FinTech and the COVID-19 Pandemic: Evidence from Electronic Payment Systems

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Abstract

This paper investigates the effects of the Covid-19 pandemic on financial institutions and consumers' adoption of FinTech in payments. We find that the pandemic: [1] Initially had a negative impact on the adoption of FinTech, but favorable short-term regulatory changes have reversed some of the negative effects [2] The use of all electronic payment cards has significantly declined during the pandemic except for charge cards. We find an increase in the use of charge cards as consumers shift towards cheaper forms of payment [3] The pandemic has magnified interbank contagion and liquidity risks and has reduced both domestic and international electronic fund transfers via RTGS. The pandemic has also resulted in a deterioration in the quality of commercial banks' assets and balance sheets [4] Remittance inflows via FinTech platforms have significantly declined reflecting contractions in global economic activities.

JEL Classifications: E58, E52, E32, G20, G21, G28, G32, O55, O16, O33

Keywords: Covid-19, Coronavirus, Fintech, Mobile Payment, Central Banks, Financial Intermediaries, Financial Technologies, Banks, Interbank transfers, Diaspora Remittances, Settlement and Liquidity risks, clearing houses, financial stability, Pandemic, M-PESA, Digital Banking.

*__Email:__ dtut@ryerson.ca: This paper will be updated as more data come in, feedback is welcomed!!

1 Introduction

We study the short-term effects of the Covid-19 pandemic on electronic payment systems. In particular, we address the question on whether the Covid-19 pandemic has facilitated the adoption of FinTech platforms in payment. The Covid-19 pandemic has impacted the ways in which banks' clients access financial products and services. Electronic payments, including mobile banking and other FinTech platforms, are important determinants of the cyclical position of the economy and are indicators of economic growth (Aditya et al 2019, Baker 2018, Galbraith and Tkacz, 2007). Electronic payments are also a unique source of information for short-term forecasting (Aprigliano, Ardizzi and Monterforte, 2019) and are therefore useful in assessing the impacts of extreme events, such as the ongoing Covid-19 pandemic on consumers' choices and spending patterns[1].

To examine whether the Covid-19 pandemic has accelerated the adoption of FinTech and other related digital platforms in payments, we focus on a country that has significant investments in FinTech and a significant fraction of the population using mobile and digital banking: Kenya. Approximately 80% of Kenya's adult population widely uses mobile banking for purposes such as opening a bank account, executing bank account transactions, purchasing pre-paid phone credit, obtaining micro-loans and short-term loans, paying utilities bills, peer-to-peer lending and for purchasing groceries (Jack and Suri, 2011, 2014)[2]. While there are several banking platforms, the most dominant banking digital platform is M-PESA[3]. The platform uses a simple short messaging service(SMS)

[1]Some important works in the use of payment data for forecasting include: Carlsen and Storgaard, 2010, Esteves, 2009, Galbraith and Tkazc, 2009, Hopkins and Sherman ,2020, on using payment data in forecasting

[2]The adoption of FinTech has partially been driven by limited number of bank branches and ATM machines. As of 2020Q1, there are only 1,255 bank branches and 2,423 ATM machines in a country the size of Belgium and France combined

[3]Note that "M" stands for mobile and "PESA" is a Kiswahili word meaning "Money". M-PESA therefore translates to "Mobile Money".

technology and mobile banking agents exchange cash for "e-money" that can then be transferred from one account to another. M-PESA also issues receipts per transaction, which in a country with weak legal institutions significantly reduce ex-post transaction costs[4]. Commercial banks in Kenya have partnered with FinTech platforms such as M-PESA and provide a wide range of financial services via these channels.

In this paper, we first address the question: What are the effects of the Covid-19 pandemic on the adoption of mobile banking and related digital platforms? We examine both the transaction values and transaction volumes and find that mobile banking transaction values declined by 6.98% between December 2019 and April 2020 and declined by 15.5% between March and April 2020. The results demonstrate that the Covid-19 pandemic has had an adverse effect on both the transaction values and transaction volumes of mobile banking. Interestingly, we find that between March and May 2020, the number of mobile banking agents increased by 8.48%, suggesting that the Covid-19 pandemic has facilitated consumers' onboarding into the FinTech space. And that financial intermediaries are responding to expected future changes in the forms of payments during the ongoing Covid-19 pandemic. The estimated increase in transactions per account between April and May 2020 is approximately 7.26%. And the estimated in increase in transaction value per agent is about 15.64%. We also find that there is a 16% increase in mobile banking transactions and an 8% increase in the value per transaction between April and May 2020 following short-term regulatory measures. These measures include increase in daily limits and eliminaton of fees and charges. The government required that commercial banks eliminate all charges related to transfers between mobile money wallets and bank accounts and to also eliminate all charges for balance enquiries on all FinTech platforms[5]. The government also reclassified the tax brackets on mobile banking transactions. These results suggest that the adoption of FinTech and other digital

[4]Mas and Morawczynski, 2009

[5]See Central Bank of Kenya(CBK), Press Release, March 2020

platforms combined with favorable regulatory measures might weaken or reverse,to some extend, the adverse effects of the Covid-19 pandemic on the economy.

Second, we examine how the covid-19 pandemic has impacted the use of electronic payment cards[6]. In 2013, Kenya shifted away from magnetic strip based cards to EMV chip enabled cards. This led to an increase of 11.3% in the use of electronic payment cards between 2013 and 2020. Our results show that between March and April 2020, credit cards transaction values declined by 26.84%, debit cards values declined by 32.4%, POS machines values declined by 41.86%, prepaid cards declined by 47.5%. However, we find that while charge cards' values initially declined by 16.7% between March and April 2020, there is a 50% increase in charge cards' values between April and May 2020. The results show that charge cards are becoming an attractive form of payment to the average consumer. Charge cards do not charge interest on outstanding amount, a consumer is only required to settle the full amount at due date. Overall, our results show that there is a decline in both the values and volume of payment cards during the Covid-19 pandemic. The results on electronic payment cards suggest that the Covid-19 pandemic has dampened consumers spending behaviour and usage of electronic cards. Consumers' are also shifting away from high interest forms of payment towards low interest forms of payment[7].

Third, our results show that the Covid-19 pandemic has increased operational costs amongst commercial banks and other financial intermediaries. We find that Tier 1 banks in Kenya have restructured loans equivalent to 13.02% of their total book value. These banks

[6]Although there is no definitive definition of FinTech, our working definition is based on FSB: that is as "technologically enabled financial innovation that could result in new business models, applications, processes or products with an associated material effect on financial markets and institutions and the provision of financial services". https://www.fsb.org/work-of-the-fsb/policy-development/additional-policy-areas/monitoring-of-fintech/

[7]This is an important shift in consumers' spending behaviour as the average monthly interest rate in Kenya on a credit card is about 3.5%. Banks receive a spread of about 11%, which is 40% above the global average. Shift towards cheaper form of payment indicates that the Covid-19 pandemic has increased the marginal value of the shilling for the average consumer.

also experienced an average increase of 12.65% in non-performing loans and an increase of 185% in loss provisions in the first quarter of 2020 when compared to the first quarter of 2019. External rating agencies have downgraded or revised their outlook on all Tier 1 banks to negative[8]. And at least 38% of Tier 1 banks have reneged on already declared dividends. There is also a significant increase in cost-to-income ratios amongst commercial banks, reflecting low net interest margins due to the Covid-19 pandemic. The overall effect of the Covid-19 pandemic on commercial banks is deterioration in banks' assets quality and overall balance sheets.

Fourth, we examine how the Covid-19 pandemic has impacted interbank linkages and interbank liquidity flows via real-time gross settlement system (RTGS) and via the automated clearing house (ACH). We document that the decline in values and volumes via RTGS between March and April 2020 are approximately 21.97% and 7.96% respectively. We also find that the decline in transaction values via the clearing house is approximately 29.8% for debit cheques and 25.3% for credit electronic funds transfers. We also find an average decline in values of 37.4% in foreign denominated currencies between March and April 2020. Additionally, we document a decline in the number of interbank money market deals and a decline in the values of interbank money market deals during the Covid-19 pandemic. The results from RTGS and ACH suggest that the Covid-19 pandemic has had a significant adverse effect on domestic, regional and international interbank liquidity flows and has potentially compounded credit and settlement risks in Kenya's financial system[9].

We also examine how FinTech and related digital platforms have accelerated global transmission and propagation of the Covid-19 pandemic shocks. In Kenya, a large fraction

[8]In general, there is an inverse relationship between bank's capitalization and credit rating- Gambacorta and Shin, 2018.

[9]These results combined with deteriorating banks' asset quality are consistent with the notion that outbreaks have a contagion effect: Bae, Karolyi and Stulz 2003, Allen and Gale 2000, Bhagwati 1998, Kaminsky and Reinhard 2000, Cabrales, Gale and Gattardi, 2016

of diaspora remittances are transfered via M-PESA and other digital platforms[10]. Remittances are important as they mitigate the effects of shocks on consumption, that is remittances act to smooth consumption (Yang and Choi, 2007). A significant fraction of Kenya's population is vulnerable to external shocks which induce income fluctuations (Aker and Mbiti, 2010). Kenya is a net remittance receipient and remittances constitute about 4% of the GDP. Assessing how the Covid-19 pandemic has impacted remittances is crucial in understanding the potential effect of the Covid-19 pandemic on the adoption of FinTech. We document that there is a decline of 9% in remittance inflows between March and April 2020. Most of the decline is attributable to early shut down measures in Europe and in the rest of the world. We also show that there is a slight upward trajectory in remittance inflows between April and May 2020, attributable to the 2.78% depreciation of the Shillings against the US. dollar[11]. The results show that the uncertainty associated with both the nature and the potential pathways of the Covid-19 pandemic has significantly dampened economic activities globally and that these shocks are manifested in Kenya via the decline in remittance inflows.

Our analysis considers the effects of the Covid-19 pandemic on electronic payment systems, financial intermediaries and FinTech platforms such as mobile banking in Kenya. There are several important reasons why Kenya can serve as a natural experiment. Kenya is a small indebted emerging open market economy, with 54% of the domestic debt held by closely linked domestic commercial banks. The ratio of commercial banks relative to the population(adult) is about 0.79(1.5), the highest in Africa, implying that the country is significantly overbanked. Commercial banks' assets constitute about 49.5% of nominal

[10]This include "Poapay", "Simbapay, "Jambo Global","Mshwari" "Wave". For a broader access to the local market, International leaders in forex exchange and cross-border money transfers such as the Western Union have partnered with local FinTech platforms.

[11]The shilling has depreciated by 5.46% against the US dollar between March and July 2020- Central Bank of Kenya, 2020

GDP. Kenya also has the highest usage and adoption of moble banking and Fintech platforms in Africa. The banking sector, digital platforms and the stock exchange are interlinked through the Central bank's managed automated clearing house and real-time gross settlement system. This suggests that Kenya's financial system is susceptible to potential contagion risks arising from the Covid-19 pandemic. Additionally, Kenya is the third largest economy in the Sub-Saharan Africa and has strong trade ties with the Eastern and Southern African regions, Europe, North America and Asia- particularly with China. As these trade partners face severe shocks and contractions, Kenya is likely to experience weakening economic environment, lower net exports and lower investments flows[12], which will impact the adoption of FinTech and other digital platforms. As a result, Kenya can serve as a natural experiment for showing the effects of Covid-19 pandemic on electronic payment systems, FinTech and digital platforms banking in an emerging economy.

Our paper makes several contributions. First given the recency of the Covid-19 pandemic, there is very little work on the effects of the Covid-19 on the FinTech space and electronic payment systems. Our paper, to our knowledge, is the first to document that Covid-19 pandemic has had adverse short-term effects on the use of mobile banking and related digital platforms but that favorable regulatory measures and environment will not only facilitate onboarding and adoption of FinTech in banking, but will also potentially mitigate the adverse effects of the Covid-19 pandemic. Our results make a significant contribution to the larger literature on technology as a positive engine for economic growth (Demirgüç-Kunt, Klapper, Singe, Hanser and Hess, 2018, Philipon 2016, Rysman and Schuh, 2017). Our results on electronic payment systems is complementary to studies that show that such systems are important in monitoring macroeconomic conditions and are determinants of the cyclical position of the economy(Aditya et al 2019, Aprigliano et al., 2019 and Baker 2018). We also contribute to the literature on contagion and interbank risks (Bae, Karolyi and Stulz, 2003,

[12]Kenya's 2020Q1 growth declined by 5.5% when compared to 2019Q1. GDP estimates has been revised down to only 1.6% from an initial estimate of 5.9%- Central Bank of Kenya and Cytonn MPC Report, 2020

Degryse and Nguyen 2017, Allen and Gale 2000, Van Lelyveld and Lierdorp 2014, Diamond and Dybig, 1983), showing that the Covid-19 pandemic has had a negative effect on banks' asset quality. We also document a decline in remittance inflows thus contributing to the larger literature on the role of remittances in consumption-smoothing (Jack and Suri, 2014, Yang and Choi, 2007, Asharaf et al. 2015, Abdih et al. 2012).

The rest of this paper is organised as follows. Section 2 presents the data. Section 3 discusses and presents our empirical results. Section 4 concludes.

2 Data

We obtain our monthly data on electronic payments from the Central Bank of Kenya (CBK). Data on financial access and financial intermediaries are obtained from FinAccess Household Surveys and the FinAccess Geospatial Mapping Surveys. Data on the Covid-19 tests is obtained from Our World in Data. We obtain data on commercial banks from quarterly balance sheet reports, which are publicly available. Table 1 presents summary statistics for the period: January 2010 to May 2020. Given the strong economic and trade ties between China and Kenya (21% of imports originate from China), we define the Covid-19 pandemic event window as between December 2019 and May 2020. This is because the first cases of Coronavirus were reported in Wuhan, China in December 2019[13]. Our analysis also pay special attention to the, March-April 2020 window, which is considered to be the crux of the Covid-19 pandemic for the rest of the world as World Health Organization(WHO) declared Covid-19 as a Pandemic on 11^{th} March 2020.

Table 1 presents summary statistics of our variables of interest. Table 1 shows that between the period 2010-2020, the average transaction values of mobile payment is about 220.89 billions Kenyan shillings, which is approximately 2.08 billion US dollars at current market exchange rate. The distribution of mobile payment ranges from 130.7 billion Kenyan

[13]**Source:** World Health Organization(WHO): https://www.who.int/news-room/detail/29-06-2020-covidtimeline

shillings at the 25^{th} per centile and about 308.9 billions shillings at the 75^{th} per centile. Figure 1 shows that the rate of positive Covid-19 tests has been steadily increasing between March and July 2020. There was only one positive case in early March, cases increased to about 1,888 by the end of May 2020 and the figure currently stands at 15,600 in July 2020.

[INSERT TABLE 1 & Figure 1 ABOUT HERE]

3 Empirical Results:

3.1 Mobile Banking and Mobile Payments

The use of financial technologies has been significantly on the rise in Kenya. Figure 2 demonstrates that the use of mobile banking and other FinTech platforms is much higher and is being adopted at a faster rate than any other channel of financial access. The usage of mobile banking increased by 80% between 2006 and 2020, while the usage of traditional banks increased only by 30% over the same time period. This drastic increase has mostly been driven by the rise in 3G and 4G networks in the country and due to the associated low transaction costs (Rao, 2011, Jack and Suri, 2014). As a result, mobile banking has become an integral part of the financial system in Kenya. Mobile banking and other FinTech platforms are used by consumers to access short-term loans and micro-loans, for bank account transactions, transfer credit, peer-to-peer lending and for payment of general expenses such as utilities bills and groceries. Mobile banking platforms have also become an important tool for building a credit history especially for low income and regionally marginalized consumers[14].

[INSERT FIGURE 2 ABOUT HERE]

In this section, we address the effects of the Covid-19 pandemic on mobile banking in

[14]Similar results on demographic usage in FinTech are observed even in developed economies. For example in the US, millenials and younger generations are adopting mobile banking and other digital platforms at a much higher rate than the rest of the population-Crowe, Tavilla and Mcguire, 2017.

Kenya. We attempt to answer the following question: Has the Covid-19 pandemic accelerated the adoption of FinTech and other related digital platforms? There are two economic rationales why this question is important and why the effects of the pandemic on the adoption of FinTech, such as mobile banking, are ex ante not obvious. Firstly, it could be the case that the pandemic has led to an increase in the use of mobile banking, driven by the ease of use, limited access to traditional banks due to restrictions in hours of operation and an increase in short-term demand for essential goods. Consumers' online spending, e-commerce related activities and adoption of mobile banking digital applications might increase as consumers are likely to minimize face-to-face contact, as a result of restrictive social distancing guidelines combined with strong containment and mitigation measures[15,16,17]. Additionally, consumers might be anticipating an upward pressure on prices stemming from disruptions in both the local supply chains and the global supply chains. Approximately 21% of Kenya's imports come from China, the disruption in supply chains and the average higher cost(s) of imports from alternative trade partners indicates an upward pressure on prices. Local firms might also increase prices as they experience declining profit margins. Consumers might respond to this inflationary pressure by increasing spending as they stockpile essential goods. These factors would have a positive impact on the utilization and adoption of mobile banking and other FinTech platforms.

[INSERT FIGURE 3 ABOUT HERE]

Second, Figure 3 illustrates that mobile banking and other FinTech platforms have the highest incidence of money loss and the highest rate of loan default, second only to the informal banking sector. Given the contractions in economic activities, financial

[15]Early evidence from Ireland shows that sectors that are highly dependent on face-to-face contact or physical interaction have been hit the hardest. See: Quarterly Bulletin No. 3, 2020

[16]There are some anecdotal evidence that consumers are worried that Covid-19 might be transmitted via cash- NYT, 2020. "No more dirty cash". https://www.nytimes.com/2020/07/06/business/cashless-transactions.html

[17]See NYT 2020, for some examples of adopted strict and punitive Covid-19 containment measures- https://www.nytimes.com/2020/05/08/world/africa/kenya-coronavirus-quarantine.htmlhttps://www.nytimes.com/reuters/2020/07/20/world/africa/20reuters-health-coronavirus-kenya.html

intermediaries might either increase fees, interest charges or reduce total loan borrowings[18]. And given the adverse effects of the Covid-19 pandemic on the labor market, the marginal value of a shilling (Ksh.) is much higher than before the onset of the pandemic. Consumers might prefer to save (precautionary saving motive) rather than spend due to the uncertainty regarding the nature, the length and the potential pathways of the Covid-19 pandemic. Consumers might also be less likely to use mobile Banking due to vulnerability from evolving and emerging digital risks[19]. Note that more than 40% of money loss incidences in Mobile banking and other FinTech platforms in Kenya are due to data breaches and fraudulent activities such as "hacking" (CBK, 2019). Additionally, a significant portion of mobile banking customers are denied loans due to overdrawn accounts and loan arrears that negatively impact their credit ratings. These factors would have a negative effect on the utilization and adoption of mobile banking and other FinTech platforms during the ongoing Covid-19 pandemic.

[INSERT FIGURE 4, Figure 5 & TABLE 2 ABOUT HERE]

In Figure 4, we examine both the transaction values and transaction volumes of mobile banking during the Covid-19 pandemic. Figure 4 shows two effects. First, the Figure shows that there is a precipitous decline in the values and the volume of transactions between December 2019 and April 2020. And as shown in Table 2 and Table 3, the estimated decline in the mobile transaction values for the period is about 6.98%. This translates to a decline of 14.5% in April 2020 transaction values when compared to April 2019 transaction values. And a decline of 2.09% in the first quarter of 2020 when compared to the first quarter of 2019. At the crux of the pandemic, that is between March and April 2020, mobile transactions declined

[18]Transfers between bank accounts and mobile accounts are charged at a minimum of 4%, the interest rate is a function of the transferred amount. There are additional charges for checking balances on mobile banking

[19]The government of Kenya has passed regulations and laws to curb some of these fraudulent activities- See National payment System Act 2011, and Payment System Regulations 2014

by 15.51%. Interestingly, the decline in mobile banking transactions and volume is not driven by changes in the number of mobile banking accounts. Figure 5 shows that the growth in the number of mobile banking accounts has remained fairly stable while the growth rate in the number of transactions has sharply declined during the Covid-19 pandemic. The results show that the pandemic initially had an adverse effects on consumers' spending patterns and on the adoption of mobile banking and digital platforms in Kenya.

[INSERT FIGURE 6, Figure 7 & TABLE 3 ABOUT HERE]

However, there is a positive note to these results. Observe that that there is an upward trend between April 2020 and May 2020. The estimated value of this upward trend is approximately 16%. This was driven by an ease in regulatory measures and lockdown restriction combined with a reduction and elimination of mobile banking transaction fees and charges by most commercial banks[20]. As commercial banks reduce or eliminate charges and fees on mobile banking and other FinTech platforms, consumers are likely to shift towards these platforms, as shown by the upward trend between April and May following such measures. Figure 6 shows that there is an upward trend in both the transactions per account and transaction value per agent.The estimated increase in transactions per account between April and May 2020 is approximately 7.26%. And the estimated value in the increase in the transaction value-per-agent is about 15.64%. And Figure 7 shows that there has been a sharp upward trend in the number of mobile banking agents and in the value-per-transaction. The number of mobile agents increased by 1.19% and value per transaction increased by 8.68% between March and May 2020. These results suggests that short-term regulatory measures[21] aimed at relaxing constraints on mobile banking are

[20]In late March 2020, three Tier 1 banks- Standard Chartered bank, Co-operative Bank and Stanbic bank- eliminated all mobile Banking charges until June 30^{th} 2020.

[21]The Central Bank of Kenya (CBK) required that commercial banks eliminate some charges and fees on Mobile banking during the pandemic. The CBK also double the daily limits to Ksh. 300,000 (approx. $3,000). Elimination of monthly limits on Mobile tansfers. Lowering tariffs charge on transactions. 100% elimination of charges on values under Ksh. 1,000 and transfers between Mobile wallets and bank account.

having positive effects on consumers' spending and on the overall economy. Our results are consistent with the notion that improvement in regulatory measures is a significant determinant in the diffusion of FinTech (Philippon, 2016). These results support the notion that FinTech are a critical component of economic growth (Frost, Gambarcota and Gambacorta, 2020) and might be critical instruments in styming the adverse effects of the Covid-19 pandemic on the global economy. Overall, our results are consistent with the notion that the Covid-19 pandemic has accelerated the adoption of mobile banking and related FinTech platforms.

3.2 Electronic Payment Cards

One way to estimate the effects of the Covid-19 pandemic on economic activities and on the adoption of FinTech platforms is to examine consumers' spending patterns. Prior literature finds that transactions using electronic cards are a real-time indicators of the cyclical position of the economy and are useful in evaluating the impact of extreme events on the real economy (Galbraith and Tkacz, 2007, Aditya et al 2019). Additionally, understanding how the Covid-19 pandemic has impacted the use of payment cards is important as consumers' are still uninformed on the value of FinTech platforms over current existing payment systems (Rysman and Schuh, 2017). In Kenya, electronic payment cards and FinTech platforms such as M-PESA are complementary means of payment. In 2013, commercial banks migrated away from strip based cards to EMV chip enabled cards. This transition made Kenya's electronic payment cards a secure form of payment and globally acceptable. As a result of this migration to EMV chip enabled cards, the total number of cards increased by 23.2% between 2013 and 2019.

In this section, we address the following question: What are the effects of the Covid-19 pandemic on electronic payment cards? It is not obvious that consumers spending and use

These measures have now been extended until December 2020. - CBK, Circular 2020

of electronic payment cards would decline during the Covid-19 pandemic. On the one hand, consumers might be informed on the adverse effects of the Covid-19 pandemic on global supply chains. Specifically, on the disruptions in both the local and global supply chains. This might lead to an increase in retail spending and stockpiling of essential items, which would result in an increase in transaction values and volumes of electronic payment cards. On the other hand, due to restrictive lockdown measures, restrictions on movement of labor and capital flows, immoderate and sudden rise in external debt[22] coupled with uncertainty regarding the future would imply that consumers are less likely to spend. Specifically, as consumers revise their expectations about the future, they are more likely to increase savings and reduce current consumption. The net result would be a decline in the transaction values and transaction volumes of electronic payment cards.

[INSERT FIGURE 8 ABOUT HERE]

Electronic payment cards in Kenya can largely be broken down into five major categories or types: credit cards, debit cards, charge cards, prepaid cards and POS Machines. Table 3 and Figures 8 represent univariate analysis and time series trends in the transaction values of electronic payment cards. Payment cards usage declined precipiously in value by about 32.4% from March 2020 to April 2020. This represents a decline of 19.8% when compared with March 2019 and a decline of 44% when compared with April 2019. Table 3, shows that the overall decline during the first quarter of 2020 in the values of electronic cards payments translates to about 11.74% when compared to the first quarter of 2019.

When we examine the effects of the Covid-19 pandemic on each type of electronic card payment, we find that transaction values via credit cards declined by about 26.84% between March 2020 and April 2020. This translates to a decline of about 9.21% when compared with March 2019 transaction values. And a decline of 36.23% in April 2020 credit cards transaction values when compared to April 2019 credit cards transaction values. The overall

[22]Kenya's extenal debt increased by 5.81% between March and May 2020- Central Bank of Kenya, 2020.

effect is a decline of about 15.38% in credit cards transaction values in the first quarter of 2020 when compared with the first quarter of 2019.

[INSERT FIGURE 9 ABOUT HERE]

Transaction values in the use of debit cards declined by about 32.4% between March and April of 2020, which translates to a decline of 19.71% when compared to March 2019 and a decline of 44.5% when compared to April of 2019. This represents a decline of 11.7% in the first quarter of 2020 when compared to the first quarter of 2019. The use of prepaid cards declined by 47.4% between March and April 2020, which translates to a decline of 43.2% in the first quarter of 2020 when compared to the first quarter of 2019. Transaction values of POS Machines increased by 13.4% in March 2020 when compared to March 2019 but sharply declined by 41.86% between March and April of 2020. This represents a decline of 0.91% in the first quarter of 2020 when compared with the first quarter of 2019. Note that while transaction values in charge cards declined by 16.7% between March and April 2020, there is a sudden increase in May 2020. The increase in transaction values of charge cards is about 50% between December 2019 and May 2020. And a 50% increase in transaction values between April 2020 and May 2020. Note that charge cards do not charge interest on outstanding amount, the consumer is only required to settle the full amount at due date. The result on charge cards reflect consumers substituting away from costly forms of payment to cheaper forms of payment during the Covid-19 pandemic.

These results are important for two main reasons. First, the overall declined in the usage of electronic payment cards combined with the moderate rise in the use of mobile banking suggest that, during the ongoing Covid-19 pandemic, consumers are shifting towards FinTech platforms relative to other forms of payment. Second, a decline in consumers' spending patterns might translates into systemic risk and the inability of banks and other financial institutions to settle claims (Crockett, 1998). This documented decline in the values of transactions of electronic payment cards points to a potential disruption in the flow of

money and in the clearance of payment instruments due to the Covid-19 pandemic. The results signal to the pandemic as a potential source of contagion risks; credit risk, liquidity and settlement risk. The next section examines the effects of the Covid-19 pandemic on interbank lending activities and transfer of funds. Specifically, we ask whether the Covid-19 pandemic is a potential source of interbank contagion and liquidity risk.

3.3 Real-Time Gross Settlement System (RTGS)

The expansion in economic activities, increase in transaction values and growth in emerging markets has led to the adoption of Real-time gross settlement system (RTGS) by the central banks. RTGS exhibit economies of scale and scope and reduces settlement risk as payments are settled one-by-one in real time, and payments are deemed final and irrecoverable (Borio and Van den Bergh, 1993, Bech, Shimizu and Wong, 2017). In 2005, the Central Bank of Kenya (CBK) introduced and adopted the Kenya Electronic Payment and Settlement System (KEPSS). KEPSS is a fast automated electronic RTGS which has since interconnected about 93% of Kenya's commercial banks and financial institutions. Prior to KEPSS, the Central Bank of Kenya used a paper-based interbank settlement system which was subjected to systemic settlement risk inherent in large value net settlements.

The main objective of KEPSS is to speed up and securely facilitates real-time interbank transfer of funds. The KEPSS has integrated the banking system and the financial markets in Kenya and is classified as a systematically important payment system (SIPS). The adoption of this technology has led to greater volume of transactions and greater flow in interbank transfers. In 2005, KEPSS handled Ksh. 6.5 trillion annually and for the period 2010-2020 (Table 1), KEPSS handled about Ksh. 21.4 trillion annually, which is approximately 183 billion U.S dollars at the current market exchange rate. The Central Bank of Kenya (CBK) has also mandated that banks can no longer use cheques for any transaction amount of more than Ksh.1million. These transactions of more than one million Kenyan shillings

must be conducted through the KEPSS. Additonally, over the last few years, transaction amongst brokers in the Nairobi Securities Exchange (NSE) are also conducted through the KEPSS. In 2019, the system cleared about 412,322 transactions per month and about 20,600 transactions per day, an increase of about 3,150% in daily transactions from its inception in 2005. As a result, the KEPSS has not only become an important driver of financial stability but also a channel for transmission of shocks and disturbances.

While the centrality of RTGS might mitigate interbank lending liquidity shocks (Allen and Gale, 2000, Cabrales, Degryse and Nguyen 2007, Gale and Gottardi, 2016), the Covid-19 pandemic shock is an exogenous global shock to the interbank networks. And as a result would result in positively correlated liquidity shocks, creating contagion risk for Kenya banking system. To this end, we attempt to answer the following question: what are the short-term effects of the Covid-19 pandemic on liquidity and interbank fund transfers via KEPSS/RTGS?

[INSERT FIGURE 10 & Figure 11 ABOUT HERE]

Figure 10 plots the time series trend in the monthly transactions values and transactions volume in KEPSS (RTGS) from 2019 to May 2020. The figure documents and illustrates three key findings. First, there is a decline in both transactions values and transactions volume during the Covid-19 pandemic. Second, the decline is not uniform as there was a sharp decline in values between December 2019 and January 2020 but then there was an increase between February and March 2020 and a sharp precipitous decline between March and May 2020. Specifically, as shown in Table 2, the decline between March and April 2020 in transaction values was about 21.97%. This translates to a decline of about 19.21% from the December 2019 to May 2020. Third, the decline in volume from December 2019 to May 2020 is almost a sharp and a uniform drop of 10.94% as shown in Table 3. The decline in volume between March and April 2020 is about 7.96%.

Taken together, the decline in transaction values and in transaction volume suggest that

the Covid-19 pandemic has had an adverse effect on interbank lending activities in Kenya. The adverse effect translates to a total decline of 9.28% in the value per unit of transanctions from December 2019 to May 2020. And a total decline of 15.22% in the value per unit of transaction from March 2020 to April 2020, a period which is considered to be the crux of the Covid-19 pandemic. These results combined with the decline in interbank lending rates and volumes (Figure 11) points to potential credit, liquidity and settlement risks emanating from the decline in economic activities due to the Covid-19 pandemic.

3.3.1 Automated Clearing House (ACH)

The Nairobi automated clearing house (ACH) is another instrument in Kenya's financial system and in the interbank market. Cheques and electronic funds transfers (EFTs) under one million Kenyan shillings are process through the clearing house. Debit cheques and credit ETFs greater than one million are generally process through the RTGS. As a result, the efficiency of the clearing cycle has improved over the last seven years from T+3 to T+1. The clearing house has facilitated banking sector consolidation and it is therefore an important mechanism in how banks manage risks. As a result, the clearing house is a potential channel for contagion risks. This is because the clearing house is an appendage in the market structure and an important determinant of interbank linkages in Kenya. As such, the clearing house is a source of liquidity and serves as an indirect measure of banks' credit exposure. Prior literature has establish that such an integrated structure is prone to contagion risk (Van Lelyveld and Liedorp 2004, Muller 2003).

[INSERT FIGURE 12 ABOUT HERE]

Figure 12 demonstrates the impact of the Covid-19 pandemic on electronic funds transfers (debit and cheques) processed via the clearing house. The results show that there is a steep decline in electronic funds transfer, which translates to a decline of 29.8% in debit cheques and a decline of 25.3% in credit electronic funds transfers (EFTs). As shown in Table

2, column 6, the decline in April 2020 debit and credit EFTs is about 28.45% and 18.5% respectively when compared to April 2019. This decline translates to 6.99% for debit cheques and a 2.94% for Credit EFTs for the first quarter of 2020 when compared to the first quarter of 2019 (See Table [3]).

[INSERT FIGURE 13 & FIGURE 14 & FIGURE 14B ABOUT HERE]

We next examine the effects of the Covid-19 pandemic on regional and international interbank liquidity flow. Specifically, we look at interbank domestic foreign currency cheques inflows via the automated clearing house. These cheques reflect cross-border payment transfers and international trade activities. The cheques are generally demoninated in either Euro or U.S dollar[23]. Figure 13 and Figure 14 show that there is a steep decline in both the values of s and the volumes of cheques domestic foreign currency cheque. The average decline in values between March and April 2020 is about 37.4%. Figure 14B shows a general decline in both the number of interbank money market monthly deals and total deal values during the Covid-19 pandemic. The results reflect dampening in international and regional trades, contraction in trade partners' economies and disruptions in global supply chains due to the Covid-19 pandemic.

The results from RTGS and the automated clearing house demonstrate that the Covid-19 pandemic has had an adverse effects on interbank liquidity flow. The estimates in the reduction on monetary transaction values and transaction volumes suggest that Covid-19 pandemic is a negative shock to the economy and has had a significant negative impact on the whole of Kenya's financial system. There is a concern that these liquidity shortages and exposures might lead to credit and potential contagion risk. These would negatively impact the solvency positions of some of the local commercial banks[24]. Prior literature finds

[23]Given that Kenya is a former British colony and has close trade ties to the UK, about 4% of the domestic foreign currency cheques are denominated in British pounds. Most trades settlement from the EU zone are denominated in Euro or US dollar

[24]In recognition of potential contagion and liquidity risks due to the Covid-19 pandemic, the Central Bank

that such knock-on effects can amplify interbank exposure and might potential trigger banks failures (Wells, 2004). In the next section, we examine and document the short-term effect(s) of the Covid-19 pandemic on commercial banks' balance sheets.

3.4 Commercial Banks' Balance Sheets

The Covid-19 pandemic has accentuated information asymmetry between banks and borrowers. In the short run, already financially constrained borrowers are more likely to borrow or request extension on credit. And because of the uncertainty regarding the nature the duration, and the potential pathways of the Covid-19 pandemic, even currently unconstrained borrowers might not be in a position to re-finance extended loans in the near future. Commercial banks are likely to become more risk averse leading to higher spreads. This problem is further magnified by pre-existing non-performing loans on commercial bank's balance sheets. As a result, the effects of the Covid-19 pandemic on commercial banks' balance sheets would be a deteriorating assets quality, increases in loss provisions, increases in non-performing loans and increases in total restructured loans. The overall effect would be elevations in liquidity and credit risks for commercial banks.

Table 4 and Table 5 present results that support the above hypothesis. Our results focus on Tier 1 commercial banks in Kenya. These banks constitute an estimated 52% of the market share in Kenya and are generally considered to be relatively stable and have the highest asset quality. Tier 1 banks control not only a significant size of the market but also exert influence on lending interest rates and interbank liquidity (Were and Wambua, 2014, Nyachol, Namiinda and Muema, 2019). The short-term effects of the Covid-19 pandemic on these banks would be indicative of the potential downside risk and the deteriorating economic environment that commercial banks face in Kenya.

of Kenya has thus far undertaken the following short-term measures: [a] lowered the Central Bank Rate to 7.25% from 8.25% [b] reduced cash reserve ratio(CRR) to 4.25% from 5.25% [c] Made available an additional Ksh.35.2 billions in liquidity to distressed banks- CBK, MPC, 2020.

[INSERT Table 4 & Table 5 ABOUT HERE]

Our results show that on average there is an increase in non-performing loans across almost all banks. Approximately 75% of Tier 1 banks reported a significant increase in total non-performing loans in the first quarter of 2020 when compared to the first quarter of 2019. In the first quarter of 2020, Tier 1 banks reported an average increase of 12.65% in non-performing loans and an increase of 185% in total loss provisions. But as shown in Table 4, some banks reported significantly higher losses. For example, Kenya Commercial Bank (KCB) (the largest commercial bank in the country) reported an increase of 37.5% and 141.7% in non-performing loans and total loss provisions respectively. Equity bank reported an increase of 648% in total loss provisons. Figure 15 demonstrates a precipitous rise in commercial banks' cost-to-income and operating income-to-expense ratios during the Covid-19 pandemic. These results suggest that there is significantly higher concentration and elevated credit risk due to the Covid-19 pandemic[25].

[INSERT FIGURE 15 ABOUT HERE]

The results also show that banks have restructured a significant fraction of loans. Total restructured loan is about Ksh.364.5 billions ($3.5 billions) which is about 13.02% of all commercial banks' total book value[26]. Increases in the total restructured loans and increases in non-performing loans combined with increases in total loss provisions, suggest that the Covid-19 pandemic is having a deteriorating effect on the quality of assets of the commercial banks in Kenya.

Table 5, column 10, shows that operating expenses significantly increased relative to the

[25]The average commercial banks in Kenya has at least 85% of portfolio invested in the local economy. Local banks are likely to face elevated credit risk, concentration risk and sytemic risk due to the Covid-19 pandemic.

[26]This figure is likely higher since the Central bank of Kenya put forth measures that constrained the type of loan that can be reclassified or restructured. The relief measures apply only to borrowers whose loan repayments were upto date as of March, 2, 2020. CBK also mandated that extension on personal loans should not exceed 1 year-Ref. CBK Circular No. 3, 2020

first quarter of 2019 and that some commercial banks have responded to the pandemic by withholding already declared quarterly dividends (column 6). Banks' decisions to withhold already declared dividends inspite of the potential penalty from the market (Jagannathan, Stephen and Weisbach, 2000), suggest that banks expect the marginal short term cost of the failure to issue dividend to be less than the marginal short term benefit of capital preservation. Column 3 of Table 5 shows that external rating agencies have downgraded most of Tier 1 banks and have changed economic and bank balance sheet outlook to negative. These results suggest that the Covid-19 pandemic constitutes a significant risk to the operating business environment. The rating downgrades would increase external costs of borrowing, decrease interbank liquidity flows and amplify contagion risk.

3.5 Diaspora Remittances

What are the channels for transmission and propagation of Covid-19 pandemic shocks on the global economy? While the literature has focus mainly on disruptions of global supply chains, there is very little discussion on how diaspora remittances could be another propagation channel for transmission of the Covid-19 pandemic shocks on the global economy. For most developing countries, remittances are becoming an important source of growth and also act as currency stabilizers[27]. Remittances also play an important role in consumption-smoothing (Yang and Choi, 2007). Diaspora remittances are send for either investment purposes in a segment of the local market or for altruistic reasons. In Kenya, remittances constitutes about 3.85% of GDP and a large fraction of remittances are sent via mobile banking and other FinTech platforms[28]. For example, Western Union the largest transactor in cross-currency money transfers, use M-PESA platform in Kenya[29]. M-PESA is a FinTech and mobile

[27]Ref: Abdih, Dagher and Montiel 2012, Ncube and Brixiova, 2012, Adeniyi, Ajide and Raheem, 2019, Hosni, 2020

[28]See CBK, 2018 Commentary on Diaspora Remittances

[29]Western Union and M-PESA partnership- https://www.businesswire.com/news/home/20181107005336/en/

banking platform (Jack and Suri, 2011). Understanding how Covid-19 has impacted cross-border money transfers is important as it addresses two questions: [1] How are remittances a potential channel for the propagation of Covid-19 effects on the global economy [2] What are the roles of FinTech in accelerating or styming the effects of Covid-19 pandemic on the global economy?

We examine the short-term effects of the Covid-19 pandemic on remittance inflows in Kenya. The Covid-19 pandemic has had a significant dampening effects on economic activities globally. The uncertainty associated with both the nature and the length of the pandemic indicate that diasporans are less likely to send remittances. Diasporans might be building up cash reserves in anticipation of further decline in economic activities and might also be accounting for the adverse shocks of the Covid-19 pandemic on their disposable incomes. On the other hand, due to the negative shocks of the pandemic on the local economy and the lack of effective social safety nets in Kenya, diasporans might increase remittances for altruistic reasons.

[INSERT FIGURE 16 ABOUT HERE]

Figure 16, shows that there is a significant decline in remittance inflows between December 2019 and April 2020. As shown in Table 3, the estimated decline in remittance inflows is about 8.57% for the period. Table 2, shows that the decline at the crux of the Covid-19 pandemic, that is between March and April 2020, is approximately 9%. Observe also that there is an increase of 3.1% in total remittance inflows in March 2020 when compared to March 2019 but there is a decline of 15.14% in April 2020 inflows when compared to April 2019. The results suggest that Covid-19 had a significant adverse effects and the decline is mostly drivien by the 9% decline between March and April 2020.

[INSERT FIGURE 17 & Figure 18 ABOUT HERE]

While there is a significant decline in remittance inflows between March and April 2020, the decline is not uniform across regions[30]. Figure 16 shows that there is a steeper decline in

[30]About 52% of remittance inflows originate from Europe and the Rest of the world, with 48% coming

remittance inflows from Europe and the rest of the world relative to the U.S. These results can be explain by the early lockdown measures in both Europe and Asia relative to the US[31]. Figure 18 demonstrates that there is a significant decline in quarterly growth rate of remittance inflows during the ongoing Covid-19 pandemic. Observe that in Figure 17, there is a slight upward trend in remittance inflows between April and May 2020 in Figure 17. These inflows are mostly attributable to the depreciation of the Kenyan shilling relative to other major currencies during the ongoing Covid-19 pandemic. The Kenya shilling depreciated by 2.78% against the U.S dollar between March and May 2020. The depreciation of the shilling partially explains the upward trend in remittance inflows between April and May 2020. Overall, the results suggest that Covid-19 pandemic has weakened, to some extent, the consumption-smoothing role and currency stabilizing role of remittances.

4 Conclusion

This paper examines the effects of the ongoing Covid-19 pandemic on electronic payment systems. We first examine whether the pandemic has accelerated consumers' adoption of FinTech and other digital platforms in payments. We find that the pandemic initially had a negative impact on mobile banking but following a set of favorable regulatory measures, these negative effects have been partially reversed.

Second, we find that the Covid-19 pandemic has had a negative impact on the use of all electronic payment cards except for charge cards. We argue that this is because consumers who use charge cards do not incur interest on outstanding amount but are only expected to settle the full amount at due date. The results on electronic payment cards suggest that consumers are shifting away from more expensive forms of payment towards cheaper forms

from North America

[31]China instituted a lockdown in late January in Wuhan, Italy in early March and UK in Mid to late March

of payment.

Third, we document a decline in interbank fund transfers via the real-time gross settlement system (RTGS) and via the automated clearing house (ACH). Our results suggest that the pandemic has elevated credit and settlement risks amongst financial institutions. We also show that the pandemic has led to a deterioration in commercial banks' balance sheets and has led to a deterioration in the quality of commercial banks' assets. In particular, we document an increase in non-performing loans, increase in loan loss provisions, downgrading in ratings of financial institutions, increase in cost-to-income ratios and we show that some commercial banks have responded to the Covid-19 pandemic by withholding already declared dividend payments.

We also document a negative effect on remittance inflows, suggesting that the pandemic has weakened the consumption-smoothing role and the currency stabilization role that remittances play. We argue that remittances are a potential channel via which the Covid-19 pandemic shocks are transmitted globally.

Taken together, our results suggest that the Covid-19 pandemic has had a significant negative impact on economic activities and that this has facilitated FinTech and digital platforms onboarding, but also that favorable regulatory measures are important determinants in mitigating the negative impacts of the Covid-19 pandemic.

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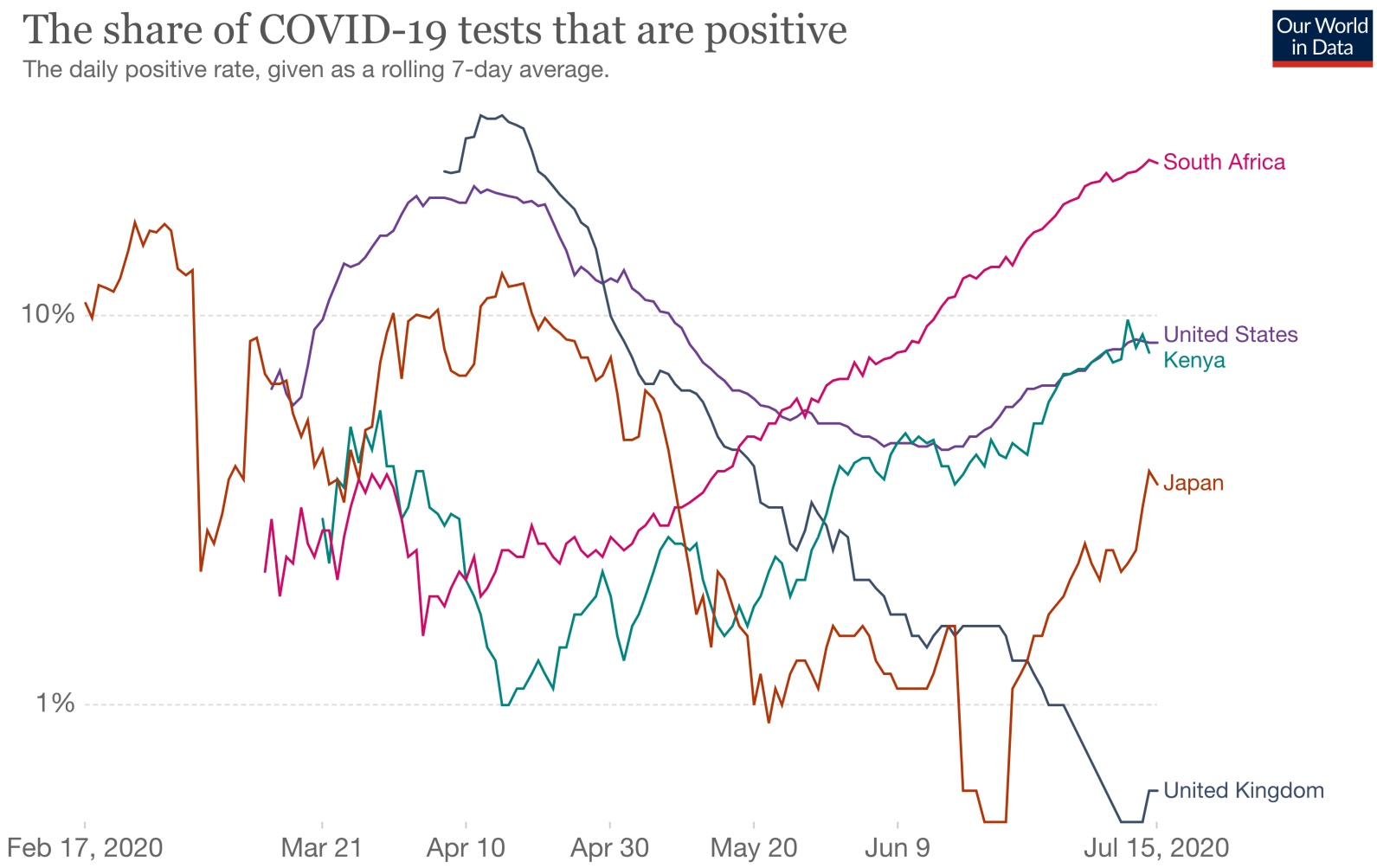
Figure 1: ***Positive Cases in Kenya***



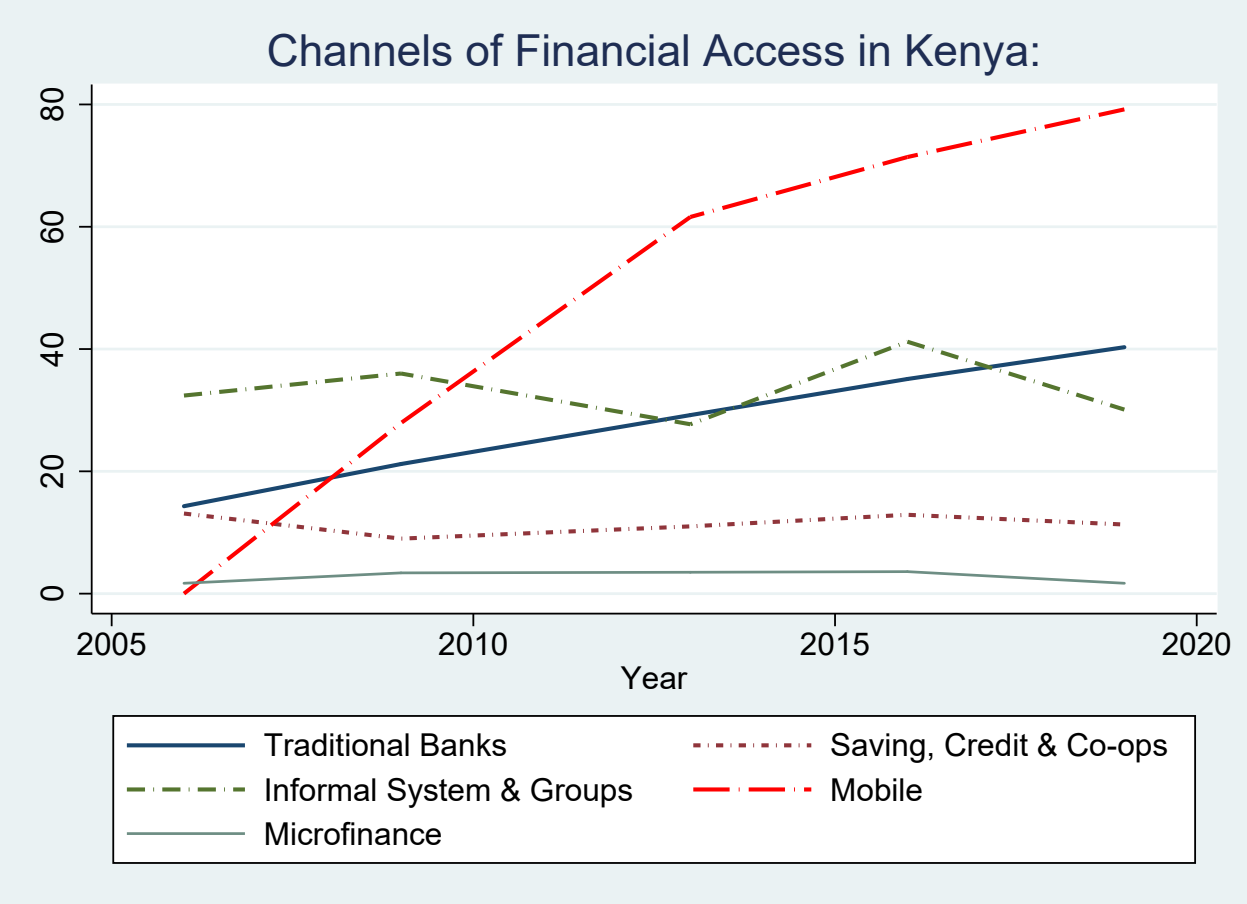


Figure 2: ***Channels of Financial Access:***

Figure 2: This figure illustrates the evolution of channels of financial access over time in Kenya.

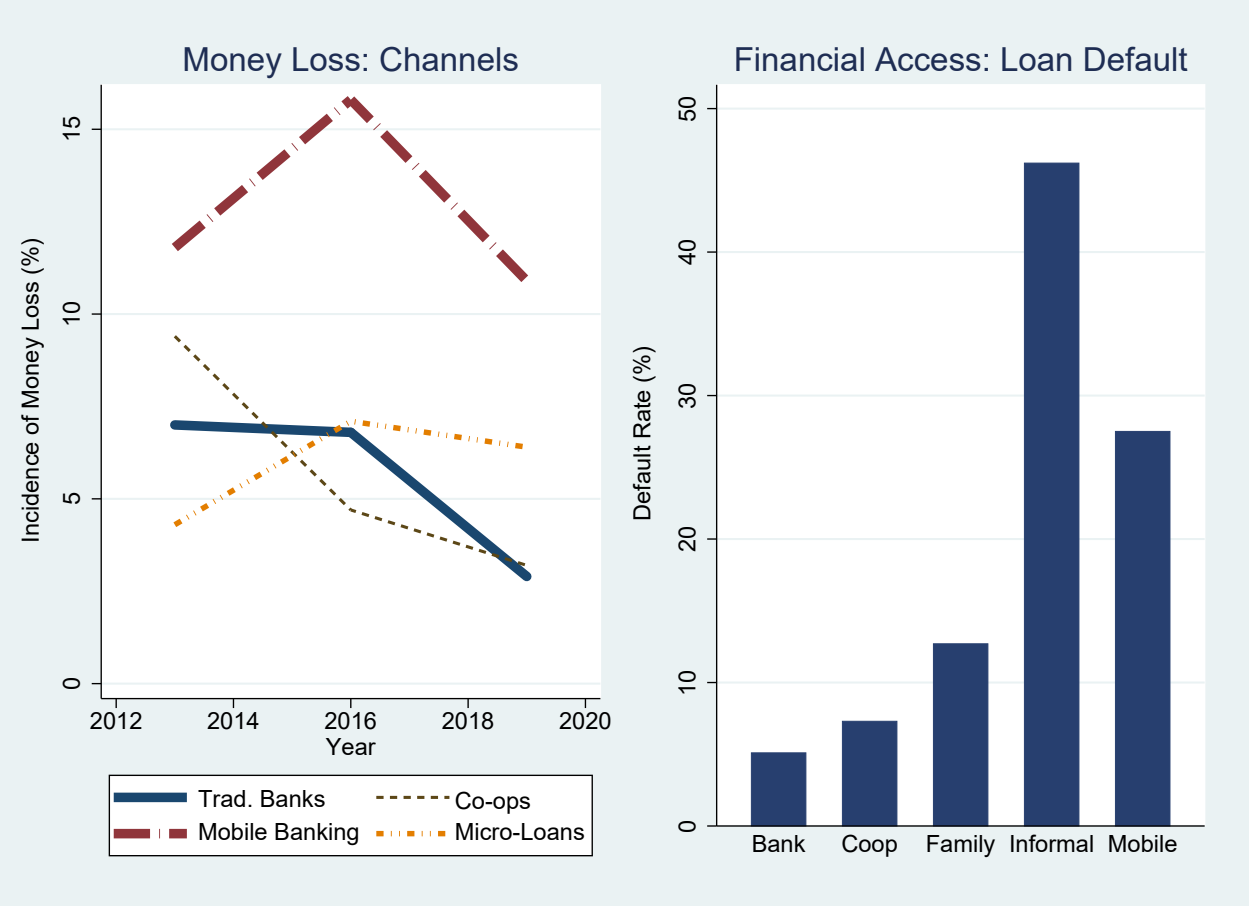


Figure 3: ***Money Loss via Channels***

Figure 3: These figures illustrate incidence of money loss and rate of default across different financial intermediaries and channels

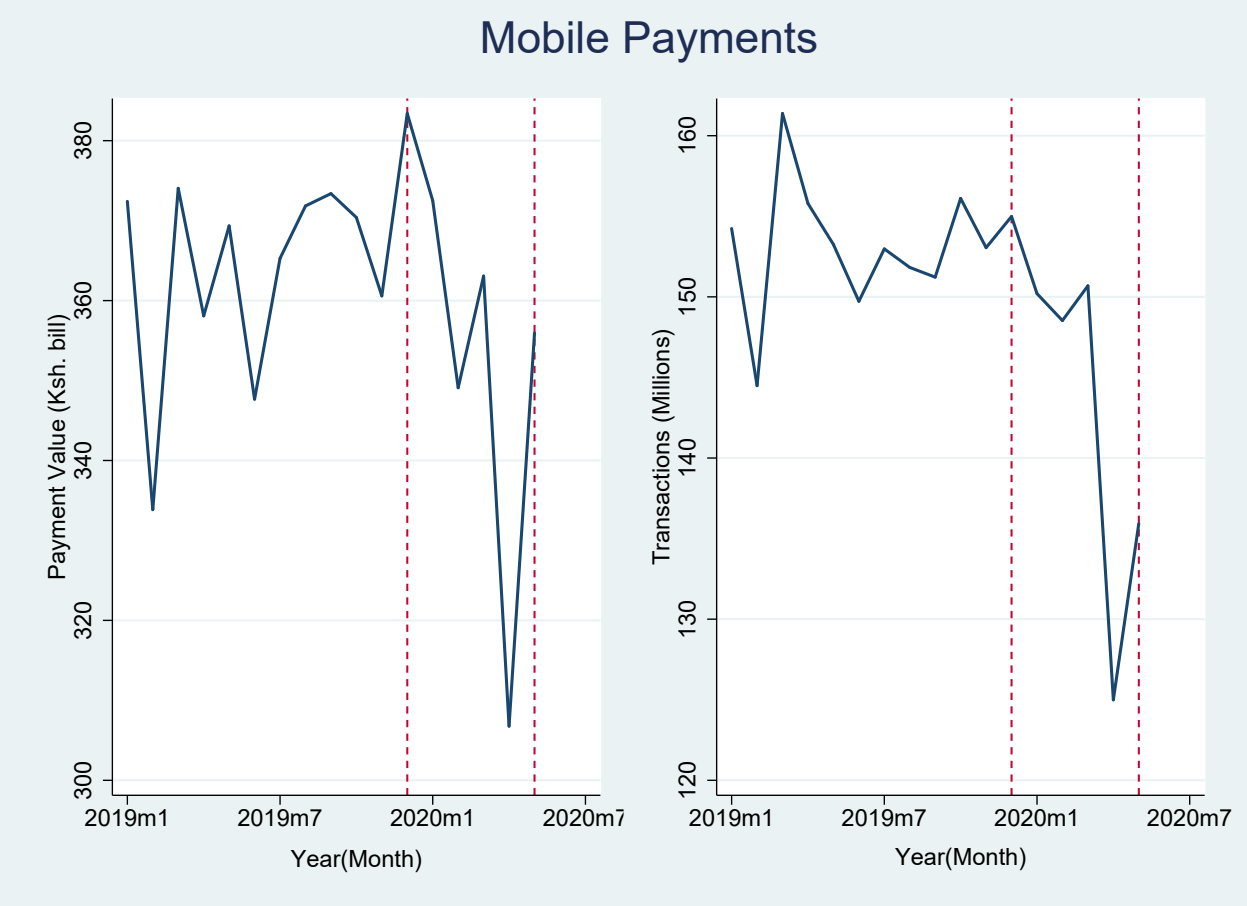


Figure 4: ***Mobile Banking***

Figure 4: These figures illustrate the effects of the Covid-19 pandemic on mobile banking transactions values and transactions volumes

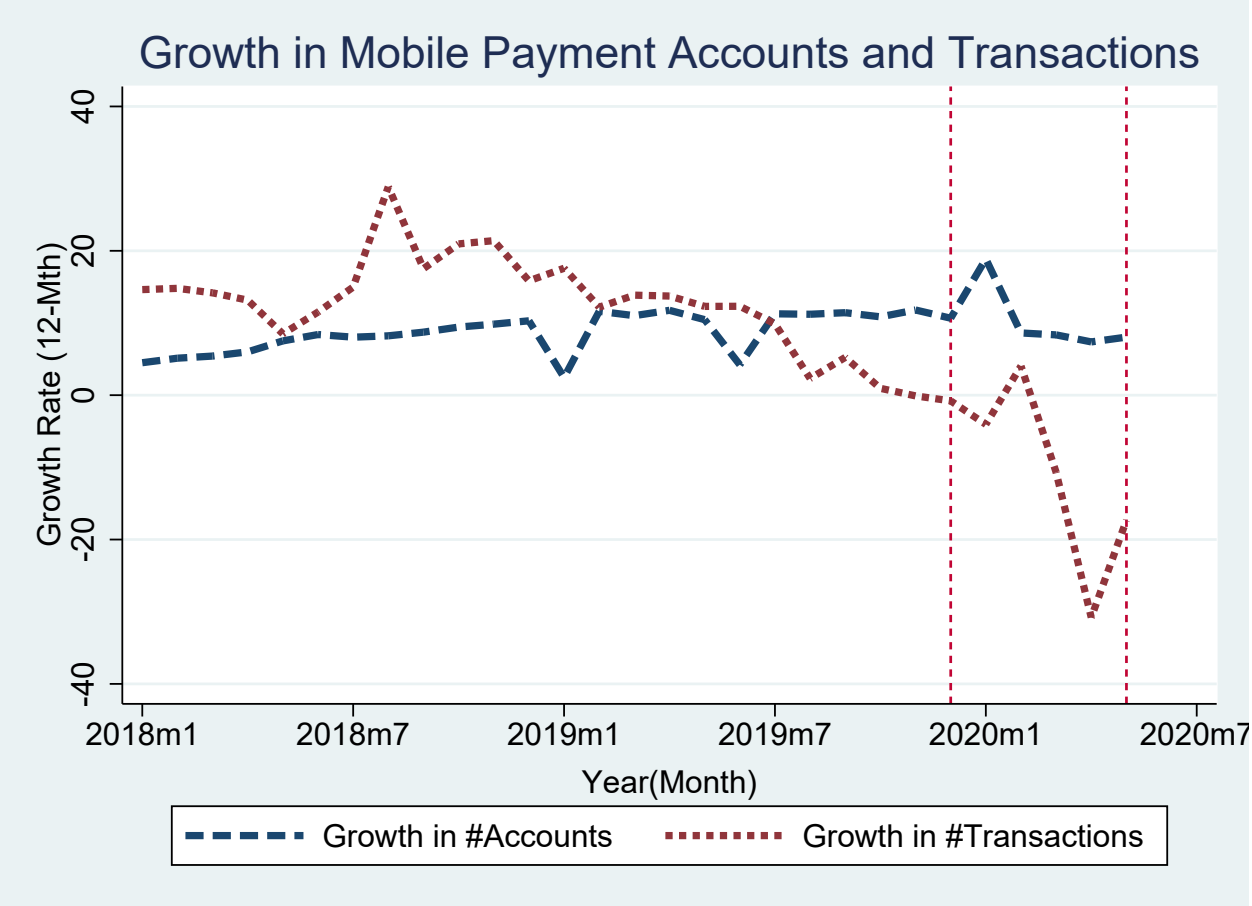


Figure 5: ***Mobile Banking***

Figure 5: This figure illustrates the effects of the Covid-19 pandemic on the growth on mobile banking accounts and growth in Mobile banking transactions.

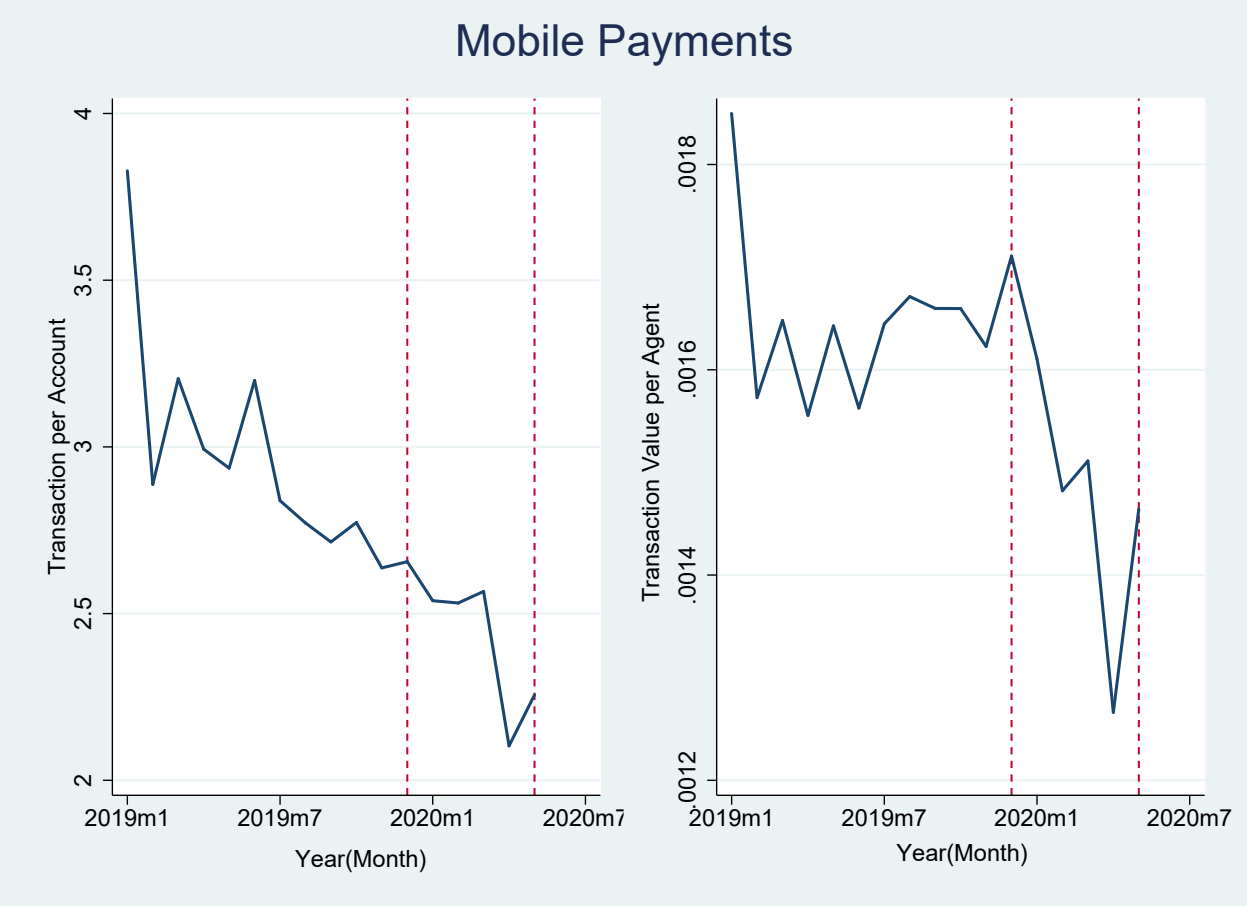


Figure 6: ***Mobile Banking***

Figure 6: These figures represent the effect of the Covid-19 pandemic on mobile banking transactions per account and transaction values per agent.

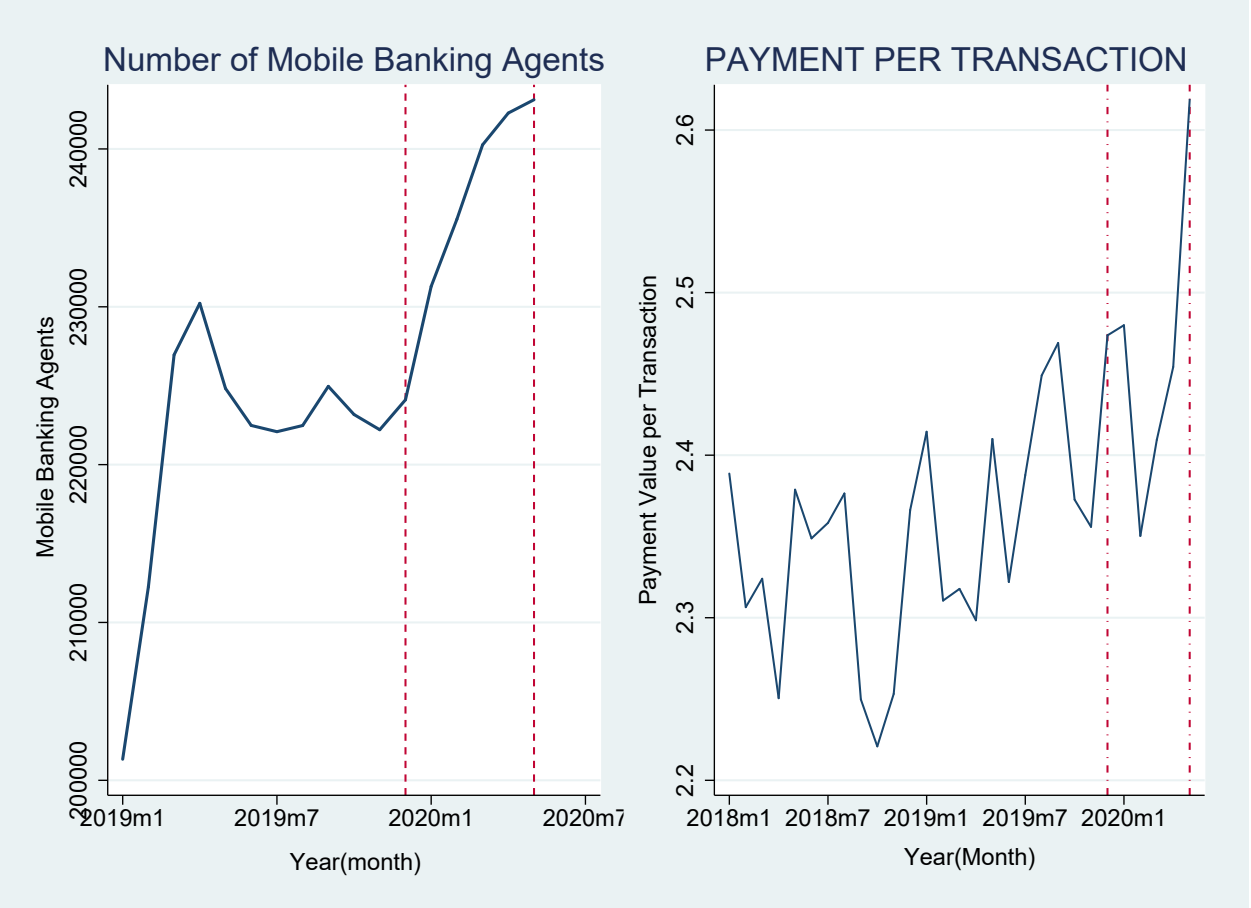


Figure 7: ***Mobile Banking***

Figure 7: These figures represents the effect of the Covid-19 pandemic on mobile banking value-per-transaction and evolution of mobile banking agents.

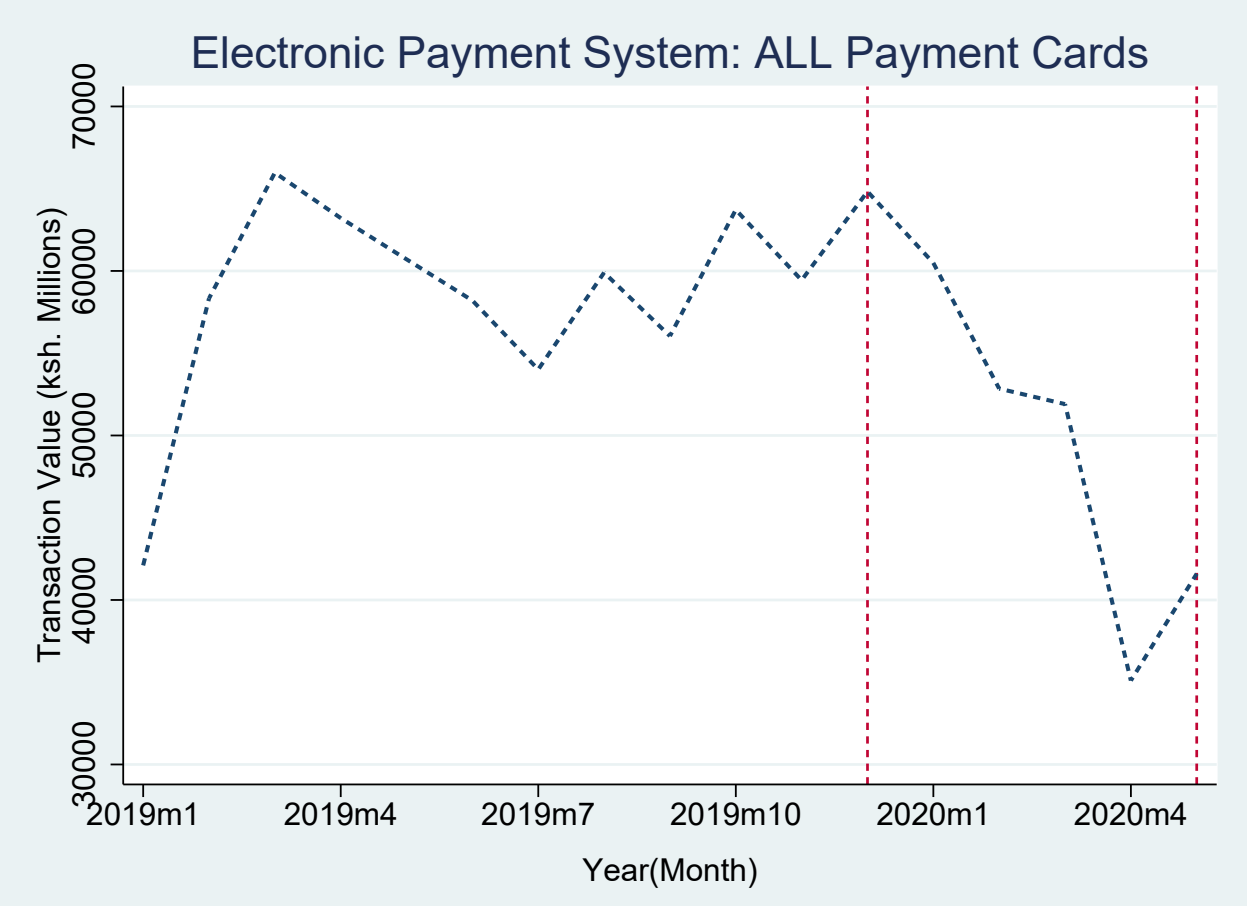


Figure 8: ***Payments Cards***

Figure 8: This figure illustrates the evolution of electronic payment cards transactions and the effects of Covid-19 on total transaction value

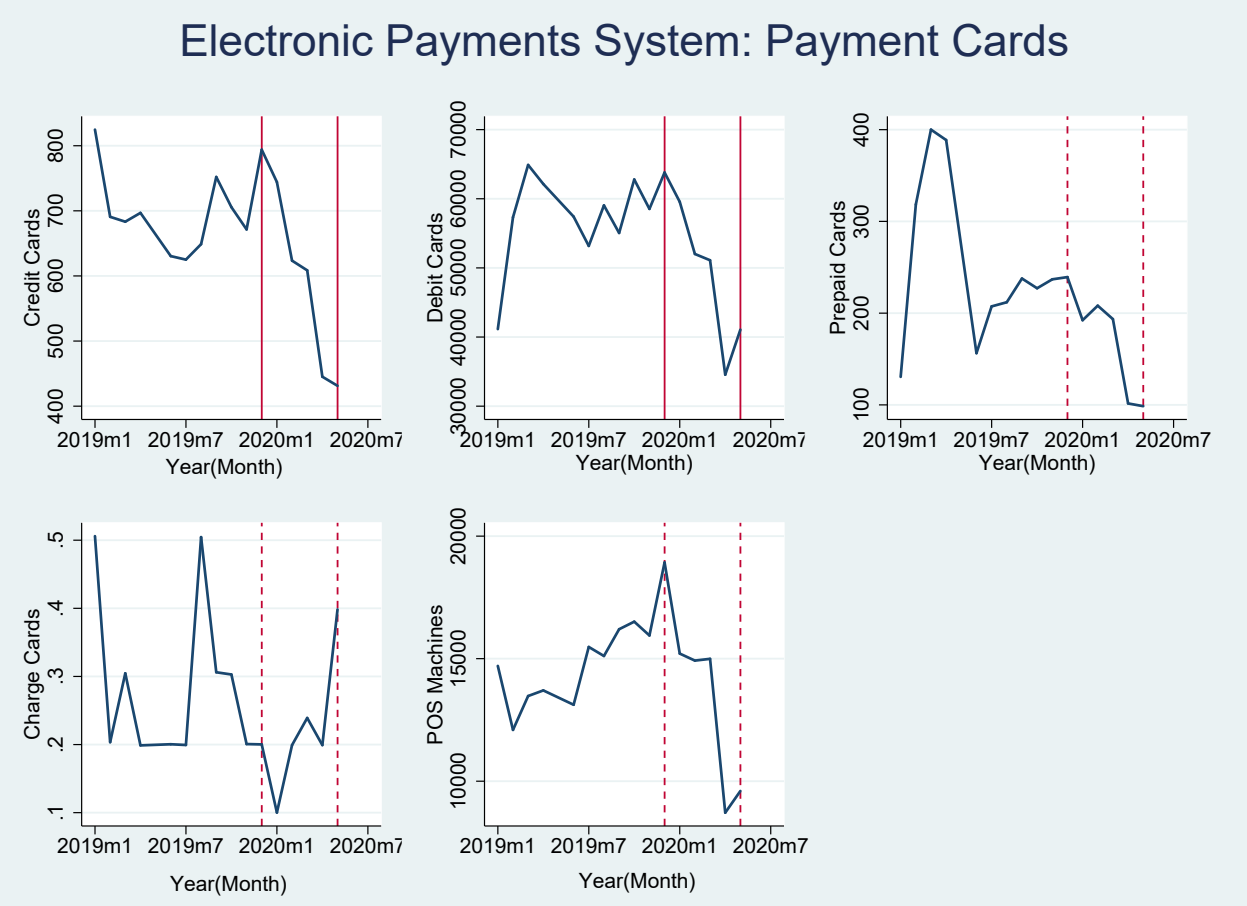


Figure 9: ***Payments Cards***

Figure 9: These figures illustrate the effects of the Covid-19 pandemic on different electronic payment systems.

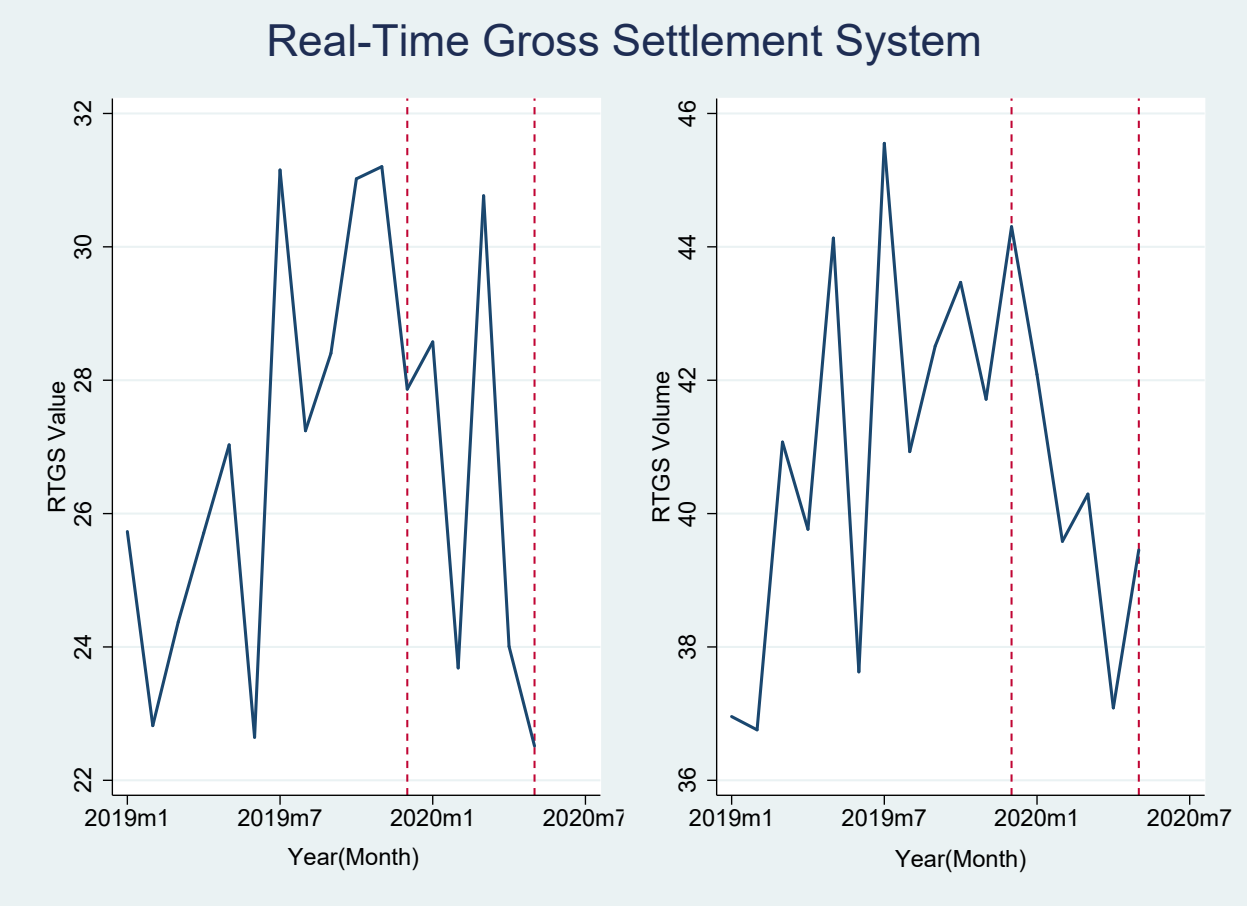


Figure 10: ***Real-Time Gross Settlement System***

Figure 10: These figures represent the time-series evolution of total value and volumes of RTGS and the effects of the Covid-19 pandemic on usage of RTGS.

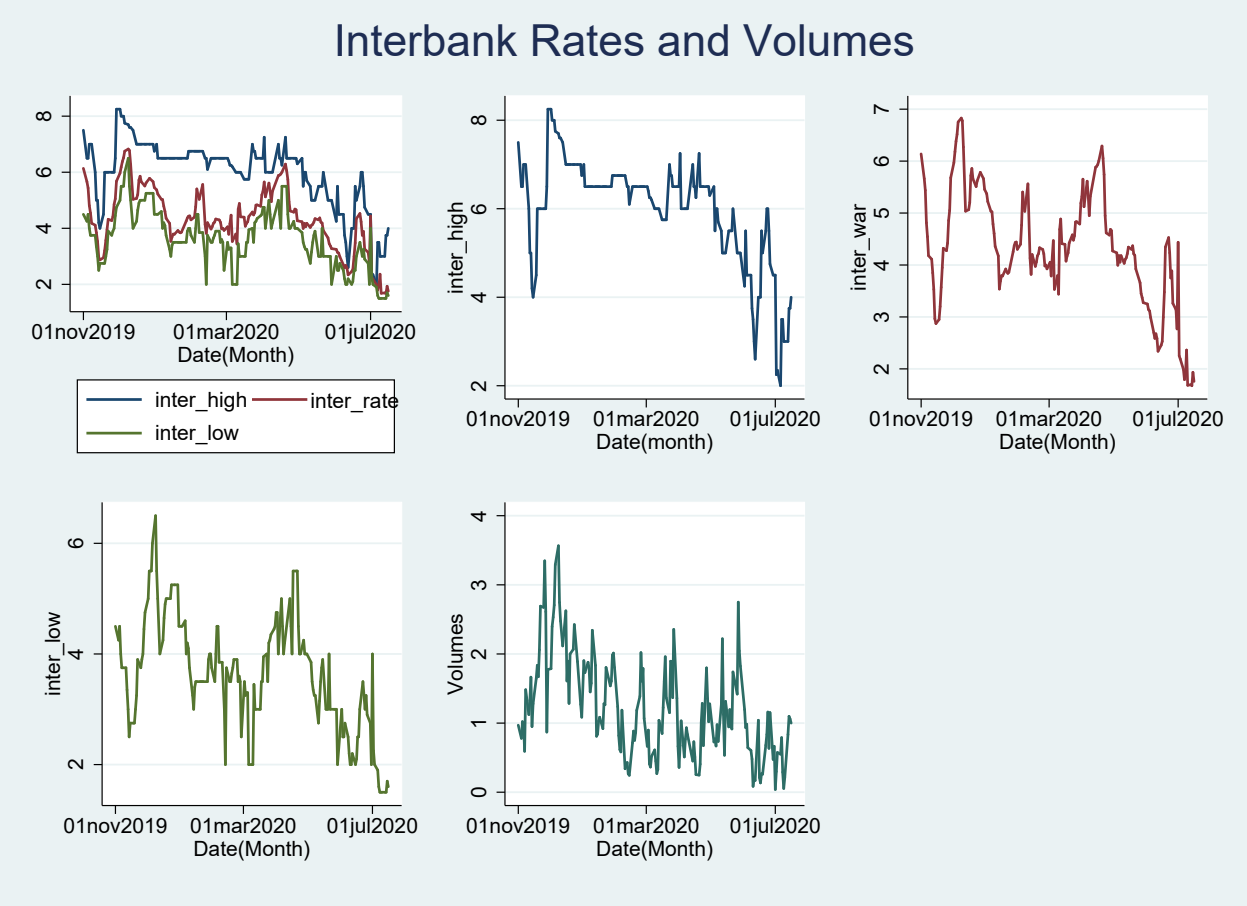


Figure 11: ***Real-Time Gross Settlement System***

Figure 11: These figures illustrate the time-series evolution of interban rates and total interbank volumes.

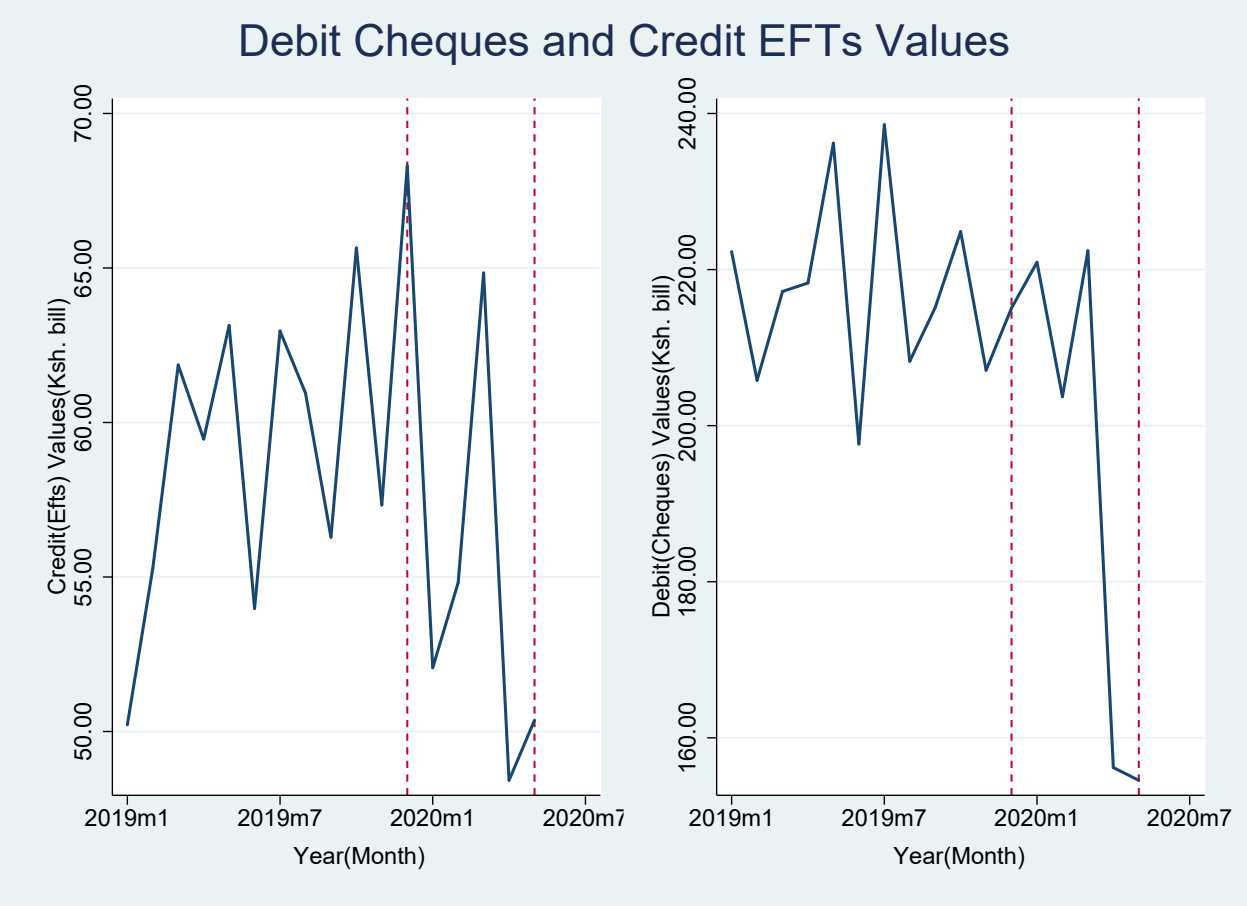


Figure 12: ***Debit Cheques and Credit EFTs Values***

Figure 12: These figures illustrate the time-series evolution and the effect of the Covid-19 pandemic on debit and credit electronic funds transfers.

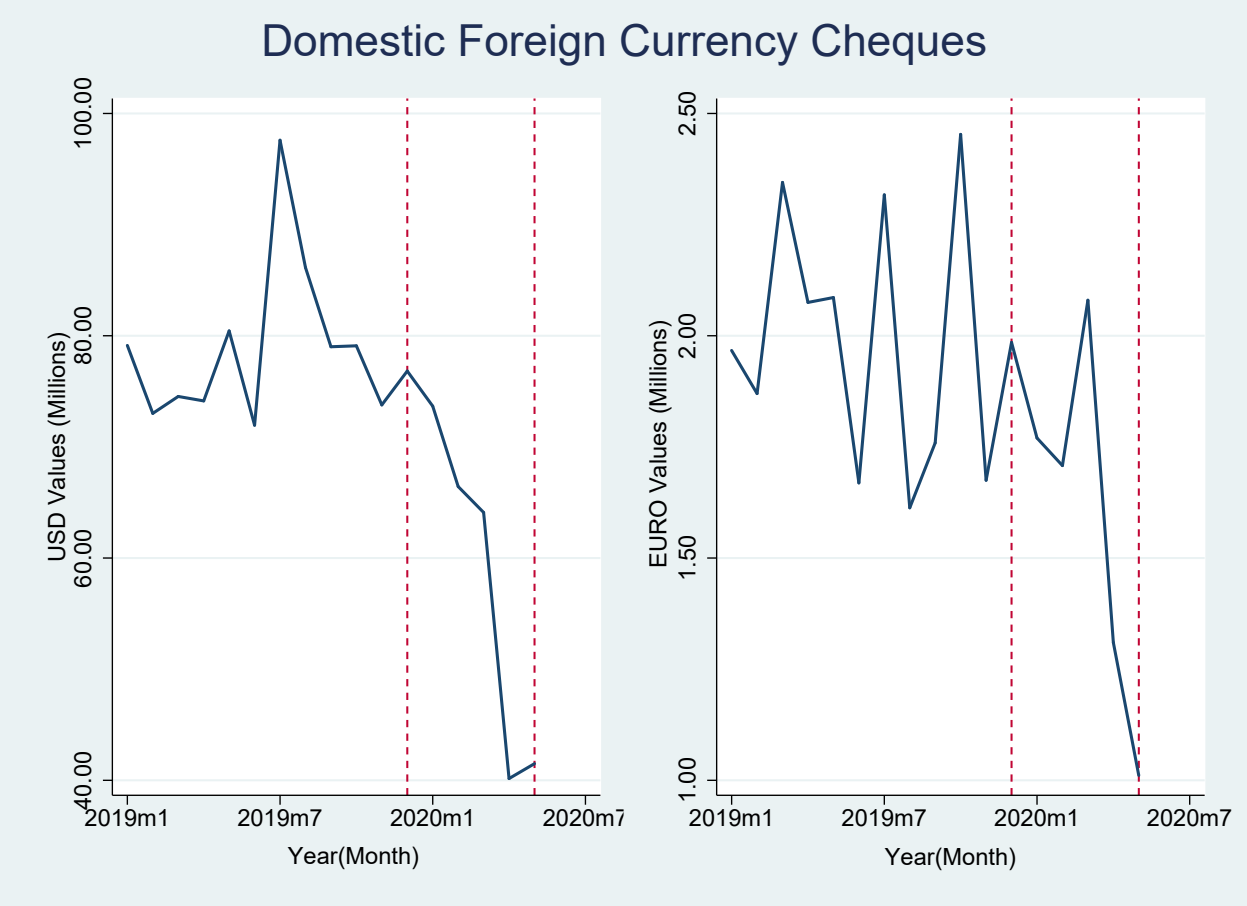


Figure 13: ***Domestic Foreign Currency Cheques- Transaction Values***

Figure 13: These figures illustrate the time-series evolution of the transactions **values** of the domestic foreign dominated currency cheques processed through the automated clearing house (ACH).

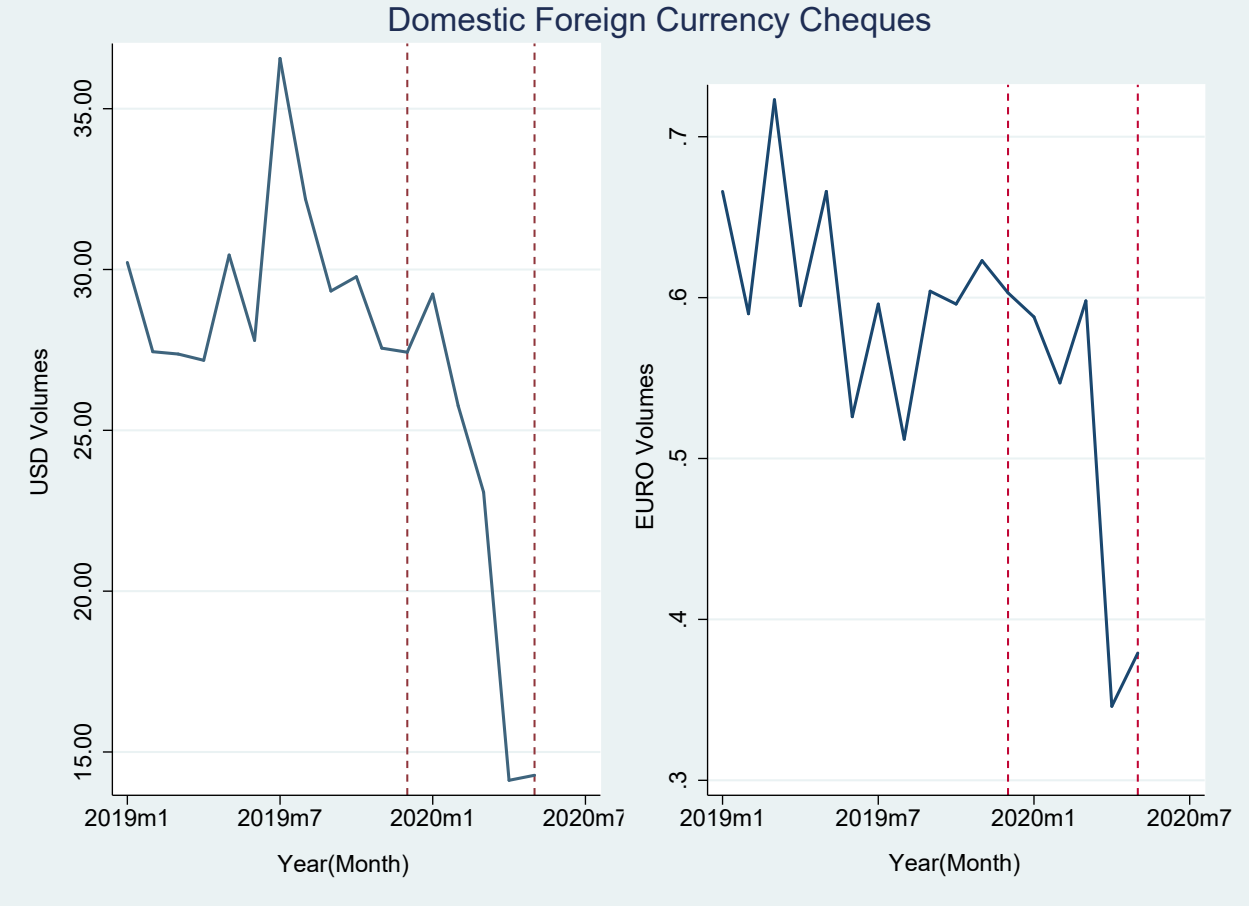


Figure 14: ***Domestic Foreign Currency Cheques- Transaction Volumes***

Figure 14: These figures illustrate the evolution of the **volumes** domestic foreign dominated currency cheques processed through the automated clearing house (ACH).

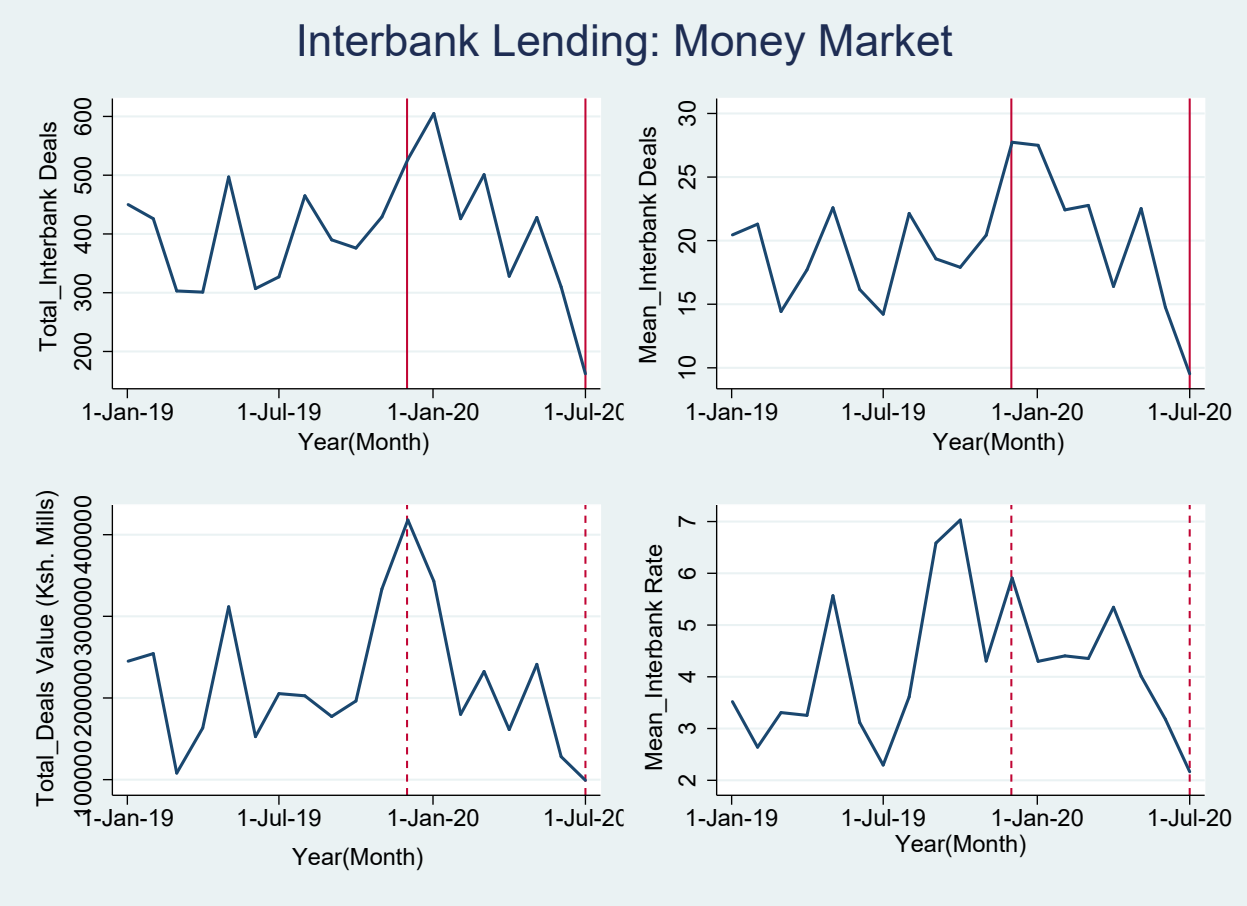


Figure 14b: Interbank Money Market

Figure 14B: These figures represent interbank money market deals and interbank rates from January 2019-July 2020.

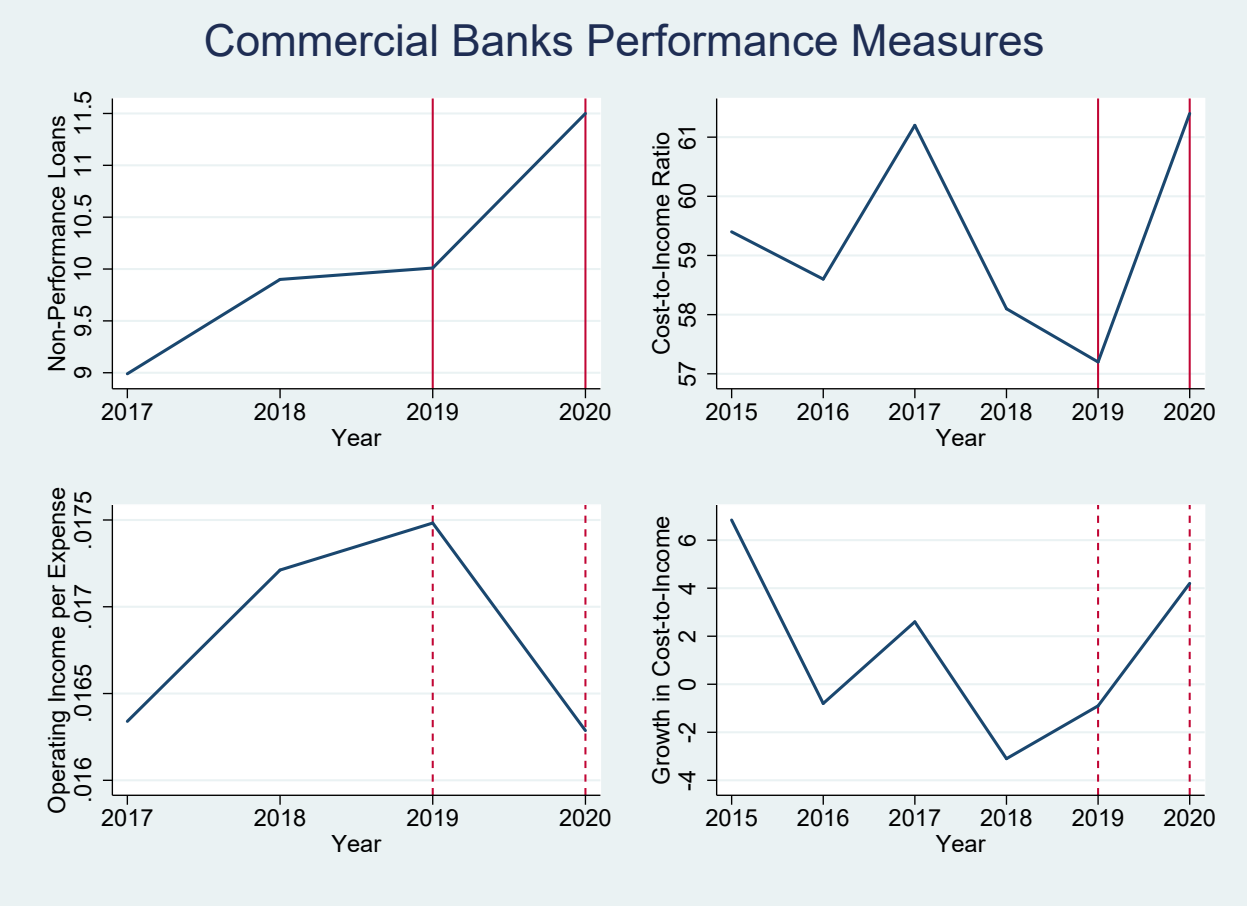


Figure 15: ***Commercial Banks Profitability***

Figure 15: These Figures represent the time series of some metrics and measurement of Commercial Banks Profitability

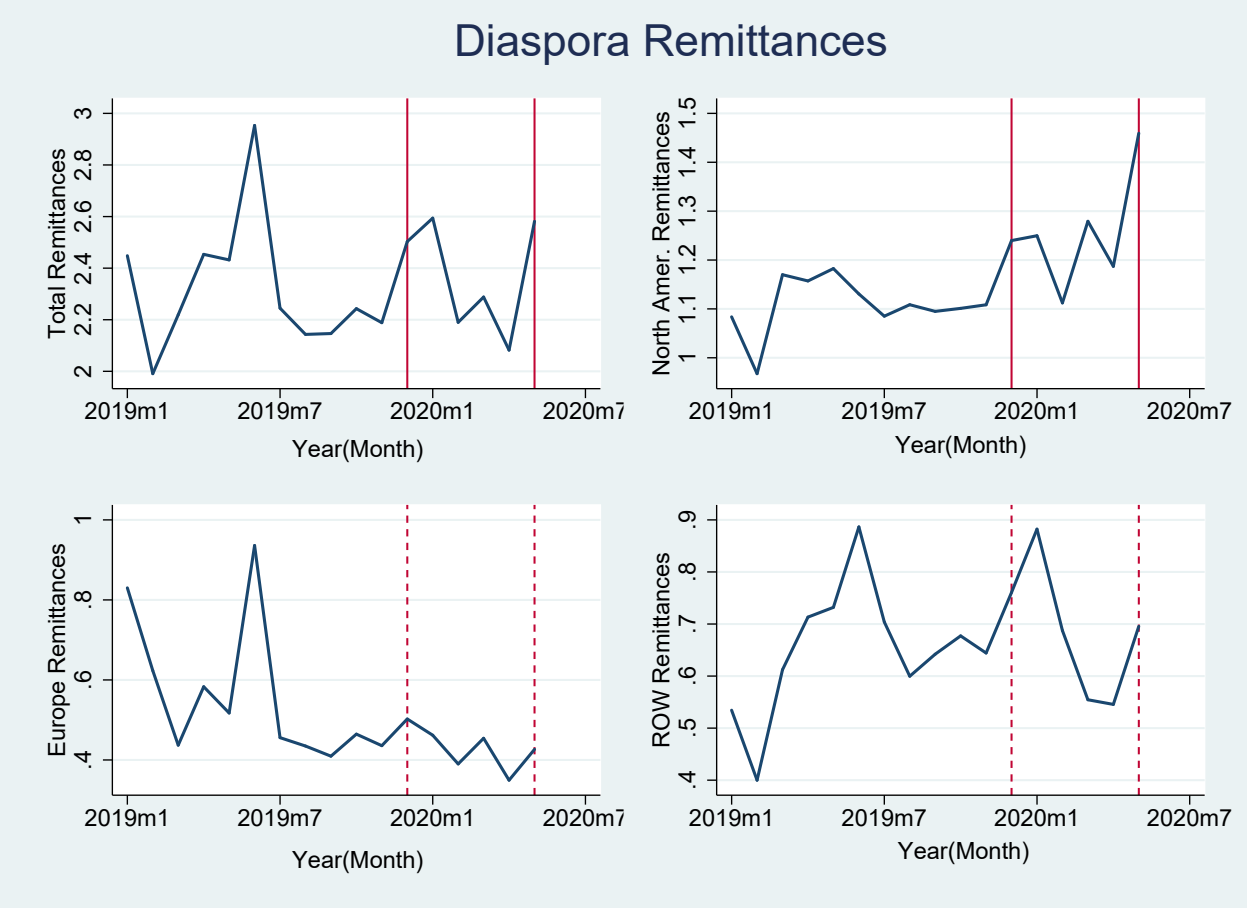


Figure 16: ***Diaspora Remittances***

Figure 16: These figures illustrate the evolution and the effects of the Covid-19 pandemic on diaspora remittances

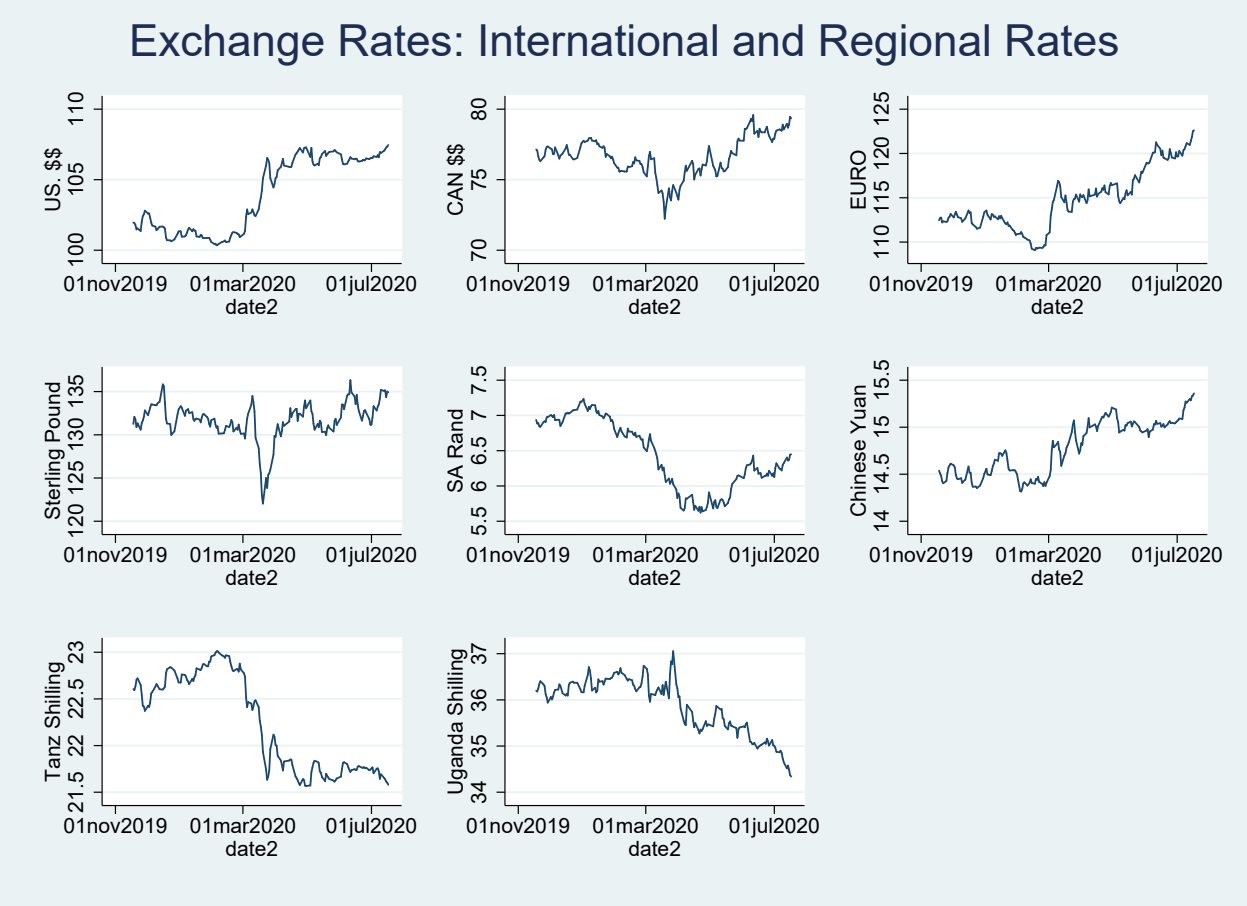


Figure 17: ***Exchange Rates***

Figure 17: These figures represent the evolution of exchange rate of Kenya Shillings against a basket of foreign currencies.

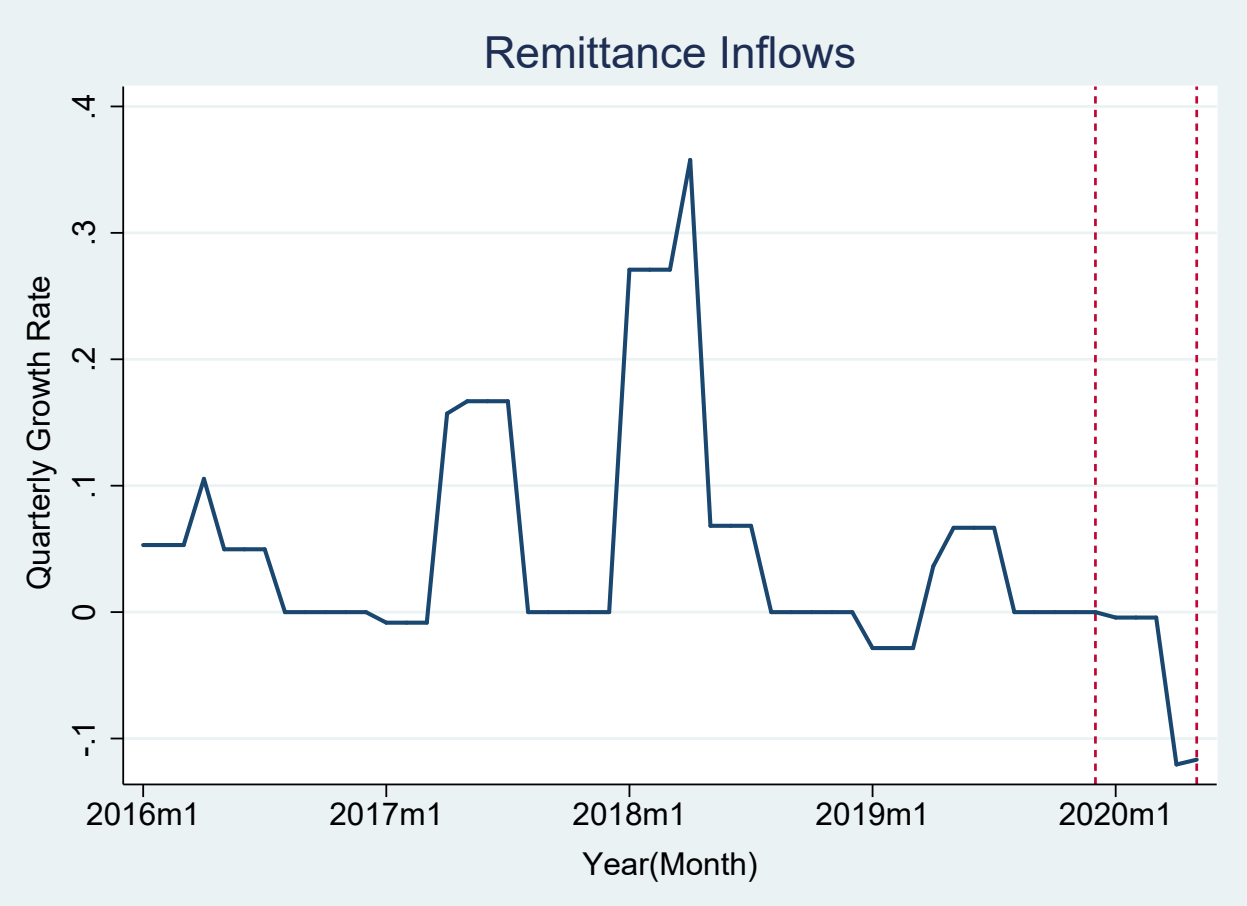


Figure 18: ***Diaspora Remittances***

Figure 18: This figure demonstrates quarterly growth rate and the effects of Covid-19 pandemic on diaspora remittances

TABLE 1 : Summary Statistics

This table presents the descriptive statistics for our sample. The sample period is from January 2010 to May 2020. Mobile payments include all Fintech and digital related transactions. DFCC(USD) and DFCC(EURO) are domestic foreign currency in US dollars and Euro respectively, all values are in millions USD or EURO. KEPSS/RTGS is Kenya electronic payment settlement system/Real-time Gross settlement values are in millions Ksh. EFTs are electronic fund transfers, all values are in billion Ksh.All electonric payment cards values are in millions Ksh. Mobile payments are in billion shillings. Remittances are in thousand US dollars. All values are seasonally adjusted

Sample Period:	January 2010		May 2020	
	Mean	**Std. Dev**	**25^{th}**	**75^{th}**
Mobile Payments	220.892	101.149	130.69	308.893
Payment Cards	38,230.4	9,208.249	33,775.5	40778
Debit Cards	37,362.56	9,136.743	3,2955.5	39850
POS Machines	8,057.774	3,434.965	5,366	9,851.5
Credit Cards	771.016	374.491	461.5	1021.5
Prepaid Cards	96.498	68.226	50.974	117.9
Charge Cards	0.353	0.238	0.2	0.46
DFCC(USD)	98.526	23.951	78.07 1	119.756
DFCC(EURO)	2.878	1.032	1.982	3.559
Debit Cheques	198.568	25.919	179.788	218.282
Credit (EFTS)	42.817	11.380	33.099	50.672
KEPSS/RTGS	2,140,643	460085.2	1801550	2432512
Diaspora Remittance	137,513.9	59,094.87	98,496.24	1,75639.7

TABLE 2: Univariate Analysis: Electronic Payments Systems-Seasonally unadjusted

This table presents univariate tests for electronic payment systems in Kenya. Our window of the Covid-19 pandemic is from December 2019 to May 2020. The Table documents a significant decline on almost all forms of electronic payments with some positive results on Mobile and related digital platforms in banking.

	2019 March	**2020 March**	Δ **%**	**2019 April**	**2020 April**	Δ **%**	Δ{4-3} **%**
Mobile Payments	368.39	364.511	**-1.05**	360.216	307.991	**-14.50**	**-15.51**
Mob_Pay per Trans	2.283	2.419	**5.96**	2.312	2.4641	**6.58**	**1.86**
Mobile Agents	226.957	240.261	**5.86**	230.22	242.275	**5.24**	**0.84**
Mobile Accounts	50.36	58.71	**16.58**	52.05	59.43	**14.18**	**1.23**
Payment Cards	64,979	52,114	**-19.80**	63,594	35,241	**-44.58**	**-32.38**
Debit Cards	63,912	51,309	**-19.71**	62,502	34,692	**-44.49**	**-32.39**
POS Machines	13,272	15,052	**13.41**	13,786	8,750	**-36.53**	**-41.86**
Credit Cards	673	611	**-9.21**	701	447	**-36.23**	**-26.84**
Prepaid Cards	394	194.25	**-50.69**	391	102	**-73.91**	**-47.49**
Charge Cards	0.3	0.24	**-20.00**	0.2	0.2	**0.00**	**-16.67**
DFCC(USD)	74.54	64.103	**-16.28**	74.14	40.16	**-45.83**	**-37.3**
DFCC(EURO)	2.345	2.08	**-11.3**	2.075	1.310	**-36.87**	**-37.02**
Debit Cheques	217.197	222.402	**2.40**	218.28	156.19	**-28.45**	**-29.77**
Credit (EFTS)	61.861	64.839	**4.98**	59.464	48.421	**-18.53**	**-25.32**
KEPSS/RTGS	2,437.414	3,076.602	**26.22**	2,570.91	2,400.76	**-6.62**	**-21.97**
KEPSS_Vol	443026	402925	**-9.05**	397647	370858	**-6.74**	**-7.96**
Remittance	221.926	228.811	**3.10**	245,359.52	208.22	**-15.14**	**-9.00**

TABLE 3: Univariate Analysis: Electronic Payments Systems-Seasonally unadjusted

This table presents univariate tests for electronic payment systems in Kenya. Our window of the Covid-19 pandemic is from December 2019 to May 2020. This Table documents a significant decline on almost all forms of electronic payments with some positive results on mobile and related digital platforms in banking

	2019 Dec	**2020 May**	Δ **%**	**2019 Qtr1**	**2020 Qtr1**	Δ **%**	Δ{Dec19-20Q1} **%**
Mobile Payments	382.93	357.37	**-6.68**	356.19	348.72	**-2.09**	**-6.98**
Payment Cards	64,750	41,761	**-35.50**	56,878.25	50,201	**-11.74**	**-22.47**
Debit Cards	63,719	41,229	**-35.30**	55,854.25	49,420	**- 11.70**	**-22.44**
POS Machines	18,903	9,639	**-49.01**	13,369.25	13,491.25	**-0.91**	**-28.63**
Credit Cards	793	433	**-45.39**	717	606.75	**-15.38**	**-23.49**
Prepaid Cards	239	99	**-58.58**	306.75	174.31	**-43.18**	**-27.07**
Charge Cards	0.2	0.4	**50.00**	0.3	0.185	**-38.33**	**-7.50**
DFCC(USD)	76.83	41.49	**-45.99**	74.14	40.16	**-45.83**	**-47.73**
DFCC(EURO)	1.985	1.011	**-49.07**	2.075	1.310	**-36.87**	**-34.01**
Debit Cheques	215.08	154.56	**-28.14**	215.89	200.81	**-6.99**	**-6.63**
Credit (EFTS)	68.30	50.37	**-26.25**	56.705	55.04	**-2.94**	**-19.41**
KEPSS/RTGS	2,786.59	2,251.403	**-19.21**	2,465.84	2,675.83	**8.52**	**-3.98**
KEPSS_Vol	443026	394549	**-10.94**	386376	397623	**2.91**	**-10.25**
Remittances	250.31	258.150	**3.13**	227.78	228.85	**0.47**	**-8.57**

TABLE 4: Univariate Analysis: Commercial Banks' Balance Sheets

This table presents comparative tests of banks' performance metrics. Our window of the Covid-19 pandemic is from December 2019 to May 2020. The Table documents a significant decline in performance of commercial banks, in particular, a deteroriation in banks' assets quality during the ongoing Covid-19 pandemic.

	2019 Q1 Ebit	**2020 Q1 Ebit**	**Δ Δ %**	**2019 Q1 Loss**	**2020 Q1 Loss**	**Δ Δ %**	**2019 Q1 NPL**	**2020 Q1 NPL**	**Δ Δ %**	**2020 Q1-to-June Restruct.(%)**
Diamond Trust	2.34	2.36	**1.71**	0.101	0.185	**83.1**	14.3	16.6	**16.81**	**40.79(20.22)**
Equity Group	8.8	7.0	**-20.45**	0.41	3.07	**648.8**	9.16	11.2	**22.27**	**92(25.06)**
KCB	8.5	8.9	**4.71**	1.2	2.9	**141.67**	8.0	11.0	**37.5**	**120.2(22)**
CBK	3.6	3.7	**2.78**	0.5	0.9	**80.00**	11.1	10.8	**-2.70**	**15.3(6.0)**
ABSA	3.0	3.4	**13.33**	0.6	1.1	**83.3**	8.1	8.1	**0.01**	**8.3(4.25)**
Std. Chart.	2.9	3.5	**20.69**	0.42	0.43	**2.38**	15.9	14.2	**-10.69**	**22.0(8.1)**
NCBA	3.3	2.4	**-27.27**	0.7	3.8	**442.86**	11.8	14.1	**27.19**	**35(15.69)**
Stanbic	3.1	2.1	**-32.26**	0.63	0.62	**-1.58**	11.1	12.2	**9.01**	**31(21.4)**
Total_Banks										**364.5(13.02%)**

TABLE 5: Univariate Analysis: Commercial Banks' Balance Sheets

This table presents comparative tests of banks' metric in Kenya. Our window of Covid-19 pandemic is from December 2019 to May 2020. The Table documents a significant decline in performance of commercial banks, in particular a deteroriation in banks' assets quality during the ongoing Covid-19 pandemic.

	2019 Q1 Rating	**2020 Q1 Rating**	**Δ ↓↑**	**Moody's Out Look**	**2019 Q1 Div.**	**2020 Q1 Div.**	**Δ %**	**2019 Q1 Oper. Exp**	**2020 Q1 Oper. Exp**	**Δ %**
Diamond Trust	-	-	**-**		2.6	2.7	**3.85**	3.2	3.3	**3.13**
Equity Group	B1	B2	↓	Neg.	2	WH	**-100**	8.8	12.9	**46.59**
KCB	B1	B2	↓	Neg.	2.5	2.5	**0.00**	10.3	14.0	**35.92**
CBK	B1	B2	↓	Neg.	1.0	1.0	**0.00**	6.0	7.3	**21.67**
ABSA	BB+	BB	↓	Neg.	1.1	0.9	**-18.2**	4.9	5.2	**6.12**
Stand. Chart.	A1	A1	**-**		20.0	WH	**-100**	3.8	4.02	**5.79**
NCBA	-	-			1.5	WH	**-100**	5.6	8.3	**48.21**
Stanbic	BB+	BB-	↓	Neg.	7.5	5.8	**-22.67**	11.1	12.1	**9.01**