EFFECTS OF THE MOBILE MONEY SERVICES ON KENYAN ECONOMIC GROWTH

BY

MARY MAXINE WANJIRU NG'ANG'A – X51/35620/2019

RESEARCH PROJECT PAPER SUBMITTED IN PARTIAL FULFILMENT OF THE REQUIREMENTS FOR THE AWARD OF THE DEGREE OF MASTER OF ECONOMIC POLICY MANAGEMENT AT THE UNIVERSITY OF NAIROBI.

AUGUST, 2023

DECLARATION

This thesis is entirely my work and to the best of my knowledge, has not been submitted for the purpose of conferring a degree.

Name: Ng'ang'a Mary Maxine Wanjiru Reg: No: X51/35620/2019

Signature: . . . . . Date: . . . 13/09/2019. . . . .

This thesis has been submitted for examination with my approval as the University Supervisor

Name: Prof Seth O. Gor

Signature: . . . . . Date: . . . . . 13/09/2019. . . . .

ACKNOWLEDGMENT

The success of my project is successful largely due to many others. First, I want to thank the Almighty God for giving me the chance to study a master's degree in economic policy management at the University of Nairobi. I also wish to thank Prof. Seth Gor , my supervisor, for his invaluable insights in doing my project. Lastly is to appreciate school of economics for their support during my study.

DEDICATION

This research study is dedicated to my parents who have sacrificed a lot to ensure that I had everything I needed and I never lacked.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

ABBREVIATIONS

ICT- Information Communication and Technology

(GDP)-Gross Domestic Product

MNO- Mobile Network Operator

IMPS- Immediate Payment Services

MFI- Mobile Financial Institutions

KNBS- Kenya National Bureau of Statistics

CBK- Central Bank of Kenya

ABSTRACT

Using labor and capital as control variables, the study's overall objective was to determine whether mobile money services have an effect on Kenya's economic growth. Its specific objectives, however, were to determine whether active mobile money subscriptions, mobile money agents, and the value of transfers made through mobile money services had an effect on Kenyan economic growth. To determine the relationship between the dependent and independent variables, the study used the financial intermediation theory and the saving investment theory. The theory of endogenous growth, which analyzes the relationship between technical advancement and economic growth, elaborated on the phenomenon of mobile money transfer services in great detail. The study used an explanatory research methodology that focuses on the economic effects of mobile money services. The agents, mobile money transactions, and number of subscriptions were collected from the Kenya National Bureau of Statistics (KNBS) and the Central Bank of Kenya (CBK) for a period spanning January 2014 to December 2021 and used as independent variables in the STATA analysis, the dependent variable was economic growth. Descriptive statistics were used to summarize the findings, which were then displayed in tables and inferred from. According to the study, the number of active mobile money agents and subscriptions had little influence on economic growth. On the other hand, the value of mobile money transfers significantly and favorably impacted economic growth. The report urges policymakers to develop measures that promote the usage of mobile money transfers, which will mostly result in the creation of jobs and further lowering of the nation's poverty levels.

CHAPTER ONE

INTRODUCTION

1.1 Background

The ICT sector had been dynamic in the past years with a great implication on mobile money services. Mobile money also referred to as a 'mobile wallet' is a technological innovation that makes it possible to access financial services (Donovan, 2012). These services include receiving, storing and spending money through mobile transactions, which have become a part of everyday life for billions of people. These services are a convenient and secure alternative to cash and banks because it can be used anywhere there is a mobile phone service. (Donovan, 2012).

Mobile money services in Kenya begun through a Mobile Network Operator (MNO) - Safaricom, using a product referred to as M-PESA in March, 2007(Hughes et al, 2007). The introduction of M-pesa led to more MNOs having products such as Airtel Money by Airtel Kenya and T-Kash by Telkom Kenya Limited. These services were established to benefit the unbanked, especially those in the rural areas and households that were financially excluded and lacked access to savings accounts and payment services.

Mobile money services keep money in an electronic account tied to a cellular number. Customers can send and receive money, pay bills, save and apply for loans, top up cell airtime, and withdraw cash at authorized mobile money agents using the mobile money service menu.

Kenya's GDP over the years has continued to spiral upwards and experience significant growth through the different sectors in the economy. The GDP is seen to have grown by 5.4%, with a 10.3 percentage growth in the ICT (KNBS, 2020). The growth in the sector is largely realized through the increase in demand and uptake of mobile money services.

Government expenditure, used as the measure of economic growth, is the total amount of money governments spend on products and services such as social security, education, healthcare and defense. In Kenya, the advent of mobile money services has simplified service delivery and government business operations. This digitization aims to improve public services while also mobilizing domestic resources.

Governments that include mobile money transactions in their digital services can reach a larger number of citizens and companies. The digitalization of government payments enhances public finance management and strengthens financial transparency while providing greater convenience to payers. Due to efficient financial planning by the government, enhanced transparency, accountability, and traceability of monies acquired, benefits a county's economy in the form of increased revenue and increased savings.

1.1.1 Mobile money services and Kenyan economic growth

Kenya is amongst the leading countries in Africa where mobile money services are prominent and have led to a myriad of opportunities that have had a significant effect on government expenditure and the country's economic growth at large. Mobile money services in Kenya were championed by Kenya's largest MNO, Safaricom, which launched M-pesa in March of 2007, where 'M' stood for mobile and 'Pesa' in Swahili stood for money. (Safaricom, 2017). In the 14-year period from 2007, there have been more than 32.5 million active mobile money subscriptions, 5.2 billion transfers and 264,390 active mobile money gents (KNBS, 2020).

Financial inclusion is evident in the telecommunication sector, which has continued to provide a platform to bank the unbanked through providing services offered by financial institutions such as account-based savings, payments and conducting other transactions. Porteous (2006) distinguishes

transformational and additive features as the two major aspects of mobile money services. Transformational elements emerge when the usage of a cellular phone is linked to a financial product intended towards people without a formal bank account with a banking institution to use their phones as an additive feature and path to an existing bank account.

Financial inclusion brought about by mobile money services has facilitated the interpersonal transfer of cash and also investments in various sectors of the economy (Ozili, 2018). This makes the people in an economy to actively engage in facilitating different aspects of the economy.

1.1.2 Mobile money services and economic growth in the globe

Mobile money service adoption is considered to be higher in emerging economies, where the mobile phone is considered as just another form of payment. Financial services in industrialized economies are seen to be within the reach of its citizens as the majority of people have bank accounts. However, in emerging economies, mobile money services are utilized to allow people without bank accounts access financial services (Donovan, 2012).

Africa is one of the continents with the most emerging economies has telecom service providers that have embraced innovative approaches that allow consumers to easily access financial services (Vong, 2015). In Ghana, mobile money services were first introduced in 2009, through a product dubbed MTN Mobile Money. Introduction of mobile money services in Ghana had a 0.2456 percent long-term and 0.884 percent short-term influence on the country's financial development (Asongu, 2012). This indicated that mobile money services aided Ghana's financial sector development and had a favorable long-term and short-term link with the amount of currency in circulation. That is, as the use of mobile money services grew, so did the need for cash, resulting in more currency in circulation (Manfred, 2017).

MTN Mobile Money however did not gain as much traction in the onset of the services because of the Bank of Ghana's Branchless Banking Guidelines ((Mckay, 2011). A revise in its regulation saw Ghana's mobile money market grow the fastest in Africa, with 235,000 and 14.7 million active mobile money agents and active mobile money accounts respectively (Atanga, 2020). The introduction of these services led to financial inclusion and increased financial interactions, eased access of money to customers at anytime and anywhere and provided employment opportunities (Nicco-Annan, 2020).

The mobile money service sector in Sub-Saharan Africa has flourished and is the region's key driver of growth (Gateway, 2021) 64% was accounted for in the region, for all the mobile money values transacted globally by the end of 2020, totaling $490 billion, up 23% from the previous year. By the end of 2020, the region had 53 percent of all monthly active mobile money accounts and 2.5 million active mobile money agents. West and East Africa had the highest absolute growth rates, while Southern Africa expanded at the fastest rate of 24 percent year on year. (GSMA, 2021). In the region, international remittances made and received via mobile money climbed by 52% year on year, reaching $10 billion in 2020. By the end of 2021, the value of foreign remittances via mobile money in Sub-Saharan Africa exceeded $1 billion per month (Geteway, 2021). This evidence of cash flow in the region has had its fair share of effects on government expenditure as an increase in money supply lowers interest rates and more money is available for borrowing. In the short run, when the rates of borrowing and lending are lower, government consumption increases, which affects the economy of a country (Ross, 2021).

Immediate Payment Services (IMPS) was established in India to provide mobile money services to organized retail establishments. Since 2013, these services have seen rapid growth in providing additional transactions over cellular networks, thanks to collaborations between mobile service

providers with banks and payment gateway providers. India had a mobile wallet adoption of 55.4% in 2019 (Jakhiya et al, 2020). Mobile money subscriptions rose by 95-fold whereby there were 13 subscriptions per 1,000 adults in 2014, that rose to 1,265 in 2019. Mobile money transactions in 2019 increased from 0.02 percent in 2015 to 0.9 percent as a percentage of the country's gross domestic product. (Fund, 2020).

Two Chinese tech giants, Alibaba and Tencent, pioneered digital merchant payments in China which have since pushed the country's economy away from cash payments. This has accounted for 90% of the $17 trillion mobile payment market (Parasol, 2022). Alibaba, the world's largest merchant e-commerce platform launched Alipay in 2008, this has seen thedigital payment service that facilitated business-to-business transactions. In 2013, Tencent launched WeChat Pay, which increased China’s mobile money service users from 350 million to 1.1 billion in 2018 (Yiping Huang, Xue Wang, Xun Wang, 2020). With a 93 percent share of the mobile payment market, the two have established an enormously lucrative business. Every day, more than 20 million individuals use WeChat Pay to make transactions, and 200,000 people sign up for the program. (Klein, 2020). With changes in credit evaluation processes, online lending and digital insurance, China's mobile payment sector has ushered in a financial industry revolution through financial inclusion that has linked individuals to SMEs that in the past had no other payment alternative. Mobile payment service providers have since continued to develop complete ecosystems that include a wide range of services. (Yiping Huang, Xue Wang, Xun Wang, 2020).

1.2 Statement of the Problem

Accessing financial services is a challenge that affects people and businesses of all levels. In Kenya, financial services are traditionally associated with commercial banks and Micro Finance Institutions. However, these were largely inaccessible to a section of the population, affecting the

level and rate of economic growth. Inability of large sections of the population to undertake financial transactions, money transfers and other services in a way that is convenient led to stunted growth as drivers of the economy were mainly large corporations whose growth is not substantial. For instance, where the government could increase revenues and collection from taxes, broadening tax base is more preferred to increasing revenues from the existing taxpayers. Further, while 17% of Kenyan adults are unbanked, Kenya has about 59 million mobile phones connected to a network, a potential market for mobile banking, and contribution to the economic growth and development. Notably, while only 2% of the 65 million bank accounts hold KShs. 100,000 or more, mobile money transactions are placed at Kshs. 14 billion daily.

Economic growth is dependent on mobile money service and their efficacy. In turn, the research investigated the relation between mobile money services and growth of the economy through aspects of transactions which include agents, mobile money transfers and number of mobile money subscribers. The study therefore bridged a knowledge gap on mobile money services and their effect on Kenyan economic growth.

1.3 Objectives

1.3.1 Research objective

The primary objective was to identify the effect of mobile money services on economic growth in Kenya.

1.3.2 Specific objectives

1. To identify the effects active mobile money agents have on economic growth in Kenya
2. To identify the effects active mobile money subscriptions have on Kenyan economic growth

3. To determine the effects mobile money transfers have on Kenyan economic growth
4. To use the findings obtained from the study to make policy prescriptions

1.4 Research Questions

The main question this study sought to answer was: ‘what effects do mobile money services have on growth of the conomy in Kenya?’ The specific questions were;

1. What effects do active mobile money agents have on the Kenyan economic growth?
2. What effects do active mobile money subscriptions have on the Kenyan economic growth?
3. What effects do mobile money transfers have on the Kenyan economic growth?

1.5 Significance of the Study

Academically, the study will have expounded on the relationship mobile money services have and its effects on the Kenyan economy, thereby adding to the existing body of knowledge.

Policymakers in various economies will benefit from this study as they will thereafter gauge the effects mobile money services have in the economy and develop regulations to ensure the maximization of its effects and also encourage its adoption in their economy.

1.6 Scope of the Study

The study's objective was to investigate the effect mobile money services have on Kenya's economic development. This study's geographic focus was Kenya, with the use of quantitative secondary data that was presented quarterly during a 7-year period, from January 2014 to December 2021.

CHAPTER TWO

LITERATURE REVIEW

2.0 Introduction

Theoretical review and empirical review of the study were explained in this chapter. The theoretical review focused on theories related to the study which while the empirical review highlighted the various studies that other researchers and scholars did as well as their findings. Lastly, this chapter was concluded by looking at the research gap through comparing and contrasting the reviewed studies.

2.1 Theoretical Review

2.1.1 Financial intermediation theory

This theory states that financial institutions such as banks, obtain funds from a depositors and lend them out to the borrowers. There are two main categories of financial instruments. The first and most common category is deposits, which are specifically for a fixed amount of time, unrelated to the portfolio performance. The second category is short-term deposits, which have a significantly shorter time period. Finally, there are financial instruments whose liabilities are chequable, and their liabilities and assets are primarily non-transferable (Mitchell, 2004) and (Bisignano, 1998).

Financial intermediaries act as intermediaries between the ultimate lenders who are savers and ultimate borrowers who are investors. According to Scholtens and van Wensveen (2003), financial institutions developed specialized financial commodities, which are generated anytime. Thereafter, intermediaries discover that they can sell them for prices that are expected to pay all direct and opportunity costs of production.

Financial intermediaries exist where there is the presence of an imperfect market in the process of lending and borrowing. Financial intermediation reduces transaction costs which are costs of bringing lenders and borrowers together, encouraging portfolio diversification, gathering and production of information and lastly evaluation of credit risks.

A major aspect of the financial intermediation theory, has been presented by (Scholten&Wensween, 2003) who argued that in the era of enhanced information technology, deregulation and deeper financial markets, intermediation as explained by the theory becomes useless. The technological innovations that have allowed mobile money to grow in the country have opened up the presence of financial intermediates beyond the conventional examples of banks, Sacco's and investment banks.

2.1.2 Saving-investment theory

Households dispose their income acquired after taxation through saving and spending. An individual's decision to save is therefore influenced by among other things, their income. According to Keynes' saving function, saving is a direct function of income and so is a positive function of income. The higher the income, the higher the possibility of saving (Cochrane, 2017). Keynes argued that the equalization of savings and investment was brought about by changes in the level of income.

The savings ratio indicates the proportion of household income that is saved. If the savings ratio is low, funds available for investments are fewer thus negatively affecting economic growth. Since savings is equal to investments, increased savings implies an increase in investment. This resulted to the banking of the unbanked thus has enabled them to save, leading to an increase in investments that positively influences the gross domestic product.

2.1.3 Endogenous growth theory

This theory contends that economic growth stems from internal factors in the economy. Unlike the neo-classical theorists, Romer (1986) through his proposed endogenous theory, argued that technological progress is determined endogenously, which implied that savings affects economic growth in the long run. He suggested that if production in an economy is increased above the private return to investment by capital accumulation, investment can steer sustained growth (Bertola, 1993)

As investments created by savings increase, technological progress is experienced leading to increasing returns to scale that positively affects economic growth. This approach applies squarely on the research by attempting to tie the ability of a country to save and invest through technological enhancements to sustained economic growth (Zucchi and Malamud , 2019). In this study, it will be fundamental to understand how mobile money services fit in the promotion of saving and investment and thus, by extension, economic growth.

2.2 Empirical Review

Kirui et al (2013) set out to understand how mobile phone-based money transfer (MMT) services affected Kenyans. The data was collected in a cross-sectional manner. The information was gathered from randomly selected homes in three Kenyan provinces. The survey found that while mobile money transfer awareness was high, it did not translate into a large number of users, with farmers accounting for 52 percent of those who used it. Money used in purchasing of farm equipment, seeds, fertilizer, paying farm workers and land leasing for farming contributed to 32% of the MMT. As a result, there was a significant increase in household farm incomes, household annual input use, and household agricultural commercialization. Some market failures, such as no or constrained access to financial services, that farmers face have been resolved by mobile money

transfer through cellular phones, particularly in rural locations. A large number of access points (agents) countrywide and simplicity of service operations are just but among the host of factors that have contributed to the success of the mobile banking system and in agriculture to be specific.

In their study on the impact of mobile phone-based money transfer services in agriculture, Kirui et al. (2013) gathered cross-sectional data from 379 participants and used propensity score matching to evaluate the data. The study showed that mobile banking in the agricultural sector brought about increased annual household inputs by ksh.3300, agricultural commercialization by 37% and farm incomes by Ksh. 17,700. This was made possible since mobile banking, being a simple service to operate, register and only required an active mobile number, enabled customers (farmers) to make mobile money transactions using their phones like a bank account and debit card. The funds exchanged were put to use for the leasing of land, the procurement of seeds, fertilizers for planting and topdressing, farm equipment, and the payment of farm laborers. As a result, the market failure or constrained access to financial services that farmers faced was resolved. This significantly brought about positive changes to the economic growth of Kenya, with agriculture as the catalyst, more so for the poor and unbanked.

Mobile money services enhanced gross economic activity in Uganda (Mawejje et al, 2019). Positive mobile money balances were linked to higher consumer price indices and private-sector lending, with mobile money's short-term macroeconomic effects being similarly minimal. With a bigger desire to save than transactional mobile money aims, shocks to mobile money transfers had a greater influence on money demand and gross domestic product, as well as the ameliorating impacts of mobile money on monetary policymaking. The study concluded that mobile money services helped consumers by allowing them to replace liquid and other lumpy assets with financial assets, having little effects on the macro economy and the potential to broaden financial inclusion.

Nyasimi (2016) looked into the impact mobile money transfer services had on Kenya's economic expansion. These services were represented by agents that worked in mobile money transfer services, customer enrollment, transaction frequency and deposit value, with interest rates and exchange rates as moderating variables. From the study, it was evidenced that there was a need for the increase of the number of agents aimed at increasing service provision of mobile money transfer services, which in turn affected economic growth in the short and long run. There was also a positively insignificant relationship between the number of customers and GDP growth, which required the creation of awareness by the MNOs to create more mobile money transfer service awareness amongst the locals, because they are more flexible and secure than carrying physical currency. Similar to this, the growth of GDP was positively impacted by the frequency of mobile money transactions, which called for the encouragement and expansion of mobile money transfer agents into underserved areas in relation to the demand for money transfer services, which will ultimately affect economic growth.

Momanyi (2011) looked at M-Pesa in different perspectives, using company level data from competing transfers firms. In this study, M-Pesa resulted to significant price reductions among competitors. In micro-level data from Fin access surveys, frequent M-Pesa users were more likely to be urban, educated, banked, and affluent, which increased transfers, decreased the use of informal saving mechanisms, and increased the likelihood of being banked. This suggested that M-Pesa was a bank's complement, as it increased demand for banking products. M-pesa services were largely utilized to transfer money from person to person, according to the study's findings.

2.3 Overview of literature

Mobile payments have gradually been increasing in Kenya. This is because it allows the unbanked as well as the banked in the country to conveniently transact, more safely and easy. The financial

intermediary theory has demonstrated how the depositors and lenders interact. The financial institution obtains funds from the depositors and lend to the borrowers hence the technological progress. Endogenous theory has shown that the technological progress leads to the economic growth in an economy. This was supported by Kirui et al (2013), who demonstrated that the mobile banking services has increased the purchasing power of farmers by 52% hence increasing the demand for commodities in the economy leading to economic growth. Also, Nyasimi (2016) concluded that the money transactions services have led to economic growth in Kenya through number of agents, number of transactions and deposits. While Momanyi (2011), concluded that the introduction of the transfer services contributed to growth in money service transfer firms, this has resulted to the expansion in the market hence growth in the economy.

CHAPTER THREE

METHODOLOGY

3.1. Introduction

The third chapter focused on the theoretical and empirical framework, as well as the study strategy. It provided comprehensive information on data collection methods, sources, and tools. The final thoughts in the chapter focused on sample size and diagnostic procedures.

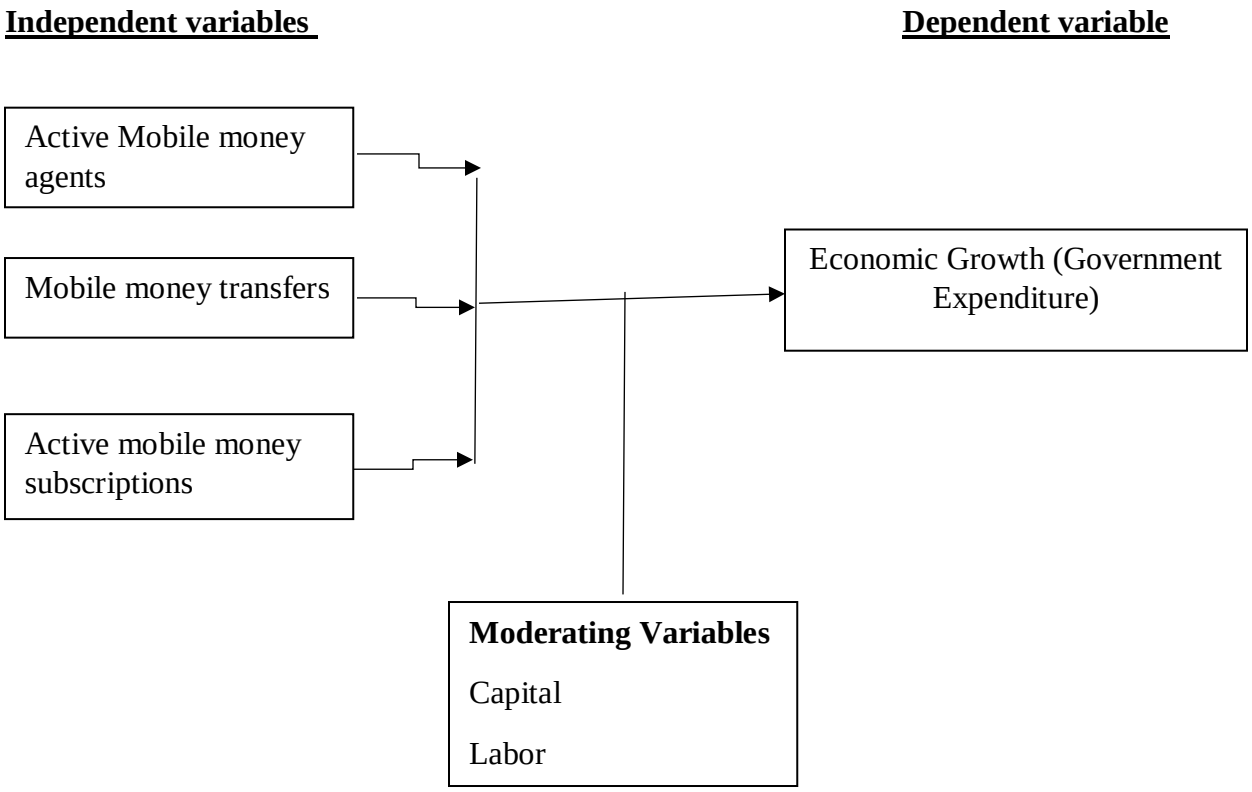
3.2. Research Design

Secondary data that sourced from KNBS and CBK from January 2014 to December 2021 was employed in the study.

3.3 Conceptual Framework

This section depicted the relation between the research variables. According to the study, the dependent variable, economic growth measured through government expenditure approach. Mobile money services were considered as the independent variable which was measured through active mobile money agents, transfers and active mobile money subscriptions. In addition, the study examined the effects of labor and capital as moderating variables. Figure 1 showed the breakdown of these variables.

Figure 1: Conceptual Framework



3.4 Theoretical Framework

The endogenous growth model provides the anchor for this study. It embraces the role of technological progress in advancements on economic growth (Romer, 1994). The theory suggests that diminishing returns on production factor is eliminated, allowing for unlimited growth in production per worker. The model considers improvement in productivity through technological progress as the ultimate source of long-term economic expansion. In this instance, technological progress is primarily reliant on internal economic variables such as knowledge, creativity, and human capital. Consequently, the premise of diminishing marginal returns to capital accumulation

is eliminated. In the endogenous growth model, economic growth as a result of technical progress is expressed as follows:

$$Y_t = A_t K_t^{\alpha} L_t^{1-\alpha} \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots 3.1$$

Where A_t is the technological progress, K_t and L_t the capital and labor accumulation respectively. The value α<1, implies the existence of diminishing marginal returns to capital accumulation. The endogenous growth model, on the other hand, assumes that capital investments generate increasing marginal returns to scale. As a result, one method of "endogenising" the growth rate is to abandon the diminishing marginal returns assumption entirely. By so doing, we set α = 1 which results to:

$$Y_t = A_t K_t \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots 3.2$$

Equation 3.2 is the simple AK model (Sergio, 1993), first developed by Frankel (1962). He suggested that because enterprises acquire additional capital, some of it is intellectual capital that contributes to technological improvement. Aggregate production function shows a constant or increasing marginal product of capital as maintained by Frankel. In the event that the marginal product of capital is exactly constant, aggregate output Y_t is proportional to the aggregate stock of capital K_t which includes both physical and human capital, and A_t which reflects a positive constant level of technology as shown in equation 3.2.

To define the steady growth path, we obtained the logs and derivatives of equation 3.2. The output model was determined as;

$$\frac{Y^{\cdot}{}_t}{Y_t} = \frac{A^{\cdot}{}_t}{A_t} + \frac{K^{\cdot}{}_t}{K_T} \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots 3.3$$

Savings as a function of income and capital depreciating at a constant rate ‘δ’, the change in capital stock was traced through:

$$\dot{K}_t = sY_t - \delta K_t \ldots 3.4$$

Where $\dot{K}_t$ is capital and s is the level of savings.

The growth of capital stock was obtained by dividing both sides of equation 3.4 by K_t, showing change in capital stock to give;

$$\frac{\dot{K}_t}{K_t} = \frac{sY_t}{K_t} - \delta = sA_t - \delta \ldots 3.5$$

Equation 3.3 elaborates clearly that the growth of output does not only depend on the growth of technology but it also depends on the level of technology. This means an increase in A_t will lead to an explosive path of output, such that the steady growth of technology $\frac{\dot{A}_t}{A_t}$ is equal to zero. Therefore, the growth is of AK model is given as;

$$\frac{\dot{Y}_t}{Y_t} = sA_t - \delta \ldots 3.6$$

From the equation above, the growth of output is as a result of the effects of advancements in technological. However, for the level of A_t (technological progress) to grow, it requires government intervention, where governments come up with policies, incentives and subsidies for businesses. These interventions are geared towards increasing research and development opportunities in both the private and public sectors, so that they can continue to drive innovation which is effective in fostering technological progress.

Equation 3.1, showed the key role that labor played in the formulation of the AK model. Further, labor can be skilled or unskilled whereby skilled labor is assumed to produce more output than unskilled labor. To this end, the total stock of such 'skills' accumulated through education, termed

as human capital, will be included as a distinct variable with a beneficial impact on the volume of output. The production function shown in equation 3.1 was expounded to;

$$\mathrm{Y_t} = A_t \mathrm{K_t^{\alpha}} H_t^{1-\propto} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots 3.7$$

The steady state growth path shown in equation 3.3 with the inclusion of H_t (human capital) and K_t (Physical capital) therefore becomes;

$$\frac{Y^{\cdot}{}_t}{Y_t} = \frac{A^{\cdot}{}_t}{A_t} + \alpha \frac{K^{\cdot}{}_t}{K_t} + (1-\propto) \frac{H^{\cdot}{}_t}{H_t} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots 3.8$$

It is reasonable to assume that the unskilled labor in the function postulates a production function as;

$$Y_t = A_t K_t^{\propto} H_t^{\beta} L_t^{1-\propto-\beta} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots 0 < \alpha < 1 < \beta \ldots\ldots\ldots\ldots 3.9$$

Where L_t is the unskilled labor. This postulated that the AK model was converging towards the steady state of the output. Therefore, if the economy is expected to be growing at a steady state, then the economy with more technological progress has a higher growth rate.

3.5 The Empirical Model

The study's goal was analyzed to estimate the unknown effect of modifying one variable over the other, which is multiple linear regression analysis (Watson, 2005). To linearize equation 3.2, we used the logarithm function. Taking logs of the series in the set of the equation led to;

$$Log\ \mathrm{Y}_t = \propto_0 + \sum_{i=1}^{n} \propto_i \log A_t + \sum_{i=1}^{n} \beta_j Log Z_j + \varepsilon_t \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots 3.10$$

Equation 3.10 is further broken down to;

$$\textstyle\sum_{i=1}^{n} \propto_i \log A_t = \propto_1 \log X_1 + \propto_2 \log X_2 + \propto_3 \log X_3 \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots 3.11$$

And

$$\sum_{i=1}^{n} \beta_j LogZ_j = \beta_1 \log H_t + \beta_2 \log K_t \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots 3.12$$

Where $\propto_1 \ldots\ldots\ldots \propto_n$ and $\beta_1 \ldots\ldots \beta_n$ are coefficients that represent a change in y relative to unit change in the X_1, X_2, X_3 variables as well as H_t and K_t where , X_1 is active mobile money agents, X_2 is mobile money transfer and X_3 is active mobile money subscriptions. H_t is labor and K_t is capital which are the moderating variables in the model. Combining equation 3.11 and 3.12, the equation becomes;

$$Log\ Y_t = \propto_0 + \propto_1 \log X_1 + \propto_2 \log X_2 + \propto_3 \log X_3 + \beta_1 \log H_t + \beta_2 \log K_t + \varepsilon_t \ldots\ldots\ldots\ldots\ldots 3.13$$

3.6 Data Analysis

In order to explain the cause and effect relationship between variables in the multiple linear regression model, the data was modelled in a time series format, and a number of tests and analysis were carried out. Microsoft Excel and STATA were employed to analyze the study data, and the information was presented using tables, charts, and figures to make it easy to understand and interpret.

3.6.1 Normality Test

The data was tested to check whether it is normally distributed through the skewness and kurtosis coefficient test. Multiple linear regression model assumes that the error term in the regression equation is distributed normally with zero mean, variance as sigma squared and covariance as zero (Gujarati, 2006). This test was used to estimate the probability that a random variable referred to as an outlier would have a normal distribution as well as whether the data set came from a population that was normally distributed.

3.6.2 Multicollinearity Test

The independent variables in the study were tested for correlation using the Variance Inflation Factor (VIF). A high intercorrelation between the independent factors in a model with multiple regression leads to a larger confidence interval which produces probabilities that are less reliable in determining the effect of the independent variables in a model. This in turn makes it hard to identify the particular predictor variable that contributes to the variance in the dependent variable. If a VIF is larger than 10, multicollinearity is severe, according to the rule of thumb. The greater the VIF, the more severe the multicollinearity effects.

3.6.3 Heteroscedasticity and Autocorrelation Tests

The Breusch-Pagan test tested for heteroscedasticity in this model, whereas autocorrelation was tested using the Durbin-Watson Statistic test to check the correlation between error terms across time, to ensure the assumption of independence of observations and the residuals modelled are correctly specified.

3.6.4 Unit Roots

The time series properties of stationary of the multiple regression model were tested through the ADF (Augmented Dickey-Fuller) test. A model is said to have unit roots if it is non-stationary, because it gives invalid results since the mean and variance of estimations derived from such data are non-constant, which will then affect the results and interpretation after analysis.

3.7 Variable Measurement and definition

Table 3.6.1 Variable measurement and definition.

Variable	Source	Definition	Measurement
Economic Growth (Government Expenditure)	International Monetary Fund (IMF)	Government expenditure is money spent by the public sector on the acquisition and provision of goods and services.	Weighted Average
Active Mobile Money Agents	International Telecommunications Union (ITU)	This refers an account registered and can be used to facilitate the mobile money services through an agent.	Weighted Average
Mobile Money Transfers	International Telecommunications Union (ITU)	This is an amount of money moved from one mobile money account to another.	Weighted Average
Active Mobile Money Subscriptions	International Telecommunications Union (ITU)	This is the total number of mobile money client accounts that have	Weighted Average

		utilized the service at least once in the last three months to make transactions that involved the transfer of value and produced income.	

CHAPTER FOUR

DATA ANALYSIS, PRESENTATION AND INTERPRETATION

4.1 Introduction

The study findings which comprised of the results and interpretation of analyzed data were discussed in this chapter. This included the descriptive statistics, multivariate normality test, multicollinearity test, heteroscedasticity and autocorrelation tests, unit root test as well as a regression analysis of the variables.

4.2 Descriptive Statistics

The variables were in a monthly basis from January 2014 to December 2021. In Table 4.1, there were three categories of measures; central tendency, dispersion and distribution.

Table 4.1: Descriptive Statistics

Measure	Log Government Expenditure	Log Active Mobile Money Subscriptions	Log Active Mobile money agents	Log Mobile Money Transfers	Log Capital	Log Labor
Mean	9.37	7.44	5.24	11.93	10.63	3.86
Median	9.45	7.44	5.27	12.06	10.64	3.84
Std. Dev	0.35	0.06	0.15	0.52	0.08	0.07
Minimum	8.65	7.32	5.00	10.55	10.51	3.79
Maximum	9.84	7.55	5.49	12.64	10.76	3.96
Observations	32.00	32.00	32.00	28.00	8.00	8.00

Source: Author, STATA Output

Interpretation of the results

The country's log of the value of GDP measured by government expenditure and the dependent variable in the study ranged from a value of 8.65 minimum to a value of 9.84 maximum. The mean and standard deviation stood at 9.37 and 0.35 respectively. The data points were positioned extremely close to the Mean. Evans (1951) in his study, he emphasized that the Mean is more

reliable when the Standard Deviation is closer to 0, which also shows very little volatility in the sample. On this basis therefore, the total expenditure with a standard deviation of 0.35 was considered to be a consistent variable.

The log value of the active mobile money subscriptions, an independent variable in the study used to measure mobile money services registered a value of 7.32 minimum and a value of 7.55 maximum, with a mean and standard deviation of 7.44 and 0.06 respectively. The standard deviation was 0.06 which is a value close to 0 and therefore translated to the variable being consistent.

The log value of agents ranged between a high of 5.49 and a low of 5.00. It registered a mean and standard deviation of 5.24 and 0.15 respectively, which showed that the variable is consistent and the scores were close to the value of the mean which was a good representation of the typical respondent.

The log value of the Mobile commerce an independent variable and measure of mobile money services, had a low of 10.55 and a high of 12.64, while the mean and standard deviation stood at 11.93 and 0.52 respectively. The standard deviation being a value close to 0 shows that the variable was consistent, with a reliable mean.

The log value of capital and labor which were the moderating variables in the study registered a minimum of 10.51 and 3.79 respectively, while their maximum values stood at 10.76 and 3.96 respectively. Capital registered a mean and standard deviation of 10.63 and 0.08 respectively, while labor registered a mean and standard deviation of 3.86 and 0.07 respectively. From the findings, both variables were consistent variables.

4.3 Diagnostic Testse

4.3.1 Normality Test

The normality test was used to determine how the data was distributed, which investigated the random variables underlying the data set, to be normally distributed, thereafter guiding the inference made. Distribution of the data was employed through the measure of Kurtosis and skewness parameters.

The rule of thumb for skewness and kurtosis was that a dataset was normally distributed/ symmetric when skewness values fell in the range of − 3 and + 3, and kurtosis values ranged between − 10 to + 10 (Brown, 2006).

Table 4.2: Skewness and Kurtosis Statistics

Variable	Log Government Expenditure	Log Active Mobile Money Subscriptions	Log Active Mobile Money Agents	Log Mobile Money Transfers	Log Capital	Log Labor
Skewness	-0.65	0.13	-0.08	-0.79	-0.22	0.31
Kurtosis	2.30	1.90	1.79	3.31	1.88	1.40

Source: Author, STATA Output

Table 4.2 showed that the skewness of log value of total expenditure, log value of active mobile money subscriptions, log value of active agents, log value of mobile commerce, capital and labor stood at -0.65, 0.13, -0.08, -0.79, -0.22 and 0.31 respectively, which were all within the given rule of thumb, hence were normally distributed. Similarly, the kurtosis test carried out on the variables showed that the data was normally distributed, with total expenditure, active mobile money subscriptions, active agents, mobile commerce, capital and labor registering a kurtosis of 2.30, 1.90, 1.79, 3.31, 1.88 and 1.40 respectively.

4.3.2 Heteroscedasticity and Autocorrelation Tests

Heteroscedasticity occurs when the variance of the error terms varies. A dataset that has varying variance gives unreliable information to make inferences and conclusions of a study. Heteroscedasticity was tested using the Breusch-Pagan test Gujarati et al, (2009). The results are in Table 4.3.

Table 4.3: Heteroscedasticity Test: Breusch-Pagan

Null hypothesis	Chi-squared	P-value
Constant variance in Government Expenditure	0.57	0.4519

Source: Author, STATA Output

Table 4.3 presents the result of Breusch-Pagan test that showed a homoscedastic data set with constant variance in the residuals.

The null and alternative hypotheses used in this test were:

H_o: *Constant variance*

H_a: *Non-constant variance*

The Chi-squared was found to be greater than the 5% critical value and 0.4519 > 0.05 P-value, therefore the null hypothesis was accepted.

Autocorrelation was carried out to test for the correlation of a series of observations ordered in time (Gujarati, 2009). In Table 4.4, the Breusch-Godfrey Statistic which tested autocorrelation was presented.

Table 4. 4: Breusch-Godfrey Test

Lag (p)	**Chi-squared**	**Degrees of freedom**	**P-value**
1	0.000	1	1.000

Source: Author, STATA Output

The residual diagnostic results of serial correlation were shown in Table 4.4. The hypotheses of the test were;

H_o: No serial correlation

H_a: Serial correlation.

The results showed that the model passed the test of serial correlation using p-value and the Chi-squared value when comparing the test-statistic 0.000 with 1.96 critical value (5% level of significance) using the null hypothesis, no serial autocorrelation.

4.3.3 Correlation Analysis

The relation between the study variables was tested using correlation analysis. A coefficient of; 1 indicated perfect correlation, between 1 and 0.5 showed high correlation, between 0.5 and 0.3 denoted moderate correlation, and below 0.3 denoted a weak relationship between two variables.

The outcomes of this analysis are displayed in Table 4.5.

Table 4.5: Correlation analysis

	Log Government Expenditure	**Log Active Mobile Money Subscriptions**	**Log Active Mobile Money Agents**	**Log Mobile Money Transfers**	**Log Capital**	**Log Labor**
Log Government Expenditure	1					
Log Active Mobile Money Subscriptions	0.8600	1				
Log Active Mobile Money Agents	0.9158	0.9144	1			

Log Mobile Money Transfers	0.9140	0.7625	0.9504	1		
Log Capital	-0.1069	0.1288	0.0467	-0.1053	1	
Log Labor	0.9518	0.9349	0.9205	0.8604	-0.1424	1

Source: Author, STATA Output

The analysis showed a significant correlation between the log of government expenditure and the log of active mobile money subscriptions, log of active mobile money agents, log of mobile money transfers and log labor. This meant that a rise in these factors led to a rise in government spending, which in turn led to a rise in economic growth.

On the contrary, a one unit increase in the log of capital in the telecommunication sector results to a lower government expenditure and thus lowering growth.

4.3.4 Unit Roots

To determine if a time series data collection is stationary or not, the Augmented Dickey Fuller (ADF) was used. Presence of unit root suggests that variables are non-stationary. However, differencing the variables will make them stationary. Since estimates derived from non-stationary time series data will have constant mean and variance, using such data for data analysis may produce inaccurate conclusions (Gujarati, 2009). This test is performed before regression analysis as a pre-estimation test.

Table 4.6: ADF Unit Root Test

Variable	Test Statistic	1% level	5% level	10% level
Log Government Expenditure	-8.248	-4.334	-3.58	-3.228
Log Active Mobile Money Subscriptions	1.104	-2.65	-1.95	-1.602
Log Active Mobile money agents	-2.621	-4.334	-3.58	-3.228
Log Mobile Money Transfers	3.182	-2.657	-1.95	-1.601
Log Capital	0.403	-2.657	-1.95	-1.601
Log Labor	1.514	-2.66	-1.95	-1.6

Source: Author, STATA Output

The hypotheses of the test were;

H_o: Unit Root

H_a: No unit root

The ADF test statistic was compared to the critical values of 1%, 5%, and 10% respectively as the choice criteria. When the test statistic exceeds the crucial value, the null hypothesis will be rejected (Lowry, 2014). When the ADF test statistic is less than the crucial values, the null hypothesis was rejected if the values were negative.

The log value of Government Expenditure ADF test statistic of -8.248 was less than -4.334, -3.58 and -3.228 at the respective levels of significance. There was no unit root since the null hypothesis was rejected.

The log value of Active mobile money subscriptions ADF test statistic of 1.104 was greater than -2.65, -1.95 and -1.602 at the respective levels of significance, showing no unit root.

The ADF test statistic for the log value of agents stood at -2.621, which was less than -4.334, -3.58 and -3.228 which were respectively at the respective levels of significance. Therefore, we accepted the null hypothesis and concluded that there was a unit root.

The ADF test statistic for the log value of mobile money transfers stood at 3.182, which was greater than -2.657, -1.95 and -1.601 at the respective levels of significance. There was no unit root since the null hypothesis was rejected.

The ADF test statistic for capital stood at 0.403, which is greater than -2.657, -1.95 and -1.601 which were respectively at the 1%, 5% and 10% levels of significance. Therefore, the null hypothesis was rejected and concluded that there was no unit root.

Labor registered an ADF test statistic of 1.514, which is greater than -2.66, -1.95 and -1.6 at the respective levels of significance respectively. The null hypothesis was therefore rejected and it was concluded that there was no unit root.

4.4 Regression Analysis

In Table 4.7, regression was employed to investigate the cause-effect relation between the study variables. Government expenditure was regressed as the outcome variable while active mobile money agents, mobile money transfers, active mobile money subscriptions as the predictor variables, while capital and labor were the moderating variables.

Table 4.7: Regression Analysis (i)

No. of Observations	F(5, 18)	P-value	R-Squared	Adjusted R-Squared	Root MSE
7	6.22	0.2950	0.9688	0.8130	0.04147

Source: Author, STATA Output

The hypothesis was that there was a relationship between economic growth represented by government expenditure and mobile money services measured through active mobile money agents, mobile money transfers, active mobile money subscriptions, capital and labor in the study. Table 4.7 showed that both controlled and independent variables had no significant influence on the government expenditure since the F statistic was 0.82<1.96 and 0.2950 p-value, greater than 0.05.

To further test the results from this regression, we used the multicollinearity test to identify if the model was affected by a problem of collinearity through the Variance Inflation Factor (VIF). The collinearity among predictor variables was tested within the multiple regression model by calculating an independent variable and regressing it against every other predictor variable.

Table 4.8: VIF Test (i)

Variable	VIF	1/VIF
Log Active Mobile Money Agents	348.96	0.002866
Log Mobile Money Transfers	202.07	0.004949
Log Labor	189.51	0.005277
Log Active Mobile Money Subscriptions	81.78	0.012228
Log Capital	2.76	0.362251
Mean VIF	165.01	0.7751

Source: Author, STATA Output

The mean VIF 165.01 as shown in Table 4.8, is more than the threshold of 10 indicating that multicollinearity would interfere with the research findings, thus contributing to the insignificance of the regression model. To deal with this problem of multicollinearity and significance of the regression model, some of the variables namely: Log active mobile money agents, Log labor and Log active mobile money subscriptions were simultaneously dropped to improve the result findings as postulated in the Tables 4.8 and 4.9

Table 4.9: Regression Analysis (ii)

No. of Observations	F(2, 4)	P-value	R-Squared	Adjusted R-Squared	Root MSE
7	10.15	0.0271	0.8354	0.7531	0.04765

Source: Author, STATA Output

The standard error of regression as per Table 4.9 is 0.04765. This can be interpreted as the average distance of the data from the fitted line to be about 4.765%. R-squared on the other hand shows that the model predicts 83.54% of the study variables while the adjusted R-squared shows that the model accounts for 75.31% of the study variables after adjustments of the number of predictors in the model. The percentage has gone down hence confirming that the new terms improves the model by less than expected by chance.

Table 4.10: VIF Test (ii)

Variable	VIF	1/VIF
Log Mobile Money Transfers	1.01	0.988906
Log Capital	1.01	0.988906
Mean VIF	1.01	0.988906

Source: Author, STATA Output

From the results obtained above, it is evident that the problem of multicollinearity has been resolved, with the mean VIF as 1.01, which was below the rule of thumb of 10. The results showed that the variables were not correlated hence multicollinearity did not interfere with the regression analysis results.

Table 4.11 showed that the regression model from the analysis was significant.

Table 4.11: Model Significance

Null Hypothesis	F-statistic	P-value
Model is not significant	10.15	0.0271

Source: Author, STATA Output

The study hypothesized that there was a relationship between government expenditure and active mobile money agents, mobile money transfers, active mobile money subscriptions, capital and labor. Table 4.11 shows that both mobile money transfers and capital as the independent and control variables respectively have a significant influence on the government expenditure after the variables were adjusted. The F statistic 10.15 was more than 1.96 critical value and 0.0271< 0.05 p-value, meant that the model was statistically significant.

Table 4.12: Coefficients

Log Government Expenditure	Coefficient	Std . Err .	t	P > t	95% Conf.	Interval
Log Mobile Money Transfers	0.1331438	0.0297505	4.48	0.011	0.0505432	0.2157445
Log Capital	-0.0141069	0.2687891	-0.05	0.961	-0.760385	0.7321712
_cons	8.162692	2.923765	2.79	0.049	0.0450194	16.28036

Source: Author, STATA Output

Table 4.12 shows the contribution of the predictor variables to the response variable.

Mobile money transfers had a coefficient and test statistic of 0.1331438 and 4.48 respectively**.** It was therefore statistically significant at 5% level of significance because 4.48 > 1.96. This implies mobile money transfers had an impact that was significant on government expenditure. A p-value of 0.011 ascertained its significance. A unit increase in the mobile money transfers would increase government expenditure by 0.1331438 units ceteris paribus.

Capital had a coefficient of -0.0141069 and a significance of -0.05. Since the t-statistic -0.05 > -1.96 and the p-value of 0.961 > 0.05, this implied that capital was statistically insignificant at a 5% level of significance. A unit increase in capital invested in the telecommunication sector would decrease government expenditure by -0.0141069 units, ceteris paribus.

The intercept had a positive coefficient of 8.162692, which was the change brought about by other factors not captured in this model. This meant that government expenditure would increase by 8.162692 units given that mobile money transfers and capital were at zero.

These results show that equation 3.15 based on the regression results becomes;

$$Log\ Y_t = \propto_0 + \propto_2 \log X_2 + \varepsilon_t \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots 3.16$$

Where coefficients $\propto_0$ and $\propto_2$ represent a change in y (Government expenditure) relative to unit change in X_2 represents mobile money transfers.

Table 4.13 shows the Analysis of Variance statistics.

Table 4. 13: ANOVA

Source	Sum of Squares	Degrees of Freedom	Mean of Squares
Model	.046108595	2	.023054298
Residual	.00908265	4	.002270663
Total	.055191246	6	.009198541

Source: Researcher, STATA Output

R-Squared accounted for variation in the dependent variable explained by predictor variables. From the model summary Table 4.12 the R squared was 83.54%. The predictor variables namely; mobile money transfers and capital explained 83.54% of the variation in government expenditure. Approximately 16.46% was captured by other factors which have influence on government expenditure, excluded from the model.

CHAPTER FIVE

SUMMARY, CONCLUSIONS AND POLICY IMPLICATIONS

5.1 Introduction

The research findings, which included a summary, a conclusion, and recommendations for public policy, were presented as described in the preceding chapter.

5.2 Summary of findings

The main study objective was to determine the effect of mobile money services on economic growth in Kenya, with economic growth as the dependent variable measured using government expenditure and mobile money services measured by active mobile money subscriptions, mobile money transfers and active mobile money agents, which were the independent variables. Control variables introduced in the study were capital and labor in the telecommunication sector. The secondary data on the variables were collected from KNBS and CBK, organized and cleansed to run the analyses using STATA.

The study's conclusions showed that there was a weak correlation between Kenya's economic growth and mobile money services. This was due to the high level of multicollinearity identified in the model. This meant that the intercorrelation between the independent variables were unreliable in determining the studies main objective. As a result, the researcher resulted in dropping of variables to remedy the identified problem.

Once variables were dropped, the research findings resulted to mobile money transfers having a positively significant effect on economic growth measured through government expenditure. The analysis showed that a unit increase in mobile money transfers increased government expenditure by 0.1331438 units. Mobile money transfers were also statistically significant at 5%. However,

the results from the analysis postulated that the control variable, capital, had an insignificant influence on the effects mobile money services had at 5% confidence interval.

5.3 Conclusions

The results showed that on one hand the mobile money services; mobile money agents and mobile money subscriptions as well as the moderating variables capital and labor had a statistically insignificant effect on economic growth. However, after further analysis, the findings evidenced that mobile money transfers had a positively significant effect on economic growth. This therefore indicates that mobile money services alone cannot contribute to a significant effect on economic growth, which is consistent with Nyasimi (2016) whose results indicated that in both the short run and the long run, the number of consumers and agents had little to no impact on economic growth.

5.4 Policy Recommendations

Evidenced from the research findings, active mobile money agents and active mobile money subscriptions do not fully benefit economic growth, due to their insignificant effect on economic growth. The study findings suggested the following recommendations;

First, when formulating policies to promote economic growth and development, policymakers should take mobile money transfers into account. As shown, mobile money transfers had a large impact on economic growth while having an insignificant association with the quantity of active mobile money agents, active mobile money subscribers, capital, and labor in the telecommunications sector. If significant change is observed, the influence can be noticeable. This further assumes that although there may be a causal link, it comes about because of the convenience that mobile money transfer services bring to the economy. Mobile money transfers increase financial inclusion and employment prospects, which increases the likelihood that underserved and unserved populations may use mainstream financial services. These transfers

make sending and receiving money from overseas more convenient and less expensive. Second, there should be government intervention. This can be achieved through the implementation of a cashless transactions economy, which will increase uptake of mobile money transfers and in turn would boost the active mobile money subscriptions base. In the long run, this could open up new opportunities for micro and small enterprises, especially in low-income countries, to access financial services.

Third, the population should be sensitized to save by utilizing mobile money services such as M-shwari which is a new technological innovation that is showing great potential in impacting the economic growth through increased mobile money savings and thus should be encouraged.

5.5 Suggestions for Further Research

In the course of this research, some areas were identified which could be studied to give a broader insight on mobile money services and their effect on economic growth. It is suggested that future studies may use primary data to determine the qualitative influence of the effect of the mobile money services on economic growth in Kenya, first-hand from the Kenyan population. A study could be carried out on how the government and financial institutions influence mobile money services in the economy, through economic integration. The creation of common markets will open up opportunities for arbitrage profits, particularly in currency exchanges because member countries may seek out different interest rates and profit from inflation rate mismatches.

REFERENCES

Asongu, S. A., & Nwachukwu, J. C. (2016). Foreign aid and governance in Africa. *International Review of Applied Economics*, *30*(1), 69-88.

Atanga, S. N. (2020). Digitalization of agriculture: How digital technology is transforming Small-scale a farming in Ghana.

Bertola, G. (2000). Macroeconomics of distribution and growth. *Handbook of income distribution*, *1*, 477- 540.

Bisignano, J. (1998). *Towards an understanding of the changing structure of financial I intermediation: an evolutionary theory of institutional survival* (No. 4). SUERF Studies.

Brown, S(2006). Measures of shapes: Skewness and Kurtosis

Cochrane, J. H. (2017). The new-Keynesian liquidity trap. *Journal of Monetary Economics*, *92*, 47-63.

Donovan, K. (2012). Mobile money for financial inclusion. *Information and Communications for development*, *61*(1), 61-73.

Evans, W. D. (1951). On the variance of estimates of the standard deviation and variance. *Journal of the American Statistical Association*, *46*(254), 220-224.

GSMA. (2021). State of the industry report on mobile money.

Gujarati, D. N., & Porter, D. C. (2009). Causality in economics: The Granger causality test. *Basic Econometrics (Fifth international ed.). New York: McGraw-Hill*, *652*.

Huang, Y., Wang, X., & Wang, X. (2020). Mobile payment in China: Practice and its effects. *Asian Economic Papers*, *19*(3), 1-18.

Hughes, N., & Lonie, S. (2007). M-PESA: mobile money for the "unbanked" turning cellphones into 24- hour tellers in Kenya. *Innovations: technology, governance, globalization*, *2*(1-2), 63-81.

Jakhiya, M., Bishnoi, M. M., & Purohit, H. (2020). Emergence and growth of mobile money in modern India: A study on the effect of mobile money. In *2020 Advances in science and engineering technology international conferences (ASET)* (pp. 1-10). IEEE.

Kenya National Bureau of Statistics. (2020). *Economic survey*. Government Printer.

Kirui, O. K., Okello, J. J., Nyikal, R. A., & Njiraini, G. W. (2013). Impact of mobile phone-based money transfer services in agriculture: evidence from Kenya. *Quarterly Journal of International A Agriculture*, *52*(892-2016-65177), 141-162.

Klein, A. (2020). China's digital payments revolution. *Brookings Institution, Washington*.

Malamud, S., & Zucchi, F. (2019). Liquidity, innovation, and endogenous growth. *Journal of Financial E Economics*, *132*(2), 519-541.

Manfred K. (2017). Effects of mobile money services on financial development in Ghana

Mawejje, J., & Lakuma, P. (2019). Macroeconomic effects of Mobile money: evidence from Uganda. *Financial innovation*, *5*(1), 1-20.

Mckay, C. (2011). Ghana, aiming for interoperability in branchless banking. *Ghana, Aiming for I Interoperability in Branchless Banking*.

Mitchell, J. (2004). Financial intermediation theory and the sources of value in structured finance markets. *National Bank of Belgium*.

Momanyi, V. K. (2011). *Factors affecting effective capacity in mobile phone money transfer Services: A c case of Safaricom M-Pesa services* (Doctoral dissertation).

Nicco-Annan, K. (2020). *That's MoMo like it: everything you need to know about mobile money in Ghana*

Nyasimi, E. W. (2016). *Effects of mobile money transfer services on economic growth in Kenya* (Doctoral dissertation, Kca University).

Onsomu, E., Nyabaro, V., & Munga, B. (2021). Policy Brief No. 9 of 2020-2021 on Exploiting J Job Creation Potential for Youth in the Information and Communication Technologies Sector in Kenya.

Ozili, P. K. (2018). Impact of digital finance on financial inclusion and stability. *Borsa Istanbul Review*, *18*(4), 329-340.

Parasol, M. (2022). China's Digital Yuan: Reining in Alipay and WeChat Pay. *Banking & Finance Law Review*, *37*(2), 265-303.

Porteous, D. (2006). The enabling environment for mobile banking in Africa.

Romer, P. M. (1986). Increasing returns and long-run growth. *Journal of political economy*, *94*(5), 1002- 1037.

Romer, P. M. (1994). The origins of endogenous growth. *Journal of Economic perspectives*, *8*(1), 3-22.

Ross, S. (2021). What Is the Relationship Between Money Supply and GDP?

Rouse, M. (2017). Mobile banking in Sub-Saharan Africa: setting the way towards financial development.

Safaricom (2017), Kenya Marks 10 Years of M-Pesa Transforming Lives.

Scholtens, B., & Van Wensveen, D. (2003). *The theory of financial intermediation: an essay on what it does (not) explain* (No. 2003/1). SUERF Studies.

Sector, S., & Itu, O. F. (2016). ITU-T.

Vong, J., & Song, I. (2015). *Emerging technologies for emerging markets* (Vol. 11). Springer.