

A Study of the Impact of Banking Self-Service Technologies Extension on Return on Equity

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Abstract

This research aims to examine the impact of the banks' Self-Service Technology (SST) extension on Return on Equity (ROE) from 2011 to 2020. For this purpose, among 16 banks, 11 were selected based on their relevant and accessible data. Three indicators are used to measure the extent of SST among selected banks, including the percentage growth of sales terminal transactions, the percentage growth of branch terminal transactions, and the percentage of Automated Teller Machines (ATM) transactions. The hypotheses were tested using a composite data model (data panel). Experimental evidence of the study shows that the expansion of Point-of-Sale (POS) systems and ATMs devices leads to an increase in banks' ROE. Still, PIN pad or PIN entry device development is not significantly related to the rise in banks' ROE. This research extends the literature on SST and provides practical information for banks investing in SST. In this study, we examine the effect of various bank SSTs on the banks' profitability. We first review the literature on SSTs in banking, and then we continue to review the theoretical backgrounds and set our hypotheses. Next, we present our model, variables, and analysis. Then we conclude our paper with the research findings, implications, and limitations.

Keywords: Self-service technology, Financial performance, ROE, Banking industry

1. Introduction

Nowadays, the benefits of the bank's SST have become more prominent. It has shown its impacts in the economic, social, and environmental fields such as cost savings, energy efficiency, monitoring, and internal controls. It is also combating phenomena such as money laundering, crime in society, and pollution. These services in combination with human

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interaction services can prepare a great experience of financial services for customers, and these good experiences may affect some intentions of customers [1]. These intentions are critical for achieving the different goals of a bank. The effects of SSTs on banks' various aspects of performance are also significant, including the increase in the service speed and a decrease in the costs. In this regard, assessing the development of this type of service in promoting ROE can determine its importance to control and investment management in the banking industry.

According to the 2021 Digital Innovation Benchmark Report, the speed at which a business innovates is critical in determining overall performance. 62% of tech executives believe they are at risk of being supplanted by faster-innovating competitors. 51% believe their organization would be out of business in fewer than three years if they failed to keep pace with innovation – up from 37% in 2020. Companies are now forced to redesign their business processes to incorporate new technologies to be more competitive in global markets [2]. This issue became doubly crucial at the Covid-19 pandemic and the urgent need to maintain social distance. This unpredictable situation was able to show the value and importance of new services based on information technologies [3]. Overall, digital transformation in service delivery processes is critical in creating a significant change in companies' competitive advantages. The banking sector is not an exception to this phenomenon. Banks realize those meeting customers' needs and providing technological capabilities (i.e., POS, ATMs) and online and digital banking is not optional but mandatory. Because banks seek to create positive experiences in customers and perceived benefits and ease of use due to technologies such as SSTs are well able to create such experiences in them [4]. In this field, studies such as Nguyen et al. [5] showed that customers' experiences, especially in forcing the use of new banking technologies (such as the time of Covid-19 pandemic), have significant effects on performance in the banking industry and, in particular on its financial performance.

According to Fidelity National Information Services (FIS), which works with 50 of the world's central banks, new mobile banking registrations in the USA increased by 200% in April 2020, and mobile banking traffic increased by 85% [6]. Moreover, according to the FIS Survey, more than 45% of bank customers have modified how they connect with their banks since the pandemic began. FIS mentioned that 45% of survey respondents said they are using a mobile wallet of some kind, and 16% indicated they are currently using paper-based currency less than before the pandemic [7].

On the other hand, banks are concerned about reducing their operating costs like many other businesses. SST developments can help banks save money by including customers in the banking process and eliminating the need for bank employees to act as agents. Customers would like to receive a response to their needs straight soon rather than waiting for an agent, and they even prefer to meet their needs themselves right away [8]. Self-service is an essential factor that fully transforms a bank into a mobile bank. These services can meet customers' needs by adapting to continuous changes in requirements and providing real solutions for users. SST improves service delivery by processing transactions more efficiently and consistently, allowing marketers to adjust better to demand fluctuations and provide a more standardized service delivery [9]. Therefore, investment in this area is of particular importance; however, what is not clear is the monetary impact of these technologies and to what extent different services impact the financial performance of the banks. SSTs provide a high level of data and data-driven insights about the customers for the banking sector. They enable banks to provide a realistic experience with awareness of customers' needs obtained from the data. Overall, it seems SSTs enhance the financial performance of the banks.

However, the question is to what extent and types of SST in the banking system might need to invest more. Does adopting a new technology impact service costs or service quality and improve a bank's financial performance. So, this paper aims to investigate the impact of banking SSTs extension on long-run financial performance. More specifically, in this study, we investigate the effects of SSTs extension on the ROE index in the banking industry. It is considered as a criterion for evaluating the efficiency of company management about the use of company assets to obtain profit. So, investigating the effective factors of improving ROE is critical for companies like banks to increase their long-run financial performance.

2. Literature review and hypotheses development

2.1. SSTs in the banking industry

The concept of SSTs began to expand and develop in the early 1990s with the advent of ATMs [10]. Moreover, with the growth of high-speed internet, SSTs have become more popular, such as internet banking and online shopping [8].

The first definition of SST was proposed by Meuter et al. [11], who defined it as "technological interfaces that enable customers to produce a service independent of direct service employee involvement." This definition is the most popular definition of SST, and Meuter et al.'s article cited more than 4000 by scholars until now. SST in banking is a quick and easy user interface for customers with no direct interaction between employees and customers [11]. The benefits of SST offered by service providers include technological advancement, improved customer experience, and cost savings connected to employee expenses[12]. SST is widely used to express self-service inquiries and online investment transactions. Some of the popular SSTs among customers include ATM, online banking, mobile banking, automatic checkout in retail stores and hotels, self-service government systems, and online shopping are some of the common SSTs [8][13]. SST has been classified into different categories. For example, Cunningham et al. [14] divided SST into six categories according to 3 levels of products and services (highly separable, moderately separable, and inseparable) and two levels of customization (each level of separability is either customized or standardized). In general, SSTs create value for customers by customization services, increasing various choices for doing work, and expanding indirect interaction with the organization [15]. So, SSTs is a create value for service providers by increasing service efficiency and engaging in designing intelligent services.

It is almost impossible to find a bank that does not provide its services with the internet and smartphones regarding the banking industry. As a result, many financial transactions will be handled through self-service banking in the future, and more advanced technology with greater capacities will be available. Bank branches will probably be phased out by that time. Customers have higher expectations from the financial network due to recent improvements in banking systems [16]. Self-service banking's pros are evident now. Its impact on economic, social, and environmental issues such as cost savings, increased efficiency, lower labor costs, internal controls, and problems like money laundering are well known [16]. According to Daugherty et al, SSTs in the banking industry can enhance the desire to use these technologies in individuals through strengthening various advantages to customers [17].

The quality of SSTs depends on seven factors, including performance, design, customization, pleasure, confidence, convenience, security, and privacy [18]. Based on extensive studies in technology acceptance, these factors facilitate the acceptance and expansion of these systems in different societies [16]. In small towns of Middle Eastern

countries, the development of banking self-service systems is limited. There is not enough information about using these systems, and customers do not know how to work with them, which decreases the growth process. Furthermore, decision-makers are skeptical about banks' investments in developing countries since they do not know how far the growth and development of these technologies can help the bank's performance. Banks are forced to provide higher performance levels to investors due to the risk associated with these investments [13]. Therefore, this study investigates the impact of banks' SST use on ROE which has not been examined with actual data on the number of active systems [9][13].

In providing fast services at a low cost, the banking industry has been using new technologies based on service delivery to achieve and maintain strategic advantages. Several studies have investigated the relationship between innovative services and banks' performance. Uzokurt et al. [19] examined the mediating role of innovation in organizational culture and bank performance. The findings of their study showed that in the banking sector, the interaction between corporate culture and innovation directly and positively affects the bank's performance [19]. At the same time, it was found that organizational culture in the presence of organizational innovations has a small regression coefficient on the level of bank performance. The result emphasizes that the mechanisms created to encourage an innovative culture in the organization are likely to introduce, accept, and disseminate innovation, leading to better bank performance. However, just a few studies have looked into the impact of various service investments on banking operations [9].

The services provided by SST are more flexible than traditional banking services. Self-service banking makes customers an active part of the service which actively participates in the service delivery. Declining flexibility means an increase in fixed costs, which affects performance. The customers have a passive role, making these services more profitable than traditional banking services [20]. Therefore, it is expected that in line with existing literature and perspectives, the development of self-service banking will lead to an improvement in corporate financial performance indicators. The self-service banking considered in this study is sales terminals, branch terminals, bank ATMs, and their extent, depending on each bank's number of transactions, reflecting the bank's particular attention to this type of technology. Accordingly, the research hypotheses are formulated as follows:

- (1) Increasing the extent of e-banking services of the bank sales terminals lead to an increase in the bank's ROE.
- (2) Increasing the extent of e-banking services of the bank branch terminals leads to an increase in the bank's ROE.
- (3) Increasing the extent of the banks' e-banking services of the bank's ATMs leads to an increase in the bank's ROE.

3. Methodology

3.1. Sampling and data collection

To investigate the hypothesis of this research, a quantitative method was adopted. Statistical data were collected from 11 banks which 6 of them used self-service banking in Iran between 2011 and 2020. Due to the data accessibility, the rest of the five banks could not investigate. The required data and information for each of these banks were collected from the annual activity reports of the board of directors available in the online databases.

3.2. Model and variables

In this study, to test the hypothesis of the regression model (1) is used.

$$ROE_{it} = \alpha_0 + \beta_1 POSD_{it} + \beta_2 PINPADD_{it} + \beta_3 ATMD_{it} + \beta_4 SIZE_{it} + \epsilon_{it}$$

In this regression model:

- (a) ROE_{it}: represents the rate of return on equity of bank i in year t
- (b) POSD_{it}: Indicates the growth rate of bank i terminals in the year t
- (c) PIN PADD_{it}: represents the transaction growth rate of bank i branch terminals in year t
- (d) ATMD_{it}: represents the growth rate of bank i ATM transaction in year t
- (e) PM_{it}: represents the net profit margin of bank i in year t
- (f) AT_{it}: represents the assets turnover of bank i in year t
- (g) FL_{it}: Indicates the financial leverage of bank i in year t
- (h) ϵ_{it} : The perturbation component α is a constant coefficient, and β are also coefficients.

Independent variables in this regression model include POSD, PIN PAD, and ATMD. PM, AT, and FL variables are also considered control variables adapted from the DuPont analysis system, which breaks down equity rate incentives. There are three elements to calculating equity returns in the DuPont model that help discover the sources of a firm's equity returns. [Table 1] defines conceptual and operational variables.

Table 1. The variables and how to measure them

Variable type	symbol	Variable name	Variable definition	How to measure
Dependent	ROE	Stock returns	Represents the rate of return on stocks.	$\frac{Net\ Profit}{Shareholder's\ equity}$
Control	SIZE	SIZE	The total assets of the bank are called.	Natural logarithm of total assets of each bank
Independent	POSD	transaction growth amount of banks' sales terminals	A device connected to the banking system via telephone or network communication provides the ability to automatically transfer the purchase amount.	$\frac{(t)Transaction\ amount\ in\ the\ period - (t-1)Transaction\ amount\ in\ the\ period}{(t-1)Transaction\ amount\ in\ the\ period}$
	PIN PADD	transaction growth amount of banks' branch terminals	A device that is installed in banks and is directly connected to the banking network and all acceleration operations can be performed with it.	$\frac{(t)Transaction\ amount\ in\ the\ period - (t-1)Transaction\ amount\ in\ the\ period}{(t-1)Transaction\ amount\ in\ the\ period}$
	ATMD	transaction growth amount of banks' ATMs	A device for providing services such as receiving, paying, and transferring funds, to buy credit, payment of bills and provide some banking services automatically to customers at any time of the day or night	$\frac{(t)Transaction\ amount\ in\ the\ period - (t-1)Transaction\ amount\ in\ the\ period}{(t-1)Transaction\ amount\ in\ the\ period}$

Control	PM	The ratio of net profit to operating income	The amount of profit earned from operating activities	$\frac{Net\ Profit}{Operating\ Income}$
	AT	The ratio of operating income to total assets	The efficiency of using assets in generating operating income	$\frac{Operating\ Income}{Total\ Assets}$
	FL	The ratio of total debt to total assets	The amount use of capital borrowed to increase the potential return on an investment	$\frac{Total\ Debt}{Total\ Assets}$

3.3. Data analyzing method

The data panel method analyzed the data and tested the hypotheses. The statistical techniques of this econometric method are Chow and Hausman test to select the best model for estimating the regression model [21]. In general, the data analysis process can be seen in [Figure 1].

4. Findings

4.1. Descriptive statistics

The descriptive statistics section examined the research variables using scatter and central indices and symmetry. [Table 2] reports the results of this stage.

Table 2. Descriptive index of variables

	ROE	POSD	PINPADD	ATMD	PM	AT	FL
Mean	0.016679	1.187342	1.123395	1.232708	-0.224013	0.056530	0.940073
Median	0.139782	0.905857	0.895699	0.896591	0.143512	0.044218	0.940570
Maximum	0.682853	3.598549	4.320660	4.659866	0.639161	0.154041	1.415556
Minimum	-3.604866	0.401549	0.390588	0.508799	-28.55645	0.001605	0.569879
Std. Dev.	0.525930	0.690426	0.673914	0.787191	2.917438	0.036850	0.088838
Skewness	-4.673317	1.545126	2.162346	1.901245	-9.399118	1.369463	0.923980
Kurtosis	28.45509	4.832405	8.256401	6.864961	91.69587	3.964356	15.51885
Jarque-Bera	3033.201	53.24288	191.1225	121.2620	33908.87	34.78073	660.5636
Probability	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
Sum	1.651258	117.5468	111.2161	122.0381	-22.17727	5.596427	93.06723
Sum Sq. Dev.	27.10701	46.71541	44.50770	60.72759	834.1213	0.133077	0.773431
Observations	99	99	99	99	99	99	99

Descriptive statistics of variables show that among the selected statistical sample, the average rate of return on equity equals 0.016, which shows an average of 1.6% profitability for banks has been obtained for each Rial of equity. In addition, the maximum of this variable indicates that the highest profitability for each Rial of equity was equal to 68.2%, but its minimum suggests that a particular observation (year-bank) is unprofitable and shows that 360.4% loss has been obtained for every Rial of equity. The average growth variables of sales terminals, transaction growth of branch terminals, and ATM transaction growth show that the average transaction growth of these instruments among the selected statistical sample was 118%, 112%, and 123%, respectively. Therefore, electronic payment tools have grown significantly between 2011 and 2020. Descriptive statistics of control variables also show that

the average net profit margin of selected banks was negative. It can be interpreted that banks' profitability is not very safe. In other words, the banking industry is not in a good position. However, the maximum profit margin is 0.639, which shows that the highest profit from operating activities was 63.9%. Also, the average asset turnover equals 0.056, which declares that the efficiency of using assets in generating operating income averaged 5.6% among the statistically selected sample. In comparison, the highest asset turnover was equal to 15.4%, and the lowest asset turnover was 0.01% which shows the low efficiency of the bank year in the use of assets to generate income. Finally, the average financial leverage of 0.940 demonstrates that selected banks have financed 94% of their resources by borrowing.

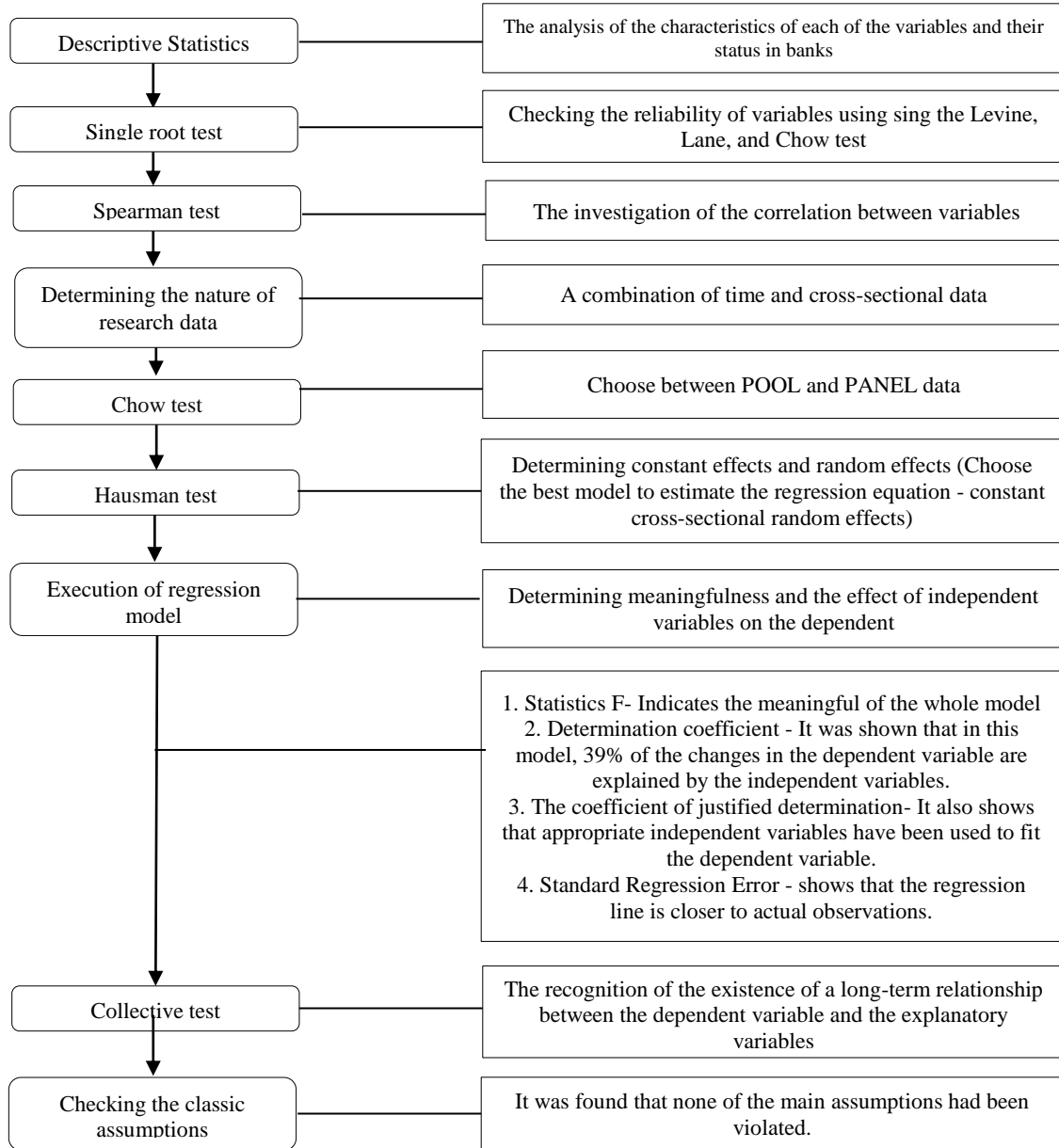


Figure 1. Research data analysis process

4.1. Correlation between variables

This section reports correlation coefficients to investigate multiple alignment problems between independent and control variables using the correlation matrix. Table 3 shows that the correlation coefficients did not exceed the threshold of 0.811 proposed by Kennedy [22]. Therefore, there is no co-linearity between variables. The results show that the highest correlation coefficient equals 0.599 between profit margin and financial leverage variables.

Table 3. Covariance analysis: Spearman rank-order

	POSD	PINPADD	ATMD	PM	AT	FL
POSD	1.000000					

PINPADD	0.189423	1.000000				
	0.0604	-----				
ATMD	0.091294	0.247052	1.000000			
	0.3688	0.0137	-----			
PM	0.092308	-0.080124	-0.018751	1.000000		
	0.3635	0.4305	0.8538	-----		
AT	0.284426	-0.001991	-0.048108	0.291293	1.000000	
	0.0043	0.9844	0.6363	0.0034	-----	
FL	-0.187783	-0.107663	-0.155467	-0.599963	-0.379072	1.000000
	0.0627	0.2888	0.1244	0.0000	0.0001	-----

4.2. Inferential statistics

Variables should be tested for reliability before taking the tests to choose the best pattern and estimate regression. If a variable is unknown, the accuracy of the statistical tests based on these series is questionable. Also, under these conditions, a problem called Spurious Regression may occur. In this way, while there is no significant relationship between the model variables, the coefficient of determination obtained is very high, leading to erroneous inferences about the relationship between the variables [23]

4.3. Stability test

Levin, Lin & Chu (LLC) test showed that using the single root of this data in the combined data has more test power than using a single root test for each section separately [24]. Therefore, this test has been used to evaluate the variability of variables. The results are reported in [Table 4].

Table 4. Summary of LLC test for research variables

Variable Name	The amount of statistic	The level of probability of statistical error	Test Mode	Test Result
ROE	5.519-	0.000	With intercept elevation and time process	stable
Ln POSD	32.874-	0.000	With intercept elevation and time process	stable
Ln PINPADD	3.623-	0.000	With intercept elevation and time process	stable
Ln ATMD	107.671-	0.000	With intercept elevation and time process	stable
size	3.459-	0.000	With intercept elevation and time process	stable

As the test results show, because the probability level of statistics in all variables is less than 0.05, all variables are stable. Based on these results, it can be said that the research variables have a set of zero degrees; (i.e., i is (0)). Therefore, there is no need to perform collective tests.

4.4. Special model selection tests

[Table 5] shows the specific tests for selecting the model and checking the goodness of the model, including the Chow test the Hausman test.

Table 5. Special tests of model

Test	Statistic	Probability	Test Result
Choice test between fixed effects model VS integrated model (Chow test)	5.629	0.000	Select a fixed-effects model
Choice test between fixed effects model VS random model (Hausman test)	1.278	0.972	Select of random effects model
Testing the hypothesis of no serial autocorrelation between residuals (Breusch–Pagan test)	65.830	0.150	There is no serial autocorrelation between residuals.
Multicollinearity (VIF variance inflation test)	2.840	---	There is no strong correlation between explanatory variables.

According to [Table 4], the best method for estimating the regression model is the random effects method. There are also primary classical hypotheses such as no serial autocorrelation between wastes, no heterogeneity of variance between wastes, and no severe co-linearity between explanatory variables.

4.5. Model estimation results

The results of estimating the panel regression model with stochastic effects are reported in [Table 6]. In this table, it can be seen that first, the impact of control variables without independent variables on ROE was tested, and then independent variables were added to the model one by one. The reason for this is to check the stability of the results. It is observed that in all five estimated models, control variables have a significant effect on ROE so that the effect of profit margin and asset turnover variables on ROE is positive and the impact of financial leverage variable on ROE is negative, which is in line with expectations. In addition, it was found that the variables of sales terminal transaction growth and ATM transaction

growth have a positive and significant effect on ROE. In contrast, the development of branch terminal transactions does not substantially impact ROE.

Table 6. Regression model estimation results

Variable	1	2	3	4	5
intercept elevation	0.483	0.317	0.524	0.341	0.270
t-Statistic	2.329	1.817	2.399	1.989	1.699
Prob	0.022**	0.072***	0.018**	0.049**	0.092***
POSD		0.0878			0.085
t-Statistic		1.867			1.840
Prob		0.065***			0.068***
PINPADD			0.028		0.053
t-Statistic			1.067		1.538
Prob			0.288		0.127
ATMD				0.055	0.055
t-Statistic				2.209	2.629
Prob				0.029**	0.010**
PM	0.126	0.128	0.125	0.127	0.128
t-Statistic	26.067	41.381	24.251	30.103	42.531
Prob	0.000*	0.000*	0.000*	0.000*	0.000*
AT	2.364	1.965	2.448	2.444	2.224
t-Statistic	3.730	4.397	3.561	3.844	4.298
Prob	0.000*	0.000*	0.000*	0.000*	0.000*
FL	0.608-	0.518-	0.623-	0.533-	0.490-
t-Statistic	2.138-	2.119-	2.153-	2.117-	2.120-
Prob	0.035**	0.047**	0.033**	0.036	0.036
R square	0.625	0.638	0.626	0.632	0.647
Adjusted R square	0.613	0.622	0.610	0.616	0.624
Watson Camera	1.796	1.836	1.817	1.885	1.965

Significance levels of 1%, 5% and 10% respectively are shown by *, ** and ***

4.6. The integration test of Engle-Granger

The integration test of Engle-Granger is used to ensure a long-term relationship between the dependent variable (ROE) and the independent variables [25]. In this way, a single root test is performed for the residuals obtained from the regression estimate. Suppose the zero hypotheses are rejected based on at least one root for the rest. In that case, this means that the variables are aggregate models, and there is a long-term equilibrium relationship between the dependent variable and the explanatory variables. The results of this test are reported in Table 7. This result indicates a long-term equilibrium relationship between ROE and other explanatory variables.

Table 7. LLC test for residuals

Variable	Statistics value	probability level	Test mode	Test result
Residual	-13.022	0.000	With intercept elevation & time process	Stable

5. Discussion

The first hypothesis of the study was stated that with the increase in the range of electronic banking services of banks' sales terminals, the Return on Equity (ROE) would increase. The results of the study support this hypothesis. The coefficient estimation results show H1 is

significant ($t = 4.006$), and its standard coefficient is 0.18. Confirmation of this hypothesis means that as banks' sales terminals increase, the bank's ability to generate net profits for shareholders will also increase. Thus, banks can increase their net profit by handing over more sales devices and expanding them across the country; because more use of these devices equals more fees for banks.

The study's second hypothesis stated that by increasing the extent of e-banking services at bank branch terminals, the return on equity (ROE) increases. The evidence obtained in this study does not support this hypothesis. As a result, the extent of bank branch terminals is not significantly related to banks' return on equity. Given the functionality of branch terminals, such a relationship is not unexpected; the branches' terminals, unlike sales terminals used in stores and shopping malls, are devices that are only installed in banks. They are mainly used by customers who come to the banks in person. Consequently, they cannot be as profitable as the POS devices, which, especially nowadays, their use is common and growing even among the smallest sellers and shopping malls, and even vendors. As a result, the non-significance of this variable seems logical.

The third hypothesis of the study was stated that the Return on Equity (ROE) increases with the expansion of the ATM of banks. The results of the study support this hypothesis too. Confirmation of this hypothesis means that the development of ATMs is associated with profitability for banks. Each bank will eventually pay and receive a fee, depending on how many ATMs are installed and how many cards are issued. After deducting these amounts, the ultimately becomes a debtor or creditor of the banking network. Those banks with a more significant number and a more appropriate ATM network may be credited, and those with fewer ATMs than issued cards may be in debt. Therefore, with the growth of ATMs' electronic banking services, banks' profits will increase. As a result of banks' action to install ATMs, compared to the cards issued by the bank, this can be useful for the bank's profitability.

5. Conclusion

The results show that expansion of self-service banking (such as POS and ATM devices) leads to an increase in banks' ROE. Still, the development of PIN PAD devices does not have a meaningful relationship with the rise in banks' ROE. Based on these results, investing in this area can help increase banks' profitability. The negative coefficient and the inverse relationship between the extent of ATMs and ROE of banks could be using ATMs only generates revenue for banks when the owners of each bank use their device, which in practice, such a thing rarely happens. We can also mention that banks with more issuing cards but fewer ATMs will be more indebted than other banks. As a result, the expansion of ATMs reduces the bank's ROE. Although the amount is minimal, it cannot be negligible. Based on these results, it is impossible to give a definite opinion about the increase in ROE of banks due to banks' wide range of self-service services in Iran. But it seems that investing in this area increases ROE to meet the needs of bank customers, and after exceeding the market, the ROE decreases. To increase the effectiveness and efficiency of self-service systems, the banks are increasing the motivation of customers to use these systems with various methods, including training, advertising, discounts, ease of use, compulsory services, and so on. This area is well covered in technology acceptance studies. Also, experimental evidence of the study shows that the expansion of point-of-sale (POS) systems and ATMs devices can increase banks' ROE. Still, PIN pad or PIN entry device development is not significantly related to the rise in banks' ROE.

To guarantee progress for commercial capacities in the banking system, it is necessary to invest in several sectors:

(1) Analysis: The amount of data available is increasing due to the use of SST; Distributed investments and financial services can be modeled, tracked, and reported. Banks should invest in analytics capabilities tailored to their customers to understand this new data.

(2) Appropriate pricing: The customer service needs of self-service are more complex than the needs of a traditional customer. So banks need to design and offer customized products at specific customer requests which reflect the total financial situation and their approach towards risk.

(3) Distribution: banks must use extensive and reputable systems to distribute financial services. The wrong choice of communication channel can significantly increase administrative costs.

(4) Agility: Banks should be more flexible concerning new technologies. Schumpeter stated that the stages of prosperity and recession in the economy result from innovation. Positive economic cycles, influenced by the force of innovation, are defined by Schumpeter as "creative destruction" periods. This theory is critical in markets with no market stability, product, or production processes.

(5) Continuous innovation: This is an essential factor in the banking sector because it creates value for the customer. Market positioning strengthens the bank due to its ability to innovate quickly and successfully.

(6) Digital risk management: Banks can work with their customers to improve their financial services.

Eventually, management of service delivery with self-service devices is of particular importance. In terms of bank fees and debts - In case of failure to provide devices with appropriate quality and quantity- and the bank's long-term activity scope and development. Moreover, updating the bank's systems in all areas of self-service is worth considering.

The main limitation of this study was the lack of similar research using financial statement data regarding the relationship between the scope of electronic services and the bank's return on equity. In addition, due to the lack of information about the transaction of self-service devices, the statistical sample of the study is limited; therefore, caution should be exercised in generalizing the results. In this study, the relationship between the scope of e-banking services and banks' return on equity was investigated. As a result, future studies can measure the relationship between e-banking service performance indicators and other indicators of financial performance, such as asset return rates, Tobin's Q ratios, and bank efficiency. In general, due to the lack of comprehensive studies in this field, further study in the future can help to develop a proposed research model.

6. Statements and declarations

The data described in this article are derived from 11 banks that were selected as a statistical sample. The required information for each of these banks was collected from the annual activity reports of the board of directors, and it is available in the online databases.

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