



**ADDIS ABABA UNIVERSITY**

**COLLEGE OF NATURAL AND COMPUTATIONAL SCIENCES**

**SCHOOL OF INFORMATION SCIENCE**

**THE IMPACT OF ICT INVESTMENT ON COMMERCIAL BANKS' PERFORMANCE:  
IN THE ETHIOPIAN BANKING INDUSTRY.**

By

**CHRISTIAN KASSA**

May, 2017

ADDIS ABABA, ETHIOPIA



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A Thesis Submitted to School of Graduate Studies of Addis Ababa University in Partial  
Fulfillment of the Requirements for the Degree of Master of Science in Information Science

By: Christian Kassa

Advisor: TemtimAssefa(PhD)

May, 2017

Addis Ababa, Ethiopia



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### **Declaration**

This thesis has not previously been accepted in substance for any degree and is not being concurrently submitted in candidature for any degree in any university.

This thesis is the result of my own investigations, except where otherwise stated. Other sources are acknowledged by citations giving explicit references. A list of references is appended.

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## Abstract

The market environment of the new century has undergone rapid and accelerating change, creating more and more uncertainty and complexity to the business. Companies compete in this fierce environment to achieve a sustainable competitive advantage, positioning itself strategically with the available resources and capabilities through knowledge and innovation. The use of large investments in information and communication technology (ICT) has been one of the solutions found by organizations to deal with these markets and create a competitive advantage in their business landscape. Yet, arguments rose in whether ICT can create a competitive advantage for business in the theme called “Productivity Paradox”. Organizations are under tremendous pressure to justify the enormous financial resources invested in ICT. The greater the competition as a result of globalization and other market factors, it becomes even more important for organizations to act in the best of their capabilities. The decision process for the acquisition of ICT assets has become less objective and transparent contrary to the statements made by the decision makers, giving rise to the paradox in the objectives achievement and consequently in obtaining benefits. The inability to realize the true value of investments in IT creates lack of alignment between the business and ICT’s strategic value. Consequently, it creates the impression that ICT technologies being seen as a cost center and not as a strategic business partner. The Ethiopian banking industry is no lessevidenced to have increasingly using ICT investments in their day to day operations. This study examined the impact of ICT investment on bank performance in Ethiopia for the period 2011- 2015 using the robust two-step system GMM on a panel data of 15 banks. ROA was taken as a proxy for Bank performance. Annual report and audit financial statement of the 15 banks over the period 2011- 2015 were used. The Result showed that ICT investment has produced a positive return. This finding seems to negate Solow’s “Productivity Paradox”. Though the contribution of ICT investment in ROA seems positive, yet the statistical insignificance and the small coefficient seems to have an insignificant impact on bank profitability. This insignificant impact may be due to the moderate competition that exists among the banks, underutilization of technology, and mismatch between organizational structure and banking technology and duplication of ICT resources in the banking industry.

Keywords: ICT, Bank profitability, Commercial Banks, Investment, System GMM

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## **List of Acronyms**

ICT	Information and Communication Technology
NBE	National Bank of Ethiopia
CBE	Commercial Bank of Ethiopia
ROA	Return on Asset
GDP	Growth Domestic Product
GMM	Generalized Method of Moments

## **1. Background of the Study**

Today's business environment is very dynamic and experiences rapid change as a result of creativity, innovation, technological changes, increased awareness and demands from customers. Business organizations, especially the banking industry operates in a complex and competitive environment characterized by dynamic changing conditions and highly unpredictable economic climate with information and communication technology.

Information and communication technology (ICT) refers to a wide range of computerized technologies that enable communication and the electronic capturing, processing and transmission of information. (Ovia, 2005) These technologies include products and services such as desk top computers, laptops, hand held devices, wired or wireless intranet, business productivity software, data storage and security, network security etc. With the use of ICT, businesses can interact more efficiently and enables businesses to be digitally networked. With the use of ICT, the time constraint and distance barrier to accessing relevant information is eliminated or drastically reduced; hence it improves coordination of activities with in organizational boundaries (Spanos et al., 2001).

The increased demand for information and communication technology (ICT) in banking sector became imminent and unavoidable in the world at large and Ethiopia in particular. Invariably, the future lies in the ICT driven banking systems and services. Banks have embarked on deployment of ICT based banking products and services such as automated teller machine (ATM), internet banking, mobile banking solutions, point of sale terminals, computerized financial accounting and reporting, human resources solution among others (Ovia, 2005).

The use of information technology in the Ethiopian banking sector increased dramatically following the banking license liberalization from government owned to public at the early 1990s. Theyear witnessed the birth of the new generation banks (i.e. Awash Bank, Dashin Bank, Abyssiniya Bank etc.) that commenced operations with the state-of-the-art technology, which exposed the sluggishness and inefficiency of the older state owned banks (i.e. Commercial Bank of Ethiopia, Construction and Business Bank). The ever growing competition of these new banks, then witnessed to compel the old banks to change in the overall banking operation specifically on the use of ICT. (Alemayehu, 2006).

Yet, some studies provides research outputs related to the impact of ICT on banks profitability referring to the Solow Paradox in reaching at the conclusion that IT will actually decrease productivity, Solow (1987). As to evaluate and validate the arguments stated by Solow (1987), "you can see the computer age everywhere thesedays, except in the productivity statistics",different scholars took the subject into research. Shu et al (2005) studied 12 banksoperating in the US for the period of 1989-1997 and found that although ICT has been one ofthe most marginal productive factors among all inputs, it cannot increase banks' profits. Onthe other hand, there are some studies agreeing with the positive influence of IT spendingto business value. Kozak (2005) examines the impact of the progress in ICT on the profitand cost efficiencies of the US banking sector during the period of 1992-2003. The researchshows a positive correlation between the levels of implemented ICT and both profitability andcost savings.

The significant role ICT plays in the financial industry by stimulating economic growth through the intermediation of funds to economic agents that need them for productive activities by alleviating the time and space barriers is indisputable. This role is very vital for any economy that intends to experience meaningful growth because it makes arrangement that bring borrowers and lenders of financial resource together and more efficiently too, than if they had to relate directly with one another. (Adam, 1998)

It would be fascinating to know whether such investment in ICT infrastructure when compared with other factors has led to remarkable improvement in the profitability of banks. Unfortunately, a survey of existing literature worldwide revealed conflicting results. Organizations are under tremendous pressure to justify the enormous financial resources invested in ICT. The greater the competition as a result of globalization and other market factors, it becomes even more important for organizations to act in the best of their capabilities. The decision process for the acquisition of ICT assets has become less objective and transparent contrary to the statements made by the decision makers, giving rise to the paradox in the objectives achievement and consequently in obtaining benefits. The inability to realize the true value of investments in IT creates lack of alignment between the business and ICT's strategic value. Consequently, it creates the impression that ICT technologies being seen as a cost center

and not as a strategic business partner. Thus, the purpose of this research is to see the impact of ICT investment in business performance.

## **1.2. Statement of the problem**

According to Loonamet. al., (2008), ICT advancements, globalization, competition and changing social trends such as heightened customer proactiveness and increased preferences for convenience have caused intense restructuring of the banking industry.

Some evidences from previous empirical studies indicate that ICT has a positive impact on banks' financial performance, owing to multitude of benefits it offers to its users and provides alike. The decision to provide on line services is currently perceived as vital for customer retention and maintaining competitive advantage (DeYoung et al, 2002).

The benefits of application of ICT in the enhancement of banking services is not only limited to cost reduction benefits alone, the innovation also found to have significant contribution in giving access to customers residing outside the branch network and create opportunities for effectiveness (Spanos et al., 2001).

In their research to examine technological progress and its effects in the banking industry, Berger et al. (2003) find that ICT investment leads to improvements in costs. The improvement was hinged on productivity increase in form of improved "back-office" technologies which is in form of organization related benefits such as reduced costs of operation as well as improved "front-office" technologies which is in form of benefits to customers such as improved quality and variety of banking services.

The modernization of ICT has set the stage for extraordinary improvement in banking procedures throughout the world. For instance, the development of worldwide networks has considerably decreased the cost of global funds transfer. Berger et al. (2003) reveals banks that are using ICT related products such as online banking, electronic payments, security investments, information exchanges, can provide high quality customer service delivery to customers with less effort. Companies compete in this fierce environment to achieve a sustainable competitive advantage, positioning itself strategically with the available resources and

capabilities through knowledge and innovation. The use of large investments in information and communication technology (ICT) has been one of the solutions found by organizations to deal with these markets and create a competitive advantage in their business landscape. Yet, arguments rose in whether ICT can create a competitive advantage for business in the theme called “Productivity Paradox”.

In order to investigate the impact of the investment of ICT on bank performance with respect to the paradox stated, this study intended to investigate the following question:

*Does ICT investment impact commercial banks’ performance; in the Ethiopian banking industry?*

### **1.3. Research questions**

The use of large investments in information and communication technology (ICT) has been considered as a tool for organizations to deal with the ever growing markets and to create a competitive advantage in their business landscape. Yet, the justification of the enormous financial resources invested in ICT to create a competitive advantage has become less objective giving rise to the paradox in the objectives achievement. These create lack of alignment between the business and ICT’s strategic value. Consequently, it creates the impression that ICT technologies being seen as a cost center and not as a strategic business partner. The Ethiopian banking industry is no lessevidenced to have increasingly using ICT investments in their day to day operations. Thus, the study is addressed the following questions,

- Is there any relationship between ICT investment and return on asset (ROA)?
- What is the contribution of ICT on banks performance?
- Is there any relationship between bank performance and ICT investment?

### **1.4. Objective**

#### **1.4.1. General Objective**

The general objective of this study isto analyze the impact of ICT investment on bank performance inthe Ethiopian commercial Banks.

### **1.4.2. Specific Objectives**

In order to achieve the general objective of this study, the following specific objectives were addressed:

- To assess the relationship between bank performance and ICT investment.
- To evaluate the relationship between ICT investment and return on asset (ROA).
- To identify the contribution of ICT on banks performance.

### **1.5. Significance of the Study**

This study is devoted to assess the impact of ICT investment on bank performance in Ethiopian Commercial Banks. Hence, the banks under study can make use of this research output to see the existing impact of ICT investment on bank performance in the industry. Beyond that, the finding of the study detailed with the impact of information and communication technology in commercial banks in Ethiopia might also be used for different stakeholders such as banking industry and researchers as follows. For National Bank of Ethiopia, the finding of this study might be used as directive input in developing regulatory standards regarding the ICT policies of commercial banks of Ethiopia. In addition, this study could initiate the commercial bank's management to give due emphasis on the management of these identified variables and provides them with understanding of activities that will enhance ICT usage performance. Furthermore, the findings of this study could initiate researchers for further studies. Lastly, this study could serve as reference for other researchers in related area. Thus, it can minimize the literature gap in the area of study particularly in Ethiopia.

### **1.6. Scope of the Study**

Specifically, the study intends to investigate the impact of ICT investment on selected commercial banks performance i.e. all commercial banks in Ethiopia which started their business before 2011. The study covered only the period from 2011 to 2015.

The study of this nature is normally assumed to face with lack of accessibility to reliable data because most of the data are classified and considered to be confidential in nature. However, this limitation is overcome by relying on secondary data of the annual financial report of all banks

under study which is capable of furnishing the required information. The data obtained is meant to serve the purpose of the analysis. Data obtained from published reports are expected to serve as the basis for this analysis.

The study is addressed all commercial banks in Ethiopia which were started their business before 2011.

### **1.7. Limitation Of the study**

In order to investigate the relation between bank performance and ICT investment, the study has used bank specific and macroeconomic variables as an instrument. The Ethiopian banking industry has relatively smaller number of banks and the study used a limited time period. Furthermore, the variance of banks heterogeneity in this study is expected to be higher. This could lead to a weak instrument problem for the methodology used.

The other limitation is related to data obtained from the banks. ICT investment recorded is not uniform across the banks. Most banks do not maintain a separate account for hardware, software and services. This condition could prevent this study from studying the impact of each component in a detail manner. Classifying the ICT data by its components could have helped to have a deeper understating of the impact of the technology.

In addition to the above limitation, the study took bank ROA as a proxy for bank performance. There are also other variables which can be defined banks performance from different perspectives. Thus, interpretation under this study is made on the perspective of ROA as a proxy for bank performance.

### **1.8. Organization of the Thesis**

This thesis has the following chapters. It consist five chapters. Chapter one is provide important introductory issues, which include background of the study, statement of the problem, objectives of the study, and significance of the study.

Chapter two is dealt with literature review on the areas of information and communication technology (ICT), productivity paradox, commercial banks, the Ethiopian banking industry and investment on ICT in the financial industry. It is also present works done related to ICT investment and bank performance in business setup.

Chapter three presents the research methodology.

Chapter four discusses with data presentation, analysis and discussion based on information obtained from secondary data from audited financial statements of the selected banks.

The thesis is then concluded by Chapter five, which summarizes the main findings, draws conclusions and suggests recommendations regarding shortcomings and other issues that need remedies.

## **2. Review of Related Literature**

### **2.1. ICT Theoretical Background**

Commercial banks play an important role in the economic development of any nation. The need for efficiency and effectiveness in the performances of the banks as leading players in the financial services cannot be overemphasized. Recent advances in the technological world which gives birth to the emergence of information and communication technology, have led to remarkable changes in the ways businesses are running in contemporary times.

According to Haq (2005) banks' existence depend on their ability to achieve economies of scale in minimizing asymmetry of information between savers and borrowers. Today, one of the major challenges facing the banking industry is how ICT has helped banks to sustain the economies of scale whilst shifting from bricks and mortar banking to online banking.

As stated by DeYung et al. (2005), the ICT delivery channel may generate scale economies in excess of those available to traditional distribution channels. In this context, DeYoung et al. (2005) refer to the internet banking as a "process of innovation that functions mainly as a substitute for physical branches for delivering banking services".

According to Hernando et al., (2007), the adoption of ICT as a delivery channel involves a gradual reduction in overhead expenses. This effect is statistically significant after one and half year of adoption. The cost reduction translates in to an improvement in banks profitability, which becomes significant in terms of return on assets (ROA) and after three years in terms of return on equity (ROE).

Thus, the trend in the interdependent of banking and ICT becomes complex as the passage of time and provides a multifaceted benefit to business process.

### **2.2. Definition of ICT**

Information and Communication Technology is a combination of information and technology. It merges computing with high speed communication link carrying data, sound and video. It deals with the collection, storage, manipulation and transfer of information using electronic means.

Communication technology refers to the physical devices and software that link various computer hardware components and transfer data from one physical location to another (Laudon, et.al 2001).

The convergence of computer and telecommunication after about four decades of applying computers to routine data processing, mainly in information storage and retrieval, has created a new development where information has become the engine of growth around the world. This development has created catch up opportunities for developing countries to attain desired levels of development without necessarily reinventing the wheels of economic growth. This new technology has brought far reaching revolution in societies, which has tremendously transformed most business scenes (Ovia, 2005).

### **2.3. Role of ICT in the Banking Industry**

Information and Communication Technology (ICT) is the automation of processes, controls, and information production using computers, telecommunications, software's and other gadget that ensure smooth and efficient running of activities. It is a term that largely covers the coupling of electronic technology for the information needs of a business at all levels. ICT has surpassed the role of support services or only electronic data processing; its fields of applications are global and unlimited. Its devices especially the Internet and modern computer email facilities have further strengthened early modernizations like the telephone and fax. Other ICT devices include data recognition equipment, factory automation hardware and services, telecommuting and teleconferences using real time and online system (Adeoti, 2005).

It is a concept that is having a remarkable effect on almost entire aspects of the human endeavors. This implies that it involves the application of principles to engage physical component in achieving an intended goal.

The application of information and communication technology concepts, techniques, policies and implementation strategies to banking services has become a subject of fundamental importance and concerns to all banks and indeed a prerequisite for local and global competitiveness. ICT directly affects how business goes on, how and what products and services are offered in the banking industry. It has continued to change the way banks and their corporate relationships are

organized worldwide and the variety of innovative devices available to enhance the speed and quality of service delivery.

Apparently, ICT creates unprecedented opportunities for the bank sector in the ways they organize financial product development, delivery, and marketing via the internet. While it offers new opportunities to bank sector, it also brings many challenges such as the innovation of ICT applications, the blurring of market boundaries, the breaching of industrial barriers, the entrance of new competitors and appearance of new business models (Cheung et al., 2003).

The revolution in ICT has made the banking sector changed from the traditional mode of operations to presumably better ways with technological innovation that improves efficiency. ICT can enhance efficiency via its use and in recent times banks have been encouraged by the rapid decline in the price of ICT gadgets. This has perhaps increased the bank level of ICT usage (Ovia, 2005).

Electronic banking is a high order construct, which consists of several distribution channels. It should be noted that electronic banking is a bigger platform than just banking via internet. However, the most general type of electronic banking is banking via internet, in other words internet banking. The term electronic banking can be described in many ways. In very simple form, it can mean the provision of information or services by a bank to its customers, via a computer, television, telephone or mobile phone. It can be described as an electronic connection between bank and customer in order to prepare, manage and control financial transactions. Internet banking allows consumers to access their bank and accounts to undertake banking transactions (Daniel, 1999).

Furthermore, electronic banking is said to have three different means of delivery: telephone, personal computer and the internet. Daniel (1999), for example, introduces four different channels for electronic banking: personal computer banking, internet banking, managed network and TV based banking.

According to Daniel (1999) electronic banking is relatively the newest delivery channel in many countries and there is a wide agreement that the new channel will have a significant impact on

the market. It offers the traditional players in the financial services sector the opportunity to add a low cost distribution channel to their numerous different services.

**Table 1. Delivery platform available for electronic banking**

Types of Service	Description
PC Banking	Proprietary software, distributed by the bank, is installed by the customer on their PC. Access to bank via a modem linked directly to the bank.
Internet Banking	Access their bank via internet.
Managed network	The bank makes use of an online service provided by another party.
TV based	The use of satellite or cable to deliver account information to the TV screens of customers (also internet based).
Telephone banking	Customers access their bank via telephone (own personal ID and password required).
Mobile Phone banking (SMS, WAP, 3 <sup>rd</sup> generation)	Access with text message (SMS), internet connection or high speed 3rd generation mobile connection also internet based.

Source: Daniel, (1999)

More and more banks adopted technology to deliver their services and this has resulted in reduced costs, the creation of value added services for customers, the facilitation of their

employees' jobs, and ultimately, the provision of self-service options for customers (Thu et al., 2002).

## **2.4. ICT Investment**

The information and communication technology infrastructure of an organization comprises of its physical ICT asset stock. The business functionality of an organization depends on the reach and range of the stock of this resource. It is a major business resource and a key source for attaining long term competitive position. (McKenney, 1995)

According to et.al, (2010) Information and Communication Technology has become the heart of banking industry, while banking industry is the heart of the economy. ICT has created a new infrastructure for the world economy to become truly global and also provided the users of new technology a competitive advantage over their rivals. Electronic banking system has become the main technology driven revolution in conducting financial transactions. However, banks have made huge investments in telecommunication and electronic systems, users have also validated to accept electronic banking system as useful and easy to use (Adesina et al , 2010).

Castells (2001) reveals that, now transactions worth billions of dollars can only take place in seconds in the electronic circuit throughout the globe by pressing a single button. Although ICT has revolutionized the way of living as well as businesses, there are various studies which have received a great deal of attention over its productivity over the last decade. And it continues to pose challenges for business practitioners and academic scholars.

Imran et. al., (2012) investigated the role of ICT on the efficiency of the bank and also explored the relationship between the investment in ICT and bank efficiency measures. The result showed that investment in information systems is contributing new products and services. These are the major benefits of investment in ICT which are propelling many banks to invest in ICT.

Considering the dynamism in the drivers of the economies across the globe, it is notable that the world has moved currently to a knowledge based economy of which the ICT has become one of the principal driving forces. The effects of ICT are seen in the improvements in productivity and economic growth at the level of the firm and the economy overall (Stiroh, 2002).

Interestingly, ICT in particular play an important role in the financial industry and this is one reason why the banking sector is among the most intensive industries deploying ICT. With the increase of internet services and cash machines available in various locations, the most recurring problems have been mitigated and in some cases, solved; as an effect, the volume of customers' services increased, became easier, and the customer experience turned out to be more comfortable. It is noticeable that the new technologies, particularly ICT, enabled banks to serve customer not only in branches and other dedicated servicing cites, but also in domiciles, work places and stop and shop stores, as well as in a myriad of other channels (Al-Hawari et. al.,2005).

However, to successfully cope with the challenge of the ICT, the banking sector must understand the nature of the changes that revolves around them, changes in terms of ICT, innovation and demography. Without this understanding, attempts to mitigate to ICT may be doomed to failure. Today, banks that are well equipped with a good grasp of the electronic banking phenomenon will be able more to make informed decision on how to transform ICT and to exploit the opportunity in electronic banking. In today's competitive market, establishing core capabilities can help the banking industry reorganize their product and customer service delivery, so as to sustain competitive advantages and to achieve congruence whilst shifting from the conventional banking to electronic banking (Stiroh, 2002).

ICT revolution has distorted the conventional banking business model by making it possible for banks to break their comfort zones and value creation chain so as to allow customer service delivery to be separated in to different businesses. Thus, for example, primarily internet banks distribute insurance and securities as well as banking products produced by their group (Delgado et.al, 2004).

However, the main economic argument for diffusion of adopting the internet as a delivery channel is based on the expected reduction in overhead expenses made possible by reducing and ultimately eliminating physical branches and their associated costs. The internet delivery channel may generate scale economies in excess of those available to traditional distribution channels (Delgado et al, 2004).

## 2.5. IT productivity paradox

On July 12, 1987 Robert Solow wrote a book review on the New York Times. His review entitled “we’d better watch out” was a review of “Manufacturing Matters: The Myth of the Post-Industrial Economy” written by Cohen and Zysman. In one of the paragraphs Solow has forwarded his view by noting that technology revolution in the US is accompanied in every part of the world but its effect was disappointing i.e. rather than steeping up the productivity growth it slowed it down. His observation is summarized in the following often quoted aphorism: “you can see the computer age everywhere but in the productivity statistics” (Solow, 1987)

According to Dreyfuss et al (2004), this observation is supported with studies conducted from 1970s to the early 1990s. They indicate that before the widespread of IT investment the expected return on investment as measured by productivity was 3-4 percent. But with the widespread of IT during the 1970s to the early 1990s it becomes only 1%.

Macdonald et al (2000) explained that the discussion on the productivity paradox took place largely in the US, especially in Massachusetts. Solow’s often quoted statement has contributed to the public discussion on the relation between IT investment and IT performance.

Various authors have presented different explanation for the existence of the paradox. Brynjolfsson (1993) has provided four explanations for the paradox. His first explanation is related to the measurement of the output and input. The second explanation is related to lag which are due to learning and adjustment. But he argued that this explanation shows the drawbacks in studies as the cause of the paradox. He further argued that the IT investment benefits are large but there are no proper measures of its true impact. With regard to the long term benefits of IT investment he explained that if there is extensive learning by both individuals and firms the payoff would be higher. However, in the short term, the benefits are not as expected. The third explanation is related to redistribution and dissipation profit. This argument suggests that individuals or organizations who invest privately are the beneficiary from the investment in technology at the expense of others. Therefore, at the aggregate level there is no net gain. The fourth explanation is related to mismanagement of IT. He explained that some firms invest in IT when they should not have. Some firms or industries also use it in an unproductive way.

In another study, Triplett(1999) has summarized and presented some most common positions on the existence of the productivity paradox; first he explained that IT equipment's share in the GDP capital stakes is relatively small. In his word "an input with a very small share cannot make a large contribution to economic growth". He explained that since IT takes small share of capital stock, its contribution is not expected to be large. Second, information technology is intensively used in sectors where output is poorly measured. Hence, measuring productivity becomes difficult. Third, some of the services from IT are not included in the statistics of economic activities. Even though IT helps increase the output of a company there may not a proper way to record it. The fourth reason for the paradox is that like other technologies, for example, the diffusion of electricity, the impact of IT may not visible in the short run. However, in the long run, the return could be unfolded. Finally, he argued that the gain from IT may not be as much as we think because in the IT industry there is a constant upgrading of hardware and software which adds a cost on consumers. In addition to this the gain from IT is reflected on individuals or firms but the gain at the general economy in insignificant.

Bruqueet. al(2002) have also identified five perspective to understand the technology paradox. They argued that an organization can gain a competitive advantage from technology only after some time lag. Their first argument implied that we see insignificant contribution of IT at the initial stage. Their second line of argument focuses on strategic necessity of IT. According to their statement companies invest in IT not to obtain a positive return form IT but it is because of the fear that they might be forced out of the business. In the end all firms in the sector get in to competition and the result from the technology might not be as expected. The other explanation provided by the authors for the paradox is related to transactions. They explained that the paradox could show itself if the investment on IT fails to bring a reduction in transaction cost. They further argued that if the investment on IT is not accompanied by a transformation of complementary resource, the benefit from IT may not be realized. Finally, they said that the paradox could result if investment in IT is not supported by a value generating business model. For example, if an investment in IT does not result in efficiency of search cost, simplicity, velocity and economies of scale, we may observe the paradox.

## 2.6. ICT in Ethiopian Banking Industry

The history of the Ethiopian banking industry, in its modern sense, began towards the end of the reign Emperor Menilek. This period witnessed the establishment of the country's first bank, called Bank of Abyssinia, which was an affiliate of the National bank of Egypt, and was founded in 1905 (National Bank of Ethiopia Annual Report, 2014/15).

Currently, banking sectors in Ethiopia is showing progressive development in terms of number of branches, total assets and human resource utilization. Thus, as of June 30, 2014/15 number of banks in Ethiopia reached eighteen as shown in the following table.

**Table 2. Number of Banks and their Branches in Ethiopia as of June 30, 2014/15.**

No.	Name of Bank	Number of Branches	% Share per branches	Market per branches	Year of Establishment
1.	Commercial Bank of Ethiopia	1145	33		1963
2.	Awash International Bank	252	7.2		1994
3.	Dashen Bank	193	5.5		1995
4.	Abyssinia Bank	182	5.2		1996
5.	Wegagen Bank	184	5.3		1997
6.	United Bank	198	5.7		1998
7.	Nib International Bank	191	5.5		1999

8.	Cooperative Bank of Oromia	152	4.3	2004
9.	Lion International Bank	168	4.8	2006
10.	Oromia International Bank	151	4.3	2008
11.	Zemen Bank	16	0.4	2008
12.	Bunna International Bank	149	4.2	2009
13.	Berhan International Bank	139	4	2009
14.	Abay Bank	134	3.8	2010
15.	Addis International Bank	84	2.4	2011
16.	Debub Global Bank	78	2.2	2012
17.	Enat bank	52	1.4	2013

Source: National Bank of Ethiopia Annual Report, 2014/15

According to Gardachew (2010) cited in Ayana (2014), the appearance of e-banking in Ethiopia goes back to the late 2001, when the largest state owned, Commercial Bank of Ethiopia (CBE) introduced ATM to deliver service to the local users. In addition to ATMs located Addis Ababa and other province, CBE has had visa membership since November 14, 2005. But, due to lack of appropriate infrastructure it failed to reap the fruit of its membership. Despite being the pioneer

in introducing ATM based payment system and acquired visa membership, CBE lagged behind Dashen bank, which worked aggressively to maintain its lead in e-banking.

## **2.7. Review of empirical literatures**

Many researchers have studied the relationship between ICT investment and firm performance. Bitler (2001) investigated the relationship between information and communication technology and firms' performance. His study revealed that there is a significant performance difference between firms that adopt ICT and those that do not adopt the technology.

Banking industry in the USA analyzed by Berger et al., (2003) on technological progress and its effects in the banking industry using data collected from the banking industry over the period 1967 to 2001. The author employed multiple regression model, and the findings revealed that improvements in costs of lending capacity due to improvements in back office technologies, as well as consumer benefits from improved front office technologies suggests investment on ICT provides a significant overall productivity increase in terms of improved quality and variety of banking services.

Another study was conducted by Eyadat et al., (2005) to evaluate the effects of ICT on gains efficiency and banks cost in American banks between 1992 and 2000. The study showed a positive relationship between level of ICT implementation and profitability of the bank's assets and costs reduction. However, efficiency has increased for all American banks but the cost efficiency was less than the benefit. This point reflects the fact that introduction of new banking services lead to increase revenues yet incurs new and higher expenses.

Others also examined the Indian banks on the implications of internet banking on the banking industry using information drawn from a survey of 85 scheduled commercial banks' websites, during the period June 2007, by applying multiple linear regression models (Malhotra et.al 2009). Results revealed however, that profitability in the banking industry while offering internet banking does not have any significant association with their overall performance.

Other empirical study conducted by Dos Santos et. al., (1993) on the effects of early adoption of Automated Teller Machine (ATM) technology by banks on employee efficiency using a sample

of 3,838 banks covering the period 1970 to 1979 by applying multiple regression models. The finding revealed that investment on ATM technology improves the bank's performance.

The Jordanian banking industry was also examined by Akramet. al. (2010) to rectify the investment of information and communication technology (ICT) on banking industry for the period 2003 – 2007. The authors used a sample of 15 banks to analyze the data obtained by applying multiple regression model to check the normality and multicollinearity problems. The results of the study indicated that there is a significant impact on the use of ICT in Jordanian banks on the market value added (MVA) earnings per share (EPS), Return on Assets (ROA) and Net Profit Margin (NPM).

Kagan, et al., (2005) examined the impact of online banking applications on community bank performance in the United States using data collected from 1183 banks operating in Iowa, Minnesota, Montana, North Dakota and South Dakota. The authors employed an econometric model (Structural Equation Model) for the data analysis. The findings of the study revealed that online banking helps community banks improve their earning ability.

Studies on the effects of ATMs on profitability provide evidence of cost savings and better services for customers. Survey of banks conducted by Katagiri (1989) in Japan and Shawkey(1995) in the USA revealed that investing in ATMs reduces banking transaction costs, the number of staff and the number of branches. Therefore, investing in ATMs increases the value of deposit accounts, which are cheaper in terms of costs of funds than other sources, such as borrowing money from other institutions, hence reducing the overall cost of funds. This suggests that there is a role for IT investment in the explanation of bank profitability.

Kozak (2005) analyzing the values of return on asset (ROA) over the period of 1992 - 2003 found out that the value of return on assets for the U.S, the banking sector has increased by 51 percent. This result suggests that IT investment, associated with extensive office networks and ranges of offered services have helped to generate additional revenues for banks. For the same period much smaller reduction of the non-interest costs has been achieved. It means the value of cost efficiency fell by 13 percent. This means that a huge number of diverse operations require higher IT investments and additional non-interest charges. In order to assess relationships

between the degree of the IT progress, and the profitability (ROA) and cost efficiency, the regression analysis was used to achieve more precise statistical results.

The banking industry in Nigeria has witnessed tremendous changes linked with the developments in ICT over the years.

Brucher et al., (2003) pointed out that ICT adoption improves three critical domains which are efficiency, quality, and transparency in any organization. Agboola et al., (2002) discussed the dimensions in which automation in the banking industry manifest in Nigeria. They include: Bankers Automated Clearing Services: Automated Payment Systems, Automated Delivery Channels.

According to Ovia (2005) banking in Nigeria has increasingly depended on the deployment of Information Technology and that the IT budget for banking is by far larger than that of any other industry in Nigeria. He contended that On-line system has facilitated Internet banking in Nigeria as evidenced in some of them launching websites. He found also that banks now offer customers the flexibility of operating an account in any branch irrespective of which branch the account is domiciled. Woherem (2000) revealed that Nigeria banks since 1980s have performed better in their investment profile and use of ICT systems than the rest of industrial sector of the economy. Ovia (2005) discussed the revolution in ICT has made the banking sector changed from the traditional mode of operations to presumably better ways with technological innovation that improves efficiency. ICT can enhance efficiency via its use and in recent times banks have been encouraged by the rapid decline in the price of ICT gadgets. This has perhaps increased the bank level of ICT usage. The increase might have also been attributable to business environment that became relatively flexible to accommodate new forms of technological change as a result of reforms in the country.

According to Wali (2010) the relationship between ICT and the various organizational activities is similar to government & civil servants while Governments outlines policies and civil servants execute those policies. ICT acts as a tool for the actualization of various organizational activities in order to implement and enforce policies.

Osabuohien, (2008) established that while the gender of the bank officials does not affect efficiency in ICT use, factors such as age, educational qualification, computer literacy and type of ICT gadgets, were significant in influencing banks' intensity of ICT usage. Also ICT was found to impact positively the speed of banking service delivery, productivity and profitability. Banks should incorporate ICT into their strategic plans for effective performance in payment and delivery systems. This calls for proper analysis to determine the type, nature and extent of ICT products required for effectiveness and efficiency. It is imperative for bank management to intensify investment in ICT product to facilitate speed, convenience and accurate service. Orhan (1997) observed the relevance of a modern information infrastructure to the economic and social well-being of a society as the quality of the information determines the effectiveness of any given choice. Wisdom, knowledge and information infrastructures promote dialogue between those holding various ideas.

Some related studies are conducted by different researchers in different parts of the world. However, there are limited numbers of studies conducted in Ethiopia related to ICT and banking business.

Gardachew (2010) conducted research on the opportunities and challenges of E-banking in Ethiopia. The aim of his study was focused on analyzing the status of electronic banking in Ethiopia and investigates the main challenges and opportunities of implementing E-banking system. The author conducted a survey on the existing operating style of banks and identifies some challenges of using E-banking system, such as, lack of suitable legal and regulatory frame works for E-commerce and E- payments, political instability in neighboring countries, high rates of illiteracy and absence of financial networks that links different banks.

Wondwossen et al (2005) also studied on the challenges and opportunities of E-payments in Ethiopia; their objective was studying of E-payment practices in developing countries, taking Ethiopia as a reference. The authors employ interview and on site observation to investigate challenges to E-payment in Ethiopia and found that, the main obstacles to the development of E-payments are, lack of customers' trust in the initiatives, Unavailability of payment laws and regulations particularly for E-payment, lack of skilled manpower and frequent power disruption.

According to Wondwossen et al (2005), an adequate legal structure and security framework could foster the use of E-payments.

## **2.8. Summary**

In summary, the majority of the literature review regarding the impact of ICT investment on commercial banks performance is pointing to the fact that ICT has impact on performance of commercial banks.

To the knowledge of the researcher there is no empirical studies done regarding the impact of ICT investment on commercial banks in Ethiopia. Since ICT in banking industry in Ethiopia is at its infant stage there is no ample empirical data on the relationship between ICT spending and commercial banks performance in Ethiopia.

In general, this study is different from previous works done by others; specifically, it examines the impact of ICT spending on the commercial banks performance using a panel data in commercial banks in Ethiopia and then assesses the quantitative data for these determinants based on the context of Ethiopia.

### **3. Methodology**

#### **3.1. Research Design**

This study was aimed to examine the impact of ICT in the commercial banks operate in Ethiopia. As noted by Kothari (2004), explanatory research design examines the cause and effect relationships between dependent and independent variables. Therefore, since this study examined the cause and effect relationships between ICT performances of commercial banks, it is explanatory research.

According to Creswell (2003), the objective to be achieved by the research is a base for determining the research approach. If the problem identified is factors affecting the outcome having numeric values, it is quantitative research. Therefore, the researcher employed quantitative research approach. The study investigate the regression result analysis with respective empirical literatures on the impact of ICT investment on commercial banks performance.

Thus, the researcher used data from 2011 to 2015 period for selected commercial banks in Ethiopia.

#### **3.2. Target Population**

In Ethiopia currently there are 18 banks from which seventeen are commercial banks and one is developmental bank. Target population of the study was all banks that engage in commercial activities and registered by National Bank of Ethiopia. Consequently, 15 banks of the available 17 commercial banks as of 2015 were selected based on data availability from 2011 to 2015. The study covers a period of five years from 2011-2015.

#### **3.3. Sample size and sampling Design**

Sampling is a technique of selecting a suitable sample for the purpose of determining parameters of the whole population. Population is the list of elements from which the sample may be drawn (John, 2007). A sample is drawn to overcome the constraints of covering the entire population with the intent of generalizing the findings to the entire population.

As noted by Kothari (2004), good sample design must be viable in the context of time and funds available for the research study.

Yet, for this particular research all population have been assumed for the study. Currently in Ethiopia, there are 17 commercial banks and one developmental bank registered to work in the industry. From the seventeen banks, 2 banks are established after 2011 i.e. Debu Bank and Enat Bank (Birritu, 2015). For the purpose of this study, only banks established before 2011 i.e. 15 commercial banks were selected. All the available annual financial report data have been for the purpose of drawing inferences with respect to the entire population of the 17 commercial banks in Ethiopia.

Accordingly, the study deployed a purposive sampling technique to select the required sample banks from the commercial banks in Ethiopia.

### **3.4. Sources of Data**

This research used secondary source of data to analyze the impact of information and communication technology on commercial banks performance. Hence, it used a Panel data. A panel data contain measurements on the same firms over several periods. The required secondary data were collected from various published documents maintained by the commercial banks, and annual reports of the commercial banks.

The research was based on panel data of 15 commercial banks in Ethiopia. Annual report and audited financial statements of the 15 banks from the 2011 to 2015 were used. Furthermore, data on macroeconomic indicators obtained from the National Bank of Ethiopia's annual report. Since commercial banks in Ethiopia do not have a special account on total ICT expenditure we have aggregated all recorded expenditures which are related to ICT computer hard ware (computers, storage device, printers and other peripherals); computer software (operating systems, programming tools, utilities applications, and internal software development); computer service (information technology consulting, computer and network system integration, web hosting, data processing service, and other services); communication services (voice and data communication services) and wired and wireless communication equipment. It is the total monetary value at the end of year  $t$  based on the common definition of technology. (Ovia, 2005)

### 3.5. Conceptual Framework

Investment in information and communications technology affects bank's profitability through various ways. The review of relevant literature in the above has shown that in production analysis, IT has the capacity to improve the productivity of a company's productive forces via labour and capital inputs. By either using new or improved technology workers' productivity as the production process is enhanced in the average and marginal productivity of labor inputs increase with each IT inputs.

For this research Flaminiet. al's (2009) model for the panel data were adopted as shown below;

$$ROA_{it} = \gamma + \alpha ROA_{it-1} + \beta_1 ictinv_{it} + \beta_2 capit_{it} + \beta_3 amix_{it} + \beta_4 size_{it} + \beta_5 rgdpgr_t + \beta_6 inf_t + \eta_{it} + \nu_{it}$$

Where; ROA, ictinv, cap, amix and size are the return on asset, annual investment on ICT, capital, activity mix, and size of individual banks at the end of year t respectively.

$\gamma$  is a constant term.

$ROA_{it-1}$  is the one period lagged profitability.

$\alpha$  is a measure of the speed of mean reversion (the tendency of profit to converge (revert) slowly to its equilibrium or long run level, i.e. the mean, after a shock).

rgdpgr is annual real GDP growth rate of Ethiopia.

Inf is the annual inflation rate of Ethiopia.

$\eta_{it}$  is the unobserved bank specific effect (unique for each bank). It is the permanent effect associated with individual unit and can be thought of as capturing unobserved individual heterogeneity. It captures the impact of time-variant individual characteristics such as management style of individual bank that affect profitability.

$\nu_{it}$  is the time variant individual error term.

$\beta_s$  are parameters to be estimated

According to Hernando et al., (2007), the adoption of ICT as a delivery channel involves a gradual reduction in overhead expenses. This effect is statistically significant after one and half year of adoption. From his analysis the cost reduction translates in to an improvement in banks profitability, which becomes significant in terms of return on assets (ROA) and after three years in terms of return on equity (ROE).

This in turn implies that the trend in the interdependent of banking and ICT becomes complex as the passage of time and provides a multifaceted benefit to business process.

The impact of the progress in IT on the profit and cost efficiencies of the US banking sector during the period of 1992-2003, as it was examined by Kozak (2005), shows a positive correlation between the levels of implemented IT and both profitability and cost savings.

Most evidences from previous empirical studies indicate that ICT has a positive impact on banks' financial performance, owing to multitude of benefits it offers to its users and provides alike. The decision to provide on line services is currently perceived as vital for customer retention and maintaining competitive advantage (DeYoung et al, 2002).

The benefits of application of ICT in the enhancement of banking services is not only limited to cost reduction benefits alone, the innovation also found to have significant contribution in giving access to customers residing outside the branch network and create opportunities for effectiveness (Spanos et al., 2001).

Porter (1985) also explains that competitive advantage grows fundamentally out of the value a firm is able to create for its buyers that exceeds the firm's cost of creating it. In this sense, value is what buyers are willing to pay, and superior value stems from offering lower prices than competitive price for equivalent benefits or providing unique benefits/different service or product relative to the competition that more than offset a higher price. The provision of unique benefits/different service or product relative to the competition is called differentiation. To achieve sustainable profit, therefore, a firm needs sustainable advantage, in either cost or differentiation (Porter, 1985). Thus, there are two basic types of competitive advantage: cost leadership and differentiation. These two basic types of source of competitive advantage combined with the scope of the firm's activity lead to three known generic strategies – cost

leadership, differentiation strategy and focus strategy for achieving above average performance in an industry.

As it is discussed in the above, ICT has the potential to increase bank performance either by reducing the input cost which requires through the process of service/product creation or by increasing the utility value of the output of the service/product at the end.

Kabiru (2015) shows three processes through which IT influences banks profitability in his study in the following schema.

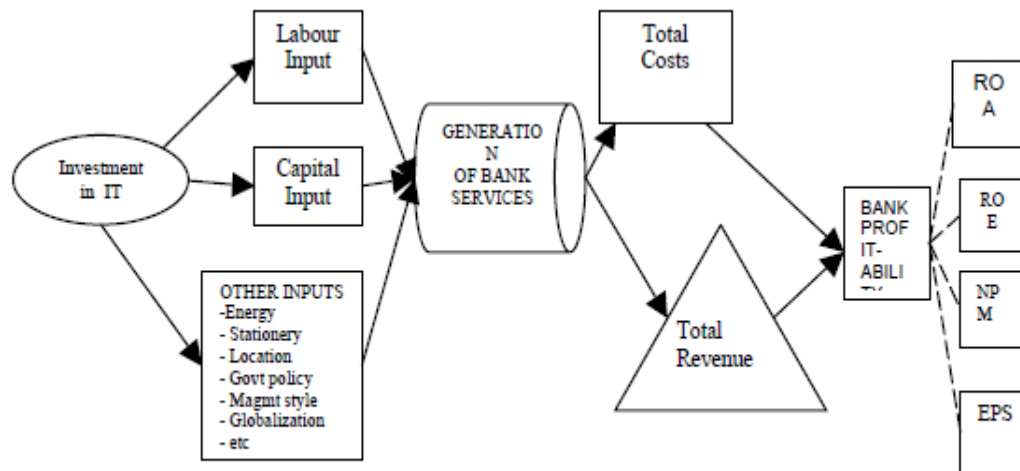


Figure 1: A schematic depiction of the relationship between IT and Bank Profitability

Source: Kabiru (2015).

Based on the above schematic depiction of the relationship between IT and Bank profitability, the following logical description has been extracted as to show the relationship between ICT investment and bank performance.

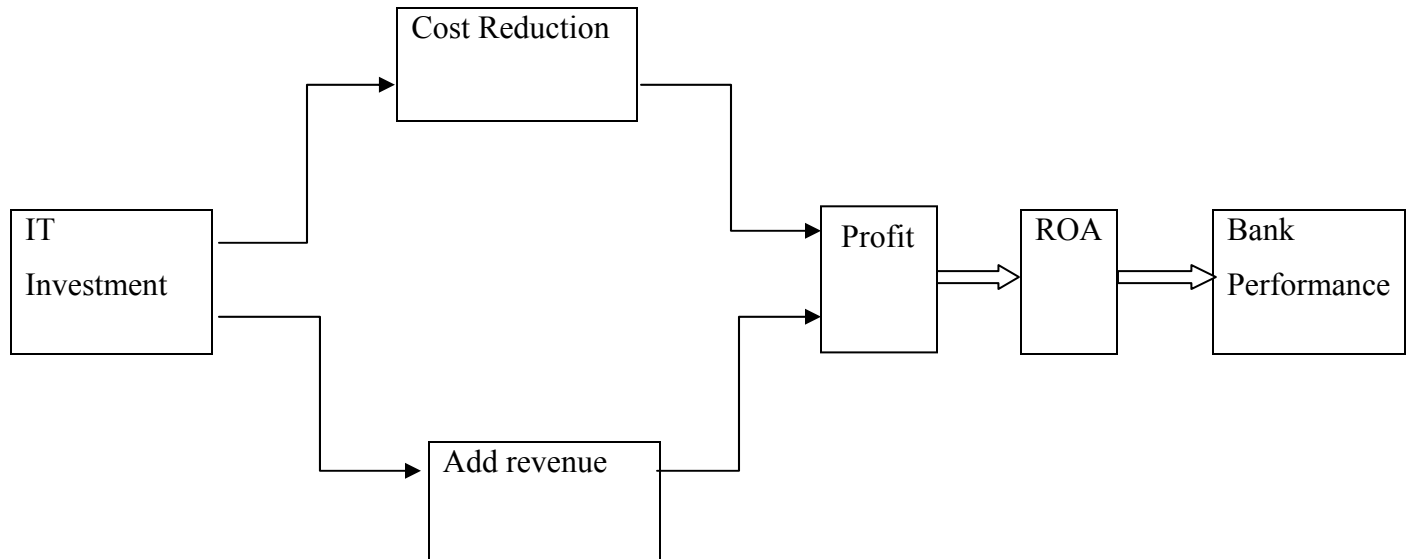


Figure 2.Relation between IT investment and bank performance

Source; Adopted and modified from Kabiru (2015).

Thus, from the theoretical and empirical evidence discussed in the literature part this study was assumed that ICT investment to have a positive relationship with the banks performance.

In order to investigate the relationship between ICT expenditure and bank profitability the two step Windmeijer corrected system GMM was used. According to Roodman (2006), the system GMM is used to improve efficiency of estimators as well as to avoid finite sample biases that result from weak instrument. Roodman (2006) stated that system GMM is used in situations where we have few time period and large number of samples, distributed fixed individual effects, endogenous regressors, and heteroskedasticity and serial correlation of individual disturbances. He also added that the two step GMM estimator is efficient and robust to whatever patterns of heteroskedasticity.

Arellano and Bond (1991) have also explained that the two step GMM results in an apparent gain of precision. However, they also warned that this precision may reflect a down ward finite sample bias. Blundell and Bond (1998) have shown that in the two steps GMM estimation estimated asymptotic standard error of the efficient two step GMM estimator can be severely downward biased in small samples. Windmeijer(2005) argued that this phenomenon could lead

to a very poor performance of estimation. Therefore, he advised a mechanism to correct this problem. He showed that in the Monte Carlo study of a panel data the correct variance leads to more accurate inference.

In this study, the two step Windmeijer corrected system GMM is selected because of the following reasons.

1. Various literatures show that profit is persistent. Hence, profitability of the banks may be dynamic i.e. current profit of bank may depend on past profits.
2. Banks may have arbitrary distributed fixed individual effects.
3. We suspect the covariates like capital may be endogenous.
4. Bank specific time varying errors may have heteroskedasticity and serial correlation
5. In our study, the time period is very small compared to the number of banks we have.

Despite the above benefits and convenience the methodology has its own limitations. The system GMM can generate too many instruments. Mehrhoff (2009) has pointed out that the number of instruments in dynamic panel data models grows quadratically in time leading to inconsistency of the GMM estimates. Roodman (2006) has also expressed his concern about the proliferation of instrument in the GMM. He indicates that in finite sample, like in our case, the instrument may lack enough information to estimate the large matrix well. This could affect the efficiency of our estimates. Second, as our estimate count rises, the bias of the estimate would also raise leading to over fitting of our endogenous variables.

- **Hypothesis**

Based on various literatures, all the independent variables i.e. ICT investment, capital, bank size, activity mix, real GDP growth and inflation have a positive influence on banks performance.

- **Description of variables and measurement**

- ✓ **Dependent variables**

**Return on asset(ROA)**– it was assumed to be the measure of bank performance. It measures how effectively a bank has utilized its existing assets to earn profit. It is measured as the ratio of after tax profit and total asset size at the end of year t.

## ✓ Independent variables

**Information communication technology(ICT) investment:** it is the total expenditure made on computer hard ware (computers, storage device, printers and other peripherals); computer software(operating systems, programming tools, utilities applications, and internal software development); computer service(information technology consulting, computer and network system integration, web hosting, data processing service, and other services); communication services(voice and data communication services) and wired and wireless communication equipment. It is the total monetary value at the end of year t.(Ovia, 2005). Here we are not included depreciation costs of ICT goods.

### **Capital**

It is the sum of share capital, legal reserve, general reserve and retained earnings of individual bank per its asset size. Following various literatures, we have treated capital as endogenous variable (see Athanasologluo et.al(2005).

### **Activity mix**

It is the proxy of the overall risk undertaken by the banks. It is the ratio of net interest income of individual banks to total income.

### **Size**

It is the value of the total asset of individual banks at the end of year t measured in birr.

### **Real GDP growth**

It is the annual growth rate of gross national product adjusted for inflation.

### **Inflation**

It is the annual consumer price index.

For this particular research panel-data set was analyzed using the STATA econometric software version 13.

For the purpose of data analysis each bank under the study has been coded as follows.

Table 3: Banks and their ID number

<b>No.</b>	<b>Name</b>	<b>ID.No.</b>
1.	Commercial Bank of Ethiopia	1
2.	Awash International Bank	2
3.	Dashen Bank	3
4.	Abyssinia Bank	4
5.	United Bank	5
6.	Nib International Bank	6
7.	Oromoia International Bank	7
8.	Wegagen Bank	8
9.	Cooperative Bank of Oromia	9
10.	Zemen Bank	10
11.	Lion International Bank	11
12.	Birihan International Bank	12
13.	Abay Bank	13
14.	Bunna International Bank	14
15.	Addis International Bank	15

## 4. Finding and discussion

### 4.1. Finding

The advancement in technology affects the way business is doing. Banks believe that ICTs, like core banking systems, would enable them to deliver convenient and efficient services to their customers. As a result commercial banks in Ethiopia are allocating a sizable amount of money to the technology. Their annual reports show that during the five year period (2011-2015) they have spent more than 15.4 Billion Birr (about 707 million dollar) on computer hardware and software, computer services (information technology consulting, computer and network system integration, web hosting, data processing service, and other service) and communications.

From table 4 below, we can observe that the minimum amount of return on asset from the observation was 0.021 and the maximum amount was 0.048. The minimum amount of ICT investment per year was Birr 119 million (7.2 million USD) in 2011. The maximum amount of ICT investment per year by individual bank was Birr 521 million (28.3 million USD) observed in year 2015. The mean return on asset of all the observation was 0.03 and the mean of ICT investment was 206.3 million (around 10.7 million USD) over the study period.

Table 4. Summary of the variables used.

```
. summarize ROA ICTinv Capital ActMix Size GDP Inflation
```

Variable	Obs	Mean	Std. Dev.	Min	Max
ROA	75	.0301333	.0056361	.021	.048
ICTinv	75	206.3867	80.842	119	521
Capital	75	1.751507	2.690945	.201	15.2
ActMix	75	.6401333	.0576685	.49	.78
Size	75	24.43387	51.66029	1.2	281.99
GDP	75	9.46	.9542225	8	10.4
Inflation	75	16.6	10.03911	7	33

```
.
```

Source: Own computation StataSE version 13.

Figure 3 below shows ICT investment of individual banks. As depicted in the graph, the five largest spenders on ICT goods and services are CBE, Awash International Bank, Dashin Bank, Abyssinia and United Bank respectively. These banks are relatively working for a longer period of time in the Ethiopian banking industry and have a largest size relative to the others. It seems ICT investment has a relationship with the size of the bank i.e. due to the wide branch expansion and E- banking systems they have. Birhan International Bank, Abay bank, Bunna International Bank and Addis International Bank are the least spender. This is perhaps as a new entrant to the industry and due to a small number of physical branches and ICT infrastructure.

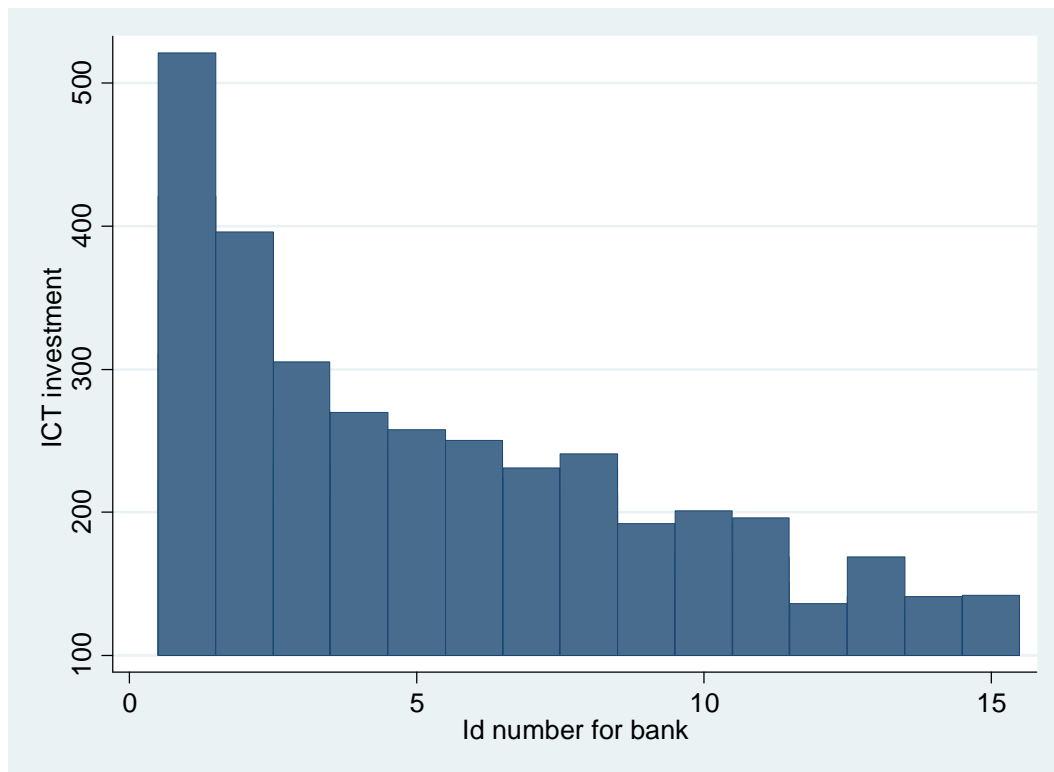


Figure 3: ICT expenditure individual banks in Ethiopia for the period (2011-2015)

Source: own computation compiled from annual reports of banks.

Figure 4 shows the average ICT investment of commercial banks in Ethiopia over the reporting years (2011-2015). It indicates that ICT investment is increasing over time as indicated on the graph. At the end of the 2015, the average ICT investment of the banking industry in Ethiopia

depicted to be more than half a billion. The reporting year (2015) also shows the highest increase in the ICT investment from the previous years. The rate of increase from 2013 to 2015 was quite high relative to the previous year which was moderate in ICT investment. This could be the result of the increase in the number of new banks to the industry.

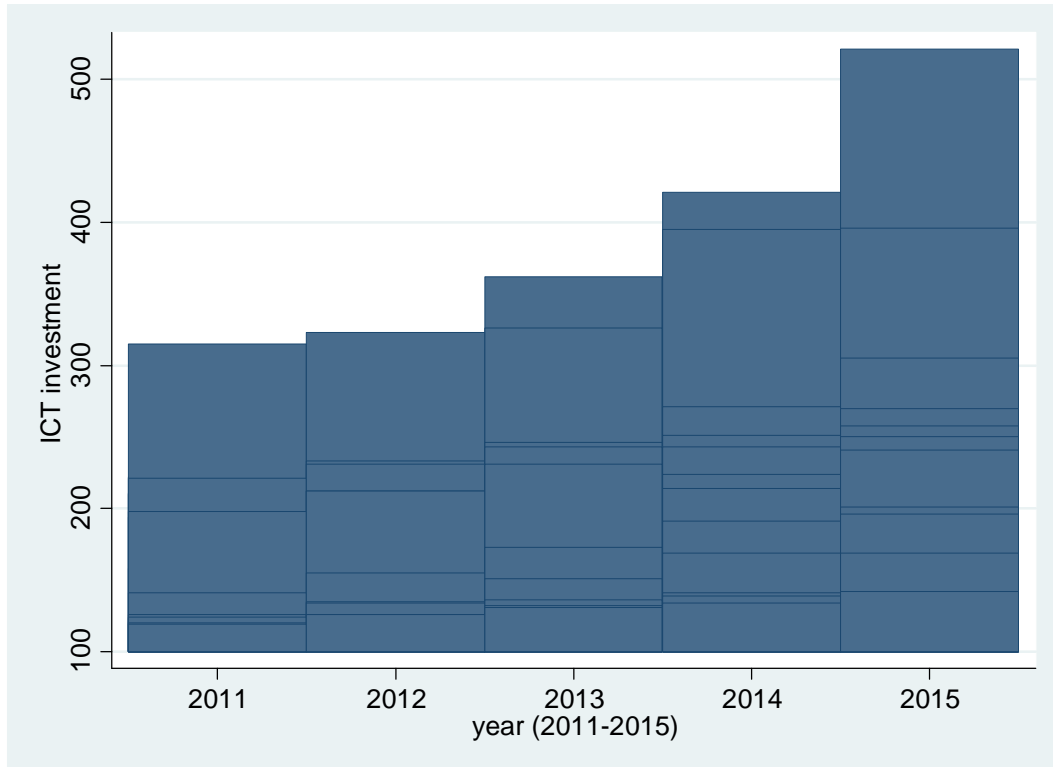


Figure 4: The average ICT investment of commercial banks

Source: own computation compiled from annual reports of banks.

Figure 5 below shows the average return on asset of all commercial banks in Ethiopia. It indicates that the industry was earning the highest ROA in 2013. The trend shows that the ROA has increased from 2011- 2013 and starts to decrease from 2013- 2015. This may be due to the diminished market share of the industry as a result of new entrant into the market (7 new banks joined the market from 2010-2015); and may be due to nature of financial products as it is difficult to differentiate ones product from the competing banks.

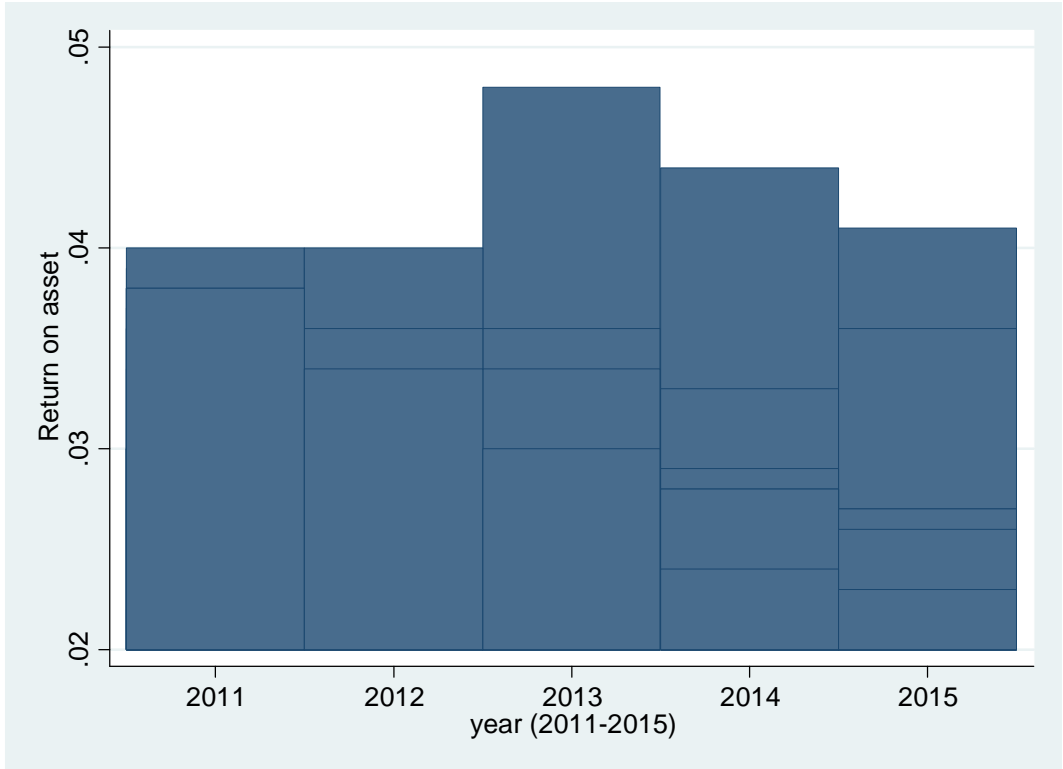


Figure 5 Average returns on asset of all commercial banks in Ethiopia

Source: own computation compiled from annual reports of banks.

Figure 6 below shows the average earning on ROA of individual banks. The five years average ROA for CBE and Zemen Bank were the highest. During those 5 years, the banks had an average return of 0.048 and 0.04 respectively. Five banks score the least average score with an average return of 0.032.

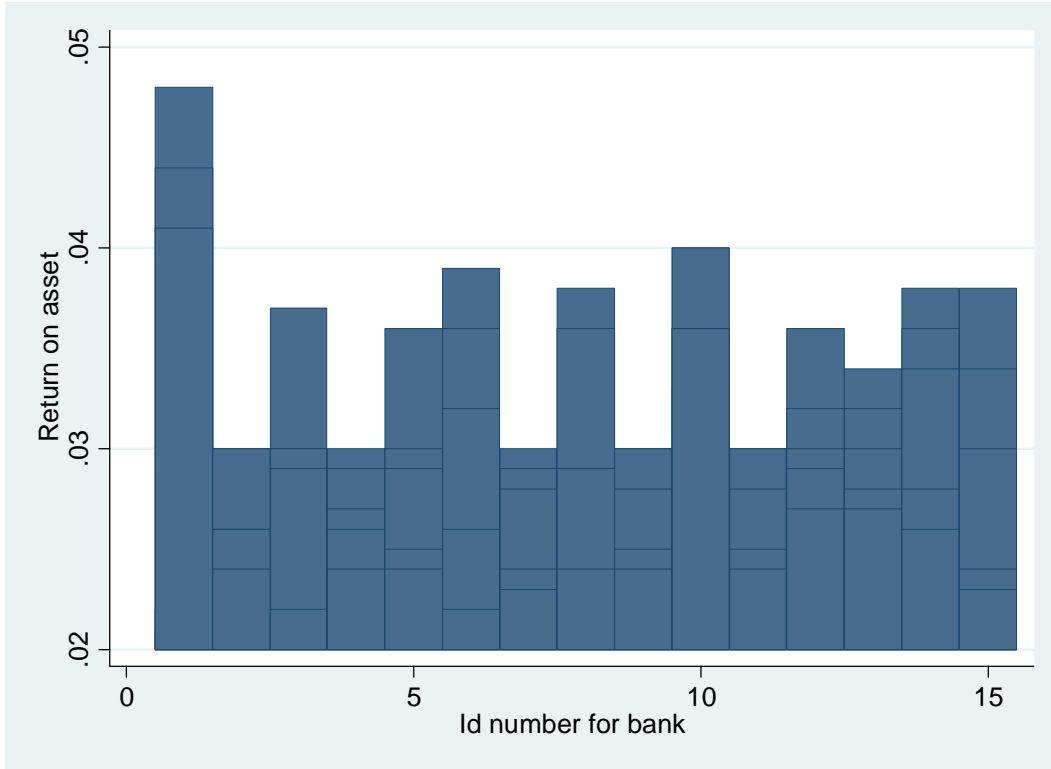


Figure 6: The average earning on ROA of individual banks

Source: own computation compiled from annual reports of banks.

Below table 4, show estimation results. Result from estimation procedure show that the null hypothesis of joint insignificance of the coefficient of all independent variables is rejected. This is confirmed by the Wald –test. This shows that variables selected for the estimation procedure are valid. i.e. bank specific, lagged profitability, and macroeconomic variables are relevant in explaining the performance of banks jointly. The Arellano –Bond test for serial correlation also shows the first differenced errors at order one are serially correlated. Therefore, in order to test the validity of the moment condition we perform tests at higher order.

Table 5: Estimation results of all banks.

```

System dynamic panel-data estimation      Number of obs      =      60
Group variable: BankID                   Number of groups   =      15
Time variable: Year

Obs per group:   min =      4
                  avg =      4
                  max =      4

Number of instruments =      16           Wald chi2(7)      =      1651.73
                                                Prob > chi2       =      0.0000
    
```

Two-step results

ROA	Coef.	WC-Robust Std. Err.	z	P> z	[95% Conf. Interval]	
ROA L1.	.2897597	.1401756	2.07	0.039	.0150205	.5644988
ICTinv	.0000358	.0000482	0.74	0.458	-.0000586	.0001302
Capital	-.0049931	.0006652	-7.51	0.000	-.0062968	-.0036894
ActMix	.0296967	.0310138	0.96	0.338	-.0310892	.0904826
Size	.0002209	.0000403	5.48	0.000	.0001419	.0003
GDP	.00026	.0004919	0.53	0.597	-.0007042	.0012242
Inflation	9.53e-06	.0001142	0.08	0.934	-.0002143	.0002334
_cons	-.0049551	.0262434	-0.19	0.850	-.0563912	.0464809

Instruments for differenced equation

GMM-type: L(2/.)ROA

Standard: D.ICTinv D.Capital D.ActMix D.Size D.GDP D.Inflation

Instruments for level equation

GMM-type: LD.ROA

Standard: \_cons

. estat abond

Arellano-Bond test for zero autocorrelation in first-differenced errors

Order	z	Prob > z
1	-1.0109	0.3121
2	.71369	0.4754

H0: no autocorrelation

Source: own computation.

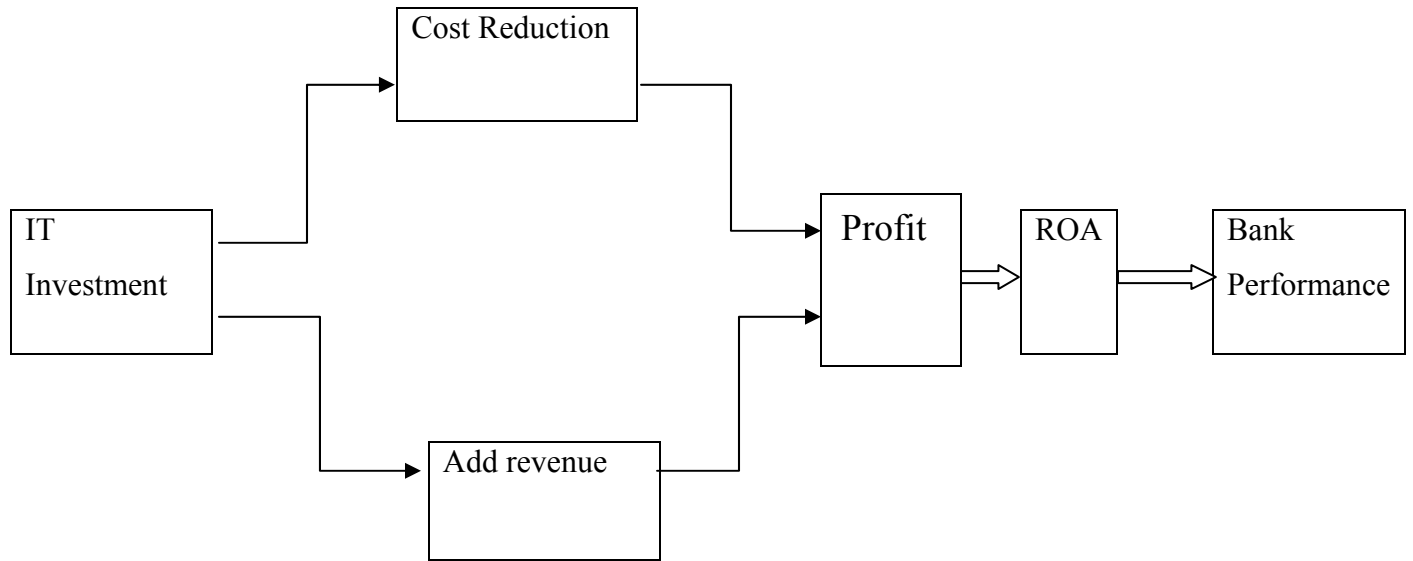


Figure 7.Relation between IT investment and bank performance

The Arellano- Bond test for zero autocorrelation in first differenced errors at order two shows that errors are not serially correlated implying the parameters are consistent. The Z-test also shows that there is a mix of independent variables significant at 5% significant level. Furthermore, except for Capital, all variables have the expected signs.

From the estimation result, we observe that past profitability in the banking sector affects current profits positively, showing persistence of returns. The value of profit is moderately significant in determining future profit. This is indicated by the positive and highly significant coefficient of return on asset (ROA). The coefficient's high significant ( $P > 0.039$ ) indicates that our profitability model is indeed dynamic. Its magnitude (0.28) also indicates that the market power in the sector is moderate which implies that the departure from a perfectly competitive market in Ethiopian banking industry may not be wide. Thus, we can say that the banking industry is relatively competitive. This finding is in line with the finding from other industries and the banking industry itself. (eg. Stierwald, 2009( $\alpha=0.36$ ), Flamini, 2007( $\alpha=0.21$ ) and Athanasoglou et al, 2005( $\alpha=0.35$ )).

In this analysis ICT investment is found to be positively related to performance of the banking sector. However, the relation is insignificant showing that annual ICT investment on ICT made

by the banks has not contributed much to their profitability. This finding is in accord with the theoretical postulation of Ovia, (2005) and the empirical findings of Agbolade, (2011) which hold that positive correlation exist between ICT and Banks performance.

Table 5 indicates that capital has a negative and significant effect at 5% level of significance on bank profitability. As it is known, in order to mobilize the deposit, banks incur costs to expand branch networks and to manage the deposit accounts. This in turn has the effect of holding the available capital before it converted to profit at least in the short run. Other reasons might be banks have been required by the NBE to lend much of their capital in a long term for government priorities like manufacturing which affects the opportunity the banks can invest it otherwise in the short and middle term in other industry. On the other hand 27% of every loan has to be invested in the Renaissance Dam Project which is the government priority with minimal interest rate 3%. This could reduce the capacity of the banking industry to convert the capital on hand into ROA.

The empirical result indicates that real GDB growth has a positive but it has insignificant effect on bank profitability. As report of the national bank of Ethiopia (2014/15) shows Ethiopia's economy has been growing on average at 9.5 % per annum for the last 5 years. This growth result in boosting the profitability of banks. Similar result has been reported by Samuel (2015) and Habtamu (2012) who have studied the determinate of banks profitability in Ethiopia.

Inflation has also a positive effect on bank profitability. This may be due to banks manager ability to foresee future inflation. Athanasoglou et al. (2005) have explained that inflation could affect bank's managers' capability to forecast future inflation. The result in this study is in line with Samuel (2015) and Athanasologou et al (2005) who found positive relationship between inflation and bank profitability.

Bank size has also the expected sign. As it can be seen from the above table, size which is defined as total asset of the banks, shown to have a positive relationship with ROA of the banks at 5% significant level. It asserts that larger banks have an advantage to be more profitable than smaller bank. This finding is in line with many findings (see Demirguc-Kunt et al, 2012, Flamini 2009, Samuel 2015).

From Table 5, we can also see that the coefficient on activity mix is positive but not significant. This is expected as the share of interest income for banking business is quite larger than incomes generated from other means i.e. service charge, commission and exchange fee. Thus, as the total income is highly dependent on loan and advance, banks income is generated from interest income activities which in effect affect ROA as a proxy for Bank performance.

## 4.2. Discussion

In the above finding ICT investment is found to be positively related to performance of the banking sector in Ethiopia. The finding affirms the relationship between ICT investment and ROA as a proxy for bank performance is positive and the Solow's paradox "IT productivity Paradox" seems doesn't hold true in the Ethiopian banking industry.

The above relationship is expected to be positive from the model shown in fig. 1. Kabiru (2015). Porter (1985) also explained that competitive advantage grows fundamentally out of the value a firm is able to create for its buyers that exceeds the firm's cost of creating it. In this sense, value is what buyers are willing to pay, and superior value stems from offering lower prices than competitive price for equivalent benefits. Here, ICT can serve as a cost minimizer in the process of service/product creation from the input side. Berger et al., (2003) confirmed the cost advantage that can be gained in the bank environment. Accordingly he revealed that improvements in costs of lending capacity due to improvements in back office technologies, as well as consumer benefits from improved front office technologies suggests investment on ICT provides a significant overall productivity increase in terms of cost saving and improved quality in the variety of banking services.

On the other hand Porter (1985) again explained that the cost dimension is only one part of maximizing the profit of a given firm. Providing unique benefits/different service/product relative to the competition that more than offset a higher price can also create a profit for a given firm. Provision of unique benefits/different service or product relative to the competition is called differentiation. Thus, ICT can create additional value by providing ways to add value on the existing banking services. (See Berger et al., (2003))

As it is discussed in the above, ICT has the potential to increase bank performance either by reducing the input cost which required through the process of service/product creation or by increasing the utility value of the output of the service/product at the end.

However, the relationship is not significant showing that annual investment on ICT made by the banks has not contributed much to their profitability. This finding is in accord with the theoretical postulation of Ovia, (2005) and the empirical findings of Agbolade, (2011) who studied the relationship between ICT and Banks performance.

The insignificant impact of ICT investment may be explained by various factors. Bruqueet. al (2002) argued that an organization can gain a competitive advantage from technology only after some time lag. Their first argument implied that we see insignificant contribution of ICT at the initial stage. In Ethiopian banking industry, the utilization of ICT can be considered as in the infant stage. Private banking license deregulated only some 20 years ago. And the majority of private bank joined the industry after 10 years of the deregulation. The ever growing competition of these new banks, then witnessed to compel the old banks to change in the overall banking operation specifically on the use of ICT. (Alemayehu, 2006). Thus, ICT requires some time for the return to show up.

Their second line of argument focuses on strategic necessity of ICT. According to their statement companies invest in ICT not to obtain a positive return from ICT but it is because of the fear that they might be forced out of the business. This could be one factor for the insignificant contribution of ICT in this finding. Banks in Ethiopia are spending more money on ICT goods and services and hence reducing their net profit which in effect reduces the ROA of each bank. Thus, the result from the technology might not be as expected.

The other reason may be due to the existing pressure of competition. HO et al (2010) in their study on the banking industry in the USA argued that the contribution of ICT investment to bank profitability is insignificant due to pressure of competition on rival banks. In the Ethiopian banking sector, although banks invest more money to have a competitive advantage, this has reduced their income streams in effect. As can be seen from the reports of the banks, almost all banks in Ethiopia have introduced or are on their way to introduce the latest innovations in the banking technology to their process. This has the potential to increase the competition among banks. Due to a reduction of price in the banking technology all banks has the same access to this cost saving technology. This price competition has the potential to reduce the benefits that banks could get from ICTs. HO et.al (2010) had proved this explanation to be true on their study of US banks.

The other explanation is that even though banks have spent large amount of money to acquire the technology, they have not been able to utilize this in an effective and efficient manner. Triplett(1999) argued that some firms invest in ICT when they should not have. Some firms or

industries also use ICT in an unproductive way. The annual performance report of commercial bank Ethiopia (2013/14) has indicated that there is low level of public awareness in using E-payment product and service. The report showed that in 2013/14 out of the 973,700 card holders, only 32.3% of them had been transacting on ATM transaction per card. The remaining card holders (67.7%) were inactive. At the end of June, 30, 2014 the bank had 8.2 million account holders. Compared to this number, the number of card holder is very low, only (11.9%). Monitoring results on 417 ATMs also showed that during the same period on average these ATM have been idle for 27% of the time. Although this study couldn't find date on the other banks, it could be one of the reasons for the insignificant impact on ICT investment on their profitability; i.e. the underutilization of these technology.

The other reason for insignificant relationship may be related to the existence of unsuitable organizational structure. In the banking industry there might be a “technology syndrome” in which banks race to acquire banking technologies without preparing their organizational structure to fit to the new phenomenon. Brynjolfsson et al (2000) have advised that fitting organizational structure to technology capability; i.e. worker's skill, work process, organizational cultures, values and structures to suit the investment on technology is important to reap the benefit of ICT. Thus, mismatch between technology and organizational structure could be one reason for the small magnitude coefficient and insignificant relationship in the Ethiopian banking industry.

Finally, in the literature it is well documented that the return from investment on infrastructure takes time to show up itself. For the purpose of this research, banks under the study have been classified as Old and New banks based on their years of establishment. Accordingly, banks established before 2000 considered being an Old bank and banks established after 2000 considered to be New bank. (see table 2). As we have seen from the estimation results of the Old banks and New banks as shown below in table 6 and table 7 respectively, the ICT investment tends to have a positive impact on the ROA as a proxy for bank performance for Old banks. (see table 6). On the other hand, the impact of ICT investment on ROA for New banks shown to be negative. (see table 7). Brynjolfsson (1993) with regard to the long term benefits of IT investment, he explained that if there is extensive learning by both individuals and firms the payoff would be higher. However, in the short term, the benefits are not as expected. Triplett



Table 7: Estimation results of new banks.

```
. xtdepdsys ROA ICTinv Capital ActMix Size GDP Inflation, lags(1) twostep vce(robust) artests(2)
```

```
System dynamic panel-data estimation      Number of obs      =      32
Group variable: BankID                   Number of groups   =      8
Time variable: Year

Obs per group:   min =      4
                  avg =      4
                  max =      4

Number of instruments =      16           Wald chi2(7)      =      3371.00
                                           Prob > chi2       =      0.0000
```

Two-step results

ROA	Coef.	WC-Robust Std. Err.	z	P> z	[95% Conf. Interval]	
ROA L1.	1.088715	.2936138	3.71	0.000	.5132425	1.664187
ICTinv	-.0000232	.0000544	-0.43	0.671	-.0001299	.0000836
Capital	-.007227	.0056859	-1.27	0.204	-.0183712	.0039172
ActMix	.0050538	.011516	0.44	0.661	-.0175171	.0276247
Size	-2.78e-06	.0003019	-0.01	0.993	-.0005944	.0005889
GDP	-.0022106	.0011293	-1.96	0.050	-.004424	2.91e-06
Inflation	-.0000405	.000077	-0.53	0.599	-.0001915	.0001104
_cons	.0206517	.017324	1.19	0.233	-.0133027	.054606

```
Instruments for differenced equation
GMM-type: L(2/.)ROA
Standard: D.ICTinv D.Capital D.ActMix D.Size D.GDP D.Inflation
Instruments for level equation
GMM-type: LD.ROA
Standard: _cons
```

## **5. Conclusion and recommendation**

### **5.1. Conclusion**

This research empirically analyzed the impact of ICT expenditure on ROA as a proxy for bank performance in Ethiopia for the period of 2011-2015 using panel data of 15 banks. The study has employed the robust two step system GMM. We found that the investment that has been made on ICT during the study period has a positive return on bank performance specific to return on asset. It has influenced the profitability of banks positively but not significant. This result seems to negate Solow's "productivity paradox".

The relationship between ICT and bank performance was expected to be positive from the conceptual model shown in fig. 1 addressed by Kabiru (2015). The finding of this study confirms it. The model was in line with the theoretical explanation of Porter (1985) who explained that competitive advantage grows fundamentally out of the value a firm is able to create for its buyers that exceed the firm's cost of creating it. In this sense, value is what buyers are willing to pay, and superior value stems from offering lower prices than competitive price for equivalent benefits. Here, ICT can serve as a cost minimizer in the process of service/product creation from the input side. Empirical research conducted by Berger et al., (2003) supports this finding by confirming that the cost advantage can be gained in the bank environment. Accordingly he revealed that improvements in costs of lending capacity due to improvements in back office technologies, as well as consumer benefits from improved front office technologies suggests investment on ICT provides a good deal of overall productivity increase in terms of cost saving and improved quality in the variety of banking services (see Berger et al., (2003).

On the other hand Porter (1985) again explained that the cost dimension is only one part of maximizing the profit of a given firm. Providing unique benefits/different service/product relative to the competition that more than offset a higher price can also create a profit for a given firm. Thus, ICT can create additional value by providing ways to add value on the existing banking services. (See Berger et al., (2003)

Therefore, the finding of this research confirmed, ICT has the potential to increase bank performance either by reducing the input cost which requires through the process of service/product creation or by increasing the utility value of the output of the service/product at

the end. This negates the often quoted aphorism forwarded by Solow “you can see the computer age everywhere but in the productivity statistics” (Solow, 1987).

The insignificant contribution of ICT to the banks ROA as a proxy of bank performance could be from the moderate competition that exists among the bank, underutilization of technology, the excess expenditure made on ICT by the banks, mismatch between the organizational structure and banking technology and duplication of ICT resources in the banking industry. Furthermore, since banks in Ethiopia have started using ICT intensively only in recent times, it will take some time for the return to show up (see Brynjolfsson, 1993; Triplett, 1999; Bruque et.al 2002)

## **5.2.Recommendations**

As it is depicted by the finding, ICT investment has a positive contribution to banks ROA as a proxy of banks’ performance. Various research outputs have confirmed the finding. (see Berger et al., 2003; Eyadat et al., 2005; Malhotra et.al, 2009; Dos Santos et. al., 1993, Akram et. al, 2010; Kagan, et al., 2005)

Thus, in this study the paradox doesn’t hold true. Various authors have presented different explanation for the existence of the paradox. Brynjolfsson (1993) argued that the IT investment benefits are large but there are no proper measures of its true impact. This argument is agreed with Triplett (1999) who argue that information technology is intensively used in sectors where output is poorly measured. Hence, measuring productivity becomes difficult. With regard to the long term benefits of IT investment he explained that if there is extensive learning by both individuals and firms the payoff would be higher. He also added that some firms invest in IT when they should not have. Some firms or industries also use it in an unproductive way. In another study, Triplett (1999) argued some of the services from IT are not included in the statistics of economic activities. He also added the impact of ICT may not visible in the short run. However, in the long run, the return could be unfolded. Finally, he argued for the insignificant contribution of ICT that the gain from IT may not be as much as we think because in the ICT industry there is a constant upgrading of hardware and software which adds a cost on consumers. In addition to this the gain from IT is reflected on individuals or firms but the gain at the general economy is insignificant.

Bruqueet. al (2002) have also identified five perspective to understand the technology paradox. They argued that an organization can gain a competitive advantage from technology only after some time lag. Their first argument implied that we see insignificant contribution of IT at the initial stage. Their second line of argument focuses on strategic necessity of IT. According to their statement companies invest in IT not to obtain a positive return from it but it is because of the fear that they might be forced out of the business. In the end all firms in the sector get in to competition and the result from the technology might not be as expected. The other explanation provided by the authors for the paradox is related to transactions. They explained that the paradox could show itself if the investment on IT fails to bring a reduction in transaction cost. They further argued that if the investment on IT is not accompanied by a transformation of complementary resource, the benefit from IT may not be realized. Finally, they said that the paradox could result if investment in IT is not supported by a value generating business model.

Thus, more efforts need to be applied to increase the return on ICT investment in the banking industry. To this end the following recommendations are forwarded;

- First, bank managers should assess the necessity of a specific banking technology before they made decisions to procure one. They have to classify the technology based on its functions. After identifying the requirement, investment should be made to the technology which is strategic in nature.
- Second, when banks decide to acquire ICT goods and services, they have tomake sure that their organizational structure fits the technology.
- Third, banks should improve the utilization of banking technology by implementing various awareness creations programs to the market.
- Finally, banks should cooperate among themselves in deploying and using technologies in a pool system such as cloud computing rather than installing and implementing individually. This system could reduce the cost to the overall banking industry and hence improve ROA as a proxy to bank performance.

### **5.3.Future Research**

Generally, the literature on the relationship between ICT and bank performance is not yet addressed fully. Therefore, future researchers could take this as an opportunity to study the relationship between ICT investment and the performance of the banking sector.

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