

Statistical Analysis of the Macro-economic Variables Affecting the Profitability of Commercial Banks of Pakistan

Muhammad Zubair Khan¹, Muhammad Iqbal²

¹ Faculty of Arts and Basic Sciences, Balochistan University of Information Technology
Engineering & Management Sciences Quetta,
² Department of Statistics, University of Peshawar

Abstract

This paper aims to examine the level of influence of some external factors (macro-economic variables) have on the profitability of commercial banks in Pakistan. The study covers the period from 2005 to 2009. The period under analysis (2005-2009) was selected mainly because during the said period, the world banking industry showed a huge declining trend in profitability due to global economic recession with many renowned banks filing for liquidation and this affected the Pakistani banking scenario as well, and the local banks both public and private showed a declining trend. The data used in the study is panel data. Panel data refers to pooling of observations on a cross-section of firms (say banks) over several time periods. Four variables including interest rate, exports, imports and inflation rate are used as independent variables (external factors). All the analysis of this study is carried out using the statistical package "Eviews". The stationarity of data is tested by applying the individual unit root test. To test the multicollinearity in the data the correlation matrix is made. Durbin-Watson statistic is used to detect auto correlation. To measure the individual impact of each of these independent variables on ROA as well as their pair wise impact on ROA and further joint impact of three variables on ROA, the technique of "all possible regression" is used to reach the best panel regression model. The results obtained from the regression models show that interest rate and imports have significant affect on the bank's profitability. The best regression model is consisting of the macro-economic variables, imports, inflation rate and interest rate.

Keywords: Macro-economic variables, Commercial Banks of Pakistan

Corresponding Author's email: iwu2005@yahoo.com

INTRODUCTION

Banks play an important role in the operation of an economics. This is particularly true in the case of Pakistan, where banks are the major providers of funds and their stability is very important to the financial system. An understanding of determinants of banks profitability is essential and crucial to the stability of the economy. External factors used by contemporary researchers as determinants of bank's profitability include interest rate (intr), inflation rate (ir), exports and imports (imp), etc. There are a number of studies on determinants of profitability in the banking sector (Indranarain 2009, Valentina et al. 2009, Panayiotis 2005, Kyriaki et al., 2002, Krunakar et al. 2008), there is hardly any such study in the context of Pakistan. State Bank of Pakistan is the

governing body of the banking sector in Pakistan. Banking sector of Pakistan comprises of banking and non-banking financial institutions. The banking institutions mainly comprises commercial banks which may be further classified as domestic and foreign commercial banks. Domestic commercial banks are further classified as; public sector and private sector commercial banks.

This study examines the contribution of macro-economic (external) factors to the variation in profitability across domestic commercial banks in Pakistan. The quarterly data of macro-economic variables for 5 years for the period 2005-2009, is used to determine the important factors in achieving high profitability. The study used Return on Assets (ROA) as a measure of profitability in line with

Indranarain 2009, Valentina et al., 2009, Panayiotis 2005, Kyriaki et al., 2002 and Krunakar et al., 2008. ROA, defined as net income divided by total assets, reflects how well a bank's management is using the bank's real investment resources to generate profits. The banking sector in Pakistan has been going through a comprehensive but complex and painful process of restructuring since 1997. It is aimed at making these institutions financially sound and forging their links firmly with the real sector for promotion of savings, investment and growth. Although a complete turnaround in banking sector performance is not expected till the completion of reforms, signs of improvement are visible. The almost simultaneous nature of various factors makes it difficult to disentangle signs of improvement and deterioration. Today's commercial banks are more diverse than ever. We can find a tremendous range of opportunities in commercial banking like starting at the branch level where you might start out as a teller to a wide variety of other services such as leasing, credit card banking, international finance and trade credit. Public banks are those which are operated by government. A public bank is that in which there are numerous partners or shareholders, and they elect from their own body a certain number, who are interested with its management. There are four public banks in Pakistan. Limited Bank that is limited by charter or by regulation to offering only certain services to the public. Limited service banks have narrow product lines, such as credit cards or auto loans, and may offer other services on an irregular basis.

MATERIALS AND METHODS

As there are 29 domestic (4 public + 25 private) commercial banks in Pakistan so a sample of 15 banks is drawn by simple random sampling using Goldfish bowl method. Sample size of $n=15$ banks out of $N=29$ is a moderate size ($n/N > 50\%$), and the sample results can better depict the target population. For a sample that consists of 15 banks and each bank requires data for six variables. Data for the four external variables (interest rate, exports, imports and inflation rate) is retrieved from the web site of IMF through State Bank of Pakistan.

Data Analysis

Since this study involves panel data, so the technique of "all possible regression" is applied to panel data to reach the best model. The best model is selected on highest R^2 . A panel data regression differs from a regular time-series regression or cross-section regression in that way that it has a double subscript on its variables, i.e.

$$y_{it} = A + BX_{it} + \varepsilon_{it}$$

where, $i = 1, \dots, N$; $t = 1, \dots, T$

"i" denotes the bank and "t" denotes the period or the time. In other words "i" denotes the cross-section and "t" denotes the time series. "A" is the intercept; "B" is $K \times 1$ vector and " X_{it} " is the ith bank on kth independent variable at time "t".

Where $\varepsilon_{it} = u_i + v_{it}$

" u_i " is called unobserved effect and " v_{it} " is the remainder disturbance. For example in an equation measuring the profitability of bank, " y_{it} " measures the profit of the ith bank, whereas X_{it} contains the set of independent variables like bank size, deposits, interest rate etc. " u_i " is time-invariant and accounts for individual banks that is not included in the regression. In our study " u_i " is banks unobserved ability and " v_{it} " varies with banks and time and therefore called as usual disturbance term in the regression. Alternatively in profitability equation y_{it} measures the output and X_{it} measures the inputs. The unobserved bank specific effect is measured by " u_i " and we can think of this as unobserved managerial skills (Baltagi, 2005).

This study used cross-section weights for every observed bank i at time t , and the true variance components, in order to produce a matrix-weighted average of the within and the between (which is obtained by regressing the cross section averages across time) estimators (Baltagi, 2001). More over all the panel regression models are run using fixed effect (FE), because of the reason that null hypothesis under Hausman test is; there is no substantial difference between FE and random effect (RE) models. If the null hypothesis is re-

jected, FE model is better than RE model (Gujarati, 2004).

Before running the panel regression models some preliminary tests are performed which include unit root test for checking stationarity of data, correlation matrix for checking multicollinearity and Durbin-Watson Statistic is used as a check for autocorrelation. The study is already using the least square method to fixed effects models, where the standard errors are calculated by using White's (1980) transformation to control for cross-section heteroscedasticity.

Preliminary Tests

The correlation matrix (Table-1) showed that the variables exports and imports have high correlation (coefficient of correlation greater or equal to 0.90). The variable 'import' is removed from the regression models but its individual significance is measured on ROA before its removal and proved insignificant. Table (2) shows the results of individual unit root test for the four external variables. P-values of all the four variables are suggesting stationarity of data at 10% level of significance. Durbin-Watson statistic is given in each table of regression model suggesting no autocorrelation problem at all for all the variables.

Table1: The Correlation Matrix

	EXPORTS	IMP	INTR	IR
EXPORTS	1	0.935587	0.820249	0.664447
IMP	0.935587	1	0.761665	0.734661
INTR	0.820249	0.761665	1	0.318169
IR	0.664447	0.734661	0.318169	1

Note:- "*" indicates high correlation.

Table2: Panel Unit Root Test for Bank Specific variables

S/N	Variable	ADF Fisher Chi-Square	Im, Pesaran & Shin W-Statistic	Hadri Z-statistic	Brietung t-statistic	Stationary/ Non-Stationary
1	Interest Rate (intr)	44.5669* (0.0423)	-1.2588* (0.1040)	2.7523* (0.0030)	-2.8050* (0.0025)	Stationary
2	Exports	64.0095* (0.0003)	-3.9498* (0.0000)	4.4255* (0.0000)	0.0353* (0.5141)	Stationary
3	Imports (imp)	35.0277* (0.2416)	-1.2898* (0.0986)	1.8245* (0.0340)	-2.6812* (0.0037)	Stationary
4	Inflation Rate (ir)	62.2420* (0.0005)	-3.8039* (0.0001)	5.6123* (0.0000)	-10.2067* (0.0000)	Stationary

- Note:
1. * shows the value of the statistic used.
 2. In the parenthesis p-values are given.
 3. Exports and imports are considered stationary as three out of four tests suggest stationarity.

RESULTS AND DISCUSSION

Using the technique of "all possible regression" four models are run each of which is for one external variable to test its individual significance. Table (4) suggests that only 'interest rate' is significantly affecting the profitability on individual basis. All the four external variables are affecting the ROA negatively. The best significant regression model on the basis of highest R² is,

$$ROA = 0.279227 - 0.006347 (\text{interest rate}).$$

Table 3: Individual Impact of Variables on ROA

Variable	Coefficient	Std. Error	t-Statistic	Prob.	R-Squared	Durbin-Watson statistic
IMP	-9.45E-08	7.63E-08	-1.238346	0.2166	0.422556	1.316936
INTR*	-0.006347	0.005253	-1.813746	0.0708	0.363542	1.309016
IR	-0.003671	0.005463	-0.672068	0.5021	0.431942	1.311532
EXPORTS	-1.54E-07	1.20E-07	-1.285783	0.1996	0.420487	1.856716

Note:- "*" shows the significant variables at 10% level of significance.

Table (5) shows pair wise results. All the three models (pairs) are significantly affecting ROA as all the p-values are zero. Individually no variable is significant. The best significant regression model on the basis of highest R² is,

$$ROA = 0.269160 + 0.000904 (\text{exports}) - 2.06E-07 (\text{inflation rate}).$$

Predictors	F-Stat	individually Significant variable	P-Value	R-Squared	Durbin-Watson statistic
Exports, intr	8.861908	NIL	0	0.351149	1.838200
Exports, ir *	11.65659	NIL	0	0.415838	1.685123
Intr, ir	9.342024	NIL	0	0.363262	1.702156

Note:- "*" shows best model among all.

Table (6) shows result for full fledge model. The model is significantly affecting ROA but individually no variable is significant. The variable 'exports' is positively affecting the ROA while the others negatively affect the ROA. The model is,

$$ROA = 0.280647 + 2.92E-11 (\text{exports}) - 0.002613 (\text{inflation rate}) - 0.006846 (\text{interest rate}).$$

Table 6: Full panel regression model with three predictor Variables

Dependent Variable: ROA

Method: Panel EGLS (Cross-section weights)

Date: 09/09/12 Time: 15:40

Sample: 2005Q1 2009Q4

Cross-sections included: 15

Total panel (unbalanced) observations: 279

Linear estimation after one-step weighting matrix

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.280647	0.050912	5.512385	0.0000
IR	-0.002613	0.006956	-0.375675	0.7075
EXPORTS	3.89E-08	3.95E-07	0.098300	0.9218
INTR	-0.006846	0.008074	-0.847971	0.3972
Effects Specification				
Cross-section fixed (dummy variables)				
Weighted Statistics				
R-squared	0.349328	Mean dependent var	0.281991	
Adjusted R-squared	0.306947	S.D. dependent var	0.325361	
S.E. of regression	0.270863	Sum squared resid	19.14869	
F-statistic	8.242587	Durbin-Watson stat	1.827651	
Prob(F-statistic)	0.000000			
Unweighted Statistics				
R-squared	0.334879	Mean dependent var	0.210329	
Sum squared resid	21.62282	Durbin-Watson stat	1.669186	

In all the regression models Durbin-Watson statistic is suggesting no autocorrelation problem. All the external variables are negatively affecting the profitability (ROA) of domestic commercial banks of Pakistan.

CONCLUSION

This study is all about analyzing the important and significant external factors, affecting the profitability of domestic commercial banks of Pakistan. "All possible regressions" technique is used to estimate the impact of each individual predictor variable, pair wise predictor variables and three predictor variables on ROA. Only one variable out of four predictor variables was found individually significantly affecting the profitability of commercial bank of Pakistan; the variable is interest rate. All the four co-efficient are negatively affecting the bank's profitability.

All the three panel regression models of pair wise bank specific variables are significantly affecting the ROA. Co-efficients of all variables are negative in all the three regressions. The full fledge panel regression model is also significantly affecting the ROA. Co-efficients of inflation rate and interest rate are negative while co-efficient of exports is negative in this model.

REFERENCES

- Baltagi BH. (2001). *Econometric Analysis of Panel Data* (second edition). John Wiley & Sons, Chichester. P, 93-113.
- Baltagi BH. (2005). *Econometric Analysis of Panel Data* (third edition). John Wiley & Sons, Chichester.
- Gujarati D. (2004). *Basic Econometrics* (4th edition). New York: McGraw-Hill.
- Indranarain R. (2009). Bank-Specific, Industry-Specific and Macroeconomic Determinants of Profitability in Taiwanese Banking System: Under Panel Data Estimation, *International Research Journal of Finance and Economics*. 34: 160-167.
- Karunakar M, Vasuki K and Saravanan S. (2008). Are Non - Performing Assets Gloomy Or Greedy From Indian Perspective?, *Research Journal of Social Sciences*, 3: 4-12.
- Kyriaki K, Sailesh T, Fotios P. (2005). Determinants of Profitability of Domestic UK Commercial Banks: Panel Evidence from the Period 1995-2002, Money Macro and Finance Research Group, 37th conference. 1-27
- Panayiotis PA, Sophocles NB and Matthaios DD. (2005). Bank-Specific, Industry-Specific and Macroeconomic Determinants of Bank Profitability, working paper No.25, Bank of Greece 5-35.
- Valentina F, Calvin M and Liliana S. (2009). The Determinants of Commercial Bank Profitability in Sub-Saharan Africa, IMF working Paper, WP/09/15, 2-32.