**
Farming	2,534	20.84	2,043	23.40	4,577	21.91
Waged	859	7.06	1,180	13.51	2,039	9.76
Casual worker	2,838	23.34	3,115	35.67	5,953	28.50
Self employed	2,073	17.05	1,173	13.43	3,246	15.54
Retired	48	0.39	98	1.12	146	0.69
Total respondents	12,159	58.20	8,732	41.80	20,891	100
Residence						
Rural	7,952	65.40	5,661	64.83	13,613	65.16
Urban	4,207	34.60	3,071	35.17	7,278	34.84
Total respondents	12,159	58.20	8,732	41.80	20,891	100
Disability						
Disabled	1,835	15.10	1,022	11.71	2,857	13.68
Not disabled	10,315	84.90	7,705	88.29	18,020	87.32
Total respondents	12,150	58.20	8,727	41.80	20,877	99.93
Financial Literacy						
Literate	4,827	39.77	4,338	49.75	9,165	43.94
Illiterate	7,311	60.23	4,382	50.25	11,693	56.06
Total respondents	12,138	58.20	8,720	41.80	20,858	99.84
Phone Ownership						
Own	9,899	81.66	7,507	86.34	17,406	83.61
Not own	2,223	18.66	1,188	13.66	3,411	16.39
Total respondents	12,122	58.23	8,695	41.77	20,817	99.65
Internet Usage						
Daily	8,618	71.09	5,266	60.56	13,884	66.69
Weekly	1,913	15.78	2,039	23.45	3,952	18.98
Monthly	866	7.14	770	8.86	1,636	7.86
Less often	138	1.14	129	1.48	267	1.28
Never	588	4.85	491	5.65	1,079	5.18
Total respondents	12,123	58.23	8,695	41.77	20,818	99.65
Identification_Documents (IDs)						
Has IDs	11,327	93.39	8,161	93.83	19,488	93.57
No IDs	802	6.61	537	6.17	1,339	6.43
Total respondents	12,129	58.24	8,698	41.76	20,827	99.69

Table 4 Continued

Sample (n)	Female		Male		Total	
	Size	**%**	**Size**	**%**	**Size**	**%**
	12,159	**58.20**	**8,732**	**41.80**	**20,891**	**100**
Central	1,252	10.30	844	9.67	2,096	10.03
Coast	1,208	9.94	1,068	12.23	2,276	10.89
Eastern	2,109	17.35	1,554	17.80	3,663	17.53
North Eastern	636	5.23	537	6.15	1,173	5.61
Nyanza	1,765	14.52	1,191	13.64	2,956	14.15
Rift Valley	3,639	29.93	2,527	28.94	6,166	29.52
Western	1,191	9.080	764	8.75	1,955	9.36
Total respondents	12,159	58.20	8,732	41.80	20,891	100

These statistics show that 57.42% of respondents were married, 22.54% were single, 12.32% were widowed, and 7.72% were divorced. Widows made up 18.44% of female respondents and 3.78% of men. Youth (18–35) made up the majority of responders. This group has 51.41 percent female respondents and 47.56 percent male respondents. Primary education was obtained by 40.34 percent of respondents, followed by secondary education by 28.65 percent. There were 22.79 percent female responders and 13.44 percent male respondents without schooling. Women respondents are mostly low-income (95.63%), with a small percentage in the high-income category (4.37%). This was lower than the 9.86 percent of higher-income male respondents. Female respondents were mostly self-employed (17.05%), whereas men dominated other occupations. 65.16 percent of participants lived in rural areas, with women outnumbering men (65.4% vs. 64.84%). Participants were 56.06 percent financially illiterate. Male respondents (49.75%) were more financially literate than female respondents (39.77%). Many male participants had IDs and phones (86.34 % had phones and 93.83% had IDs). Most responders were from the Rift valley, Eastern, and Nyanza areas (29.52, 17.53, and 14.15%).

Regression results

This section examines if gender differences still hold in the uptake of digital financial services when controlling for other individual level socio-economic variables/ characteristics. Logit regression results for the main indicators of digital financial inclusion are displayed in Table 5. Specifically, Table 5 presents the logistic regression marginal effects. The logic regression coefficients are presented in Appendix A. Appendix B presents the coefficients from the multivariate probit model. From the results in Appendix B, all the DFS inclusion indicators are significantly correlated. However, the coefficients from the logistic model and the multivariate probit model move in the same direction and leading to the same conclusion.

Table 5: Determinants of digital ginancial inclusion in Kenya, marginal effects

Variables	DFS_Savings	DFS_Credit	DFS_Accounts	DFS_Others
	dy/dx	dy/dx	dy/dx	dy/dx
Residence, Rural	0.017**	-0.0479***	0.0013	-0.0151**
	(0.007)	(0.0069)	(0.0047)	(0.0061)
Gender, Female	-0.010	-0.0454***	-0.0089**	-0.0165***
	(0.007)	(0.0063)	(0.0042)	(0.0056)
Age	0.003***	0.0136***	0.0052***	0.0007
	(0.001)	(0.0015)	(0.0006)	(0.0010)
Age^2	-0.0001***	-0.0002***	-0.0001***	0.00001*
	(0.000)	(0.0000)	(0.0000)	(0.0000)
Marital Status, Married	0.012	0.0162**	0.0389***	0.0224***
	(0.009)	(0.0080)	(0.0062)	(0.0071)
Marital Status, Divorced	-0.005	0.0270**	0.0225**	0.0010
	(0.014)	(0.0128)	(0.0090)	(0.0113)
Marital Status, Widowed	-0.047***	0.0361**	0.0299***	0.0228*
	(0.015)	(0.0153)	(0.0091)	(0.0124)
Education, Primary Education	0.089***	0.1399***	0.0487***	0.0699***
	(0.011)	(0.0096)	(0.0071)	(0.0088)
Education, Secondary Education	0.120***	0.1906***	0.0734***	0.1266***
	(0.012)	(0.0107)	(0.0085)	(0.0102)
Education, Technical Education	0.129***	0.2119***	0.1018***	0.1843***
	(0.017)	(0.0146)	(0.0123)	(0.0145)
Education, University Education	0.106***	0.2040***	0.1267***	0.2838***
	(0.020)	(0.0173)	(0.0156)	(0.0199)
Income, Low Income	0.010	0.0194*	-0.0241**	-0.1028***
	(0.014)	(0.0115)	(0.0122)	(0.0130)
Occupation, Farming	0.044***	0.0075	-0.0071	0.0080
	(0.010)	(0.0109)	(0.0063)	(0.0091)
Occupation, Salaried	0.048***	0.0165	0.0316***	0.1534***
	(0.013)	(0.0116)	(0.0092)	(0.0119)
Occupation, Casual	0.016	0.0205**	0.0131**	0.0030
	(0.010)	(0.0097)	(0.0058)	(0.0084)
Occupation, Business & Investment	0.103***	0.0539***	0.0361***	0.0587***
	(0.011)	(0.0106)	(0.0069)	(0.0094)
Occupation, Retired	-0.016	0.0798*	0.0586**	0.1673***
	(0.038)	(0.0408)	(0.0248)	(0.0366)

Table 5 Continued

Variables	DFS_Savings	DFS_Credit	DFS_ Accounts	DFS_Others
	dy/dx	dy/dx	dy/dx	dy/dx
Internet Frequency, Daily	0.100***	0.1069***	-0.0005	0.1799***
	(0.010)	(0.0094)	(0.0071)	(0.0099)
Internet Frequency, Weekly	0.065***	0.0824***	-0.0145*	0.1056***
	(0.012)	(0.0113)	(0.0084)	(0.0109)
Internet Frequency, Monthly	0.095***	0.1210***	-0.0345*	0.0502**
	(0.026)	(0.0271)	(0.0196)	(0.0236)
Internet Frequency, Less often	0.102***	0.0984***	0.0274***	0.0845***
	(0.014)	(0.0136)	(0.0094)	(0.0131)
Documents, Passport, ID &Alien ID	0.302***	0.1793***	0.3893***	0.1699***
	(0.017)	(0.0115)	(0.0191)	(0.0104)
Phone, Own	0.506***	0.2322***	0.6018***	0.1125***
	(0.010)	(0.0073)	(0.0119)	(0.0091)
Disability, Yes	-0.023**	-0.0148	0.0017	0.0142
	(0.010)	(0.0105)	(0.0059)	(0.0088)
Financial Literacy, Literate	-0.041***	-0.0022	0.0032	0.0315***
	(0.007)	(0.0066)	(0.0046)	(0.0061)
Region, Central	-0.027	0.0154	-0.0562***	-0.1079***
	(0.021)	(0.0181)	(0.0169)	(0.0203)
Region, Coast	-0.111***	0.0448**	-0.0447***	-0.1079***
	(0.021)	(0.0180)	(0.0167)	(0.0203)
Region, Eastern	-0.148***	-0.0017	-0.0386**	-0.1499***
	(0.021)	(0.0172)	(0.0163)	(0.0197)
Region, North Eastern	-0.244***	-0.1880***	-0.0320*	-0.2561***
	(0.025)	(0.0182)	(0.0176)	(0.0216)
Region, Nyanza	0.007	0.0597***	-0.0429***	-0.0909***
	(0.021)	(0.0176)	(0.0165)	(0.0200)
Region, Rift Valley	-0.086***	0.0268	-0.0676***	-0.1440***
	(0.020)	(0.0166)	(0.0162)	(0.0193)
Region, Western	0.028	0.1228***	-0.0399**	-0.0994***
	(0.022)	(0.0192)	(0.0170)	(0.0210)
Observations	18,671	18,671	18,671	18,671
Pseudo R^2	0.2269	0.1928	0.5116	0.2573
Log Likelihood	-9637.8549	-8805.8639	-4441.609	-7350.382

Notes: Standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1

Individual financial decisions are influenced by their area of residence, either rural or urban. As a result, the respondents' place of residence was assessed to determine if it had any impact on the use of DFS. Table 5 shows that the residence variable was significant, both positively related with DFS_Savings and negatively related with DFS_Credit and DFS_Others categories. This indicates that the probability of the rural population to use DFS_Credit is lower by 4.79% when compared to the urban population. Similarly, the residence variable was negative and significant for DFS_Others, an indication that the residents in the rural areas had a lower likelihood (by 1.5%) of using other DFS. The residence variable was positive and significant for DFS_Savings, an indication that the residents in the rural areas had a 1.7% higher probability of saving using DFS than those in the urban areas. This is because saving in a safe place in rural areas can be more difficult therefore the value proposition of saving is higher in rural areas. Most rural residents are most likely to face various factors such as lower income levels and lower levels of education which can contribute to exclusion in other digital financial services as highlighted by Allen et al. (2012). Similarly, Sapovadia (2018) reported on the lower uptake of other DFS in rural areas and linked the results to be due to the characteristics of rural areas like underdeveloped infrastructure, poor network coverage, lower income levels and low transactions, all which increase the chances of being excluded from access to digital financial services. The lower uptake of DFS in rural areas, as observed from the results, could also be due to existing bias in the provision of digital finance services since. Providers may choose to withdraw or discontinue the provision of specific digital finance services to high-risk rural areas or communities that lack the supporting infrastructure to sustain specific DFS, resulting in lower financial inclusion, as reported by Ozili (2018).

Several researchers have also reported similar results, for example, Biscaye et al. (2017) documented that living in the rural areas increases the chances of being excluded due to limitation in awareness of available digital financial services. In Kenya, Kiai et al. (2016) found significant disparities in financial service utilization between rural and urban families. The research reported that in comparison to their rural counterparts, urban households were roughly 4% more likely to use formal savings, according to the authors. Rural households were also reported to face unique problems when it comes to accessing financial services. According to Malkamaki (2009), rural inhabitants utilize 30.4% more informal financing than urban dwellers (26.5%). According to Villasenor et al. (2016) the situation is no different for mobile accounts. According to the survey, approximately 70% of urban respondents were active registered users of mobile money, compared to approximately 51% of rural respondents.

The gender variable was negative and significant (at 1% significance level) indicating that females were less likely to be included in the uptake of credit services via digital channels by 4.54% compared to males. The gender variable was also negative and significant for DFS_Account, indicating that women were less likely to own DFS_Accounts by 0.89%. Similarly, with regards to other DFS, the gender variable was negative and significant, an indication that the females were 1.65% less likely to be included in uptake of DFS_Others.

The lack of finances for women, especially in the undeveloped nations could be the reason for the exclusion in DFS_Account ownership as reported by Chamboko et al. (2018). This is a result of women's poor involvement in the labour force, lack of control over household finances, lack of education and low socio-economic standing in comparison to males (Chamboko et al., 2018). Social attitudes and restrictive laws also prevent women from having equal access to DFS. For example, existing laws in at least 167 countries limit women's economic potential (G20 GPFI, 2020). Women are also less likely to be included in the uptake of DFS_Credit. This might be so since women might prefer to acquire credit through informal financial services. According to research in India by Schaner and Theys (2018), certain societal attitudes discourage young women from acquiring telephones that allow access to mobile money out of fear that they will use the telephones to interact with unrelated men, increasing the risk of abuse and possibly affect their focus on their children and marriage.

The observations made from these results could also be contributed by the issues of convenience and discretion as some women from some communities would prefer to invest in settings where they can conveniently access their funds, particularly during periods of hardship. Having access to emergency finances was revealed as a constant reason women diversify their saving sources by saving with friends, relatives, or neighbours across countries. Furthermore, women prefer discretion to better satisfy known and unknown future demands (Chamboko et al., 2018). Since mobile money is designed to offer both anonymity and simplicity of access to cash, both qualities should be highlighted while promoting mobile money services to women.

Women were also less likely to be involved in the utilization of other digital financial services, implying that being female can affect other transactions such as debit card, credit card, acquiring insurance policy by searching online and buying the policy, access to bank account and buying securities using digital channels. This indicates that an individual's gender can affect their usage of digital channels to make these transactions. This could be due to the lack of female representation in financial institutions and access points, thereby hindering women from utilizing the DFS, according to G20 GPFI (2020). Research by Chamboko et al. (2021) also indicated that continued under-representation of women in financial institutions may prevent women from accessing and using DFS optimally, since they may prefer to interact with agents of their gender even during registration. Chamboko et al. (2021) also reported that that female clients prefer to trade with female agents, particularly when conducting high-value transactions.

At the levels of p<0.01, the age variable was positive and significant for DFS savings, credit, and account whereas Age2 was negative and significant for savings, credit and account. This shows that as age increases so does the uptake of these digital financial services indicators. As age increases so do the needs and independence of an individual grow (Setyari et al., 2018). The age-related influence is in line with the results of several studies that have found an inverted U-shaped association between age and financial inclusion. People are more likely to be excluded when they are young. The level of inclusion rises with age but subsequently falls as people get older. Kiai

et al. (2016) documented that as banks attempted to identify the creditworthiness of potential borrowers, age demonstrated a quadratic connection in the formal, semi-formal and informal strands, rising quickly at first before slowing and eventually turning negative.

The findings of this research found a non-linear association between age and the likelihood of using digital financial services which has been reported. For example, Kiai et al. (2016) reported that older Kenyans are more likely than younger Kenyans to use financial services. Malkamaki (2009) also observed that citizens aged 25–44 were more likely to use financial services than those aged 18–24 and over 44. Similarly, Johnson and Arnold (2012) documented that age had a significant impact on financial inclusion, with older persons being far more likely to have a bank account than younger people. According to Ndii (2009), Kenyans under the age of 25 and over the age of 55 are the least likely to use financial services, while those between the ages of 35 and 44 are the most likely to utilize formal financial services. According to World Bank (2013), elderly individuals use formal financial services more than younger people all over the world.

Marital status variable (married category) was positive and significant for all the DFS inclusion indicators, except savings. This implies that being married increases the likelihood of uptake of DFS_Credit by 1.62%, owning DFS Accounts by 3.89% and engaging in other DFS by 2.24%. This is because being married is associated with the increased demand for money and the associated expenditure, therefore the high likelihood of being included in DFS. Kiai et al. (2016) documented that being single in Kenya might have a significant impact on exclusion from financial services. According to the survey, married people had a better probability of getting included since they are regarded more responsible. Single persons were frequently thought to be less dependable or less stable because they do not have family or relatives to rely on. Mwangi and Kihiu (2012) also found comparable results and claimed that service providers feel married people have higher degrees of responsibility and hence are more trustworthy. According to our study, a married individual had a 3.48% better chance of obtaining financial services than a non-married person, while the chance of remaining financially excluded decreased by 4.40%.

The divorced category was also more likely to be included in DFS_Credit services and own DFS_Accounts which was indicated by a significant positive relationship at the level $p<0.05$ with DFS_Credit and Dfs_Accounts at 2.7% and 2.25%, respectively. Similar positive and significant relationships were observed for the widowed category with regards to the DFS_Credits access and DFS_Account ownerships and other DFS. The two categories could be included due to their household consumption needs, for emergency or for business purposes. However, a negative significant relationship was noted for the DFS_Savings, an indication that widows were less likely to save money using DFS which could be due to the constraining family needs.

The coefficient of education at all levels was positive and significant across all four categories at $p<0.01$, which indicates that higher levels of education increased the likelihood of digital financial inclusion, but the effect was more pronounced on

DFS_Credit with higher levels of education. Similar observations were made by Kiai et al. (2016) who reported that the utilization of financial services increases with education level. Kenyans with primary, secondary and/or university education use formal financial services more than Kenyans without any formal education. Mobile financial services use follows the same pattern as bank accounts. Similarly, Mwangi and Sichei (2011) found that increasing education level by one level increases access to semi-formal services by 14.1% and formal services by 0.9%. According to their study, increasing one's education level reduces the likelihood of remaining excluded by 8.5% and education assists to enlighten people on the numerous financial services available while also developing awareness on how to best manage the available services. Since the service provider's aim is to make profit, this can cause educational bias in the supply of digital financial services. If the net monetary benefit of providing digital finance to poor communities is relatively small, digital finance providers can opt to focus less on delivering digital finance to poor and uneducated populations who lack the basic financial literacy to use and understand digital finance. With regards to financial literacy, research shows that having general educational attainment has a significant impact on financial market participation. People with a higher level of education outperform others in a variety of areas, including budgeting, living within their means, attitudes toward the future and impulse control (Kiai et al., 2016).

Income levels displayed positive and significant relationships with DFS_Credit. This indicates that people with low-income levels were most likely to be included in the uptake of DFS_Credit by 1.94%. The individuals at low-income levels were also less likely to be included in the ownership DFS_Accounts by 2.41% and in the utilization of other DFS. Similar results have been observed by Ozili (2018) who reported that income disparities can result in disproportionate gains from DFS adoption in a population. Such disparities can occur when providers of digital services seek to make profits or maximize profitability in their businesses linked with digital finance providers, which include banks, financial and non-financial entities. The enterprises of digital finance services can use an aggressive marketing approach to persuade high- and middle-income customers to use a new or existing digital finance platform or infrastructure, while using a less aggressive marketing strategy to persuade low income and poor customers to use new or existing digital platforms or infrastructure if they believe low-income customers cannot afford the associated fees, as explained by Ozili (2018). Allen et al. (2016) also examined factors that influence the decision to open a bank account or a savings account in 123 countries, focusing on individual and national characteristics. They showed that higher income and education levels are connected with greater financial inclusion. This means that poor, low-income and illiterate people do not gain proportionately from financial inclusion, which is a major issue.

At various levels of significance, the primary employment classifications were significant and positively associated with all four categories of DFS inclusion metrics. The waged employees, casual labourers, self-employed and retirees were more likely to have DFS_Accounts and be included in the uptake of other DFS. Similarly, farmers, waged employees and self-employed individuals were more likely to be included in

DFS_Savings for the purposes of saving their cash from monthly salaries or profits from the businesses. Casual workers, self-employed people and pensioners were also more likely to be included in the uptake of DFS_Credit for business purposes, emergencies or household consumption. Izaguirre et al. (2018) documented that the casual and the waged employees are among the most likely to use digital credit to meet day-to-day household needs, which could indicate a payday loan type of function in which digital credit provides funds while borrowers are waiting for their next pay cheque.

Ownership of a telephone and identification documents were significant and positively associated to all four categories of DFS inclusion metrics. Similarly, the frequency of Internet usage (daily, weekly, monthly and less often) was significant and positively associated with savings, credit and other DFS. However, the respondents who used Internet on a weekly and monthly basis were less likely to have DFS_Accounts, as indicated by the negative and significant associations. Research has indicated that financial services are increasingly being accessible via mobile telephones, with current (and up to date) operating software systems and applications that support digital finance services; this may be part of the supporting infrastructure required to make DFS run efficiently, as reported by Ozili (2018). The persisting disparity in access to mobile telephones and the Internet in third world nations prevents individuals from accessing financial services such as mobile money. In developing countries, for example, 86% of males and 79% of women have access to mobile telephones, a 7% gender disparity (Demirguc-Kunt et al., 2018). Similarly, according to the GSMA (2015), women in middle income nations are 37% less likely to have access to Internet services. According to the 2017 Findex, even though women in many nations have access to digital technologies, they lack a good blend of digital skills and financial capabilities when compared to males (Demirguc-Kunt et al., 2018). Chamboko (2022) also stated that women's low levels of financial understanding impede them from utilizing DFS.

The disability variable also attained the same model where person with disabilities were less likely to save using DFS_Savings by 2.3%. Some of the factors that can be attributed to the financial exclusions include lower employment rates and lower educational attainment of persons with disabilities. Also, households with disabled members tended to spend more on medical expenses and their special needs, leaving less cash for saving. Persons with disabilities also were less likely to own a mobile device and significantly less likely to own a smartphone than other populations, making digital financial inclusion tougher.

With financial literacy, a negative and significant relationship was observed with DFS_Savings, an indication that the financially literate person within the respondents were less likely to have their savings in DFS platform by 4.1% but more likely to be included in other DFS_Others. Research shows that individuals with higher incomes and education levels were likely to use bank channels more than others to collect their earnings, save and make digital payments for products and services. This is due to the fact that most educated individuals acquire official professions, earn more than their colleagues, and have their earnings transferred into their bank accounts (Akinyemi and Mushunje 2020).

With the region variable, positive and significant relationships were observed with DFS_Credit, indicating that the residents from Coast, Nyanza and Western regions were most likely to be included in the uptake of credit through DFS. This could be due to the need of the residents in these regions to meet their short-term household or business liquidity needs. This was reported by Izaguirre et al. (2018) in a survey which showed that most borrowers in Kenya and Tanzania use digital credit for consumption. The authors reported that many in the financial inclusion community have looked to digital credit as a means of helping small, often informal, enterprises manage daily cash-flow needs or as a way for households to obtain emergency liquidity for things like medical emergencies. However, a survey in Kenya and Tanzania indicated that digital loans are mostly used for consumption, including ordinary household needs, airtime and personal or household goods. The residents of these regions could be included in the uptake of DFS_Credit for these discretionary consumption activities, not the business or emergency needs many had hoped digital credit would be used for.

Fairlie decomposition results

The Fairlie decomposition results for digital financial inclusion across gender in Kenya are displayed in Table 6.

Table 6: Fairlie decomposition of gender gap in access to digital financial services

Variables	DFS_Savings	DFS_Credit	DFS_Accounts	DFS_Others
Age	0.00002	-0.002544***	0.000312	0.000595
	(0.0002)	(0.0004)	(0.0003)	(0.001)
	0.25%	**-3.28%**	**0.55%**	**0.78%**
Residence	-0.00024	0.000742***	-0.000037	0.000291*
	(0.0001)	(0.0002)	(0.0001)	(0.0002)
	-0.40%	**0.96%**	**-0.07%**	**0.38%**
Marital Status	0.00892***	-0.000711	-0.002240*	0.000221
	(0.002)	(0.001)	(0.001)	(0.001)
	14.92%	**-0.92%**	**-3.97%**	**0.29%**
Education	0.01152***	0.012760***	0.009064***	0.015200***
	(0.001)	(0.001)	(0.001)	(0.001)
	19.27%	**16.46%**	**16.07%**	**19.82%**
Income	-0.00039	-0.000694	0.000574**	0.007800***
	(0.001)	(0.001)	(0.0002)	(0.001)
	-0.65%	**-0.90%**	**1.02%**	**10.17%**
Occupation	0.00433**	0.007683***	0.004711***	0.013569***
	(0.002)	(0.001)	(0.001)	(0.001)
	7.24%	9.91%	8.35%	17.69%

Table 6 Continued

Variables	DFS_Savings	DFS_Credit	DFS_Accounts	DFS_Others
Internet Use Frequency	0.01060***	0.013982***	-0.000585	0.019921***
	(0.001)	(0.001)	(0.001)	(0.001)
	17.73%	**18.04%**	**-1.04%**	**25.97%**
Document Possession	0.00374***	0.002048***	0.006326***	0.000541**
	(0.0003)	(0.0004)	(0.0004)	(0.0002)
	6.25%	**2.64%**	**11.22%**	**0.71%**
Phone Ownership	0.02168***	0.007164***	0.030748***	0.002797***
	(0.0005)	(0.0004)	(0.001)	(0.0003)
	36.25%	**9.24%**	**54.52%**	**3.65%**
Disability	0.00096***	0.000605**	0.000168	-0.000547
	(0.0004)	(0.0003)	(0.0003)	(0.0004)
	1.61%	**0.78%**	**0.30%**	**-0.71%**
Financial Literacy	-0.00455***	0.000314	0.000477	0.003387***
	(0.001)	(0.001)	(0.001)	(0.001)
	-7.61%	**0.41%**	**0.85%**	**4.42%**
Region	-0.00466***	-0.001208**	0.000019	-0.001820***
	(0.001)	(0.001)	(0.0003)	(0.0005)
	-7.79%	**-1.56%**	**0.03%**	**-2.37%**
Observations	18,671	18,671	18,671	18,671
Males	0.647	0.316	0.842	0.267
Female	0.587	0.238	0.786	0.190
Difference/ Gender Gap	0.0598	0.0775	0.0564	0.0767
Explained Gap	0.0522	0.0401	0.0495	0.0620
	87.23%	51.74%	87.77%	80.83%
Unexplained Gap	0.0076	0.0374	0.0069	0.0147
	12.77%	48.26%	12.23%	19.17%

Note: Standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1; percentage contribution in bold

Table 6 reports the results of the decomposition of gender gap in the use of DFS, including the contributions of the variables. The results of the decomposition for each indicator of digital financial service inclusion are presented. The decomposition of DFS_Savings shows that men were more likely to save using digital financial services (0.647) than women (0.587). Most (87.23%) of the gap is explained by socio-economic variables in the model while 12.77% is unexplained. Of the explained gap, telephone ownership contributed 36.25%, education 19.27%, frequency of Internet use 17.72%, marital status 14.95%, occupation 7.24%, document possession 6.25%, disability 1.61%, region -7.79% and financial literacy -7.61%. Positive values suggest that the gap is increasing while negative values mean that the gap is reducing.

Regarding the decomposition of DFS_Credit, men were more likely to borrow through a digital financial channel (0.316) than women (0.238). Thus, 51.74% of the gap is explained by the socio-economic variables while 48.26% remains unexplained. Of the explained gap, frequency of Internet use contributes 18.04%, education 16.46%, occupation 9.91%, telephone ownership 9.24%, age -3.28%, document possession 2.64%, region -1.56%, residence 0.96% and disability 0.78%.

The decomposition results of DFS_Accounts show that men were more likely to register for mobile money and mobile banking (0.842) than women (0.786). Most (87.77%) of the gap is explained by socio-economic factors and 12.23% remains unexplained. Of the explained gap, telephone ownership contributes 54.52%, education 16.07%, document possession 11.22%, occupation 8.35%, income 1.02% and marital status -3.97%. Finally, the decomposition results of DFS_Others showed that were are more likely to use these digital financial services (0.267) than women (0.190). Some 80.83% of the gap is explained by the socio-economic variables in the model while 19.17% remains unexplained. Of the explained gap, frequency of Internet use contributes 25.97%, education 19.82%, occupation 17.69%, income 10.17%, financial literacy 4.42%, telephone ownership 3.65% and region -2.37%. Document possession and residence contribute 0.71% and 0.78% respectively.

Overall, the gender gap in uptake of DFS is largely explained by explanatory variables. Across all platforms, males had a higher likelihood of using DFS than women. The "unexplained" part of the gender gaps in uptake of DFS may be due to discrimination against women. Indeed, education was the key driver of the gender gap in use of digital financial services, with an average contribution of 16%. This result converges with the capabilities argument which assumes that the unequal allocation of resources to individuals, such as education, may be a source of discrimination and inequalities between them (Walker and Unterhalter, 2007). Therefore, the differences between men and women in the use of DFS is explained by the fact that men are more likely than women to have access to education. These findings corroborate empirical works by Abdu et al. (2015), Botric and Broz (2017), Ghosh and Vinod (2017) and Ndoya and Tsala (2021).

5. Emerging themes from the key informant interviews on policy landscape in DFS

Policy guidelines for digital financial inclusion advocate the need to develop an enabling environment, a robust digital infrastructure and payment systems; enhance inclusivity, literacy and education; and prioritize the interests of consumers. The policies not only strengthen and spread financial services and literacy but also make them inclusive of youth, women, persons with disabilities, rural areas, low-income households and small enterprises. The following thematic areas arose in understanding the policy landscape and how it affects uptake of DFS in Kenya;

The requirements to access DFS like opening a DFS_Account and accessing DFS_Credit are gender neutral (they are universal and do not give any special attention to gender orientation of customers):

DFS providers require that all customers regardless of gender present documents such as ID and Kenya Revenue Authority (KRA) pin certificate. From the quantitative analysis, results revealed that possession of such documents was positively significant meaning that possession increased the chances to be included in DFS. Moreover, the quantitative results also showed that 11.22% of the gender difference in ownership of a DFS_Account was explained by possession of IDs. The FinAccess survey of 2021 (KNBS, 2021) showed that more adults in rural areas lacked IDs than in urban areas at 10.3% and 6.7% respectively. The survey also found out that more adult women did not have IDs than male adults. This means this policy leads to exclusion of more women in accessing digital financial services considering that they also form a large population of people living in rural areas and those in lower income brackets. The chances of not owning a national ID are exacerbated for people in lower income brackets and those who do not own mobile telephones. Similar experiences have been shared in other countries, for example, a study in Uganda by Tusubira and Mbabazi (2021) revealed that ID ownership was statistically significant in prediction of financial inclusion. Kodongo (2018) recommended that the Government of Kenya consider relaxing requirements of national ID in some instances as some countries like India have done. However, more awareness and sensitization can be done, especially through local administration units like chiefs, to encourage registration since the pros of these requirements outweigh the cons.

Age-restricting regulatory requirements are often regarded as a factor limiting financial inclusion. However, access to financial products by underage individuals is often restricted intentionally and appropriately. Increasing access for the sake of

access may compromise financial protection of young consumers and lead to long-lasting financial problems. Some countries have introduced limited exceptions and regulatory changes to lower the minimum age to access specific types of financial products (i.e., particular kinds of savings accounts), in an attempt to increase youth financial inclusion and promote youth empowerment (Monye, 2022).

Data from Communications Authority of Kenya indicated that there were 64.8 million SIM cards registered in Kenya as at September 2021 (Sunday, 2022). This was against an adult population that stood at 26 million in 2019, according to the Kenya National Bureau of Statistics (Sunday, 2022). That additionally meant that many minors resorted to using their parents' or guardians' ID to register SIM card to access digital financial services such as M-Pesa since it is impossible to register an M-Pesa line without an ID card, which you obtain at 18 years old. This meant minors under the age of 18 could not register an M-Pesa line. For this reason, Safaricom introduced a new service, M-Pesa GO, which seeks to empower parents and guardians to raise a generation that is financially healthy and is prepared for a cashless world. The M-Pesa GO is similar to the M-Pesa app which is geared towards enhancing the financial literacy as it is tailored for minors of between the age of 10 and 17 years old .

Data protection Act may encourage women participation in DFS due to guaranteed privacy.

The Office of Data Protection Commissioner (ODPC) is mandated to regulate the processing of personal data and protect the privacy of all individuals residing in Kenya as per the Data Protection Laws. The Data Protection Act, 2019 came into force on 25 November 2019 and is now the primary statute on data protection in the country. It gives effect to Article 31 (c) and (d) of the Constitution of Kenya, 2010 (right to privacy). However, the awareness of these laws among consumers is still low. In many cases of financial fraud women are the most likely to be victims where they voluntarily give personal data without knowledge of where the data will be used, and privacy agreements set out. Moreover, women fall behind in digital literacy and knowledge, especially those living in marginalized areas like rural settings (Wechsler and Siwakoti, 2022). In fact, quantitative results reveal that women feature more in the lower levels of education than men. Kenya The ODPC should sensitize people on its mandate and conduct countrywide education drives on the importance of data privacy and protection. Such efforts can catalyse curbing the gender gap in DFS inclusivity as more women will be encouraged to use digital financial services.

There is commitment by the regulators such as Communications Authority of Kenya, and the Ministry of Information, communication and Technology (ICT) Innovation and Youth Affairs to enhance the digital infrastructure in Kenya.

The government through the Ministry of ICT Innovations and Youth Affairs recently rolled out the Kenya National Digital Masterplan that gives guidelines on how the digital infrastructure in Kenya is set to be improved. Imbalance in infrastructure development between urban and rural areas is still evident and a big factor in

contributing to exclusion of women in digital financial services. The ICT policy guidelines of 2020, show that there is a commitment to connect up to 66 million Kenyans to the Internet by 2030. The GSMA report on mobile gender gap carried out in 2019 showed that women were 39% less likely to have access to Internet compared to men (GSMA 2019). This is in line with the quantitative results from this current study that show that there is a gender difference in telephone ownership in favour of men. The ICT policy commits to inclusivity in ICT environment by ensuring gender equality and accessibility by persons with disability. However, the policy does not specifically elaborate how gender equality will be achieved to ensure inclusivity. Therefore, such a commitment may just remain on paper rather than being implemented fully.

Digital financial services and products are gender neutral

Digital financial services providers revealed that there are no specific considerations on gender when designing products. This means that they do not consider gender biases that arise due to socially constructed notions, beliefs and cultural norms that contribute to exclusion of women in DFS. For example, where women are not part of the decision-making process in the household, they may not be involved in making decisions about money (Manta, 2019). This means that they do not have the financial freedom to enable them access DFS. Therefore, bringing products that are specifically tailored to attract women may boost inclusivity of women where such cultural norms exist. Presently, there are efforts by some financial institutions who now have services tailored specifically for women. These efforts may help to reduce gender gap between men and women in DFS.

Government investing in DFS by providing digital credit that attracts low interest rates compared to other digital credit providers will encourage uptake of DFS.

In November 2022 the government launched the first phase of the financial inclusion fund, a digital financial fund that lends to the people of Kenya at low interest rate, with no collateral. The fund also does not list defaulters in the credit reference bureau. For these reasons the fund is attractive and easily accessible to all Kenyans. These efforts by the government will ensure more people are included in the DFS, especially DFS credit. From, the quantitative results DFS_Credit ranks lowest in terms of uptake; therefore, such efforts will boost accessibility and uptake, especially by groups in low-income brackets, low levels of education and those living in rural areas.

DFS providers have innovative products and policies that are designed to attract low-income earners in the community hence encouraging DFS uptake, especially in rural areas and by women.

DFS providers have introduced innovative products and options that cater for the needs of people in low-income groups. Such products include access to mobile telephones by paying on credit referred to as lipa mdogo mdogo introduced by Safaricom and use of Bonga points to pay for mobile telephones. Such products encourage more people to have access to telephones, increasing the uptake of DFS.

The policy on universal education for all is a step to boost literacy levels in Kenya that will in turn boost the uptake of DFS.

In 2003 the Government of Kenya introduced the free primary education programme with the aim of providing more opportunities to the disadvantaged school age children (Otach 2008). Kenya's access to basic education is a human right entrenched in the 2010 Constitution. However, over the years the government has struggled to make this a reality since some children still miss school and drop out due to different factors. This is pronounced in marginalized areas, arid and semi-arid areas of the country where parents prefer to educate male children over female children. Educational participation in terms of access, retention and progression of children, especially girls from one level of education to another in arid and semi-arid areas continues to be extremely low compared to sedentary regions (Ruto, Ongweny and Mugo, 2008). If access to education is fully achieved this would improve literacy levels in the country to a great extent. Education mainly influences the uptake of DFS as revealed by the quantitative results. Therefore, the implementation of universal education fully will encourage uptake of DFS.

Innovation and Technology

Development in technology and innovation has become an integral part of the modern financial system, which has led to changes in the financial system niche, proving it possible to strengthen the relationship between the financial management tools and man. Financial technology and innovation of various forms enhance the efficiency of financial intermediation, provide new choices of financial products and services, facilitate trade and consumption and enhance financial inclusion with positive outcomes on growth which has become an integral part of financial deepening in Kenya (Misati et al., 2022).

The current changes in the financial system have been proliferated by the rapid innovations and technological advancements that have resulted in new financial products, multiple delivery channels, adoption of new business models and development of DFS. The utilization of DFS has had several benefits such as the increase in efficiency in financial service delivery, enhanced speed, transparency, security and availability of tailored financial services that serve all categories of consumers. Some of the examples of technologically enabled financial innovations in Kenya include branchless banking, electronic payment systems, Internet banking and mobile banking. These innovations have also redefined the delivery of services as financial institutions strive to enhance access to customers as well as differentiate their products and services. Banks in Kenya have thus continuously leveraged on digital financial platforms to manage micro-accounts, build up deposits and extend financial services to the previously unbanked and underserved population. For example, banks have introduced new products that are pegged on digital payments as such is the adoption of Fuliza, a digital overdraft facility offered by banks through Safaricom mobile money operator (KNBS, 2021). The overdraft facility enables Safaricom customers, mostly at the retail end, to make payments, receive money,

pay bills and buy goods and services from their telephones.

With such it is noted that the extent to which advancements in innovation and technology can positively impact the digital financial services niche is tremendous, and with Internet usage, everything around us has been in continuous change. Whether it is a business process, a financial transaction, money management, currency exchange, search for financial institutions and lenders, using credit cards, inquiring about a loan or getting a home equity loan, it has been directly and tremendously affected by the Internet and its technologies.

Regulation of digital credit lenders/ providers by the Kenyan government through the Central Bank of Kenya

All digital credit providers (DCP) should be regulated by the Central Bank of Kenya (CBK) as per the CBK Act of 2022. The regulations provide for the licensing and oversight of previously unregulated DCPs. The regulations seek to address concerns raised by the public given the recent significant growth of digital lending particularly through mobile telephones. These concerns relate to the predatory practices of the previously unregulated DCPs, and in particular, their high cost, unethical debt collection practices and the abuse of personal information. The regulations provide for inter alia the licensing, governance and lending practices of DCPs. They also provide for consumer protection and credit information sharing and outline the Anti-Money Laundering and Combating the Financing of Terrorism (AML/CFT) obligations of DCPs. From the KIIs it was noted that these regulations will encourage gender inclusion in DFS since many borrowers particularly women will be protected by these regulations.

Levies charged on mobile money transfers and digital credit services

Digital platforms for money transfer and lending play an important role in including the poorest populations in digital financial services. In addition, digital platforms are the biggest enablers to accessing finances in the most marginalized areas. In many rural areas it is common to find residents without bank accounts, but they have mobile money accounts for saving, accessing credit and generally carrying out other transactions. However, the levies charged on such services are incurred by the consumer, making the services expensive. This threatens financial inclusion, especially for marginalized groups and communities. During the Covid-19 pandemic, the Government of Kenya suspended all charges relating to transactions between bank accounts and mobile money wallets. These led generally to an increase in uptake of DFS. These charges have since been reintroduced though significantly reduced from those initially charged before the pandemic. According to Ndung'u (2017), excise taxes follow a laffer curve, whereby once the optimal point is surpassed then it becomes a distortion. Contrary to traditional belief that this does not change consumer behaviour it actually distorts it. Therefore, such levies lead to exit of consumers, resulting in financial exclusion. From the KIIs it was noted policies around these charges should be designed to determine the effect of such charges on consumer behaviour.

Conclusion and policy implications

Kenya continues to lead in provision of digital financial services in Africa with the biggest use being mobile money services. This has attracted more investment in fintech and challenged banks to innovate, resulting in the industry digitizing its services. The gender gap in digital financial inclusivity has reduced over the years, and now stands at 4% based on the FinAccess survey of 2021 (KNBS, 2021). In order to fully realize digital financial inclusivity and close the gender gap, DFS providers in collaboration with regulators need to address the issues that contribute to this gap. This study found that socio-economic factors are significant in bringing about the gender gap in digital financial services inclusivity.

Logit regression model and multivariate probit model were used to identify socio-economic factors contributing to the gender gap in uptake of DFS. Most of the variables in the empirical model were significant. The residence variable was positively significant for DFS_Savings indicator and negatively significant for DFS_Credit indicator. This implied that those living in rural areas were less likely to be included in DFS_Credit but more likely to be in DFS_Savings. The gender variable was negatively significant to DFS_Credit, showing that female respondents were more likely to be excluded from access to DFS_Credit. Marital status was positively significant across all the DFS indicators. Interestingly, respondents who were divorced were more likely to be included in the DFS_Credit and DFS_Account. The education variable was positively significant across all levels of education and all DFS indicators. This showed that the higher the level of education the more likely one was to be included in DFS. Further, we established that respondents in lower income levels were more likely to be included in the DFS_Credit. Telephones and identification documents were positively significant across all DFS indicators, showing that possession of these would likely lead to one being included more in DFS. The Fairlie decomposition technique was used to decompose the gender gap in the use of DFS, including the contributions of the various variables across the DFS indicators. The level of education was the major consistent factor that brought about the gender differences in DFS inclusivity, with its contribution at an average of 16% across all the digital financial services indicators considered in this study. Telephone ownership ranked high in the explained differences in DFS_Savings and DFS_Account.

A qualitative approach using KIIs sought to evaluate the policy landscape in order to establish how policies contributed to gender gap in DFS inclusivity. Thematic areas revealed that indeed there are gaps in policy that contribute to gender differences in DFS, thereby affecting gender inclusivity. The main themes that emerged were gender neutral policies that do not consider gender issues and the commitment by the government to intentionally grow the digital infrastructure in order to increase inclusivity. The DFS providers also had many innovative policies that encourage participation of low-income earners and women, encouraging DFS uptake.

Based on these findings several policy implications and recommendations can be drawn. First, strengthening the regulatory frameworks governing DFS will improve the uptake of DFS across all gender groups in Kenya. The regulations should be clear and supportive enough to promote innovation, protect consumers and foster a competitive environment. Regulators should work with various DFS providers to develop appropriate guidelines and standards that address issues related to customer protection, disclosure, comparative disclosure, data privacy and interoperability among various DFS platforms and providers. Regulators should fully implement existing regulations. The Central Bank of Kenya should move to fully licence and regulate all digital credit lenders (DCPs) in the country. The Office of Data Protection Commissioner (ODPC) should increase sensitization and awareness efforts on data protection. These regulations will encourage gender inclusion in DFS since many borrowers, particularly women, will be protected by these regulations.

Second, the consumer led approach to designing DFS products and policies should be adopted. The introduction of a government DFS credit lending platform, the "hustler fund" needs continuous review of policy framework based on consumer insights on use. This approach should be adopted by other DFS providers. DFS providers should develop products tailored specifically for women since this will attract women and may boost more inclusivity of women where such cultural norms exist.

Third, it is important to address infrastructure gaps and promote affordable connectivity in Kenya as a whole. To fully utilize DFS, one requires access to reliable and affordable Internet connectivity. The stakeholders in DSF should prioritize investing in expansion of Internet coverage, particularly in rural and underserved areas in Kenya. Furthermore, efforts should be geared towards promotion of affordable data plans and mobile devices such as feature phones which have long-lasting batteries. This will ensure that individuals can afford to access and use many DFS.

Finally, education plays an important role in encouraging uptake of and bridging the gender gap in DFS. The government through the universal education policy should ensure that all citizens acquire basic education, which includes digital skills. People from under-developed areas may lack the knowledge and skills to effectively use DFS platforms. The stakeholders should provide training programmes on digital skills and mobile technology usage. This will enable people to confidently navigate and utilize DFS platforms. Stakeholders should invest in comprehensive financial literacy programmes to educate the general public on the benefits, risks and operations of DFS. By improving financial literacy and digital skills, individuals can make informed decisions, mitigate risks and fully access the benefits of DFS. This will boost growth of the digital economy that includes the DFS ecosystem.

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Appendices

Appendix A: Determinants of DFS inclusion in Kenya: Logic model coefficients

Variables	DFS_Savings	DFS_Credit	DFS_Accounts	DFS_Others
	Coefficients	Coefficients	Coefficients	Coefficients
Residence, Rural	0.100**	-0.2956***	0.0202	-0.1203**
	(0.042)	(0.0419)	(0.0713)	(0.0480)
Gender, Female	-0.058	-0.2836***	-0.1366**	-0.1322***
	(0.039)	(0.0394)	(0.0640)	(0.0449)
Age	0.019***	0.0856***	0.0794***	0.0055
	(0.007)	(0.0096)	(0.0098)	(0.0079)
Age2	-0.000***	-0.0012***	-0.0008***	0.0001*
	(0.000)	(0.0001)	(0.0001)	(0.0001)
Marital Status, Married	0.071	0.1036**	0.5629***	0.1837***
	(0.053)	(0.0518)	(0.0848)	(0.0595)
Marital Status, Divorced	-0.029	0.1707**	0.3117**	0.0083
	(0.080)	(0.0807)	(0.1267)	(0.0956)
Marital Status, Widowed	-0.266***	0.2269**	0.4237***	0.1865*
	(0.082)	(0.0957)	(0.1300)	(0.1006)
Education, Primary Education	0.477***	1.0819***	0.6150***	0.6649***
	(0.056)	(0.0928)	(0.0822)	(0.0939)
Education, Secondary Education	0.660***	1.3810***	0.9842***	1.0830***
	(0.066)	(0.0970)	(0.1046)	(0.0993)
Education, Technical Education	0.715***	1.5002***	1.4591***	1.4504***
	(0.095)	(0.1122)	(0.1860)	(0.1154)
Education, University Education	0.575***	1.4566***	1.9282***	2.0096***
	(0.114)	(0.1242)	(0.2804)	(0.1307)

continued next page

Appendix A Continued

Variables	DFS_Savings	DFS_Credit	DFS_Accounts	DFS_Others
	Coefficients	Coefficients	Coefficients	Coefficients
Income, Low Income	0.061	0.1238*	-0.3857*	-0.7245***
	(0.083)	(0.0747)	(0.2046)	(0.0819)
Occupation, Farming	0.247***	0.0480	-0.1001	0.0659
	(0.058)	(0.0702)	(0.0883)	(0.0758)
Occupation, Salaried	0.271***	0.1052	0.4872***	1.0573***
	(0.077)	(0.0740)	(0.1454)	(0.0795)
Occupation, Casual	0.087	0.1304**	0.1938**	0.0254
	(0.055)	(0.0622)	(0.0848)	(0.0706)
Occupation, Business & Investment	0.611***	0.3348***	0.5624***	0.4494***
	(0.065)	(0.0663)	(0.1086)	(0.0725)
Occupation, Retired	-0.086	0.4872**	0.9602**	1.1394***
	(0.207)	(0.2387)	(0.4569)	(0.2167)
Internet Frequency, Daily	0.589***	0.6392***	-0.0082	1.2250***
	(0.061)	(0.0538)	(0.1089)	(0.0597)
Internet Frequency, Weekly	0.370***	0.5007***	-0.2140*	0.7832***
	(0.070)	(0.0656)	(0.1213)	(0.0726)
Internet Frequency, Monthly	0.556***	0.7170***	-0.4841*	0.4053**
	(0.163)	(0.1503)	(0.2526)	(0.1750)
Internet Frequency, Less often	0.596***	0.5914***	0.4464***	0.6454***
	(0.088)	(0.0776)	(0.1614)	(0.0897)
Documents, Passport, ID &Alien ID	1.581***	1.4395***	3.0228***	2.0536***
	(0.091)	(0.1346)	(0.1039)	(0.2249)
Phone, Own	2.590***	2.0858***	3.8818***	1.0699***
	(0.066)	(0.1235)	(0.0677)	(0.1076)
Disability, Yes	-0.134**	-0.0943	0.0259	0.1126
	(0.058)	(0.0676)	(0.0901)	(0.0688)
Financial Literacy, Literate	-0.244***	-0.0139	0.0494	0.2501***
	(0.042)	(0.0416)	(0.0708)	(0.0477)
Region, Central	-0.172	0.0981	-0.9360***	-0.7231***
	(0.141)	(0.1166)	(0.3072)	(0.1282)
Region, Coast	-0.658***	0.2785**	-0.7628**	-0.7229***
	(0.138)	(0.1147)	(0.3055)	(0.1284)
Region, Eastern	-0.855***	-0.0112	-0.6673**	-1.0599***
	(0.134)	(0.1113)	(0.3012)	(0.1245)
Region, North Eastern	-1.340***	-1.8744***	-0.5608*	-2.2503***
	(0.151)	(0.2086)	(0.3200)	(0.2025)

Appendix A Continued

Variables	DFS_Savings	DFS_Credit	DFS_Accounts	DFS_Others
	Coefficients	Coefficients	Coefficients	Coefficients
Region, Nyanza	0.050	0.3670***	-0.7349**	-0.5980***
	(0.138)	(0.1121)	(0.3026)	(0.1245)
Region, Rift Valley	-0.522***	0.1691	-1.0974***	-1.0095***
	(0.132)	(0.1073)	(0.2971)	(0.1200)
Region, Western	0.196	0.7263***	-0.6883**	-0.6594***
	(0.146)	(0.1194)	(0.3105)	(0.1328)
Observations	18,671	18,671	18,671	18,671
Pseudo R2	0.2269	0.1928	0.5116	0.2573
Log Likelihood	-9637.8549	-8805.8639	-4441.609	-7350.382

Notes: Standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1

Appendix B: Determinants of DFS inclusion in Kenya: Multivariate probit model coefficients

Variables	DFS_Savings	DFS_Credit	DFS_Accounts	DFS_Others
	Coefficients	Coefficients	Coefficients	Coefficients
Residence, Rural	0.0575**	-0.1796***	0.0183	-0.0657**
	(0.0249)	(0.0250)	(0.0348)	(0.0272)
Gender, Female	-0.0297	-0.1604***	-0.0786**	-0.0688***
	(0.0228)	(0.0235)	(0.0315)	(0.0253)
Age	0.0089**	0.0409***	0.0396***	0.0031
	(0.0040)	(0.0053)	(0.0049)	(0.0043)
Age^2	-0.0001***	-0.0006***	-0.0004***	0.0001*
	(0.0000)	(0.0001)	(0.0000)	(0.0000)
Marital Status, Married	0.0451	0.0818***	0.2486***	0.1181***
	(0.0309)	(0.0310)	(0.0417)	(0.0337)
Marital Status, Divorced	-0.0057	0.1150**	0.1625**	0.0080
	(0.0470)	(0.0480)	(0.0635)	(0.0532)
Marital Status, Widowed	-0.1555***	0.1453***	0.1995***	0.1208**
	(0.0486)	(0.0551)	(0.0653)	(0.0555)
Education, Primary Education	0.2876***	0.5749***	0.3178***	0.3430***
	(0.0339)	(0.0479)	(0.0421)	(0.0477)
Education, Secondary Education	0.3954***	0.7546***	0.4958***	0.5809***
	(0.0394)	(0.0510)	(0.0522)	(0.0515)
Education, Technical Education	0.4320***	0.8397***	0.6956***	0.8188***
	(0.0557)	(0.0616)	(0.0848)	(0.0623)
Education, University Education	0.3555***	0.8062***	0.8578***	1.1370***
	(0.0663)	(0.0696)	(0.1187)	(0.0717)

Appendix B Continued

Variables	DFS_Savings	DFS_Credit	DFS_Accounts	DFS_Others
	Coefficients	Coefficients	Coefficients	Coefficients
Income, Low Income	0.0322	0.0763*	-0.1417	-0.4193***
	(0.0481)	(0.0450)	(0.0896)	(0.0475)
Occupation, Farming	0.1565***	0.0239	-0.0457	0.0221
	(0.0346)	(0.0405)	(0.0445)	(0.0416)
Occupation, Salaried	0.1589***	0.0737*	0.2122***	0.6212***
	(0.0444)	(0.0441)	(0.0683)	(0.0458)
Occupation, Casual	0.0634*	0.0847**	0.0883**	0.0109
	(0.0327)	(0.0363)	(0.0427)	(0.0391)
Occupation, Business & Investment	0.3571***	0.2053***	0.2680***	0.2515***
	(0.0377)	(0.0391)	(0.0533)	(0.0409)
Occupation, Retired	-0.0278	0.2138	0.3980*	0.6474***
	(0.1235)	(0.1367)	(0.2209)	(0.1248)
Internet Frequency, Daily	0.3354***	0.3877***	0.0145	0.7196***
	(0.0352)	(0.0327)	(0.0523)	(0.0345)
Internet Frequency, Weekly	0.2216***	0.2985***	-0.0960*	0.4461***
	(0.0412)	(0.0397)	(0.0580)	(0.0421)
Internet Frequency, Monthly	0.3178***	0.4443***	-0.2645**	0.2512**
	(0.0936)	(0.0903)	(0.1189)	(0.0999)
Internet Frequency, Less often	0.3485***	0.3539***	0.1895**	0.3575***
	(0.0501)	(0.0470)	(0.0762)	(0.0514)
Documents, Passport, ID & Alien ID	0.9021***	0.7660***	1.6266***	0.9945***
	(0.0522)	(0.0694)	(0.0566)	(0.1012)
Phone, Own	1.5669***	1.1330***	2.2058***	0.5359***
	(0.0367)	(0.0589)	(0.0359)	(0.0513)
Disability, Yes	-0.0683**	-0.0564	-0.0053	0.0628
	(0.0340)	(0.0390)	(0.0454)	(0.0383)
Financial Literacy, Literate	-0.1391***	-0.0059	0.0030	0.1454***
	(0.0248)	(0.0247)	(0.0349)	(0.0269)
Region, Central	-0.0877	0.0549	-0.4644***	-0.4198***
	(0.0785)	(0.0706)	(0.1396)	(0.0742)
Region, Coast	-0.3667***	0.1526**	-0.3249**	-0.4391***
	(0.0773)	(0.0696)	(0.1395)	(0.0746)
Region, Eastern	-0.4812***	-0.0060	-0.3201**	-0.6106***
	(0.0749)	(0.0675)	(0.1369)	(0.0720)
Region, North Eastern	-0.7801***	-0.9940***	-0.2394	-1.2397***
	(0.0856)	(0.1072)	(0.1466)	(0.1084)

Appendix B Continued

Variables	DFS_Savings	DFS_Credit	DFS_Accounts	DFS_Others
	Coefficients	Coefficients	Coefficients	Coefficients
Region, Nyanza	0.0447	0.1983***	-0.2949**	-0.3693***
	(0.0767)	(0.0681)	(0.1381)	(0.0723)
Region, Rift Valley	-0.2923***	0.0906	-0.5265***	-0.5795***
	(0.0736)	(0.0653)	(0.1348)	(0.0696)
Region, Western	0.1254	0.4240***	-0.2503*	-0.3875***
	(0.0813)	(0.0723)	(0.1432)	(0.0769)
Observations	18,671			
Wald chi^2	13550.02			
Log likelihood	-29341.512			
Correlation matrix	$\begin{bmatrix} 1 & .2230 & .5035 & .2356 \\ .2230 & 1 & .2986 & .2705 \\ .5035 & .2986 & 1 & .2327 \\ .2356 & .2756 & .2327 & 1 \end{bmatrix}$			

Notes: Standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1
Likelihood ratio test of correlation coefficients $\rho_{12} = \rho_{13} = \rho_{14} = \rho_{23} = \rho_{24} = \rho_{34} = 0$:
chi^2= 1811.48 prob > chi2 = 0.0000

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