UNIVERSITY OF CAPE COAST

FINANCIAL INNOVATION AND FINANCIAL FRAUD IN SOME SELECTED COUNTRIES IN AFRICA

EDWINA ESI AFFUL

2021

UNIVERSITY OF CAPE COAST

FINANCIAL INNOVATION AND FINANCIAL FRAUD IN SOME SELECTED COUNTRIES IN AFRICA

BY

EDWINA ESI AFFUL

Thesis submitted to the Department of Finance of the School of Business, College of Humanities and Legal Studies, University of Cape Coast in partial fulfilment of requirements for the award of Master of Commerce degree in Finance

DECEMBER 2021

DECLARATION

Candidate's Declaration

I hereby declare that this thesis is the result of my own original research and that no part of it has been presented for another degree in this university or elsewhere.

Candidate's Signature …… Date …….

Name: Edwina Esi Afful

Supervisor's Declaration

I hereby declare that the preparation and presentation of the thesis were supervised in accordance with the guidelines on supervision of thesis laid down by the University of Cape Coast.

Supervisor's Signature …… Date …….

Name: Professor Siaw Frimpong

ABSTRACT

The banking industry is witnessing a revolution as a result of financial innovations that have become a common feature of banking in the contemporary business environment. The increasing activities of the internet and the proliferation of mobile telecommunication companies in financial activities present both an opportunity and a challenge to banks on the continent. The surge in fraud activities in the finance sector, despite recent convenience, has raised questions as to whether one should use and trust these innovations. The purpose of this research is to identify the effect of financial innovations (product and process) on financial fraud in some selected African countries. This study is a quantitative research (explanatory design) of 17 countries in Africa over a seven-year period (2013-2019). The study explored the fixed effect and random effect models in order to solve heterogeneity issues in the panel data and the Generalised Method of Moments. The study found that domestic credit to private sector by banks, the number of automated teller machines and research and development expenditure had negative relationship with fraud loss (dependent variable). On the other hand, broad money (M3) and the number of patent applications had a positive relationship with fraud loss. Also, unemployment, as a control variable, had a positive relationship with fraud loss. The study concludes that product and process innovations have both positive and negative implications on financial fraud. The study recommends that domestic credit to private sector and research and development expenditure should be increased in countries. In addition, patent application process should ensure that security features are secure and the number of ATMs in the countries are increased.

KEYWORDS

Cyber crime

Cyber security

Financial Fraud

Financial Innovation

Fraud Loss

Product Innovation

Process Innovation

ACKNOWLEDGEMENTS

I would like to express my sincere gratitude to my supervisor, Prof. Siaw Frimpong, of the Department of Finance, for his professional guidance, advice and patience with which he guided this work. I am exceptionally grateful.

I am also grateful to Mr. Paul Mensah Adjei, Mr. Ishmael Acquah and Mr. Jones Arkoh Painstil for their generous contributions in making this work better. I also appreciate my family and friends for their support and encouragement. I am truly very grateful.

DEDICATION

To my mother, Anna and my sisters, Veronica and Sharon.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF ACRONYMS

ACFE	-	Association of Certified Fraud Examiners
ASSOCHAM	-	Associated Chambers of Commerce and Industry of India
ATM	-	Automated Teller Machine
BFID	-	Banking Fraud Investigations Department
CIMA	-	Chartered Institute of Management Accountants
EFT	-	Electronic Fund Transfer
FD	-	First Difference
FDI	-	Foreign Direct Investment
FE	-	Fixed Effect
FGLS	-	Feasible Generalized Least Square
GCB	-	Ghana Commercial Bank
GDP	-	Gross Domestic Product
GLS	-	Generalised Least Squares
GMM	-	Generalised Method of Moments
ICT	-	Information and Communication Technology
IMF	-	International Monetary Fund
LSDV	-	Least Square Dummy Variable
MFIs	-	Micro-Financial Institutions
MFS	-	Mobile Financial Service (s)
NDIC	-	Nigeria Deposit Insurance Corporation
OLS	-	Ordinary Least Square
PWC	-	PriceWaterhouse Coopers
RE	-	Random Effect

ROA	-	Return of Assets
ROE	-	Return on Equity
RTGS	-	Real-Time Gross Settlement
SPSS	-	Statistical Package for the Social Sciences
SSE	-	Sum of Squared Errors
UEMOA	-	Union Economique et Monetaire Ouest Africaine
WDI	-	World Development Indicators

CHAPTER ONE

INTRODUCTION

In general, "fraud" is not a modern phenomenon, since it tends to be synonymous with human nature. Fraud is one of the many evils that individuals, regardless of their status, age, race, religious or organizational affiliation, participate in knowingly or unconsciously using a variety of strategies, techniques, and tactics. While fraud keeps the perpetrators enriched and even exalted during the intertemporal period of occurrence, it causes pains, anger, "losses," and economic retrogression to the victims, whether they be individuals, corporate entities, or nations at large (Ahmad, Ciupac-Ulici & Beju, 2021). Following the financial crisis of 2007/2008, which was blamed in part on financial innovation, there has been much discussion on the benefits and bad consequences of these fraudulent developments on the economy. However, there have been some disagreements with the earlier notion as other studies have studied the benefits of financial innovation in the growth of economies (Agbai, Haizel, Seidu & Twum, 2015; Danaa, Sappor & Diyawu, 2016; Abir, Raoudha & Emma, 2016). Dwelling on the two notions discussed above, the chapter will argue that financial innovation in Africa has resulted in a "fraudogenic" system.

Background to the Study

Development is essential for growth in every society. In many economies, most growth has been credited to innovations (Coombs, Saviotti & Walsh, 1987). According to Mosoti and Masheka (2010), if an organization or business works as if their environment is stable, then that business will lose its competitive advantage. Such a company is also bound to face huge losses.

Therefore, it has become necessary for many businesses to innovate in order to meet business needs and survive in their environment. Merton (1992) stated that new products and services in finance have categorized innovations as "an engine of economic growth." In other words, innovation serves as the basis of growth for companies that embrace it and countries that encourage it. It can also be said that "innovation embraces the firm that is first to introduce it and the subsequent spread to others" (Heffernan, Fu & Fu, 2008). The importance of innovation is for every business sector's survival and this is not different from the financial service sector (Frimpong, Domeher & Appiah, 2014).

The manufacturing sector usually has productive advances but this is not the only constitute of an economy's growth (Heffernan, Fu & Fu, 2008). No less important is the service sector, which also makes massive contributions to an economy. So, innovation in the financial service sector is crucial for growth. King and Levine (1993) showed the direct effects of innovation and financial services through how it reduces the deposit and loan rate margin and how it also encourages faster growth in an economy. This is done by promoting the expansion of financial productivity, capital investment and effective financial intermediation (Shehzad, Zaman, Jose, Kocak & Ferreira, 2021). An indication by Lerner (2006) showed that financial innovation happens to be an area which has aroused interest in both academia and the corporate world. An argument put forward by Laeven, Levine and Michalopoulos (2015) indicated that, new financial activities have evolved as a result of technical advancements, and these activities may include the invention of new financial instruments, the formation of new financial institutions, or the use of new reporting methodologies. Sweeney and

Morrison (2004) indicated that the change in the delivery of financial services in retail banking is due to innovations in the banking industry.

Modern delivery technologies, granted by customary delivery procedures, can be categorized into product or service innovations, process innovations and institutional innovations. These financial innovations have benefited banks through the reduction of transaction cost and market expansion. Financial innovations have stimulated growth and competition in the industry, as well as deepening banking services (Macnamara & Zerfass, 2017). In Ghana and other developing countries in Sub-Saharan Africa, innovations make available avenues for banks to increase their performance in their market (Frimpong, 2010). Also, the continuous rise in competition among the banking and non-banking financial institutions in Africa's financial market may have proposed to the fore that, there is the need for the creation of financial innovation in order to retain current customers and attract new customers.

Despite these innovations, a business is not guaranteed exemption from financial risk. Research has shown that financial institutions are not immune to fraud as they lose about 5-7% of its yearly revenue to fraud (Fadipe-Joseph & Titiloye, 2012). Until recently, the globalized and liberalized business environment, especially the financial sectors, had been challenged with a growing amount of fraudulent cases (Associated Chambers of Commerce and Industry of India [ASSOCHAM], 2015). The incentive to commit fraud in today's economic environment increases as changes in the business environment occurs. Some common types of fraud in the banking industry are IT fraud, identity fraud, card fraud, forgery, frauds through electronic funds

transfer, cheque fraud, clearing fraud, false claims by staff and diversion of commissions and also procurement fraud. Korir, Shishia and Sang (2015) revealed that all these types of fraud can be categorized into two - fraudulent financial reporting (management fraud) and misappropriation of assets (employee fraud). Both categories of fraud are extremely harmful to banks.

Moses (2015) stated that the expansion in the financial market has called for increase in innovative products and services may have increased the financial risk of these institutions due to vulnerabilities in the innovative products and services. Fraudsters are quick to take advantage of these vulnerabilities, thereby making them innovative in their crimes as well. Therefore, the idea of a better and faster process of transacting business may have given rise to financial fraud. Also, technological developments and frequent evolution of the global business have led to issues surrounding the perpetration and camouflage, prevention, detection and investigation of fraud (Yego, 2016). Thus, technological advancements have made banks more vulnerable to fraud. Therefore, banks must take more sophisticated approaches to identify fraud and be ready to tackle their effects since there are new types of fraud emerge every day.

There are highly advanced and structured means of committing fraud (Rahman & Anwar, 2014). Financial innovations have become the "weapon of choice" for fraudsters, especially since most financial transactions are driven by technology (Beck, Chen, Lin & Song, 2016). Again, changes in financial institutions may have led to much-organized crime by fraudsters. In 2011, a report showed that cyber fraud caused losses of 245 million dollars in Kenya, Rwanda, Uganda, Tanzania and Zambia (Fassassi & Akoussan, 2016). In

2013, Ivory Coast and Senegal reportedly lost 46.6 million dollars and 27 million dollars respectively (Fassassi & Akoussan). Sub-Saharan African banks, according to specialists at Dataprotect, a Moroccan organization, are particularly vulnerable to cyberattacks. This might be attributed to a scarcity of skilled experts and a lack of cybersecurity investment. Also, innovative mobile money systems such as MTN mobile money in Ghana and Nigeria, and M-Pesa in Kenya and Tanzania have emerged into important payment services that move billions of dollars each year (Buku & Mazer, 2017). Mobile financial services (MFS) have, unfortunately, quickly become a conduit for fraud and other illegal conduct.

It was indicated that cybercrime losses in Africa amounted to 4.88 billion dollars in 2020 relative to 735.73 billion dollars across the world. This analysis shows that Africa did not perform well in cybersecurity management (Berrada, 2020). However, Mishra (2008a) pointed out that financial innovations are neither entirely beneficial nor entirely negative but contain a combination of both elements. As a result of the negative impact associated with financial innovation such as fraud, an enquiry between financial innovation and fraud is necessary if banking firms are to adequately prevent and minimize risks pertaining to innovation.

Statement of the Problem

Large amount of resources are committed in the development of corporate governance policies, risk management practices, how to execute internal control measures and also the training of employees to abide by these measures (Moses, 2015). Fraud seems to be a major problem faced by organizations around the globe and its occurrence in any organization is

damaging. Mostly, bank frauds are reported at industries that are growing rapidly in developed nations. A more recent study by Asomaning (2019) indicated that bank frauds may represent one of the major causes of bankruptcy in the world, considering the Iceland crisis in 2008. From the Indian Chamber of Commerce report, India has witnessed massive growth but has also faced challenges as incidents of fraud have been on the rise (ASSOCHAM, 2015). They indicated India lost 20 billion US dollars to fraud in that year and this affected the Foreign Direct Investment (FDI) of the country.

PricewaterhouseCoopers (PWC, 2018) found in their Fraud Survey that 49% of global firms experienced economic crime in 2017 and 2018. It was also reported that, out of the top ten countries affected most by fraud, five are African. These included South Africa with 77 percent of fraud report (topping the chart on the global fraud map), Kenya came in second on the chart with 72 percent of reports. Uganda, Gambia and Tanzania also joined the top ten list respectively. Research conducted by PwC in 2007 and the Association of Certified Fraud Examiners have shown that developed countries have lost huge sums of money to fraudsters through financial fraud (Chartered Institute of Management Accountants [CIMA], 2008).

Yego (2016) stated that “a way of making money is to stop losing it.” From 2000 to 2015, Africa was reported to have lost $836 billion in fraud (Kamau, 2020). Africa also witnessed the greatest economic crime increase from 50% in 2014 to 57% in 2016 as a region (PwC, 2016). Again, cybercrime in 2015 costs the world economy a total of 500 billion dollars which is more than South Africa's GDP (350.6 billion dollars) and a little less than Nigeria’s

GDP (521.8 billion dollars) (Nzeakor, 2018). Africa's GDP was 3.3 trillion dollars in 2017, and the impact of cybercrime was 3.5 billion dollars, with Nigeria, Kenya, and South Africa experiencing the most losses (Odonkor, 2020).

In 2019, a survey of banks from the UEMOA (Union Economique et Monetaire Ouest Africaine) member countries plus three Central African Countries revealed that 85 percent of banks have already experienced at least one cyberattack that resulted in losses, and several were subjected to recurring attacks. Out of this, only 6 percent of the incidents were detected by the financial institution's cybersecurity team. South Africa also reported that, the gross fraud losses for issued banks cards alone soared by 18 percent in 2018 from 2017 and that of online banking, banking apps and mobile banking increased by 75.3 percent. Unsecured telecommunication infrastructure has provided an enabling climate for fraud to prosper in most African countries, contributing to a drop in productivity in many industries. More than 90% of African companies operate without the required cybersecurity infrastructure, which is very concerning (Odonkor, 2020).

Despite the abundance of research on the topics separately, empirical studies on the contribution of financial innovation to financial fraud are severely constrained (financial innovation or financial fraud). The majority of African studies have focused on the relationship between financial innovation and bank performance (Danaa, Sappor & Diyawu, 2016; Asomaning, 2019). However, the few research that have looked at the effect of financial innovations on financial fraud have come up with conflicting findings (Mativo, 2016; Moses, 2015). It is, therefore, imperative to conduct a research

in the subject of financial innovation and financial fraud especially in the wake of new financial innovations being introduced along with the increase in financial crimes over the years. This study seeks to fill the gap by specifically examining how two components of financial innovations (product and process) contribute to financial fraud in the banking industry in Africa. This is because, previous studies have focused on the topic on country basis and not the continent.

Moreover, this study will use a panel data instead cross-sectional data used by most studies. This is because, panel data contains more information and more variability as compared to the cross-sectional data. It is also alleged that in many of the developed countries, the crime reported has decreased in the past two decades and a lot of debate has taken place on whether this is true (Farrell, Tseloni, Mailley & Tilley, 2011; Knepper, 2015). There is, however, a dearth of research effort in developing countries, especially as regards financial innovation, which is the primary focus of the study.

Purpose of the Study

The purpose of the study is to examine whether financial innovations contribute positively or negatively to financial fraud in Africa.

Research Objectives

This study has the general objective of determining whether financial innovations have a relationship with financial fraud in banks in Africa. To achieve this general objective, the following specific objectives are considered. These specific objectives are to:

1. Establish the impact of product innovation on financial fraud in banks in Africa.

2. Assess the effect of process innovation on financial fraud in banks in Africa.

Research Hypotheses

In order to address these objectives, the following research hypotheses were formulated for objectives one and two.

H_0: There is a no significant relationship between process innovation and financial fraud.

H_0: There is a no significant relationship between product innovation and financial fraud.

Significance of the Study

The study will provide a host of benefits to banks, governments and academia. As a result, the study will have managerial, policy and theoretical implications. Managerially, the study's findings will inform management of the various banks on issues pertaining to innovation and financial fraud in the banking industry and how best they can put measures in place to prevent and minimize its detrimental effect. Also, this study will help the banking industry in Africa and its policymakers to understand more about how financial fraud may have increased and enable them to take necessary steps to mitigate the phenomenon through inter-banking cooperation. This study will also add to literature by addressing how innovations in finance influence financial fraud thereby serving as a reference material for other researchers.

Delimitations

The study focuses on financial institutions in Africa with major concentration on few countries within the continent. This is because the number of financial institutions within the continent are numerous (many of

which are unknown to the researcher) with few countries making their fraud losses known.

Limitations

The study will focus on using quantitative research design which may limit the interpretation of results because some qualitative research may be needed to explain some results. Some challenges envisaged were the collection of data relating to financial fraud. This caused the researcher to limit the year span of data because very few countries publish their fraud data publicly. Attempts to measure the true extent of fraud has proven difficult (CIMA, 2008). This may be because majority of fraud cases are undetected, and some are not reported even when they have been detected. A reason for this may be because companies do not want to have negative publicity or press. Another reason may also be the difficulty to distinguish between careless and poor record keeping. Also, the measurement of financial fraud (fraud loss) may not reflect the true number or frequency of the occurrence of financial fraud as it considers only the cost of fraud.

Organisation of the Study

This study is organised into five chapters. The introductory chapter, which is Chapter One, presents a background to the study, statement of the problem, purpose of the study, the hypotheses, significance, limitation and delimitation of the study as well as organization of the study. The review of relevant literature, both theoretical and empirical is presented in Chapter Two. Chapter Three presents the methods employed in achieving the set objectives of the study. With reference to the literature, Chapter Four reviews and

discusses the results and key findings. The final chapter presents the summary, conclusions and recommendations of the study.

CHAPTER TWO

LITERATURE REVIEW

Introduction

The chapter presents the theoretical, conceptual and empirical review of literature relating to this study. The theoretical review presents two theories that underpin this study. The conceptual review gives a fair idea about the concepts of financial innovation and financial fraud and their various components. The empirical review of previous studies is presented in the third section of this chapter.

Theoretical Review

This research is based on two theories that bring our understanding to why financial innovations may have any influence on financial fraud in commercial banks in Africa. The theories are the Innovation Fragility View and the Fraud Triangle Theory.

Innovation-fragility View

The innovation-fragility view mainly considers the dark side of innovations which is in contrast with the innovation-growth view. The innovation-growth view emphasizes the bright side of innovations in financial institutions. It looks at how innovations in the financial sector have helped in the reduction of agency costs, facilitation of the sharing of risk and improving economic growth (Beck et al., 2016). Conversely, the innovation-fragility view which was coined by Beck et al. posits that financial innovations may have unfavourable effects on competition and stability in financial institutions. They identified innovations in finance as the major reason for the Global Financial Crisis from 2007 to 2009 because of the following reasons:

1. "It led to an unprecedented credit expansion that helped feed the boom and subsequent bust in housing prices" (Brunnermeier, 2009).
2. "It engineered securities perceived to be safe but exposed to neglected risk" (Gennaioli, Shleifer & Vishny., 2012).
3. "It also helped banks and investment banks to design structured products to exploit investors' misunderstandings of financial markets" (Henderson & Pearson, 2011).

The innovation-fragility view posits that the relationship that exists between financial innovations, increased fragility and volatility in the financial and real sectors is in the positive direction. Agency issues that exist between bank owners and executives can reduce asymmetric information through financial innovation which tend to increase risk-taking (Wagner, 2007). Looking at how lending resonated and was followed by the Global Financial Crisis, previous research indicated that financial innovations perversions, for example new derivative securities and securitization, may have been the cause (Zingales et al., 2015; Gennaioli et al., 2012).

Volcker (2009) argued that financial innovations had not contributed much to the economy's boost. Thus, financial innovations have done more harm than good.

Fraud Triangle Theory

This theory was propounded as a result of an investigation by Cressey (1953) on 200 imprisoned embezzlers. Cressey identified three factors as motivation to commit fraud. These three factors (rationalization, pressure and opportunity), he said, were necessary and that the absence of a single factor would forestall fraud. He indicated that rationalization is a trait for first time or

early offenders and will not apply to already existing criminals. Going further, pressure was the second identified key factor. This pressure may include personal or financial problems. He stated that the pressure of an offender did not have to make sense to others. Finally, opportunity was identified and considered as a temporary factor. This means that a wrong doer would take advantage of the slightest available window to perpetrate fraud. The fraud triangle theory is represented as:

Figure 1: Fraud Triangle
Source: Cressey 1953

From his investigation, Cressey said:

"Trusted persons become trust violators when they conceive of themselves as having a financial problem which is non-shareable, are aware this problem can be secretly resolved by violation of the position of financial trust, and are able to apply to their own conduct in that situation verbalizations which enable them to adjust their conceptions of themselves as trusted persons with their conceptions of themselves as users of the entrusted funds or property."

Perceived Pressure

Every unethical behaviour committed by fraudsters may be due to some form of pressure which can either be financial or non-financial in nature (Abdullahi & Mansor, 2015). That is to say, if the offenders were under any form of perceived pressure, it could motivate them to perpetrate fraud. Albrecht, Albrecht and Albrecht (2008) indicated that 95% of all fraud cases have been caused by some financial pressure faced by fraudsters. Lister (2007) grouped the perceived pressure into three types. These are personal pressure, employment stress and external pressure. He explained pressure to be "the source of heat for the fire." Meaning, pressure is a significant element in perpetrating fraud. Murdock (2017) asserted that perceived pressure may well be political and social in addition to the financial and non-financial pressure. He explained that political and social pressure may happen in circumstances where one believes that his or her reputation or status is at stake. Examples of perceived pressure include greed, family financial problems, addiction to drugs and gambling. However, Hooper and Pornelli (2010) revealed that pressure is not wholly bad but can sometimes be a positive force.

Perceived Opportunity

The futile system of governance creates the opportunity for people to carry out fraud (Ibrahim, 2015). This is also known in the accounting field as internal control weakness. Perceived opportunity is where fraudsters take advantage of the slightest vulnerabilities to carry out fraud (Kelly & Hartley, 2010). In Cressey's study, he indicated that the lower the chances of being caught, the higher the chances of perpetrating fraud. Opportunity can be explained as the capability of a person to identify the vulnerability of an

institutional structure and benefit of it in order to commit fraud (Rae & Subramaniam, 2008). Wilson (2007) also explained opportunity as the capability of a person to override the fraud controls that have been set. Thus, to overcome procedures put in place to check fraudulent activities and make fraud possible. According to Kenyon and Tilton (2006), lack of appropriate internal controls, poor supervision and inadequate segregation of duties may cause an opportunity to arise in order to make fraud possible. In line with this, the Association of Certified Fraud Examiners (ACFE) indicated an unbalanced job rotation added to the exploitation by managers and employees to commit fraud with fear or stress thereby causing organizational failures (Singleton, Bologna, Lindquist & Singleton, 2006). However, it was debated that without the presence of opportunity, financial fraud may not happen even with extreme pressure (Hooper & Pornelli, 2010).

Perceived Rationalization

Rationalization deals with the excuses a person gives to feel better about committing a fraudulent activity. It is unlikely that a person would commit financial fraud if they cannot justify the crime (Ibrahim, 2015). That is, rationalization must be some form of morally accepted idea. Persons who carry out fraud have a mind-set that permits them to have some disguise or justification for their immoral act (Hooper & Pornelli, 2010). Cressey (1953) revealed some forms of rationalization people give for committing fraud and they are: “I was only borrowing the money and I will put it back”, “I was allowed to borrow the money because my employer is cheating me,” “I had to steal because my family needed it”, “Everyone is doing it why not me too.” Kenyon and Tilton (2006) said the tendency to commit fraud may be

contingent on morals as well as on a person's attitude. Again, Rae and Subramaniam (2008) indicated that, a person's lack of individual integrity or ethical reasoning may lead to rationalization. Rationalization is also created as a link between opportunity and pressure (Howe & Malgwi, 2006).

Innovation Fragility View and Fraud Triangle Theory

According to the Fraud Triangle theory, it is agreed that a person must have a clear chance to commit fraud. Recent innovations in finance come along with certain vulnerabilities which can be considered as opportunity from Cressey's point of view. This implies that the wrong doer will take advantage of the slightest opening provided by innovations to execute fraud. As noticed from the Innovative Fragility view, financial innovations helped banks and investment banks to design well-thought-out products to exploit investors (Henderson & Pearson, 2011). Thus, process innovations were used to design product innovations that were used in exploiting investors.

Furthermore, the Fraud Triangle theory depicts that financial innovations can also serve as an excuse for wrong doers. Thus, causing fraudsters to rationalize their immoral behaviour. That is, the fraudster can use these financial innovations as a cover up to commit fraud and to feel better about the crime. For example, during the Global Financial Crisis, securities that were perceived as safe were in actuality not but rather was open to ignored risk (Gennaioli et al., 2012). That is, process innovations aided in the design securities (which are products) to look are safe when they were not.

From both theories, it is revealed that crime is inevitable in every institution. The Innovative Fragility View looks at the negative effects financial innovation has on the society, while the Fraud Triangle Theory

considers the factors which may influence an individual to commit fraud. It can also be realized that innovation may be a contributing factor for which one may commit fraud. This is because it fulfils two of the essential factors pointed out by Cressey in the Fraud Triangle Theory which are rationalization and opportunity. Therefore, the possibility that coupled with a little pressure an individual can easily commit fraud using innovation is very likely.

Conceptual Review

Financial Innovation

Frimpong (2010) revealed that, innovations create an impetus for banks to advance their performance in the market by recovering from ineffectiveness that are tangible in the banking sector. Financial innovations work perfectly in encouraging the development of an economy by reducing costs and improving profitability through its outcome on the efficiency of total factor productivity (TFP) but is in the long run detrimental to economic growth (Aboagye & Idun, 2012).

Lyons, Chatman and Joyce (2007) defined innovation as broadly as combining both creativity and implementation. Their definition focuses on producing original and useful ideas that increase effectiveness and the methods used to put the ideas into practice. Innovations can either be totally new or improving upon something old through new ways. The term 'financial innovation' means the addition of new financial apparatuses in financial institutions and markets through new technologies (Tahir, Shah, Arif, Ahmad, Aziz, & Ullah, 2018). It consists of process, product and institutional innovation. Innovation in finance is usually defined as the advent of a new or improved product and process in order to enjoy cost reduction benefit in the

occurrence of financial transactions. Tufano (2003) referred to innovation as that act of inventing or adopting new products, services or ideas. In a study by Mishra (2008b), financial innovations were known to assemble excess finances from savers and were channelled into profitable investment avenues to increase the capital accumulation rate and economic growth rate. New financial services, technologies, markets, instruments and institutions are all forms of financial innovations.

There have been several questions on whether financial innovations contributed positively or negatively to 2007's global financial crisis (Llewellyn, 2010; Beck et al., 2016; Vives, 2010). Similarly, several points have also been raised on how financial innovations differ from innovation in other sectors of an economy (Llewellyn, 1992). According to (Baicu, 2009), such points include:

1. The cost for research in the generation of products is lesser in the financial sector than for other industries.
2. The limited invention patent in the financial sector creates an easy path to copy financial innovations of other institutions.
3. These financial innovations are influenced strongly by regulations, especially those that are legal.

The spread of the development of financial innovations has been rapid in both developed economies and developing economies. In spite of their positive outcomes, the financial innovations introduce numerous difficulties in relation to regulating and supervising financial activities (Baicu, 2009). Mishkin (2007) categorized financial innovations into three groups as follows:

1. *Financial innovations as a response to changes in demand conditions.* Thus, the rise in demand of financial products and services which was meant to reduce interest rate was as a result of the interest rate volatility.
2. *Financial innovations as a response to changes in the supply conditions.* Where information technology expansions allowed the introduction of lucrative products and services by financial institutions since the processing transaction costs were reduced. This encouraged companies to issue securities because investors had easier access to information about the company.
3. *Financial innovations were meant to avoid regulations.* As a means of avoiding stringent rules that were affecting profitability, financial institutions introduced financial innovations. However, authorities responded to this action by introducing other rules.

To the layman, financial innovation may be known as changes that occur in the financial service industry. In the 1930s, Schumpeter, an economist, expounded innovation as the "introduction of new or qualitative change in existing products, processes, market inputs supply source and organizations" (Khraisha & Arthur, 2018). Lerner and Tufano (2011) expressed it as an act of crafting and popularizing new financial technologies, institutions, instruments and markets. The word "popularizing" in this definition implies the need for societies to understand and accept the innovations that have been introduced. This approval may apply to financial innovations such as product innovation but not process innovation or institutional innovation. Khraisha and Arthur also defined financial innovation as a practice that can be carried out by any institution involving

creating, promoting and adopting novel products, platforms and processes or an expert of knowledge that introduces new techniques or changes to the way financial activities are done. They argue that financial innovations do not necessary come from financial institutions.

Product Innovation

Kotler (2011) explained a product as anything accessible to a market for the purpose of consideration, acquisition and consumption so to satisfy demand. This study looks at a product in terms of the variety of products and services presented to customers by banks. Banks usually innovate their portfolio by developing new products, improving existing products and sometimes deleting some products (Antonnet, 2014). According to Azaze and Haji (2005), product innovation has to do with making and subsequently presenting goods or services that are either new or an upgrade of existing ones. Another definition by Moses (2015) identified product innovation as introducing new financial products for changes in demand in the market or for better efficiency. As regards this study, a definition by Ekpu (2016) is adopted. Ekpu's definition which expounds product innovation as introducing new goods or services or improving them significantly as regards their attributes or intended purposes. The substantial change may include technical enhancements in components, user friendliness, incorporated software, specifications and other functional characteristics.

Product innovation, according to Abir, Raoudha and Emna (2016), means an expansion of finance institutions' spectrum of financial assets and services. It may be on the margin as part of a differentiating tactic or an infringement on existing products. Again, Tahir et al. (2018) defined product

innovation as new or improved financial institutions. Yordanova (2013) stated that bank products have a direct effect on processes of business since they affect activities like investments enhancing market shares, daily transactions and development of new products. He also indicated that many product innovations are mostly connected to customer satisfaction and related technical analysis. Some product innovations include the introduction of new deposit accounts (educational account, smart goal account), foreign currency deposits, new credit arrangement and telephone banking (voice server).

Process Innovation

Process innovations refer to modern techniques of doing financial business including phone banking, online banking and new technology (Tahir et. al., 2018). Ekpu (2016) defined it as "the innovative ways of accounting for financial products, innovative methods of accounting for financial transactions and new payment techniques." Moses (2015) also defined it as introducing new processes in the business that will lead to better efficiency and market expansion. Process innovation is the practice of recent or consequential improvement in the production and delivery procedures. This includes substantial changes in techniques, software and equipment (Organization for Economic Co-operation and Development [OECD], 2012). Process innovation involves the introduction of emerging technology in connection with the process of production or distribution. In principle, IT and telematics was introduced into the operation of payment systems (Abir et. al., 2016). Process innovation can include: e-wallet, magnetic strip card, withdraw and deposit automated teller machine (ATM debit and payment cards).

Batiz-Lazo and Wood (2003) stipulated that product innovations are market-oriented, often customized specifically to satisfy a client or market's external needs. However, process innovation has an internal orientation and is largely guided by productivity to build new competences and skills. Similarly, in the context of adopting the various types of organizational competences, Batiz-Lazo and Woldesenbent (2006) suggested that a differentiation between product and process innovations is significant. In fact, product innovation requires banks to rely on consumer requirements and adjust behaviour, and to develop new conducts to enter banking markets. Furthermore, process innovation requires banks to introduce new information and communications technologies to increase product marketing performance and ensure improved quality of service (Damanpour & Gopalakrishnan, 2001).

Financial Fraud

CIMA (2008) defined fraud as the use of deceit to gain something dishonestly for oneself while creating a loss for another. Idowu (2009) intimated that financial fraud can be intentionally falsifying or covering up or eliminating the truth because an individual would want to cause financial damage to another individual or organization. Another definition is using a person's profession to enhance one's self by intentionally misusing or employing an organization's property (Rahman & Anwar, 2014). It can be said that committing financial fraud is not a mistake but a calculated and deliberate act and that every person is capable of committing it (Criminal Code (Amendment) Act, 2003).

Fraud is an act made to cheat people and to reduce their confidence in financial institution (Lang & Wambach, 2012). Financial fraud has been

classified into management fraud and employee's fraud by some notable authorities like CIMA and the Accountants Consultancy and Business Valuators. Furthermore, financial fraud has been grouped into three types by CIMA. These are internal fraud, external fraud and mixed fraud.

Internal Fraud

According to the ACFE, internal fraud (also known as occupational fraud) is the use of a person's profession or job for individual enhancement through the deliberate misappropriation of organizational resources or assets. The perpetrators of this kind of fraud usually include the employees and management of an institution. CIMA (2008) went further to categorize internal fraud into three major classes and these are:

1. Asset misappropriation – it is the misuse of an institutions assets or property for one's own gain. Example includes false invoicing.
2. Fraudulent statement – this occurs when financial statements of an organization are falsified in order to gain some benefits.
3. Corruption – a dishonest conduct by one who has been trusted with power and uses the power to acquire illicit benefit (Kruse, 2015). Šumah (2018) also defined it as the abuse of a trusted position by giving order to influence a person in connection with work. Examples of corruption are bribery, extortion, nepotism, cronyism and parochialism.

External Fraud

External fraud explained as the deceitful act by a third party to defraud, misuse resources or circumvent the law, leading to losses (CIMA, 2008). That is, it is an act by a person outside an organizational setting. It is the risk of financial or reputational loss that is not expected and occurs as a result of a

fraudulent action. This action commonly originates from customers or parties outside the firm (CIMA, 2008). The Basel II definition of external fraud is an act that results in losses, committed by a third party with an intent to defraud, embezzle funds or property and avoid the law.

The events of external fraud vary by the number of people involved and the mechanism of attack. As per the mechanism of attach, Basel III categorized external fraud into two:

1. First party Fraud: this is the kind of fraud committed by a person or group on their own account. This usually happens when an individual obtains a loan with the intention of not paying back, causing a loss to the institution.
2. Third Party Fraud: this fraud is usually committed by using a third person's identity without the knowledge or consent of that individual (CIMA, 2008).

Some other types pf external Fraud include check fraud, card fraud, ID theft, money laundering cybercrime and investment and internal scams.

Mixed Fraud

Korir, Shishia and Sang (2015) revealed that mixed fraud involves situations where there is conspiracy between staff and customers to defraud the institution through overdrafts, unauthorized loans and false accounting procedures. Hakami (2011) explained that it also involves operating staff (cashiers, accountants, supervisors among others) using forgeries. This kind of fraud is commonly categorized into management fraud and employees' fraud:

1. *Management Fraud*: This form of fraud is commonly committed by top management whose purpose is to deceive shareholders and sometimes

auditors and regulatory authorities by presenting false financial statement (Idowu, 2009).

2. *Employee Fraud*: As the name depicts, this type of fraud is perpetrated by employees who are not in management positions. It involves the misappropriation of assets of the bank or the manipulation of individual instruments such as cheques, drafts for personal gain (Nabhan & Hindi, 2009). Fraudulent acts committed by employees mostly occur after an employee has gained a position of responsibility and trust (Rahman & Anwar, 2014) . Some examples of employee fraud include the conversion of cash and other asset.

Empirical Review

Evidence on product innovation and fraud loss

For the period 1993-2010, Kanu and Okorafor (2013) analysed various types of fraudulent activities and their effects on bank deposits in Nigerian banks. They compared the amount of bank funds lost to fraud to the total deposit liabilities of Nigeria's insured money banks. In the analysis, they used descriptive and inferential statistics. It was discovered that there is a strong link between bank deposits and the amount of money lost to fraud, with fraudulent withdrawals accounting for the most of the fraud.

Frederick (2013) conducted a report to assess the effect of financial fraud and liquidity on the financial performance of Kenyan commercial banks. Fraud data was collected from the Banking Fraud Investigations Department (BFID). The study used a descriptive research method with a regression analysis model with the Return on asset (ROA) as the dependent variable. The yearly liquidity ratios and the annual fraud loss were the independent

variables. To find out how each dependent variable contributed to ROA, researchers used multiple regression analysis. Liquidity ratios and fraud loss had a strong association with banks' financial results indicator Return on Assets (ROA), as per the findings. Financial fraud loss and liquidity ratios had a strong and significant impact on financial performance of commercial banks in Kenya for the period studied, according to the strong and optimistic Pearson correlation coefficients. According to the study, commercial banks in Kenya should implement fraud detection mechanisms by establishing an effective, accurate, and operational fraud detection department to oversee all transactions that are deemed vulnerable to fraud in order to minimize the vice and optimize profits for improved financial results.

For the years 2001 to 2011, Uchenna and Agbo (2013) looked at the effect of fraud and corrupt activities on bank results in Nigeria. The study looked at the existence, extent, and economic implications of fraud in Nigeria using twenty-four deposit money banks in Nigeria. The relationship was determined using Pearson Product Moment Correlation. For the analysis of the effect of fraud and fraudulent practices on the performance of Nigerian banks, Multiple Regression Analysis was used. Between 2001 and 2005, the proportion of mobilized resources lost to fraud was at its peak, although there was some difference. However, between 2006 and 2011, there was a substantial decline.

Rahman and Anwar (2014) carried out a study to identify the common types of bank fraud that occurred mostly in Islamic banks in Malaysia. Their study also looked at the determinants and financial losses as a result of fraud. Their results indicated that the main type of fraud happening in Islamic banks

was fraudulent statements. This is followed by credit card fraud. Other factors were greed, insufficient control and financial pressure. Responses received from issued questionnaires indicated that more than RM 1 million (Malaysian Ringgit) was lost due to fraud cases. This study did not conclusively state the extensive effect of fraud to the banks.

A study by Moses (2015) addressed the relationship between financial innovation and financial fraud in Kenyan commercial banks. The study established that commercial banks had embraced process, product and innovation, which included use of credit cards, priority banking, unsecured loans, real-time gross settlement (RTGS), mobile banking, internet banking, insurance services, credit reference bureaus and Islamic banking. Commercial banks were more competitive as a consequence of the implementation of these innovation strategies, which resulted in more efficient and effective execution of duties. However, the study also discovered that, the relationship between financial innovations and fraud was direct, hence, there is need to ensure recent inventions are not exposed to risk and fraudsters who are continuously evolving and becoming more sophisticated. The study suggested further research should be conducted in commercial banks to ascertain the most fraud prone innovation techniques and strategies. The study also looked at how current changes in the financial institutions contributed to fraud in finance.

In a study by Beck et al. (2016), the researchers evaluated the relationship between financial innovation and growth in the real sector as well as the relationship between volatility in the real sector and bank fragility. Their work used the country-level and industry-level data. They collected data from 32 countries from 1996 to 2006. They then related the country-level

variation in financial innovation to the industry-level variation in volatility and profits. The results revealed that innovation led to the increase in fragility, risking taking, bank losses and profit volatility during the financial crises. In line with this research, Beck et. al. considered the possibility of financial innovation having some negative effects, which, may have contributed to failures in the financial history (the Global Financial Crisis of 2007 to 2009).

Singh and Antony (2016) investigated fraud cases that were happening in the Indian banking industry. They realized that, since 1991, there has been a considerable growth and significant changes in the banking industry of India due to liberalization. However, the industry was faced with certain challenges such as ethical malpractices, financial suffering and issues relating to corporate governance. The study sought to cover concerns such as fraud cases in banks and mounted debt on credit cards using secondary data and analysis that were detailed. An interview-based method was used through interactions with all those who were involved in the report of financial malpractice. The study found out that deposit related frauds, which used to be significant in terms of numbers, had reduced substantially and advance related frauds continued to be a major challenge owing to about 67% of fraud cases over four years. It also found that the ever-increasing technology in the banking system had caused a proliferation in cyber frauds due to sophisticated novel methods. 95% of the number of cases and amount involved in fraud were attributed to the commercial banks.

The study concluded that frauds relating credit cards had the utmost impact in banks in India due to the large amount involved and bulky procedure in detecting fraud. It also concluded that frauds in the banking industry of

India might have been as a result of inadequate supervision from top management; inappropriate incentive mechanism for staff; disagreement among employees, borrowers and third parties; poor regulatory system; inappropriate or insufficient tools and technologies for the early detection of fraud; inadequate awareness of staff and clients of the bank; and reluctance of banks across India and abroad to coordinate. Finally, the study made some recommendation on how to reduce the occurrence of frauds in the future.

Ramadani, Histrich, Abazi-Alili, Dana, Panthi, Abazi-Bexheti (2019) looked at how product innovation affected company performance in transition economies. This research conducted a multistage empirical investigation of product innovation and firm performance in transition economies using Business Environment Enterprise Performance Surveys (BEEPS) (TEs). The Crepon-Duguet-Mairesse (CDM) model, a four-stage strategy, was utilized to look into the relationship between innovation and performance. Product innovation had a favourable impact on firm performance in transition economies, according to the findings, which were reinforced by significant effects of particular control factors such as firm size, total labour cost, and capital. Age and competition from the informal sector, on the other hand, had a considerable negative impact on performance.

The Gap

Previous studies examined various aspects of how product innovations influenced the financial services and performance. Some authors researched how product innovations impacted bank fraud and other surveyed the relationship between product innovations and the performance of banks. Among the studies scrutinized, it was identified that product innovations have

conflicting contributions to the financial sector and financial fraud. Most of these studies, also investigated how the types of product innovation influenced bank performance but did not look at the risk factor that may be faced due to these products. Moreover, most of the studies used cross-sectional data while this research will most focus on the use of panel data to help understand how these innovations affect the African continent.

Evidence on process innovation and fraud loss

Ngalyuka (2013) also carried out a study to determine the relationship between information and communication technology (ICT) utilization and fraud losses in Kenyan commercial banks. Secondary data was gathered from central bank reports, the Banking Fraud Investigation Unit, and the 43 commercial banks in Kenya's audited financial reports. Data were analysed with Statistical Package for the Social Sciences (SPSS) via correlation and regression analysis. The major findings of the study showed that total values transacted via electronic fund transfer (EFT), RTGS and ATM had a positive association with the total fraud costs of commercial banks. The amount of money paid to employees had a strong connection with the amount of money lost to fraud. The main findings were that ICT use had exposed Kenya's commercial banks to further fraud. This was due to the pace at which transactions were conducted. The researchers suggested tougher procedures and policies on fraud prevention to ensure that the implementation of ICT captures all elements of fraud. The researchers proposed a related study to focus on the impact of ICT use on fraud losses on micro-financial institutions (MFIs).

A case study by Akelola (2014) was aimed at understanding frauds in Kenyan's financial institution with major focus on the banking sector. The study used the fraud triangle as a theoretical basis for analysing the incidence of fraud and what motivates fraudsters to commit fraud. The sample used in the research were managers from various departments such as audit, security and other departments concerned with combatting financial fraud. A survey conducted on sixty respondents and seventeen semi-structured interviews from thirty banks within the sector was used to carry on a qualitative and quantitative study. The study debated that the fraud triangle was ineffective in explaining the cunning and greedy nature of bank fraudsters in Kenya although it was effective in the prediction of the types of fraud that were recounted by the respondents.

The study identified internal and external factors causing fraud which included: lack of cooperation from the sector, poorly trained police and prosecutors, inappropriate government regulations, ineffective justice systems, low or non-existent budgets for fraud detection and prevention. The fraud detection and prevention mechanisms that were applied in the banking sector were the same as that of global standards. However, the local, regional and national banks were lacking (as compared to international banks in Kenya) in establishing the sector's cooperation; fraud departments that are dedicated with sufficient budget; making available resources to detect and combat fraud. The study suggested that, in order to mitigate fraud, there should be an integration of theoretical and conceptual approaches.

Okafor (2014) set out to investigate the impact of bank fraud in Nigeria. Questionnaires were issued to staff who were the study sample for the

research. The questionnaires were analysed, and the researcher discovered that computers had made a noteworthy contribution to the progress of the Nigerian banking industry, with the automated document processor, magnetic ink character recognition, optical character recognition, and automated teller machines being some of the most recent advancements in computer technology that had made an impression in the banking industry. Nigerian banks have used electronic machines to track suspicious activities such as teaching, loading foreign exchange theft, forged bank documents, etcetera. Finally, using a computer to operate on fraud detection in banks makes the job smoother and faster. As a result, electronic technology aided banks in maintaining a poor association with fraud.

Agbai, Haizel, Seidu, and Twum (2015) conducted another analysis to determine the impact of financial innovations on bank profitability in Ghana. Fidelity Bank Ghana Limited was the subject of a case study to see how the bank approaches financial innovation and how financial innovation affects profitability. During the study period, data was collected from the bank's income statements, statement of financial position, and other financial reports. The study was conducted over a five-year period, from 2009 to 2013. The bank's Return on Equity (ROE) for the study period was used as the indicator of profitability. The bank's number of branches and automated teller machines (ATMs) were also used to measure financial innovation over time. Control factors for the analysis included inflation and the exchange rate of the domestic currency against the US dollar over time. Using Microsoft Excel, a linear regression model was used to analyse the data. The results revealed that the number of branches and ATMs have a favourable association with the

bank's ROE. As a result, an increase in the number of financial innovations leads to an increase in a bank's profitability.

Another study conducted by Mativo (2016) was to determine if information systems innovations had an effect on financial fraud in Kenyan commercial banks. The researcher concentrated on all 43 commercial banks in Kenya. A multiple linear regression model was adopted in the study. The study concluded that information systems innovations and characteristics of the bank had positive effect on financial fraud in Kenya. The study also showed a direct relation between invention of more financial innovations and fraud. This makes it necessary for new innovations to be risk free and prevent increase in the vulnerability of banks to fraudulent activities.

In a research case-study conducted at Ghana Commercial Bank Limited, Danaa, Sappor and Diyawu (2016) pursued to study the effect of ICT on the performance of the Ghanaian banks. The study's ultimate objectives were to determine the impact of ICT on the financial results of Ghana Commercial Bank Limited (GCB), to determine the contribution of ICT-based goods to customer loyalty, and to investigate how ICT has changed the banking industry. GCB's operating costs were reduced, and the impact of information technology on the bank's liquidity was determined. Qualitative data was gathered purposive sampling technique. SPSS was used to explain the 100 interview guide and open-ended questionnaires administered by the descriptive study. The study showed that ICT Capital had increased the bank's growth. ICT also allowed high and medium professional work to be absorbed. This had a positive impact on the bank's overall productivity. The study found that the bank's use of ICT had allowed a wide range of services to be offered

to clients, branch operations co-ordinated and adjustments to the rules and policies of the government were met. The study found that the use of ICT by the bank had an effect on the bank's efficiency by increasing bank profitability and reducing the bank's operating expense.

Another study by Udeh and Ugwu (2018) sought to examine fraud cases happening in the banking industry of Nigeria. The use of ex-post facto research design was used for the research for which data pertaining to fraud, profits made by banks, assets of banks and deposits made to banks were collected from the annual reports of the Nigeria Deposit Insurance Corporation (NDIC). Data analysis was conducted using descriptive analysis and ordinary least square (OLS) methods. In their research, it was revealed that the relationship between fraud and profits made by banks was negative and insignificant, and a positive but insignificant relationship existed between fraud and assets of banks as well as deposits made to banks. It was also revealed that there had been an increase in the number of fraud cases in the country over the years due to the increase in bank products, of which most were electronic. The researchers suggested that the fraud amount should be included in banks' financial statements and good corporate governance (Fraud Box Model) should be established as contained in the fraud diamond.

A recent study by Asomaning (2019) examined how effective fraud risk management practices were in the Ghanaian banking industry. Data collected using of questionnaires from both local and foreign banks revealed that exposure level of banks to both internal and external fraud risk was low. This was due to banks being highly effective in the management of fraud risk.

The study suggested to banks to invest more in modern software tools, ignoring the vulnerabilities attached and the exposure it may provide.

Worku (2020) attempted to investigate the strategies used by three Ethiopian banks to strengthen their e-banking fraud management. The research also looked into the different kinds of frauds and the methods used to combat them. The study focused on three Ethiopian banks with a combined market share of 57.1 percent. Semi- structured Interview and examination of secondary data were taken as a means of data collection. To investigate the phenomena of the subject under study, a qualitative approach of material and thematic analysis is used. The study's results revealed that banks and their clients were dealing with a variety of fraud-related issues, and some banks are attempting to address them by applying multiple techniques at various levels of the fraud. According to the results, banks should determine their weakest link and conduct a vulnerability review on their systems in order to implement the most effective and easy fraud management solutions available.

Using data from 185 countries between 2012 and 2015, Achim and Borlea (2020) investigated the impact of technology on the level of economic and financial crime. First, it was shown that low-income countries' economic and financial crime was almost double that of high-income countries, while their research and development expenditure (as a percentage of GDP) was roughly four times that of high-income ones. Increased technology has been shown to lessen the magnitude of economic and financial crime. Furthermore, research and development expenditures were found to be more important in lowering economic and financial crime in low-income countries than in high-income countries.

Okafor (n.d.) further considered how information technology affected banks' operational performance to determine if the large capital investment was justified. Okafor used a questionnaire and personal interview as research instruments for employees and customers of the bank with the main purpose of exploring how the use of information technology influences the activities of commercial banks in terms of productivity, performance, competition, customer base, and globalization. The basic frequency percentage was used as the statistical metric, and chi-square was used to assess hypothesis testing. Finally, the study found that information technology has significantly increased the development and efficiency of Nigerian commercial banks. Customer loyalty had increased, operational performance had improved, processing times had decreased, the bank had gained a competitive advantage, operating costs had decreased, and service quality had become more responsive due to information technology.

The Gap

The empirical literature reviewed depicts a variety of conclusions on how ICT influences financial fraud and the impact of ICT on bank performance. While some authors established that ICT had a positive relationship with financial performance, few argued the contrary, stating that it rather contributed to financial fraud activities. Other authors also indicated that, despite the positive implications of financial innovations on bank performance, it also made massive contributions to the increase of financial fraud. Therefore, alerting the need to investigate into these arguments. Again, most of the studies reviewed concluded on the firm-level activities while this

research looks further into how process innovations, specifically, influence financial fraud in banks in some African countries.

Chapter Summary

The chapter begun by explaining the theories of this study. The chapter explained the innovation fragility view, which means that financial innovations have unfavourable effects on competition and stability of financial institutions. The fraud triangle theory is also explained that rationalization, pressure and opportunity are factors that may motivate person to commit fraud. The last theory that was expounded in this study was the differential association theory which indicated that crime is learnt. The chapter considered the various concept of variables; financial innovation, product innovation, process innovation and financial fraud. Again, various empirical studies were considered. These mainly looked at the relationship between financial innovation and real sector growth, bank or financial fraud and the occurrences of fraud in the banking industry.

CHAPTER THREE

RESEARCH METHODS

This chapter presents the methods used in analysing the relationship that exist between financial innovation and financial fraud in some selected African countries. The chapter covers the research paradigm, research approach, research design, source of data, data collection source and model specification, description of the variables used for the study and the post estimation tests.

Research Paradigm

As explained by Kuhn (2012), research paradigm is a conceptual framework shared by a group of researchers. A research paradigm provides researchers with a convenient model for analysing problems and finding a solution in a study. Simply put, it is a research culture of a group of researchers with similar beliefs, values and assumptions regarding the nature and conduct of a study. There are three major recognised methods under the research paradigm. These are interpretivism, pragmatism and positivism. This research is based on the positivism paradigm since it has a quantitative and objective nature. Positivists argue that reality is objectively provided and can be quantified using qualities that are independent from the researcher and his or her apparatus (Alise & Teddlie, 2010). Most researchers in finance usually deploy the positivism paradigm due to its quantifiable and objective nature (Amaral et al., 2013).

Research Approach

In research the approaches mainly adopted are quantitative and qualitative and, in some cases, the mixed method. Quantitative methods relate

to objective and numeric analysis as well as generalization of findings (Amaral et al., 2013). Hittleman and Simon (1997) stated that quantitative research makes use of revised and tabulated data which allows for the data to be characterised by the use of statistical analysis. Thus, quantitative research is the kind of research that uses deductive reasoning to create meaning, establish, confirm, or validate the relationships between variables to provide generalizations that contribute to a theory. Qualitative research on the other hand, has to do with studies that concentrate on events that occur naturally and in natural settings. Myers (2019) argued that qualitative approach helps researchers to understand people, the social and the cultural context they find themselves in. The mixed method is a combination of the quantitative and qualitative research methods (Amaral et al., 2013).

This study adopted a quantitative approach using a mathematical model to ensure objective analysis. The implementation of quantitative method provides results that support statistical comparison between entities; results are precise, definitive and standardized (Sukamolson, 2007). The quantitative approach was used in this study because it allows for analysis of collected data using statistical procedures and hypothesis testing (Creswell, 2008). Generally, the quantitative research approach requires the determination of relationships between variables of a study using statistical techniques and hence the use of quantitative research approach in the study.

Research Design

The study employed explanatory research design. The explanatory design was used in investigating the relationship between financial innovation and financial fraud in some selected African countries (Mativo, 2016).

Explanatory research is mainly concerned with causes or "why" factor about some phenomenon. The research purpose in this case is to gain familiarity in unknown areas.

In fact, explanatory research is a kind of research design which focuses on explaining the unknown components of a study (Saunders, Lewis, Thornhill & Bristow, 2019). Explanatory research is undertaken to assist in identifying the problem which has not been thoroughly investigated before. Explanatory research is not utilized to provide us with any definite proof but to assist more effectively in comprehending the situation. It does not attempt to answer research questions in a conclusive way but enables researchers to examine the research at varied depths. Because of a lack of statistical strength, it does not produce definite conclusions, but determines how and why things happen. It is used because, it emphasizes how important it is to analyses situations in order to explain the link between variables (Gill, Johnson & Clark, 2010).

Sources of Data

The study used secondary data from various websites including crime and fraud investigative websites of the various countries and websites of the central banks of 17 African countries. Data was also collected from various reports concerning financial fraud in Africa such as the ACFE reports, PWC reports and International Monetary Fund (IMF) reports. Again, data was collected from the World Development indicators (WDI) for the analysis of the study.

Seventeen countries were used in the study due to the availability of data for those countries. Most of these countries are widely known to be

Africa's leading fraud prone countries with about five countries being part of the global top ten charts continuously for three years. Also, most of the countries included in the study have been identified to have had immerse improvement in their financial technology. The period span for the study was from 2013 to 2019. The source of data for financial fraud is indicated in Table 1.

Table 1: Data Source

Countries	Source
Egypt	ACFE Report to the Nations
Eswatini	Integrated Annual Report – Central Bank of Eswatini
Ethiopia	Ethiopia Deep Dive – Financial Crime News
Gabon	Gabon Deep Dive – Financial Crime News
Gambia	Gambia Deep Dive – Financial Crime News
Ghana	Banking Industry Fraud Reports – Central Bank of Ghana
Kenya	Central Bank of Kenya Financial Sector Stability Report
Malawi	Audit Report on Fraud and Mismanagement in Malawi
Mauritius	ACFE Report to the Nations
Mozambique	Financial Crime News – Mozambique
Namibia	Financial Intelligence Centre Annual Report
Nigeria	NDIC Annual Report
Rwanda	Kroll Global Fraud and Risk Report - Rwanda
South Africa	SABRIC Banking Crime Report
Tanzania	Global Economic Crime Survey – Tanzania
Uganda	Deloitte Financial Crimes Survey – Uganda
Zambia	Global Economic Crime Survey – Zambia

Source: Afful (2021)

Explanation of variables

Fraud loss

Fraud loss is the unreimbursed costs and expenses that have actually been incurred as a result of the fraudulent activities against an institution

(Frederick, 2013). It is measured by the actual amount of bank funds lost to fraud.

Broad money (M3)

Broad money refers to the amount of money in circulation in each economy. It is defined as the most comprehensive method of calculating a country's money supply, taking into account narrow money and other assets that can easily be converted into cash to purchase goods and services. Broad money (M3) contains currency (M1), agreement deposits for up to two years, payable up to three monthly notification (M2) and repurchase agreements, shares or units of cash-market fund and borrowing securities for up to two years (Lim & Sriram, 2003). Financial innovation is positively linked to money demand, according to Mannah-Blankson and Belnye (2004), who used co-integration techniques. In their research, Ansong, Marfo-Yiadom, and Asmah (2011) used the broad money (M2) to narrow money (M1) ratio as a proxy for financial innovation.

To calculate the economy's liquid liabilities, this study used the broader concept of money (M3) as a percentage of GDP. Since monetary aggregates such as M2 or M1 may be a weak proxy in economies with underdeveloped financial systems. M3 is used as a financial depth measure as money is used as a store of value in the absence of other more appealing alternatives in economies with underdeveloped financial systems (Khan & Senhadji, 2003). A higher liquidity ratio suggests that the financial system is more involved. The premise is that the size of the banking sector is related to the size of the financial services sector (King & Levine, 1993).

Domestic credit to private sector (by banks)

Domestic credit to the private sector applies to financial resources given to the private sector by financial institutions, such as loans, non-equity securities purchases, trade credits, and other receivables that provide a claim for repayment. Credit to public companies is included in some countries' claims. Monetary authorities and deposit money banks are among the financial institutions, as are other financial organizations where data are available (including organizations that do not allow transferable deposits but incur liabilities such as time and savings deposits) (World Bank [WDI], 2021). A high domestic credit-to-GDP (gross domestic product) ratio indicates not only a higher level of domestic investment but also greater financial system growth. (Baoko, Acheampong & Ibrahim, 2017). Financial systems that give more credit to the private sector are more likely to conduct research, exert corporate influence, provide risk management control, facilitate transactions, and mobilize savings (Levine, 2005), all of which require a higher level of financial development.

Automated teller machines (ATMs)

Automated teller machines are computerized telecommunications systems that provide public access to financial transactions for customers of a financial institution (WDI, 2021). Access to finance will increase opportunity for everyone with greater rate of access and use of banking facilities linked to lower financial barriers for individuals and companies. Also essential for a thriving society and market economy is a sound financial structure that encourages effective savings and investments. Access to financial services has a number of aspects: availability, expense, and service quality. The growth and

development of the credit markets rely on prompt, secure and precise access to data on the lending experiences of borrowers. Access to credit can be strengthened by facilitating the establishment and implementation of leverage arrangements and by increasing knowledge on the creditworthiness of prospective borrowers.

Number of patents

It is difficult to measure the innovativeness of the services industry in general due to a lack of appropriate innovation indicators (Abreu, David, Legčević, Segura, Formigoni & Mantovani, 2015). Intellectual property rights can help a society's innovation by encouraging innovative thinking (Al-Sharieh & Mention, 2013). The evolution of financial innovation can be seen through the prism of patents (Lerner, Seru, Short & Sun, 2020). As one of the most recognizable artefacts of R&D operations, patents are one of the most significant innovation measures for assessing technical competition on the micro and macro levels (Freeman, 1982; Grupp, 1997).

In all markets, service innovations have a positive interaction with patents and trade secrets (Morikawa, 2019). Patent applications can be used to estimate a firm's secured outputs and knowledge base (Frietsch & Schmoch 2006). A data collection was assembled using publicly accessible patent applications. Previous empirical studies (such as Lin, Liu & Lai, 2018; Kabulova & Stankevicienc, 2020; Lerner, Seru, Short & Sun, 2020) have demonstrated that patent applications can be used as an alternative of measuring financial innovation.

Research and development (R&D)

Innovation is often linked to the research and development which is associated with creating new products. According to Buciuni (2019), "research and development as an indicator stems from the ability to quantitatively relate to innovation directly". They argued that, data on R&D may not provide a complete picture of innovation and may not be reliable as an indicator of innovation. However, there are many studies on innovation which reveal that an increase in research and development activities lead to more innovative products which enable companies to have competitive advantages and to gain market share (Freeman & Soete, 2012). This makes R&D one of the most common measurement for innovation. An increase in R&D expenditure may depict an increase in the conception of financial innovations. Also, some empirical studies have shown that, an increase in financial innovation may result in an increase in fraudulent activities which makes R&D relevant.

Unemployment

Unemployed people are described as those who are not working, have been looking for work in the recent past, and are actively looking for employment, including those who have lost their jobs or who have voluntarily left their jobs (WDI, 2021). Unemployed people who did not look for jobs yet have made plans are also counted. Low unemployment rates, on the other hand, can mask significant poverty in a region, while high unemployment rates can exist in countries with high economic growth but low poverty rates. Employees in countries with well-developed safety nets can continue to wait for positions that are ideal or attractive. However, persistently high unemployment points to significant inefficiencies in capital allocation.

Definition of Variables

Table 2: Definition and Measurement of Variables

Variable	Indicator	Nature	Operationalization	Source
Financial Fraud	Fraud loss (FLoss)	Dependent Variable (DV)	The amount of money that has been lost as a result of fraud	Fredrick (2013)
Product Innovation	Broad money (M3)	Independent Variable (IV)	M3 as a proportion of GDP	Lim and Sriram, (2003)
	Domestic credit to private sector (DomCredit)	Independent Variable (IV)	The degree of difficulty in using the new and updated systems.	WDI (2021)
	ATM	Independent Variable (IV)	The total number of ATMs for every 100,000 adults in the reporting country	WDI (2021)
Process Innovation	Research and Development (R&D)	Independent Variable (IV)	R&D expenditure	Buciuni (2019)
	Patent	Independent Variable (IV)	Number of patents application for new technology invented for banks by residents of the country	Kabulova and Stankevicienc, (2020)
	Unemployment (Unemp)	Control Variable (CV)	The rate of the number of people who are not in activate employment in the country	WDI (2021)

Source: Afful (2021)

Today's young men and women face growing uncertainty in their hopes of making a successful transition into the labour market, and this uncertainty and disillusionment will have negative consequences for people, families, economies and society. Youth unemployment and underemployment

are also preventing businesses and countries from innovating and creating strategic advantages dependent on human resource investment, putting economic opportunities at risk. Unemployment could also lead to increase in vices in an economy.

Model Specification

Fixed effect, random effect and generalised method of moment

Static panel analysis is used in this research, with two well-known estimation techniques: fixed-effects (FE) estimation and random effects (RE) estimation. The panel data estimation is based on the premise that, each cross-sectional unit's "heterogeneity" is taken into account during the estimation phase. Fixed effect and random estimations are suitable for solving issues of heterogeneity in panel data (Baltagi & Levin, 1986). These models are based on the idea that differences between cross-sectional units can be captured as intercept term specific to each cross-sectional unit. The FE model considers this term of intercept to be a fixed parameter, while the RE model considers it to be random.

Fixed effect model

The FE model allows for an arbitral correlation α_i and X'_{it}. That is, the explanatory variables are associated with unobserved heterogeneity.

$$Y_{it} = \alpha_i + \gamma X'_{it} + v_{it} \quad (1)$$

Where α_i is a fixed effect specific to the individual countries, and the errors are independent and identically distributed with zero mean and constant variance, $v_{it} \sim IID(0, \delta^2_v)$. The fixed effect model controls all time-invariant differences between individual countries so that the estimated coefficients of the fixed effect models cannot be biased due to omitted time-invariant

characteristics such as culture, religion, gender, race, etc. Thus, the intercept may differ across individual countries, each country's intercept does not vary over time.

Random effect model

With the random effects model, the country-specific effect or variation across entities assumes a random variable. That is, the unobserved heterogeneity is unrelated to the model's explanatory variables. Instead of treating α_i as fixed, we assume that it is a random variable with a mean value of α_1. A country's intercept value can be expressed as $\alpha_{1i} = \alpha_1 + v_{it}$

$$Y_{it} = \gamma_0 + \gamma X'_{it} + (\alpha_i + v_{it}) \quad (2)$$

Where $\gamma_0$is the constant term, α_i represent the country-specific random effect or a period not included in the regression, and the errors are independent and identically distributed with zero mean and constant variance, $v_{it} \sim i.i.d(0, \delta^2{}_v)$. It is assumed in the random effect model that α_i is independently distributed of X_{it}.

Generalised method of moment (GMM)

Contrary to fixed and random effect estimation is generalised method of moment. As previously mentioned, using first differences or applying inside transformations as fixed effects models eliminates unobserved heterogeneity with each cross-sectional unit, whereas random effects models do not (Hsiao, 1985). However, first differencing's ability to eliminate unobserved heterogeneity introduces one or more lagged dependent variables, allowing the model to be partially or completely correlated with the error term. The v_{it} error component enters every value of Y_{it} by assumption, so that the lagged dependent variable cannot be independent of the composite error process

(Hsiao & Zhang 2015; Arellano 1989). Consequently, the model becomes endogenous, and the coefficient becomes biased. Instrumentation was proposed by Arellano and Bond (1988) as a solution to this problem. Thus, this endogeneity problem can be mitigated by using the lags of the dependent variable as instruments in the model. The model is then specified as:

$$Y_{it} = \gamma_0 + \beta y_{\iota t-1} + \gamma X'_{it} + (\alpha_i + v_{it}) \quad (3)$$

Where $\gamma_0$is the constant term, α_i represent the country-specific random effect or a period not included in the regression, Y_{it}, $y_{\iota t-1}$ and X'_{it} are the dependent variable, the lag of the dependent variable and the independent variables in the model respectively while the errors are independent and identically distributed with zero mean and constant variance, $v_{it} \sim i.i.d(0, \delta^2_v)$. Thus, the study employed GMM to estimate more consistent and reliable estimators between financial innovation and financial fraud.

Estimating the fixed effect model

Depending on the assumptions used to generate the data, various methods to estimating the fixed effect model can be used. These are the Within Estimators, the Least Square Dummy Variable (LSDV), and the First Differenced (FD) estimator. The Least Square Dummy Variable LSDV uses dummy variables, whereas the "within" estimation does not. These methods yield similar regressor parameter estimates. The "between" estimation fits a model using individual or time means of dependent and independent variables without dummies.

Since it is easier to estimate and interpret, the LSDV is commonly used. However, when panel data includes a large number of individuals (or groups), this LSDV becomes problematic. If T is fixed and $n \to \infty$ (n is the

number of observations and T is the number of time periods), parameter estimates of regressors are consistent but the coefficients of individual effects, $\gamma_0 + \alpha_i$, are not (Baltagi, 2008). Dummy variables aren't used in the "within" estimation; instead, deviations from the group (or time period) means are used. That is, instead of using a large number of dummies, "within" calculation uses variance within each country. The "within" estimation as given in equation 4 as:

$$(y_{it} - \bar{y}_i) = (x_{it} - \bar{x}_i)'\gamma + (\varepsilon_{it} - \bar{\varepsilon}_i) \quad (4)$$

Where $\bar{y}_i$ is the mean of the dependent variable (DV) of the individual (group), $\bar{x}_i$ represent the means of the independent variables (IVs) and $\bar{\varepsilon}_i$ is the mean of errors of the group. In the "within" estimation, the incidental parameter problem is no longer an issue. The parameter estimates of regressors in the "within" estimation is identical to those of LSDV. The "within" estimation reports the correct sum of squared errors (SSE). The "within" estimate, however, has a number of drawbacks. To begin, all time-invariant variables (gender, ethnic group and race) that do not differ within the entity are removed during data transformation for the "within" estimation (Kennedy, 2008). Furthermore, the "within" estimation yields unreliable figures. Finally, since the intercept term is suppressed, the R^2 of the "within" estimation is inaccurate.

The "between groups" estimation uses variations between individual entities (groups). Specifically, this estimation calculates group means of the dependent variable and the independent variables and thus reduces the number of observations. The between estimation, therefore, is stated in equation 5 as:

$$\bar{y}_i = \alpha_i + \bar{x}_i + \bar{\varepsilon}_i \quad (5)$$

Where, $\bar{y}_i$ is the mean of the dependent variable, $\bar{x}_i$ represent the means of independent variables and $\bar{\varepsilon}_i$ is the mean of errors of the group. Therefore, the empirical fixed effects models for objective two and three is expressed as:

$$FLoss = \alpha_i + \gamma_1 M3_{it} + \gamma_2 DomCredit_{it} + \gamma_3 Unemp_{it} + v_{it} \quad (6)$$

$$FLoss = \alpha_i + \gamma_1 ATM_{it} + \gamma_2 patent_{it} + \gamma_3 RDev_{it} + \gamma_4 Unemp_{it} + v_{it} \quad (7)$$

Where FLoss represents the amount lost due to fraud of the countries under study, M3 represents the broad money of the countries in the study, DomCredit represents the domestic credit circulating in the economy, ATM represents the number of ATMs in a country, patent represent the number of patent applications received from residents of the country, RDev represents the expenditure on research and development in the country, Unemp represents the rate of unemployment in the country and α_i and v_{it} represent the intercept term and the error term respectively.

Estimating the random effect model

In the composite error term of a one-way random effect model, α_i is assumed independent of the traditional error term v_{it} and the regressors. This postulation is not required for a fixed effect model. The random effect model is presented in the equation;

$$y_{it} = \gamma_0 + X'_{it}\gamma + (\alpha_i + v_{it}) \quad (8)$$

Where $\alpha_i \sim IID(0, {\sigma^2}_\alpha)$ and $v_{it} \sim IID(0, {\sigma^2}_v)$. The covariance elements of $Cov\,(\varepsilon_{it}, \varepsilon_{js}) = E\,(\varepsilon_{it}\varepsilon'_{js})$ are ${\sigma_\alpha}^2 + {\sigma_v}^2$ if $i = j$ and $t = s$, and ${\sigma_\alpha}^2$ if $i = j$ and $t \neq s$. Therefore, the covariance structure of the composite errors is $\Sigma = E\,(\varepsilon_i \varepsilon'_i)$ for individual i and the variance-covariance matrix of the entire disturbances or errors (V) are:

$$\Sigma = \begin{bmatrix} {\sigma_\alpha}^2 + {\sigma_v}^2 & {\sigma_\alpha}^2 & \dots & {\sigma_\alpha}^2 \\ {\sigma_\alpha}^2 & {\sigma_\alpha}^2 + {\sigma_v}^2 & \dots & {\sigma_\alpha}^2 \\ \vdots & \vdots & \vdots & \vdots \\ {\sigma_\alpha}^2 & {\sigma_\alpha}^2 & \dots & {\sigma_\alpha}^2 + {\sigma_v}^2 \end{bmatrix} \quad (9)$$

and

$$V = I_n \otimes \Sigma = \begin{bmatrix} \Sigma & 0 & \dots & 0 \\ 0 & \Sigma & \dots & 0 \\ \vdots & \vdots & \vdots & \vdots \\ 0 & 0 & \dots & \Sigma \end{bmatrix} \quad (10)$$

A random effect model is estimated by the GLS when the covariance structure is known, and by FGLS when the covariance structure of the composite error is unknown. The empirical random effect models for objective two and three is expressed as;

$$FLoss = \gamma_0 + \gamma_1 M3_{it} + \gamma_2 DomCredit_{it} + \gamma_3 Unemp_{it} + (\alpha_i + v_{it}) \quad (11)$$

$$FLoss = \gamma_0 + \gamma_1 ATM_{it} + \gamma_2 patent_{it} + \gamma_3 RDev_{it} + \gamma_4 Unemp_{it} + (\alpha_i + v_{it}) \quad (12)$$

Where FLoss represents the amount lost due to fraud of the countries under study, M3 represents the broad money of the countries in the study, DomCredit represents the domestic credit circulating in the economy, ATM represents the number of ATMs in a country, patent represent the number of patent applications received from residents of the country, RDev represents the expenditure on research and development in the country, Unemp represents the rate of unemployment in the country and α_i and v_{it} represent the intercept term and the error term respectively.

Estimating the generalised method of moment

Similarly, the empirical model estimation for the dynamic panel for the first and second objective is specified as follows:

$$FLoss_{it} = \gamma_0 + \beta FLoss_{it-1} + \gamma_1 M3_{it} + \gamma_2 Dom\ Credit_{it} + \gamma_3 Unemp_{it} + (\alpha_i + v_{it}) \quad (13)$$

$$FLoss_{it} = \gamma_0 + \beta FLoss_{it-1} + \gamma_1 ATM_{it} + \gamma_2 patent_{it} + \gamma_3 RDev_{it} + \gamma_4 Unemp_{it} + (\alpha_i + v_{it}) \quad (14)$$

Where FLoss represents the amount lost due to fraud of the countries under study, M3 represents the broad money of the countries in the study, DomCredit represents the domestic credit circulating in the economy, ATM represents the number of ATMs in a country, patent represent the number of patent applications received from residents of the country, RDev represents the expenditure on research and development in the country, Unemp represents the rate of unemployment in the country and α_i and v_{it} represent the intercept term and the error term respectively.

Post Estimation Tests

Test for heteroscedasticity

In panel analysis, the variance of cross-sectional units may differ in several panel datasets. This effect can be attributed to variations in the size of the dependent variable within units as one of the causes. In other words, it determines whether the variance of regression errors is affected by the values of the independent variables. As a result, a revised Wald test is performed to see if the residuals of our fixed-effect regression have some groupwise heteroscedasticity. The variance of the error is the same for all entities under the null hypothesis (homoscedasticity). For the random effect model, the Breush and Pagan (1979) test is appropriate for the test of heteroscedasticity (Long & Ervin, 2000). Breusch Pagan Test was introduced by Trevor Breusch

and Adrian Pagan in 1979. The BP test is used to tests for the null hypothesis that all individual specific variance components are zero (homoscedasticity). This is done after having run the random effect model.

Test for autocorrelation

Since serial correlation biases standard errors and makes findings less effective in linear panel-data models, researchers must recognise serial correlation in the idiosyncratic error term in a panel-data model. Although a variety of tests for serial correlation in panel-data models have been proposed, Wooldridge (2002) proposes a test that is appealing because it needs few assumptions and is simple to apply.

Baltagi (2005) debates about serial correlation testing in the case of random and fixed effects in precise detail. Many of these tests make predictions about the existence of individual effects or test for multiple individual-level effects at the same time. The Wooldridge test, on the other hand, is more robust because it relies on less hypotheses.

Hausman specification test

The Hausman post estimation test is used to assess the robustness and accuracy of the regression estimates. When utilizing panel data, one needs to determine either to employ a fixed effects model or a random effect model in order to examine an empirical phenomenon. The correlation between the unit effects and independent variables is what is used to determine whether to use one model or the other (Bole & Rebec, 2013).

The Hausman specification test contrasts fixed and random effect models under the null hypothesis that individual effects are uncorrelated to

any model regressor (Hausman, 1983). This test statistic is based on the chi-squared distribution of k degrees of freedom.

$$LM = \left(b_{fixed} - b_{random}\right)' \widehat{W}^{-1}\left(b_{fixed} - b_{random}\right) \sim x^2\ (k)$$
$$= Var\left[b_{fixed} - b_{random}\right] = Var\left(b_{fixed}\right) - Var\left(b_{random}\right) \quad (15)$$

The Hausman test aims to see if "the estimate of random effects is not substantially different from the unbiased estimate of fixed effects" (Kennedy, 2008). $\widehat{W}$ is the difference between the estimates of fixed and random effect's approximated covariance matrices. The test helps to determine which regression method is best. Therefore, if the null hypothesis is rejected, a fixed effect model is favoured over the random counterpart.

Arellano-Bond test

Manuel Arellano and Stephen Bond suggested Arellano-Bond test in 1991, based on earlier work by Alok Bhargava and John Denis Sargan in 1983. To check for autocorrelation, the Arellano-Bond (1991) test is used. The test was originally developed for a specific linear Generalized Method of Moments dynamic panel data estimator, but it can be applied to any linear GMM regression. It is suitable for both time-series and cross-section regressions, hence time-series (panel) regressions.

In panel analysis, the Arellano-Bond test for AR (1) and the Arellano-Bond test for AR (2) can be employed. If there is no second-order serial correlation in disturbances under the null hypothesis of no serial correlation (autocorrelation), the null hypothesis is not rejected, and this is favourable. Because of the lagged dependent term, first order serial correlation is predicted and should not be a concern. Criteria for acceptance or rejection: p-value ≥ 0.05(5 percent). The null hypothesis is therefore denied if the likelihood

obtained is less than 0.05. As a result, a p-value of greater than or equal to 5 percent is desired.

Sargan test

The Sargan test examines the validity of over-identifying restrictions, which are based on the premise that model parameters are defined by a priori restrictions on the coefficients. Through building a quadratic form based on the cross-product of the residuals and exogenous variables, the test statistic can be calculated from residuals from instrumental variables regression. The statistic is asymptotically distributed as a chi-square factor with (m - k) degrees of freedom under the null hypothesis that the over-identifying constraints are true or valid (where m is the number of instruments and k is the number of endogenous variables).

Criteria of rejection or acceptation: Prob>chi2 ≥ 0.05(5%). If the possibility obtained is equal to or greater than 0.05, the measurement instruments are valid, and overidentication does not exist. As a result, there is no need to reject the null hypothesis. However, if the likelihood is less than 0.05, the evidence suggests that the instruments are not valid, and the model is overidentified as a result. Therefore, the null hypothesis is rejected. If the probability is similar to one, the instruments aren't necessarily valid. It indicates that the test's asymptotic properties have not been implemented. In that case, we should reject H_0, as in the case where the probability is lower than 0.05 (Roodman 2009).

Chapter Summary

This chapter presented the research methods employed in the study. The study is based on the positivism research paradigm and the quantitative

research approach. The study also employed the quasi-experimental research design as it sought to explain the relationship between product innovation and process innovation and financial fraud in the financial institutions. The chapter also looked at the study area and population, as well as data source and the description of measurement of dependent and independent variables. The chapter continued with the theoretical specification of the fixed effect, random effect and general method of moment models as well its empirical specifications. The chapter ended with definitions of variables and the post estimation test of the study.

CHAPTER FOUR

RESULTS AND DISCUSSION

Introduction

The study examined financial innovation and financial fraud in some selected countries in Africa. This chapter presents the results and the discussion of the study. The chapter begins with introduction, then discussion of the descriptive statistics of the study. The chapter continues with the discussion of graphs used as part of the presentation of the descriptive statistics. This is followed by the discussion of ordinary least squares regression results, random and fixed effect estimations and finally the results of the dynamic panel estimations. The chapter concludes with an overview of the discussions carried out in this chapter.

Descriptive Statistics

Table 3 shows the descriptive statistics for the variables used to illustrate the relationship between financial innovation and financial fraud in some selected countries in Africa. The dependent variable had a mean value (fraud loss) of $8,244,910.10, and a standard deviation of $9,403,081.80. The dependent variable (fraud loss) also had a minimum value of $509,985.79 while its maximum value was $45,405,584. This means that, if the fraud losses of the countries studied were shared, each country would incur a loss of $8,244,910.10. Again, a comparison of the mean and the standard deviation reveals a difference of $1,158,171.1, which suggests that the fraud loss variable is highly skewed. This is further evidenced by the range $44,895,598.21 of the fraud loss. This means that, fraud levels differ significantly across the countries studied. That is, some countries have low

levels and others recorded high levels over time. The level of skewness and kurtosis indicated that fraud loss was highly skewed to the right and leptokurtic, respectively. Also, the p-value of the Jarque-Bera test showed that fraud loss is not normally distributed. In this analysis, fraud loss is used as a measure of financial fraud to see how financial innovation affects the occurrence of fraud in African banks. Few studies such as Kanu and Okorafor (2013) and Uchenna and Agbo (2013) also included the use of fraud to identify the actual loss of financial fraud appropriately. The use of fraud loss to evaluate the connection between financial innovation and financial fraud of the panel units in this study is thus justified.

The mean value of the economy's money supply (broad money, M3) was 41.091 percent, with a standard deviation of 25.218 percent. The lowest value was 18.064 percent and the highest value was 120.794 percent. Broad money was highly skewed to the right as well as leptokurtic. Broad money data was also not normally distributed. Table 3 also shows that, the mean value for domestic credit to the private sector (by banks) (Dom Credit) was 27.802 percent, with a standard deviation of 22.968 percent. It had a minimum value of 5.443 percent and a maximum value of 106.26 percent. Domestic credit to the private sector highly skewed to the right, leptokurtic and also not normally distributed.

ATM had a mean of 20.658 and a standard deviation of 19.479 with its minimum and maximum values being 4.04 and 72.45 respectively. The values of skewness and kurtosis for ATM showed that the number of ATMs was highly skewed to the right and leptokurtic. The Jarque-Bera value indicated that the data was not normally distributed.

Table 3: Descriptive Statistics

Variable	Mean	Std. Dev.	Min	Max	Skew.	Kurtosis	Jac. Bera
Floss	8244910.1	9403081.8	509985.79	45405584	2.392	8.678	273.347
							0.000
M3	41.091	25.218	18.064	120.794	1.471	4.334	51.72
							0.000
DomCredit	27.802	22.968	5.443	106.26	1.822	5.662	101.006
							0.000
ATM	20.658	19.479	4.04	72.45	1.468	3.881	46.584
							0.000
Patent	152.523	245.639	1	1027	2.357	7.401	206.201
							0.000
RDev	0.101	0.234	0	0.832	2.123	5.905	131.21
							0.000
Unemp	9.377	8.029	0.99	28.47	0.893	2.425	17.437
							0.000

Source: Afful (2021)

The number of patent applications (patent) across the study's panel units had a standard deviation of 245.639 and a mean value of 152.523, with minimum and maximum values of 1 and 1027, respectively. This shows that patent application across the countries had great variabilities as the standard deviation was larger than the mean. These variabilities can further be noted as the difference between the mean and standard deviation was 93.116 with a range of 1026. The number of patent applications was highly skewed to the right. The kurtosis and Jarque-Bera values indicated that the number of patent applications to be leptokurtic and not normally distributed.

Table 3 also shows that, the mean of research and development value of each nation (RDev) was 0.101 percent with a standard deviation of 0.234 percent. The minimum and maximum values were zero (0) and 0.832 percent, respectively. In comparing the mean and standard deviation of research and development, it was found that there was a difference of 0.133 percent and a range of 0.832 percent indicating that, research and development among the countries were not evenly spread. Furthermore, research and development expenditure was also highly skewed to the right, leptokurtic and not normally distributed. For the control variable which is unemployment, the mean value was 9.377 percent with a standard deviation of 8.029 percent and a minimum value of 0.99 percent and its maximum value being 28.47 percent. Unemployed among the countries studied was moderately skewed to the right and platykurtic. The p-value of the Jarque-Bera test depicted that the data is not normally distributed.

Matrix of Correlations

Table 4 presents a pairwise correlation matrix for all the variables employed in the empirical analysis. The absolute value of the coefficient determines the strength of the relationship while the sign of the coefficient depicts the direction of the variable (Cohen, 1988). All the variables recorded positive coefficients with the least positive coefficients being recorded by fraud loss and broad money (M3) with a coefficient of 0.1483 and fraud loss and research and development with a coefficient of 0.1828 indicating a very weak correlation. A large correlation was recorded by domestic credit and broad money, ATM and Domestic credit and finally, research and development and patent which had coefficients of 0.8568, 0.7433 and 0.7028, respectively. A close examination of the correlation matrix reveals no multicollinearity in the specification because the other independent variables did not exhibit correlation coefficients of more than 0.90 (Adam & Peterson, 2015).

Table 4: Matrix of Correlations

Variables	Floss	M3	DomCredit	ATM	Patent	RDev	Unemp
FLoss	1						
M3	0.1483	1					
DomCredit	0.2646	0.8568	1				
ATM	0.3343	0.5784	0.7433	1			
Patent	0.3624	0.4734	0.2114	0.2864	1		
RDev	0.1828	0.4492	0.285	0.2994	0.7028	1	
Unemp	0.2878	0.2668	0.3196	0.7197	0.4082	0.2809	1

Source: Afful (2021)

Trends of Fraud Loss

Trends of fraud loss (per countries)

Figure 2, 3, 4 and 5 will discuss and compare the fraud loss among the countries in the study. Figure 2 shows the trends of fraud loss of the countries that were used in the study. It is noted that Egypt, The Gambia, and Mozambique all saw small rises over the years, comparable to Tanzania, that saw a decrease in fraud losses in 2014 and thereafter increased in fraud losses. Countries such as Eswatini, Gabon, and Ghana, on the other hand, saw a decrease in fraud losses in 2015, while Mauritius saw a decrease in 2016, after which they all saw a steady increase in subsequent years. Ethiopia also faced an increase in fraud loss in 2014 and a massive decline in 2016 after which there has been a continuous increase.

Kenya and South Africa, however, saw steady increase since 2013. Malawi and Namibia witnessed ups and downs in terms of fraud losses. Malawi saw an increase in 2014, a decrease in 2015, and then another increase in 2018, while Namibia saw a decrease in 2014, an increase in 2015, and then another decrease in 2016. Fraud losses in Nigeria rose slightly in 2014, decreased until 2016, and then increased again in 2018. In Rwanda, there was also a rise in fraud losses in 2014, which decreased until 2016 before steadily increasing after that. Between 2014 and 2015, Uganda experienced a rise and fall in fraud loss, and has since experienced a significant increase in fraud loss. Zambia's fraud losses decreased significantly in 2016, but had steadily risen since then.

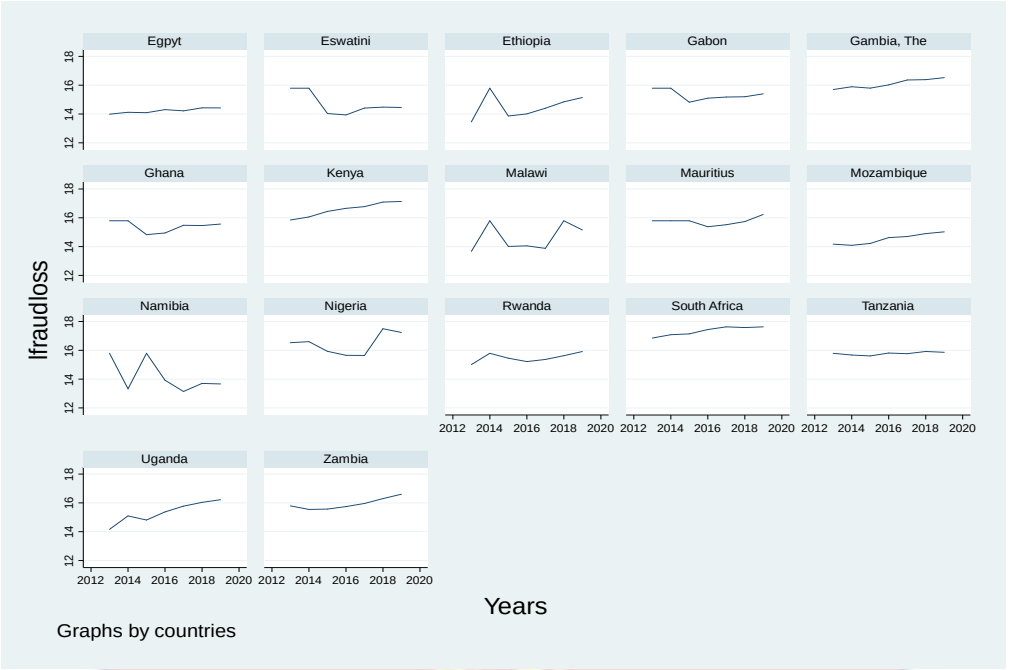

Figure 2: Countries of Trends of Fraud Loss
Source: Afful (2021)

Comparison of fraud loss

Figure 3 depicts a country-by-country comparison of fraud loss trends in the countries under study. As noted, Namibia's rise and fall indicates that the nation suffered one of the lowest losses after 2016. South Africa, Nigeria, and Kenya, on the other hand, saw some of the largest fraud losses in Africa from 2013 to 2019. Figure 3 also shows that Ethiopia and Malawi recorded the lowest fraud losses at the beginning of 2013 and 2015 but later climbed to the ranks. It should also be noted that, despite its rise in 2014, Rwanda was experienced some of the highest frauds among the countries. The Gambia moved up to fourth place after 2016. Egypt, Ethiopia, Eswatini, Gabon, Ghana, Malawi, Mauritius, Mozambique, Tanzania, Uganda, and Zambia were among the remaining countries with equal clustering as displaced in the diagram. This means that the characteristics of fraud loss in these countries were identical.

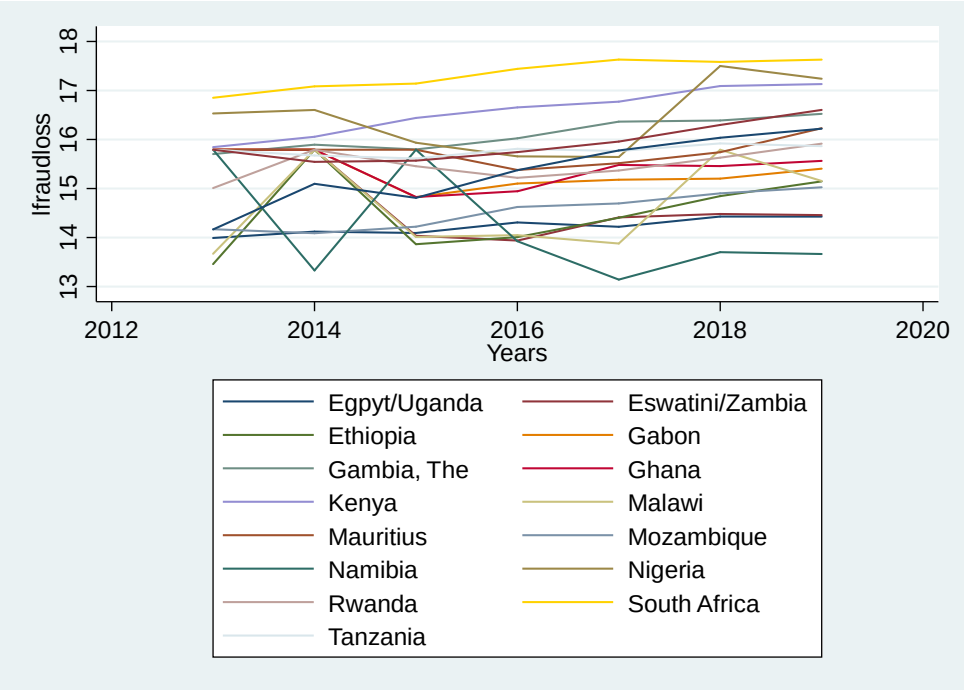

Figure 3: Country Comparison of the Fraud loss
Source: Afful (2021)

Comparison of mean of fraud loss (by countries)

Figure 4 provides an excellent overview of fraud loss behaviour in the countries surveyed. The mean value of fraud loss for each country is plotted against it. South Africa had the highest mean value of fraud loss of all the nations. This means that the country loses a greater amount of money than the other countries surveyed in this study. After South Africa, Kenya came in second with the second highest mean value, followed by Nigeria and The Gambia. The Gambia is closely followed by Zambia then Tanzania. Rwanda took eighth place after Mauritius. Egypt had the lowest mean, which may suggest that the country has better fraud prevention procedures than the other nations. Egypt was followed by Namibia, which had the second lowest average. Ethiopia and Mozambique have approximately the third lowest mean. Eswatini and Malawi had the fourth lowest means. Ghana was seen to fall in the middle in ninth place slight above Gabon.

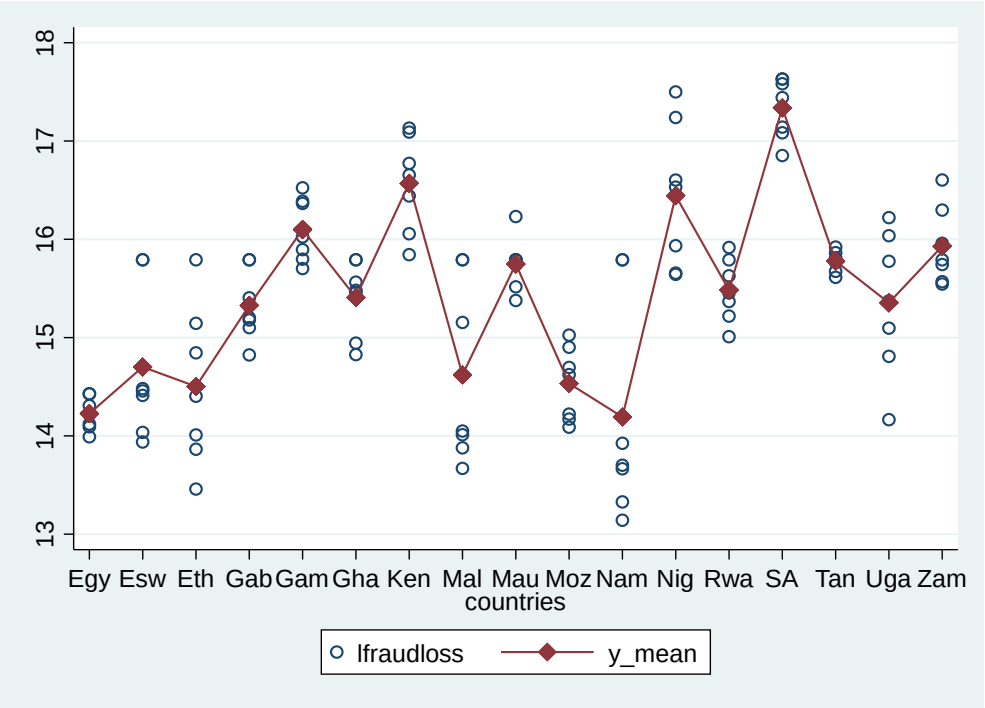

Figure 4: Comparison of mean of Fraud Loss by Countries
Source: Afful (2021)

Comparison of mean of fraud loss (by year)

Figure 5 shows the fraud loss distribution over the years of the study's sample period. As can be seen, the lowest mean value was in 2015 and 2016, while the highest average value was in 2019. Also, after an increase in 2014, the trend showed a steady decline in 2015 which did not change in 2016, before slowly reversing and increasing in 2017. Thus, the descriptive have shown that over the recent years, there has been an increase in fraud loss.

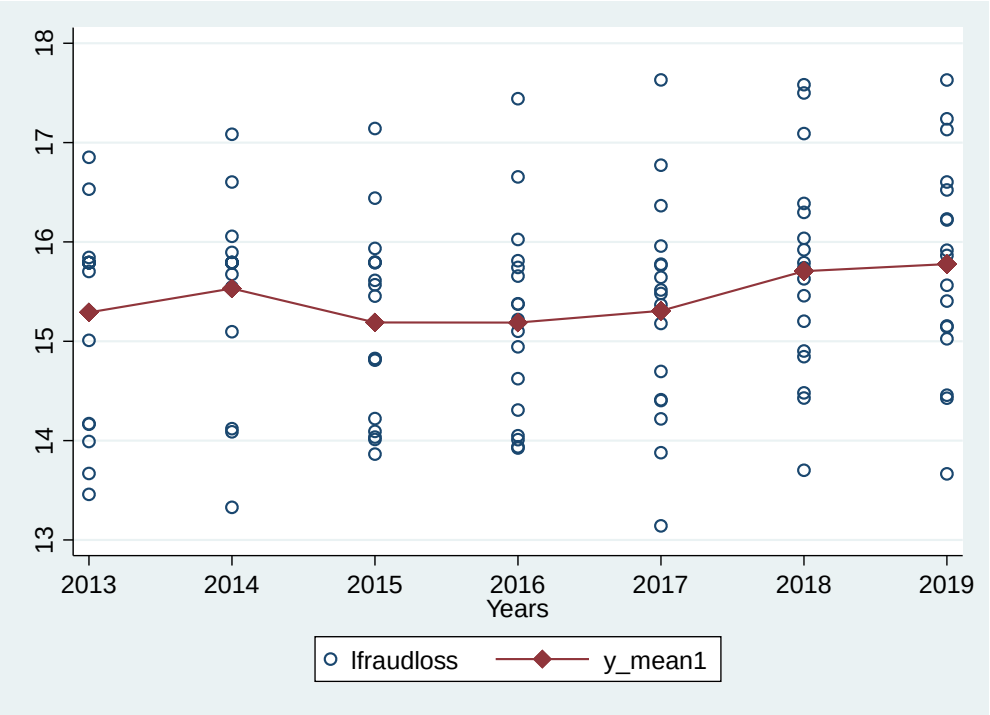

Figure 5: Comparison of mean of Fraud Loss by Year
Source: Afful (2021)

Scatter Plot of Fraud Loss

Scatter plot of fraud loss and broad money (M3)

Figure 6 shows the scatter plot of fraud loss and money supply in the economy of the countries under study. The unitary slope which depicts the relationship between fraud loss and broad money shows that, the relationship between fraud loss and broad money may be positive or negative with a slightly positive slope. It is also shown that, majority of the money supply among the countries under study was between 20 and 40 with very few being above 100 and the rest spread within 40 to 100. This shows that some of the countries had relatively low money supply in their economy as compared to the others.

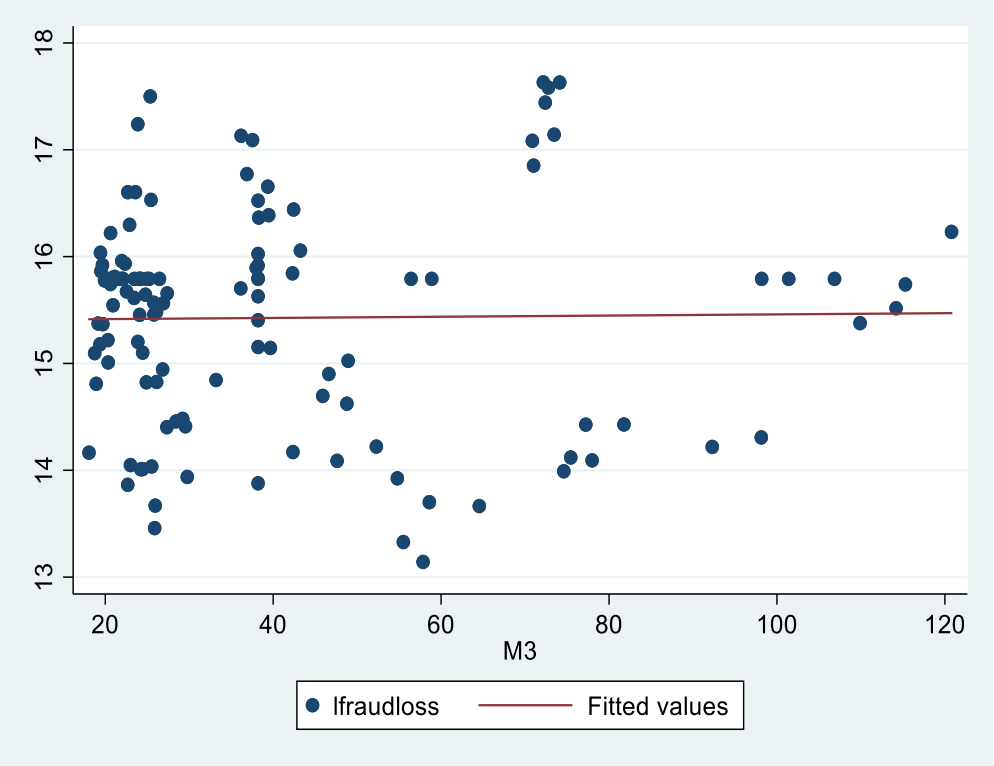

Figure 6: A Scatter Plot of Fraud Loss and Broad Money (M3)
Source: Afful (2021)

Scatter plot of fraud loss and ATM

Figure 7 shows the spread between the fraud loss and the number of ATMs in the study countries. The number of ATMs among the countries studied is comparatively low, as the numbers range from zero (0) to 20. In addition, only few countries had between 20 and 80. The unitary slope shows a slightly positive relationship between fraud loss and ATMs. However, the number of ATMs in a nation is nevertheless expected to negate the economy's fraud loss.

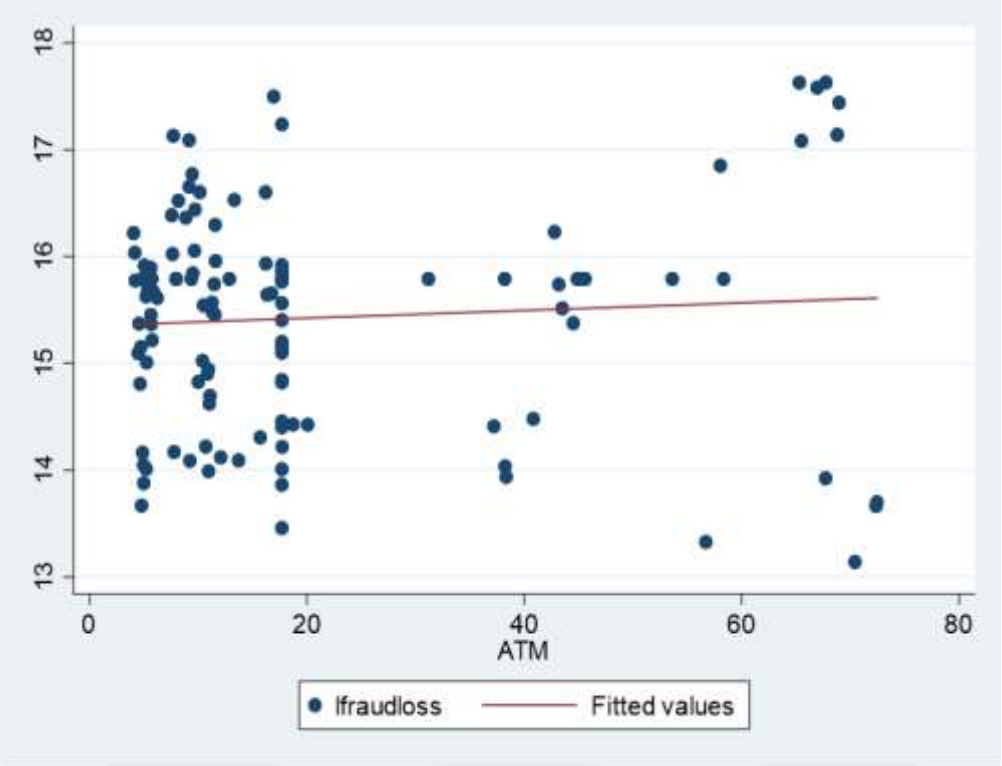

Figure 7: A Scatter Plot of Fraud Loss and ATM
Source: Afful (2021)

Scatter plot of fraud loss and patent

The scatter plot between fraud loss and the number of patent applications is shown in Figure 8. The majority of patent applications are in the range of 0 to 200, with just two applications in the range of 200 to 400. Furthermore, only a few countries have applications ranging from 400 to 1000 with only two above 1000. A slightly positive relationship existed between fraud loss and the number of patent applications, as shown in Figure 8. This suggests that the fraud loss regression coefficients could be positive. As a result, it is predicted that as a country's number of patent applications grows, so will its fraud losses.

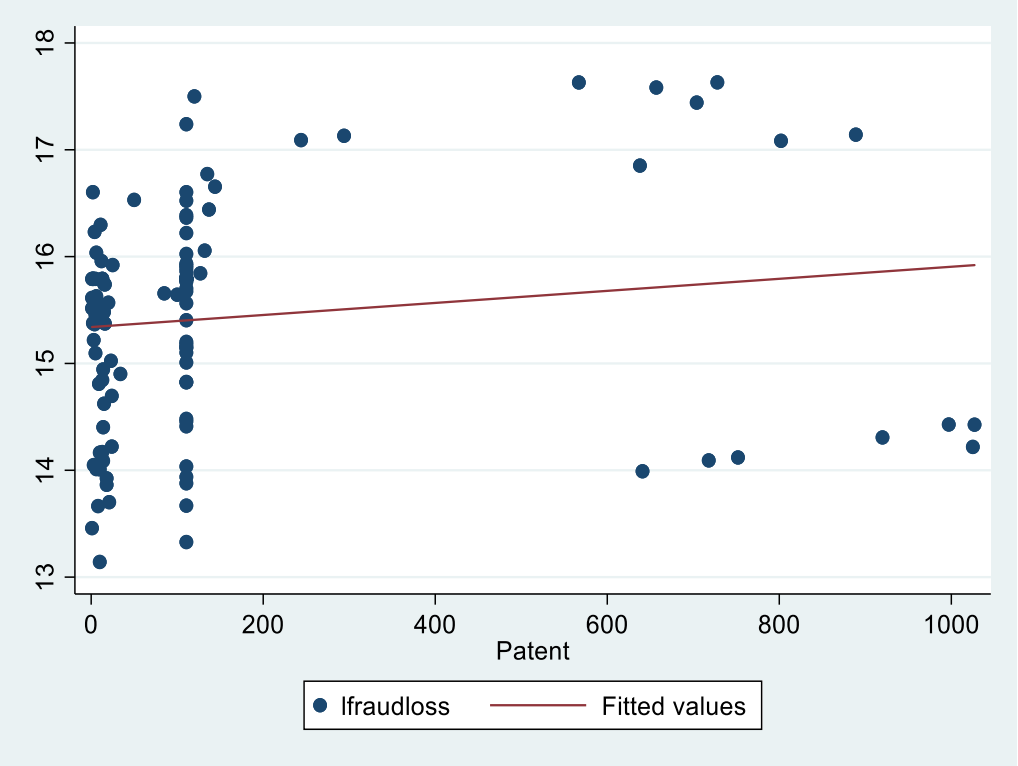

Figure 8: A Scatter Plot of Fraud Loss and Patent
Source: Afful (2021)

Fitted Values of Fraud Loss

Fitted values of fraud loss and broad money (M3)

The fitted values between fraud loss and broad money in the countries of study is seen in Figure 9. The regression line is the thick black line, which also represents the average of the countries in terms of fraud loss and broad money. This analysis shows that countries above the average line have had fraud losses (in terms of broad money) higher than the average of the countries under study (countries such as Mauritius, South Africa, Kenya, Zambia, the Gambia, Tanzania and Nigeria). On the other hand, fraud losses were lower than the average in countries like Egypt, Namibia, Malawi, Mozambique, Ethiopia or Eswatini (in terms of broad money). The individual countries depict a positive relationship between fraud loss and broad money.

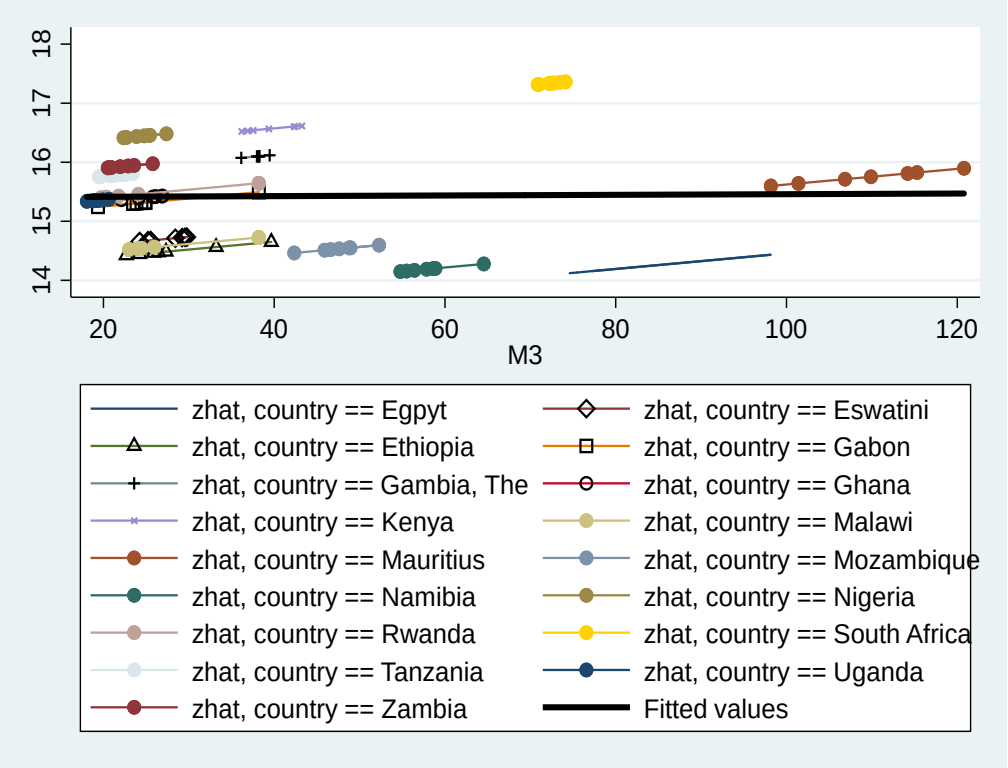

Figure 9: A Scatter Plot of Fraud Loss and Broad Money (M3)
Source: Afful (2021)

Fitted values of fraud loss and ATM

Figure 10 shows the fitted values between fraud loss and the number of ATMs. The black line represents the regression line as well as the average of the countries under study in terms of fraud loss and ATM. Thus, South Africa, Nigeria, Mauritius, Kenya, The Gambia and Tanzania have all experienced fraud loss (in terms of ATM) above the average line. Countries such as Ghana, Gabon, Uganda and Rwanda experienced fraud losses (with respect to ATM) below and above the average line. Others like Malawi, Egypt, Eswatini, Namibia and Ethiopia also experienced fraud losses (with respect to ATM) below the average. Also, in contrast with the regression line, most of the countries depicted a negative relationship between fraud loss and ATM.

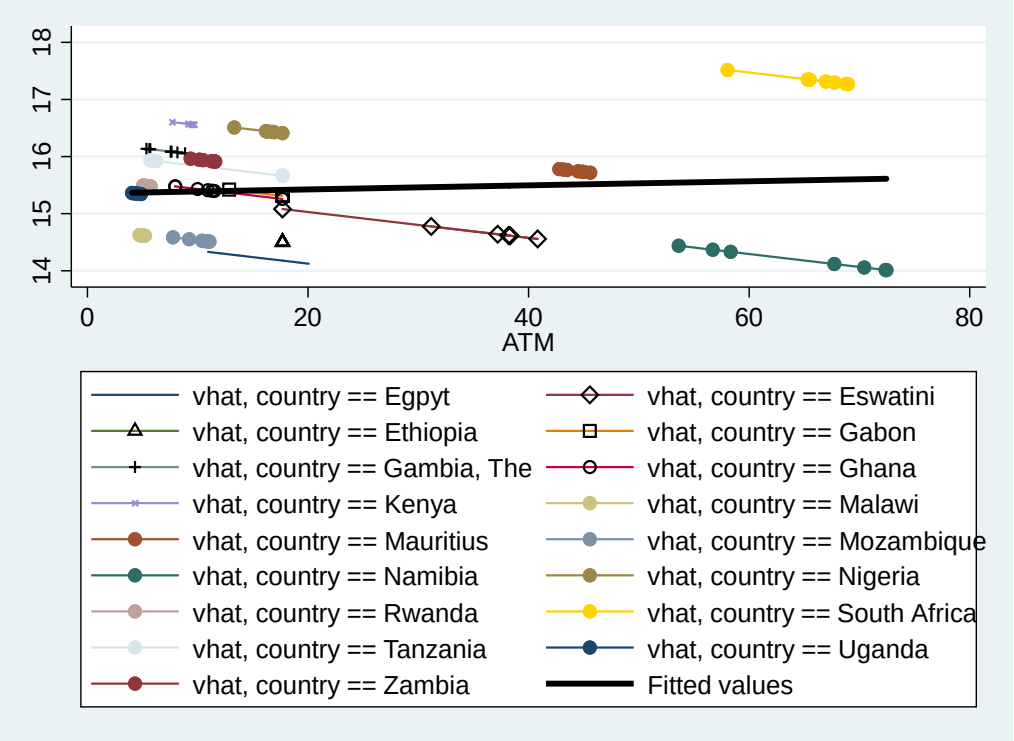

Figure 10: A Scatter Plot of Fraud Loss and ATM
Source: Afful (2021)

Fitted values of fraud loss and patent

In Figure 11, the fitted values between fraud loss and patent applications for the countries studied are presented. The straight black line represents the regression line of the number of patent applications on the countries' fraud losses. The estimated values for each of the countries under analysis are also plotted on the graph. All countries above the average line in terms of fraud loss and patent application (South Africa, Kenya, Nigeria, Tanzania, Mauritius, Zambia, the Gambia and Rwanda) experienced fraud loss (with respect to patent) above the average of the countries. In comparison, Egypt, Namibia, Eswatini, Mozambique, Malawi and Ethiopia experienced fraud losses (with respect to patent) that were lower than the average of the selected countries. Gabon and Ghana seem to have fallen in line with the average. Uganda initially showed values slightly below the average but later

goes a little above the average. Also, just like the unitary slope, almost all the countries depicted a positive relationship between patent and fraud loss.

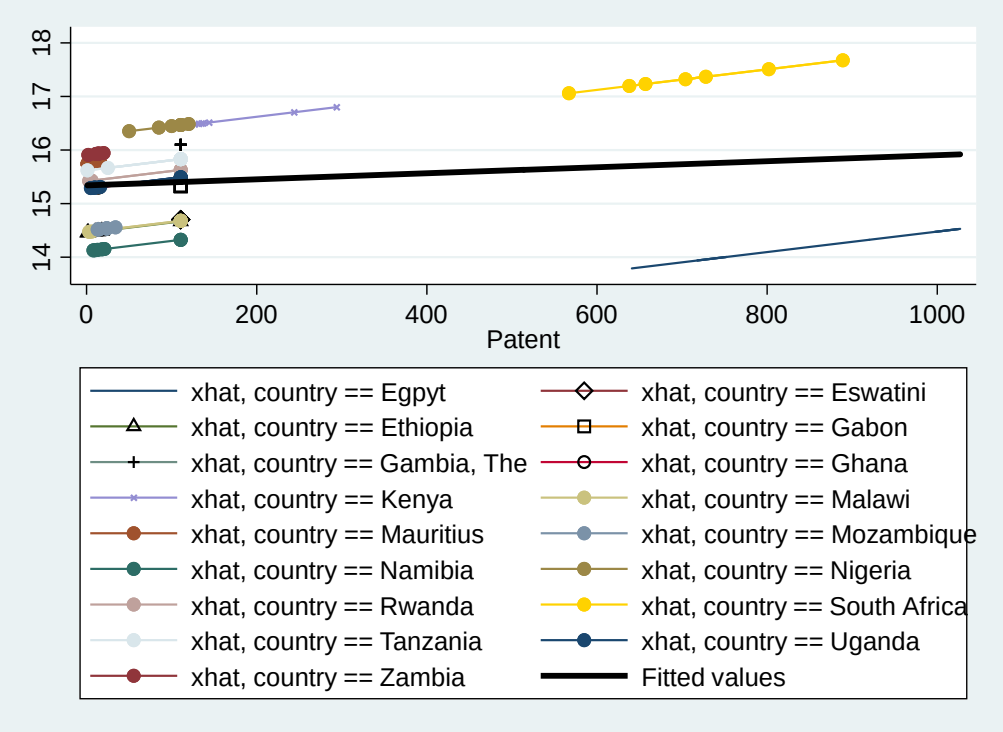

Figure 11: A Plot of Fitted Values of Fraud Loss and Patent
Source: Afful (2021)

Impact of Product Innovation on Financial Fraud

The first objective of the study was to analyse the impact of product innovation on financial fraud. The OLS results are presented in Table 5 to show the effect of product innovation on the fraud loss of a country. Column (1) presents OLS results without accounting for the variations in each of the countries' heterogeneity in predicting the effect of product innovation on fraud loss. Column (2), on the other hand, accounts for the countries' heterogeneities in estimating the relation between product innovation and fraud loss. From the results in column (1), all the variables used in this study to measure product innovation (broad money and domestic credit to private sector) are statistically significant. Broad money is statistically significant at 5 percent alpha level with a negative coefficient of 0.016. This indicates that an increase in the

supply of money by one unit will lead to a 1.6 percent decrease in fraud loss. On the other hand, domestic credit was significant at 1 percent alpha level with a positive coefficient of 0.022, indicating that there will be an increase in fraud loss by 2.2 percent if domestic credit to private sector increases by a unit. Unemployment, however, was not significant and had a coefficient of zero (0), implying that unemployment does not influence the impact of product innovation on fraud loss.

Table 5, column 2, presents the results of the OLS of the individual country's heterogeneity or country specific factors that affect broad money and domestic credit (Least Square Dummy Variable - LSDV) in predicting the fraud loss in the countries. As noted in column 2, all of the variables used in the study to measure product innovation are not statistically significant. However, in considering the country specific factors, most of the countries under study were statistically significant. The Gambia, Ghana, Kenya, Nigeria, Rwanda, South Africa, Tanzania, Uganda and Zambia were all statistically significant at 1 percent alpha level. Malawi, Mauritius and Mozambique were also statistically significant at 5 percent alpha level while Ethiopia was statistically significant at 10 percent alpha level. This could be an indication that these countries are prone to having product innovation increase their fraud loss in future if appropriate measures are not taken into consideration to control or mitigate the activities of fraud in their financial institutions. However, Eswatini, Gabon and Namibia were not statistically significant. Thus, product innovation does not influence the fraud loss in these countries. It is important to specify that the OLS is, however, not efficient to solve panel issues as shown in Tables 5,6,7, 8, 9 and 10.

Table 5: Impact of product innovation on fraud loss: Country comparison

	(1) OLS	(2) LSDV
VARIABLES	Lfraudloss	Lfraudloss
M3	-0.016**	0.018
	(0.007)	(0.012)
DomCredit	0.022***	-0.016
	(0.008)	(0.012)
Unemp	0.000	0.076
	(0.012)	(0.058)
Country (base=Egypt)		
Eswatini		0.510
		(0.934)
Ethiopia		1.841*
		(0.952)
Gabon		1.322
		(0.847)
Gambia, The		2.655***
		(0.645)
Ghana		2.483***
		(0.866)
Kenya		3.928***
		(0.870)
Malawi		1.657**
		(0.809)
Mauritius		2.470**
		(0.948)
Mozambique		1.581**
		(0.757)
Namibia		0.173
		(0.723)
Nigeria		3.444***
		(0.845)
Rwanda		2.988***
		(1.018)
South Africa		2.823***
		(0.993)
Tanzania		3.171***
		(1.013)
Uganda		2.803***
		(1.045)
Zambia		2.655***
		(0.789)
Constant	15.494***	12.260***
	(0.195)	(1.275)
Observations	119	119

Standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1
Source: Afful (2021)

Thus, OLS does not appropriately account for the differences or the heterogeneity that has been observed across the countries which the LSDV does (Wooldridge, 2016).

Fixed effect versus random effect

Table 6 presents the result of the effect of product innovation on fraud loss by employing the two most widely used panel estimation methods - the fixed effect and the random effect. As observed in Table 5 OLS cannot effectively estimate the results because of the time effect that OLS fails to take into account in its estimation. Fixed effect assumes that in order to account for the effect of broad money and domestic credit on fraud loss, then, the slope parameters or the coefficients of the broad money and domestic credit on fraud loss should be constant for all the countries. That is, only the country specific characteristics cause the changes that will be observed in the fraud loss over the time period (Gujarati, 2003). Random effect, on the other hand, argues that, instead of treating broad money and domestic credit as fixed, it should be treated as random occurrence with its disturbance term when assessing its effect on fraud loss (Gujarati).

Before deciding which of the two results to interpret, Hausman (1983) provided a caveat for determining which of the model presents efficient or consistent results. The null hypothesis for the Hausman test is that the differences in the fixed effect results and the random effect results are not systematic. In other words, there is no substantial difference between the results of the fixed effect and the random effect against the alternative hypothesis that the differences are systematic. Appendix A presents the results of the Hausman specification test.

With a chi-square value of 5.39 and a p-value of 0.2497, the test failed to reject the null hypothesis and concluded that there was no substantial difference in the random effect results with that of the fixed effect results. As noted in Table 6, both the random effect results and the fixed effect results were close and thus, confirms the choice of random effect by the Hausman test. The results made it known that indeed, OLS failed to predict the relationship between product innovation and fraud loss as both the fixed effect and random effect results indicate that none of the variables were statistically significant. As observed, broad money was positive with a coefficient of 0.008 while domestic credit was negative with a coefficient of 0.007 and unemployment was also positive with a coefficient of 0.017, all of which were insignificant.

Table 6: Impact of product innovation on fraud loss: fixed effect versus random effect

	(1)	(2)
	Fixed Effect	Random Effect
VARIABLES	lfraudloss	lfraudloss
M3	0.018	0.008
	(0.012)	(0.009)
DomCredit	-0.016	-0.007
	(0.012)	(0.010)
Unemp	0.076	0.017
	(0.058)	(0.026)
Constant	14.407***	15.122***
	(0.792)	(0.419)
Observations	119	119
R-squared	0.041	
Number of country	17	17

Standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1
Source: Afful (2021)

Post estimation tests

Appendix B presents the test for heteroscedasticity. From the post estimation test of the fixed effect model, the model suffers from heteroscedasticity because the p-value is 0.0000 which is below 0.05. Therefore, we reject the null hypothesis of a constant variance in the error term. The random effect post estimation also shows a p-value of less than 0.05 and thus, the null hypothesis is rejected and it is concluded that, the alternative is true. The test for autocorrelation (serial correlation) depicts a p-value of 0.1777 which is above 0.05. In this case, the null hypothesis that there is no autocorrelation (serial correlation) is not reject. The test for autocorrelation is presented in Appendix C.

Generalised method of moment results

In Table 7, the dynamic panel estimation method of Generalised Method of Moment (GMM) is presented. Again, in a bid to account for the issues of endogeneity which results from the fact that the lag values of the dependent variable (fraud loss) is having an impact on the current values of the dependent variable, the study employed the Generalised Method of Moments to deal with the endogeneity issues which the static panels estimation methods could not cater for.

Table 7: Impact of product innovation on fraud loss: GMM

	(1)	(2)
	GMM Result	GMM Result
	One-step	Two-step
VARIABLES	lfraudloss	lfraudloss
L.lfraudloss	0.242**	0.217***
	(0.114)	(0.034)
M3	0.050***	0.049***
	(0.014)	(0.009)
DomCredit	-0.046***	-0.044***
	(0.014)	(0.010)
Unemp	0.023	0.028***
	(0.047)	(0.007)
Constant	10.725***	11.061***
	(1.845)	(0.435)
Observations	102	102
Number of country	17	17

Standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1
Source: Afful (2021)

From the results, the dynamic panel estimation reveals that the coefficient of the lag of fraud loss (L.lfraudloss) was 0.242 in the one-step and 0.217 in the two-step. These coefficients were positive and statistically significant at 5 percent and 1 percent alpha levels respectively. This implies that the past levels of fraud loss affected the current levels. Thus, it is possible that the factors which contributed to these fraud losses in previous years were not efficiently dealt with and still influenced the current levels.

The study focused on the results of the two-step GMM, which shows that broad money had a positive relationship with fraud loss and was significant at 1 percent alpha level. With a co-efficient of 0.049, this implies

that when money supply increases in an economy by a unit, there will also an increase in fraud loss by 4.9 percent, all other things being equal. This finding is confirmed by Frederick (2013), who indicated that fraud loss and liquidity have a strong positive relationship. Also, Kanu and Okorafor (2013) indicated that bank deposits contributed largely to the amount of money lost to fraud. However, this assertion is argued against by Singh and Anthony (2016) whose study indicated that, bank deposits had reduced fraud losses.

Moreover, domestic credit had a negative relationship with fraud loss and was also statistically significant at 1 percent alpha level. Thus, all other things being equal, a unit increase in domestic credit to the private sector results in a 4.4 percent decrease in fraud loss. This also implies that, the availability of credit to the private sector reduces financial pressure which is a catalyst for committing fraud. This result is in line with a study by Ramadani, Histrich, Abazi-Alili, Dana, Panthi and Abazi-Bexheti (2019) where they concluded that product innovations had a positive relationship with firm performance.

In contrast, Rahman and Anwar (2014) concluded despite product innovation being the second most contributor to fraud, it had also increase productivity in banks. Also Moses (2015) agreed with studies by Kanu and Okorafor (2013), Frederick (2013) and Rahman and Anwar (2014) that indeed product innovation contributed positively with financial fraud. Unemployment was positive and significant at 1 percent alpha level. With a coefficient of 0.028, this indicates that a rise in unemployment will lead to an increase in fraud loss by 2.8 percent. This means unemployment contributed to the rise in fraud loss that occurred through product innovation.

Post estimation tests

The Arellano-Bond test was conducted in order to test for the presence of autocorrelation (serial correlation). The p-value of the first order differentiation was 0.0740 and the second order differentiation was 0.2875, both of which are above 0.05. Therefore, the study failed to reject the null hypothesis of no autocorrelation (serial correlation). The test of Arellano-Bond test for zero autocorrelation is presented in Appendix D. The test for overidentifying restrictions (the Sargan test) is presented in Appendix E. From the test, the null hypothesis that, overidentifying restrictions are valid is not rejected. This is because the p-value of the test was 0.8067 with a chi-square of 13.59651. Also, these finding were in line with other empirical studies.

Fixed effect, Random effect and GMM results

From the three models, the results were similar but not the same. All the models indicated that broad money had a positive relationship with fraud loss at very different percentages. Also, the GMM depicts a significant relationship between fraud loss and the independent variables as well as the control variable. However, the fixed effect and random effect models showed that there was no significant relationship between fraud loss and the independent variables except unemployment (the control variable). The GMM results are preferred because it tends to be correctly specified. Thus, the dynamics are in the estimated part of the model rather than being displaced in the error terms, which invalidates the fixed and random effect models.

Effect of Process Innovation on Financial Fraud

The second objective of the study aimed at analysing the effect of process innovation on financial fraud. The OLS findings are shown in Table 8

to demonstrate the effect of process innovation on a country's fraud loss. According to the findings in column (1), patent and research and development were statistically significant at 5 percent and 10 percent alpha levels respectively. It is worth noting that, fraud loss and patent had a positive relationship with a coefficient of 0.001. This means that a unit rise in patent resulted in a 0.1 percent increase in fraud loss. Also, research and development had a negative relationship with fraud loss, which means, an increase in research and development by one unit decreased fraud loss by 112.7 percent.

According to the findings of LSDV in Table 8, column 2, all of the variables used in estimating process innovation (ATM, patent and research and development) were statistically significant. While ATM and research and development were statistically significant at 5 percent alpha level with negative coefficients indicating a negative relationship with fraud loss, patent was statistically significant at 1 percent alpha level with a positive coefficient representing a positive relationship with fraud loss. With a coefficient of 0.035, a unit increase in the number of ATMs would mean a 3.5 percent decrease in fraud loss among the countries under study.

Table 8: Effect of Process innovation on fraud loss: Country comparison

VARIABLES	(1) OLS Lfraudloss	(2) LSDV Lfraudloss
ATM	0.006	-0.035**
	(0.007)	(0.015)
Patent	0.001**	0.003***
	(0.001)	(0.001)
RDev	-1.127*	-0.864**
	(0.572)	(0.333)
Unemp	-0.012	0.109*
	(0.018)	(0.057)
Country (base= Egypt)		
Eswatini		1.594*
		(0.926)
Ethiopia		3.433***
		(1.163)
Gabon		1.922**
		(0.801)
Gambia, The		3.541***
		(0.848)
Ghana		3.520***
		(1.000)
Kenya		4.605***
		(1.017)
Malawi		2.445**
		(0.978)
Mauritius		5.113***
		(1.143)
Mozambique		3.014***
		(1.111)
Namibia		2.633**
		(1.169)
Nigeria		4.535***
		(0.946)
Rwanda		4.048***
		(1.186)
South Africa		3.716***
		(1.113)
Tanzania		4.317***
		(1.109)
Uganda		3.733***
		(1.158)
Zambia		3.621***
		(0.900)
Constant	15.318***	11.487***
	(0.147)	(1.250)
Observations	119	119

Standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1
Source: Afful (2021)

It was also known that a positive relationship exists between patent and fraud loss, which means an increase in a unit of patent application led to a 0.3 percent increase in fraud loss. It was understood that there is a negative relationship between research and development and fraud loss, implying an 86.4 percent decline in fraud loss as a result of a unit rise in research and development, all other things being equal. Again, at a significance level of 10 percent, the control variable (unemployment) indicated that, a one-unit rise in unemployment increased fraud loss by 10.9 percent.

In addition, considering the country's specific factors and using Egypt as the baseline, the rest of the countries were statistically significant. Ethiopia, The Gambia, Ghana, Kenya, Mauritius, Mozambique, Nigeria, Rwanda, South Africa, Tanzania, Uganda and Zambia were all statistically significant at 1 percent alpha level. At a 5 percent alpha level, Gabon, Malawi and Namibia were significant, while Eswatini was significant at a 10 percent alpha level. All the countries showed a positive relationship with fraud loss, meaning that they are likely to see an uptick in fraud losses in the future if effective steps to control or reduce fraud operations in their financial markets are not taken into account, especially with relation to process innovations.

Fixed effect versus random effect

From Hausman test in Appendix A, the study failed to reject the null hypothesis with a chi-square value of 5.77 and a p-value of 0.3296, implying that there is no significant difference between the random and fixed effect results. As seen in Table 9, the random effect and fixed effect effects are close, but there is no significant difference, confirming the Hausman test's preference of the random effect. ATM was statistically significant at 10 percent alpha

level with a negative coefficient of 0.019 implying that when the number of ATMs increased by one unit, fraud loss decreased by 1.9 percent. As can be seen from Table 9, each additional unit of patent increased fraud loss by 0.2 percent, and was statistically significant at 5 percent alpha level. This implies that, patent application which indicates an increase in financial process innovations led to fraud losses. This research corroborates some similar studies that found a connection between process innovation and financial fraud (Mativo, 2016; Ngalyuka, 2013).

Table 9: Effect of process innovation on fraud loss: fixed effect versus random effect

	(1)	(2)
	Fixed Effect	Random Effect
VARIABLES	lfraudloss	Lfraudloss
ATM	-0.035**	-0.019*
	(0.015)	(0.011)
Patent	0.003***	0.002**
	(0.001)	(0.001)
RDev	-0.864**	-0.869***
	(0.333)	(0.330)
Unemp	0.109*	0.039
	(0.057)	(0.031)
Constant	14.769***	15.278***
	(0.654)	(0.360)
Observations	119	119
R-squared	0.158	
Number of country	17	17

Standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1
Source: Afful (2021)

Also as observed, a unit increase in research and development decreased fraud loss by 86.9 percent and this was statistically significant at 1 percent alpha level. This means that research and development provides solutions to fraud loss or fraudulent activities. The finding of this study contradict other studies (Ngalyuka, 2013; Mativo, 2016) but agrees with a study by Achim and Borlea (2020) that found that research and development expenditure can help reduce economic and financial crimes especially in low income countries whose expenditure is four times lower than those of high income countries. Unemployment, however, was not significant despite being positive and had a coefficient of 0.039.

Post estimation tests

Appendix B presents the test for heteroscedasticity. The fixed effect model post estimation test depicts a p-value of 0.0000 which is below the threshold of 0.05. This means that, the null hypothesis of no heteroscedasticity is rejected and concluded that, the model suffers from heteroscedasticity. Also, from the test of heteroscedasticity of the random effect model, with a p-value of 0.0000, the null hypothesis is rejected and the alternative is concluded to be true since the p-value is below 0.05. Further, the test for autocorrelation in Appendix C indicates that, there is no autocorrelation. That is, with a coefficient of 0.1377, the null hypothesis is not rejected since the p-value is above 0.05.

GMM results

The coefficient of the lags of fraud loss (lfraudloss) in the one-step and two-step of the GMM findings in Table 10, are 0.222 and 0.151, respectively. At 10 percent and 5 percent alpha levels, all coefficients were statistically

significant and positive. This means that previous levels of fraud loss influenced the existing levels. As a result, it is likely that the causes that led to fraud losses in previous years but were not adequately addressed were still present at current levels. In the two-step results of the GMM (column 2), it is noted that all the variables used as proxies for process innovation were statistically significant.

ATM had a negative relationship with fraud loss and was statistically significant at 1 percent alpha level. ATM had a coefficient of 0.041 indicating that the number of ATMs when increased by a unit led to a decline in fraud loss by 4.1 percent. Agbai, Haizel, Seidu and Twum (2015) had similar results in their study where they argued that, ATMs had a positive relationship with bank returns rather than making negative contributions to bank returns.

Patent, on the other hand, was significant at 1 percent alpha level with positive coefficient of 0.003 which depicts that fraud loss increased by 0.3 percent when patent application rose by a unit, all other things being equal. This conforms with studies by Mativo (2016) and Ngalyuka (2013), whom stated that financial innovations had created opportunities for the occurrence of financial fraud especially in technology.

Table 10: Effect of process innovation on fraud loss: GMM

VARIABLES	(1) GMM Result One-step Lfraudloss	(2) GMM Result Two-step Lfraudloss
L.lfraudloss	0.222*	0.151**
	(0.116)	(0.071)
ATM	-0.051***	-0.041***
	(0.014)	(0.010)
Patent	0.004***	0.003***
	(0.001)	(0.001)
RDev	-0.821**	-0.885**
	(0.465)	(0.535)
Unemp	0.182***	0.147***
	(0.054)	(0.032)
Constant	10.885***	12.086***
	(1.889)	(1.202)
Observations	102	102
Number of country	17	17

Standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1
Source: Afful (2021)

The negative association between research and development and fraud loss was statistically significant at 5 percent alpha level. The research and development coefficient was 0.8853. As a result, research and development helped to reduce fraud loss by 88.53 percent. Thus, it will be appropriate to say that countries with low research and development spending, such as Gabon, Ghana, Kenya, Malawi, Nigeria, Uganda, and Zambia should increase their research and development spending in order to combat financial fraud. This is in line with Okafor (2014) and Achim and Borlea (2020) which found that, the development of computer technology had aided banks in the detection of fraud losses and activities. However, Ngalyuka (2013) argued differently,

stating that advanced technology or ICT had done more harm than good in the banks.

Furthermore, unemployment was statistically significant at the 1 percent alpha level with a co-efficient of 0.147. This demonstrates that unemployment is a factor in the fraud loss in these nations by 14.7 percent.

Post estimation tests

In Appendix D, the Arellano-Bond test was conducted in order to test for the present of autocorrelation (serial correlation). The p-value of the first order differentiation was 0.0846 and the second order differentiation was 0.2488, both of which were above 0.05. Therefore, the study failed to reject the null hypothesis of no autocorrelation (serial correlation). The test for over identifying restrictions is presented in Appendix E. From the test, the null hypothesis of over identifying restrictions are valid is not rejected since the p-value of the test was 0.6945 with a chi-square of 15.43583. Also, the findings were in line with other empirical studies.

Fixed effect, Random effect and GMM results

The results of the fixed and random effect models and the GMM, though similar, were not the same. The models were in consensus that fraud loss had a negative relationship with ATM and research and development and a positive relationship with patent and employment. However, the values differ as well as the significant levels. Also, while the fixed effect model and the GMM indicated a significant relationship between fraud loss and unemployment, the random effect model showed that there was no significant relationship between the two variables.

Interaction Effects of Variables

Interaction between M3 and domestic credit (MD)

In order to understand more clearly the effect of broad money and domestic credit on fraud loss, an interaction analysis was performed.

Table 11: Interaction between M3 and Domestic Credit (MD)

	(1)	(2)	(3)
	Fixed Effect	Random Effect	GMM Result
VARIABLES	Lfraudloss	lfraudloss	lfraudloss
L.lfraudloss			0.226*
			(0.119)
M3	0.024	0.007	0.065***
	(0.015)	(0.012)	(0.017)
DomCredit	-0.002	-0.011	0.001
	(0.023)	(0.019)	(0.028)
MD	-0.000	0.000	-0.001**
	(0.000)	(0.000)	(0.000)
Unemp	0.077	0.019	0.038
	(0.059)	(0.027)	(0.049)
Constant	14.209***	15.190***	10.208***
	(0.843)	(0.550)	(1.929)
Observations	119	119	102
R-squared	0.046		
Number of country	17	17	17

Standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1
Source: Afful (2021)

From Table 11, it can be noted that, the interaction between broad money and domestic credit was not significant using both the fixed effect model and the random effect model. However, using the GMM, the interaction effect was significant at a 5 percent alpha level with a negative coefficient of 0.001. Thus, the higher the money supply, the lower the effect of domestic credit on

fraud loss. Similarly, the higher the domestic credit, the lower the effect of broad money on fraud loss.

Interaction between ATM and patent (AP)

The interaction of ATM and Patent (AP) gives a better understanding of the effect the two variables had on fraud loss. Table 12 presents the interaction effect using the FE model and RE model as well as the GMM.

Table 12: Interaction between ATM and Patent (AP)

	(1)	(2)	(3)
	Fixed Effect	Random Effect	GMM Result
VARIABLES	lfraudloss	lfraudloss	lfraudloss
L.lfraudloss			0.22*
			(0.116)
ATM	-0.034**	-0.022**	-0.049***
	(0.016)	(0.011)	(0.014)
Patent	0.003*	-0.000	0.006***
	(0.002)	(0.001)	(0.002)
RDev	-0.857**	-0.836***	-0.805*
	(0.346)	(0.349)	(0.493)
AP	-0.000	0.000**	-0.000
	(0.000)	(0.000)	(0.000)
Unemp	0.108*	0.020	0.175***
	(0.059)	(0.026)	(0.054)
Constant	14.768***	15.590***	10.905***
	(0.657)	(0.287)	(1.891)
Observations	119	119	102
R-squared	0.158		
Number of country	17	17	17

Standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1
Source: Afful (2021)

The interaction effect (AP) in Table 12 indicates that, the FE model and the GMM results were not significant. Conversely, the RE model depicted a significant relationship at a 5 percent alpha level. Nonetheless, there is no influence of this interaction as the coefficient of the interaction effect between

ATM and patent was zero (0). This means that the interaction effect does not have any influence on fraud loss.

Interaction between ATM and research and development (AR)

Table 13 presents the results of the interaction analysis between ATM and research and development (AR) using the fixed effect and random effect models and the GMM. As noted in Table 13, the interaction between ATM and research and development was not significant in any of the models used. This means that, ATM and research and development collectively did not influence fraud loss.

Table 13: Interaction between ATM and Research and Development (AR)

	(1)	(2)	(3)
	Fixed Effect	Random Effect	GMM Result
VARIABLES	Lfraudloss	Lfraudloss	lfraudloss
L.lfraudloss			0.226*
			(0.117)
ATM	-0.034**	-0.013	-0.050***
	(0.015)	(0.010)	(0.014)
Patent	0.003***	0.001**	0.004***
	(0.001)	(0.001)	(0.001)
RDev	-0.761	-0.872**	-0.672
	(0.577)	(0.561)	(0.821)
AR	0.003	0.016	-0.013
	(0.014)	(0.013)	(0.019)
Unemp	0.107*	0.023	0.177***
	(0.059)	(0.026)	(0.054)
Constant	14.776***	15.360***	10.817***
	(0.658)	(0.266)	(1.897)
Observations	119	119	102
R-squared	0.158		
Number of country	17	17	17

Standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1
Source: Afful (2021)

Interaction between patent and research and development (PR)

Table 14 shows the results of the interaction between patent and research and development (PR). The interaction between the two variables was performed using fixed and random effect models and also the GMM. The results depict that an interaction between patent and research and development was not significant to fraud loss in any of the models.

Table 14: Interaction between Patent and Research and Development (PR)

VARIABLES	(1) Fixed Effect Lfraudloss	(2) Random Effect Lfraudloss	(3) GMM Result lfraudloss
L.lfraudloss			0.222*
			(0.117)
ATM	0.035**	-0.020*	-0.051***
	(0.015)	(0.012)	(0.014)
Patent	0.003***	0.002**	0.004***
	(0.001)	(0.001)	(0.001)
RDev	0.877**	-0.851**	-0.850
	(0.470)	(0.465)	(0.670)
PR	0.001	0.000	-0.000
	(0.001)	(0.001)	(0.001)
Unemp	0.109*	0.041	0.181***
	(0.058)	(0.031)	(0.054)
Constant	14.805***	15.294***	10.885***
	(0.658)	(0.372)	(1.902)
Observations	119	119	102
R-squared	0.161		
Number of country	17	17	17

Standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1
Source: Afful (2021)

Chapter Summary

The chapter presented the results and discussion of the analysis performed using the models presented in Chapter three. The chapter began with the descriptive statistics of the variables used in the study. The matrix of

correlation was also presented and the results showed no multicollinearity among the variables under study. The chapter also showed the trends of fraud loss which were presented by country (individually), by country comparison, by mean comparison and by year comparison. The findings of the first objective which was to analyse the impact of product innovation was presented and discussed using the OLS and LSDV model in Table 5. Tables 6 and 7 presented findings of the analysis using FE model, RE model and the GMM. Also, post estimation tests were conducted for the FE and RE models as well as the GMM. For the third objective, which was to assess the effect of process innovation on financial fraud, the results were presented using OLS, LSDV, FE and RE model and the GMM. Post estimation tests were also performed for the FE model, RE model and the GMM. Furthermore, for both objectives, the Hausman test was conducted to know which model was more appropriate for discussion between the FE and RE models. Additionally, interaction effects were conducted between broad money and domestic credit (MD), ATM and patent (AP), ATM and research and development (AR) and finally patent and research and development (PR) to see how they influence fraud loss.

CHAPTER FIVE

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

Introduction

The study examined financial innovation and financial fraud in some selected countries in Africa. To achieve the objectives of the study, a panel analysis of 17 countries over a period of seven years was employed. This chapter presents the summary, conclusion and the recommendations of the study. The chapter begins with the summary of the study, followed by the conclusions and then the recommendations.

Summary of the study

The study examined financial innovation and financial fraud in selected countries in Africa. Chapter one presented the introduction, background of the study and the problem statement of the study. The chapter highlighted the importance of financial innovation to the growth of every economy and to organisations especially in the banking industry. The opportunities created by financial innovations for criminals or fraudsters were emphasised in this chapter. Further in this chapter, the problem that fraud presents to banks due to innovations introduced in the financial sector were accentuated. The chapter proceeded to present on the objectives of the study which were to establish the impact of product innovation on financial fraud and to assess the effect of process innovation on financial fraud in African banks.

Chapter two presented the literature review on both theoretical and empirical studies of financial innovation and financial fraud. Specifically, the study reviewed theoretical literature on the concept on financial innovation

and fraud. The study proceeded to highlight financial innovation narrowing it down to process innovation and product innovation and further discussed financial fraud and its categories as well as ways of mitigating it. An empirical review of other studies was also presented on financial innovation and financial fraud, I.C.T and financial fraud and financial fraud on bank performance, among others.

Furthermore, the study examined the various methods to estimating panel analysis. As discussed in chapter three, the study presented the research paradigm, research approach and research design. This research employed the positivism paradigm, a quantitative research approach and the explanatory design to achieve its objectives. Data for analysis was sourced from various sites including the World Development Indicators (WDI). The dependent variable was measured using fraud loss while broad money (M3) and domestic credit to private sector by banks were measures for product innovation and number of ATMs, patent applications and research and development expenditure were used to measure the process innovation. Unemployment in the various countries was used as a control variable

Additionally, chapter three presented the methods needed for the estimation of panel analysis. It started with the model specification of classical regression model. That is, the ordinary least squares and proceeded with the theoretical and empirical specification of fixed effect methods, random effect methods and the generalised method of moments. The study highlighted the assumption that underpin fixed effect, which is, the assumption that the betas or the slope parameters are fixed and thus, the change in the betas arise from individual heterogeneity in the model. Random effect, on the other hand,

assumed the betas or the slope parameters are random with their disturbance term. Thus, this disturbance terms plus the model error term forms the composite error term. In addition, the study presented the post estimation test for the random and fixed effects as well as the GMM. These tests include the Hausman test, the test for heteroscedasticity, the Wooldridge test (for autocorrelation in the FE and RE models), the Arellano-Bond test (for autocorrelation in the GMM) and the Sargan test (for validity of the overidentifying restrictions)

In Chapter four, the study presented the results and the discussion of the findings of this research. Specifically, the study presented the descriptive statistics of the variables used in the model. It was revealed in the descriptive statistics that, fraud loss, research and development and patent applications across the countries have the standard deviation being larger than the mean. This situation indicates that those variables have great variabilities across the countries studied. The matrix of correlation indicated that there was no multicollinearity among the variables studied.

Also, the study presented graphs and scatter plots of the variables used in the model. It was revealed that almost all the countries under study had faced some rises and declines in their fraud loss since 2013 except South Africa and Kenya that saw a steady increase from the beginning of the time period with South Africa having the highest mean value. Across the years, the study revealed that 2019 was the year with the highest fraud loss while 2015 and 2016 recorded the lowest mean value for fraud loss. The scatter plot of fraud loss and broad money further revealed that, many of the value of broad money were between 20 and 40 signifying that broad money is slightly low

across the countries studied. Similarly, the scatter plot of fraud loss and ATM showed that majority of ATMs were within zero (0) and 20 with the remaining spread over from 20 to 80. With the scatter plot of fraud loss and patent, many of the patent values were clustered between zero (0) and 200 with some few others dispersed from 200 to 1000 and above. This signified that patent applications were relatively low in most of the countries studied.

Further, the fitted values of the fraud loss and broad money revealed a positive relationship. The fitted values of fraud loss and ATM exhibited a contrast between the individual countries and the average where the ATMs of the individual countries had a negative relationship with fraud loss. Also, the fitted values of fraud loss and patent depicted a positive relationship which was confirmed by the OLS results. However, the study acknowledged the limitation posed by OLS in the presence of panel estimation.

After performing the Hausman specification test for objectives one and two, the results indicated the random effect results were consistent. The results for objective one revealed that, broad money was insignificant and positive but domestic credit to private sector by banks was insignificant and negative. Also, unemployment as a control variable was positive and insignificant. The results of objective two showed that, ATM and research and development was significant but negative. Thus, an increase in ATM and the expenditure of research and development would cause fraud loss to decline, all other things being equal. The findings revealed that, patent was significant and positive which means, as patent applications increases, fraud loss would also go up. The results also depicted that unemployment as a control variable in the process innovation model was positive and significant. Meaning,

unemployment enabled the use of process innovation in fraudulent activities. The post estimation tests for both models (test for heteroscedasticity and autocorrelation test) showed that, the model suffered from heteroscedasticity but not autocorrelation. Furthermore, the findings of the GMM for objective one revealed that all the product innovation variables were significant including the control variable (unemployment). However, while broad money and unemployment had a positive relationship with fraud loss, domestic credit to the private sector by banks did not.

The results of objective two indicated that, all the variables for process innovation were significant as well as the control variable. The results showed that, patent and unemployment impacted on fraud loss positively while ATM and research and development had a negative impact on fraud loss. In addition, interaction effects were conducted on broad money and domestic credit, ATM and patent, ATM and research and development and finally, patent and research and development to know how they influenced fraud loss. From the findings, the interaction effect between broad money and domestic credit had significant relationships with fraud loss in the GMM. Also, the interaction effect of ATM and patent was significant but had not influence with fraud loss in the random effect. On the other hand, the interaction between ATM and research and development as well as that of patent and research and development did not show any significance in any of the models.

Conclusions

The study examined financial innovation and financial fraud in some selected African countries. The following conclusions were made from the findings of the study. First, because the values of the standard deviation of

fraud loss, research and development and patent were larger than their mean values, the study concludes that there were great variabilities in fraud loss, research and development as well as patent applications across the countries. Meaning some countries had very high levels while others had low levels.

This study deduces that most countries have faced a steady increase in fraud loss over recent years. This assertion is because the findings revealed that after the decline in 2016 (the second lowest mean was recorded this year) there was a continuous increase up till 2019, when the highest mean was recorded. Looking at the scatter plot for ATM and fraud loss, it can also be inferred that the number of ATMs was low across the countries studied since most of the values were mostly between zero (0) and 20. Correspondingly, the scatter plot between patent and fraud loss depicted a cluster of values mostly between zero (0) and 200 signifying low applications in some countries while very few had high applications going slightly above 1000.

Additionally, pertaining to the specific objective of the impact of product innovation on financial fraud, the fitted values of the fraud loss and broad money indicated a slightly positive relationship. However, the GMM clearly indicated a positive relationship between broad money and fraud loss. This means that fraud loss increases as money supply in an economy also increases. Domestic credit, on the other hand, had a negative relationship with fraud loss, meaning the more credit made available to the private sector, the better. In other words, available credit to households contributes less to fraud loss. Unemployment had positive relationship with fraud loss which means as unemployment increases, fraud loss also increases. It can therefore be

concluded that, product innovations contribute both positively and negatively to fraud loss among the nations.

With the second objective which was to examine the effect of process innovation on financial fraud, the GMM results revealed a negative relationship between fraud loss and ATM. This means, increasing the number of ATMs would cause a reduction in fraud loss. The fitted values of fraud loss and patent depicted a positive relationship which was also confirmed by the GMM. This implies that, an increase in patent applications would cause an increase in fraud loss. Moreover, research and development indicated a negative relationship with fraud loss as revealed in the GMM results. Thus, an increase in research and development expenditure would cause a decrease in fraud loss. Therefore, a conclusion can be drawn that research and development can contribute to eradicating fraud loss. Under this objective, unemployment was also positive and significant. It can therefore be said that unemployment contributes to fraud loss using process innovations. The study, therefore, concludes that process innovations also contributed positively and negatively to the increase in the fraud loss of the selected countries over the recent years.

Recommendations

Based on the findings from the study, the following recommendations are proposed. The study recommends that, credit should be made available to the private sector, especially to households. This is because the study found a negative relationship between domestic credit and financial fraud. This will help reduce the financial pressure faced in the private sector and thus, discourage the occurrence of fraudulent activities. This is mostly encouraged

in Eswatini, Ethiopia, Gabon, The Gambia, Ghana, Malawi, Namibia, Nigeria, Uganda, Tanzania and Zambia.

Furthermore, the study recommends ATMs which are financial innovation could help solve the issue of financial fraud if they are increased in the selected countries as they have a negative influence on financial fraud. Also, patent applications which depict a rise in financial innovations should have measures put in place to ensure that new financial innovations have the appropriate security measures to prevent financial fraud. Also privacy terms of financial innovations should be secured for users (especially with financial applications).

In addition, the study recommends that countries in Africa should increase their expenditure in research and development especially in the area of financial innovation. This is mostly encouraged in countries with extremely low research and development expenditure like Gabon, Ghana, Kenya, Malawi, Nigeria, Uganda, and Zambia.

Suggestions for Further Research

Future research should consider employing other measurement of financial innovation or financial fraud. The frequency of fraud activities may be considered as a measure for financial fraud to better understand how the financial innovations influence the occurrence of financial fraud.

REFERENCES

Abdullahi, R., & Mansor, N. (2015). Fraud Triangle Theory and Fraud Diamond Theory: Understanding the Convergent and Divergent For Future Research. *International Journal of Academic Research in Accounting, Finance and Management Sciences*, *5*(4), 30–37.

Abir, M., Raoudha, D., & Emna, R. (2016). Interaction Effect between Product and Process Innovation: The Case of Tunisian Banks. *Banks and Bank Systems*, *11*(1), 60-70.

Aboagye, A. Q., & Idun, A. A.-A. (2012). Financial Innovations and Economic Growth in Ghana: Evidence from Autoregressive Distributive Lags (ARDL) and Granger Causality Approaches. *SSRN Electronic Journal*, *1952*, 1–19.

Abreu, R., David, F., Legčević, M., Segura, L., Formigoni, H., & Mantovani, F. (2015). *Ethics and Fraud in E-banking Services*. Paper presested at Iberian Conference on Information Systems and Technologies, Aveiro, Portugal.

Achim, M. V. & . Borlea, S. N. (2020). Economic and Political Determinants of Economic and Financial Crime. In Organized Crime Series Editor, *Economic and Financial Crime : Corruption, Shadow Economy and Money Laundering (73-176)*.

Adam, A. M. & Peterson, O. J. (2015). *Financial Econometrics: An Example-Based Handbook.* Accra, Ghana: Nova Science Publisher.

Ahmad, B., Ciupac-Ulici, M. & Beju, G. (2021). *Economic and Non-Economic Variables Affecting Fraud in European Countries.*

Agbai, P., Haizel, E., Seidu, A. J. & Twum, M. A. (2015). *Financial Innovation and Its Impact on Bank Profitability.* (Master's Dissertation, University of Ghana, Ghana).

Akelola, S. (2014). Prosecuting Bank Fraud in Kenya: Challenges Faced by the Banking Sector. *Journal of Finance and Management in Public Services*, *14*(1), 60–78.

Albrecht, W. S., Albrecht, C., & Albrecht, C. C. (2008). Current trends in fraud and its detection. *Information Security Journal*, *17*(1), 2–12.

Alise, M. A., & Teddlie, C. (2010). A Continuation of the Paradigm Wars? Prevalence Rates of Methodological Approaches Across the Social/Behavioural Sciences. *Journal of Mixed Methods Research, 4*(2), 103-126.

Al-Sharieh, S. & Mention, A. (2013*). Open Innovation and Intellectual Property: The Relationship and Its Challenges*. Charlotte, North Carolina, USA: Information Age Publishing.

Amaral, G., Bushee, J., Cordani, U. G., Kawashita, K., Reynolds, J. H., Almeida, F. F. M. D. E., De Almeida, F. F. M., Hasui, Y., De Brito Neves, B. B., Fuck, R. A., Oldenzaal, Z., Guida, A., Tchalenko, J. S., Peacock, D. C. P., Sanderson, D. J., Rotevatn, A., Nixon, C. W., Rotevatn, A., Sanderson, D. J., Junho, M. C. B. (2013). Covariance structure analysis of health-related indicators in the elderly at home with a focus on subjective health. *Journal of Petrology*, *369*(1), 1689–1699.

Antonnet, A. J. (2014). *The Effects of Product Innovatin on Financial Performance of Commercial Banks Kenya*. (Master's Dissertation, School of Business. University of Nairobi).

Ansong, A., Marfo-Yiadom, E. & Ekow-Asmah, E. (2011). The Effect of Financial Innovations on Financial Savings: Evidence from an Economy in Transition. *Journal of African Business, 12,* 93-113.

Arellano, M., & Bond, S. (1988). *Dynamic Panel Data Estimation Using DPD-A Guide for Users. London*: Institute for Fiscal Studies.

Arellano, M. (1989). A Note on the Anderson-Hsiao Estimator for Panel Data. *Economics Letters, 31*(4), 337-341.

Arellano, M. & Bond, S. (1991). Some Tests of Specification for Panel Data: Monte Carlo Evidence and an Application to Employment Equations. *The Review of Economic Studies, 58*(2), 277–297.

Asomaning, A. O. (2019). *Assessing the Effectiveness of Fraud Risk Management Practices in the Banking Sector of Ghana*. (Master's Dissertation, University of Ghana). Retrieved from http://ugspace.ug.edu.gh/

Associated Chambers of Commerce and Industry (2015). *Current Fraud Trends in the Financial Sector*. New Delhi, India: PWC. Retrieved from http://www.pwc.in/

Azaze A. & Haji A. (2005). The Impact of Strategic and Environmental Factors on the Malaysian Furniture Industry Export Marketing Performance. Unpublished Masters Thesis, School of Management, Selangor, Universiti Putra Malaysia.

Baicu, C. G. (2009). The Impact of Financial Innovation on Banking Regulation: Evidence from the Global Financial Crisis. *Universitatea Spiru Haret*, *2*(4), 31–40.

Baltagi, B. H., & Levin, D. (1986). Estimating Dynamic Demand for Cigarettes Using Panel Data: The Effects of Bootlegging, Taxation and Advertising Reconsidered. *The Review of Economics and Statistics*, 148-155.

Baltagi, B. H. (3rd ed.). (2005). *Econometric Analysis of Panel Data*. West Sussex, UK: John Wiley Sons Ltd.

Baltagi, B.H. (2008). *Econometric Analysis of Panel Data*. Sussex, UK: John Wiley & Sons.

Baoko, G., Acheampong, I.A. & Ibrahim, M. (2017). Determinants of Bank Credit in Ghana: A Boundstesting Cointegration Approach. *African Review of Economics and Finance 9*(1), 33–61.

Batiz-Lazo, B. & Wood, D. (2003). Strategy Competition and Diversification in European and Mexican Banking. *International Journal of Bank Marketing*, *21*(4), 202-216. Retrieved from

Batiz-Lazo, B. and Woldesenbet, K. (2006). The Dynamics of Product and Process Innovation in UK Banking. *International Journal of Financial Services Management, 1*(4), 400-421.

Beck, T., Chen, T., Lin, C., & Song, F. M. (2016). Financial innovation: The Bright and the Dark Sides. *Journal of Banking and Finance*, *72*(1), 28–51.

Berrada, E.M. (2020). Cybercrime: West African banks are under-protected. *The Africa Report*.

Bole, V., & Rebec, P. (2013). Bootstrapping the Hausman Test in Panel Data Models. *Communications in Statistics: Simulation and Computation , 42*, 650-670.

Breusch, T.S. & Pagan, A.R. (1979). A Simple Test for Heteroskedastic City and Random Coefficient Variation. *Econometrica*, 47(5), 1287-1294.

Brunnermeier, M. K. (2009). Deciphering the Liquidity and Credit Crunch 2007–2008 Banking Industry Trends Leading Up to the Liquidity Squeeze. *Journal of Economic Perspectives*, *23*(1), 77–100.

Buciuni, G. (2019). The Elgar companion to Innovation and Knowledge Creation. *Journal of Economic Geography, 19*(5), 1171-1172.

Buku, M., & Mazer, R. (2017). Fraud in Mobile Financial Services: Protecting Consumers, Providers and the System. *CGAP Brief*, p. 14.

Chartered Institute of Management Accountants. (2008). Fraud Risk Management: A Guide to Good Practice. *Chartered Institute of Management Accountants*, 1–80.

Cressey, D. R. (1953). *Other People's Money*. Montclair, New Jersey, USA: Patterson Smith Publishing.

Creswell, J. W. (3rd ed.). (2008). *Educational Research: Planning, Conducting and Evaluating Quantitative and Qualitative Research*. Upper Saddle River, New Jersey, USA: Pearson Education, Inc.

Criminal Code (Amendment) Act 1988. (2003). *Criminal Code (Amendment) Act, 1988*. *1960*(Act 29).

Cohen, J. (1988*). Statistical Power Analysis for the Behavioural Sciences* (2nd ed.). Hillside, NJ: Lawrence Erlbaum Associates.

Coombs, R., Saviotti, P. & Walsh, V. (1987). *Economics and Technological Change*. London, UK: Macmillan.

Damanpour, F. & Gopalakrishnan, S. (2001). The Dynamics of the Adoption of Product and Process Innovations in Organisations. *Journal of Management Studies*, *38*(1), 45-65.

Danaa, A. A. A., Sappor, E. D., & Diyawu, M. (2016). Accessing the Impact of Information and Communication Technology (ICT) on the Performance of Banks in Ghana: A Case Study of Ghana Commercial Bank Limited. *International Journal of Science and Engineering Applications*, *5*(6), 290–299.

Ekpu, V. (2016). *Measuring and Reporting Financial Innovation Performance and Its Impact : A review of methodologies*. Paper presented at Financial Regulators and Supervisors Seminar, Dubai.

Fadipe-Joseph, O. A., & Titiloye, E. O. (2012). Application of Continued Fractions in Controlling Bank Fraud. *Journal of Business and Social Science*, *3*(9), 210–213.

Farrell, G., Tseloni, A., Mailley, J., & Tilley, N. (2011). The Crime Drop and the Security Hypothesis. *Journal of Research in Crime and Delinquency*, *48*(2), 147–175

Fassassi, & Akoussan, (2016, July 7). Cybercrime in Africa: Facts and Figures. *The Trust Project*.

Frederick, O. (2013). *The Effects of Financial Fraud and Liquidity on Financial Performance of Commercial Banks in Kenya*. Unpublished Master's Dissertation, School of Business. University of Nairobi. Nairobi, Kenya.

Freeman, C. (2nd ed.). (1982). *The Economics of Industrial Innovation*. London, England.: Frances Printer.

Freeman, C., & Soete, L. (3rd ed.). (2012). The Economics of Industrial Innovation.

Frietsch, R. & Schmoch, U. (2006). Technological Structures and Performance Reflected by Patent Indicators. In Dordrecht: Springer, *National Systems of Innovation in Comparison* (ed.), (89–105).

Frimpong, J. M. (2010). Investigating Efficiency of Ghana Banks: A Non-Parametric Approach. *American Journal of Scientific Research, Vol. 7*, 64–76.

Frimpong, J., Domeher, D., & Appiah, T. (2014). Adoption of Financial Innovation in the Ghanaian Banking Industry. *African Review of Economics and Finance*, *6*(2), 88–114.

Gennaioli, N., Shleifer, A., & Vishny, R. (2012). Neglected Risks, Financial Innovation, and Financial Fragility. *Journal of Financial Economics*, *104*(3), 452–468.

Gill, J., Johnson, P. & Clark, M. (2010). *Research Methods for Managers*. Sage Publications, Washington DC.

Grupp, H. (1997). The Links between Competitiveness, Firms' Innovative Activities and Public R&D Support in Germany: An Empirical Analysis. *Technology Analysis & Strategic Management, 9*(1), 19-34.

Gujarati, D.N. (2003). Panel data regression models. In Gujarati (4th ed.), *Basic Econometrics* (636-655). McGraw-Hill, Boston.

Hakami, T. A. (2011). *Fraud Prevention Policies and Strategies of Banks in Saudi Arabia*. Master Dissertation, Faculty of Accountancy, Universiti Teknologi Mara, Shah Alam.

Hausman, J. A. (1983). Specification and Estimation of Simultaneous Equation Models. *Handbook of Econometrics*, *1*, 391-448.

Henderson, B. J., & Pearson, N. D. (2011). The Dark Side of Financial Innovation. *SSRN Electronic Journal*, *202*.

Heffernan, S., Fu, M. & Fu, X. (2008). Financial Innovation in the UK. *SSRN Electronic Journal*, *4*, 1–26.

Hittleman, D. R., & Simon, A. J. (1997). *Interpreting Educational Research: An Introduction for Consumers of Research*. Upper Saddle River, New Jersey, USA: Prentice-Hall, Inc.

Hooper, M. J. & Pornelli, C. M. (2010). Deterring and detecting financial fraud: A platform for action. *Center for Audit Quality*, Washington D.C.

Howe, M. A., & Malgwi, C. A. (2006). Playing the Ponies: A $5 Million Embezzlement Case. *Journal of Education for Business*, *82*(1), 27–33.

Hsiao, C. (1985). Benefits and Limitations of Panel Data. *Econometric Reviews*, *4*(1), 121-174.

Hsiao, C., & Zhang, J. (2015). IV, GMM or Likelihood Approach to Estimate Dynamic Panel Models When Either N or T or Both Are Large. *Journal of econometrics*, *187*(1), 312-322.

Ibrahim, M. H. (2015). Issues in Islamic Banking and Finance: Islamic Banks, Shari'ah-Compliant Investment and Sukuk. *Pacific Basin Finance Journal*, *34*, 185–191.

Idowu, A. (2009). An Assessment of Fraud and Its Management in Nigeria Commercial Banks. *European Journal of Social Sciences*, *10*(4), 628-640.

Kabulova, J. & Stankevičienė, J. (2020). Valuation of Fintech Innovation Based on Patent Applications. *Open Access Journal*, *12*(23), 1-15.

Kamau (2020, October 15). Africa's Loses. African Banking and Finance.

Kanu, S. I. & Okorafor, E. O. (2013). The Nature, Extent and Economic Impact of Fraud on Bank Deposits in Nigeria. *Interdisplinary Journal of Contemporary Research in Business*, *4*(9), 253- 265.

Kelly, P., & Hartley, C. A. (2010). Casino Gambling and Workplace Fraud: A Cautionary Tale for Managers. *Management Research Review*, *33*(3), 224–239.

Kennedy, M. T. (2008). Getting Counted: Markets, Media and Reality. *American Sociological Review, 73*, 270–295.

Kenyon, W. & Tilton, P. D. (1st ed.). (2006). *Potential Red Flags and Fraud Detection Techniques: A Guide to Forensic Accounting Investigation*. New Jersey, USA: John Wiley & Sons, Inc.

Khan, M. S., & Senhadji, A. S. (2003). Financial Development and Economic Growth: An Overview. *Journal of African Economies*, *12*(2), 89–110.

Khraisha, T., & Arthur, K. (2018). Can We Have a General Theory of Financial Innovation Processes? A Conceptual Review. *Financial Innovation*, *4*(1).

King, R. E., & Levine, R. (1993). Finance and Growth: Schumpeter Might Be Right. *The Quarterly Journal of Economics*, *108*(3), 717-737.

Knepper, P. (2015). Falling Crime Rates: What Happened Last Time. *Theoretical Criminology*, *19*(1), 59-76.

Korir, M. C., Shishia, A., & Sang, W. (2015). Financial Innovations and Performance of Commercial banks in Kenya. *International Journal of Economics, Commerce and Management*, *3*(5), 1242–1265.

Kotler, P. (2011). Reinventing Marketing to Manage the Environment Imperative. *Journal of Marketing*, *75*(4) 32-135.

Kruse, K. M. (2015). One Nation Under God: How Corporate America Invented Christian America. *New York: Basic Book*s, p. 7.

Kuhn, T. S. (2012). *The Structure of Scientific Revolutions: 50th Anniversary Edition* (p. 264). Chicago, Illinois, USA. Chicago Press.

Laeven, L., Levine, R., & Michalopoulos, S. (2015). Financial Innovation and Endogenous Growth. *Journal of Financial Intermediation*, *24*(1), 1–24.

Lang, M., & Wambach, A. (2012). The Fog of Fraud – Mitigating Fraud by Strategic Ambiguity. *SSRN Electronic Journal*, *81*, 255-275.

Lerner, J. (2006). The New Financial Thing: The Origins of Financial Innovations. *Journal of Financial Economics*, *79*(2), 223-255.

Lerner, J., & Tufano, P. (2011). The Consequences of Financial Innovation: A Counterfactual Research Agenda. *Annual Review of Financial Economics*, *3*(1), 41–85.

Lerner, J., Seru, A., Short, N., & Sun, Y. (2020). Financial Innovation in the 21st Century: Evidence from U.S. Patenting. *Working Paper*.

Levine, R. (2005). Finance and Growth: Theory and Evidence. *Handbook of Economic Growth*, *1*, 865-934.

Lim, E. G., & Sriram, S. (2003). Factors Underlying the Definitions of Broad Money: An Examination of Recent U.S. Monetary Statistics. In *IMF Working Papers* (p. 36).

Lin, C., Liu, S., & Lai, W. (2018). Banking and innovation: A review. *ADBI Working Paper, (Issue 815)*, Series Asian Development Bank Institute, Tokyo.

Lister, M. (2007). Institutions, Inequality and Social Norms: Explaining Variations in Participation. *British Journal of Politics and International Relations*, *9*(1), 20–35.

Long J. S. & Ervin, L. H. (2000). Using Heteroscedasticity Consistent Standard Errors in the Linear Regression Model. *The American Statistician, 54*(3), 217-224.

Llewellyn, D. T. (1992). *Financial Innovation: A Basic Analysis*. London, UK: Routledge.

Llewellyn, D.T. (2010). The Global Banking Crisis and the Post-Crisis Banking and Regulatory Scenario, Topics in Corporate Finance. *Amsterdam Centre for Corporate Finance*, 17-33.

Lyons, R. K., Chatman, J. A., & Joyce, C. K. (2007). Innovation in Services: Corporate Culture and Investment Banking. *California Management Review*, *50*(1).

Macnamara, J., & Zerfass, A. (2017). Evaluation Stasis Continues in PR and Corporate Communication: Asia-Pacific Insights into Causes. *Communication Research and Practice*, *3*(4), 319–334.

Mannah-Blankson, T. & Belnye, F. (2004). Financial Innovation and the Demand for Money in Ghana. *Bank of Ghana Working Paper, WP/BOG-2004/08*, Bank of Ghana, Accra.

Mativo, I. (2016). *Information Systems Innovations and Financial Fraud in Commercial Banks in Kenya*. Unpublished Master's Dissertation, School of Business. University of Nairobi. Nairobi, Kenya.

Merton, R. C. (1992). Financial Innovation and Economic Performance. *Journal of Applied Corporate Finance*, *4*(4), 12-22.

Mishkin, F. (8th ed.). (2007). *The Economics of Money, Banking, and Financial Markets.* Boston, Massachusetts, USA: Pearson Addison Wesley.

Mishra, P. K. (2008a). Financial Innovation in Emerging Markets: Possible Benefits and Risks. *SSRN Electronic Journal*, 1-9.

Mishra, P.K. (2008b). Financial Innovation and Economic Growth: A Theoretical Approach. *SSRN Electronic Journal*, 1-6.

Morikawa, M. (2019). Firm Heterogeneity and International Trade in Services. *The World Economy*, *42*(1), 268-295.

Moses, O. K. (2015). *The Relationship between Financial Innovation and Financial Fraud in Commercial Banks In Kenya.* Unpublished Master's Dissertation, School of Business. University of Nairobi. Nairobi, Kenya.

Mosoti, Z., & Masheka, B. (2010). Knowledge Management: The Case for Kenya. *The Journal of Language, Technology and Enterpreneurship in Africa*, *2*(1), 107–133.

Murdock, G. (2017). Mediatisation and the Transformation of Capitalism: The Elephant in the Room. *Javnost, 24*(2), 119–135.

Myers, M. D. (2019). *Qualitative Research in Business & Management*. London, UK: Sage Journals.

Nabhan, R. A. L., & Hindi, N. M. (2009). Bank Fraud: Perception of Bankers in the State of Qatar. *Academy of Banking Studies Journal, 8*(1),15-38.

Ngalyuka, C. (2013). *The Relationship Between Ict Utilization and Fraud Losses.* Unpublished Master's Dissertation, School of Business. University of Nairobi. Nairobi, Kenya.

Nzeakor, O. F. (2018). Field Assessment of Factors of Cybercrime Victimiz. *International Journal of Cyber Criminology, 14*(1), 83-99.

OECD. (2012). Innovation in the Crisis and Beyond. *OECD Science, Technology and Industry Outlook*, 21–57.

Odonkor (2020, October 27). Unveiling the Cost of Cybercrime in Africa. CGTN

Okafor, O. (n.d.). *Implications of Information Communication*. Retrieved from

Okafor, O. (2014). *The Effect of Fraud in Commercial Banks: A Study of Firstbank of Nigeria Plc* (Master's Dissertation, National Open University of Nigeria).

PwC. (2016). *Time to Change Tack a Need for New Thinking by the Financial Services Industry*. Retrieved from http://www.pwc.com/crimesurvey-fs

PwC. (2018). Pulling Fraud out of The Shadows. *PwC's Global Economic Crime and Fraud Survey 2018*. Retrieved from http://www.pwc.com/fraudsurvey

Rae, K., & Subramaniam, N. (2008), Quality of Internal Control Procedures: Antecedents and Moderating Effect on Organisational Justice and Employee Fraud. *Managerial Auditing Journal*, *23*(2), 104-124.

Rahman, R. A., & Anwar, I. S. K. (2014). Effectiveness of Fraud Prevention and Detection Techniques in Malaysian Islamic Banks. *Procedia - Social and Behavioral Sciences, 145*, 97–102.

Ramandi, V., Histrich, R. D., Abazi-Alili, H., Dana, L. Panthi, L. & Abazi-Bexheti, L. (2019). Product innovation and firm performance in transition economies: A multi-stage estimation approach. *Technological Forecasting and Social Change, 140*, 271-280.

Roodman, D. (2009). A Note on the Theme of Too Many Instruments. *Oxford Bulletin of Economics and Statistics*, 71(1), 135-158.

Saunders, M., Lewis, P., Thornhill, A. & Bristow, A. (2019). "Research Methods for Business Students" Chapter 4: Understanding research philosophy and approaches to theory development.

Singh, C., & Antony, K. (2016). Frauds in the Indian Banking Industry. *IIM Bangalore Research Paper*, 1–24.

Shehzad, K., Zaman, U., Jose, A., E., Kocak, E. & Ferreira, P. (2021). *An Officious Impact of Financial Innovations and ICT on Economic Evolution in China: Revealing the Substantial Role of BRI.*

Singleton, T. W., Bologna, G. J., Lindquist, R. J., & Singleton, A. J. (3rd ed.). (2006). *Fraud Auditing and Forensic Accounting*. New Jersey, USA: John Wiley & Sons, Inc.

Spalek, S. (2012). The Role of Project Management Office in the Multi-Project Environment. *International Journal of Management and*

Enterprise Development, *12*(2), 172–188.

Sukamolson, S. (2007). Fundamentals of Qualitative Research. *Language Institute, Chulalongkorn University*, 1-20.

Šumah, Š. (2018). Corruption, Causes and Consequences. In Vito Bobek (ed.), *Trade and Global Market*.

Sweeney, A., & Morrison, M. (2004). Clicks vs. Bricks: Internet-Facilitated Relationships in Financial Services. *International Journal of Internet Marketing and Advertising*, *1*(4), 350–370.

Tahir, S. H., Shah, S., Arif, F., Ahmad, G., Aziz, Q., & Ullah, M. R. (2018). Does Financial Innovation Improve Performance? An Analysis of Process Innovation Used in Pakistan. *Journal of Innovation Economics & Management*, *n 27*(3), 195.

Tufano, P., (2003). Securities Innovations: A Historical and Functional Perspective. *Journal of Applied Corporate Finance, 4*, 90-104

Uchenna, C. & Agbo, J.C. (2013). Impact of Fraud and Fraudulent Practices on the Performance of Banks in Nigeria. *British Journal of Arts and Social Sciences*, *15*(1), 12-28.

Udeh, S. N., & Ugwu, J. I. (2018). Fraud in Nigerian Banking Sector. *International Journal of Academic Research in Business and Social Sciences*, *8*(5).

Vives, X. (2010). Competition and Stability in Banking. *Centre for Economic Policy Research (CEPR)*. CESifo Working Paper Series No. 3050.

Volcker, P.A. (2009). Paul Volcker: Think More Boldly. *Wall Street Journal*, 1-4.

Wagner, J. (2007). Exports and productivity: A Survey of the Evidence from Firm-Level Data. *The World Economy*, *30*(1), 60–82.

Wilson, I. (2007). Regulatory and Institutional Challenges of Corporate Governance in Nigeria Post Consolidation. *Nigerian Economic Summit Group (NESG) Economic Indicators*, *12*(2).

Wooldridge, J. M. (2002). *Econometric Analysis of Cross Section and Panel Data*. Cambridge, Massachusetts, USA: MIT Press.

Wooldridge, J. M. (6th ed.). (2016). Multiple Regression Analysis: Inference. In Nelson Education, *Introductory econometrics: A modern approach* (105-146).

Worku, Y. (2020). *E-banking Fraud Management Strategies: Managers Perspective from the Selected Commercial Banks in Ethiopia*. (Master's Thesis, Addis Ababa University). Addis Ababa, Ethiopia.

World Development Indicators. The World Bank Group, (2021), https://databank.worldbank.org/source/world-development-indicators

Yego, J. K. (2016). *The Impact of Fraud in the Banking Industry: A Case of Standard Chartered Bank* (Doctoral dissertation, United States International University- Africa). Nairobi, Kenya.

Yordanova, Z. (2013). Innovative Business Bank Products. *Trakia Journal of Sciences*, *11*, 322-330.

Zingales, L., Ashraf, N., Guiso, L., Hart, O., Morse, A., Picarelli, D., Rajan, R., Rolnick, G., Sapienza, P., Seru, A., Shleifer, A., Sufi, A., & Tucker, P. (2015). Nber Working Paper Series Does Finance Benefit Society? *Journal of Financial Economics*, *117*(1), 60-76.

APPENDICES

A: Hausman (1978) specification

	Coef.(Obj 1)	Coef. (Obj 2)
Chi-square test value	5.39	5.77
P-value	0.2497	0.3296

Source: Afful (2021)

B: Test for Heteroscedasticity

(Fixed effect)

	Coef. (Obj 1)	Coef. (Obj 2)
Chi-square test value	3644.96	137.75
P-value	0.0000	0.0000

Source: Afful (2021)

(Random effect)

	Coef. (Obj 1)	Coef. (Obj 2)
Chi-square test value	258.79	163.31
P-value	0.0000	0.0000

Source: Afful (2021)

C: Test for autocorrelation

	Coef. (Obj 1)	Coef. (Obj 2)
Chi-square test value	1.988	2.442
P-value	0.1777	0.1377

Source: Afful (2021)

D: Arellano-Bond test

Objective 1

	Coef. (1st order)	Coef. (2nd order)
Chi-square test value	-1.7863	-1.0636
P-value	0.0740	0.2875

Source: Afful (2021)

Objective 2

	Coef. (1st order)	Coef. (2nd order)
Chi-square test value	-1.7248	-1.1533
P-value	0.0846	0.2488

Source: Afful (2021)

E: Sargan test

	Coef. (Obj 1)	Coef. (Obj 2)
Chi-square test value	15.43583	13.59651
P-value	0.6945	0.8067

Source: Afful (2021)