Journal of Economics and Sustainable Development
ISSN 2222-1700 (Paper) ISSN 2222-2855 (Online)
Vol.4, No.11, 2013

Consideration the effect of E-Banking on Bank Profitability; Case Study Selected Asian Countries

Sadr, Seyed Mohammad Hossein
Ph.D student in Management Information Technology, Department of Management and accounting, University of Allame Tabataba'I (ATU)

Abstract

E-Banking is one of the gifts to human beings by computer technology. Use of computers have automated banking process and thus has given birth to e-Banking. E-Banking is a fast spreading service that allows customers to use computer to access account-specific information and possibly conduct transactions from a remote location - such as at home or at the workplace. ATM cards, credit cards ,debit cards, smart cards ,all these have eased human life up to such an extent that today life without these seems to be hard, full of misery. The increased adoption and penetration of Internet has recently redefined the playground for retail banks. The retail banks are now offering their services majorly through their internet branches. However, the effect of internet banking on bank performance mainly on the bank profitability has remained an unstudied issue. Our analysis covers fourth banks that have adopted online banking in Asian selected countries between 1990 and 2010. The empirical results support of a short-run cointegration relationship after allowing for the heterogeneous country effect. The long-run relationship is estimated using a full-modified OLS. By using bank specific and macroeconomic control variables, we investigate the impact of internet banking on the return on assets (ROA) and equity (ROE). Our results show that internet banking starts contributing to banks' ROE with a time lag of three years confirming have a negative impact is observed for one year lagged.

Keywords: E-Banking, Profitability, Panel Model.

1- Introduction

Financial services industry over time has opened to historic transformation that can be termed as e-developments which is advancing rapidly in all areas of financial intermediation and financial markets such as e-finance, e-money, electronic banking (e-banking), e-brokering, e-insurance, e-exchanges, and even e-supervision. The new information technology (IT) is turning into the most important factor in the future development of banking, influencing banks' marketing and business strategies. In recent years, the adoption of e-banking began to occur quite extensively as a channel of distribution for financial services due to rapid advances in IT and intensive competitive banking markets (Menson Auta, 2010).

Ceylan Onay and et al (2008) stats that Internet has changed the dimensions of competition in the retail banking sector. Following the introduction of PC banking, ATMs and phone banking, which are the initial cornerstones of electronic finance, the increased adoption and penetration of Internet has added a new distribution channel to retail banking: Internet/Online-banking. Allen et al (2002) define E-finance as "the provision of financial services and markets using electronic communication and computation" and today retail banks are switching to multi-channel distribution of financial services in hybrid platforms where the traditional services of banks are provided through both "bricks and mortar" branches and Internet. However the research on the adoption of internet banking by the consumers has been vast, while there has been very limited research on the effects of internet banking on the bank profitability especially within the European Union context. As EU continues to enlarge, the integration of financial services sector towards achievement of a Single European Banking Market gains real importance. EU has also mentioned in its various communications the priority it gives to the E-finance and accordingly internet banking (Ceylan Onay and et al, 2008).

Simpson (2002) suggests that e-banking is driven largely by the prospects of operating costs minimization and operating revenues maximization. A comparison of online banking in developed and emerging markets reveal that in developed markets lower costs and higher revenues are more noticeable. While Sullivan (2000) finds no systematic evidence of a benefit of internet banking in US click and mortar banks, Furst et al. (2002) find that federally chartered US banks had higher ROE by using the click-and-mortar business model. Furst et al (2002) also examine the determinants of internet banking adoption and observe that more profitable banks adopt internet banking after 1998 but yet they are not the first movers (Ceylan Onay and et al, 2008).

Ceylan Onay and et al (2008) stats that the greater use of Internet in retail banking however brings additional risk components to overall risk profile of the banks. The Basel committee has recognized these related risks and has issued Risk Management Principles for Electronic Banking (2003). It aims to promote safety and soundness of e-banking activities while preserving the necessary flexibility in implementation due to speed of change in technology (Ceylan Onay and et al, 2008).
The purpose of this paper is to empirically examine the long-run co-movement and the causal relationship between e-banking and profitability in selected Asian countries. We combine cross-sectional and time series data to examine the relationship between this variables using updated data for selcted Asian countries for the years 1990–2010.
The paper is organized as follows: In Section 2 we provide a brief discussion of the panel unit root test and the panel cointegration procedure. Empirical results are provided in Section 3. Finally, Section 4 concludes and policy implications.

2. Methodology

2.1. The panel unit roots test

In order to investigate the possibility of panel cointegration, it is first necessary to determine the existence of unit roots in the data series. For this study we have chosen the Im, Pesaran and Shin (IPS, hereafter), which is based on the well-known Dickey-Fuller procedure. Investigations into the unit root in panel data have recently attracted a lot of attention. Levine and Lin, (1993) proposes a panel-based ADF test that restricts parameters γ_i by keeping them identical across cross-sectional regions as follows:

$$\Delta y_{it} = \alpha_i + \gamma_i y_{it-1} + \sum_{j=1}^{k} \alpha_j \, \Delta y_{it-j} + e_{it} \qquad (1)$$

where t =1,. . ., T time periods and i =1,. . .N members of the panel. LL tests the null hypothesis of γ_i=γ =0 for all i, against the alternate of $\gamma_1 = \gamma_2 \ldots = \gamma \ < 0$ for all i, with the test based on statistics $t_\gamma \ = \hat{\gamma}/s.e.(\hat{\gamma})$. One drawback is that c is restricted by being kept identical across regions under both the null and alternative hypotheses (Lee, Chien-Chiang, 2005).

For the above reason, IPS (1997) relax the assumption of the identical first-order autoregressive coefficients of the LL test and allow γ to vary across regions under the alternative hypothesis. IPS test the null hypothesis of $\gamma_i = 0$ for all i, against the alternate of $\gamma_i < 0$ for all i. The IPS test is based on the mean-group approach, which uses the average of the t_{γ_i} statistics to perform the following $\bar{Z}$ statistic:

$$\bar{Z} = \sqrt{N}(\bar{t} - \ E(\bar{t}))/\sqrt{Var(\bar{t})} \qquad (2)$$

where $\bar{t} = (\frac{1}{N}) \sum_{i=1}^{N} t_{\gamma_i}$, the terms E($\bar{t}$) and Var($\bar{t}$) are, respectively, the mean and variance of each t_{γ_i} statistic, and they are generated by simulations and are tabulated in IPS (1997). The $\bar{Z}$ converges to a standard normal distribution. Based on Monte Carlo experiment results, IPS demonstrates that their test has more favorable finite sample properties than the LL test.

Hadri (2000) argues differently that the null should be reversed to be the stationary hypothesis in order to have a stronger power test. Hadri's (2000) Lagrange multiplier (LM) statistic can be written as (Lee, Chien-Chiang, 2005):

$$\widehat{LM} = 1/N \sum_{i=1}^{N} \left(\frac{\frac{1}{T^2} \sum_{t=1}^{T} S_{it}^2}{\hat{\sigma}_\varepsilon^2} \right), \quad S_{it} = \sum_{j=1}^{t} \widehat{\varepsilon_{ij}} \qquad (3)$$

where $\hat{\sigma}_\varepsilon^2$ is the consistent Newey and West (1987) estimate of the long-run variance of disturbance terms.

The next step is to test for the existence of a long-run cointegration among GDP and the independent variables using panel cointegration tests suggested by Pedroni (1999 and 2004). The panel cointegration tests Pedroni (1999) considers the following time series panel regression

$$y_{it} = \alpha_{it} + \delta_{it}\, t + X_i B_i + e_{it} \tag{4}$$

where y_{it} and X_{it} are the observable variables with dimension of $(N * T) \times 1$ and $(N * T) \times m$, respectively. He develops asymptotic and finite-sample properties of testing statistics to examine the null hypothesis of non-cointegration in the panel. The tests allow for heterogeneity among individual members of the panel, including heterogeneity in both the long-run cointegrating vectors and in the dynamics, since there is no reason to believe that all parameters are the same across countries (Lee, Chien-Chiang, 2005).

Two types of tests are suggested by Pedroni. The first type is based on the within dimension approach, which includes four statistics. They are panel υ-statistic, panel ρ statistic, panel PP-statistic, and panel ADF-statistic. These statistics pool the autoregressive coefficients across different members for the unit root tests on the estimated residuals.

The second test by Pedroni is based on the between-dimension approach, which includes three statistics. They are group ρ statistic, group PP-statistic, and group ADF-statistic. These statistics are based on estimators that simply average the individually estimated coefficients for each member. Following Pedroni (1999), the heterogeneous panel and heterogeneous group mean panel cointegration statistics are calculated as follows.
Panel υ-statistic:

$$Z_\upsilon = \left(\sum_{i=1}^{N}\sum_{t=1}^{T} \hat{L}_{11i}^{-2}\, \hat{e}_{it-1}^{2}\right)^{-1}$$

Panel ρ-statistic:

$$Z_\rho = \left(\hat{\sigma}^2 \sum_{i=1}^{N}\sum_{t=1}^{T} \hat{L}_{11i}^{-2}\, \hat{e}_{it-1}^{2}\right)^{-1/2} \sum_{i=1}^{N}\sum_{t=1}^{T} \hat{L}_{11i}^{-2}\, (\hat{e}_{it-1}\, \Delta\hat{e}_{it} - \hat{\lambda}_i)$$

Panel ADF-statistic:

$$Z_t^* = \left(\hat{s}^{*2} \sum_{i=1}^{N}\sum_{t=1}^{T} \hat{L}_{11i}^{-2}\, \hat{e}_{it-1}^{*2}\right)^{-1/2} \sum_{i=1}^{N}\sum_{t=1}^{T} \hat{L}_{11i}^{-2}\, \hat{e}_{it-1}^{*}\, \Delta\hat{e}_{it}^{*}$$

Group ρ-statistic:

$$\tilde{Z}_\rho = \sum_{i=1}^{N}\left(\sum_{t=1}^{T} \hat{e}_{it-1}^{2}\right)^{-1} \sum_{t=1}^{T} (\hat{e}_{it-1}\Delta\hat{e}_{it} - \hat{\lambda}_i)$$

Group PP-statistic:

$$\tilde{Z}_t = \sum_{i=1}^{N}\left(\hat{\sigma}^2 \sum_{t=1}^{T} \hat{e}_{it-1}^{2}\right)^{-1/2} \sum_{t=1}^{T} (\hat{e}_{it-1}\Delta\hat{e}_{it} - \hat{\lambda}_i)$$

Group ADF-statistic:

$$\tilde{Z}_t^* = \sum_{i=1}^{N}\left(\sum_{t=1}^{T} \hat{s}_i^{2}\, \hat{e}_{it-1}^{*2}\right)^{-1/2} \sum_{t=1}^{T} (\hat{e}_{it-1}^{*}\Delta\hat{e}_{it}^{*})$$

Here, $\hat{e}_{it}$ is the estimated residual from Eq. (4) and $\hat{L}_{11i}^{2}$ is the estimated long-run covariance matrix for $\Delta\hat{e}_{it}$. Similarly, ${\hat{\sigma}_i}^2$ and ${\hat{s}_i}^2$ $({\hat{s}_i}^{*2})$ are, respectively, the long-run and contemporaneous variances for individual i. The other terms are properly defined in Pedroni (1999) with the appropriate lag length determined by the Newey–West method. All seven tests are distributed as being standard normal asymptotically. This requires a standardisation based on the moments of the underlying Brownian motion function. The panel m-statistic is a one-sided test where large positive values reject the null of no cointegration. The remaining statistics diverge to negative infinitely, which means that large negative values reject the null. The critical values are also tabulated by Pedroni (1999) (Lee, Chien-Chiang, 2005).

In the presence of unit root variables, the effect of superconsistency may not dominate the endogeneity effect of the regressors if OLS is employed. Pedroni (2000) shows how FMOLS can be modified to make an inference in being cointegrated with the heterogeneous dynamic. In the FMOLS setting, non-parametric techniques are exploited to transform the residuals from the cointegration regression and can get rid of nuisance parameters (Lee, Chien-Chiang, 2005).

3. Empirical investigation

We follow an empirical model based on previous works by Ceylan Onay and et al (2008), where we define bank performance, Y_{it} (measured by ratio of bank's pre-tax profits to total assets (ROA) or to its equity (ROE)) for bank i in year t as follows (Ceylan Onay and et al, 2008):

$$Y_{it} = \alpha_0 + \alpha_1 GDP_{it} + \alpha_2 TDD_{it} + \alpha_3 LEND_{it} + \varepsilon_{it} \quad (5)$$

α_0 is a bank fixed effect term that captures time-invariant influences specific to bank i, GDP is real gross domestic production per capita and LEND is average lending rate charged by banks in year t. *IDD is* Total deposits in bank i as a ratio of total assets in year t, total loans of bank i as a ratio of total assets in year t. ε_{it} is a mean zero, constant variance disturbance term. The empirical period depends on the availability of data, where the time period used is 1990–2010. All variables used are in natural logarithms.

Table 1 presents the panel unit root tests. At a 5% significance level, all statistic of the level model confirm that all series have a panel unit root. Using these results, we proceed to test GDP, TDD, LEND, and bank's profitability for cointegration in order to determine if there is a long-run relationship to control for in the econometric specification.

Table 1 – Panel unit root tests

Variable	LL		IPS		Hadri	
	No time effects	Time fixed effects	No time effects	Time fixed effects	No time effects	Time fixed effects
GDP	-2.69	0.90	-1.32	-1.41	6.70	5.00
Y	-2.77	0.85	-1.58	-1.89	6.00	4.45
TDD	-2.29	-2.50	-2.29	-2.48	3.36	3.98
LEND	0.61	2.87	0.87	-1.29	5.56	3.70

Data Source: World Development Indicators (2011)

Where it allows for cointegrating vectors of differing magnitudes between countries, as well as country (α) and time (δ) fixed effects. Table 2 reports the panel cointegration estimation results. For the all statistics significantly we cannot reject the null of no cointegration. Thus, it cannot be seen that the GDP, TDD, LEND, and Y move together in the long run. That is, there is not a long-run steady state relationship between e-banking profitability and other variable for a cross-section of countries. The next step is an estimation of such a relationship.

Table 2- Panel cointegration tests

	No time effects	Time fixed effects
Panel variance	1.12	1.38
Panel ρ	-1.02	0.73
Panel PP	-1.38	-1.01
Panel ADF	-2.04	-2.89
Group ρ	-0.63	1.47
Group PP	-1.12	-1.19
Group ADF	-2.69	-2.79

Statistics are asymptotically distributed as normal. The variance ratio test is right-sided, while the others are left-sided.

Table 3 reports the results of the individual and panel FMOLS. The panel estimators with and without common time dummies are shown at the bottom of the table. The coefficients of EC and K are statistically significant at the 5% level, and the effect is positive as expected by the theory.

Once the four variables are cointegrated, the next step is to implement the Granger causality test. We use a panel-based error correction model to account for the long-run relationship using the two-step procedure from Engle and Granger (1987). The first step is the estimation of the long-run model for Eq. (5) in order to obtain the estimated residuals,

Table 3- Full modified OLS estimates (dependent variable is ratio of bank's pre-tax profits to total assets (ROA))

Country groupings	C	GDP	TDD	LEND
Panel (without time dummies)	0.32 (2.26)	0.62 (4.10)	0.55 (3.22)	-0.032 (-3.26)
Panel (with time dummies)	0.28 (2.88)	0.42 (8.11)	0.36 (5.14)	-0.028 (-5.39)

Data Source: World Development Indicators (2011)

Table 4- Full modified OLS estimates (dependent variable is ratio of bank's pre-tax profits to equity (ROE))

Country groupings	C	GDP	TDD	LEND
Panel (without time dummies)	-2.45 (-3.14)	1.03 (4.55)	2.37 (4.38)	0.47 (6.20)
Panel (with time dummies)	-4.04 (-5.36)	1.13 (3.28)	3.19 (4.76)	0.53 (4.26)

Data Source: World Development Indicators (2011)

The results of our estimations using FNOLS with Common Intercept are available on table 3 and 4. The adoption of online banking does not seem to have a significant impact on the performance of selected countries banks measured in terms of ROA and ROE in the year of adoption. However, we see a significant decrease in the profitability. This could be attributed to the increase in IT expenditures following the adoption of the new technology. Only in the second year following the adoption of the technology, we see a positive coefficient of the variable on the ROE estimation. This indicates that the process is gradual. The sign of the coefficient on the ROA for the same period is also positive but this variable is not significant.

4. Conclusions

This paper employs data on selected Asian countries from 1990 to 2010 to examine the relationship between e-banking profitability and economic growth (GDP) and Total deposit. The panel cointegration and the resulting panel-based error correction models are conducted to answer the question. The full-modified OLS deals with the problem of endogeneity. Our evidence shows results suggesting that there is a short run steady-state relationship between this variable for a cross-section of countries and vice versa.

Previous studies having used time series data may yield unreliable and inconsistent results due to the short time spans of typical datasets. By contrast, this paper applies the new heterogeneous panel cointegration technique to investigate the relationship between this variable across this countries. Internet has changed the dimensions of competition in the retail banking sector by adding a new distribution channel to retail banking. It has also provided opportunities for emerging countries to build up their financial intermediation infrastructure through the leapfrogging effect as recent literature has argued.

In this research we have analyzed the effects of online banking activities on the performance of the banking sector in selected countries. By using panel data from this countries that have adopted internet banking sometime between 1990 and 2010, we have estimated the effect of online banking activities on the three common determinants of bank performance, namely the return on assets and return on equity. Our results provide some evidence that investment in e-banking is a gradual process. The internet banking variable has had a positive effect on the performance of the banking system.

Reference

1. Allen, F., Mcandrews, J. and P. Strahan, 2002, E-finance: An Introduction, Journal of Financial Services Research 22:1/2 5-27.
2. Ceylan Onay, Emre Ozsoz and Aslı Deniz Helvacıoğlu, 2008, "The impact of Internet-Banking on Bank Profitability the Case of Turkey", Oxford Business &Economics Conference Program.
3. Engle, R., Granger, C., 1987. Cointegration and error correction: representation, estimation, and testing. Econometrica 55, 257– 276.
4. Furst, K., Lang, W.W. and D.E. Nolle, 2002. Internet Banking, Journal of Financial Services Research, 22:1/2 95-117.
5. Hadri, K., 2000. Testing for stationarity in heterogeneous panel data. Econometrics Journal 3, 148– 161.
6. Im, K.S., Pesaran, M.H., Shin, Y., 1997. Testing for unit roots in heterogeneous panels. Working paper. University of Cambridge.
7. Johansen, S., 1988. Statistical analysis of cointegration vectors. Journal of Economic Dynamics and Control 12, 231– 254.
8. Lee, Chien-Chiang, 2005. "Energy consumption and GDP in developing countries: A cointegrated panel analysis," Energy Economics, Elsevier, vol. 27(3), pp. 415-427.
9. Levine, A., Lin, C.F., 1993. Unit root tests in panel data: asymptotic and finite sample properties, working paper. Department of Economics, University of California at San Diego.

10. Menson Auta, Elisha, 2010, "E-banking in developing economy: empirical evidence from Nigeria", Journal of Applied Quantitative Methods, Vol. 5 (2), pp. 212-222.
11. Newey, W., West, K., 1987. A simple positive semi-definite, heteroskedasticity and autocorrelation consistent covariance matrix. Econometrica 69 (6), 1519– 1554.
12. Pedroni, P., 1999. Critical values for cointegration tests in heterogeneous panels with multiple regressors. Oxford Bulletin of Economics and Statistics 61, 653– 670.
13. Pedroni, P., 2000. Full modified OLS for heterogeneous cointegrated panels. Nonstationary Panels Panel Cointegration and Dynamic Panels, Advances in Econometrics, vol. 15. JAI Press, pp. 93–130.
14. Pierse, R.G., Shell, A.J., 1995. Temporal aggregation and the power of tests for unit root. Journal of Econometrics 65, 335–345.
15. Simpson, J., 2002. The Impact of the Internet in Banking: Observations and Evidence from Developed and Emerging Markets. Telematics and Informatics, 19, pp. 315-330.
16. Sullivan, Richard J., 2000. How has the adoption of Internet banking affected performance and risk at banks? A look at Internet banking in the tenth Federal Reserve district,'' Federal Reserve Bank of Kansas City. Financial Industry Perspectives (December), 1–16.
17. World Bank, 2011, Development Challenges in the New Century Washington DC, the World Bank.

This academic article was published by The International Institute for Science, Technology and Education (IISTE). The IISTE is a pioneer in the Open Access Publishing service based in the U.S. and Europe. The aim of the institute is Accelerating Global Knowledge Sharing.

More information about the publisher can be found in the IISTE's homepage:
http://www.iiste.org

CALL FOR PAPERS

The IISTE is currently hosting more than 30 peer-reviewed academic journals and collaborating with academic institutions around the world. There's no deadline for submission. **Prospective authors of IISTE journals can find the submission instruction on the following page:** http://www.iiste.org/Journals/

The IISTE editorial team promises to the review and publish all the qualified submissions in a **fast** manner. All the journals articles are available online to the readers all over the world without financial, legal, or technical barriers other than those inseparable from gaining access to the internet itself. Printed version of the journals is also available upon request of readers and authors.

IISTE Knowledge Sharing Partners

EBSCO, Index Copernicus, Ulrich's Periodicals Directory, JournalTOCS, PKP Open Archives Harvester, Bielefeld Academic Search Engine, Elektronische Zeitschriftenbibliothek EZB, Open J-Gate, OCLC WorldCat, Universe Digtial Library , NewJour, Google Scholar