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The Impact of Applying Information Technology Investment in Small and Large Jordanian Banks

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Abstract
The benefits of using Information Technology (IT) in financial institution are multifaceted: i) expansion of market shares; ii) improving communication with customers, vendors and employees; iii) fast responses to customer inquiries; and iv) easier ordering and tracking; improving the quality and transaction process and speed. The importance of this research is to undertake a comprehensive study to understand the impacts Information Technology Investment (ITI) on the Financial Performance (FP) of banks and explain and identify precise contributions of IT to the Jordanian banking sector. In other words, the study attempts to ascertain to what extent ITI has impacted on the FP of the commercial banks in Jordan.
Keywords: Information Technology (IT), Information Technology Investment (ITI) and Financial Performance (FP)

1. Introduction

The quick development of Software application and the rapid use of Information Technology (IT) by commercial entities engaged in trade, investment and financial services have increased their capacity to achieve more benefits for banks; which includes gains in profitability due to efficiency of operation and reduction in transaction costs. Moreover, IT innovations are used as tools for gaining competitive advantage and enhancing business positions strategically. In fact, the significant developments in IT have had various effects on economies, including globalization for information which in turn, has changed the whole world into a small global village where all individuals affect each other more frequently. However, these developments have also sharpened the role of financial banks mainly that of commercial banks in facilitating trade, investment and other activities. As a result, this has imposed a huge challenge before these banks because IT is frequently misused by unethical financial frauds. Therefore, it becomes necessary to understand the role of IT in increasing the efficiency and competency of the operations. This research will explore the link lectures Information Technology Investment (ITI) and Financial Performance (FP).

The IT, refers to the technology side of information system. That includes modern technologies such as computer, facsimile, telecommunications, microelectronics, hardware, database, software, networks and other devices . ITI is the investment in these technologies described above. The FP that includes different variables such as return on assets (ROA) that calculated by equal current net profit divide by average total assets, return on equity (ROE), which measure by equal current net profit divide by equity.

2. Research Problem

As a result of increasing globalization, competition and customer awareness, IT provided a competitive advantage by increasing the organizational performance. The benefits of using IT in financial institution are: i) expanding their marketplace; ii) improving communication with customers, vendors and employees; iii) fast responses to customer inquiries; iv) easier ordering and tracking; improving the quality and transaction process and speed. The use of IT help bank management resources, technical expertise and capital, hence, the banks seek to enhance the financial performances during use IT.

The research problem lies in answering the following main question: What are the effects of ITI on FP in the Banking sector in Jordan?

3. Empirical Analysis

This part is the crux of the research. After discussing data and their definitions, first we present summary statistics. However, to provide satisfactory answers to the research question, we conduct panel data estimations of the profit function, where ITI is one of the explanatory variables. Then we provide some simulation results and conclusions of the effects of ITI on the FP in Jordan banks.

According to the theories of financial analysis discussed in the previous paragraphs, this research will employ the following profitability equation and will apply it to heterogeneous panel data. The preliminary model is given as the following:

$$\Pi = \int(IT, Controls, \ \varepsilon) \quad (1)$$

Where this dependent variable, Π=a bank profitability measures (ROA, ROE), and explanatory variables are

IT=investment proxies, and controls = other control variables that influence bank profitability, and = an error term.

In order to set up the profitability equation in a good manner, we need a theoretical framework to determine the relation between all the variables which affect bank profitability. To achieve this, this paper will use theories of business analysis (Jang, 2002) or financial analysis. We will use Business or financial analysis to study business activities. analysis. On the other hand, the financial analysis which studies the financial factors is classified into five groups: 1.productivity analysis, 2. stability analysis, 3. activity analysis, 4. profitability analysis, and growth analysis.

Activity analysis measures the banks asset efficiency through activity ratios; such as the ratios of operating revenue (sales) divided by main asset items. Productivity analysis measures efficiency of banks at production level via productivity measures such as output to input in production. Growth analysis investigates whether the banks economic position in the specific industry or in the entire economy is properly maintained and whether growth ratios are satisfactory. Growth ratios consist of growth rates of operating revenue, net profit, total assets, loans, total liabilities, deposits, equity, earnings per share (EPS), book value per share (BPS), etc.

Based on the theories of financial analysis elaborated, this research employs the following profitability equation :

$$\Pi_{it} = \alpha_i + \beta_{1i} DEBTR_{it} + \beta_{2i} DLMR_{it} + \beta_{3i} EAR_{it} + \beta_{4i} RESR_{it} + \beta_{5i} LDR_{it} + \beta_{6i} IT_{it} + \beta_{7i} INF_{t} + \beta_{8i} WG_{it} + \varepsilon_{it} \quad (2)$$

Where:

Π_{it} : Profitability for bank: i = 1, 2, 3 . . . , N, at time: t = 1, 2, 3 . . . . , T.

β : The coefficient vector on explanatory variables

$DEBTR_{it}$: The debt to equity ratio (/debts divided by equity). it is expected that there is a negative relationship.

$DLMR_{it}$: Loans minus deposit rate spread (/average interest rate on loans minus average rate on deposits: the deposit minus /loan margin rate) the financial analysis theory predicated positive sign.

EAR_{it} : The equity to total assets ratio (equity divided by total assets).Expected to have a positive sign.

$RESR_{it}$: The reserve ratio (/reserves (surplus) divided by paid-in capital).Expected to have a positive sign.

LDR_{it} : The loan minus deposit ratio (/loans divided by deposits). Should have a negative sign, since a high ratio, corresponds to a low business stability in financial analysis theory.

IT_{it} : Investment proxies such as the computer budget ratio (computer budget divided by total budget) and the capital budget ratio (computer capital budget divided by computer budget). The large IT investments produce a stronger position influence on profitability measures.

WG: The wage price of labour to number of employee. Should have a negative sign

INF: Inflation Rate. Should have a positive sign

ε_{it} : Is the disturbance term.

4. Data Gathering

These data will be obtained for all the 22 banks based in Jordan, over 1993-2010 periods. Most will be furnished through primary data sources such as annual and monthly statistical bulletins and reports issued by banks and the central bank of Jordan.

Table (1) exhibits descriptive statistics of the dependent and explanatory variables used in empirical analyses. There are 3 large size asset banks and 19 small banks, while there are 6 large IT investment banks and 16 small banks.

4.1 Testing for unit root and cointegration

Based on the literature review discussed in research, we will describe the models and proxies that will allow us to test for the effects of ITI on Profitability performance. The variables are selected based on the main variables used by other authors who are supported in previous empirical work. As a part of the cointegration analysis, we will test for the finding of a unit root in a time series. Testing for unit roots indicates nonstationary which has implications for economic theory and modeling. Results from regressions will not be meaningful if the variables are not stationary, that is, if they possess time trend. Nonstationary data may lead to cointegrating relationships, a series Yt is said to be integrated of order denoted by Y-I (d) if it becomes stationary after differencing d times and thus Y, contains d unit roots. A series which is l (0) is said to be stationary. To determine whether a series is stationary or non-stationary, unit root test must be carried out. The study adopts the Augmented Dickey Fuller

(ADF) Unit Root Test for unit root testing. If the series is not stationary in levels, a further test will be carried out on their first differences Attia, (2005).

In a series that has one of the Unit root equal to one, the time series of Non-stationary, and then the ΔY t = U t If the first difference series of Stationary; the original series are Integrated of first Order. If the string is static after obtaining a second difference, the original string be integrated level II. If the original string still said to be integrated of zero order I (0), in the sense that the string static asset.

It is noted in this connection that the time series are not static or heading to sleep only if the rate of short-term volatility in declining to guarantee the converge to develop a long-term equilibrium Attia, (2005).

$$\Delta Y = \alpha 0 + \alpha 1 Yt - 1 + \sum_{t=1}^{p} B1 \Delta Yt - 1 + \varepsilon t$$

Where, refers to the first difference of variable Y, p is the number of lagged terms which are chosen to ensure that the errors are uncorrelated and for t=1,……,N is assumed to be white noise. In (1), the null hypothesis that α_0 =0 against the alternative hypothesis $\alpha_0 \neq 0$ is tested.

The ADF is implemented as rejecting the null hypothesis of a unit root (non-stationary) if the ratio is smaller than the critical value. In this case the level of time series Y, is characterized as integrated of order zero, i.e. I (0). If it is found that the individual time series in equation (1) are stationary after the first difference, then the series is characterized as integrated of order one, I(1). The next step is to examine the cointegration relationship among the series. The cointegration test determines whether there exists a long run equilibrium relationship between two or more different variables over time Gujarati, (1995). If variables are cointegrated, then it can be interpreted as the variables are "stationary" relative to each other implying that the differences between the two values fluctuate around a fixed value. In other words if two series are cointegrated, short run deviations are possible, but market forces ensure that equilibrium is regained in the long run.

In addition to the assumptions outlined in above, the economic variables that are used in estimation must be stationary. That is, its variance and the co-variance must be constant through time. If such conditions are not met, then the data will not be stationary, and in this case the coefficients of the model cannot be estimated by using OLS method. If OLS method was applied, it would be possible to get a spurious regression or spurious correlation. If, at least, one of these explanatory variables is non-stationary, the trend will appear in the function, and the coefficients of the explanatory variables are non-stationary and statistically not meaningful. In addition, the coefficient of determination, R^2, will have a high value, thus, the result will be unrealistic and misleading Thomas, (1997).

In order to obtain a stationary series, the first difference, or the second, or the third difference should be taken. The process of taking the differences will continue until the time series is stationary. That is, the stationarity of the time series cannot be materialized until a difference that is higher than the first difference is obtained. In this case, the Augmented Dickey – Fuller (ADF) is used to test for stationarrity.

The feature of stationarity was tested through the Augmented Dickey-Fuller (DF) and Philips Peron (P.P) test. According to (ADF) test, all the variables are non-stationary except for the foreign investment which was stationary at a significant level of 10%. P.P test also showed that all variables at the level were non-stationary. According to these tests, Ordinary least squares (OLS) will be used. The linear relationship that exists between a dependent variable and the independent variables and it is intended to minimize the sum of the squared differences (or errors). However, the use of OLS implies the adoption of some assumptions; mainly the population regression function should be both linear in variables and parameters. This assumption is not a sufficient condition to ensure that there is a precise statistical relationship between the estimators and the "true" corresponding values. There is a basic set of assumptions that are comprised in the classical regression model that will give us the certainty of obtaining unbiased estimates:

- Normality. - Y values are normally distributed for each X, probability distribution of error is normal.
- Homoscedasticity (constant variance).
- Independence of errors.
- Linearity (relationships between variables is a linear function).

When using OLS, if the previous assumptions are met, it can be implied that the OLS method will produce BLUE (best linear unbiased estimates) and would be consistent with the Gauss-Markow theorem which states that "gir7en the assumptions of the classical linear regression model, the least-squares estimates, in the class of unbiased linear estimates, have minimum variance, that is, they are BLUE" Gujarati, (1995). The methodology of OLS is used to estimate the model outlined above. It is a method that analyzes co-integration to estimate the coefficients of financial performance variable function as it reflects the problems of endogeneity of data and coefficients being bias and serial correlation. To estimate the regression functions, Eviews Software was used.

5. Empirical Results

5.1 Finding Unit Root and Multicollinearity

According to Levin et.al, (2002), Breitung, J. (2000) results, tests are based on the common unit root process, an

assumption that autocorrelation coefficients of the tested variable across cross-sections are identical. As mentioned during the discussion about the unit root test, testing for unit roots indicated nonstationary (if date possess a time trend). The importance of testing for unit roots is that nonstationary data may lead to cointegrating relationship (biased results).

Results from the previous unit root test fail to reject the hypothesis of a unit root for independent variable of 0.05 and 0.01 levels. Therefore we conclude that variable used for the analysis for profitability equations are I (0) or Stationary.

The next step is to proceed to test for panel cointegration relationships for our analysis, to determine whether there is a long-term equilibration relationship between the specified dependent variables (ROA, ROE) and explanatory variables (DEBT, DLMR, EAR, RESR, LDR, IT, WG, INF) in the profitability equations. According to Kao (1999) results for panel cointegration test, the null hypothesis of the test is no cointegration. In the two profitability equations, the null of no cointegration is strongly rejected.

5.2 Regression result

Table (2) contain the results for the analysis of the effect of IT investments on ROA and ROE of the Banking sector in Jordan. The next step is to proceed to test for cointegration relationships for our analysis. The results obtained for the cointegration analysis performed on the variables included for the analysis of the profitability equation. Finding from the cointegration analysis were of a significant unidirectional Granger causality among for DLMA to Granger cause ROA, and among ROA and INF.

Through the analysis for effect on ROA we made an attempt to model most of the variables that have been used in previous literature. Our findings (table) for the analysis of aggregate banks sector were of appositive and significant evidence of IT ratio, EAR, RESR and INF as expected by theory. The estimates of the DEBRT turn out to be significantly negative as predicted by financial analysis theory.

Our funding did not find evidence of DLMR, LDR and WAGE as determinant of ROE.

Table (3) contains the results for analysis of the effect of IT on ROE. The analysis was done by panel least squires. Our findings for this analysis are consistent with the findings for the effect on ROA, where evidence of positive and significant coefficient were found for IT ratio, EAR and INF. The estimates of the DEBRT turn out to be significant negative as expected. Our finding did not find evidence of DLMR, LDR, RESER, and WG.

Generally, the IT ratio and EAR and INF have relatively strong explanatory power for Jordanian's bank profitability.

In Table (2) the R2 values and adjusted R2 values are 0.0706 and 0.0641, which are similar those in the existing literature.

Table (4) depicts the results we gained by applying the bank group analysis by assets size. Large Jordanians banks with assets size greater than %8 while small ones less than %8. As a result there are 3 large banks and 19 small banks.

6. Conclusion remarks

In this paper we attempted to measure the affect of ITI by Jordanian banks on their FP using panel least squares and panel cointegration testing. The empirical analysis of this study is:

First, it is found that there indeed exist unit root in the level data variables by KAO residual cointegration panel unit root test.

Then, the profitability equation is estimated by panel least squares. Moreover, the effect of ITI on bank profitability are estimated and compare for different bank group classified into large and small banks (by assets size), and high and low IT bank (by ITI ratio).

IT is found that IT ratio has a stronger positive relationship with bank returns. Specifically, the relationship between ROE and IT ratio turns out to be stronger than ROE and IT ratio. Summarizing the estimation results of the profitability equation, the IT ratio, DEBRT, EAR and INF have relatively strong explanatory power for bank return.

In the banks group analysis by asset size and ITI ratio, the IT ratio of most groups banks, have positive effects on profitability improvements. Specifically, the relationship between banks group and ROE, But both that the IT ratio of small banks and low IT ratio banks show a stronger positive effect on banks returns than that of large banks and low IT ratio banks, because diminishing return to scale.

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Table 1. Exhibits descriptive statistics of the dependent and explanatory variables

	ROA	ROE	DEBRT	DLMR	EAR	IT	LDR	RESR	WG	LOG(INF)
Mean	0.011178	0.114606	0.193048	0.074006	0.107286	0.002833	0.974915	0.374980	0.021788	-3.416934
Median	0.011000	0.116000	0.009000	0.070000	0.096000	0.001540	0.693000	0.227000	0.017000	-3.381395
Maximum	0.059000	1.038000	2.673000	0.667000	0.683000	0.039420	67.57800	5.901000	0.510000	-0.116534
Minimum	-0.074000	-0.979000	0.000000	0.000000	0.032000	0.000000	0.026000	0.011000	0.004000	-5.115996
Std. Dev.	0.012986	0.155935	0.394232	0.043911	0.055953	0.004552	3.647953	0.539733	0.028611	0.835911
Skewness	-1.497761	-1.617513	3.515624	9.820203	4.109521	4.800321	17.44460	6.725105	14.24225	-0.015340
Kurtosis	12.80415	19.43903	17.49967	122.0934	36.43375	29.59880	317.0192	64.15956	241.7766	3.780319
Jarque-Bera	1545.766	4128.735	3819.445	214285.5	17434.79	11761.79	1468264.	57677.25	850519.0	8.969718
Probability	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.011278
Sum	3.946000	40.45600	68.14600	26.12400	37.87200	1.000010	344.1450	132.3680	7.691000	-1206.178
Sum Sq. Dev.	0.059364	8.559178	54.70733	0.678704	1.102034	0.007294	4684.262	102.5418	0.288137	245.9590
Observations	353	353	353	353	353	353	353	353	353	353

Table 2. effect of ITI on ROA of the Banking sector in Jordan

Variable	Coefficient	Std. Error	t-Statistic	Prob.	
C	0.014240	0.003483	4.088314	0.0001	R^2 =0.070617
DEBRT	-0.002401	0.001357	-1.768607	0.0779	
DLMR	-0.017235	0.011526	-1.495315	0.1358	F=3.058302
EAR	0.041474	0.012649	3.278963	0.0012	
IT	0.372340	0.221248	1.682908	0.0934	Prob (F-sta.)=
LDR	2.98E-06	0.000114	0.026100	0.9792	0.002476
RESR	-0.002398	0.000921	-2.602879	0.0097	
WG	0.005594	0.007071	0.791091	0.4295	
LOG(INF)	0.002594	0.001283	2.022273	0.0440	

Table 3. Effect of ITI on ROE of the Banking sector in Jordan

Independent Variable	Coefficient	Std. Error	t-Statistic	Prob.	
C	0.142278	0.017463	8.147389	0.0000	R^2 =0.064107
DEBRT	-0.037556	0.020210	-1.858356	0.0640	
DLMR	-0.261659	0.179907	-1.454416	0.1468	
EAR	0.388505	0.208560	1.862797	0.0634	F=2.757061
IT	10.98264	6.355946	1.727932	0.0850	
LDR	0.000221	0.001503	0.147297	0.8830	
RESR	-0.006557	0.014903	-0.439959	0.6603	Prob (F-sta.)= 0.005863
WG	-0.018213	0.308388	-0.059057	0.9529	
LOG(INF)	0.037340	0.011508	3.244808	0.0013	

Table 4. Effect of ITI on ROA of the Large Bank in Jordan

Variable	Coefficient	Std. Error	t-Statistic	Prob.	
C	0.011184	0.002848	3.926850	0.0003	R^2
DEBRT	-0.015283	0.002455	-6.225729	0.0000	=0.755584
DLMR	0.023805	0.048382	0.492015	0.6254	
D(EAR)	0.069749	0.041966	1.662026	0.1043	F=12.36557
D(IT)	0.216069	0.108005	2.000543	0.0523	
D(LDR)	-1.75E-05	2.32E-05	-0.751572	0.4567	Prob (F-sta.)=
RESR	0.001303	0.001507	0.864489	0.3925	0.00000
D(WG)	0.240948	0.083898	2.871904	0.0065	
D(LOG(INF))	0.000987	0.000775	1.273816	0.2101	

Table 5. Effect of ITI on ROE of the Large Bank in Jordan

Variable	Coefficient	Std. Error	t-Statistic	Prob.	
C	-0.033743	0.050986	-0.661815	0.5119	R^2 =0.490209
DEBRT	-0.004681	0.014842	-0.315416	0.7541	
DLMR	2.276458	0.758658	3.000638	0.0046	
D(EAR)	0.436185	0.174381	2.501336	0.0166	F=3.846360
D(IT)	4.330235	2.732752	1.584569	0.1209	
D(LDR)	-0.000382	0.000571	-0.668704	0.5075	Prob (F-sta.)=
RESR	0.044019	0.031032	1.418506	0.1638	0.001060
D(WG)	2.442661	1.538948	1.587228	0.1203	
D(LOG(INF))	0.018128	0.019565	0.926554	0.3597	

Table 6. Effect of ITI on ROA of the Small Banks in Jordan

Variable	Coefficient	Std. Error	t-Statistic	Prob.	
C	0.018468	0.006107	3.024283	0.0027	R^2 =0.083449 F=3.300459 Prob (F-sta.)= 0.001264
DEBRT	0.001360	0.001420	0.957690	0.3390	
DLMR	0.005698	0.019842	0.287165	0.7742	
EAR	0.003040	0.036389	0.083553	0.9335	
IT	1.618328	0.670466	2.413734	0.0164	
LDR	-0.001125	0.000590	-1.907980	0.0574	
RESR	-0.001960	0.000885	-2.214495	0.0276	
WG	-0.030488	0.020557	-1.483103	0.1391	
LOG(INF)	0.002731	0.001362	2.005245	0.0459	

Table 7. Effect of ITI on ROE of the Small Banks in Jordan

Variable	Coefficient	Std. Error	t-Statistic	Prob.	
C	0.253406	0.051358	4.934065	0.0000	R^2 =0.061807 F=2.388095 Prob (F-sta.)= 0.016599
DEBRT	0.006667	0.017043	0.391206	0.6959	
DLMR	0.009159	0.146645	0.062454	0.9502	
EAR	-0.196565	0.158196	-1.242546	0.2150	
IT	11.13126	6.217974	1.790175	0.0745	
LDR	-0.011362	0.006738	-1.686261	0.0928	
RESR	-0.014881	0.011233	-1.324835	0.1863	
WG	-0.283138	0.167577	-1.689604	0.0922	
LOG(INF)	0.036614	0.015735	2.326836	0.0207	

Table 8. Effect of ITI on ROA of the Low IT Banks in Jordan

Variable	Coefficient	Std. Error	t-Statistic	Prob.	
C	0.179104	0.082962	2.158865	0.0319	R^2 =0.250359 F=3.209038 Prob (F-sta.)= 0.000004
DEBRT	0.014265	0.034264	0.416335	0.6776	
DLMR	0.034372	0.317666	0.108201	0.9139	
EAR	-0.045017	0.193094	-0.233135	0.8159	
IT	33.40293	17.55090	1.903203	0.0583	
LDR	-0.000937	0.000974	-0.962095	0.3371	
RESR	-0.013273	0.034309	-0.386881	0.6992	
WG	-0.383015	0.436830	-0.876806	0.3815	
LOG(INF)	0.030440	0.018809	1.618400	0.1070	

Table 9. Effect of ITI on ROE of the Low IT Banks in Jordan

Variable	Coefficient	Std. Error	t-Statistic	Prob.	
C	0.015199	0.005471	2.778244	0.0059	
DEBRT	0.000717	0.002321	0.308940	0.7577	
DLMR	0.009843	0.016319	0.603121	0.5470	R^2 =0.216804
EAR	-0.008070	0.018560	-0.434811	0.6641	F=2.659873
IT	3.219005	1.410328	2.282451	0.0234	Prob (F-sta.)=
LDR	-8.20E-05	0.000191	-0.430287	0.6674	0.000121
RESR	-0.002463	0.002462	-1.000407	0.3182	
WG	-0.035711	0.025244	-1.414663	0.1586	
LOG(INF)	0.002098	0.001099	1.907954	0.0577	

Table 10. Effect of ITI on ROA of the High IT Banks in Jordan

Variable	Coefficient	Std. Error	t-Statistic	Prob.	
C	0.034011	0.006372	5.337610	0.0000	
DEBRT	-0.014774	0.004307	-3.430411	0.0009	
DLMR	-0.250137	0.082320	-3.038596	0.0031	
D(EAR)	0.105527	0.050670	2.082627	0.0402	R^2
D(IT)	0.406081	0.301102	1.348647	0.1809	=0.385972
D(LDR)	-0.000145	0.000896	-0.162146	0.8716	F=4.255070
RESR	-0.003027	0.001143	-2.648179	0.0096	Prob (F-
D(WG)	0.062257	0.089089	0.698817	0.4865	sta.)=
D(LOG(INF))	0.002735	0.001710	1.599707	0.1132	0.000018

Table 11. Effect of ITI on ROE of the High IT Banks in Jordan

Variable	Coefficient	Std. Error	t-Statistic	Prob.	
C	0.215828	0.060442	3.570855	0.0006	
DEBRT	-0.041397	0.050619	-0.817814	0.4157	
DLMR	-1.059421	0.786149	-1.347609	0.1812	
D(EAR)	0.524814	0.456979	1.148443	0.2539	R^2
D(IT)	5.739416	3.138379	1.828784	0.0708	=0.358775
D(LDR)	-0.003210	0.010677	-0.300626	0.7644	F=3.787482
RESR	-0.010892	0.014650	-0.743455	0.4592	Prob (F-
D(WG)	-0.021663	0.954326	-0.022700	0.9819	sta.)=
D(LOG(INF))	0.031845	0.017283	1.842569	0.0688	0.000081