Inquiring the Existence of Solow's Paradox in Pakistan's Banking Sector: Fixed Effect with Driscoll and Kraay Standard Errors Technique

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Abstract

Considering the widespread and extensive application of Information and Communication Technology (ICT) in banking sector, this study examines its impact on banks performance in Pakistan. Data set comprises of annual data from 2005 to 2013 of relevant variables. The data was analyzed using fixed effects and random effects models that revealed lack of statistically significant impact of ICT on banks performance hinting at possible presence of Solow's paradox. Findings of this paper highlight the need for efficient utilization of the ICT equipment such as credit, points of sales, phone banking, electronic payment debit, cash withdrawal machines, to mention but few. In order to promote more patronage of ICT and e-banking services, efforts should be made to increase financial literacy and digital literacy among the population.

Key Words: Solow's Paradox, Information Communication Technology (ICT), Fixed Effect with Driscoll and Kraay standard errors, ATM, Computer Software.
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Introduction

Today's business environment is very dynamic and has undergoing rapid changes as a result of technological innovation, increased awareness and demand from customer. Globalization has increased competition in the banking industry worldwide and Information and Communication Technology (ICT) is considered as the center of this global change curve. Needless to say that in order to catch up with

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the global banking industry, a robust ICT network is a pre-requiste. ICT has brought a major shift in the banking industry by reducing transaction costs and improving the quality of performance. The increased demand of ICT in banking sector is eminent and unavoidable due to which banks are deploying their assets in computer hardware and software equipment. Banking industry has adopted 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, of which play salient role in enhancing the performance of banks world over (Ovia, 2005). Although in Pakistan, banks have deployed ample of their resources to ICT, yet the main challenge lies whether this investment is in conformity with the banking practices and their performance? Accordingly, this study sets to investigate the impact of ICT on performance of commercial banks in Pakistan.

Objective and Hypothesis

The objective of this study is to analyze the role of ICT in enhancing the performance of banking operations with reference to all the commercial banks in Pakistan. Specifically this research work is to empirically test whether ICT has improved the performance of commercial banks in Pakistan or otherwise. Following the objective of the study, the hypothesis is set as follows:

H_1: *Introduction of ICT has positively affected the performance of commercial banks in Pakistani banking industry.*

In following section, relevant literature is reviewed to highlight the current state of debate.

Literature Review

Research on the impact of ICT on banks' performance is still limited and the available studies are more related to US, European and Australian banking industries. For instance, Saloner and Shepard, (1995) used data spanning the period 1971-1979 to explore the relationship between ICT and banks' performance in US. The study uncovered two outcomes. Firstly, ICT cuts down the operational expenses of the banks form cost-benefit analytical point of view. For example, internet technology enables and speeds up banks procedures to accomplish maximum transactions at a time which adds value to its system. Secondly the results revealed that internet technology increases the transactions within the same network. Also, ATMs are considered significant for creating network effect.

Brynjolfsson & Hitt (2000) indicate that ICT capital contributes 81% marginal increase in output, whereas non-ICT capital contributes 6%. Carlson et al (2000) and Furst et al (2002) examined the relationship between e-banking and banks profitability. Furst et al (2002) concluded that government owned US banks had higher Return on Equity (ROE) and ICT was one of the major contributors to banks' profitability during the period under study. On the contrary, Egland et al (1998), found no evidence of major differences in performance of electronic banking in the US.

Beccalli (2005) investigated whether investment in ICT influences the performance of banking, using a sample of 737 European banks over the period 1994-2000. Using simple correlation coefficients, the findings revealed a negative and statistically significant correlation between profit efficiency and ICT. Shu and Stresemann (2005) conducted a survey on 12 banks in the US for the period of 1989-1997. According to them although ICT is a dynamic factor for creating profitability but it cannot improve banks earning in terms of return on assets (ROA). However, literature also exists that approves the positive impact of ICT expenses on business value (Brynjolfsson & Hitt, 2000 and Kozak, 2005).

Lin (2007) studied the impact of ICT on US banking industry using a cross-sectional data of 155 banking firms for the period 1995 to 1999 by employing multiple linear regression models. Results of the study indicated that ICT contribute to the overall value-creation performance of banking firms. Malhotra and Singh (2009) examined the implications of internet banking on the Indian 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. Results revealed however, that profitability in the banking industry while offering internet banking does not have any significant association with their overall performance.

Akram and Hamdan (2010) examined the effects of ICT on Jordanian banking industry for the period of 2003 – 2007. The authors used a sample of 15 banks to analyze the data obtained by applying multiple regression model and diagnostics test 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).

Furthermore, Muhammad and Muhammad (2010) examined the impact of ICT on organizational performance using primary data collected through in-depth interviews and fields surveys of 48 manufacturing and 24 banking industry in

Pakistan over the period 1994 to 2005. The data was tested using multiple linear regression model and ratio analysis. Findings of the research show that ICT has positive impact on organizational performance of all sample organizations.

Uppal (2011) examined the growth of ICT in various bank groups in India using data collected over the period 2008-2009. The findings revealed that the growth of ICT led to high bank performance. Conversely, Abubakar *et al.,* (2013) study the impact of ICT on banks performance in Nigeria for 2001- 2011 period. The study employed fixed and random effects to reveal the negative impact of ICT on banks performance.

Studies on the effects of ATMs on profitability provide evidence of cost savings and better services for customers. Survey of banks conducted by Abdullah (1985) in Malaysia, Katagiri (1989) in Japan and Shawkey (1995) in the US, 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. These have low costs of funds than other sources, e.g. borrowing money from other institutions; hence reduce the overall cost of funds. This suggests that there is a role for ICT investment in explaining banks' profitability.

Surveying the studies, absence of similar studies on Pakistani banking industry is observed. Therefore, current study tries to fill the gap in literature by addressing the case of Pakistan.

Methodology

In this study, secondary information in the form of panel data has been used. The data is collected from the banks' annual financial reports for the period 2005-2013. The data for relevant variables comprises of net profits, total assets, total equity, ATM machines and computer software expenses of selected commercial banks of Pakistan, depending on data availability.

Variables and their Measurements

The variables used in this study are explained in this section. Bank Performance – Return on equity (ROE) has been used as a proxy to banks performance. It is measured as net income after tax divided by total equity capital. It measures the rate of return to the shareholder (Adegbaju and Olokoyo, 2008; Ahmad and Khababa, 1999; and Kim and Kim, 1997). The explanatory variables in the model are:

i) Net Profit (NP): This is measured as total earnings of the bank after accounting for all the costs.

ii) ATM: This variable is measured by the number of ATM machines in banking sector for the period under study.

iii) e-banking services (CS): This variable is quantified by taking computer software expense from annual reports.

Model Specification

In trying to assess the impact of ICT on commercial bank's performance in Pakistan, the following model has been used:

$$ROE_{it} = \alpha_0 + \alpha_1\, CS_{it} + \alpha_2\, ATM_{it} + \alpha_3\, NP_{it} + \mu$$
……………………………………………….(8)

Where

ROE = Return on Equity

α_0 = Intercept

CS = Computer software expense

ATM = No. of ATM machines

NP = Net Profit

μ = Error term

Subscripts 'i' and 't' show banks and years respectively of the variables in panel dataset.

Data and Analysis

The data was extracted from twenty six Pakistani commercial banks over the period 2005 to 2013. These are Samba Bank, Albaraka Bank, Allied Bank, Askari Bank, Bank Alfalah, Bank Al-Habib, Bank Islami, Bank of Khyber, Burj Bank, Dubai Islamic Bank, Faysal Bank, First Women Bank, Habib Metropolitan Bank, Habib Bank, JS Bank, KASB Bank, MCB, Meezan Bank, National Bank of Pakistan,

NIB, Silk Bank, Soneri Bank, Standard Chartered Bank, Summit Bank, United Bank and ZTBL.

Breusch and Pagan Lagrangian Multiplier Test

In order to confirm the presence of panel effects, we use Breusch and Pagan Lagrangian multiplier test for random effects. Its null hypothesis of no panel effects is rejected, implying that the selection of random effects model in place of pooled OLS is justified. $\bar{\chi}^2(01)$ is 156.53 with probability value of 0.000.

Hausman Specification Test

To decide between fixed and random effects we ran a Hausman test where the null hypothesis states that the preferred specification of model is random effects against the alternative that suggests that the preferred model is fixedeffects. The results show that the fixed effects model is more appropriate since χ^2isequal to 7.88andits p-value is 0.048 which is significant at 5% level of significance. However, all results are listed in Table 2.

For checking the presence of Multicollinearity, we have employed variance inflation factor (VIF) test as shown in Table 1.

Table 1: Test for Multicolliearity	
Variable	**Variance Inflation Factor**
CS	1.11
ATM	1.03
NP	1.08
Mean VIF	1.02

Source: Authors' estimates

Results reveal that there is no multicollinearity among independent variables. Modified Wald test is applied to find the presence of group-wise heteroskedasticity in regression model. The null hypothesis is that there is constant variance for all 'i'. Since p-value is less than 0.05, null hypothesis is rejected. This shows the presence of heteroskedasticity. Value of χ^2is1268.01. For autocorrelation, Wooldridge test is used with the null hypothesis of no first order autocorrelation. F statistics hasvalue of14.683 and probability value is 0.001. It shows the presence of first order autocorrelation. Presence of autocorrelation and heteroskedasticity creates the need for re-estimating the fixed effects model with Driscoll and Kraay standard errors. For related examples of Fixed Effects Model with Driscoll and Kraay standard errors, see

Mehmood & Hassan (2014), Mehmood, Shahid & Ahsan (2013), and Mehmood, Younas, & Ahmed (2013).

Since fixed effects model with Driscoll and Kraay standard errors is the most suitable among the four estimation techniques, we interpret the results of the same. All independent variables contribute positively to ROE. While, ATM is not statistically significant, CS and NP are at 1%. This implies that ATMs are not playing a statistically significant positive role in this case, but may become statistically significant in some other sample. R^2 is considerably high for all estimation techniques, showing that three independent variables account for approximately 44% of the total variation in ROE.

Table 2: Regression Results

Independent Variables	Pooled OLS	Fixed Effects Model Using OLS	Random Effects Model Using OLS	Fixed Effects with Driscoll and Kraay Standard Errors
Dependent Variable: Return on Equity (ROE)				
Constant	0.1766	0.6476	0.4968	0.5677
	(0.571)	(0.020)	(0.085)	(0.000)
CS	0.0777	0.0817	0.0823	0.7794
	(0.002)	(0.001)	(0.000)	(0.000)
ATM	0.0136	0.0067	0.0048	0.0008
	(0.661)	(0.763)	(0.827)	(0.906)
NP	0.1788	0.0927	0.1221	0.1418
	(0.000)	(0.000)	(0.000)	(0.000)
R^2	0.4492	0.4326	0.4439	0.4492
Overall Significance	$F(3, 230) = 62.53$ p-value = 0.000	$F(3, 205) = 12.85$ p-value = 0.000	Wald $\chi^2(3) = 67.61$ p-value = 0.000	$F(3, 8) = 27.59$ p-value = 0.000

Source: Authors' estimates

In fixed effects with Driscoll and Kraay standard errors estimations, R^2 is 0.4492. Overall significance of all models, using all estimation techniques, is established using F test and Wald Chi square test. Signs and statistical significance remains unchanged in all four techniques used, showing robustness of results.

Conclusion

This study examines the impact of ICT on banks' performance in Pakistan using a panel data set sourced from annual reports of commercial banks. The data was analyzed using fixed and random effects model which revealed that ATMs reveal the

presence of Solow's paradox (1987) in Pakistani banking industry while computer software do not. This finding indicates that the use of ATMs do not influence banks' performance in Pakistan. Though the positive sign of its coefficient is there and a change in sample banks might make this positive influence statistically significant. Lack of statistical significance can also be attributed to mere change of mode of transaction i.e. from manual to electronic. However, ATMs have the potential of expediting the transactions. Though, its effect on output of bank via increased frequency of transactions does not seem ample at this stage, yet it might become evident in future due to availability of more relevant data and more suitable proxies of bank efficiency. Moreover, ATMs are usually used for withdrawal of cash, so the deposits of bank reduce leading to a decline in profitability/performance of the bank. Consequently, a glimpse of Solow's paradox ("We see computers everywhere but in the productivity statistics") can be eyed here, since improvement does not seem to be affected by ATM, out of this sample. These findings are also in lines with that in Shu and Stresemann (2005).

On the other hand, computer software (CS) has statistically significant effect on ROE. Here Solow's paradox seems refuted. It is no surprise that direct impact of software adoption on banking sector has uplifted to efficiency of bank working substantially. This imputes has brought a noticeable change in internal (with the same bank) and external (with clients and other banks) communication. Substantial and statistically significant positive contribution of computer software is, therefore, justified. This findings match with that in Brynjolfsson & Hitt (2000) and Kozak (2005).

The policy implications of findings are pointing towards margin for improvement in role of ICT in banking sector. Emphasis should be given on efficient utilization of the ICT equipment such as credit, points of sales (POS), phone banking, electronic payment debit, cash withdrawal machines, to mention but few. However, for banks and populace alike to actually reap the benefit of ICT more campaigns and orientation of clients need to be vigorously pursued to create awareness for them to patronize the facilities. It is worth noting that the success of this policy does not only depend on the literacy rather on the level of financial literacy as well as digital literacy in the country.

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