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FORECASTING OF CUSTOMERS' RETENTION IN TERMS OF MERGER AND ACQUISITION PROCESSES OF EGYPTIAN BANKS USING PANEL DATA TECHNIQUES

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Abstract

This paper aims at analyzing the response of banks' customers, due to changes of banking market structure, where many of these customers may switch their banks, and this is why, determinants of these decisions should be elaborated. In this study, the sample contains 6 cases, out of 20 cases of merger and acquisition processes (M&As) between Egyptian banks, during the period from the beginning of 2005 to the end of 2010.

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Using Panel Data with random effects model, we could reject hypotheses regarding the effects of “Change in No. of Services” “Change in No. of Branches”, “Change in Bank Deposits”, and “Change in Bank Loans” on “Customers’ Retention”. *p*-value, Wu-Hausman test, Likelihood Ratio test and Breusch-Pagan test justify these results.

1. Introduction

Capital adequacy has been related to risk, for the extent, that makes us see that the function of capital in banks is to absorb banking operations risks. As the nature of banks is related to financial intermediation, the risks of related firms affect banks. This means that banks have, not only their risks, but also risks of other firms.

In the early seventies of the last century, many banks had been bankrupt, and many others had not acceptable levels of capital adequacy. For these reasons, “Basle Committee” aimed to develop a unified standard for measuring bank capital adequacy. The committee determined the components of the ratio, where its numerator includes core capital and supplementary capital, and its dominator includes 4 categories representing 4 levels of risk (Sinkey [18, p. 271]). It seems that the first ratio issued in 1988 has not been sensitive to banking risks, even after modification of 1998. This leads to preparing a new ratio called “*Basle*2”, which includes 3 major dimensions: the first is the minimum requirements of capital, the second is the auditing control, and the third is market discipline (Saunders and Cornett [15, p. 524]; Pujal [14, pp. 36-39]).

Locally, the law no. 37 for year 1992 required that bank issued capital should be L.E. 100 million as a minimum. Finally, the unified bank law for year 2003 noted it should be L.E. 500 million as a minimum. In the early nineties of the last century, the number of banks was 59 and it is reduced to be 42 at the end of the last century. By other M&As processes, it turned to be 32 at the end of 2010.

This paper aims at analyzing the response of banks’ customers, due to changes of banking market structure, where many of these customers may

switch their banks, and this is why, determinants of these decisions should be elaborated. Research problem could be summarized as follows:

- Is there a significant impact of "bank size" on the decision of bank selection, and consequently, "banking customers' loyalty" due to changes in Egyptian banking market structure?
- Is there a significant impact of "number of bank branches" on the decision of bank selection, and consequently, "banking customers' loyalty" due to changes in Egyptian banking market structure?
- Is there a significant impact of "number of bank services" on the decision of bank selection, and consequently, "banking customers' loyalty" due to changes in Egyptian banking market structure?

Determinants of "banking customers' loyalty', to be examined, are "bank size", "number of bank branches" and "number of bank services". Elaborating determinants of "banking customers' loyalty" are important for banks' administration, to take actions that could enhance loyalty, according to the suggested model.

After this introduction, Section 2 reviews research literature. Section 3 is for developing variables and hypotheses. Section 4 explains the suggested model and illustrates related tests. Section 5 is for empirical work, presenting results and discussing how these results answer research questions. Section 6 summarizes the paper and provides brief conclusions.

2. Literature Review

In this section, we try to present some of previous work, which has been conducted in the field of "banking customers' loyalty" during the new millennium.

McDougall and Levesque [13] introduced core service quality and relational quality as well as perceived value as the drivers of customer satisfaction. Some researchers considered satisfaction as an antecedent of service loyalty. Caruana [5] argued that overall satisfaction with an experience does lead to customer loyalty. It is apparent that high customer

satisfaction should indicate increased loyalty for current customers. This means more customers will repurchase (be retained) in the future.

The concept of brand loyalty also extends from goods to services, where service loyalty can be defined as: “Service loyalty refers the degree to which a customer exhibits repeat purchasing behavior from a service provider, possesses a positive attitudinal disposition toward the provider, and considers using only this provider when a need for this service arises” (Caruana [5, p. 813]).

Shamsuddoha and Alamgir [16] addressed two basic questions, where the first concerns with determining the relationship between satisfaction and loyalty in retail banking, and the second with determining the role of dimensions of service quality towards satisfaction. The findings reveal that satisfaction and loyalty are related to each other. Moreover, satisfaction has a positive and direct impact on loyalty in retail banking. The study reveals that individual indicator of quality dimensions has great impact on satisfaction. The main conclusions can be summed up as: (1) satisfaction is the most important determinant of customer loyalty in retail banking sector and there exists a positive relationship between them; (2) service quality dimensions are the important antecedents of satisfaction.

Afsar et al. [1] attempted to find the factors affecting customer loyalty as applied on banking industry in Pakistan. Using a questionnaire based on the data which is gained from the 316 respondents’ answers the results shows that received quality, satisfaction, trust, switching cost and commitment are the factors which influence the loyalty of the customers. Theses factors also influence each other as well. Shergill and Bing [17] defined switching costs, as the technical, financial or psychological factors which make it difficult or expensive for a customer to change brand. Chaudhuri and Holbrook [6] defined brand trust as the customer’s willingness to rely on the ability of the brand to perform its stated function.

The evaluation of banking channels of distribution is, to a great extent, an evaluation of banking technological innovations. Branches remain the major delivering vehicle of banking services (Soteriou and Zenios [19, p. 4]).

Berger and DeYoung [4] assessed the effects of geographic expansion on bank efficiency, for 7000 U. S. banks, over the period 1993-1998. The results imply that there may be no particular optimal geographic scope for banks. Also, Akhavein et al. [2] found that the number of branches and size are positively related to the diffusion (i.e., probability and timing) of the adoption of new technology by its "first movers". Soteriou and Zenios [19] indicated that analyzing banks' efficiency should include branches, service quality, operations, and profitability, simultaneously.

Gayed and Alber [8] used a sample of 14 Egyptian banks (out of 33 banks) at the end of June 2010. Tests indicated accepting hypotheses regarding the effects of "credit interest rate", "debit interest rate" and "number of tellers" on "Retention of New Customers" of Egyptian banks. Also, they refer to the need to reject the effects of "bank age", "number of services", "number of branches", "number of ATMs" and "budget of salaries".

To our knowledge, there is no scientific effort used "Panel Data" technique to estimate bank customers' retention, and this is why this paper is different from previous work in this area of research.

3. Research Variables and Hypothesis

Research variables

Research variables represent banks customers' retention and its assumed determinants, which could be calculated as follows:

Table 1. Banks customers' retention and its determinants

Customers Retention	Y	Retained Customers/All Customers
Change in Bank Equity	X_1	Change in Equity/Equity before M&As
Change in Bank Assets	X_2	Change in Assets/Assets before M&As
Change in Bank Deposits	X_3	Change in Deposits/Deposits before M&As

Change in Bank Loans	X_4	Change in Loans/Loans before M&As
Change in No. of Branches	X_5	Change in No. of Branches/No. of Branches before M&As
Change in No. of Services	X_6	Change in No. of Services/No. of Services before M&As

Research hypothesis

This research aims at testing the following hypotheses:

- There is no significant effect of “bank equity” on “banking customers’ loyalty”.
- There is no significant effect of “bank assets” on “banking customers’ loyalty”.
- There is no significant effect of “bank deposits” on “banking customers’ loyalty”.
- There is no significant effect of “bank loans” on “banking customers’ loyalty”.
- There is no significant effect of “bank branches” on “banking customers’ loyalty”.
- There is no significant effect of “bank services” on “banking customers’ loyalty”.

4. Statistical Technique

In this section, we try to illustrate the Panel Data Model (which takes the form of the fixed or random effects model), discuss the main techniques used to test these models and develop the Research Hypothesis.

Within the social sciences, panel analysis has enabled researchers to undertake longitudinal analyses in a wide variety of fields. With repeated observations of enough cross-sections, panel analysis permits the researcher to study the dynamics of change with short time series. The combination of time series with cross-sections can enhance the quality and quantity of data

in ways that would be impossible using only one of these two dimensions (Gujarati [11]).

Panel analysis can provide a rich and powerful analysis, if one is willing to consider both the space and time dimensions. There are several types of panel data analytic models, like fixed effects models, and random effects models. Solutions to problems of heteroscedasticity and autocorrelation are of interest here.

(1) The fixed effects model

One type of panel model has constant coefficients, referring to both intercepts and slopes. Another type of panel model would have constant slopes but intercepts that differ according to the cross-sectional unit. These models are called *fixed effects models*.

Another type of fixed effects model could have constant slopes but intercepts that differ according to time. In this case, the model would have no significant space differences but might have autocorrelation owing to time-lagged temporal effects. The residuals of this kind of model may have autocorrelation in the process. In this case, the variables are homogeneous across the spaces. Another type of fixed effects model has differential intercepts and slopes. This kind of model has intercepts and slopes that both vary according to the space (Yaffee [21]).

Because fixed effects estimators depend only on deviations from their group means, they are sometimes referred to as within-groups estimators. If the cross-sectional effects are correlated with the regressors, then the cross-sectional effects will be correlated with the group means. Ordinary least squares estimation on the pooled sample would be inconsistent, even though the within-groups estimator would be consistent. If, however, the fixed effects are uncorrelated with the regressors, then the within-groups estimator will not be efficient. If there is only variation between the group means, then it would be permissible to use the between-groups estimator, but this would inconsistent if the cross-sectional errors are correlated with the group means of the regressors (Davidson and MacKinnon [7]).

Fixed effects models are not without their drawbacks. The fixed effects models may frequently have too many cross-sectional units of observations requiring too many dummy variables for their specification. Too many dummy variables may sap the model of sufficient number of degrees of freedom for adequately powerful statistical tests. Moreover, a model with many such variables may be plagued with multicollinearity, which increases the standard errors and thereby drains the model of statistical power to test parameters. If these models contain variables that do not vary within the groups, then parameter estimation may be precluded.

The Fixed Effects Model could be expressed as follows:

$$Y_{it} = B_0 + B_1 X_{1it} + B_2 X_{2it} + \cdots + B_k X_{kit} + a_i + u_{it},$$

where:

Y_{it} : Dependent variable for sector i at time t

B_0 : Constant

B_j : Coefficients of independent variables, where $j = 1, 2, ..., k$

X_{jit} : Independent variables for sector i at time t, where $j = 1, 2, ..., k$

K : Number of independent variables, $k = 1, 2, ..., n$

a_i : Fixed effect or unobserved heterogeneity

u_{it} : Idiosyncratic error.

According to The Fixed Effects Model, there are two main approaches, as follows:

Deviation of averages approach, where the model is modified, by subtracting the average values of variables, as follows:

$$Y_{it} - \overline{Y}_{it} = B_1(X_{1it} - \overline{X}_{1it}) + B_2(X_{2it} - \overline{X}_{2it}) + \cdots + B_k(X_{kit} - \overline{X}_{kit}) + (u_{it} - \overline{u}_{it}).$$

Therefore, the fixed effect is removed and then the model coefficients estimates are unbiased.

Dummy variables approach, where the model is modified, by adding dummy variables D_i, as follows:

$$Y_{it} = B_0 + B_1 X_{1it} + B_2 X_{2it} + \cdots + B_k X_{kit} + D_i a_i + u_{it}.$$

(2) The random effects model

Greene [10] called the random effects model a regression with a *random constant term*. One way to handle the ignorance or error is to assume that the intercept is a random outcome variable. The random outcome is a function of a mean value plus a random error. This model allows both random intercept and slope parameters that vary around common means. The random parameters can be considered outcomes of a common mean plus an error term, representing a mean deviation for each individual. This model assumes neither heteroscedasticity nor autocorrelation within the panels to avoid complicating the covariance matrix. In multilevel models pertaining to students, schools, and cities, there can be individual student, school, and city random error terms as well. There can also be cross-level interactions within these hierarchical models.

If there is autocorrelation from one temporal period to another, it is possible to analyze the "differences in differences" of these observations, using the first or last as a baseline (Wooldridge [20]). If autocorrelation inheres across these observations, then the model may be first partial differenced to control for the autocorrelation effects on the residuals (Greene [9]).

There are a number of problems that plague panel data models. Outliers can bias regression slopes, particularly if they have bad leverage. These outliers can be down weighted with the use of *M*-estimators in the model. Heteroscedasticity problems arise from groupwise differences, and often taking group means can remove it. The use of a white heteroscedasticity consistent covariance estimator with ordinary least squares estimation in fixed effects models can yield standard errors robust to unequal variance along the predicted line (Greene [9]; Wooldridge [20]).

The Random Effects Model could be expressed as follows:

$$Y_{it} = B_0 + B_1 X_{1it} + B_2 X_{2it} + \cdots + B_k X_{kit} + a_i + u_{it},$$

where a_i denotes unobserved random effect and

$$a_i \sim i.i.d.\ N(0, \sigma_a^2),$$

$$u_{it} \sim i.i.d.\ N(0, \sigma_u^2).$$

This model is assumed that a_i and u_{it} are independent and the unobserved random effect a_i is uncorrelated with each explanatory variable in all time periods.

To estimate the parameters of Panel Data Model, according to the previous two models, the OLS method could not be used, as it is not BLUE. The GLS (Generalized Least Square) method is better, as it is consistent, efficient and gives BLUE (Best Linear Unbiased Estimation).

Tests of panel data models

Tests of this model could be illustrated as follows:

- **Wu-Hausman test.** This test is the classical test of whether the fixed or random effects model should be used. The research question is whether there is significant correlation between the unobserved person-specific random effects and the regressors. If there is no such correlation, then the random effects model may be more powerful and parsimonious. If there is such a correlation, then the random effects model would be inconsistently estimated and the fixed effects model would be the model of choice. The Hausman test is a kind of Wald χ^2 test with $k-1$ degrees of freedom (where k = number of regressors) on the difference matrix between the variance-covariance of the LSDV with that of the Random Effects model (Yaffee [21]).

Hausman test is used to compare the Fixed Effects (FE) and Random Effects (RE) estimates. If these estimates are very different, then the Random

Effects assumption is probably invalid. In this case, (FE) has to be used. Otherwise, (RE) is more efficient. According to Hausman test, Null and Alternative hypotheses could be shown as follows (Hausman [12]):

Estimates of RE parameters	Estimates of FE parameters	Hypotheses
Consistent and efficient	Consistent but not efficient	H_0
Not consistent	Consistent but not efficient	H_1

Hausman test value is calculated as follows:

$$\text{Wu-Hausman} = \hat{q} Var(\hat{q})^{-1} \hat{q}.$$

This test has a chi-squared distribution with *k* degrees of freedom, where $\hat{q} = \hat{B}$ (of RE model) – $\hat{B}$ (of FE model).

If the value of this test is less than the critical χ^2, then H_0 is accepted.

- **Breusch-Pagan.** Heteroscedastic models are usually fitted with estimated or feasible generalized least squares (EGLS or FGLS). Heteroscedasticity can be assessed with a White or a Breusch-Pagan test (B-P Test). For the most part, fixed effects models with groupwise heteroscedasticity cannot be efficiently estimated with OLS. If the sample size is large enough and autocorrelation plagues the errors, then FGLS can be used. Random sampling and maximum likelihood iterated by generalized least squares have also been used (Greene [9]). If B-P is greater than the critical χ^2, then the null hypothesis is rejected (Arellano [3]), where:

$$\text{B-P} = \frac{NT}{2(T-1)} \left\{ \frac{\sum_{i}^{N} \left(\sum_{t}^{T} \hat{U}_{it} \right)^2}{\sum_{i}^{N} \sum_{t}^{T} \hat{U}_{it}^2} - 1 \right\}^2 .$$

- **Likelihood ratio test.** If this ratio *D* is greater than the critical χ^2,

then the null hypothesis is rejected, where:

$$D = -2\ln[L_0/L_1] = -2(\ln L_0 - \ln L_1),$$

where:

L_0 : Value of likelihood function, including all independent variables,

L_1 : Maximum value of likelihood function, if all parameters equal zero except B_0.

5. Results of Empirical Study

In this study, the sample size contains 6 cases, out of 20 cases of M&As processes between Egyptian banks, during the period from the beginning of 2005 to the end of 2010 (24 quarters).

We use the S-plus to process the data by the GLS technique, as follows:

- Using the Fixed Effects Model.
- Using the Random Effects Model.
- Using the Random Effects Model, without un-significant variables.

Using the Fixed Effects Model, by the GLS technique, we got the following results:

Table 2. Determinants of customers' retention using fixed effects model

Variable	**Estimated parameters**	***p*-value**
Constant	0.5482	
X_1	3.2415	0.0031
X_2	0.5432	0.8521
X_3	3.4881	0.0042
X_4	–0.6654	0.2412
X_5	0.0203	0.6572
X_6	0.0324	0.1402
Log Likelihood : 150.94 *R*-squared : 0.8312		

According to *p*-value, we could reject hypotheses regarding the effects of "Change in Bank Equity" and "Change in Bank Deposits" on "Customers Retention". Also, it refers to the need to accept hypotheses regarding the effects of "Change in Bank Assets", "Change in Bank Loans", "Change in No. of Branches" and "Change in No. of Services", then we could reject the first and third hypotheses.

Using the Random Effects Model, by the GLS technique, we got the following results:

Table 3. Determinants of customers' retention using random effects model

Variable	**Estimated parameters**	***p*-value**
Constant	0.8432	
X_1	1.5621	0.5620
X_2	2.8772	0.5311
X_3	3.5233	0.0024
X_4	–1.6422	0.0012
X_5	0.1312	0.0005
X_6	0.0202	0.0023
Log Likelihood : 110.25 *R*-squared : 0.8732		

According to *p*-value, we could reject hypotheses regarding the effects of "Change in Bank Deposit" "Change in Bank Loans", "Change in No. of Branches" and "Change in No. of Services" on "Customers Retention". Also, it refers to the need to accept hypotheses regarding the effects of "Change in Bank Equity" and "Change in Bank Assets", then we could reject the third, fourth, fifth and sixth hypotheses.

Using Wu-Hausman test, we compare the "Fixed Effects Model" with "Random Effects Model" and find that the estimates of the second model are better than the first one. This is justified by *Wu-Hausman value of* 8.662.

Using the Random Effects Model (without un-significant variables), by the GLS technique, we got the following results:

Table 4. Determinants of customers' retention using random effects model without un-significant variables

Variable	Estimated parameters	Confidence interval of estimated parameters		*p*-value
		Lower limit	Upper limit	
Constant	0.8426			
X_3	3.4852	1.1521	5.1812	0.0003
X_4	–0.1548	–0.2121	3.1012	0.0021
X_5	0.1206	0.0312	0.1415	0.0062
X_6	0.0121	0.0014	0.0201	0.0151
Log Likelihood : 109.25 *R*-squared : 0.8643 B-P Test : 1.994				

According to *p*-value, we could reject hypotheses regarding the effects of "Change in Bank Deposit" "Change in Bank Loans", "Change in No. of Branches" and "Change in No. of Services" on "Customers Retention", then we could reject the third, fourth, fifth and sixth hypotheses.

Breusch-Pagan test (B-P test) assures the homoscedasticity, as this is justified by *Breusch-Pagan value of* 1.994.

The narrower the period of confidence, the greater the impact of the independent variable. So, the most important variable is X_6 (period of confidence = 0.0187), the second variable X_5 (period of confidence = 0.1103), the third variable X_3 (period of confidence = 4.0291), and the last variable X_4 (period of confidence = 4.3133).

Then, the suggested panel data model with random effects is used for forecasting of the bank customers' retention, as follows:

$$Y_{it} = 0.8426 + 3.4852\,X_{3it} - 0.1548\,X_{4it} + 0.1206\,X_{5it} + 0.0121\,X_{6it}.$$

6. Summery and Conclusions

This paper aims at analyzing the response of banks' customers, due to changes of banking market structure, where many of these customers may switch their banks, and this is why, determinants of these decisions should be elaborated. In this study, the sample contains 6 cases, out of 20 cases of M&As processes between Egyptian banks, during the period from the beginning of 2005 to the end of 2010 (24 quarters).

Determinants of "banking customers' loyalty", to be examined, are "bank equity", "bank assets" "bank deposits" "bank loans" "number of bank branches" and "number of bank services".

Panel data with random effects is the best model for forecasting of the bank customers' retention and the most effective variables on Customers' Retention, respectively, are "change in no. of services", "change in no. of branches", "change in bank deposit" and "change in bank loans".

The positive effect of expansion (in deposits, branches and services) on customers retention is expected, while negative effect of expansion in loans embarrassing. This negative effect may be explained by rethinking about the logic of this hypothesis that assumes that raising loans may be an indicator of banking expansion. Raising loans could be considered as an administrative decision rather than a customer reaction, and this is why it affects customer retention according to the quality of administrative decision, regarding providing loans.

Based on these results, we recommend banks' administration, to take actions that could enhance loyalty, according to the suggested model, where the level of desired loyalty could be achieved according to the parameters of its determinants. Also, we recommend providing banking services that match customers' needs and expectations through current and new branches, results show that expansion in branches and services could enhance customers' retention more than other determinants.

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