Eurasian Academy of Sciences
Eurasian Econometrics, Statistics & Emprical Economics Journal
2017 Volume:6 S: 74 - 88
Published Online January 2017 (http://econstat.eurasianacademy.org)
http://dx.doi.org/10.17740/eas.stat.2017-V6-05

Long-term Relationship Between Internet Banking and Bank Performance in Europe

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ABSTRACT

In this study, long-term interactions are investigated between internet banking and bank profitability performance. Pedroni cointegration tests and then estimations of the error correction model are made for the data from 2005 to 2014 for the European Union countries. ROA and ROE ratios are taken into account as a bank performance criteria. Analysis has not only been limited to the entire sample, but also the two sub-samples were analyzed as Euro Area countries and member countries outside it. The findings of previous similar studies have shown that short-term interaction between bank profitability and internet banking in Europe. The conclusion of this study is the relationship between long-term profitability of banks and internet banking have shown that only exist in EU countries outside the euro area. Lack of long-term impact on the profitability can be considered as reasonable for the Euro Area counries internet banking markete had reached a certain maturity because of advanced economical and financial structures. However, profitability on a long-term equilibrium relationship is not surprising in consequence of internet banking market is under development in the union members outside the euro area except for Denmark, Britain and Sweden.

Keywords: Internet banking, bank performance, panel cointegration tests, error correction

JEL Classifications: C23, G21

Avrupa Birliği'nde Internet Bankacılığı ve Banka Performansı Arasındaki Uzun Dönem İlişkiler

Öz

Bu çalışmada internet bankacılığı ile banka karlılık performansı arasındaki uzun dönemli etkileşimler araştırılmıştır. Analizlerde Avrupa Birliği ülkelerinin 2005-2014 dönemini kapsayan verileri kullanılmış ve Pedroni eşbütünleşme testleri ardından da hata düzeltme modeli tahminleri yapılmıştır. Banka performans ölçütleri olarak ROA ve ROE oranları dikkate alınmıştır. Analizler bütün örneklemle sınırlı tutulmamış, Euro Area ülkeleri ve bunun

dışındaki üye ülkeler olarak iki alt örneklem de analiz edilmiştir. Daha önceki benzer çalışmaların bulguları, Avrupa ülkelerinde banka karlılığı ve internet bankacılığı arasında kısa dönemli etkileşimler olduğunu göstermiştir. Bu çalışmada ulaşılan bulgular ise, banka karlılığı ve internet bankacılığı arasında uzun dönemli ilişkinin sadece Euro Alanı dışındaki AB üyesi ülkelerde mevcut olduğunu göstermiştir. Ekonomik ve finansal yapıları daha gelişmiş olan Euro Alanına dahil ülkelerde internet bankacılığı piyasası belirli bir olgunluğa ulaştığından banka karlılığına uzun dönemli etkilerinin olmaması doğal görülebilir. Buna karşın Danimarka, İngiltere ve İsveç haricinde Euro Alanı dışındaki birlik üyeleri için internet bankacılığı piyasası gelişme aşamasındadır ve bu nedenle karlılıkla uzun dönemli bir denge ilişkisi gözlenmesi şaşırtıcı değildir.

Anahtar Kelimeler: Internet bankacılığı, banka performansı, panel eşbütünleşme testleri ve hata düzeltme

1. Introduction

The most important driving forces of internet banking applications are contemporary urban life and the widespread adoption of it. Both technological progress and improving infrastructure as long as socio-cultural development have increased people's demand for electronic-based services. Banking is also strongly affected by these developments. The characteristics of bank customer vary everyday. The customers living in urban and having active business demand form banks are varying. Internet banking is an ideal distribution channel for bank customers who want to access services without location on the twenty four hour basis. On the other hand, the expansion of trade over the internet, people's secure payment system for virtual shopping and in this sense are another factor that increases the demand for online banking services.

The tendency of banks to the internet banking has three basic factors such as cost advantages, high profitability and low risk. Studies show that the initial setup costs of internet banking investment will be provided and realized profits in the short time if there is enough demand for internet banking. Empirical studies on various countries reveal that internet banking increases performance of the bank. Internet banking provides significant advantages to banks as well as customers' demand has played a very important role in spreading of internet. However, expected results have not been derived in some less developed and developing countries need both infrastructure investment has not been done enough and customers tendency to traditional branch-based banking in excessively. Cyber security is another important factor in the process of the development of internet banking. In generally, the demands of costumers using internet banking are not as high as expected level because of security concerns in countries troubled with internet infrastructure.

In this study, proceeding from this assessment, long-term relations between internet banking and bank profitability performance has been investigated for the European Union countries of 28. In the application of this study, we used sectoral data because of that can not be accessed internet activity data in some countries. Thus, it is targeted to reach more accurate conclusions. Pedroni panel cointegration tests analysis and dynamic error correction model were used as analysis methods.

2. Literature Review

The number of studies related with the impacts of Internet banking on bank performance has been increasing. Important part of various studies on the effects internet banking on the performance of banks consider the applications in developed and developing countries. Some of the research has done so far by Sullivan (2000), DeYoung (2001), Hasan (2002), Pigni et al. (2002), Kagan (2005), Alam et al. (2007), Arnaboldi & Claeys (2008), Malhotra & Singh (2006, 2007 ve 2009), Ciciretti et al. (2009), Weigelt & Sarkar (2012), Gutu (2014), Stoica et al. (2015), Tunay et al. (2015).

Except for Arnaboldi & Claeys'n (2008), all of the studies listed are related with a single country and its banking system of the country. The Arnaboldi and Claeys compare conventional banking with internet banking in Finland, Spain, Italy and the UK practices. It is showed that internet banking is more contribution to the performance of the bank when compared to traditional branch banking and improve competition in the sector.

Hasan (2002), Pigni et al. (2002) and Ciciretti et al. (2009) works based on Italy banking system gave similar results as Arnaboldi & Claeys (2008). ROA, ROE, commission and fee income and stock returns are affected positively the internet banking activity (Hasan, 2002, was Ciciret et al., 2009). There is a significant relationship between internet banking and operational risks. In addition, internet banking reducing impaired loans of banks and risk of volatility of stock returns (Hassan, 2002). On the other hand, the banks are described as innovative bank, whose costs are below the industry average, which used internet banking and other electronic banking applications (Pigni et al., 2002).

Both Stoica et al. (2015) and Tunay et al. (2015) are the researchers analyzed the effects of the bank's internet banking performance in emerging and developed economies in Europe. The modernization of the banking sector in the new member countries of the European Union has become a major trend. In this context, it holds an important place in internet banking services. Stoica etc. (2015) study conducted on Romania demonstrated that internet banking increased the banks' activity level increased performance. Tunay et al. (2015) that performed the analysis with panel casuality tests investigated the relationships between profitability performance and internet banking in European countries. The sample is divided into two sub-samples in the form of Euro Area and other countries. It was determined to be a strong mutual relationship between internet banking and bank performance in both euro area countries as well as the whole sample. However, it is not determined that strong interactions for other European countries. When the whole sample considered, It is observed mutual relationship of the dominant influence of the euro area countries as a result of the conclusion.

Generaly findings concerning developing countries are consistent with those obtained from developed countries. Findings that Dinh et al. (2015) on Vietnam, Muirur and Ngari (2014), Combi and Wafula's (2015) on Kenya and Ngango et al. (2015) on Rwanda shows that internet banking applications promote profitability by both increase bank earnings and reducing operating costs. This process of raising the competitiveness of the banks increases the overall service quality of the services provided over the Internet but also has a strong indirect effect. In this context, it is also important that ensuring cyber security besides strengthening of Internet infrastructure and banking transactions. For example, Ngango et al. (2015), indicated the importance of the effects of internet banking on the bank's performance may contribute to effective and efficient service for users.

Alam et al., (2007), Khrawish & Al-Sadi (2011), Hosein (2013) and Gutu 's (2014) studies showed that internet banking of high infrastructure costs in some developing countries, lack of sufficient number of customers adversely affect the profitability of banks. Gutu (2014) even determined that banks position did not changed inspite of depositing on higher advertising budget for internet banking. This shows us that customers still demand the traditional branch-based banking services in these countries. Therefore, the expected cost reduction still could not be provided and profitability of electronic banking services are adversely affected. Internet infrastructure based on relatively old technology can prevent to reach the expected performance for banks in developing countries (Alam et al. 2007, Gut 2014).

It has been observed that internet banking activities has been mostly done by large banks in some developing countries(Malhotra ve Singh, 2006, 2009). It is also observed that less expenses fulfilled to fixed assets, high deposit volume and less branches of large-scale private banks tended to internet banking and generally aimed to increase low market share. On the other hand, banks accelerate to tendency to internet banking when rivals start internet banking (Malhotra and Singh, 2007).

Internet banking is to make increase the asset quality of banks and affect directly ROA performance (Kagan et al., 2005). On the other hand, there are also strong indirect effects on profitability through cost. Internet banking and other electronic banking services decrease average operational costs on banks tolerating physical overhead expenses (DeYoung, 2001). Here is the great importance of the electronic infrastructure used by banks. The more developed infrastructure falls cost per transaction and increases profitability. However, it is also been implicated that the level of education of the customer and the bank's website functionality play a role in the success of internet banking services. High level educated customer demand is higher than the ordinary bank customers for internet banking services (Sullivan, 2000). If the number of bank customers using internet and other electronic banking services is not increased, the costs of such services for the bank profitability will be low.

Results of empirical studies indicate that investing in internet banking usually have a positive effect on the profitability of banks through various channels. However, Onay et al. (2008) study show that such effects can be observed via delayed on Turkey. On the other hand, Weigelt & Sarkar (2012) showed that the technological innovation stage is gradually increase for companies used outsourcing, emphasizing the importance of how to improve the efficiency increasing the effectiveness of the provision of resources out of the bank for online banking. But, increasing the level of technology coordinates coping efficiency and adaptability in a dilemma caused trade-off. Banks are required to reflect technological developments and services with changing customer needs. Also customers accustomed to new technological products takes time. In this context, it is important to design and present of the product.

3. Methodology

3.1 Research Goal

In this study, We will firstly investigate internet banking and bank performance based on ROA and ROE by using Pedroni panel cointegration test. Then we will describe which error correction model can be used to analyze the short and long term relationship.

Pedroni (2004), method contains a series of different test statistics about the absence of co-integration in heterogeneous panel. The first group tests are called “dimension inside". These are panel-v, panel rho (r) tests with Phillips and Peron tests consist of similar to the panel non-parametric test (pp) and parametric panel Augmented Dickey-Fuller (adf) statistics. Panel parametric and panel non-parametric statistics are, similar to the same one ADF test equation. Another group of tests are used for analysis in "between dimensions" . They are also similar to the average panel test group developed by Im et al. (2003) and consist of group-rho and group-pp such as group-ADF. The seven Pedroni tests are estimated from the following long-term model of the ruins:

$$y_{it} = \alpha_i + \sum_{j=1}^{m} \beta_{ij} X_{ij} + \varepsilon_{it} \qquad (1)$$

where, y_{it} is dependent variable, X_{ij} vector of explanatory variables and ε_{it} is the residuals of the panel regression. The null hypothesis test whether ρ_i is unit or not in the following equation:

$$\varepsilon_{it} = \rho_i \varepsilon_{i(t-1)} + w_{it} \qquad (2)$$

All statistics are considered to be normally distributed in the Pedroni test. Statistics can be compared with the appropriate critical values and if the critical values are exceeded the critical values, the null hypothesis is rejected as the absence of co-integration. In other words, it gives the proof that they are cointegrated variables and has a long-term relationship between them. The Pedroni method, tests for the presence of long-term relationship between variables, but it does not show the direction of the relationship between variables, i.e., casuality (Moudatso and Kyrkilis, 2009).

If the analyzed variables are I(1) and cointegrated (cointegrated), the error term of the model is the process I(0) for all i. Cointegrated variables react to long-run equilibrium deviations. Therefore, an error correction model is required because of short-term dynamics of the variables in the system is affected by the deviation from equilibrium. This model can be represented/stated as follows (Blackburn and Frank, 2007):

$$\Delta y_{it} = \phi_i (y_{i,t-1} - \theta_i' X_{it}) + \sum_{j=1}^{p-1} \lambda_{ij}^{*} \Delta y_{i,t-j} + \sum_{j=0}^{q-1} \delta_{ij}'^{*} \Delta X_{i,t-j} + \mu_i + \varepsilon_{it} \quad (3)$$

In the equation (3) is $\phi_i = -(1 - \sum_{j=1}^{p} \lambda_{ij})$, $\theta_i = \sum_{j=0}^{q} \delta_{ij} / (1 - \sum_k \lambda_{ik})$, $\lambda_{ij}^{*} = -\sum_{m=j+1}^{p} \lambda_{im}$ (j =1,2, …, p-1), $\delta_{ij}'^{*} = -\sum_{m=j+1}^{q} \delta_{im}$ (j =1,2, …, q-1). The parameter ϕ_i is the speed of adjustment error-correction term. If ϕ_i = 0, then there is no evidence of a long-term relationship. To be able to state about the parameter has long-term balance relationship where the parameter is expected to be negative and significant and the vector θ'_i shows long-term relationships between variables.

The analyzed sample of panel sizes in both time and greater variety of approaches are recommended in the estimation of dynamic heterogeneous panel. Three of them stand out. The first one is the dynamic fixed effects / DFA approach. In this method, the time series of each group was pooled and allowed to vary only between the two groups fixed. If the slope coefficients are not identical, DFE produces inconsistent and potentially misleading results.

The second approach is Pesaran and Smith (1995) estimator developed by the MG. The estimator of the individual regression coefficients estimated for each group and is based on taking the simple arithmetic average. Thirdly, the Pesaran, Shin and Smith (1997, 1999) developed the estimator PMG. This estimator considers both pooling and averaging. It is allowed only changing the short-term factor and not to long-term coefficients under the assumption of the unit. ML estimator used when the parameters are non-linear (Pesaran, Shan and Smith, 1999).

3.2. Sample

In the study, 28 advanced and emerging European countries are discussed. The names of these countries are presented in Table A.1 in the appendix of the study. Each cross-section of the panel data set consists of annual data considered countries for the 2005-2014 period. Total number of observations is 840. Internet banking utilization data is per capita rate (%) compiled from Eurostat, e-Commerce and e-Banking Statistics. The performance data are aggregated banking ROA and ROE ratios of the countries concerned from the IMF Financial Soundness Indicators. In this study, both the full sample as well as the Euro Area countries and the countries outside of the two sub-samples that were analyzed separately. Descriptive statistics on the main and sub-sample is presented in Table 1.

When descriptive statistics are taken in to consider, none of these variables having normality. ROA and ROE corresponds to the left distorted and distribution structure is quite steep, Int_Bnk has skewed slightly to the right and a relatively flat distribution.

Table 1. Descriptive Statistics

	Int_Bnk	ROA	ROE
Mean	33.818	0.450	6.955
Median	30.500	0.600	9.630
Maximum	86.000	3.510	33.330
Minimum	0.000	-9.520	-97.620
Std. Dev.	22.863	1.266	15.088
Skewness	0.458	-3.323	-2.753
Kurtosis	2.270	22.241	15.140
Jarque-Bera	15.994 [0.000]	4834.716 [0.000]	2073.109 [0.000]

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Table 2. Panel Unit-root Tests

		Int_Bnk			ROA			ROE		
Whole Sample		Statistic	Prob.*	Lag**	Statistic	Prob.*	Lag**	Statistic	Prob.*	Lag**
Level	Im, Pesaran and Shin W-stat	-2.4964	0.0063	1	-1.41225	0.0789	1	-0.2969	0.3833	1
	Hadri Z-stat	9.6950	0.0000		3.1694	0.0008		3.6622	0.0001	
1st Diff.	Im, Pesaran and Shin W-stat	-10.1828	0.0000	1	-8.2999	0.0000	1	-3.4180	0.0003	1
	Hadri Z-stat	3.5142	0.0002		17.4517	0.0000		9.1038	0.0000	
Euro Area										
Level	Im, Pesaran and Shin W-stat	-3.5505	0.0002	1	-1.1698	0.1210	1	-0.7113	0.2384	1
	Hadri Z-stat	8.2924	0.0000		2.7749	0.0028		3.7043	0.0001	
1st Diff.	Im, Pesaran and Shin W-stat	-3.1066	0.0009	1	-3.4722	0.0003	1	-3.7545	0.0001	1
	Hadri Z-stat	5.3658	0.0000		4.4992	0.0000		3.4749	0.0003	
Other EU Members										
Level	Im, Pesaran and Shin W-stat	0.8367	0.7986	1	-0.7912	0.2144	1	0.5405	0.7056	1
	Hadri Z-stat	5.4155	0.0000		5.2097	0.0000		5.0430	0.0000	
1st Diff.	Im, Pesaran and Shin W-stat	-2.3937	0.0069	1	-3.4959	0.0002	1	-3.2788	0.0005	1
	Hadri Z-stat	5.7744	0.0000		4.3543	0.0000		4.4185	0.0000	

(*) Probabilities are computed assuming asympotic normality.

(**) Lag length selection based on Schwarz information criterion.

Table 3. Pedroni Tests

	ROA and Int_Bnk				ROE and Int_Bnk				ROA, ROE and Int_Bnk			
	Statistic	Prob.	Weighted Stat.	Prob.	Statistic	Prob.	Weighted Stat.	Prob.	Statistic	Prob.	Weighted Stat.	Prob.
Panel v-Statistic *	-1.0145	0.8448	5.0542	0.0000	-1.3210	0.9067	3.7101	0.0001	-1.8433	0.9674	2.8663	0.0021
Panel rho-Statistic *	1.4666	0.9288	1.3008	0.9033	1.4856	0.9313	1.6777	0.9533	1.9008	0.9713	2.0227	0.9784
Panel PP-Statistic *	-7.7204	0.0000	-3.8300	0.0001	-7.4501	0.0000	-2.5102	0.0060	-12.8552	0.0000	-4.0828	0.0000
Panel ADF-Statistic *	-4.3801	0.0000	-3.3734	0.0004	-4.3020	0.0000	-2.4011	0.0082	-5.1487	0.0000	-2.9773	0.0015
Group rho-Statistic **	2.1073	0.9825			2.3996	0.9918			3.1285	0.9991		
Group PP-Statistic **	-5.1189	0.0000			-4.0510	0.0000			-7.8416	0.0000		
Group ADF-Statistic **	-2.5678	0.0051			-2.1337	0.0164			-2.4202	0.0078		
Lags ***	1				1				0			

(*) Ha: common AR coefs. (within-dimension).
(**) Ha: individual AR coefs. (between-dimension).
(***) Lag length selection based on Schwarz information criterion.

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3.3. Findings

The first step in the analysis, both sub-sampling and whole sampling of the variables was investigated in terms of stationary by panel unit root tests. However, the number of cross-sectional dimension of time for whole sampling and sub-sampling containing Euro area countries .and in the sampling, Im, Pesaran ve Shin (2003) ve Hadri (2000) tests are applied the sampling which two dimensions are close in sizes for other EU countires. Test results showed that all three variables for the whole sample and the sub-sample including the euro area countries is stable at lower levels. However, any variable isvnot stationary in levels for the sample containing other EU member states. They become stationary when taken in first difference.

In the second stage of analysis , long-run equilibrium relationship was investigated.by Pedroni tests. Tests applied to variable pairs as well as all of the variables. Assuming a strong effect on the unit and time in the sampling pattern constant and trend are added to model. Test results are presented in Table 3. Alternative results are quite consistent. The variables are co-integrated for all tests except for Panel Rho and group Rho. ROA and ROE performance criteria are related to the long term for internet banking in EU countries outside the Euro area.

So the long-term parameters can be estimated. However Tunay et al. (2015) showed the presence of bilateral relations in the short term in respect between bank profitability and internet banking for Europe for a similar sample. Therefore, the estimation of the combination of long and short term parameter would be more appropriate. For this purpose, error correction model in Eq (3) is estimated for our variables. ROE and ROA individually modeled, Int_Bnk is used as mainly explanatory variable in both models. DFE, MG and PMG estimators are used for error correction. The estimation results are presented in Table 4. Different festimators yielded similar results. But the significance of the coefficient is very low, except for the PMG estimator. Using the Hausman tests are applied to define which estimation is valuable and the PMG estimator is defined as more effective than the alternative estimator (Blackburn and Frank, 2007).

The error correction parameter it is negative and significant as expected for the model that ROA taken as the dependent variable. This parameter has a very high value, such as -0.5514, and the imbalance can be expected as 55% in the future. Approach to long-term equilibrium rate is quite high and long-term parameter which show the Interbank banking is also significant. Bu, all these parameters taken as negative and extremely small values of -0.0027. Short-term parameter is not significant. The results are similar fort he model which dependent variable as ROE. Only long-term parameter reflecting attunement rate (-0.6420) is much higher. The long-term impact on the profitability of Internet banking based on ROE still negative, but it is much higher than that of the original model. There was no significant effect in the short term in this model.

Table 4. Error-Corection Model Results

	DFE			MG			PMG		
	Coeff.	z test		Coeff.	z test		Coeff.	z test	
ROA									
int_bnk	-0.011	-0.510		0.014	0.100		-0.003	-1.750	*
EC	-0.276	-2.440	**	-0.925	-5.140	***	-0.551	-3.570	***
D(int_bnk)	-0.001	-0.200		0.061	0.970		0.045	0.810	
Constant	0.200	0.810		1.520	3.020	***	0.435	1.860	*
Hausman Test:									
Chi Square		1.8700	1		0.0001	2			
		[0.1716]			[0.9626]				
ROE									
int_bnk	-0.203	-1.050		-1.198	-1.780	*	-0.228	-7.730	***
EC	-0.421	-3.570	***	-0.899	-6.610	***	-0.642	-4.220	***
D(int_bnk)	-0.018	-0.190		0.385	0.620		0.386	0.630	
Constant	5.575	1.560		23.034	3.680	***	13.390	2.510	**
Hausman Test:									
Chi Square		0.0001	1		0.9200	2			
		[0.9659]			[0.3386]				

(***), (**), (*) shows that 1%, 5% and 10% significant z tests, respectively.

(1) PMG is efficient estimation than DFE under null hypothesis.

(2) PMG is efficient estimation than MG under null hypothesis.

Internet banking is also very small negative effect of making the banks even if connected to the negative impact of the height of the Internet infrastructure maintenance and development costs on long-term profits in models. In both models lack of significant short-term parameter indicates that only valid fot long-term effects. The results are considered non-EU developed countries such as England, Sweden, and Denmark and emerging economies. It is obstacle/prevent long-term profitability to observe the relationship between internet banking that structural economic differences of these countries.

4. Conclusion

In this study, short and long-term relationships have been investigated based on the performance of bank's profitability and Internet banking for the 28 members of the European Union countries. Analyses were performed for the years 2005-2014 for those countries. The sample is carried out as a whole, both within and without the country, including the euro area within the framework of two subsample. All samples and including variables Euro zone are stationary in level, has concluded that the absence of a long-run equilibrium relationship. For this reason, the panel cointegration tests were only applied the countries not including Euro area in EU. Later, the long and short term relationships were investigated by using dynamic error correction model.

The empirical results clearly shows that to be a long-term equilibrium relationship between the rate of use of Internet banking services and bank profitability (ROA and ROE). The nature of this relationship was investigated by error correction models. The findings showed that a possible disequilibrium revealed in the following period and it would be a quick convergence to long-run equilibrium with approximately 54% to 64%. However, in alternative models has been observed that the use of internet banking negatively affects profitability. This effect may be linked to the presence of countries at different levels of economic development in the analyzed sub-samples. However it is another important reason which the high maintain and develop costs of internet infrastructure of banks that are forced to keep pace with rapid changes in technology and competition.

When the results are evaluated collectively, the long-term relationship between profitability and internet banking not observed in the more developed members of EU. Although widely used internet banking in developed countries, the contribution to profitability of the internet banking can be observed in a very short period of acceptable long term because of market saturation. However, internet banking market in the developing countries such as majority of EU members of outside the Euro zone is relatively unsaturated. If it increases investments such a market and expands the customer base, the bank profits will natural that affected by this process in long-run.

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Annex

Table A.1. Countries in The Sample

Austria	Italy
Belgium	Latvia
Bulgaria	Lithuania
Croatia	Luxembourg
Cyprus	Malta
Czech Republic	Netherlands
Denmark	Norway
Estonia	Poland
Finland	Portugal
France	Romania
Germany	Slovakia
Greece	Slovenia
Hungary	Spain
Ireland	Sweden