# Bank Competition, Digital Finance, and Gender Differences in Financial Inclusion in East Africa

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# Bank Competition, Digital Finance, and Gender Differences in Financial Inclusion in East Africa[1]

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# Abstract

Competition in the banking sector is a catalyst for innovation and the adoption of digital channels to provide financial services. The low cost of providing financial services through digital channels has been leveraged on by banks to extend services to the underserved and the excluded. This paper deploys panel regressions and binary response models to analyse the impact of competition in the banking sector on penetration and utilization of digital financial services across gender in Kenya, Uganda, and Tanzania, controlling for competition in the telecommunications sector. The latest wave of Finscope Survey (2017) and financial inclusion household survey (FinAccess, 2021) datasets are used. The analysis shows that males have a higher probability of using digital financial services than females. Females in rural areas, engaged in the agriculture, services, trade and casual labour are less likely to use digital financial services compared to their male counterparts. Competition in the banking industry increases utilization of digital financial services due to banks leveraging on innovation to provide relevant services at low cost. Therefore, a policy approach that considers gender differences and fosters competition in banking and mobile telecommunication industries will encourage providers of financial services providers to effectively leverage on mobile money and digital finance to close gender gaps in the utilization of digital financial services in the EAC region.


**Keywords:** *Bank Competition, Digitalisation, Financial Inclusion, Gender Differences*

# 1. Introduction

Competition in the provision of digital financial services in the financial sector is growing. This is not only in the banking sector, but also between banks and non-bank financial service providers. For instance, banks in the East African region have leveraged on digital financial services to innovatively and cost efficiently provide services, thus supporting their profitability and growth. At the same time, non-bank financial service providers have intensified innovation to provide services that were hitherto dominated by banks.

Competition in the financial sector encourages digitization and innovative delivery at a lower cost, which enhances financial inclusion (Jungo et al., 2022). This augments the digital financial services' unique ability to reach the previously underserved and the excluded (Casolaro et al., 2007 and Scott et al., 2017). The gains in financial inclusion that leverage on innovation and digitization have been underpinned by favourable technological infrastructure, and a vibrant and competitive telecommunication industry in the region.

Notwithstanding the increase in penetration of digital financial services, there are regional and gender differences in access and use of digital financial products. For instance, whereas financial inclusion in Kenya increased from 66.7% in 2013 to 83.7% in 2021, financial exclusion among females declined from 26.5% to 12.4%, while the proportion of excluded males declined from 24.1% to 10.8%. With respect to access to digital financial services, evidence shows that there exists a gender gap, with 42.4% of females and 57.6% of males having access to digital financial services in the country (AFI, 2020).

In Uganda, while 52% and 10% of the population have access to mobile phones and Internet services, respectively, gender[2] and rural-urban gaps in access to mobile devices and Internet[3] exacerbate inequality in access to digital financial services (FSD-Uganda, 2018). Whereas 78% of the total adult population are financially included, there are relatively narrower gender differences in the proportions that are financially excluded, with 22% of males and 23% of females remaining financially excluded (FSD-Uganda, 2018).

In Tanzania, the proportion of adult population that is financially included[4] rose to 65% in 2017 from 58% in 2013. However, 26% of males and 30% of females in the country remain financially excluded, mainly attributed to lack of mobile devices and access to network and Internet services. About 37% of adults that do not own mobile phones are financially excluded. From the foregoing, there are divergencies in financial inclusion across the three countries, which are accentuated by gender differences, highlighting the need to analyze the impact of competition in the banking and telecommunication sectors on digitization and gender gap in utilization of financial services in Kenya, Uganda, and Tanzania.

Theoretical literature on the impact of competition in the banking industry on access to financial services is inconclusive. Gruber and Verboven (2001) argue that competition reduces profits that would be used to upgrade infrastructure, innovate, and thus support the provision of digital financial services. Additionally, Liu (2021) finds that competition can compel banks to digitize processes and provide financial services that cannot be used by some segments of the population. Therefore, digitization of process and financial products not only increases financial exclusion but also widens the existing gaps in access to financial services. In addition, competition-driven digitization of financial services compels banks to reduce physical branches and traditional banking services – that are deemed expensive to offer. The lack of physical banks may exclude some segments of the population that are unable to adopt digital services (Scott et al., 2017). However, competition provides incentives for banks to innovate and adopt financial technologies that are used to provide digital financial services to the previously unserved or underserved and close gender and regional gaps in access and use of banking services (Weber et al., 2011, Gruber and Verboven, 2001; Van der Boor et al., 2014; Demirgüç-Kunt and Klapper, 2013; Tiwari et al., 2007; and Yao and Song, 2021).

A decline in competition in the banking sector increases profits, which are used to upgrade infrastructure and adopt innovations that reduce the cost of providing financial services. The decline in the cost increases uptake of financial services, especially by women, which contributes to narrowing of gender gaps (Conway et al., 2007; Frame and Lawrence, 2006; and Jungo et al., 2022). Furthermore, a less competitive banking sector can incur sunk costs to change systems and adopt financial innovations, which enables banks to identify potential borrowers and estimate their credit risk more accurately (Beck, 2022; Yao and Liangrong. 2021). This increases uptake of financial services, thereby narrowing the access gap across gender.

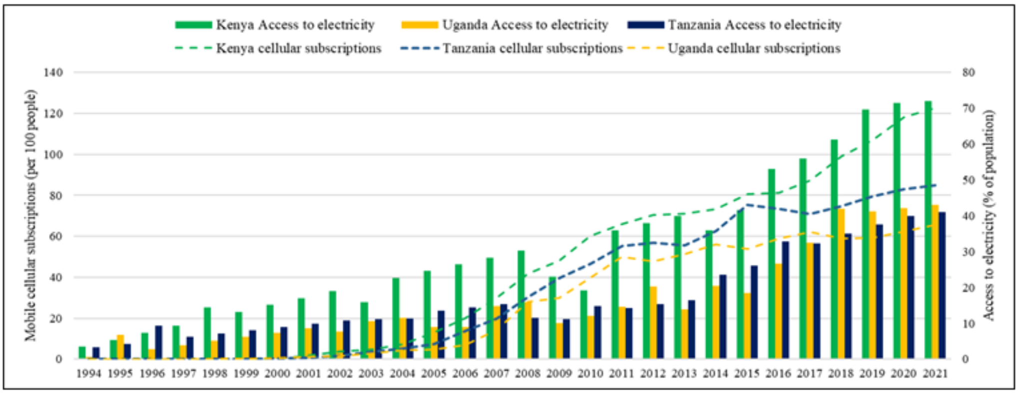
This paper investigates two key aspects. First, we analyze the effect of banking sector competition on access to and use of digital financial services in the three countries of the EAC region, i.e., Kenya, Uganda, and Tanzania. Second, the paper analyses gender differences in the use of digital financial services. The pursuit of these two objectives is premised on the argument that competition affects gendered financial inclusion through the attendant innovations that spring out of competition, as observed by (Beck, 2020; Yao and Liangrong 2021). The choice of the EAC countries is motivated by the liberalized banking and telecommunication sectors that anchor the banking sector innovations and the presence of regulations that encourage competition and innovation. These countries have a vibrant and innovative mobile money industry, which underpins rapid increase in financial inclusion. The study utilizes the latest wave of Finscope (2017) and FinAccess (2021) household financial inclusion survey datasets.

The remainder of this paper is structured as follows: section 2 provides a background on the penetration of digital financial services, reviews competition in the financial sector, and gender gaps in financial inclusion in Kenya, Uganda, and Tanzania; section 3 reviews relevant literature on the impact of competition on digital financial services and gender differences using digital financial services; section 4 details the empirical model, while section 5 presents the results and section 6 concludes.

# 2. Penetration of digital financial services, competition in the financial sector, and gender gap in financial inclusion

In Sub-Saharan Africa, investment in production and distribution of electricity, liberalization mobile telephone industry, and increase in the availability of cellphones has increased mobile and Internet network coverage and utilization. The increase in access to cellphones, Internet and mobile network has been leveraged on by providers of financial services providers through mobile payment services (Figure 1).

**Figure 1: Penetration of mobile phone and access to Internet**

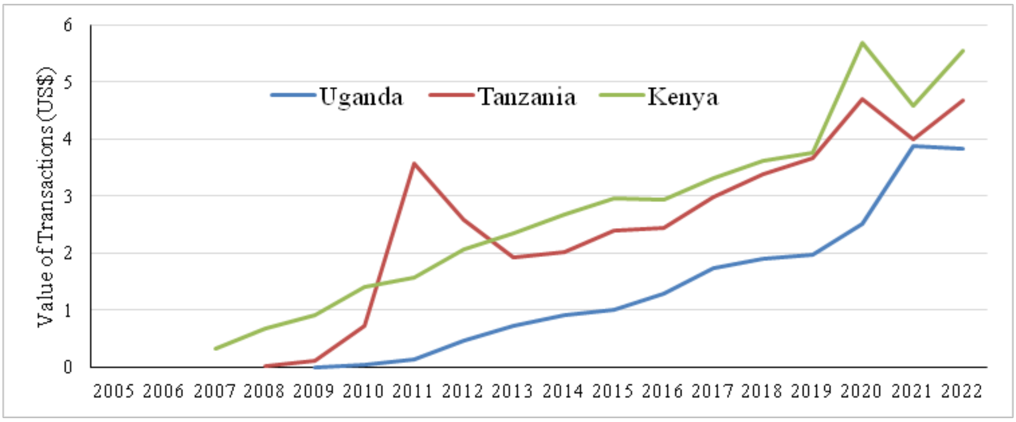



Source: Global System for Mobile Communications Association - GSMA and World Bank, World Development indicators

Telecommunications-enabled adoption of mobile money has been leveraged in the region to support payments of insurance premiums and settlement of compensations, money transfers, mobilization of savings, and payments for goods and services. As at end of 2022, the number of individuals, households and firms with registered mobile money accounts was 200 million in the EAC region. However, penetration of mobile money in some countries is less than 5% of the adult population, with women having lower access to mobile phones and mobile money (GSMA, 2022). Nevertheless, mobile money transactions increased steadily from US$ 1.0 billion in Uganda, US$ 2.4 billion in Tanzania and US$ 3.0 billion in Kenya in 2015 to US$ 3.8 billion, US$ 4.7 billion, and US$ 5.5 billion in 2022, respectively (Figure 2), whose value as a proportion of Gross Domestic Product (GDP) represented 12.6% in Kenya, 12.1% in Tanzania and 9.6% in Uganda.

The increase in the adoption and use of mobile money services, and banks leveraging on the same to offer mobile banking services, has resulted in the latter appearing to substitute the traditional banking services. In Kenya, for instance, whereas utilization of traditional bank services increased by 20.5% between 2009 and 2019, mobile banking services increased by 51.5% over the same period. The use of mobile-based transactional bank accounts in Kenya also increased to 15.1 million accounts as of 2016 compared to 8.1 million who are using traditional accounts.

**Figure 2: Mobile money transaction (US$ billions)**




The usage of mobile banking accounts in Kenya by adults rose steadily to 34.4% in 2021 from 25.3% in 2019, while those who used physical bank branches declined from 29.6% to 23.8% over the same period. Substitution is more evident in urban areas compared to rural areas. In fact, it is estimated that the number of customers using traditional bank services declined by 1.2% in rural areas and 4.8% in urban areas between 2016 and 2021 as customers switched to mobile banking platforms (Central Bank of Kenya, Kenya National Bureau of Statistics, Financial Sector Deepening-Kenya (CBK, KNBS, FSD-K)., 2021). In Uganda and Tanzania, 20% and 33%, respectively, use mobile banking (Bank of Uganda, 2022; Bank of Tanzania, 2022).

This increase in utilization of mobile banking services is due to integration of mobile money services with banking services due to the lower cost and convenience that mobile banking affords to customers. Consequently, all banks in the EAC as at the end of 2021 had mobile money paybill numbers, while 95% of banks provide Internet and mobile banking services. In addition, about 60% of banks have mobile applications that enable customers to undertake transactions (Bank of Uganda, 2022; Central Bank of Kenya, 2022; and Bank of Tanzania, 2022).[5] The integration of mobile money with banking services is one of the noble innovations in the banking sector, which has improved efficiency and profitability, while expanding access and utilization of financial services, particularly among women (Ndung'u, 2021).

For Kenya, the introduction of mobile banking reversed the gender gap in favour of females, with the number of females with mobile banking accounts exceeding males by 22% in 2022. However, traditional bank accounts for male account holders surpassed female account holders by 18% in 2016 (AFI, 2020). Similarly in Tanzania and Uganda, mobile money and mobile banking dominate traditional bank services. According to Bank of Uganda - BoU (2022), the Central Bank of Kenya - CBK (2022) and Bank of Tanzania - BoT (2022), for instance, preference for digital channels such as Internet banking, mobile banking and mobile money have resulted in a decline in the number of bank branches, automated teller machines (ATMs) and ATM cards.

The increase in adoption of mobile money and mobile banking in the EAC region has partly been supported by favourable government policies. For instance, in Kenya and Uganda, some of the favourable policies deployed in 2020 include waivers of charges on small-value mobile money transactions (mostly below US$ 10) and increase of mobile money wallet limits from about US$ 1,400 to US$ 2,900 in Uganda, Kenya and Tanzania, which increased transfers between mobile money wallets and bank accounts (CBK, 2020; BoU 2020 and BoT 2020).

As a result of these measures, deposits in banks, microfinance banks and savings and credit organizations (SACCOs) registered strong growth of between 4.5% and 5.4% across the three countries. With emergence of mobile banking and the convenience that these products offer to customers, the resultant increase in deposits mobilization over time has also been associated with increased savings mobilization and enhanced access to credit by women (UN Women, 2019). It is in fact estimated that the number of women initiating digital banking payments in Tanzania rose by 11% between 2014 and 2017 (AFI, 2020).

The non-bank financial service providers have also partnered with mobile telecommunication companies to digitize processes and provide financial services in the EAC region. The entry of these telecommunication entities in the financial sector has increased competition by offering payment, savings, credit, and financial advice, which were hitherto dominated by banks. This development has seen the number of digital lenders in the EAC increase rapidly from about 100 in 2018 to about 3,000 by 2021, leading to a growth in the value of digital loans to about 6% of GDP.

The emergence of digital lenders amidst strong growth in the adoption of mobile payment services has transformed the delivery of services in the banking sector. Banks have been able to innovate and digitize their processes, which has reduced operational costs and replaced the need for physical branch network that is relatively more costly to set up and maintain (IFC, 2017; Manyika et al., 2016). The decline in operational cost eases financial market participation constraint to the hitherto financially excluded, due to the high cost of using financial services. Furthermore, as banks collaborate with fintech to provide digital loans and payment services, transactional data is used for credit risk scoring and provision of credit and savings products that are pertinent to financial needs of individuals and firms. The partnership between financial technologies and banks has enabled large and middle-sized banks in Kenya, Uganda, and Tanzania to use the latter’s applications to develop credit scores for borrowers and provide application-based loans

More importantly, women in the credit market have started to benefit more from digitization, since a record of past transactions is used as collateral (usually inaccessible for women in developing countries) to provide credit instead of conventional credit history, assets, and social capital (UN Women, 2019). In fact, digital credit providers use communication and payments data and customer's credit score upon subscribing to digital financial services to provide credit and determine insurance premiums (Cook and McKay, 2015; and Beck, 2020). The relevance, convenience and affordability of mobile money and digital financial services (DFS) also increases utilization of financial services by the poor and women, thereby closing the gender gap in financial inclusion (CBK, Kenya National Bureau of Statistics – KNBS; FSD-Kenya, 2021).

However, the effects of DFS on access to financial services across gender and rural/urban areas remains disproportionate. For instance, in rural areas, between 25% and 30% of men are more likely to take digital loan than women (Gubbins and Totolo, 2018; FSD-Uganda, 2018; and FSD-Tanzania, 2020). Whereas mobile banking adoption increased by 5.7% and 8.9% in rural and urban areas, respectively, gender differences persist, driven mainly by inequality in access to internet-enabled mobile phones. It is estimated that 43% of women compared to 31% of men in Kenya view that their inability to access an Internet-enabled mobile phone was a major barrier to using mobile, Internet and related financial services (UN Women, 2019).

In addition, the intensity of using digital services is low due to high cost of telecommunication and payments services and concentration in the telecommunication sectors in the EAC countries (CA-K, 2022; UCC, 2022). In the EAC, a few large foreign, domestic, and pan-African banks control about 60% to 70% of the banking industry. Despite the high concentration and profitability of the banking sector, the investment in requisite infrastructure to provide digital financial services has not expanded financial inclusion among the poor and women. Market concentration and pricing imperfections have the potential of stifling innovation in the telecommunication sector (Daniel and Rodger, 2012) and by extension the banking sector that leverages on mobile technology to offer its services.

Furthermore, a large proportion of people in marginal areas and the poor have no access to telephone network and Internet services to enable them access and use digital financial services (World Bank, 2019; Imran, 2022). This undermines extensive use of digital financial services that have tremendous impact on bridging the gender and wealth gap.

# 3. Literature

Literature on the relationship between competition in the banking industry and digital finance with extensions to financial inclusion follows two main strands. First, competition in the banking sector can stifle innovation by reducing profits, which are an incentive to: (i) innovate (Schumpeter, 1943; Telser, 1982)  thereby reducing their market share and ability to generate profits (Aghion et al., 2001); (ii) supporting investments in research and development of new products, digitization of services and provision of services in the hitherto underserved and excluded segments of the population (Gruber and Verboven, 2001); and (iii) financing investments in new technologies and infrastructure that enables banks to provide digital services (Scott et al., 2017). All these effects have an implication on financial inclusion, particularly to the disadvantage of women and people in rural areas (Madden et al., 2004; Weber et al., 2011; Lashitew et al., 2019). In addition, an increase in competition compels banks to substitute digital financial services for physical branches. This development may constrain access to financial services by segments of the population that are not digitally savvy.

Bos et al. (2013) posit that the relationship between competition and financial innovation may take an inverted-U shape, so that increasing competition initially drives more innovation but, at one-point, higher competition may slow down innovation. As such, women's precarious financial situation can discourage them from adopting digital innovation, or use inappropriate credit products (Yang and Ching, 2014; GPFI, 2020).

In addition, the relationship between competition and innovation may also be dependent on whether it is a bank or a non-bank digital financial service. Increased competition in the banking sector slows down innovation when compared to non-bank digital lenders (Drasch et al., 2018). Non-bank digital lenders - new market entrants - leveraging on their digital platforms can scale up more rapidly and at lower cost than banks, who are incumbents, due to the latter's high switching cost (Laplante and Watson, 2018). Other studies, such as Beck et al. (2004) show that competition can lead to reduced amounts of credit provided by commercial banks, since efforts to build relationships in a competitive market would not be sustainable because of the free-riding problem. Consequently, there would be a decline in investment in relationship lending (Fraser et al., 2012; Owen and Pereira, 2018).

Conversely, the second strand of literature argues that competition in the banking sector can reduce the cost and increase the availability of financial services (Berger and Hannan, 1998; Carbo-Valverde, Rodriguez-Fernandez and Udell, 2009; Owen and Pereira, 2018). In highly competitive financial markets, banks with low market power are more willing to reduce the cost of digital credit than banks in a concentrated market. However, with the mobile phone access barriers, both male and females disproportionately benefit from the low cost (Alliance for Affordable Internet, 2016; and GSMA, 2018).

More importantly, competition in the financial sector forces financial institutions to collaborate with non-financial firms to leverage on strengths to provide services. In particular, the banking industry in the EAC countries typically comprises of a few firms offering differentiated financial services. To increase/retain market share, banks must innovate and differentiate products and services to build a competitive edge and generate higher profits. With the advent of non-financial firms providing financial services, banks collaborate with the non-financial firms to provide financial services using a model that leverages on the unique capabilities of non-financial firms to deliver services to segments previously unreached, including the marginalized, many of whom are women (GPFI, 2020). The partnerships enable banks to better use fintech innovation to assess borrowers and thus reach them with financial services (Madden et al., 2004; Lashitew et al., 2019).

Empirical literature on the impact of bank competition on digital financial inclusion and gender difference is inconclusive. Competition increases provision of financial services to the excluded (LaPlante and Watson, 2018; Jack et al., 2016), especially among women who traditionally lack documented and secure ownership of assets that can be used as collateral (Fletschner and Kenney, 2014; Deere et al., 2013). Klapper and Dutt (2015) assert that digital platforms can offer alternative forms of collateral for women who do not have access to traditional collateral. These include opportunities for women to build their credit history through digital transactions that enable them access credit from formal financial institutions. As such, digital finance increases financial inclusion, since it bypasses barriers to entry; a feature that explains the emergence and rapid growth of non-bank digital lenders (Scott et al., 2017).

Access and usage of digital finance especially among the rural population in most African countries is also constrained by cultural factors. Ozili (2018) argues that despite concerns of unaffordable fees charged by digital financial services providers and dominant financial illiteracy, potential and some existing digital finance users in indigenous and poor communities - despite persuasion on its benefits - can decline to use digital finance services due to superstitious and religious beliefs about technology advancement and innovation.

Digital finance that facilitates collection of relevant information from households can generate insights into the types of savings products that can incentivize uptake and use of financial services among males and females, including their price sensitivities (to transaction costs) and risk behaviour (Dupas and Robinson, 2013; Dupas et al., 2014). Nonetheless, gender gaps in the uptake of digital finance remain wide, with

200 million fewer women than men in developing countries having access to mobile phones (GSMA, 2015) and those women are 20% less likely to use the Internet on a mobile phone than men. It remains unclear as to whether increased competition in the banking sector and adoption of digital finance would further widen the gender financial inclusion gap in the East African region. In fact, Minischetti (2017) shows that the gap is most pronounced at the pre-registration stage on account of uneven access to mobile phone ownership. This constrains women from fully benefiting from owning a registered mobile money account and the attendant services. In this regard, the linkages between competition, digital finance and gender differences in financial inclusion are inconclusive.

Second, profit seeking tendency of banks compels them not to scale down provision of digital financial services or discriminate some customers to maximize profitability. Other key factors include geographical location bias, whereby banks may change from time to time or choose to withdraw and/or discontinue the provision of specific digital finance services in some regions due to their unreachability in the event of defaults. Other factors such as educational bias also play a role where banks choose to focus less on delivery of digital finance to the less-educated communities that are not literate to use and understand digital finance (Gruber and Verboven, 2001; Scott et al., 2017).

Thus, our contribution in this paper stems from the inconclusive evidence on the passthrough effects of banking sector competition on digital finance penetration and gendered financial inclusion. Therefore, we analyse the role of competition in influencing access and usage of digital financial services and their impact on gender differences in the uptake of these services.

# 4. Methodology

## Empirical model specification

We establish the relationship between using digital finance, gender, and banking sector competition by estimating a binary response model. In the model, individuals choose to use or not use digital financial services depending on a set of individual, socio-economic characteristics, and competition in the banking or mobile network industry. Proximate determinants of using digital financial services depend on the level of financial literacy, age, gender, level of income, level of education and occupation of the main income earner and access to social amenities. The explanatory variables can be broadly categorized as individual characteristics $x_i$, gender $h_i$ and location $c_i$ characteristics. The baseline relationship is specified in equation 1.

$$y_i = \propto + \beta_1 x_i + \beta_2 h_i + \beta_3 c_i + \varepsilon_i \tag{1}$$

Where $y_i$ is the status of using digital financial services, which assumes a value of one for those who use it and zero otherwise. $i$ = 1,..,$n$ represents an individual. The digital financial services are disaggregated into mobile money and mobile banking. We estimate equation 1 at country level to establish the uptake of digital financial services across gender. The impact of competition on uptake of digital financial services is assessed using a panel constructed from survey datasets for Kenya, Uganda, and Tanzania. The survey datasets captured variable of interest in a similar way, which enables the analysis of the impact of competition and gender on the penetration of digital financial services. In this regard, uptake of digital financial services within the panels depends on variations in competition, gender, individual and household characteristics. Therefore, equation 1 is re-specified in the context of panel data analysis in equation 2 as follows:

$$y_{ijt} = \propto + \beta_1 x_{ijt} + \beta_2 h_{ijt} + \beta_3 c_{ijt} + HHI_{ijt} + \varepsilon_{ijt} \tag{2}$$

Where $y_{ijt}$ is the status of using digital financial services, which assumes a value of one for those who use and zero otherwise, where $i$ = 1,..,$n$ represents an individual, $j$ is country and $j$ = 1,2 ,3 for Kenya, Uganda, and Tanzania and $t$ = 0 since it is one time dimension. Competition in the banking sector is measured using the Herfindahl-

Hirschman Index (HHI) for bank assets, captured by $HHI_{ijt}$ in equation 2. The HHI developed from bank assets is a proximate measure of competition in the banking sector. Suffice to note that HHI based on bank deposit can be constructed; however, banks compete on the asset side to maximize profitability. Other factors $x_{ijt}$ capture individual characteristics, $h_{ijt}$ represents gender, $c_{ijt}$ covers location characteristics and $\varepsilon_{ijt}$ is the error term. Equation 2 is estimated assuming unobserved household characteristics are fixed, while country characteristics influencing digital financial services use are random factors.

The analysis acknowledges that the accuracy of parameters estimated from equation 1 and 2 would possibly be undermined by the unobserved characteristics that influence the decision to use or not to use digital financial services. The unobserved characteristics would increase correlation of errors, and potentially lead to generation of biased and inefficient parameter estimates. The bias and inefficiency are accentuated by small time series and large cross sections pursued in the surveys. In addition, the choice of using digital financial services may be influenced by the same unobserved characteristics and may not be mutually exclusive (Train, 2003 and McFadden, 2012;). Recognizing this potential problem, this study considers that the inclusion of individual, household and location characteristics that influence choices mitigates the distortion of the probability of choosing a digital product just because of its existence. In this case, employing random effects model to analyze effects across large cross sections relative to time overcomes the problem of correlation among errors.

In this regard, the study estimates the impact of competition on the use of digital financial services by fitting a binary response model and estimating a random effects panel model.[6] Digital financial services involve person-to-person, person-to-business, business-to-person, and mobile banking transactions entail banking transactions effected through mobile money. Therefore, we check the robustness of the effect of competition on utilization of digital financial services by regressing mobile phone transaction $MBy_{jt}$ on HHI, controlling for access to electricity $Elect_{jt}$, competition in the mobile industry $HHIM_{jt}$, bank size $Bank\ size_{jt}$ and profitability of the banking sector, $ROA_{jt}$. This approach enables the analysis of supply-side constraints in the provision and utilization of digital financial services (Gruber and Verboven 2001; Scott et al., 2017). The estimable fixed effects equation is defined by equation 3 below.

$$MBy_{jt} = \propto + \beta_1 ROA_{jt} + \beta_2 Banksize_{jt} + \beta_3 HHIM_{jt} + HHI_{jt} + Elect_{jt} + \varepsilon_{jt} \quad (3)$$

Where j denotes country (Kenya, Uganda, and Tanzania) and $t = 1,..,T$, represents time covering the period 2007 to 2022. $HHIM_{jt}$ is developed from the number of active mobile phone subscribers, while $HHI_{jt}$ is HHI index of assets, bank size is equity, which is checked by using bank assets and electricity $Elect_{jt}$ for period $t = 1,..,T$, where t is for 2007 to 2022 and country $j$ where $j = 1,2,3$.. The country characteristics that influence utilization of digital financial services are assumed to be fixed, hence partialled out in the fixed effects estimates.

## Data and definition and measurement of variables

The study is based on data collected from household financial inclusion surveys in each of the three countries; that is, Finscope (2017) surveys of Tanzania and Uganda, and FinAccess (2021) survey of Kenya. The additional data on competition and penetration used in the study are obtained from the respective country's national statistical authorities. A list of variables of interest and their operational definitions is outlined in Table 1.

### Table 1: Definition of variables

| **Variable** | **Operational definition** |
|---|---|
| Digital financial services | Binary variable: 1 if an individual uses cellular digital financial services, 0 otherwise |
| Location | Binary variable: 1 if urban, 0 otherwise |
| Household size | Numeric variable: the number of household members |
| Gender | Binary variable: 1 if male, 0 otherwise |
| **Marital Status** | |
| Single | Binary variable: 1 if single, 0 otherwise |
| Divorced/Separated | Binary variable: 1 if divorced/separated, 0 otherwise |
| Widowed | Binary variable: 1 if widowed, 0 otherwise |
| Married | Binary variable: 1 if married, 0 otherwise |
| Other | Binary variable: 1 if other, 0 otherwise |
| Age | Numeric variable: the age of the respondent in years |
| **Education** | |
| No school | Binary variable: 1 if no school, 0 otherwise |
| Primary | Binary variable: 1 if primary, 0 otherwise |
| Secondary | Binary variable: 1 if secondary, 0 otherwise |
| Post Secondary | Binary variable: 1 if post secondary, 0 otherwise |
| **Source of Income** | |
| No income | Binary variable: 1 if no income, 0 otherwise |
| Farming | Binary variable: 1 if farming, 0 otherwise |
| Trading | Binary variable: 1 if trading, 0 otherwise |
| Service | Binary variable: 1 if service, 0 otherwise |
| Casual worker | Binary variable: 1 if casual worker, 0 otherwise |
| Rental income | Binary variable: 1 if rental Income, 0 otherwise |
| Interest income | Binary variable: 1 interest income, 0 otherwise |
| Pension/ Welfare | Binary variable: 1 if pension/ welfare, 0 otherwise |
| Dependant/ Support from family/ Friends | Binary variable: 1 if dependant, 0 otherwise |
| Income | Numeric variable: disclosed income by the respondent |
| HHI | Numeric variable: computed measure of competition using bank assets |
| HHIM | Numeric variable: computed measure of competition in mobile industry / sector using number of active subscribers |

Table 2 shows the descriptive statistics of the variables of interest listed in Table 1. The statistics indicate first that use of DFS increases with the level of education across the three countries. However, there are more pronounced variations across countries, particularly among populations with lower levels of education. Notably, the proportion of respondents with digital financial services is highest in Kenya compared to Uganda and Tanzania. This can be attributed to higher educational attainment and skills in Kenya compared to Uganda and Tanzania, which increases the capability to appreciate and adopt financial innovations (Salam et al., 2019).

Second, there is greater variabilities in the use of DFS among populations relying on different sources of income. For instance, in Kenya relative to Uganda and Tanzania, there is a high population that uses DFS among the salaried, traders, casual labourers, pensioners/those relying on welfare support, and dependants.[7] However, farmers and investors earning interest income use relatively less DFS in Kenya compared to Uganda and Tanzania. In Uganda, farmers and interest income earners are the highest users of DFS, while the salaried, traders, casual labourers and pensioners are the least users when compared to Kenya and Tanzania. The proportions of the population that use DFS in Tanzania across the income source categories lie between those of Kenya and Uganda, except rental income earners. Farmers use DFS services in all countries because they are mostly located in rural areas, which are underserved by non-digital services. In addition, the cost of in-person access to DFS in rural areas, where farmers are concentrated, is higher compared to mobile money and mobile banking. Dependants also use DFS due to larger geographical distance between the sponsor/remitter and the recipients. In addition, it is convenient to send and receive remittances through DFS (Jack and Suri, 2014).

Third, mobile money is used by a larger proportion of the population than mobile banking. This can be attributed to several factors, including the latter's higher cost, difficulties in using mobile banking and unavailability of digital banking services especially in rural areas (Chen et al., 2021). This is corroborated by about 66% to 72% of the respondents in the survey living in rural areas that have limited access to mobile telephone network and Internet, which mobile banking relies on. Rural residents also have lower mobile banking adoption due to lower skills and educational attainment, which impedes the adoption of digital financial services (Salam et al., 2019).

Fourth, disparity in the use of DFS among males and females is smallest in Kenya than in Uganda and Tanzania. This disparity can be attributed to wealth and income inequality, where women are associated with lower incomes because of their limited access to opportunities to develop skills and income generating activities (Yang and Ching, 2014; Salam et al., 2019; Chen et al., 2021). Low levels of income compel women to prioritize basic needs over technology. In addition, adoption of innovation is perceived as risky and hence requires households to self-insure against losses emanating from adoption. However, the poor and women do not have income to self-insure against the risk of adopting digital financial services and, instead, they opt to not use the digital services (Yang and Ching, 2014).

### Table 2: Descriptive statistics

| Variable | | Kenya | Uganda | Tanzania |
|---|---|---|---|---|
| Digital financial services (DFS) | | 78.06 | 53.43 | 56.10 |
| Mobile money | | 77.49 | 53.23 | 55.80 |
| Mobile banking | | 25.03 | 6.12 | 6.20 |
| Residence | Rural residents | 65.64 | 72.45 | 72.38 |
| | Urban residents | 34.36 | 27.55 | 27.62 |
| Rural residents with DFS | | 73.63 | 45.28 | 48.07 |
| Urban residents with DFS | | 86.52 | 75.63 | 77.30 |
| Gender | Male | 42.40 | 35.04 | 43.55 |
| | Female | 57.60 | 64.96 | 56.55 |
| Male with DFS | | 79.76 | 58.56 | 63.83 |
| Female with DFS | | 76.81 | 51.20 | 50.02 |
| Male with mobile banking | | 29.24 | 8.17 | 8.81 |
| Female with mobile banking | | 21.93 | 5.10 | 4.49 |
| Male with mobile money | | 79.36 | 58.37 | 63.32 |
| Female with mobile money | | 76.12 | 50.97 | 50.02 |
| Age | | 38.8 | 35.60 | 38.20 |
| Income (US$) | | 224.39 | 108.51 | 83.83 |
| HHI | | 671.9 | 968.20 | 1750.50 |
| HHIM | | 581.40 | 415.30 | 323.60 |
| Household size | | 2.30 | 5.00 | 4.70 |
| *Education with DFS* | | | | |
| No school | | 62.50 | 25.85 | 25.40 |
| Primary | | 84.15 | 39.74 | 63.05 |
| Secondary | | 90.21 | 77.07 | 83.63 |
| Post-Secondary | | 98.10 | 90.63 | 97.20 |
| *Source of Income and DFS use* | | | | |
| Salary | | 9.35 | 8.55 | 9.06 |
| Farming | | 21.06 | 47.65 | 39.13 |
| Trading | | 14.25 | 4.09 | 11.21 |
| Casual | | 27.60 | 13.32 | 19.60 |
| Rental income | | 0.47 | 1.18 | 0.32 |
| Investment | | 0.07 | 0.50 | 0.09 |
| Pension | | 0.66 | 0.12 | 0.55 |
| Welfare | | 1.39 | 0.12 | 0.26 |
| Dependants | | 25.15 | 24.47 | 14.22 |

Notes: Digital financial services include mobile money, mobile banking, ATM card, Internet banking and application-based credit. HHI and HHIM are the Herfindahl-Hirschman Index developed from bank assets and number of mobile network subscribers, respectively.

Fifth, whereas the banking sector is most concentrated[8] in Tanzania, followed by Uganda then Kenya (least concentrated), the telecommunication industry in Kenya is more concentrated than in Uganda and Tanzania. There is a strong nexus between the structure of mobile telecommunication and digital financial services, since financial service providers (banks) leverage on the telecommunication network to render their digital services. Indeed, the digitization and integration of telecommunication services in the provision of financial services has expanded access to financial services among the financially excluded (Ndung'u, 2021). Mobile money service providers obtain e-float from banks, hence a wider bank network, thus enhances provision of mobile money services, which underpins utilization of other DFS.

However, concentration in the telecommunication and banking industries can reduce incentives to innovate besides supporting a tendency by firms to increase the cost of services. This discourages uptake and utilization of financial services especially among the marginalized and the poor who are often more sensitive to the cost of financial and communication services. On the contrary, it is also possible that telecommunication companies with larger market share are more profitable and able to install telecommunication infrastructure in marginal areas, which enables the residents to access Internet and telephone network. As such, the availability of Internet and telephone networks enables banks to provide services in the marginal areas. Therefore, the need to empirically ascertain the effects of bank concentration and mobile concentration on the use of DFS.

# 5. Results and discussions

## Usage of digital financial services

Table 3 presents the results of 5 models on the utilization of digital financial services. Models 1, 2 and 3 do not account for the impact of competition (proxied using the HHI measures) in the banking sector on utilization of digital financial services. HHI for the banking sector is included in models 4 and 5. The results indicate that the odds of (reflecting the disparity in) utilizing digital financial services are 1.8, 2.4 and 3.1 times higher in urban areas compared to rural areas for Kenya, Tanzania, and Uganda, respectively. The high odds for Uganda can be attributed to greater access to mobile phones, electricity, and awareness of the services (Yang and Ching, 2014; and Salam et al., 2019).

An increase in household size by one member increases the odds of using digital financial services by 0.9 in Kenya and 1.0 in Tanzania and Uganda. An additional household member increases social and physical distance, which encourages ownership of mobile phones due to the need to connect, and by extension utilization of digital financial services. More household members also increase the diversity of financial needs, which can be addressed by using digital financial services. The odds of the married and the widowed of using digital financial services are 4.1 and 2.2 times higher in Kenya, respectively, compared to those who are single, due to the need to connect with other immediate family members and offer support more regularly.

The odds for females using digital financial services are the same as those of males in Kenya, but lower in both Tanzania (0.63 times) and Uganda (0.65). Consequently, the gender gap in using digital financial services is the widest in Tanzania compared to Uganda and Kenya. The lower utilization of digital financial services by females, though varied across the EAC regional countries, has previously been attributed to their lower income and wealth, which is an impediment to accessing digital devices and financial services (Yang and Ching, 2014).

## Table 3: Analysis of usage of digital financial services

| | Kenya | Tanzania | Uganda | EAC | EAC Mobile Banking | EAC Mobile Money |
|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 |
| Urban | 1.796** | 2.384** | 3.123** | 2.248*** | 1.622** | 2.272** |
| | (0.082) | (0.156) | (0.350) | (0.078) | (0.058) | (0.078) |
| Household size | 0.943** | 0.972** | 0.995*** | 0.957*** | 0.935*** | 0.958*** |
| | (0.013) | (0.008) | (0.015) | (0.006) | (0.011) | (0.006) |
| Female | 0.959** | 0.632** | 0.646*** | 0.934*** | 0.866*** | 0.936*** |
| | (0.044) | (0.035) | (0.120) | (0.027) | (0.030) | (0.027) |
| Divorced/separated | 2.168** | 1.221* | 0.694*** | 1.403** | 0.971*** | 1.272*** |
| | (0.182) | (0.103) | (0.151) | (0.077) | (0.070) | (0.070) |
| Widowed | 2.213** | 1.072*** | 0.753*** | 1.347** | 1.004*** | 1.138*** |
| | (0.186) | (0.102) | (0.123) | (0.070) | (0.076) | (0.058) |
| Married | 4.058** | 0.939*** | 0.692** | 2.680** | 1.303*** | 2.525*** |
| | (0.213) | (0.077) | (0.145) | (0.098) | (0.056) | (0.093) |
| Age | 1.013** | 0.997*** | 1.000*** | 1.010*** | 1.697*** | 1.920*** |
| | (0.001) | (0.002) | (0.004) | (0.001) | (0.090 | (0.074) |
| Primary | 2.583** | 3.344** | 4.474** | 2.380** | 3.868*** | 2.500*** |
| | (0.125) | (0.239) | (2.171) | (0.090) | (0.290 | (0.094) |
| Secondary | 4.487** | 3.845** | 0.238** | 2.710** | 8.029*** | 3.046*** |
| | (0.267) | (0.477) | (0.041) | (0.126) | (0.621) | (0.142) |
| Post-secondary | 45.219** | 8.264** | 0.619** | 6.535*** | 20.161*** | 6.892*** |
| | (6.884) | (0.999) | (0.081) | (0.401) | (1.673 | (0.420) |
| Farming | 0.423** | 0.363** | 0.419** | 0.343*** | 0.285*** | 0.355*** |
| | (0.051) | (0.065) | (0.100) | (0.031) | (0.017) | (0.031) |
| Trading | 0.780** | 0.481** | | 0.601*** | 0.593*** | 0.627*** |
| | (0.102) | (0.093) | | (0.060) | (0.035) | (0.061) |
| Service | | 0.616* | 0.937* | 0.611*** | 0.270*** | 0.666*** |
| | | (0.137) | (0.333) | (0.093) | (0.055) | (0.100) |
| Casual | 0.458** | 0.317** | 0.352** | 0.343*** | 0.300*** | 0.367*** |
| | (0.054) | (0.057) | (0.088) | (0.031) | (0.017) | (0.032) |
| Rental income | 0.600* | 0.324* | 0.975* | 0.473* | 0.647*** | 0.454 |
| | (0.273) | (0.152) | (0.576) | (0.126) | (0.133) | (0.119) |
| Interest income | 0.171* | 1.768 | 0.899* | 0.344* | 0.491 | 0.355* |
| | (0.121) | (2.211) | (0.579) | (0.156) | (0.237) | (0.160) |

*continued next page*

**Table 3 Continued**

| | Kenya | Tanzania | Uganda | EAC | EAC Mobile Banking | EAC Mobile Money |
|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 |
| Pension/welfare | 0.198** | 0.222** | 0.797 | 0.202*** | 0.874*** | 0.149** |
| | (0.033) | (0.065) | (0.717) | (0.027) | (0.107) | (0.019) |
| Dependant | 0.181** | 0.371** | 0.486** | 0.164*** | 0.218*** | 0.181*** |
| | (0.021) | (0.070) | (0.123) | (0.015) | (0.014) | (0.016) |
| Income | 4.364** | 1.352** | 1.101** | 1.311 | 1.820*** | 1.296** |
| | (0.357) | (0.026) | (0.025) | (0.019) | (0.058) | (0.018) |
| HHI | | | | 0.998*** | 0.995* | 0.992*** |
| | | | | (0.002) | (0.004) | (0.001) |
| N | 22,021 | 8,614 | 2,620 | 33,255 | 33,255 | 33,255 |

Notes: The dependent variable is the digital financial services and is a binary variable: 1 the respondent used digital financial services, 0 otherwise.

There are also notable variations in the odds of using digital financial services on account of marital status, age of household head, level of education and source of income. An increase in the age of the household head by 1 year increases the odds of using digital financial services by about 1%. Ageing increases an individual's network and ability to own and use a digital device and afford financial services. Furthermore, ageing, on average, increases financial obligations, which not only tightens financial constraints but also requires a portfolio of financial services to meet (Tang et al., 2021).

Similarly, individuals with post-secondary education are 45 times more likely to use digital services compared to those without education. Education increases awareness of digital financial services and the ability to use them. In addition, the educated are more receptive to financial innovations than individuals without education. These results are consistent with findings by Salam et al. (2019). The odds of using digital financial services are highest among individuals who derive a large proportion of income from trade compared to services. This is because there are more incidences of receiving and making payment in trade compared to services, thus compelling participating agents to take advantage of the efficiency presented by digital channels. Trading also increases the network relationships with clients, which increases the frequency of communication and transactions that are considered in credit scoring. Traders also experience liquidity fluctuation, which is mitigated by digital loans.

Considering the effect of competition (using model 4), a random effects model is fitted on the panel data in which the cross sections are countries $j=1,2,3$ , individuals $i=1,..,n$ and $t=1$ is the year in which the survey was conducted. The results in model 4 indicate that an increase in competition incentivizes banks to innovate and provide digital financial services. There are 0.998 odds of using digital financial services when HHI index increases by 1 point.[9] This result is consistent with that of Dell' Ariccia and Marquez (2004) and Fraser et al. (2012). This tendency of a high concentration in the banking sector reducing the likelihood of using digital financial services is also indicated by the results in model 5.

In model 5, digital mobile banking services is the dependent variable, where individuals using mobile banking assume a value of 1, while those who do not use mobile banking assume a value of 0. The odds of using digital financial services are 0.995 when HHI increases by 1 point. This implies that the probability of using mobile banking services reduces slightly compared to not using them when concentration in the banking sector increases. This could be attributed to the higher cost of digital financial services, which is associated with a concentrated sector, which reduces the affordability of financial services. A decline in competition also reduces incentives to innovate and digitize the provision of financial services (Dell' Ariccia and Marquez, 2004; Fraser et al., 2012; Bos et al., 2013; Owen and Pereira, 2018).

In model 6, mobile money is the dependent variable – another type of digital financial service – that is regressed on bank competition, alongside individual and locational characteristics. The results in model 6 indicate that odds for female respondents using digital financial services are 0.936 times that of males, while odds for banking sector assets concentration are 0.992. This implies that males have higher probability of using digital financial services than females, and an increase in concentration in the banking sector concentration reduces the probability of using mobile money. The results corroborate with the results in model 5 and 6 and are consistent with the findings of (Dell' Ariccia and Marquez 2004 and Fraser et al., 2012). In a concentrated banking sector, the cost of financial services would be elevated. The knock-on effects of higher mobile banking costs can disincentivize individuals from using mobile money.

Utilization of digital financial services is influenced by social-economic characteristics of an individual in the EAC region. Amidst this, gender gaps exist, with females notably more excluded. Occupations that require electronic payments or receipts encourage utilization of digital financial services due to a network of transactions and interlinkages generated (Suri and Jack, 2016). In this regard, Table 4 column 1 presents results in which gender is interacted with occupation. The reference category is female with rental income. Detailed results are in Appendix 1. The results indicate that males who derive their incomes from farming, trading, providing services, renting properties and pension, are more likely to use digital financial services than females with rental income.

## Table 4: Digital finance and gender analysis

| | 1 | 2 | 3 | 4 |
|---|---|---|---|---|
| Urban | 2.247** | 2.178** | 2.167** | 2.083*** |
| | (0.078) | (0.076) | (0.076) | (0.076) |
| Female | 0.741*** | 0.636*** | 0.709*** | 0.671*** |
| | (0.073) | (0.070) | (0.043) | (0.074) |
| Income | 1.295*** | 1.287*** | 1.297*** | 1.287 |
| | (0.018) | (0.018) | (0.019) | (0.018) |
| HHI | 0.998*** | 0.998*** | 0.998*** | 0.998*** |
| | 0.002 | (0.002) | (0.002) | (0.002) |
| **Gender occupation** | | | | |
| Farmer x Male | 1.597** | 1.631** | | 1.544** |
| | (0.251) | (0.256) | | (0.243) |
| Trader x male | 1.190* | 1.148* | | 1.288 |
| | (0.685) | (0.661) | | (0.741) |
| Male x service | 1.515*** | 1.498*** | | 1.494*** |
| | (0.298) | (0.295) | | (0.294) |
| Female x casuals | 0.338*** | 0.376*** | | 0.395*** |
| | (0.072) | (0.081) | | (0.085) |
| Male x rental income | 1.056 | 0.995 | | 1.086* |
| | (0.568) | (0.536) | | (0.584) |
| Male x investment income | 4.358 | 4.131 | | 4.034 |
| | (5.288) | (4.994) | | (4.870) |
| Male x pension/welfare | 1.062* | 1.125** | | 1.094*** |
| | (0.191) | (0.204) | | (0.198) |
| Female x dependents | 0.389*** | 0.412*** | | 0.426*** |
| | (0.045) | (0.048) | | (0.050) |
| **Wealth quintiles** | | | | |
| First quintile male | | 0.890* | 0.882*** | 0.883*** |
| | | (0.060) | (0.059) | (0.060) |
| Second quintile male | | 0.934*** | 0.765*** | 0.908*** |
| | | (0.078) | (0.061) | (0.076) |
| Third quintile x male | | 0.674*** | 0.592*** | 0.634*** |
| | | (0.052) | (0.045) | (0.050) |
| Fourth quintile x male | | 0.624*** | 0.569** | 0.587*** |
| | | (0.061) | (0.055) | (0.058) |
| Female x Rural | | | | 0.857*** |
| | | | | (0.031) |
| N | 33,185 | 33,255 | 33,185 | 33,185 |

Notes: The dependent variable is the digital financial services and is binary variable: equal to 1 if the respondent used digital financial services, 0 otherwise. The results are obtained from random effects model as determined by the Hausman test, as shown in Appendix 2. The results are based on Finscope (2017) surveys of Tanzania and Uganda and FinAccess (2021) survey of Kenya.

The results are consistent even after controlling for wealth quintiles in column 2. In column 2, wealth quintiles are interacted with gender, the reference category is the fifth quintiles for male. The propensity to use digital financial services across gender is affected by wealth (Yang and Ching, 2014; Salam et al., 2019) The results indicate that males in the fifth quintile are more likely to use digital financial services than females in all wealth quintiles. This implies that females have a lower probability of using digital financial services than males, even after controlling for wealth effects and occupation.

In column 3, occupation, wealth quintiles and residence are interacted with gender (sex) of the respondent. Rural residents have lower access to Internet, network coverage and education, which compounds difficulties in access to digital financial services (Suri and Jack, 2016). The results indicate that the odds of using digital financial services for males increases with their wealth, just as seen in the results in column 2. With respect to the effect of residence, females in rural areas have lower odds of using digital financial services than males in urban areas (column 4). The implications of these results are that disparity in using digital financial services across gender persists in rural areas, among poor females, and females who are casually employed and dependents.

## Competition and utilization of digital financial services

Analysis of competition and utilization of DFS shows that competition in the banking industry increases penetration of digital financial services, more so if augmented with an innovative telecommunications industry. This is despite the results being consistent in models 5 and 6 in Table 5. In line with arguments in literature that the main catalyst for innovation in the telecommunication industry is competition (Gruber and Verboven, 2001 and Honoré, 2019), we analyze the contribution of competition in the mobile and banking industry on the utilization of digital financial services. Utilization of digital financial services is proxied by mobile phone transactions from 2007 to 2022. The panel is constructed using country data where j denotes country (Kenya, Uganda, and Tanzania) and t=1,..,T, where t is for 2007 to 2022. We evaluate the appropriateness of fixed effects against random effects using the Hausman test. The Hausman test in Appendix 2 indicates that fixed effect fits the data well. Therefore, we estimate fixed effects model, and the results are shown in Table 5.

The results indicate that, all else remaining the same, an increase in concentration in the banking industry of 1 point reduces mobile transactions by 25% to 28%. Similarly, an increase in concentration in the mobile network industry by 1 point reduces mobile transaction by 15% to 25%. This implies that concentration in the mobile and banking industry reduces utilization of digital financial services. While an increase in concentration in the banking industry by 1 point reduces mobile transactions by 10.3% in Tanzania, the effect is statistically insignificant in Uganda and Kenya. An increase in concentration in the mobile money industry increases mobile transactions in Tanzania and Uganda, but not Kenya. This can be attributed to Uganda and Tanzania having lower penetration and access to mobile network, in which a concentrated sector increases penetration to realize minimum efficiency scale. Therefore, an increase in concentration in Kenya increases the cost of services, reduces uptake of mobile money, which then undermines utilization of mobile money, a catalyst for uptake of digital financial services. This result is consistent with that of Aghion et al. (2005) and Beck et al. (2004) who argue that an increase in competition in the mobile telephone and banking industries increases utilization of digital financial services. Other infrastructural development, captured by access to electricity – an essential supportive service for digital financial services - is also observed to increase utilization of digital financial services (Drasch et al., 2018). This highlights the need to focus on supportive infrastructural developments for increased uptake of digital financial services.

**Table 5: Competition and utilization of digital financial services**

| | **Kenya 1** | **Uganda 2** | **Tanzania 3** | **Pooled 4** | **Pooled 5** | **Pooled 6** |
|---|---|---|---|---|---|---|
| ROA | -0.011 | -0.333 | -0.501 | 0.693 | 0.462 | 0.682 |
| | (0.085) | (0.189) | (0.386) | (0.673) | (0.627) | (0.698) |
| HHI | -9.705 | 41.612 | -10.285* | -25.139* | -25.489* | -28.315* |
| | (18.734) | (41.717) | (5.518) | (12.672) | (11.744) | (12.998) |
| HHIM | -0.056 | 13.687* | 71.340* | -15.444* | -25.749* | -23.658* |
| | (1.474) | (6.674) | (20.484) | (10.841) | (10.213) | (11.318) |
| Equity | 0.806** | 8.420** | -1.448 | -0.472 | -1.429 | -1.406 |
| | (0.369) | (1.491) | (2.286) | (1.365) | (1.266) | |
| Electrrural | | | | 0.192** | | |
| | | | | (0.046) | | |
| Electurban | | | | | 0.229** | |
| | | | | | (0.047) | |
| Elect | 0.012 | 0.003 | 0.549** | | | 0.182** |
| | (0.014) | (0.025) | (0.101) | | | (0.048) |
| _cons | 11.238* | -109.962* | -3.699 | 30.490 | 38.290 | 45.715 |
| | (5.206) | (25.544) | (30.649) | (24.230) | (22.394) | (24.855) |
| N | 11 | 11 | 11 | 33 | 33 | 33 |

Notes: HHIM and HHI competition in mobile money and banking industry measured by HHI index; ROA is return on assets; equity is the bank equity a measure of bank size; electru and elecurban is access to electricity in rural and urban areas; elect is penetration of electricity; * p<0.05; ** p<0.01. The results ae based on time series data from Kenya, Uganda, and Tanzania for the period 2007 to 2022.

# 6. Conclusion

Competition in the banking sector is a catalyst for innovation and the adoption of digital channels to provide financial services. The low cost of providing banking services via digital channels has been leveraged on by banks to extend services to the underserved and the excluded. However, gender difference in access to and utilization of digital financial services amid increase in competition and penetration of digital financial services persist in the EAC. This study deploys panel regressions and binary response model frameworks to investigate the impact of competition in terms of market share on penetration and differences in the utilization of digital financial services across gender in Kenya, Uganda, and Tanzania. The latest waves of Finscope Survey (2017) and FinAccess (2021) household financial survey and time series datasets are used.

The analysis shows that males are more likely to use digital financial services than females. However, there exists disparities in the use of these services among occupations, wealth quintiles and in residences (rural/urban divide). Females, irrespective of their residence, have a lower probability of using digital financial services than their male counterparts even after controlling for wealth effects. Females deriving livelihood from farming, providing services, traders, dependents, and pensioners are less likely to use digital services than their male counterparts. In this regard, gender considerations would be necessary in the design of policies that shape financial inclusion programmes and products, more so attaching stronger accommodations to women in farming, service industry, trade, dependents, and those in retirement who are relatively more disadvantaged. In so doing, equity would be promoted in the increasing rollout of digital financial services in the region, otherwise women would be disproportionately served.

With respect to the effects of competition on penetration of digital financial services, competition in the mobile and banking industry increases utilization of digital financial services in all the three countries, and across gender. Therefore, implementing policies that support competition in banking and mobile telecommunication industries will encourage financial service providers to effectively leverage on mobile technology (that supports mobile money) and digital finance to close gender gaps in the utilization of digital financial services.

# Notes

1. This research project is funded by AERC-KBA institutional Collaborative Research Fund on Delivery of Financial Services and Financial Inclusion in East African Economies (EAC)- Prospects for Market Development project.

2. Out of the population with access to Internet, this represents 48% of males and 46% of females. In addition, 13% of males and 8% of females have access to Internet.

3. It is estimated that while 46% of rural population and 70% of the urban population own mobile phones, 5% of the rural population and 25% of the urban population have access to Internet.

4. People who are formally included are considered to be individuals aged 16 years or older, who have or use financial products and services provided by a financial service provider regulated or officially supervised, while individuals considered informally included are individuals aged 16 years or older, who use financial mechanisms not provided by a regulated or supervised financial institution.

5. This is based on published data and bank supervision reports compiled from Central Banks and commercial banks.

6. However, the fact that coefficients from the non-linear logit model do not give the size of the effect of each of the explanatory variables on the dependent variable, means that the estimated output is then converted into odd ratio.

7. Dependants receive remittances through mobile money wallets (Jack and Suri, 2014) long term consumption planning

8. Concentration is measured by HHI based on assets.

9. An increase in HHI indicates an increase in concentration in the banking sector.

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# Appendices

## Appendix 1: Digital finance and gender

| | 1 | 2 | 3 | 4 |
|---|---|---|---|---|
| Urban | 2.247** | 2.178 | 2.167 | 2.083 |
| | (0.078) | (0.076) | (0.076) | (0.076) |
| Female | 0.741*** | 0.636 | 0.709 | 0.671 |
| | (0.073) | (0.070) | (0.043) | (0.074) |
| Income | 1.295*** | 1.287 | 1.297 | 1.287 |
| | (0.018) | (0.018) | (0.019) | (0.018) |
| HHI | 0.998*** | 0.998 | 0.998 | 0.998 |
| | 0.002 | (0.002) | (0.002) | (0.002) |
| **Gender occupation** | | | | |
| Farmer x male | 1.597 | 1.631 | | 1.544 |
| | (0.251) | (0.256) | | (0.243) |
| Trader x male | 1.190 | 1.148 | | 1.288 |
| | (0.685) | (0.661) | | (0.741) |
| Male x service | 1.515 | 1.498 | | 1.494 |
| | (0.298) | (0.295) | | (0.294) |
| Female x casuals | 0.338 | 0.376 | | 0.395 |
| | (0.072) | (0.081) | | (0.085) |
| Male x rental income | 1.056 | 0.995 | | 1.086 |
| | (0.568) | (0.536) | | (0.584) |
| Male x investment income | 4.358 | 4.131 | | 4.034 |
| | (5.288) | (4.994) | | (4.870) |
| Male x pension/ welfare | 1.062 | 1.125 | | 1.094 |
| | (0.191) | (0.204) | | (0.198) |
| Female x dependents | 0.389 | 0.412 | | 0.426 |
| | (0.045) | (0.048) | | (0.050) |

*continued next page*

## Appendix 1 Continued

| | 1 | 2 | 3 | 4 |
|---|---|---|---|---|
| **Wealth quintiles** | | | | |
| First quintile male | | 0.890 | 0.882 | 0.883 |
| | | (0.060) | (0.059) | (0.060) |
| Second quintile male | | 0.934 | 0.765 | 0.908 |
| | | (0.078) | (0.061) | (0.076) |
| Third quintile x male | | 0.674 | 0.592 | 0.634 |
| | | (0.052) | (0.045) | (0.050) |
| Fourth quintile x male | | 0.624 | 0.569 | 0.587 |
| | | (0.061) | (0.055) | (0.058) |
| Female x rural | | | | 0.857 |
| | | | | (0.031) |
| N | 33,185 | 33,255 | 33,185 | 33,185 |

## Appendix 2: Hausman test

```
                 ---- Coefficients ----
             |      (b)          (B)            (b-B)     sqrt(diag(V_b-V_B))
             |       b            a          Difference          S.E.
-------------+----------------------------------------------------------------
         roa |    .6822307     .1478596        .5343711        .5799548
         HHI |   -28.31516    -.7674229       -27.54774        10.31398
        HHIM |   -23.65814      19.5343       -43.19244        4.774827
    internet |   -.0003444     -.000199       -.0001454        .0001729
     lequity |   -1.406216     5.498713       -6.904929               .
       elect |     .181703     .0463147        .1353883               .
------------------------------------------------------------------------------
                           b = consistent under Ho and Ha; obtained from xtreg
            B = inconsistent under Ha, efficient under Ho; obtained from xtreg

    Test:  Ho:  difference in coefficients not systematic

                  chi2(5) = (b-B)'[(V_b-V_B)^(-1)](b-B)
                          =      168.63
                Prob>chi2 =      0.0000
                (V_b-V_B is not positive definite)
```

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