

INFORMATION COMMUNICATION TECHNOLOGY AND BANK PROFITABILITY: EVIDENCE FROM ETHIOPIA

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Abstract: In recent years banks in Ethiopia are increasingly using ICT goods and services in their day-to-day operations. However, their impact on bank profitability is still unknown. This study examined the impact of ICT expenditure on profitability in Ethiopia for the period of 2011-2015 using system GMM on an unbalanced panel data of 17 banks. Results showed that ICT expenditure has not produced a positive return. This finding seems to confirm Solow's "Productivity Paradox." The insignificant impact may be due to the moderate competition that exists among the banks, underutilization of the technology, and mismatch between organizational structure and banking technology.

Keywords: Bank Profitability; Commercial Banks; ICT Expenditure; System Generalized Method of Moments (GMM).

1. INTRODUCTION

Information communication technology (ICT) is used in many sectors. However, the financial sector is one of the economic sectors which use ICT intensively. Arnaboldi and Claeys (2008) explained that modern ICTs, like the Internet, increase customer convenience, reduce costs of banks and increase their profitability. "Internet helps banks to conduct standardized, low value-added transactions through the online channel, while focusing their resources into specialized, high value-added transactions through branches (Ho & Mallick 2010, 211).

In order to deliver convenient and efficient services to their customer and increase their profitability banks are making investments in ICT. But many studies on the relationship of ICT investment and bank profitability provide conflicting results. For example, the above authors found that the adoption and diffusion of information technology (IT) investments have reduced the profit of 68 U.S.i banks over the period of 1986-2005. Becalli (2007) has also found little relationship between IT investment and improved bank profitability and efficiency of European banks over the period 1993-2000. Obinne and Willy (2013) found a negative relationship between IT investment and bank profitability in Nigeria over the period of 2006-2010. However, Y. Leckson-Leckey, Osei, and Harvey (2011) have found a

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positive relationship between IT investments and profitability of 15 Ghanaian banks over the period of 1998-2007.

Like many banks around the world commercial banks in Ethiopia are making large investments in modern ICTs in order to increase their customer satisfaction and profit as well as to get competitive advantage. For instance, from the year 2010/2011 to 2014/15 the banking sector has spent more than 3.6 billion birr (about 198 million dollars) on ICT.ⁱⁱ As a result of this and previous expenditures e-banking activities such as ATM service, internet banking, and mobile banking are either introduced or they are on the process of implementation. About 12 of the 19 commercial banks have started giving ATM services to their customers and the rest are progressing towards it.ⁱⁱⁱ

Although the banking sector is the intensive user of ICT goods and services in Ethiopia, as far as to my knowledge, the relation between ICT investment and bank profitability in Ethiopia has not been examined. Hence, the main purpose of this research is to investigate the impact of ICT expenditure on bank profitability in Ethiopia. Despite the banking sector's large amount of expenditure on ICT goods and services its impact is not well understood. Therefore, knowing the impact of ICT expenditure is useful for a range of policy issues. Policies related to taxation, information security, education and training, financial regulation, competition, etc... could be based on a deeper understanding of ICT expenditure by this sector.

In order to address the problem unbalanced panel data from 14 private commercial banks and 3 publicly owned banks has been used over the time period of 2011-2015. Data is collected from audited balance sheet, income statement and relevant documents of the banks. National Bank of Ethiopia's annual report is also our data source. In this study system Generalized Method of Moments (GMM) is selected as a method of analysis.

The paper is organized as follows: Section 2 discusses the banking sector in Ethiopia while section 3 reviews literatures related to ICT expenditure and bank profitability. Section 4 presents the empirical analysis whereas results are presented in section 5. Finally, section 6 concludes the study.

2. THE BANKING SECTOR IN ETHIOPIA-AN OVERVIEW

In Ethiopia the financial sector comprises mainly of banks, insurance, and microfinance institutions. The banking sector comprises of 16 private banks and 3 public banks. National Bank of Ethiopia's (NBE) annual report (2014/15) indicated that the capital of the banking sector had reached birr 31.5 billion (1.53 billion USDiv) in June 2015. The state-owned Commercial Bank of Ethiopia has the lion's share amounting to 34% of the total capital. The total branch network reached 2,693 in June 2015 out of

which 36.3 % are Commercial Bank of Ethiopia's branch networks. The total asset of the banking sector was about birr 474.4 billion (23.07 billion USD) in June.v Out of this total asset Commercial Bank of Ethiopia's share is 58.2%.The report also showed that total resources mobilized by the banking system in the form of deposits, loan collection and borrowing has increased by 24.5% and reached birr 138.7 billion (6.74 billion USD) at the end of June 2014/15.The report indicated that the deposit liabilities of the banking sector has reached birr 367.4 billion (17.86 billion USD) in June 2015 showing the increasing importance of banks in financial intermediation. All these bank activities are facilitated by the use of modern banking technologies.vi. The following graphs show the trend in capital, asset size and resources mobilized over five years (from 2011-2015).

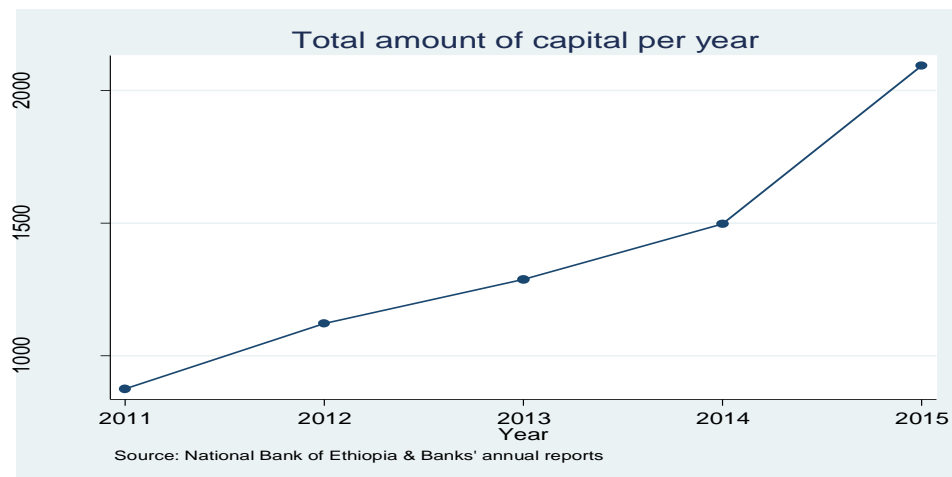


Figure 1: Total amount of capital per year (in million dollars)

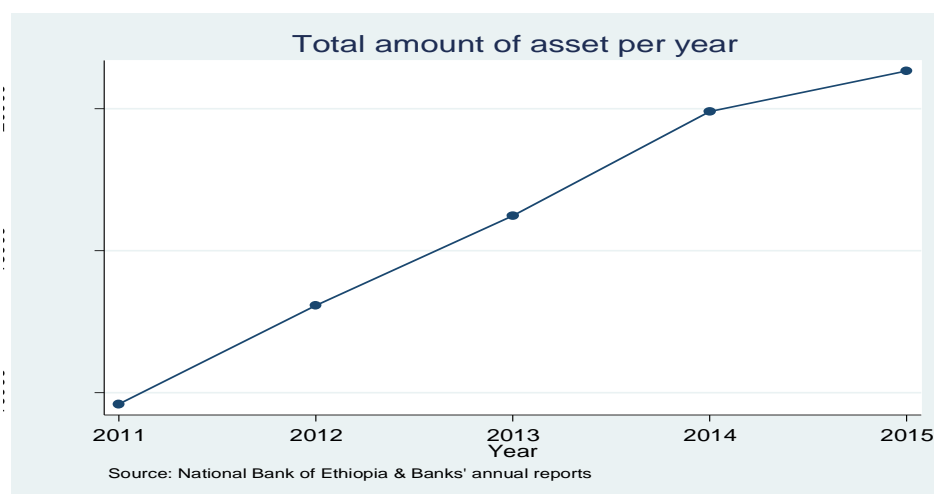
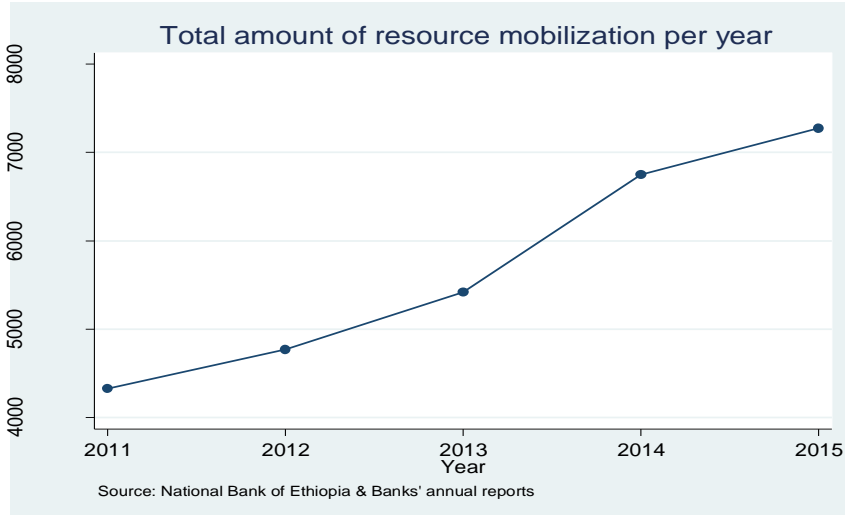


Figure 2: Total amount of asset per year (in million dollars)**Figure 3:** Total amount of resource mobilization per year (in million dollars)

3. LITERATURE REVIEW

3.1 Theoretical Literature

The 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 noted that technological revolution in the U.S was emulated by the rest of the world but its effect was disappointing i.e. it slowed productivity growth rather than stepping it up. 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, Gadson, Riding, and Wang (2008) this observation is supported with studies conducted from 1970s to the early 1990’s. They indicated that before the widespread of IT investment the expected return on investment as measured by productivity was 3-4 percent. But with the widespread use of IT during the 1970s to the early 1990s it became only 1 percent. Macdonald, Anderson, and Kimbel (2000) explained that the discussion on the productivity paradox took place largely in the U.S., especially in Massachusetts. Solow’s often quoted statement has

contributed to the public discussion on the relation between IT investment and IT performance.

Reasons for the Existence of the IT Productivity Paradox

Various authors have presented different explanations for the existence of the paradox. Brynjolfsson (1993) has provided four explanations for the paradox. His first explanation is related to the measurement of outputs and inputs. He claimed that appropriate index of the true impact of IT investment is not in place. That is, at the center of the paradox there is the problem of miss measurement of quality changes and product valuation. The second explanation is related to lags which are due to learning and adjustment. He argued 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 of profits. This argument suggests that individuals or organizations who invest privately are the beneficiaries from investment in technology at the expense of others. Therefore, at 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 unproductive ways.

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 equipments' share in the GDP capital stock is relatively small. In his words "An input with a very small share cannot make a large contribution to economic growth" (Triplett 1999, p.311). He explained that since IT accounts for a 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 service activities like product designing, marketing, distribution, and coordination. Even though IT helps increase the output of a company there is no proper technique for recording it. The fourth reason is that like other technologies (for example, the diffusion of electricity) the impact of IT may not be 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 is insignificant.

Bruque and Medina (2002) have also identified five perspectives to understand the technology paradox. They argued that an organization can obtain economic or competitive advantage from technology only after some time lag. Their second line of argument focuses on strategic necessity of the 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 business. In the end, all firms in the sector get into competition and the result from the technology might not be as expected. The other explanation 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 investment in IT is not accompanied by a transformation of complementary resources the benefits from IT may not be realized. Finally, they stated that a 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 costs, simplicity, velocity and economies of scale we may observe the paradox.

3.2 Empirical Literature

Individuals and organizations have been investing in IT equipments and services since its introduction to the market. For instance, Gartner (2016), a company which specialized in IT research and advisory, has reported that total IT spending in the form of telecommunications services, device, data center system, IT services and software has reached 3.5 trillion dollars in 2014 which is about 4.5% of world GDP in 2014.vii When we compare the annual growth rates of world IT spending and world GDP from year 2000 to the year 2014 the balance points towards IT spending. That is, the average annual growth rate for IT for the last eleven years (2005-2015) as reported by Statistic (2016) was about 3.4% whereas the average annual growth rate of world GDP for the last fifteen years (2000-2014) as reported by the World Bank (2014) was 2.6%.

The literature which investigates the relationship between bank profitability and ICT expenditure shows mixed results. Some researchers found ICT expenditure to have a favorable impact on bank profitability whereas others show either insignificant or negative impact on bank profitability.

Ho and Mallick (2010) have investigated the effect of investment on IT in the banking sector using bank level data from a panel of 68 U.S. banks over the period 1986-2005. They showed that at individual firm levels the bank profits had declined due to adoption and diffusion of IT investment. In another study conducted by Beccalli (2007) the relation between investment on IT and the performance of 737 European banks over the period 1993-2000 was insignificant. Willy and Obinne (2013) have studied the impact of IT expenditure on profitability of 4 banks in Nigeria from 2005-2011. They found that IT expenditure has a negative insignificant impact on return on asset. In 2010 Leckson-Lecky, Osei and Harvey have investigated the impact of IT investment on the performance of 15 Ghanaian banks over the period of 1998-2007. They found that banks which maintain high levels of investments in IT increased their return on asset and their return on equity. However, the result for the overall expenditure on bank profitability had the opposite effect.

Despite the above negative impacts of IT expenditure on bank profitability some researchers have found positive impact on bank profitability. Binuyo and Aregbeshola (2014) assessed the impact of ICT on the performance of South African Banking industry using annual data from four of the biggest banks over the period 1990-2012. They found that the use of ICT increased the return on asset and the return on capital.

Dandago and Bilikusu (2012) have studied the impact of investment in IT on the return on asset of 21 banks in Nigeria over the period 2000-2010. They found that investment on software, hardware and ATMs had a significant positive impact. Monyoncho (2015) has investigated the relationship between banking technologies and financial performance (as measured by return on assets) of 44 commercial banks in Kenya over the 2010-2014 period. She found that e-banking technologies had a positive influence on the performance of commercial banks in Kenya.

4. EMPIRICAL ANALYSIS

4.1 Econometric Methods

Flamini, McDonald and Schumacher (2009) have used a dynamic linear model in order to determine the profitability of commercial banks in SSA. In their model profitability is expressed as a function of bank-specific and country-specific determinants and some factors which are common to the region. Their model is specified as follows:

$$ROA_{ic,t} = \alpha + \gamma ROA_{ic,t-1} + \sum_j \beta_j X_{jic,t} + \sum_m \beta_m X_{mc,t} + \sum_n \beta_n X_{nt} + v_{i,t} \quad (1)$$

Where $ROA_{ic,t}$ is the return on assets of bank i in country c for period t ; α is constant term; $X_{jic,t}$ and $X_{mc,t}$ represent vectors of bank-specific and country-specific determinants, respectively; X_{nt} refers to factors common to the SSA region; and $v_{i,t} = v_i + \epsilon_{i,t}$ is the disturbance, with v_i the unobserved bank-specific effect, and $\epsilon_{i,t}$ the idiosyncratic error.

Following the work of Flamini et al. our model is specified as follows:

$$roait = \gamma_0 + \alpha roait-1 + \beta_1 lnictinv + \beta_2 capit + \beta_3 amixit + \beta_4 lnsizeit + \beta_5 rgdpgr + \beta_6 inf + \eta_i + v_{it} \quad (2)$$

Where $roait$, $lnictinv$, cap , $amix$, and $lnsize$ are the return on asset, annual expenditure on ICT, capital, activity mix, and size of individual banks at the end of year t respectively; γ_0 is a constant term; $roait-1$ is the one period lagged profitability; α 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; η_i 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-invariant individual characteristics such as management style of individual bank that affects profitability; v it is the time variant idiosyncratic error term; β s are parameters to be estimated.

In order to investigate the relationship between ICT expenditure and bank profitability the two-step Windmeijer corrected System GMM is 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 instruments. The estimator uses lagged first differences as instruments for the level equations in addition to lagged levels as instruments for the differenced equation.

He also stated that System GMM is used in situations where we have few time periods and large number of samples, distributed fixed individual effects, endogenous regressors, and heteroskedasticity and serial correlation of idiosyncratic 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 downward finite sample bias. Blundell and Bond (1998) have shown that in the two-step GMM estimation estimated asymptotic standard errors 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 the Wald test. Therefore, he devised a mechanism to correct this problem. He showed that in a Monte Carlo study of a panel data the corrected variance led to more accurate inference.

In this study system GMM is selected because of the following reasons: First, various literatures show that profit is persistent. Hence, profitability of the banks may be dynamic i.e. current profits of banks may depend on past profits. Second, banks may have arbitrarily distributed fixed individual effects. Third, bank specific time varying errors may have heteroskedasticity and serial correlation. Fourth, in our study the time period is very small.

Despite the above benefits and convenience, the methodology has its own limitations. For instance, it may generate too many instruments (see Mehrhoff, 2009 and Roodman, 2006). As our instrument count rises, the bias of the estimates would also rise, leading to over fitting of our endogenous variables. That is an increase in instrument count may lead to a failure to eliminate the endogenous components of our endogenous variables.

4.2 Hypotheses

Based on various literatures (see for instance Leckson-Leckey et al., 2011 and Flamini et al., 2009) we expect that ICT expenditure, capital, bank size, real GDP growth, and inflation have a positive influence on profitability of banks. However, we expect that activity mix has a negative impact on bank profitability.

4.3 Data

The research is based on an unbalanced data of 16 commercial banks and 1 specialized bank in Ethiopia. Enat Bank and Debub Global Bank are left out because each has only two years of data. Annual reports and audited financial statements of the 17 banks over the 2010/2011-2014/15 period are used. Furthermore, data on macroeconomic indicators is obtained from the National Bank of Ethiopia's annual report. Since commercial banks do not have a special account on total ICT expenditure we have aggregated all recorded expenditures which are related to ICT based on the common definition of the technology.

4.4 Description of Variables and Measurement.

Dependent variable

Return on asset (RoA): It is a measure of bank profitability. It measures how effectively a bank has utilized its existing assets to earn profits. 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) Expenditure: It is the total expenditure made on computer hardware (computers, storage devices, printers, and other peripherals); computer software (operating systems, programming tools, utilities, applications, and internal software development); computer services (information technology consulting, computer and network systems integration, web hosting, data processing services, and other services); and communications services (voice and data communications services) and wired and wireless communications equipment. It is the total monetary value at the end of year t.^{viii} Here we have 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 studies (e.g. Athanasoglou, Brissimis and Delis (2005)) we have treated capital as an endogenous variable; Activity mix: It is a proxy for the overall risk undertaken by the banks. It is the ratio of net interest income of individual bank 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.

5. FINDINGS OF THE STUDY AND DISCUSSION OF RESULTS

Figure-1 ranks banks according to their total amount of spending on ICT during the five-year period. The figure indicates that the five largest spenders on ICT goods and services are Commercial Bank of Ethiopia, Dashen Bank, Awash International Bank, Hibret Bank, and Abyssinia Bank. The newly established bank, Enat Bank, is the least spender.

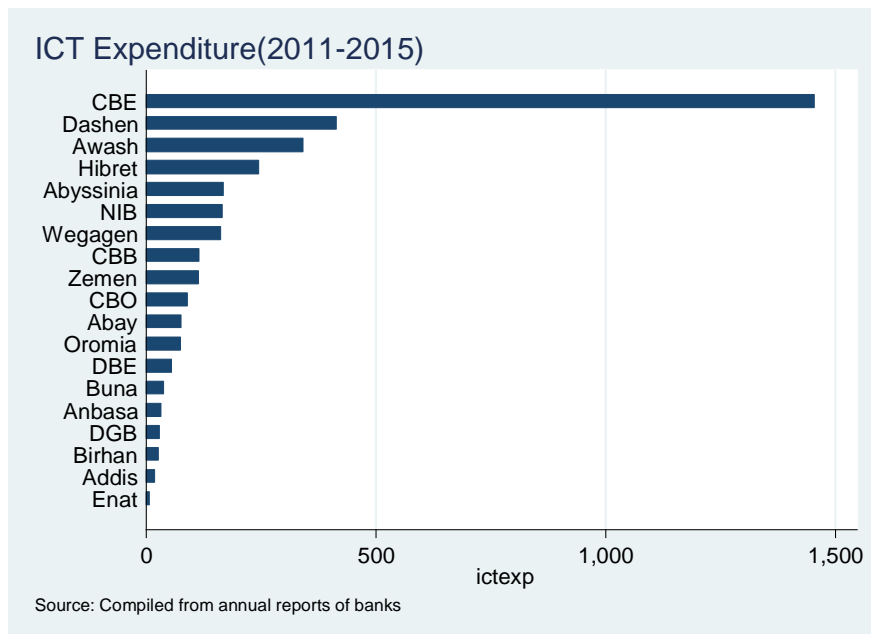


Figure 4: ICT expenditure by individual banks over the 2011-2015 period (in million birr).ix

Figure 5 shows the average return on assets of individual banks. It indicates that the 5 year average ROA for Zemen bank was the highest. During those 5 years the bank had an average return of 0.0363. Wegagen had an average return of 0.0333. Dashen was the third highest scorer with an average return of 0.0321. Abay bank has the least return on asset with an amount of 0.0152.

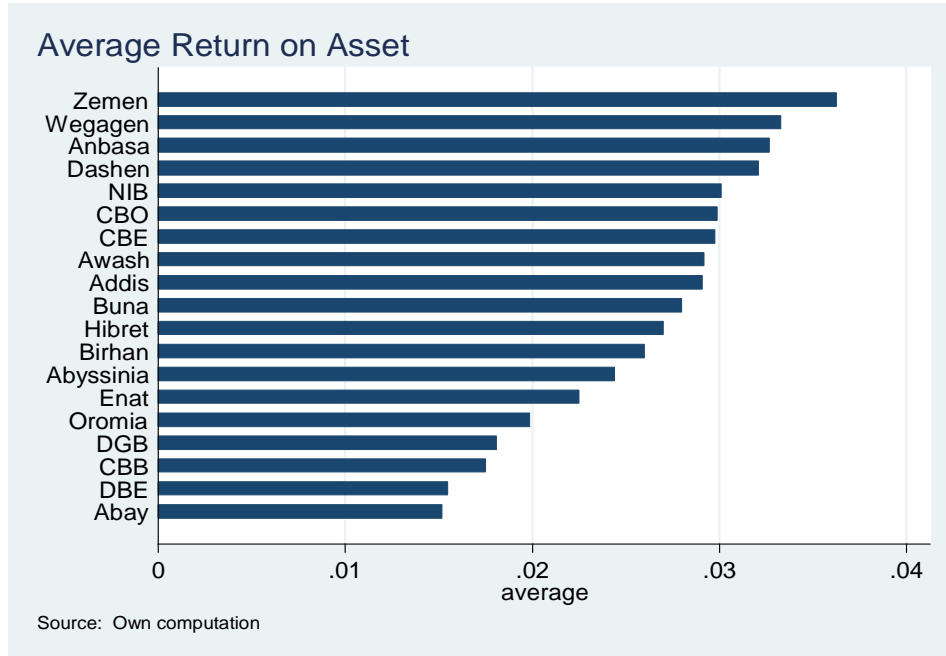


Figure 5: Average return on asset

Table 1 and table 2 show descriptive statistics of variables used and estimation results respectively. Results from the 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 profitability 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 conditions we perform tests at higher order. 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 except ICT expenditure and activity mix all variables are significant at 5% significance level. Furthermore, except activity mix and ICT expenditure all variables have the expected sign.

Table 1: Descriptive statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
roa	80	0.026880	0.008604	-0.0083	0.052500
ictinv	80	45.252410	93.749380	1.842531	622.000000

Variable	Obs	Mean	Std. Dev.	Min	Max
amix	80	0.438475	0.126949	0.110800	0.750700
cap	80	0.146423	0.055368	0.045400	0.382400
size	80	17.067850	39.326660	0.424671	244.000000
rgdpgr	80	10.082500	0.858284	8.700000	11.400000
inf	80	16.247500	9.745872	7.700000	34.100000

Source: Own computation using STATA 13.1.

From table 1 we can observe that the minimum amount of return on asset from the observations was -0.0083 and the maximum amount were 0.0525. The minimum amount of ICT expenditure per year was birr 1.8 million (0.1million USD) in 2013. The maximum amount of ICT expenditure per year by individual bank was birr 622 million (31.77 million USD) which was observed in the year 2014. The mean return on asset of all the observations was 0.02688 and the mean of ICT expenditure was 45.25 million birr (2.42 million USD) over the study period. Most banks had similar return on asset over the period. This can be seen from the small magnitude of the standard deviation which is 0.008604. However, due to a large difference in bank size their expenditure on ICT also varied widely resulting in a higher standard deviation of 93.749380.

Table 2: Regression results

Dependent variable: Return on asset (roa)

Variables	Coef.	Corr. Std.err	Z	P>Z	[95% Conf. Int.]	
roa L1.	0.3190149	0.1296581	2.46	0.014**	0.0648897	0.5731401
Cap	0.1664396	0.0825978	2.02	0.044**	0.0045508	0.3283284
Rgdpgr	0.0310755	0.0133411	2.33	0.02**	0.0049275	0.0572235
Inf	0.0021430	0.0008178	2.62	0.009*	0.0005402	0.0037458
Lnictinv	-0.0010842	0.0013458	-0.81	0.42	-0.0037220	0.0015536
Lnsiz	0.0080475	0.0035142	2.29	0.002*	0.0011598	0.0149351
Amix	-0.0057954	0.0163870	-0.35	0.724	-0.0379133	0.0263226

Variables	Coef.	Corr. Std.err	Z	P>Z	[95% Conf. Int.]
Cons	-0.3535064	0.1537996	-2.30	0.022**	-0.6549481 0.0520647
Wald				Chi2(7)= 25.73	Pr. Chi2=0.0006
Arellano-Bond test for AR(1):			Z= -2.1086	Pr.Z=.0350	
Arellano-Bond test for AR(2):			Z= 0.8863	Pr.Z=0.3755	
Number of observations			63		
Number of groups			17		
Number of instruments			21		

Note: Variables with "*" and "***" are significant at P<1% and P<5% respectively.

Source: Own computation using STATA 13.1.

From the estimation results we observe that past profitability in the banking sector affects current profits positively, showing persistence of returns. The value of profits is moderately significant in determining future profits. This is indicated by the positive and highly significant coefficient of the return on asset (roa). The coefficient's high significance ($p > 0.014$) indicates that our profitability model is indeed dynamic. Its magnitude (0.31) also indicates that the market power in the sector is moderate which implies that the departure from a perfectly competitive market in the 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 findings from other industries and the banking industry itself (e.g. Stierwald, 2009($\alpha=0.36$), Flamini, 2007($\alpha=0.21$) and Athanasoglou et al., 2005 ($\alpha=0.35$)).

In our analysis ICT expenditure is found to be negatively related to profitability of the banking sector. However, the relationship is insignificant showing that annual ICT expenditure on ICT made by the banks has not contributed to their profitability. It reduces their profitability in an insignificant manner. This result supports Ho and Mallick (2010), Beccali (2007) and Obinne & Willy (2013) findings. The negative impact of ICT expenditure may be explained by various factors. One such factor could be due to the fact that banks in Ethiopia are spending more money on ICT goods and services and hence reducing their net profit. However, on the other hand ICT expenditure has also increased the total asset of banks leading to a reduction in the return on asset of banks.

The second reason may be due to the existing pressure of competition. Ho and Mallick (2010) argued that the contribution of IT investment to bank

profitability is insignificant due to pressures of competition by rival banks. Therefore, in the Ethiopian banking sector although banks invest more money to have better competitive advantage this has reduced their income streams and increased the network effect in the sector. 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. This moderate competition can be seen from the coefficient on lagged profitability (0.32). Due to a reduction of prices in the banking technology all banks has the same access to this cost saving technology. However, since we have seen that there is a moderate competition in the industry, it might have resulted in price competition of the banking services. This price competition has the potential to reduce the benefits that banks could get from ICTs. Ho & Mallick have proved this explanation to be true on their study of U.S banks (Ho and Mallick 2010).

The third 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. For example, annual performance report of Commercial Bank of Ethiopia (2013/14) has indicated that there is low level of public awareness in using e-payment products and services. The report showed that in 2013/2014 out of the 973,700 card holders, only 32.3% of them had been transacting with at least one 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 holders is very low, only 11.9%. Monitoring results on 417 ATMs also showed that during the same period, on average, these ATMs have been idle for 27% of the time. Although we do not have data on the other banks, we suspect that one of the reasons for the unfavorable impact of ICT expenditure on their profitability is the underutilization of these technologies.

The fourth reason for the negative 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 and Hitt (2000) have advised that fitting organizational structure to technological capability is important to reap the benefits of IT. In the Ethiopian banking industry workers’ skills, work processes, organizational cultures, values and structures are not transformed to suit the investment on technology.

Finally, in the literature it is well documented that the return from investment on infrastructure takes time to show up. In the Ethiopian banking industry, the large-scale investment on ICT goods and services is a recent phenomenon. Like the other infrastructures, the positive impact of ICT investment may arise in the near future but for the time being Solow’s “IT productivity Paradox” seems to work in the Ethiopian banking industry.

From table 2 we can also see that capital has positive and significant impact on bank profitability at the 5% significance level; activity mix has the expected negative sign but insignificant effect; real GDP growth has a positive and significant effect; Inflation and bank size have a positive and significant effect at 1% significance level.

6. CONCLUSION AND RECOMMENDATIONS

This research empirically analyzed the impact of ICT expenditure on bank profitability in Ethiopia for the period of 2011-2015 using an unbalanced panel data of 17 banks. Applying two-step system GMM it was found that expenditures on ICT have not yielded any positive returns. On the contrary, ICT expenditure has influenced the profitability of banks in an unfavorable but insignificant manner. This finding seems to confirm Solow's "Productivity Paradox." We argued that the negative impact may be due to the moderate competition that exists among the banks, underutilization of the technology, and mismatch between organizational structure and banking technology. Furthermore, since banks have started using ICT intensively only in recent times, it will take some time for the return to show up.

Based on our findings we provide the following recommendations:

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 classification investment should be diverted to the technology which is strategic in nature. Second, when banks decide to acquire ICT goods and services they have to make sure that their organizational structure fits the technology. Third, banks should improve the utilization of the banking technologies by implementing various awareness creation programs. Finally, banks should cooperate among themselves in deploying and using some technologies in a pool system rather than installing and implementing individually.

Study Limitations

In order to investigate the relation between bank profitability and ICT expenditure the study has used bank specific and macroeconomic variables. As some authors (e.g. Bun and Windmeijer 2010) argued output [GDP] and financial data are highly persistent. We have also relatively smaller number of banks and time periods. Furthermore, we also suspect that the variance of bank heterogeneity is expected to be higher than the variance of the idiosyncratic errors. As the authors indicated the above conditions may lead to a weak instrument problem for the methodology used. Therefore, caution should be made when interpreting results.

The other limitation is related to data obtained from the banks. ICT expenditure record is not uniform across the banks. Most banks do not

maintain separate accounts for hardware, software, and services. This condition has prevented us from studying the impact of each component. Classifying the ICT data by its components could have helped us to have a deeper understanding of the impact of the technology.

Note

ⁱ United States

ⁱⁱ Figures for 2010/11 and 2011/12(of Buna Bank), 2014/15(of Commercial Bank of Ethiopia), 2012/13(of Debut Global Bank) and 2014/15(of Development Bank of Ethiopia) are unavailable.

ⁱⁱⁱ Commercial Bank of Ethiopia and Construction and Business Bank are merged at the beginning of 2016.

^{iv} USD = United States Dollar

^v Since figures on asset for 2014/15 of Development Bank of Ethiopia are unavailable, data from 2013/14 is taken as a proxy. Data on asset size is obtained from the annual reports of the commercial banks.

^{vi} The exchange rate at the end of June 2015 was 1USD=20.5659 Ethiopian birr.

^{vii} World Bank has reported that Global GDP in the year 2014 was 77.96 trillion dollars.

^{viii} We have used World Bank's definition for ICT.

^{ix} Abbreviations: CBB=Construction and Business Bank, CBE= Commercial Bank of Ethiopia, CBO=Cooperative Bank of Oromya, DBE= Development Bank of Ethiopia, DGB= Debut Global Bank, NIB=Nib International Bank.

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