IS THE EVOLUTION OF FINTECH/DIGITAL FINANCIAL SERVICES COMPLEMENTARY TO BANK PERFORMANCE IN KENYA?

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Abstract

This study examined the impact of fintech/digital financial services on bank performance by tiers in the period before and after interest rate controls in Kenya using both primary and secondary data. The findings from the secondary data show that digital financial services positively and significantly affect the performance of large banks in both periods but positively and significantly affect medium sized banks only in the interest rate capping period and negatively and insignificantly affect small sized banks in both periods. Analysis from the primary data shows that commercial banks still dominate the financial landscape with digital loan services constituting less than 1 percent of the entire loans in the financial system but the provision of loans from non-bank actors is growing. However the non-bank credit only provide loans at very high interest rates averaging about 70 percent per annum compared to 10-20 percent offered by commercial banks. Majority of the commercial bank respondents viewed digital financial services as complementary to enhancement of efficiency and scope of financial products and services. The results imply the need for devising strategies that avoid further financial exclusion of the low-income earners who may not afford smart phones, may not have access to internet or may be unfamiliar with smart phone features. Non-bank credit only providers have diverse sources of funds, thus, there is need to understand the implications of alternative sources of funds outside the domestic banking system. Further, the results imply a need to design and implement strategies to equip customers with adequate information including closing the gap between technology and people.

Key Words: Fintech, Mobile money, Non-bank credit only, Bank performance

Fintech start-ups are nimble piranhas, each focusing on a small part of a bank's business model to attack, (Financial Times, 14 October 2015)

1.0. Introduction

Technological advancement and rapid adoption of innovative business models, particularly digital products, in the provision of financial services by non-bank entities has disrupted the once upon a time, static and content traditional banking sector.[1] Fintech, referred to as, a financial industry that innovatively delivers financial services using technology has invaded the space that was for many decades dominated and controlled by commercial banks and is rapidly changing the competitive environment within which banks operate across the globe.[2] The environment facing commercial banks cannot be better described than in Kobler et al, (2016), who said "*With customers increasingly adapting to digital disruptions and more and more new types of competitors and solutions arising in this space, "digital" has officially arrived in the banking sector to shine a spotlight on all major banking functions".*[3]

The entry of digital financial services into the financial landscape has at least three advantages. First, it enhances competition in financial markets by providing services that traditional financial institutions do inefficiently in a bundled way or do not do at all and widening the pool of users of such services. Fintech players fixate on planning, building and executing certain components of the banking value chain in a better, appealing to the customer and faster way than what is offered by traditional banks.[4] . Second, fintech incur lower costs of search and verification implied by digital technological advancements, ride on lighter regulatory burden and depend more on transaction fee rather than interest income, which constitutes the key income for traditional banks, (Wang, 2018; Vijith and Dileep, 2017; Giorgio et al., 2017; IFC, 2017; Li et al., 2017; McAuley and Weiner, 2015; Akhisar, 2015). Third, assessment of the key bank functions vis a vis fintech reveal that the latter have an advantage in their ability to operate on big data, conduct machine learning/ and standardize information besides matching borrowers and lenders directly, unlike banks that rely on soft data and relationship based information, Giorgio et al., (2017). Fintechs are thus able to collect a huge mass of information, which facilitates analysis of past behavior and prediction of customer preferences, needs and trends. Coupled with screening and pricing risk at individual levels, fintechs are able to offer the right financial products, at the right time and at the right price within a shorter time compared to traditional credit scoring in banks. The ability of fintech to explore data on powerful computers and use algorithms to learn and identify patterns is an innovation that places them above traditional banking business models and makes implementation of price discrimination policies possible based on individual customer's information reports. On the other hand, under the traditional banking approach, the process is slow, costly, limited in product design and constrained from adapting innovation quickly due to regulations besides requiring heavy documentation and collateral. [5] In addition, fintechs are also encroaching on the payment systems space, traditionally a preserve of banks, with emerging payment methods such as Paypal, Venmo, Applepay, Alipay and M-Pesa.

Considerable qualitative and analytical work has been devoted to the advantages of fintech over traditional banking as well as the impact of fintech on commercial banks mainly focusing on whether fintech complement

[1] Disruptive innovation involves market entrants that successfully target overlooked segments such as the under banked and unbanked, including small businesses and small-loan markets that don't generate enough profit for the labor intensive traditional banking industry, (Li et al., 2017).

[2] No consensus exists on the definition of financial technology or Fintech. However, for purposes of this analysis, we adopt the dominant scientific definition in the literature. Thus, fintech here is defined as delivery of innovative financial services using digital technology, (Huebner et al., 2019; Alt et al., 2018; Furche et al., 2017; Dermine, 2017; Eickhoff et al., 2017; Vasiljera and Lukanova, 2016; Zavolokina et al., 2016; Schueffel, 2016). In addition,, fintech is used interchangeably with digital financial services, which includes all mobile financial services according to the definitions in Afi, (2016). Our focus therefore is on mobile money, mobile phone banking as well as digital apps/ money lending fintech firms that are neither regulated by banks or telecos. Conceptual issues on fintech are discussed in Appendix 1.

[3]Internet banking, mobile payments, crowdfunding, cloud computing, peer-to-peer (P2P) lending, Robo-advisory, online identity, process automation, block chain technology, biometric technology, gamification offers and digital investment, constitute some of the game changing disruptions summarized in Kobler et al., (2016) and Schueffel, (2016). Definition of some of the aforementioned terms is available in, Frame et. al., (2018); Bergara and Ponce, (2017)

[4] An example of this strategy is demonstrated in how they are expanding their base by targeting the millennium generation, who have shown preference for technology, networks and smart devices with censors and usage of contactless transactions compared to their predecessors. Indeed, according to the Millennium Disruption Index, (2013), 71 percent of the millennials surveyed indicated that they would rather visit a dentist than hear what banks are saying.

[5] Fintechs look like banks, they talk like banks but they are not regulated, (Vasiljera and Lukanovu, 2016)

or dis-intermediate financial services from a theoretical point of view. In this regard, as pointed out by Giorgio et al., (2017), the potential impact of fintech on commercial banks and financial institutions is not clear yet. Previous analysis of the potential impact of fintech on commercial banks is based on the financial intermediation theory, which posits that financial intermediaries (commercial banks) exist in the traditional sense, due to the absence of complete and perfect markets leading to information asymmetry and high transaction costs. Financial intermediaries possess comparative informational advantages which minimize information asymmetry and transaction costs between investors and savers, (Huebner et al., 2019; Molnar, 2018; Scholtens and Wensveen, 2003). According to Huebner et al., (2019), fintechs affect financial intermediation and the financial services value chain in three ways: (i) Fintechs cut out financial intermediaries without replacement, (ii) Fintechs replace existing intermediaries, and (iii) Fintechs add an intermediation layer, without replacing an existing one. Based on the analysis of these authors, the first option, which is a purely technological solution, is only possible with peer to peer (P2P) money transfer through distribution ledger technology (DLT) such as bitcoin usage as opposed to traditional banking system.[6] The experience so far shows that the second and third options are the most common but with reduced operational overheads and higher degrees of leveraging on technology.

Similar arguments by Giorgio et al, (2017) point out that fintechs will not replace banks. However, their work brings to the fore the key question pertinent to commercial banks, policy makers including central banks and financial regulators, consumers of financial services and the academia. Whether fintech entry into the financial landscape is anchored in inducement of a health competition process or it causes disruption/financial instability, especially considering that fintechs are subjected to lighter regulatory conditions compared to banks. The literature has documented possible negative aspects of the rapid evolution of fintech. Notably, Vives, (2019) and Singh, (2018) raise concerns on the legal authority to assess the available data, high interest rates and possibility of high non-performing loans. The authors further point out the limited focus in building algorithmic checks and balances; regulatory arbitrage and associated systemic risk; idiosyncratic bank fragility; cyber risks and, the extent to which big data can replace soft data, especially in some market segments such as small and medium enterprises, where concentration of risk is highly likely. The experience of fintech so far shows that the shift has been disruptive in the products, services, customer experiences, revenues, costs, margins and segments of the banking sector. In addition, it has also forced some players in the traditional banking industry to respond in form of collaborations, acquisitions, mergers and launches of their own fintechs, (Bedfort et al., 2018; Giorgio et al., 2017; Dermine, 2017).

Whereas qualitative work is relatively advanced in this area, very few quantitative analysis exists in the literature, (Bofondi and Gobbi, 2017; Schueffel, 2016), partly because the industry is young and still evolving implying limited availability of long time series data for analysis. However, it is important to conduct a quantitative analysis of fintech-bank relationship to understand whether bank performance has shrunk or expanded with fintech given that the latter industry is growing fast and has clear advantages over traditional banking but at the same time, this growth has possibility of inducing instability in the financial system. Quantitative analysis of this relationship will provide insights on the kind of policies required to encourage continued innovation with requisite risk mitigation measures.

In Kenya, research work on the fintech industry and digital revolution is also scarce in spite of witnessing the most rapid financial evolution of all time since 2007 when M-Pesa entered the market. Besides the developments in the mobile industry, credit-only institutions have equally blossomed in Kenya. Riding on advanced technology, both the mobile financial services and the credit-only institutions have progressively transformed payment services into cashless (mobile wallet) and invisible given their heavy reliance on non-brick and mortar

[6] P2P, DLT and Bitcoins are defined in Appendix 2

relationships.[7][8] For instance, since the adoption of mobile financial services in 2007, the mobile phone transfer service agents have brought about 70 percent of Kenyans within 3 kilometers of a financial access touch-point[9]. As of September 2018, mobile phone subscriptions stood at 46,630 million and mobile penetration was quoted at 100.10 percent, with the number of active registered mobile money transfer subscriptions at 29,678 million and 206,940 registered mobile money agents[10]. In December 2018 alone, 155.774 million transactions worth KShs. 367.77 billion were conducted using mobile payment platforms. According to the FinAccess Survey Report, (2019), usage of mobile money account services, mobile banking and digital apps increased to 79 percent, 25 percent and 8 percent, respectively, in 2019 from 71 percent, 17.5 percent and 0.6 percent in 2016.[11] Usage of traditional banks on the other hand reduced from 31.7 percent to 29.6 percent over the same period.

Even the few research attempts previously conducted based on Kenyan data have a number of shortcomings. They lack sufficient empirical rigor; ignore possibility of commercial banks heterogeneous responses to technological innovation; and omit important regulatory and policy developments in the last one decade, (Koki et al., 2018; Musalia and Oluoch, 2017; Monyoncho, 2015; Kisaka et al., 2015; Munyoki et al., 2015). In particular, the rapid regulatory and policy evolution in the banking system may have changed the behavior of commercial banks and affected their performance and interaction with digital financial players. It is possible that these developments may have changed commercial bank-customer relationships and affected the interaction between customers and alternative non-bank agents, including digital and mobile agents in the financial system. Thus a study on fintech-bank relationship across bank tiers on Kenyan data is important to provide insights on the possibility of these developments having implications on the pace of evolution and uptake of digital products. Moreover, most of the previous studies analyzed mobile banking through commercial banks only, ignoring other digital financial service providers (app-based financial service providers) such as Tala and Branch which use call logs, GPS, social network and contact list to transact bank-like businesses (Totolo and Gubbin, 2018).

Our study is different from previous studies in various ways. First, to the best of our knowledge, no study has empirically attempted to quantify the impact of fintech on commercial bank performance by tiers across different regulatory and policy regimes using Kenyan digital financial data. In this regard, the three main new empirical dimensions in this study include: analysis by bank tiers, demarcation of the data into two separate policy and regulatory regimes (before and after interest rate capping) and introduction of mobile financial service indicators in each bank tier and regime. Second, to complement the secondary data based approach, this paper also conducted primary research to capture information on the credit-only institutions involved in bank-like activities in Kenya to understand the shares and competitive environment in the new space where the commercial banks are not the only players. Accordingly, this paper has four main objectives:

(i) Examine the effect of digital financial services on commercial bank performance.
(ii) Determine if the impact of digital financial services differ across bank tiers
(iii) Establish whether the impact of digital financial services on commercial bank performance has changed under the interest rate capping period
(iv) Conduct a survey on the operations of digital financial services providers and commercial banks

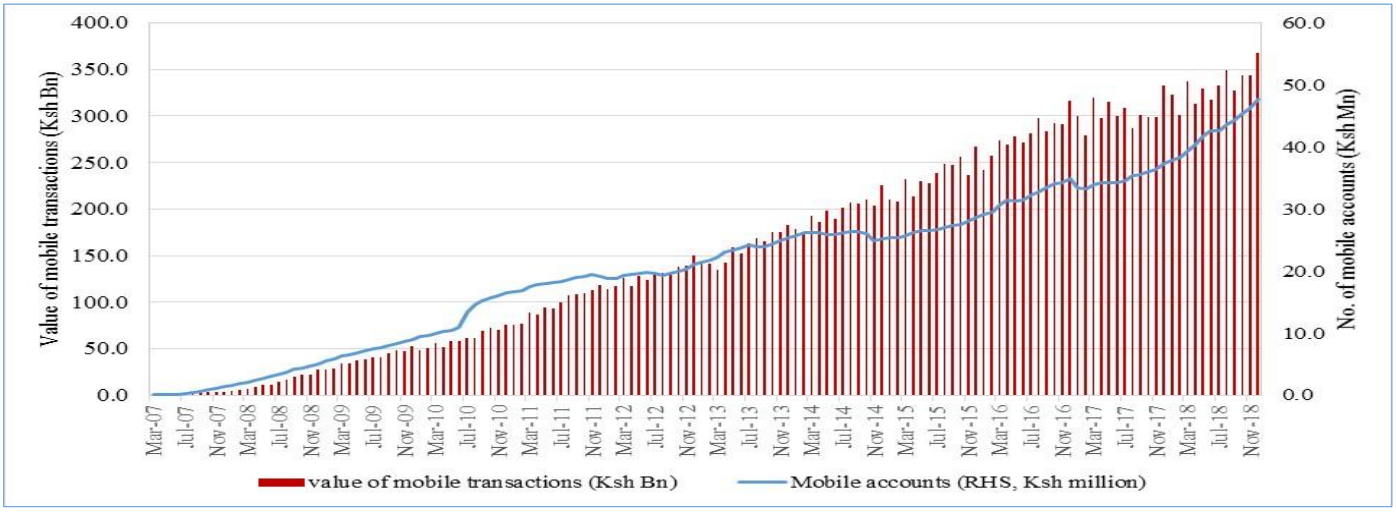
2.0. Trends of mobile money and mobile phone-based software applications

This section provides an analysis on trends of some of the key variables considered in the study including mobile money transactions and mobile phone based software applications. Figure 2.1 illustrates that transactions in

[7] A mobile wallet, also called a digital wallet is a service that allows users to access electronic funds in their smart phones for payment of goods and services. Users store their credit card, debit card, gift card or bank account data in their phones, (Omarini, 2018).
[8] The credit –only institutions are companies giving out loans without partnering with any financial institutions such as Tala, Platinum, Branch, among others. They are App-based credit-only institutions and are therefore not licensed or regulated by the Central Bank
[9] FinAccess Geospatial Survey 2015
[10] Communication Authority of Kenya Sector Statistics Report for The Financial Year 2018/2019, (July-September 2018)
[11] According to the FinAccess Report, (2019), mobile phone banking refers to mobile-phone based banking services and products by commercial banks such as Timiza and Mshwari

mobile phone money has maintained an upward trend since the commencement of M-Pesa services in March 2007. The number of mobile accounts recorded tremendous growth from 0.02 million in March 2007 to over 47.7 million by December 2018 and the corresponding value of transactions increased from Ksh 0.06 billion to over Ksh 367 billion over a similar period. This has contributed to improvement in financial inclusion in Kenya, which has risen to 82.9 percent in 2019 compared to 26.7 percent in 2006, while complete exclusion has narrowed to 11.0 percent from 41.3 percent in 2006 (FinAccess Household Survey, 2019).

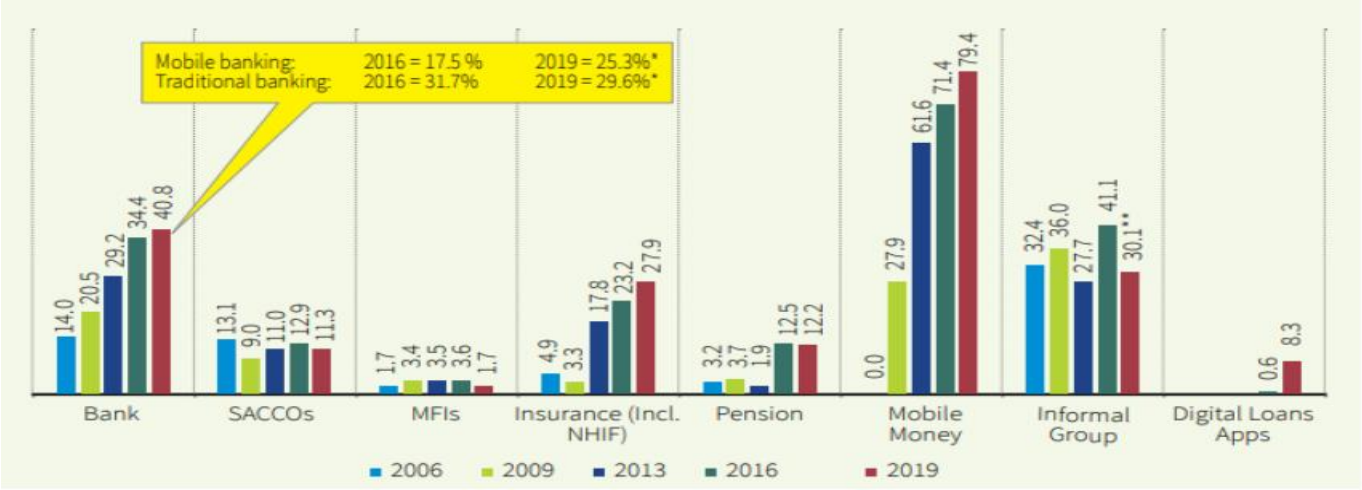
Figure 2.1. Number of Mobile Accounts and Value of Mobile Transactions



Source: Central Bank

Most banks and fintechs have acknowledged the importance of collaborations as experience has shown that fintechs will not reach scale without leveraging the customer base and capital that banks have already accumulated. Similarly banks have realized that internal production processes donot always meet customer expectations in terms of time to market and quality, (IFC, 2017). Thus, consistent with possibilities of both market players benefiting from partnerships and in response to the growing need of convenient straight-through payments using mobile solutions, a number of banks have entered into strategic alliances with mobile companies as well as Fintech firms to facilitate mobile money transfer services to their customers, (Matokho and Anyieni, 2018).

Figure 2.2. Landscape of Financial Service Provides in 2016- 2019



Source: 2019 FinAccess Household Survey

Some of the notable mobile money solutions that have been launched include; M-Shwari, M-Co-op Cash, KCB M-pesa, M-kopa (Tala), Branch, Eazzy loan, Timiza, among others. Indeed, there is evidence to attest to the fact that new partnerships led to increase in the new accounts opened in the period 2012 to 2015, (IFC, 2015). As pointed out by Totolo, (2018), since the introduction of M-Shwari in 2012, which offers savings account and digital credit, the market for digital credit has expanded substantially beyond commercial banks to fintech firms and non-bank institutions. The credit providers in this market include three dominant models. The first model such as KCP MPesa and MShwari is based on collaborations between commercial banks and telecommunication companies while the second one uses independent mobile virtual network operators (MNVO) such as Equitel. The third model such as Tala and Branch developed stand-alone smart phone apps. Further evidence as revealed in figure 2.2 shows that usage of mobile money account services, mobile banking and digital apps increased to 79.4 percent, 25.3 percent and 8.3 percent, respectively, in 2019 from 71.4 percent, 17.5 percent and 0.6 percent in 2016.[12] Usage of traditional banks on the other hand reduced from 31.7 percent to 29.6 percent over the same period, (FinAccess survey report, 2019).

3.0. Literature Review

Research work on fintech is still in its infancy stages with little scientific research and a few professional reports. The research so far has mainly focused on the evolution of fintech, benefits of fintech over traditional banking systems, potential challenges of rapid evolution of fintech on banking industry and synegies of fintech on commercial banking. Most of these studies lack empirical rigor partly due to the fluidness and dynamism of the fintech sector as well as the lack of long time series for analysis. The literature is therefore dominated with theoretical discussions as opposed to quantitative analysis. Notable among the theoretical deliberations is the evolution of fintech companies, the financial intermediation theory, complementarity verses substitutability theories and drivers of fintech companies into the financial system, among others. Little empirical work on this subject is provided in the literature and scanty literature on survey studies is also available but continuously being developed given the evolutionary nature of the subject.

The literature documents three phases of the development of financial technology with the original analogue era that lasted until the late twentieth century when a new process of digitalization of finance emerged. In 2008 a new era defined by not just financial products and services but the players involved in the delivery as well as high application of technology at retail and wholesale levels emerged. As opposed to the two earlier phases which were primarily dominated by traditional regulated industry that used technology to provide financial services, this latest development referred to as Fintech 3.0. is characterized by new start-ups and established technology companies that deliver financial products and services directly to businesses and the general public, (Arner et al., 2016). According to these authors, the Fintech 3.0 poses challenges for regulators and market participants, particularly in balancing the potential benefits of innovation with the possible risks of new approaches and their analysis argues against too-early or rigid regulation.

According to the traditional models of banking, the main distinguishing feature of banks is their ability to intermediate funds between investors and borrowers. Previous literature abounds on the role of financial intermediation by commercial banks. According to the financial intermediation theory, banks exist due to market imperfections including information asymmetry between savers and investors. These market imperfections prevent savers and investors from trading directly with each other in an optimal way. Financial intermediaries possess comparative information advantages and they therefore fill the information gap between ultimate savers and borrowers as agents and delegated monitors. They screen and monitor investors on behalf of savers, besides bridging maturity mismatch between savers and investors as well as facilitating payments between economic parties through provision of a payment and clearing system and providing funding liquidity, (Huebner, 2019; Molnar, 2018; Scholtens and Wensveen, 2003).

[12] Mobile banking is the act of making financial transactions on a mobile device (cell phone, tablet, etc.).

However, Scholtens and Wensveen, (2003), argue that in the real world, financial intermediaries are not considered as information producers but as risk managers engaged in a creative process. In this case, they transform savings, given the preference of the saver with respect to liquidity and risk into investments according to the needs and risk profile of investors. The authors point out to the role of information, communication and technology (ICT), which has led to new methods of and types of intermediation, as the facilitator of innovative new financial products, instruments and services with created/added value by traditional financial intermediaries. These new products, instruments and services cannot be created by savers or investors themselves or individually. In the process of performing this function, financial intermediaries cover risk. They use their reputation, their balance sheet and off-balance sheet items to act as counterparts, a role-that individual investors or savers cannot perform and risk taking determines the value addition of financial intermediation to national income. The bedrock of these authors' argument is embedded in the fact that the traditional financial intermediation theory is not well equipped to explain the market dynamism, flow of product innovation, effect of technological advancement and the proper role of risk transformation and management. An amended theory of financial intermediation accommodating the changing financial environment is thus necessary. Accordingly, the emphasis of the role of intermediation as reductions of frictions of transaction costs and asymmetric information is too strong; while these factors may once have been central to the role of intermediaries, they are increasingly less relevant. Facilitation of risk transfer and dealing with a complex maze of financial institutions and markets are now key activities of intermediation although the financial intermediation theory offers little explanation as to why institutions should perform this function. The amended financial intermediation theory should accordingly incorporate, dynamism in market development, product innovation, value creation, risk management, dynamics in intermediation in form of new markets, new agents, new products, etc and customer orientation, (Scholtens and Wensveen, 2003).

No consensus exists concerning whether entry of fintech substitutes/dis-intermediates or complements traditional banking systems. On the one hand, online lenders argue that they offer superior financial services to customers compared to traditional banks on the basis of better understanding of technology, agility to innovation and laser focus on narrow solutions to the exact need of customers. Similar theories according to Aaron et al., (2017) contend that, the entry of fintech in the financial sector would lead to reduction of amount of bank deposits with possible negative effects on credit extension to the economy depending on response from banks. Moreover, fintechs also engage in direct lending to borrowers in the form of Peer-to-Peer (P2P) and Investor-to-Peer (I2P), which ameliorates the problem of fixed costs of traditional banks of bundling deposits. The model of lending by fintechs processes information and manages risk by using big data and machine learning to predict default risk and speed up the approval process unlike the soft data models of traditional banking. Fintech frameworks have reduced search costs of credit information as well as widened the scope of collected credit assessment data.

Similar theories are advanced by Bateman, (2018), who contends that the entry of fintech into the financial industry may lead to the loss of efficient intermediation with adverse developmental outcomes. According to this author, lending models akin to traditional banking systems have evolved through the earlier developmental local financial model and relationship bank model to the current fintech models. The developmental model mainly involved lending to particular types of micro, small and medium enterprises (MSMEs) with the objective of enhancing development, growth and alleviating poverty. The relationship-banking model was entrenched on the availability of soft information such as the local business environment, personal quality of the entrepreneur that facilitated the assessment of possible repayments and types of businesses ventured into. The argument under this author is that these two models symbolized efficient channeling of funds to right business entities with a possibility of developmental impact. As opposed to traditional lending that was developmental and community based in purpose, capitalizing on local knowledge, trust and reciprocity. Bateman, (2018) contends that the fintech lending model is a geographically dispersed, 'pure' market driven intensely impersonal business model practicing anti-developmental financing similar to the 'turbo-charged' extension of the local neoliberal financial intermediation model of the 1980s. The fintech model uses a range of tech-fixes such as algorithms, meta-data and social media use to lend and secure successful and quick repayments with no effective intermediation leading to long term sustainable development as an objective. Loan decisions rely on transaction-based model that can

identify from a distance the most bankable projects using a range of sophisticated data analytics. Moreover, fintech lenders are mobile, fast and flexible and like other profit-driven units are vulnerable to 'herd instincts' with possibilities of supporting only borrowers prepared to pay higher interest rates and borrowers selected by algorithms thus ignoring or abandoning other sectors and individuals who would otherwise be worthy borrowers.

Contrastingly, Mulnar, (2018) who reviewed the three main functions of banks (provision of funding liquidity, transformation of assets and reduction of information asymmetry) in financial intermediation points out that the new players in the financial system complement rather than dis-intermediate traditional banks for three reasons. First, banks offer deposits, payment and lending services jointly thus providing liquidity services to customers who are uncertain about the timing of their future consumption needs. Banks pool liquidity that provides customers with insurance against idiosyncratic shocks that affect their consumption needs. Online market lenders on the other hand have limited scope of liquidity services since they lack access to central bank liquidity. Second, online lenders are unable to intermediate between borrowers and investors with heterogeneous preferences. Thirdly, loan provided by the online market lenders platforms are supplementary to bank loan in the high-risk borrower segments.

These arguments are supported by Huebner et al., (2019) and Giorgio et al., (2017) who posit that fintechs will not replace banks. Huebner et al., (2019) argue that fintech generally act as new types of financial intermediaries, and by and large do not cut middlemen out of the financial transactions. According to these propositions, the popular notion of fintechs dis-intermediating financial services cannot be supported. The authors specifically contend that fintech affect financial intermediation and financial services value chain in three ways. First, fintech cut out existing middlemen without replacement where peer-to-peer money transfers are made through distributed ledger technology (DLT) as opposed to using the traditional banking system. An example of this would be DLT-based smart contracts and usage of Bitcoin which is a purely technological solution rendering financial intermediaries obsolete for this particular function. This option is however the least common with the most common effect of fintech on financial intermediation involving either fintechs replacing existing intermediaries or fintechs adding an intermediation layer without replacing an existing one. In the former case, fintechs replace existing intermediaries and act as intermediaries themselves such as neobanks that replaced incumbent banks, P2P-lending and P2P-insurance but with reduced operational costs and higher leveraging on technology. In this case there is still match-,making platform in the middle between givers and seekers of financial services or products. In the latter case, fintechs build on top of existing intermediaries while also acting as intermediaries themselves in which case fintechs utilize the existing payment and banking infrastructure but with reduced friction and transaction speeds The documented experience of presence of digital financial services shows considerable synergies between banks and fintech firms, particularly for market players that are open and willing to partner in delivering value to a jointly shared client base. For instance, according to IFC, (2017), Fintech innovation can help banks deliver enhanced risk assessment, reduce transaction costs, make operation bank offices more efficient, lower fixed assets investment requirement and enter new markets. On the other hand, banks can help fintech innovators address their target markets. Both parties can benefit from partnerships that reconfigure financial services value chains.

4.0. Methodology

In this section, we describe the estimation technique, variables and the model considered for the analysis based on secondary data. We also provide a brief description of the data collection method and scope used for the analysis based on primary data.

4.0.1. Secondary Data Analysis

This sub-section describes the methodology used based on secondary data. The model linking digital financial services and performance of commercial banks as well as description of both the variables of interest and control variables are also provided.

4.0.1.1. Empirical Model

$$ROE_{it} = \alpha_0 + \delta_1 ROE_{it-1} + \alpha_1 Mob_{it} + \beta_1 X_{it} + u_{it} \text{,...,(1)}$$

Where ROE_{it} is the return on equity of banks, Mob_{it} represent indicators of mobile transactions while X_{it} is a set of the other explanatory variables which include bank specific (liquidity, size, capitalization, loan growth and deposit measures) and macro variables (GDP and inflation) and μ_{it} is the error term. The subscripts i= 1,…,N and t=1,…,T refer to the cross-section and time series dimensions of the data, respectively.

4.0.1.2. Definition and measurement of variables

In this sub-section, we describe all the variables that are considered in the study. The literature identifies three key indicators of bank performance, that is, profitability of the assets comprising return on assets and return on equity and the net margin interest, (Trofimov, et al., 2018; Yuksel et al., 2018; Nouaili et al. 2015). Return on equity is defined as net income as a ratio of shareholder's equity. In our study, we used return on equity, whose data is in a continuous series for our choice of sample and for brevity purposes.[13] Our main explanatory variables are indicators of mobile transactions. Number of mobile accounts, value of mobile transactions, number of mobile agents and number of mobile transactions are the key indicators identified in the literature to capture usage of mobile money services, (AFI, 2019; Arif, 2018). Research on usage of mobile money services and its linkages to other economic variables is still nascent given that the usage of mobile money transfer services gained prominence in the last one decade. Thus apart from a few primary data based studies, most of the countries tracking such transactions have so far focused on the aforementioned indicators. This study adopts similar indicators. We therefore use the value of mobile transactions and number of mobile accounts as proxies for mobile transactions. Apriori, we expect a positive relationship between proxies for mobile transactions and bank performance for banks since mobile banking services increase profitability through commission incomes and gradual reduction in overhead costs, (Mwange, 2011). However, the relationship may be initially negative due to huge investments in technology in cases where the banks have no contracts with telecommunication companies.

Consistent with previous studies, we include bank specific variables, mainly, asset quality, size of the bank, liquidity, capitalization and loan growth as well as macroeconomic variables, specifically GDP growth and inflation (Almaqtari et al., 2018; Al-Homaidi et al., 2018). Asset quality is measured by non-performing loans to total loans. Apriori, we expect a negative relationship between asset quality and bank performance since if a bank's balance sheet contains a high percentage of problem loans, banks incur losses through bad debt provisioning as well as expend more resources in the collection of non-performing loans, (Mkandawire, 2016; Abata, 2014).

Bank size, is measured by bank assets and in our case we use the log of total assets. Apriori, an ambiguous sign is expected between bank size and bank performance. The relationship can be positive since larger banks can reduce costs by utilizing the economies of scale principle. In addition, large banks are more diversified with a larger pool of funds, access to a larger and more credit worthy corporate borrowers and have more resources for the development of advanced credit risk management and evaluation systems. Thus based on the relative efficiency hypothesis, large banks may take advantage of greater market power, reduced risk and economies of scale to increase operational efficiency. Moreover, large banks have a higher capability to differentiate products

[13] We estimated equations with return on assets (net income as a ratio of total assets) but the results were generally similar to the ones obtained from return on equity. Thus, we opted to report the ones for return on equity for brevity purposes.

and services compared to smaller banks. In addition, based on the structure-conduct-performance hypothesis, the size of the bank allows it to capture a higher market share and earn greater profit. In this case, the market structure influences behaviour of firms through pricing and investment policies which in turn translate into performance, (Tesfaye and Abdurezak, 2018; Trofimov et al., 2018; Nabieu, 2013). However, product and risk diversification would lead to negative effect on bank performance since increased diversification would determine higher risks. In this case, extremely large banks would incur huge costs related to management of very big firms, overheads of bureaucratic processes and agency costs. Besides as banks grow in size, they become more susceptible to risks resulting from debt markets, (Hasanov, et al., 2018; Menicucci and Paolucci, 2016; Rahman, 2015; Aladwan, 2015).

Deposit growth is included to capture one of the sources of funds for commercial banks and the fact that it is a liability to the banks. On the one hand higher deposit growth imply higher loanable funds that can be invested to generate income but the fact that deposits are also liabilities for banks, a higher level of deposits may imply more payments for the deposit holders and thus less profit for the banks. Thus, apriori, an ambiguous sign is expected between deposits and bank performance, (Hasanov et al., 2018).

Liquidity defined as the ratio of the sum of cash balances and government securities to total assets is also included and apriori, it is expected to ambiguously impact on bank performance. On the one hand, the expected bankruptcy cost hypothesis posits that an increment in the relative liquid asset value of banks reduce their default probability with an expected positive impact on bank profitability. At the same time, the opportunity cost of banks directing most funds to liquid assets which are low yielding compared to investing them to higher return yielding assets such as loans imply a negative relationship between liquidity and bank profitability, (Marozva, 2015). A positive relationship therefore obtains so long as the marginal benefit of holding additional liquid assets outweighs the opportunity cost of their low relative return, (Ahmad and Wang, 2019; Mohd, et al., 2018; Chembe and Jing, 2018; Anupam and Ganga, 2017).

Capitalization, defined as capital to total assets measures the general soundness and financial power of banks. The relationship between capitalization and bank performance is expected to be positive since banks with higher levels of capital face lower bankruptcy and funding costs, which lead to higher relative margins, (Batten and Xuan, 2019; Menicucci and Paolucci, 2016; Tan and Floros, 2013). Similarly, the relationship between loan to asset ratio and profitability is expected to be positive unless the bank takes on un-acceptable levels of risk. A positive impact is expected as interest from loans is one of the main sources of bank profit, (Hasanov, et al., 2018)

GDP used as a measure of economic activity and defined as the natural log of GDP is also included. GDP influences many factors related to the supply and demand of loan and deposits. Favourable economic conditions would positively influence economic activity, (Fadzlan and Fakarudin, 2012). Inflation, which is, measured as the log of the consumer price index, determines the real value of costs and revenue. The ultimate effect of inflation on profitability depends on whether inflation is anticipated or unanticipated. Under the anticipated case, interest rates are adjusted accordingly, resulting in faster increase of bank revenues than costs and subsequently leading to positive impact on bank performance. In the unanticipated case, banks may be slow in adjusting their interest rates, resulting in a faster increase in bank costs than revenue, thus, resulting in negative effects on bank performance, (Fadzlan and Fakarudin, 2012).

4.0.1.3. Econometric approach

Equation (1) is a dynamic specification since it contains a lagged dependent variable as one of the explanatory variables. Baltagi (2002) has identified two main characteristics of dynamic regressions. First, is the

autocorrelation due to the presence of a lagged depended variable among the regressors and second, is the presence of unobserved heterogeneity in individual behavior. However, panel datasets, where the behavior of N-cross sectional units is observed over T-time periods, provide a solution to accommodate the joint presence of dynamics and unobserved individual heterogeneity (Giovanni, 2004). Panel estimators solve the country specific problem besides permitting the use of instrumental variables to contain the potential joint endogeneity of the explanatory variables. Moreover, panel methods provide greater power than individual country studies and hence greater efficiency.

In this study, we adopt the dynamic panel data GMM estimator. In addition to the already highlighted advantages of panel data, the GMM estimator also solves the problems of measurement error, omitted variables, endogeneity, besides allowing the users to discard error correction models, (Jose and Spiegel, 2002; Charalambos et al., 2005; Bond et al., 2001).

Dynamic Panel Data (DPD) estimation method

For purposes of illustration, an autoregressive, AR(1) model specified as follows is considered:

$$y_{i,t} = \gamma y_{i,t-1} + \beta' \chi_{i,t} + \mu_i + \varepsilon_{i,t} \quad \text{.....(2)}$$

where $y_{i,t}$ is the dependent variable, $\chi_{i,t}$ is a vector of explanatory variables, μ_i is the country specific time-invariant effect and $\varepsilon_{i,t}$ is the normal error term. In addition, it is assumed that $E\left[\mu_i\right] = 0$, $E\left[\varepsilon_{i,t}\right] = 0$ and $E\left[\mu_i \varepsilon_{i,t}\right] = 0$ for all i= 1,…, N and t=2,…,T.

The inclusion of a lagged dependent variable on the right hand side of the equation to be estimated renders Ordinary Least Squares (OLS), Fixed Effect (FE) and Random Effect (RE) estimators biased. This is because the lagged dependent variable is correlated with the error term. Instrumental estimators are used to solve the bias problem. The instrumental estimators approach was pioneered by Anderson and Hsiao (1982) and later modified by Arellano and Bond (1991), Arellano and Bover (1995) and Blundell and Bond (1998). The evolution of the instrumental estimators is discussed below.

Anderson and Hsiao Estimator (AH)

Anderson and Hsiao (1982) suggested first differencing the dynamic models to get rid of the individual effects and using $\Delta y_{i,t-2}$ as an instrument or using second lag differences as instruments. These instruments will not be correlated with the differenced error term so long as the error terms are not serially correlated. However, Arellano (1989) found that the estimator that uses differences, $\Delta y_{i,t-2}$ rather than levels, $y_{i,t-2}$ for instruments has very large variances over a significant range of parameter values.

Generalized Method of Moments (GMM)

Arellano and Bond (1991) developed the GMM estimator, in which case the orthogonality conditions that exist between lagged values of y_{it} and the disturbance term are utilized to obtain additional instruments. Moreover, they argued that the differencing proposed by AH imposes a moving average (1) structure on the error term even when the errors originally were not correlated over time. Thus the GMM is more efficient than AH estimator because it avails the following additional moment restrictions:

$$E\left[y_{i,t-s} \Delta \varepsilon_{it}\right] = 0 \quad \text{for t= 3,…T and } s \geq 2 \text{ ,.....(3)}$$

$E\left[\chi_{i,t-s}\Delta\varepsilon_{it}\right]=0$ for t=3,…T and $s\geq 2$,…….(4)

In this case, since lagged values of the explanatory variables are not correlated with the first differences of error terms, it is suggested that, the lagged levels of χ and y can be used as potential instruments to estimate the first differenced equation.

4.0.1.4. Sources of data

This study uses monthly data from all commercial banks covering the period 2009-2018. Data on non-performing loans, liquidity, bank size, deposits, capitalization and loan advances is obtained from balance sheets and profit and loss accounts of commercial banks. Data for mobile transactions is obtained from the Central Bank of Kenya while data on consumer price index and GDP is obtained from the Kenya National Bureau of Statistics.

4.0.2. Survey methodology for primary data analysis

The survey used two structured questionnaires separately targeting commercial banks and selected credit-only institutions located in Nairobi. The study targeted the entire sample of the 43 licensed commercial banks in Kenya and targeted 30 credit-only institutions based on availability of information. The authors of this paper and the Kenya Bankers Association jointly administered the questionnaire through online and phone call channels. A response rate of 42 percent and 40 percent for commercial banks and non-bank credit-only institutions, respectively, was obtained.

5.0. Econometric Results

In this section, we present results in which we have used two different equations based on the period before and after interest rate caps and two different indicators for mobile banking as proxies for digital financial services. We used return on equity, which is a one of the standard variables of bank performance, as the dependent variable. We separately estimated models containing data for all banks, large sized, medium sized and small sized banks, reported in tables 5.1 to 5.4. In each of the tables, columns 2 and 4 report results for data covering the period before interest rate caps while columns 3 and 5 reports the results based on data during the interest rate control period. In 5.0.2, we present the survey findings based on data collected from a sample of commercial banks and non-bank only credit providers. The results of the relationship between the control variables and bank performance across tiers are generally consistent with previous work, (Dang, 2019; Yuksel et al., 2018; Hallunovi and Kume, 2016; Petria et al., 2015). However, little previous research work exists on analysis of digital financial services on bank performance across tiers and across policy regimes. The results are thus new.

5.0.1. Discussion of findings

In table 5.1, we report the results based on data for all banks but demarcated into the period before interest rate caps and the period during interest rate caps. In columns 2 and 3, we considered the value of mobile transactions while in columns 4 and 5, we replaced it with the number of mobile accounts as proxies for digital financial services. The results show a positive and significant relationship between the value of mobile transactions and return on equity of all commercial banks both in the period before and after interest rate caps. The results suggest a positive relationship between mobile accounts and return on equity but they are not statistically significant. The positive and significant coefficient of the value of mobile transactions may be explained by the fact that, a number of banks, mainly, large and medium banks entered into collaborative strategic partnerships with fintech/telecommunication companies/mobile network operators and developed stand-alone telecommunication

subsidiaries, which facilitated provision of digital financial products such as KCB Mpesa, M-Shwari, Eazzy loan, among others.

Based on this result, it can be argued, that digital financial services are complementary to commercial bank performance. The fact that the coefficient of the number of mobile bank accounts is positive but insignificant while the value of mobile transactions is positive and significant would imply that some bank accounts are not active but the ones that are active engage in higher value transactions. The results also imply that the interest rate caps did not alter the relationship between digital financial services and bank performance both in terms of direction and significance.

Table 5.1. Return on equity models findings for all banks

Dependent variable is Return on Equity	Period before interest rate caps Model 1 with mobile value All banks (2009m03-2016m08)	Period after interest rate caps Model 2 with Mobile value All banks (2016m09-2018m06)	Period before interest rate caps Model 3 with Mobile accounts All Banks (2009m03-2016m08)	Period after interest rate caps Model 4 with Mobile accounts All banks (2016m09-2018m06)
Independent Variables	Coefficient(t-statistics)	Coefficient(t-statistics)	Coefficient(t-statistics)	Coefficient(t-statistics)
Credit Risk	-0.065(-0.76)	0.171(0.80)	-0.024(-0.173)	-0.335(-2.87)***
Liquidity	-0.153(-1.77)*	0.274(1.76)*	-0.178(-1.98)**	-0.400(-1.84)*
Size	0.125(0.75)	-0.824(-1.30)	0.443(1.84)*	-0.478(-1.67)*
Deposits	0.291(2.36)***	0.364(1.88)**	0.124(0.974)	0.072(0.68)
Mobile value	0.010(2.37)***	0.623(2.92)**		
Mobile accounts			0.001(0.050)	0.038(1.58)
GDP	0.319(1.98)**	-0.066(-1.11)	1.51(0.92)	1.569(1.68)*
Inflation	-0.008(-1.39)	-0.017(-1.22)	-0.009(-1.67)*	-0.037(-2.19)**
Capital	1.053(1.99)**	1.147(1.99)**	0.864(2.80)***	1.006(4.89)***
Loans growth	0.353(0.409)	0.085(1.65)*	0.333(1.03)	0.130(1.64)*
ROE(-1)	0.21(1.49)	0.109(1.04)	0.482(3.11)***	0.557(4.76)***

Liquidity and capitalization are the other key variables determining performance of banks since the coefficients of liquidity and capitalization consistently bear the expected signs and are significant in the period before and after interest rate caps for all the models. The results are consistent with the opportunity cost theory in which case there is a trade-off between holding liquid assets and earning higher returns. The positive relationship between capitalization and bank performance signal the importance of higher levels of capital in lowering bankruptcy and funding costs and hence higher relative margins. This results are consistent with other previous studies, (Hallunovi and Kume, 2016; Petria et al., 2015).

Deposits and loans growth, inflation and GDP are significant in two of the models in table 5.1 and they bear the expected signs. The significance of GDP and inflation imply that both macro and bank specific factors are important determinants of bank performance. The negative relationship between inflation and bank performance implies that unanticipated cases of inflation dominate the anticipated cases, perhaps due to the vulnerability of the economy to supply shocks or inadequate capacity of banks to project inflation. Similar results were obtained by, Yuksel et al., (2018). Credit risk is however only significant in one of the reported models.

Table 5.2. Return on equity findings for large commercial banks

Dependent variable is Return on Equity	Period before interest rate caps Model 1 with mobile value Large banks (2009m03-2016m08)	Period after interest rate caps Model 2 with Mobile value Large banks (2016m09-2018m06)	Period before interest rate caps Model 3 with Mobile accounts Large banks (2009m03-2016m08)	Period after interest rate caps Model 4 with Mobile accounts Large banks (2016m09-2018m06)
Independent Variables	Coefficient(t-statistics)	Coefficient(t-statistics)	Coefficient(t-statistics)	Coefficient(t-statistics)
Credit Risk	0.165(1.138)	0.543(1.44)	-0.152(-1.90)**	0.134(1.09)
Liquidity	-0.408(-2.16)**	-0.717(-1.96)*	-0.184(-1.55)	-0.410(-2.05)
Size	0.519(2.52)***	2.161(3.60)***	0.334(1.91)**	0.265(1.29)
Deposits	-0.259(-1.24)	0.056(0.13)	-0.303(-1.86)*	-0.136(-0.53)
Mobile value	0.530(2.03)**	0.004(1.84)*		
Mobile accounts			-0.008(-0.43)	0.043(1.77)*
GDP	1.45(2.31)**	4.85(1.83)*	-0.098(-0.16)	1.791(2.16)**
Inflation	0.005(1.23)	-0.045(-1.82)*	0.005(1.25)	0.001(0.21)
Capital	0.084(0.428)	1.576(1.96)*	-0.188(-1.16)	0.264(1.23)
Loans growth	1.44(2.03)**	-0.454(-0.43)	1.423(1.62)*	1.713(1.83)*
ROE(-1)	0.674(3.22)***	0.078(0.27)	0.606(4.37)***	0.654(2.99)***

Table 5.2 reports the results for large banks. The results are generally similar to the results for all banks reported in table 5.1. The coefficient for value for mobile transactions is positive and significant in the period before and after interest rate caps. This result is a confirmation of the synergies obtainable through collaborative initiatives and partnerships, mainly involving large banks, which has dominated the Kenyan financial sector since the advent of M-Pesa products in 2007. Mobile financial services may have therefore increased the size of the financial services revenue pool rather than taking a share of the existing revenue pool. New products such as M-Kesho, Mshwari, KCB-M-Pesa, among others, offering savings and loans to mobile money customers have driven growth in revenue and the products are provided in partnership with these large banks, thus, assisting banks to attract business from a wider market including underserved segments of the population. As noted by Cook and Claudia, (2017), the new products created by Kenya's banks in the wake of M-Pesa have driven change in business models including a shift in focus to lower income consumers. Indeed, a number of some of these banks serve as agents of Kenya mobile money providers.

The coefficients of the number of mobile accounts displayed in the last two columns show an insignificant relationship with bank performance in the period before interest rate caps but a positive and significant relationship in the period after caps. The significant positive relationship may be signaling the heightened activity of collaboration and marketing drives of the commercial banks and mobile network operators targeting the millennium segments who continuously signal preference for new smart phones in the market and in response to increased competition from digital and online apps that have been expanding customer base.

Table 5.3. Return on equity findings for medium sized commercial banks

Dependent variable is Return on Equity	Period before interest rate caps Model 1 with mobile value Medium banks (2009m03-2016m08)	Period after interest rate caps Model 2 with Mobile value Medium banks (2016m09-2018m06)	Period before interest rate caps Model 3 with Mobile accounts Medium banks (2009m03-2016m08)	Period after interest rate caps Model 4 with Mobile accounts Medium banks (2016m09-2018m06)
Independent Variables	Coefficient(t-statistics)	Coefficient(t-statistics)	Coefficient(t-statistics)	Coefficient(t-statistics)
Credit Risk	-1.517(2.34)***	0.047(0.26)	-2.88(-2.77)***	0.082(0.70)
Liquidity	-0.336(-1.58)	0.220(1.98)***	-0.199(-0.68)	-0.462(-1.73)*
Size	1.111(1.95)**	-0.057(-0.26)	1.806(2.33)***	0.325(1.62)*
Deposits	-0.418(-1.53)	-0.106(-0.92)	-0.845(-2.07)	-0.437(-1.78)*
Mobile value	0.004(1.13)	1.961(1.79)*		
Mobile accounts			0.046(1.07)	-0.821(-1.56)
GDP	-2.30(-1.29)	-0.2.08(-1.55)	0.988(0.37)	-0.050(-1.53)
Inflation	-0.330(-0.54)	0.857(0.40)	0.205(0.22)	1.987(0.90)
Capitalization	0.798(1.84)**	0.583(1.78)*	1.244(1.91)**	0.679(2.37)**
Loans growth	0.888(1.60)*	0.070(1.46)	1.539(1.76)*	-0.034(-0.69)
ROE(-1)	0.682(5.88)***	0.558(2.68)***	0.598(2.58)***	0.499(2.49)***

The results further suggest that bank specific factors and macroeconomic factors determine bank performance similar to the conclusions reached when data for all banks is considered. The coefficient of the size of the bank, growth of loans and GDP are positive and significant in three of the reported models and in the period before and after interest rate caps while the coefficient of liquidity is negative and significant in two of the reported models in table 5.2. The positive significant coefficient for bank size is consistent with the assumption that large sized banks benefit from economies of scale and scope hence higher product diversification and better access to clients. This result finds support in Trofimov et al., (2018). The positive impact of loans is not surprising since interest on loans is one of the sources of revenue for banks. The results also imply that loan growth is not accompanied by loose lending conditions. Similar result was reported by Dang, (2019).

The results for medium sized banks reported in table 5.3 show considerable divergences from previously discussed results in tables 5.1 and 5.2. In this case, only bank specific factors and value of mobile transactions are important in explaining performance of medium banks and the response of bank performance to these factors is different. For instance, while the value of mobile transactions is positive in the period before and after interest rate caps but it is significant only during the period of interest rate caps. The significance of the coefficient of value of mobile transactions may be attributed to the fact that a number of banks in this category entered into considerable strategic alliances with digital platforms since 2015. For example in 2017, usage of the visa development platform enabled about five banks in this category to integrate the mVisa API (Application Program Interface-allows applications to communicate with one another) directly into their mobile banking apps. The results for the mobile accounts-bank performance relationship are similar to the results reported in tables 5.1 and 5.2.

Table 5.4. Return on equity findings for small sized commercial banks

Dependent variable is Return on Equity	Period before interest rate caps Model 1 with mobile value Small banks (2009m03-2016m08)	Period after interest rate caps Model 2 with Mobile value Small banks (2016m09-2018m06)	Period before interest rate caps Model 3 with Mobile accounts Small banks (2009m03-2016m08)	Period after interest rate caps Model 4 with Mobile accounts Small banks (2016m09-2018m06)
Independent Variables	Coefficient(t-statistics)	Coefficient(t-statistics)	Coefficient(t-statistics)	Coefficient(t-statistics)
Credit Risk	0.001(0.01)	-4.144(-2.60)***	-0.107(-2.57)***	-2.057(-2.60)***
Liquidity	-0.092(-0.47)	0.601(2.02)**	0.017(0.19)	0.299(1.66)
Size	0.558(1.62)*	7.306(3.20)***	-0.09(-0.46)	5.380(4.84)***
Deposits	0.250(3.02)***	1.514(1.75)*	0.110(2.01)**	0.904(1.96)
Mobile value	-0.008(-1.30)	-0.002(-0.41)		
Mobile accounts			-0.006(-0.27)	-0.144(-3.22)***
GDP	-1.853(-0.86)	-0.023(-0.17)	-1.565(-1.46)	0.022(0.45)
Inflation	-0.299(-2.40)***	3.986(1.04)	-2.80(-1.74)*	-0.098(-0.47)
Capital	0.457(1.77)*	-0.147(-0.20)	0.301(2.58)***	-0.277(-0.71)
Loans growth	-0.055(-0.71)	-4.381(-0.94)	-0.075(-1.38)	-3.61(-2.97)***
ROE(-1)	0.541(7.08)***	-0.225(-0.62)	0.759(11.58)***	-0.208(-1.38)

Similarly, while credit risk was not significant in influencing bank performance for all banks and large banks in both the period before and after interest rate caps, in this case, credit risk is significant in the period before interest rate caps. This result implies that banks in this category may have experienced high non-performing loans leading to low profitability measured by return to equity. The result also reflects the developments in the market during the period under study, mainly, the placement of three banks in this category under receivership, with possible temporary effects on the aggregate profitability of banks under the category. Other important factors with

consistently significant relationship include capitalization and loan growth. However, GDP and inflation were found to be insignificant in all the models considered.

The results that used data for small sized banks are reported in table 5.4. The results differ significantly from all the previous results for most of the variables under study. The coefficient for mobile banking indicators are all negative but significant in only one model. The negative relationship may be attributed to the fact that small sized banks have limited sources of funding required for initial development of information management systems, investment in technology and creating brand recognition. Moreover, small banks have cost limitations than large banks that have cost advantages due to economies of scale and scope in research and development as well as a higher clientele base in terms of deposits. The negative and significant coefficient of the number of mobile accounts during the period of interest rate caps may be attributed to the heightened marketing drive on adoption of digital financial services of the banks in other categories that signed strategic alliances with fintech companies after 2015.

Contrary to the results based on data for medium sized banks, both bank specific and macroeconomic variables affect small sized banks. Credit risk, size and deposits are important for small banks during the period before and after interest rate caps. The positive and significant coefficient of deposits signals the importance of the limited sources of funding for this category of banks. Unlike larger banks that have diversified internal and external sources of funds.

5.0.2. **Survey Results**

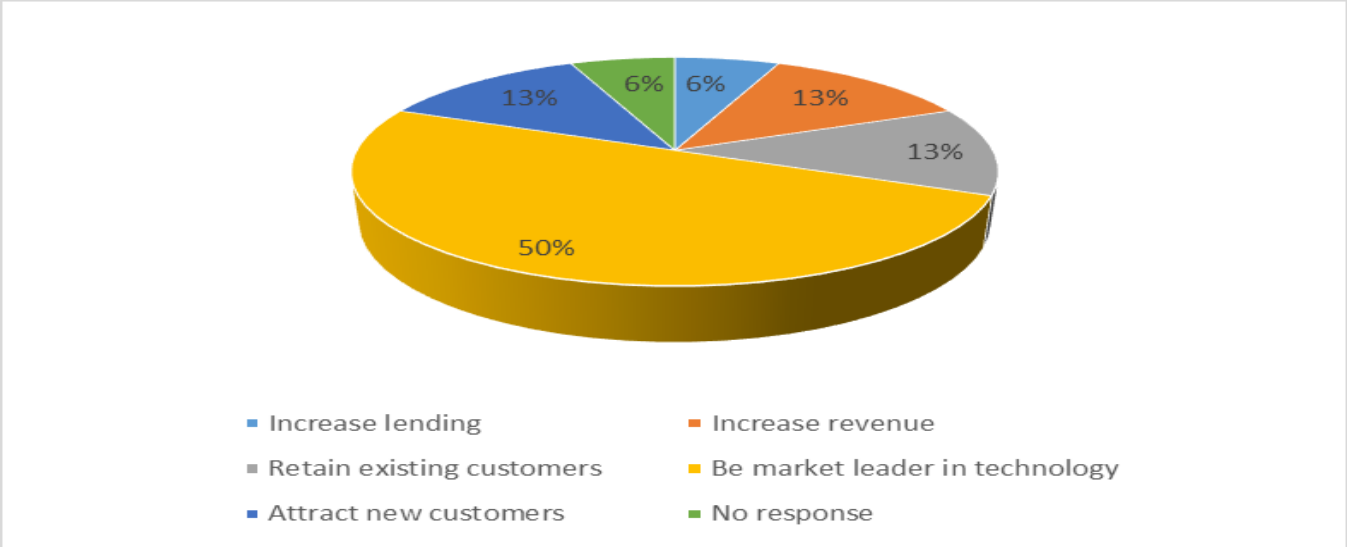
In this section, we provide findings obtained from a survey on digital products and services offered by commercial banks and non-bank digital lenders. Against a backdrop of increasing uptake of technology-based services by commercial banks and rapid growth of other digital financial providers in the financial landscape, the survey sought to understand the linkages between commercial banks and non-bank lenders as well as challenges and opportunities in supply of digital products and services.

5.0.2.1. **Key findings on commercial banks and non-bank lenders survey**

Digital lending by banks and credit-only financial institutions

The study showed that while 67 percent of the banks offered digital lending services, only 42 percent of the respondents offered digital loans in the non-bank credit only category. However, 22 percent of the commercial banks respondents did not offer digital lending but offered digital based services, that is either mobile or online banking services. The remaining 11 percent of the commercial banks respondents did not offer any digital financial services but indicated they had plans to offer them in the next 2 years. While commercial banks have been offering digital services for more than two years, most of the non-bank credit only institutions respondents started offering digital loans 1 year ago.

Figure 5.1: Reasons for going into Tech-based products

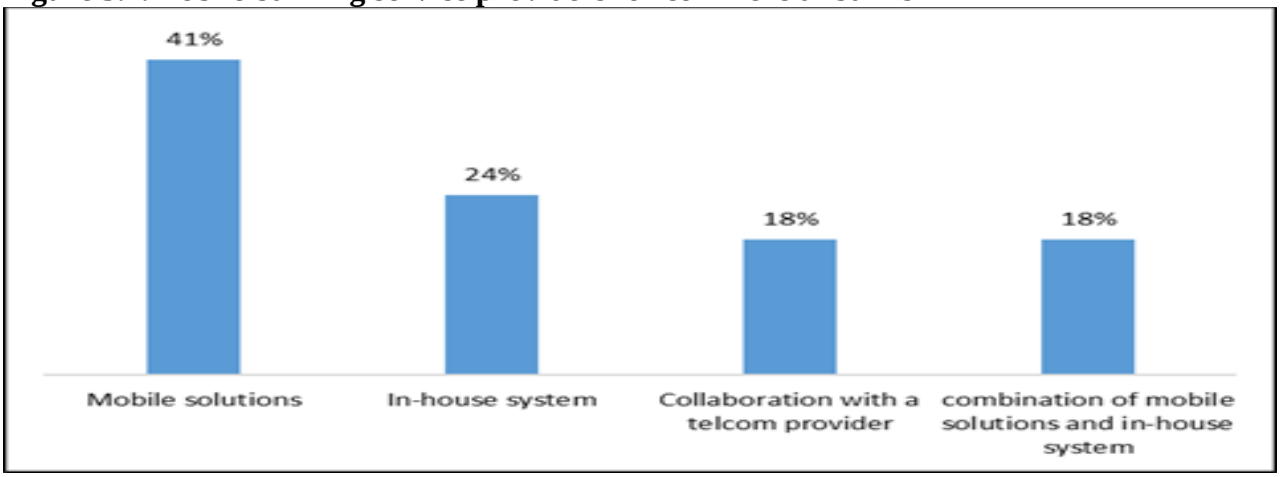


The general trend shows that banks are diversifying into tech-based services for reasons of revenue, accumulation of assets, capturing new market and retention of customers. 50 percent of the banks that offered digital lending did so to become market leaders in technology (Figure 5.1). A majority of the respondents of non-bank credit only providers cited the desire to increase lending, attract new customers while preserving existing client base as the main reasons for offering digital loans.

Reaction of commercial banks to entry of new financial players

Analysis of how commercial banks have reacted to entry of new financial players show that 80 percent of them considered it as an opportunity while 10 percent viewed it as both an opportunity and a challenge and only 10 percent regarded it as a challenge. Evidence of this analysis is manifested in seized opportunities where commercial banks obtained 65 percent of their mobile banking services from mobile solution providers and in-house systems while 18 percent obtained services from collaboration with telcom providers as illustrated in figure 5.2. Commercial banks believe that the presence of digital financial services will improve service delivery, avail more products to consumers, reach the unbanked population and increase competition, which breeds efficiency in the banking sector. One bank viewed increased activities of digital financial providers as a challenge as it increased unhealthy competition.

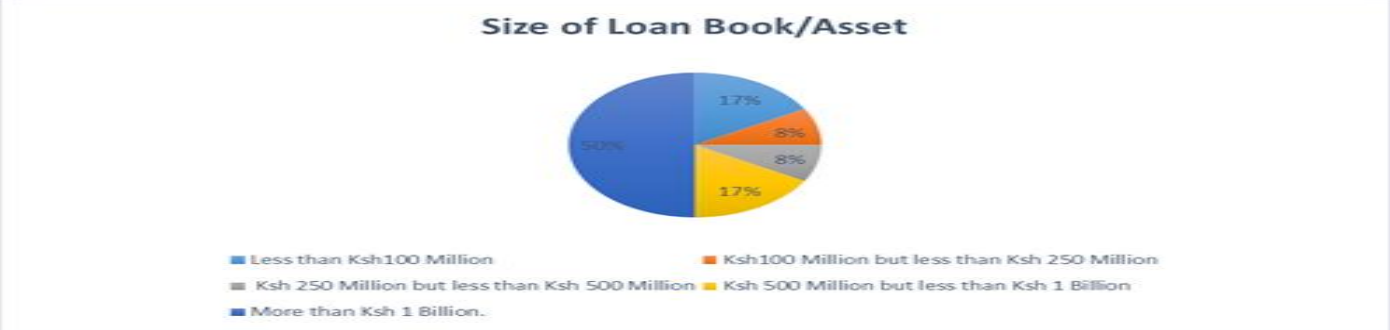
Figure 5.2.Mobile banking service providers for commercial banks



Digital loans as a share of total banking sector loans

The results from the banking industry and the non-bank credit-only lenders indicated an increasing trend in the number of mobile and online users over the last three years. However, the uptake remains less than 30 percent of the customer base for most banks for online banking, whereas, the uptake has done better for mobile banking with more than 30 percent, (up to over 70 percent for some banks) of their customer base. The low uptake of technology-based services as perceived from the supply side is due to, security concerns, lack of trust in technology based services and banking needs met through other channels. The stocks of mobile loans lent out by each commercial bank in the sample was above 1 billion annually and the stock of loans lent out through digital platform was on the increase from an average of 10 million in 2015 annually per credit provider to over 200 million in 2018. In figure 5.3, we provide further analysis, which illustrates that, about 50 percent of digital credit-only providers have over 1 billion of loans as a proportion of total assets. The increased digital lending operations within the past one year would partly be attributed to the gap created by constrained lending by banks due to interest rate caps, especially to MSMEs, which is perceived as risky. Nevertheless, in both cases, the proportion of lending is less than 1 percent of total banking sector loans.

5.3. Size of loans for non-bank credit only providers



Characteristics of the digital loans

The amounts borrowed seemed similar across commercial banks and non-bank credit only providers. 20 percent of the respondents for the non-bank credit providers indicated that their average digital loan was less than KSh 5000 while 40 percent of the respondents indicated that their average loan was between KSh 5000 and KSh 10,000. The remaining 40 percent average loan book was above KSh 10,000 but below KSh 100,000. For commercial banks, majority (60 percent) of the borrowers were between KSh 10,000 but below KSh 100,000 whereas 40 percent were between Ksh 5000 and Kshs 10000. It was evident that over 90 percent of borrowers in both commercial banks and other digital providers were below 35 years, implying digital products appeal mainly to the younger generation. The main holder categories in both cases were individuals (personal), followed by Micro, Small and Medium Enterprises. The digital loan tenure spanned from 15 days to 6 months holding. Surprisingly, some respondents of non-bank credit only loan providers indicated a low default rate of about 1 percent.

Pricing of loans by credit-only institutions

The results show that the pricing of loans differed significantly for commercial banks and non-bank credit lenders. On average, interest rate charged on loans by the non-bank credit lenders respondents is about 5.5 percent per month, translating to an annual interest rate of about 70 percent. This is nearly five times higher than the interest rate charged by commercial banks, which is 13 percent, and SACCOs, which is about 12 percent. Commercial banks offered digital loans at a rate between 10-20 percent, indicating the influence of the interest rate caps. In addition to the high interest rates offered by non-bank digital credit providers, the respondents also indicated that non-bank credit providers charge other forms of fee, mainly, insurance and facility fee. About 83 percent of the

respondents are charged at least one additional fee while 50 percent of the commercial banks imposed additional fees such as facility fee, excise duty and insurance fee on the digital loans.

Source of funds for non-bank credit providers and use of credit reference Bureaus

Two other observations were made regarding non-bank credit providers on their use of credit reference bureaus and where they got their funding. Most of the respondents indicated that they shared information with credit reference bureaus (CRBs) on a monthly basis. The respondents indicated that they informed their clients that they would share lending history with CRB's during the loan on boarding stages. Most of the respondents indicated that they communicated with their clients mainly through telephone calls, emails and face-to-face meetings. The non-credit providers also indicated that their main source of funding included, local commercial banks, offshore banks/investors and own capital. In addition, the respondents indicated that they have adequate funds to satisfy daily customer demand of loans.

Views on regulation of non-bank credit only lenders

More than half (60 percent) of the respondents for non-bank credit only lenders supported regulations that could improve digital lending services in Kenya while the remaining 40 percent opposed regulations. Some of the specific reasons for supporting regulation include, the need to improve accountability, encourage responsible lending and transparency and the need for some basic standards to protect the customer. Those who opposed introduction of regulations argued that regulation could lead to interest rate caps, which could result in customer discrimination particularly, low income earners. All the respondents (100%) from commercial banks supported imposition of regulation (Standards and policies) in the provision of digital lending to reduce exposure to cases of fraud and enhance consumer protection. Regulation would also promote a level playing field and increase the ease of interoperability between players, prevent anti-money laundering, cybercrime and customer exploitation by Fintechs.

Suggestion on improvement of digital financial service provision

All the respondents were of the view that the business environment would improve if, regulators considered setting up a real time reference database from which lenders may determine how many loans a customer holds at any given point in order to avoid over-lending/exposure. Commercial banks particularly felt that it was important to regulate other digital credit providers for the business environment to be improved. Other suggestions included, the need to educate consumers on costs and fees associated with online loan facilities since it was felt they lack understanding on costs associated with such loans. It was also proposed that it would be prudent to build better mechanisms to ensure protection of consumer privacy and data and consider the customers who have no rating in the bureau.

6.0. Conclusions and policy implications

Kenya earned a label of the global pioneer of fintech/digital financial models following the advent of its celebrated M-Pesa and the subsequent rapid evolution of the financial landscape with progressive adoption of advanced technologies. Facilitated with the latest models of smart phones, mobile apps, new technological and financial innovations, the financial system has witnessed the fastest proliferation of new business models, new financial instruments, products, services and new players, mainly, non-bank institutions performing bank-like functions in the financial system. The new digital financial entrants in the financial landscape initially focused on payments and then expanded into credit, savings, insurance and investment. Suddenly, the Kenyan customer has a wider menu of not only customer-centric financial products and services to choose from but can afford to discriminate among diversified options of financial lending institutions. A development that has seen traditional banks shift their traditional static mode of conducting business to dynamic engagements including entering into partnerships

with telecommunication companies, developing stand-alone fintechs and adopting other mobile solutions. All these developments occurred amidst an equally changing policy and regulatory financial environment with the introduction of interest rate caps in 2016.

Against this background, this study sought to understand the impact of digital financial services on the performance of commercial banks. Based on secondary data and using panel data methods, the study examined the impact of digital financial services on the performance of all commercial banks across the three bank tiers during the period before and after interest rate caps. In addition, the study used primary data to analyze digital financial services in commercial banks and credit-only institutions.

In the secondary data study, digital financial services were proxied for by value of mobile transactions and number of mobile accounts. Generally, the findings are different across bank tiers except for all banks and large banks and they exhibit sensitivity to the two indicators of mobile transactions. Whereas, the results for all banks and large sized banks show a positive and significant relationship between the value of mobile transactions and performance in the period before and after interest rate caps, the relationship is positive and significant only during interest rate capping period for medium sized banks and negative but insignificant for small sized banks. The results show a positive but insignificant relationship between number of mobile accounts and performance for all banks but a significant linkage for large banks during the interest rate capping period. The relationship between the number of mobile accounts and bank performance is insignificant for medium sized banks but it is negative and significant during the interest rate capping period for small sized banks. The results further show that both macroeconomic factors and bank specific factors explain bank performance for all banks, large and small sized banks while only bank specific factors are significant for medium sized banks.

The findings of the primary analysis show that commercial banks are diversifying to tech based services mainly to be market leaders in technology adoption, to acquire new customers as well as maintain existing ones. Whereas, interest rates on digital loans for commercial banks, which average between 10-20 percent, are contained within the interest rate caps, non-bank credit only banks charge unregulated interest rates averaging about 5.5 percent per a month, which translates to approximately 70 percent per annum in addition to other charges such as insurance and facility fee. This result reveal that that either customers are not adequately equipped in terms of information, are ignorant of their rights, are desperate and only focused on accessing funds regardless of the terms and conditions, or there would be big gaps between people and technology. It is thus critical to develop policies that bridge the gaps between people and technology and further empower customers through provision of all available information on financial services and products by all players.

Generally, commercial banks do not view digital entrants into the financial space as competitors with 80 percent of respondents indicating that they viewed the entry of digital financial services into the system as an opportunity to widen customer base, improve efficiency of service delivery and improve scope of products and services available to customers including the unbanked. This implies that digital financial services are complementary to commercial banking business. However, banks resistant to process disruption and service transformation will find it increasingly difficult to maintain their current operating models with the rapidly evolving technology and customer expectations. The results also show that although lending by non-bank credit only institutions is increasing, the market share is still very small constituting less than 1 percent of the entire sector loans. The results further showed that over 90 percent of clients of credit only loans are millennial with loan tenures of 15 days to 6 months and that medium, small and micro enterprises and personal loans constitute the most dominant type of clients. This finding confirms that, to some extent digital financial services have indeed reached previously shunned and excluded market segment of borrowers. However, there are caveats to this conclusion since it is possible that usage of smart phones, which are mainly affordable by middle income earners, may actually exclude low income earners further from accessing loans. Moreover, a majority of low income earners have no access to internet and internet charges are very high even for those who can access it.

The results further show that non-bank credit-only loan providers obtain funds for lending from local commercial banks, offshore banks and own funds. While funds obtained from commercial banks constitute part of the local credit growth, funds sourced from elsewhere without passing through the local commercial banks may be flowing as credit to the private sector but not necessarily reflected in private sector growth numbers since they are not regulated. The results also showed that the default rate in the non-bank credit only providers is low at around 1 percent of all the loans lent. While all commercial bank institutions supported regulation of unregulated digital financial services, 40 percent of the non-bank credit only regulators opposed regulation because of fear of being subjected to interest rate caps, which in their perception, would close out low income earners from accessing loans.

While it may be too early to make strong conclusions on the fintech-bank relationship given the fluid nature of innovation and the uncertainty of consumer preferences and trends of technology, the insights from this study raise a number of research questions requiring answers. First, the results indicate huge potential for efficiency gains, however, not much is known in terms of possible risks and the requisite rules and limits of regulation. Questions on the delicate balance between promoting innovation and mitigating risks through stringent regulations is still at large. It may be prudent for all stakeholders to be actively involved in communication and dialogue with one objective of supporting innovation processes while at the same time protecting the customer. Second, this analysis mainly focused on the supply side of digital financial services, very little is known on the demand side. It may therefore be instructive for researchers to invest in understanding the customer side of the developments in the financial market such as the impact of digitalization on the consumer choices in retail banking.

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Appendix 1: Conceptual issues on fintech

No consensus exists on the definition of financial technology or Fintech. As expected with all emerging innovations that are continuously fluid and dynamic, it may be over expecting to lay a frame on one particular definition encompassing such a 'moving target' from the outset. However, given that this term was first used in the 1970's and gained popularity outside the finance world since 2007, some definitions have been developed by players in the financial market, the academia and financial industry practitioners, among others. Notably, Schueffel, (2016) who reviewed 200 articles referencing the term fintech over a period of 40 years concluded based on 13 commonalities of peer reviewed definitions of the term that fintech is a new financial industry that applies technology to improve financial activities. Analysis of this and other definitions in the literature reveal that in practice, usage of technology in finance is as old as 1866 when the transatlantic telegraph was laid and this evolved to digitalization of traditional financial services that dominated the financial landscape from 1967 to 2008. The evolution of technology adoption in finance was mainly enhancing to the banking system until 2008. Thereafter, a new wave of fintech emerged where start ups and technology firms supplant banks in providing niche services to the public, businesses and banks themselves, engage in borderless and contactless operations, and use hard data to provide customer-centric services resulting in a shift in customer mindset as to who has the resources and legitimacy to provide financial services. (Didenko, 2018; Cai, 2018; Thomas and Morse, 2017; Buckley et al., 2016). Although this fintech provide bank-like activities, they are not subjected to commercial bank or telecos regulations and as pointed out by Didenko, (2018) may not easily fit in the existing regulatory framework.

In Kenya, there are three dominant models reflecting the reaction of traditional banks to fintech. The first model such as KCP MPesa and MShwari is based on collaborations between commercial banks and telecommunication companies while the second one uses independent mobile virtual network operators (MNVO) such as Equitel. The third model such as Tala and Branch developed stand-alone smart phone apps. While in practice, it may appear that some commercial banks now perform similar functions as present day fintechs, fintechs are still distinct from commercial banks since they are not regulated by similar laws regulating banks, physical contact dominates the lending model of banks, fintechs perform some functions in the banking value chain through direct lending and most fintech focus on one component or components of the banking value chain. The integration of technology into finance by banks in previous application of technology to finance before 2008 thus differs from the current usage of fintech, which refers to the recent technological development in finance, such as online peer-to-peer lending platforms or automation of robo-advisory services, (Didenko, 2018). This study acknowledges the complexity of fintech and the difficulty expressed in the literature in obtaining a common understanding and a fully accepted definition of fintech, given its fluidness, and thus adopts the scientific definition in Schueffel, (2016).

Appendix 2: Glossary

Term	Definition
Fintech	Financial industry that innovatively delivers financial services (Banking; Payments; Financial data) using technology
Artificial Intelligence (AI)	Artificial intelligence may be defined as the development of computer systems to perform tasks that ordinarily require human intelligence Machines learn from data and can identify relationships not predicted by theory
Big data	Creation and maintenance of huge data base containing characteristics and transactions of billions of economic agents and their use through advanced algorithms to derive patterns. The patterns are used to predict behavior and prices, target offers and mimic human judgement in automated decisions
Robo-adivisory	A financial product relying on AI and ML to provide automated personalized investment advice and, with the customer's agreement, automated portfolio selection and rebalancing based on each investor's goals, financial assets, and risk tolerance
Shadow banking	Shadow banking refers to non-banking entities that provide services similar to traditional commercial banks but outside normal banking regulations
Crowd Funding	The practice of funding a project or venture by raising small amounts of money from a large number of people, typically via the Internet
Block Chain	A chain of blocks that contain information . it is a growing list of records called blocks linked by using cryptography. Each block contains a cryptographic of the previous block, a time stamp and transaction data.
Peer-to-peer	Lending platforms that facilitate the provision of loans by individual investors rather than financial institutions
Distributed ledger technology	Digital system for recording transaction of assets in which the transaction and their details are recorded in multiple places at the same time. Distributed ledger have no central data store; Set of replicated , shared and synchronized digital data geographically spread across multiple sites, countries or institutions
Crypto-currencies	Cryptocurrency is an internet-based medium of exchange which uses cryptographical functions to conduct financial transactions. Cryptocurrencies leverage blockchain technology to gain decentralization, transparency, and immutability. The transactions are not controlled by any central authority

	and cryptocurrencies can be sent directly between two parties via the use of private and public keys with minimal processing fee
Bitcoin	It is a crypto-currency. Digital currency not backed by any country's central bank or government. It is a decentralized digital currency without a central bank or single administrator that can be sent from user to user on the peer to peer bitcoin network without the need for intermediaries
Algorithm	A process or set of rules to be followed in calculation or other problem solving operation especially by computers