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Empirical Study on Macroeconomic and Firm Specific Variables' Effect on Profitability of Non-life Insurance Industry in Bangladesh

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Abstract: *This* study *tries to show the causation among non-life insurance firms' profitability measured with ROE, ROA, EPS and firm-specific variables such as underwriting risk, reinsurance dependence, solvency margin, leverage, liquidity risk, growth of premium, length of the company, tangibility of firm's assets in addition to macroeconomic variables such as GDP growth, inflation and improvement of stock marketplace of the insurance business of Bangladesh. This study also focuses on seven insurance companies amid 2011-2020 considering the econometric models followed numerous diagnostic checks along with the Model specification bias test, test of heteroskedasticity, cross-sectional dependence check, followed by autocorrelation test and unit root test at the validity of the models decided on for this examine. The study found that out of all independent economic factors, only the stock market development is significantly and positively affecting the profitability measured with EPS (Earnings per share). The insurance-specific variables such as leverage and size are significantly positively and negatively affecting the profitability measured both with ROE and ROA of insurance companies, respectively. They are significantly positively affected by both liquidity and tangibility of assets too. In addition, Solvency margin and premium growth are found to have significant negative impact on return on assets which contradicts the authors' expectations. Moreover, underwriting risk is found to have a significant positive impact on EPS and ROE under the GLS and Fixed-effect method respectively. The one-step system GMM approach reveals that only the one-year lagged ratio of ROE is statistically significant among the three lag values used in the GMM approach and ROE is also significantly positively affected by underwriting risk and GDP growth. In contrast, leverage and size are found to have a significant inverse relationship respectively, with ROE in this approach, showing that tangibility of assets and leverage has a significant negative and positive impact on earnings per share. The chi-square values of the three above models are jointly statistically significant in explaining the variation in the respective dependent variable. In addition, it is noteworthy that no significant impact is found on return on assets from any of the three Macroeconomic factors considered for the study. Also, no significant relationship is found between the three measures of profitability and reinsurance dependence along with the inflation in the economy. However, other than the EPS, all the variables are jointly statistically significant in explaining 79.56% and 83.42% variation in ROE and ROA respectively under the Pooled OLS method.*

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Keywords: *Profitability, Insurance Company, Economic Factors, Random effect, Fixed effect, Pooled OLS, GLS and One-step GMM.*

1. Introduction

The insurance industry playing a crucial role in stimulating the economic growth of a country gives impetus to other sectors of the economy such as healthcare, automobiles, infrastructure, banks and capital markets. Several empirical studies have divulged a positive correlation between insurance development and growth; therefore, investigations analyzing the performance of the insurance sector have received considerable attention from researchers in developed as well as emerging economies. Macroeconomic factors such as growth of GDP and interest rates affect the expansion and profitability of the insurance industry along with other macroeconomic determinants have revealed a significant impact on the growth of insurance business in an economy.

The overall structure of this paper will reveal the causation between profitability of non-life insurance companies and insurance-specific factors such as underwriting risk, reinsurance dependence, solvency margin, liquidity risk, leverage, size, premium growth and tangibility of assets followed by macroeconomic factors such as GDP growth, inflation and stock market development using econometric modeling.

2. Literature Review

Ullah et al. (2016) executed an investigation using panel data from eight different insurance companies amid 2004 to 2014 to analyze the determinants affecting the profitability of non-life insurance companies in Bangladesh. The paper reveals that ROA is inversely influenced by underwriting risk and size followed by a positive impact exercised from the expense ratio, solvency margin and growth. Siddiqua and Parvin (2017) conducted another investigation considering data from five insurance companies over a period of 3 years and they found that the non-life insurance firms would accelerate an excellent prospect in Bangladesh. Till now, no particular paper in Bangladesh attempts to examine the effect of macroeconomic variables on the performance of insurance companies although macroeconomic determinants can exercise significant impact on operational as well as financial performance.

Hailegebreal (2016) investigates the factors specific to the company such as technical provision, underwriting risk, solvency, reliance on reinsurance, firm age, leverage ratio, liquidity ratio, premium growth, and tangibility of assets and macroeconomic factors. Apart from this, how macroeconomic factors such as gross domestic product (GDP) and inflation affecting the profitability of the Ethiopian insurance sector has been also investigated. This paper highlights that the profitability of the Ethiopian insurance sector is significantly positively affected by age, solvency ratio and GDP and premium growth followed by underwriting, technical financing, debt and the risk of inflation causing inverse impact on the

profitability of insurance firms. Datu (2016) ascertains the effects of insurer-specific indicators and macroeconomic determinants on profitability in the Philippine non-life insurance sector considering panel data over the 5-year period (2008-2012). Empirical results of this paper divulge that reinsurance use, firm size, underwriting risk, leverage and input costs have a significant influence on the profitability of insurance companies, while GDP and the inflation rate do not have a significant impact on profitability.

Kaya (2015) tests the company-specific factors affecting the profitability of 24 Turkish non-life insurance organizations with the usage of an 8 years panel data collection ranging from 2006 to 2013. Eight independent variables such as insurance leverage ratio, modern-day ratio, top class increase charge, vehicle insurance, and top class retention charge are used within the study) and two predicted variables such as the technical profitability ratio and the sales profitability ratio). The empirical outcomes display that the scale, age, loss revel in, current ratio and premium growth rate have a large impact on the profitability of organizations in the decided on sample.

Christophersen and Jakubik (2014) find a robust connection between gross written premiums (GRP) and economic growth and unemployment. Furthermore, the estimated model suggests less sensitivity to the macroeconomic environment for non-life insurance than for life insurance. The results also divulge that domestic growths opportunities are scarce when insurers are expanding their international businesses.

Doumpos and Gaganis (2012) provide an explanation for the overall performance of non-existence coverage corporations the usage of a pattern of over 2000 corporations working in ninety one unique international locations at some stage in the duration 2005–2009. According to the empirical effects of the study, macroeconomic situations together with GDP growth, inflation, and earnings inequality have big effect at the overall performance of the chosen pattern corporations. Feyen et al. (2011) take a look at a massive statistics set of ninety advanced and growing international locations over the duration 2000–2008 a good way to verify the determinants of coverage corporations' overall performance. The empirical effects display that according to capita earnings, populace length and density, demographic structures, earnings distribution, the scale of the general public pension system, kingdom possession of coverage corporations, the provision of personal credit, and faith have a big effect on top class of each existence and non-existence coverage corporations.

Pervan and PavićKramarić (2010) find evidence that firm-specific elements such as ownership and expenditure ratio along with macroeconomic factors such as inflation has a significant inverse effect on the profitability followed by past profitability has a significant positive impact on the current profitability. Nissim (2010) argues that the country's global economy affects the growth of the insurance company. The investigation also reveals that

capital income is very elastic to short as well as long term interest rates. Esho et al. (2004) suggests that the successful development of the insurance industry depends on the rule of law and the strength of the influence of authority. In addition, Shiu (2004) divulges that the determinants affecting the financial performance of UK general insurance companies use three key indicators such as ROI (return on investment), percentage change in equity and ROE over 14 years. This paper empirically investigated 12 explanatory variables and found that the performance of the selected insurance companies is significantly affected by interest rates, the return on capital, and the solvency margin with positive direction. On the contrary, inflation and reinsurance reliability have a significant negative impact on the performance of the same companies.

Adams and Buckle (2003) investigated the dynamics influencing the operating performance of Bermuda insurance companies considering a panel data set consisting of 47 insurance companies ranging from 1993-1997. Empirical outputs revealed that better operational performance is offered by companies with high leverage, low liquidity and reinsurers and vice versa. The results also show that underwriting risk significantly affects the operational performance of insurers with positive direction. In addition, this paper also divulged that the size of the company and the scope of activities had no significant impact on the performance of the companies. D'Arcy and Gorvett (2000) argued that inflation significantly affected the passive side of liability insurers' balance sheets. Grace and Hotchkiss (1995) adopted co-integration tools to derive a connection between general economic variables and underwriting enactment of insurance companies. Their investigation found that general long-term economic conditions are significantly associated with the operating performance of liability insurance companies. However, in the short term, they have no relationship. The results also revealed that real GDP and interest rates are inversely correlated with share premiums and earnings respectively.

Here is the research gap that this study is seeking to fill by addressing this issue. This paper differs inherently from previous studies because it seeks to examine the impact of macroeconomic variables along with firm-specific determinants on the performance of insurance companies in Bangladesh considering a large sample with more observations than previous investigations in Bangladesh.

3. Objective

The fundamental objective of this study is to reveal the causation between profitability of non-life insurance companies and insurance-specific factors followed by underwriting risk, reinsurance dependence, solvency margin, liquidity risk, leverage, size, premium growth and tangibility of assets along with macroeconomic factors followed by GDP growth, inflation and stock market development using econometric modeling.

Specific objectives of this paper are to reveal the predictive relationship between profitability and firm-specific along with macroeconomic variables considering both panel and Dynamic Panel data modeling approach to adjust the difficulty of endogeneity, unobserved heterogeneity and consistency of earnings or profitability of insurance industry in Bangladesh.

4. Methodology of the Study

4.1 Research Type

This is an explanatory research that divulges the relationship between profitability of non-life insurance companies and insurance-specific factors followed by underwriting risk, reinsurance dependence, solvency margin, liquidity risk, leverage, size, premium growth and tangibility of assets along with macroeconomic factors followed by GDP growth, stock market development and inflation by analyzing whether they are significantly affecting the profitability measured with EPS, ROA and ROE of insurance companies since 2010 in Bangladesh.

4.2 Data type and Sample Selection Procedure

We have used only secondary data collected for the last 12 years since 2009 of 10 non-life insurance companies operating in Bangladesh using convenience sampling under a non-probabilistic approach. So, this has become a panel data consisting of total of 120 observations.

4.3 Empirical Determinants of Profitability of Non-Life Insurance Companies

Table-1: Description of the variables included in the model

Dependent Variables	Notation	Measurement Method	Expected Impact	Source(s) of data
Earnings Per Share	EPS	Earnings available for common stock holders to Common Stocks outstanding	n/a	Annual Report
Return on Assets	ROA	Net Income to Total Assets	n/a	Annual Report
Return on Equity	ROE	Net Income to Total Equity	n/a	Annual Report
Independent variables (∑X)				
X_1 = Underwriting Risk	UR	Claim Incurred to Premium Earned	Negative	Annual Report
X_2 = Reinsurance Dependence	RND	Premium Ceded to Total Assets	Negative	Annual Report
X_3 = Solvency Margin	SM	Net Assets to Net Written Premium	Positive	Annual Report
X_4 = Liquidity Risk	LQ	Current Assets to Current Liability	No Prior Expectation	Annual Report
X_5 = Premium Growth	PMG	(P_t/P_{t-1})-1	Positive	Annual Report

X_6 = Tangibility of Assets	TNA	Fixed assets to Total assets	No Prior Expectation	Annual Report
X_7 = Leverage	LV	Total Liability to Total Assets	Positive/Negative	Annual Report
X_8 = Size	SZ	Natural log of Total Assets	No Prior Expectation	Annual Report
X_9= GDP Growth	GDP	(GDP_t/GDP_{t-1})-1	Positive	World Bank
X_{10} = Inflation	INF	(CPI_t/CPI_{t-1})-1	Negative	World Bank
X_{11}= Stock Market Development	DSEX	Index of Dhaka Stock Exchange	Positive	Dhaka Stock Exchange

Source: Authors' estimation

4.4 Construction of Hypotheses

Followings are the hypotheses developed to divulge the impact of insurance-specific and macro variables on Profitability of non-life insurance companies in Bangladesh:

H_1: EPS being profitability of insurance companies is significantly affected by insurance-specific variables such as underwriting risk, reinsurance dependence, solvency margin, liquidity risk, leverage, size, premium growth and tangibility of assets along with Macroeconomic variables such as GDP growth, inflation rate and capital market development.

H_2: ROA being profitability of insurance companies is significantly affected by insurance-specific variables such as underwriting risk, reinsurance dependence, solvency margin, liquidity risk, leverage, size, premium growth and tangibility of assets along with Macroeconomic variables such as GDP growth, inflation rate and capital market development.

H_3: ROE being profitability of insurance companies, is significantly affected by insurance-specific variables such as underwriting risk, reinsurance dependence, solvency margin, liquidity risk, leverage, size, premium growth and tangibility of assets along with Macroeconomic variables such as GDP growth, inflation rate and capital market development.

4.5 Empirical Models

Usually, the model to be estimated for revealing the impact of Insurance-specific and Macroeconomic variables on the profitability of Insurance companies has been constructed as follows:

$$EPS_{it} = \alpha_{it} + \sum_{k=1}^{11} \beta_{it} X_{itk} + u_{it} \dots\dots\dots (1)$$

$$EPS_{it} = \alpha_i + \sum_{k=1}^{11} \beta_{it} X_{itk} + u_{it} \dots\dots\dots (2)$$

$$EPS_{it} = \alpha + \sum_{k=1}^{11} \beta_{it} X_{itk} + \varepsilon_{it} + u_{it} \dots\dots\dots (3)$$

$$ROE_{it} = \alpha_{it} + \sum_{k=1}^{11} \beta_{it} X_{itk} + u_{it} \dots\dots\dots (4)$$

$$ROE_{it} = \alpha_i + \sum_{k=1}^{11} \beta_{it} X_{itk} + u_{it} \dots\dots\dots (5)$$

$$ROE_{it} = \alpha + \sum_{k=1}^{11} \beta_{it} X_{itk} + \varepsilon_{it} + u_{it} \dots\dots\dots (6)$$

$$ROA_{it} = \alpha_{it} + \sum_{k=1}^{11} \beta_{it} X_{itk} + u_{it} \dots\dots\dots (7)$$

$$ROA_{it} = \alpha_i + \sum_{k=1}^{11} \beta_{it} X_{itk} + u_{it} \dots\dots\dots (8)$$

$$ROA_{it} = \alpha + \sum_{k=1}^{11} \beta_{it} X_{itk} + \varepsilon_{it} + u_{it} \dots\dots\dots (9)$$

$$EPS_{it} = \alpha_{it} + \gamma EPS_{i(t-1)} + \sum_{k=1}^{11} \beta_{it} X_{itk} + u_{it} \dots\dots.. (10)$$

$$ROE_{it} = \alpha_{it} + \gamma ROE_{i(t-1)} + \sum_{k=1}^{11} \beta_{it} X_{itk} + u_{it} \dots\dots\dots (11)$$

$$ROA_{it} = \alpha_{it} + \gamma ROA_{i(t-1)} + \sum_{k=1}^{11} \beta_{it} X_{itk} + u_{it} \dots\dots\dots (12)$$

Here,

EPS = Earnings per Share calculated with dividing the earnings available for common stock holders by no. of common stocks outstanding

ROE = Return on Equity calculated with dividing the net income by total equity.

ROA = Return on Assets calculated with dividing the net income by total assets.

$\boldsymbol{\alpha}_{it}$, $\boldsymbol{\alpha}_{i}$, $\boldsymbol{\alpha}$ = Constant for Pooled OLS, Fixed Effect and Random Effect method respectively.

$\sum \boldsymbol{X}$ = all explanatory variables representing insurance-specific along with macroeconomic factors adopted in the model.

$\boldsymbol{\beta}$ = coefficient of the explanatory variable

$\boldsymbol{u_{it}}$ = error term of the model or error term within the entity

$\boldsymbol{\varepsilon_{it}}$ = error term between the entity

$\boldsymbol{\gamma}$ = coefficient of lagged dependent variable, i.e., EPS_{t-1}, ROA_{t-1}, ROE_{t-1}

$\boldsymbol{EPS_{t-1}}$ = One year lagged earnings per share adopted as endogenous variable due to the correlation with past and present error term of the model.

$\boldsymbol{ROA_{t-1}}$ = One year lagged Return on assets adopted as endogenous variable due to the correlation with past and present error term of the model.

$\boldsymbol{ROE_{t-1}}$ = One year lagged Return on equity adopted as endogenous variable due to the correlation with past and present error term of the model.

4.6 Empirical Method

We use the fixed effects method to estimate the coefficients in Equation 2, followed by Equations 5 and 8, which determine the causality between EPS, ROE, and ROA, respectively, and various insurance along with macroeconomic factors mentioned as predictors in the model, as mentioned above, and examine the relationship between these predictors and the outcome variables (EPS, ROE, and ROA) using equations 5 and 8. Applying the fixed effect, we assume that the constant is invariant in time and that certain Circumstances make sure - specific explanatory variables within each unit that can skew the outcome variable. This is the logic behind the hypothesis of the correlation between the entity's error term and the explanatory variable, followed by the notation (u_i, X_b).

In addition to the fixed-effects model, we used the random-effects model to estimate the coefficients of equations number 3.6 and 9, indicating causality between EPS, ROE, and ROA, respectively, and the other predictors mentioned in. The assumption that the variation between entities (non-life insurance companies) is random or stochastic and not correlated with the predictors or explanatory variables included in the models is known as the chance effect technique. We also used the Pooled OLS Method, which stands for Ordinary Least Squares, and the GLS Transverse Method, which stands for Generalized Least Square Method, to estimate the coefficients in Equations 1.4 and 7 to compare the results between these three approaches.

Furthermore, we adopted the dynamic panel data model to estimate the coefficients in the last three equations by considering the one-step GMM system, meaning generalized moment approximation methods to solve the endogeneity problem causing a condition where the explanatory variables are correlated with the error terms of the model or, in a sense, with

variables that have been omitted or excluded because endogeneity makes the estimates of the regressors' coefficients biased and inefficient.

In summary, to estimate the coefficients, equation 1, 4 and 7 will be used for Pooled OLS and GLS method. Equation 2, 5 and 8 will be used for Fixed Effect. Equation 3, 6 and 9 will be used for Random Effect and the last three equations will be used for the GMM approach.

5. Empirical Results and Findings

Table 2: Summary Statistics of all variables included in the models

Variables	Observations	Mean	Standard Deviation	Minimum	Maximum
EPS	120.0000	2.6490	3.4821	0.0000	31.8100
ROE	120.0000	1.3364	3.4934	0.0106	13.4021
ROA	120.0000	0.3246	0.5193	0.0069	1.4928
UR	120.0000	0.2143	0.1647	0.0419	0.8347
RND	120.0000	0.5130	0.5470	0.0471	3.9845
M	120.0000	3.1249	1.5439	0.2373	6.7288
LQ	120.0000	1.9436	1.2873	0.1962	6.6970
PMG	120.0000	0.1088	0.0947	-0.1467	0.3355
TNA	120.0000	0.2601	0.2219	0.0106	0.8526
LV	120.0000	0.5459	0.1439	0.2300	0.9004
SZ	120.0000	9.8646	5.1134	1.2135	22.2704
GDP	120.0000	0.1067	0.0083	0.0557	0.0815
INF	120.0000	0.1880	0.0547	0.0551	0.1140
DSEX	120.0000	0.1024	0.4213	-0.2419	1.1420

Source: Authors' estimations based on STATA 13.0

Findings: The descriptive statistics of the data seems consistent with lower values of standard deviation of the explanatory variables and lower gaps in ranges (measured from minimum and maximum values).

According to the output reported in Table No. 3 below on the next page, the coefficients of various performance factors (ratios) of the sample insurance companies explaining the changes in EPS according to the first three equations are given. Various panel data analysis methods were used for this, such as Random effect, Fixed effect, GLS and Pooled OLS. The output of the estimators shows that, among all other variables, only DEX or the stock market performance significantly and positively influences earnings per share with a significance level of 0.1% according to the Random Effect, GLS and Pooled OLS method and with a significance level of 1% under fixed effect. In addition, the underwriting risk is also

statistically significant at a significance level of 5% according to the GLS method. According to Random effect and GLS, Chi square values of 27.01674 and 31.941392, respectively, infer the common significance of all performance factors included in the model. Therefore, depending on the chi-square value, all the explanatory variables are jointly responsible for changes in EPS.

Table 3: Summary of the Output of Coefficients of models (on model/ equation 1, 2 and 3)

Explained Variable (EPS)		Estimation of Models			
		OLS	FE	RE	GLS
Explanatory Variables	UR	7.301381	5.014112	7.301381	7.301381*
	RND	0.215453	-0.173506	0.215453	0.215453
	SM	-0.38526	0.071141	-0.38526	-0.38526
	LQ	-1.736487	-1.02045	-1.736487	-1.736487
	PMG	4.319833	4.04312	4.319833	4.319833
	TNA	-2.137906	-18.8014	-2.137906	-2.137906
	LV	-2.16561	-8.54174	-2.16561	-2.16561
	SZ	0.27124	-2.48112	0.27124	0.27124
	GDP	0.000398	-6.82617	0.000398	0.000398
	INF	10.55421	7.083968	9.473611	10.55421
	DSEX	5.473428***	4.091434**	5.473428***	5.473428***
	_cons	3.2164534	31.00435	3.2164534	3.2164534
N		120	120	120	120
R^2		0.334692	0.304312		
chi^2				27.01674**	31.941392**
F		2.046215	2.433911		
sigma_u			13.00354	0	
sigma_e			4.153348	4.153348	
rho			0.922433	0	

legend: * p<0.05; **p<0.01; *** p<0.001

Source: Authors' estimations based on STATA 13.0

On the other hand, the R^2 value of 0.334692, estimated by both the fixed effect method and the pooled OLS method shows that only the 33.4692% variability of the EPS illustrates the relationship between the explanatory determinants and the EPS of the insurance companies. In addition, the F-values of 2.046215and 2.433911 under Fixed Effect and Pooled OLS, respectively, prove that all regressors of said models taken together are not statistically significant in explaining variations in earnings per share. The rho value, the interclass correlation coefficient, of 0.922433 calculated with the fixed-effect method, shows that approximately 92.2433% variation in EPS occurs due to the differences between the panels.

According to the output indicated in Table No. 4 below, the coefficients of various determinants (ratios) of the sample insurance companies were shown explaining the changes

in ROE according to the three-second equations. The output yields different significant coefficients for the four approaches in which premium growth and asset tangibility are statistically significant at a 5% significance level; leverage and size are statistically significant at a significance level of 0.1% and 1%, respectively, according to the pooled OLS method. Under the fixed effect method, underwriting risk, leverage and size are statistically significant at a constant value level of 0.1%. In addition, the tangibility of assets and GDP growth are statistically significant at a significance level of 5%.

Table 4: Summary of the Output of Coefficients of models (on equations/ models 4, 5 and 6)

Explained Variable (ROE)		Estimation of Models			
		OLS	**FE**	**RE**	**GLS**
Explanatory Variables	UR	1.024926	3.0764043***	1.024926	1.024926
	RND	0.431695	-0.04771	0.431695	0.431695
	SM	-0.114934	0.116735	-0.114934	-0.114934
	LQ	0.257360	-0.02423	0.257360	0.257360
	PMG	-5.164739*	-0.84847	-5.164739*	-5.164739*
	TNA	2.125866*	-4.4422166*	2.125866*	2.125866*
	LV	7.540136***	5.2031344***	7.540136***	7.540136***
	SZ	-0.654931**	2.2582095***	-0.654931**	-0.654931**
	GDP	8.24697	33.083939*	8.24697	8.24697
	INF	7.24933	11.7042	7.24933	7.24933
	DSEX	0.05644	0.235001	0.05644	0.05644
	_cons	-2.46697	20.422325***	-2.46697	-2.46697
N		120	120	120	120
R^2		0.926753	0.929312		
chi^2				228.149714***	133.973792**
F		12.559065	12.321121		
sigma_u			16.35301	0	
sigma_e			3.518981	3.5189813	
rho			0.955743	0	

legend: * p<0.05; **p<0.01; *** p<0.001

Source: Authors' estimations based on STATA 13.0

Under Fixed-effect, underwriting risk, leverage and size are found statistically significant at 0.1% level of significance along with the constant. Tangibility of assets and GDP growth are also statistically significant at 5% level of significance. Under Random-effect, leverage and size are statistically significant at 0.1% and 1% significance level respectively. Premium growth and tangibility of assets are statistically significant at 5% level of significance. Under GLS, solvency margin, liquidity risk, premium growth and tangibility of assets are found statistically significant at 5% level of significance; leverage and size are found statistically significant at 0.1% level of significance.

Under Random-effect and GLS, the Chi-square value of respectively, 228.149714 and 133.973792 infers the joint significance of all the performance factors included in the model. Thus, as per the chi-square value, all the explanatory variables are not jointly responsible for changes in ROE.

In contrast, the R^2 value of 0.926753 and 0.929312 estimated under Pooled OLS and Fixed-effect method respectively shows that, about 92% variability of ROE depict the relationship between performance factors and ROE of Insurance Companies. Moreover, the F-value of 12.559065 and 12.321121 under pooled OLS and Fixed-effect respectively proves that, all the regressors of the said models are jointly statistically significant in explaining changes in return on equity. The rho-value, interclass correlation coefficient, of almost 1 calculated under Fixed-effect method shows that, the whole variation in ROE happens due to the differences across the panels.

According to the Output given in the below table no. 5 of next page, the coefficients of multiple performance factors (ratios) of the sample insurance companies explaining the changes in **ROA** as per the second three equations have been shown. The Output produces several significant coefficients for the four approaches in which liquidity and tangibility of assets are found statistically significant at 5% significance level; leverage and size are found statistically significant at 0.1% and 1% significance level respectively under Pooled OLS method. Under Fixed-effect method, underwriting risk, leverage and size are found statistically significant at 0.1% significance level along with the constant. Moreover, tangibility of assets and GDP growth are statistically significant at 5% significance level. Under Fixed-effect, none of the coefficients is statistically significant; only the constant is statistically significant at 1% level of significance. Liquidity and tangibility of assets are statistically significant at 5% and 1% level of significance; leverage and size are statistically significant at 0.1% level of significance under both GLS and Random-effect.

Under Random-effect and GLS, the Chi-square value of respectively 225.79687 and 272.51346 infers the joint significance off all the performance factors included in the model. Thus, as per the chi-square value, all the explanatory variables are not jointly responsible for changes in ROA. Similarly as per the R^2 value of 0.451393 and F-ratio of 3.889587 under Fixed-effect, all the explanatory variables are not jointly statistically significant in affecting return on assets.

Table 5: Summary of the Output of Coefficients of models (on equation/ model 7, 8 and 9)

Explained Variable (ROA)		**Estimation of Models**			
		OLS	FE	RE	GLS
Explanatory Variables	UR	-0.016431	-0.01508	-0.016431	-0.016431
	RND	0.017243	-0.4692	0.017243	0.017243
	SM	-0.05493	0.06117	-0.05493	-0.05493
	LQ	.1443475*	-0.06347	.1443475*	.1443475*
	PMG	-0.31657	0.083460	-0.31657	-0.31657
	TNA	.340396*	-0.043617	.340396**	.340396**

	LV	1.194636***	0.013549	1.194636***	1.194636***
	SZ	-.015348**	-0.46358	-.015348**	-.015348**
	GDP	-1.469284	-0.43619	-1.469284	-1.469284
	INF	-1.13321	-0.63141	-1.13321	-1.13321
	DSEX	-0.001469	-0.7529	-0.001469	-0.001469
	_cons	-0.08341	.582439**	-0.08341	-0.08341
N		120	120	120	120
R^2		0.795628	0.451393		
chi^2				225.79687***	272.51346***
F		20.52699**	3.889587		
sigma_u			12.29169	0	
sigma_e			0.679907	0.67990677	
rho			0.99695	0	

legend: * p<0.05; **p<0.01; *** p<0.001

Source: Authors' estimations based on STATA 13.0

In contrast, the R^2 value of 0.795628 estimated under Pooled OLS method shows that, about 79% variability of ROA is depicting the relationship between performance factors and ROA of Insurance Companies. Moreover, the F-value of 20.52699** under pooled OLS proves that, all the regressors of the said models are jointly statistically significant in explaining changes in return on assets. The rho-value, interclass correlation coefficient, of almost 1 calculated under Fixed-effect method shows that, the whole variation in ROA happens due to the differences across the panels.

Table 6: Summary of the Output of Hausman Test (between equation/ model no. 2 and 3, 5 and 6, 8 and 9, respectively)

Models	EPS	ROE	ROA
chi2	6.24	49.13	56.57
p-value	0.3971	0.00	0.00

Source: Authors' estimations based on STATA 13.0

In the above table no. 06, the Output of Hausman test has been conducted to test the appropriateness of using the Random-effect model or Fixed-effect model. The null hypothesis that the Random-effect preferable to Fixed-effect. As the value of Chi-square is 6.24 and the P-value is 0.3971, the null hypothesis can be accepted and we can conclude that Random-effect is more appropriate than the Fixed-effect for the model in which EPS is the dependent variable. In contrast, the Fixed-effect is appropriate for the models consisting of ROE and ROA as the dependent variable.

Table 7: Summary of the Output of BP-LM Test (between equation 1 and 3, 4 and 6, 7 and 9, respectively)

Models	EPS	ROE	ROA
chi2	0.6146	0.1054	0.8349
p-value	0.921	0.746	0.573

Source: Authors' estimations based on STATA 13.0

The Breush and Pagan Lagrangian Multiplier Test for Random-effect test assume the H_0 that the Pooled OLS is preferable to Random-effect. According to the above chi-square and p-values shown in the table 07, the null hypothesis cannot be rejected, and we can conclude that Pooled OLS and Cross-sectional FGLS generate better estimates than the Random-effect method.

Table 8: The Output of BP-LM Test of Independence (on equation 2)

Correlation Matrix of Residuals							
	__e1	__e2	__e3	__e4	__e5	__e6	__e7
__e1	1						
__e2	0.8288	1					
__e3	-0.8577	-0.8533	1				
__e4	-0.5502	-0.8768	0.7654	1			
__e5	-0.7048	-0.722	0.6094	0.5638	1		
__e6	-0.5674	-0.7325	0.7551	0.8004	0.8102	1	
__e7	-0.7762	-0.9032	0.8502	0.8505	0.5512	0.725	1

chi2(21) = 119.352, Pr = 0.000

Source: Authors' estimations based on STATA 13.0

Table 9: The Output of BP-LM Test of Independence (on equation 5)

Correlation Matrix of Residuals							
	__e1	__e2	__e3	__e4	__e5	__e6	__e7
__e1	1						
__e2	0.1941	1					

__e3	0.1031	0.3869	1				
__e4	0.6078	0.5272	0.3346	1			
__e5	-0.4611	-0.0825	-0.2485	-0.3663	1		
__e6	0.2342	0.8736	0.4653	0.3173	-0.1718	1	
__e7	-0.2161	-0.8726	-0.4083	-0.7106	-0.0212	-0.7385	1

$chi^2(21) =$ 45.628, Pr = 0.0014

Source: Authors' estimations based on STATA 13.0

Table 10: The Output of BP-LM Test of Independence (on equation 8)

Correlation Matrix of Residuals							
	__e1	__e2	__e3	__e4	__e5	__e6	__e7
__e1	1						
__e2	-0.7337	1					
__e3	0.6381	-0.523	1				
__e4	-0.1774	0.1095	-0.2412	1			
__e5	-0.0087	0.1275	0.2461	-0.3076	1		
__e6	-0.6574	0.6856	-0.2307	-0.0818	0.4903	1	
__e7	0.2104	-0.4976	0.2186	0.2499	-0.4102	-0.0628	1

$chi^2(21) =$ 32.689, Pr = 0.0498

Source: Authors' estimations based on STATA 13.0

Cross-sectional dependence poses a problem for macro-panel data especially for time-series data covering substantially larger period like 20 or 30 years. However, to check for cross-sectional dependence, B-P/LM test of independence has been adopted considering the null hypothesis: residuals across entities are not correlated. The Output shown in the above table no. 8, 9 and 10 rejects the null hypothesis for all the three models as per the chi-square and their corresponding p-values. Hence, we conclude that residuals are correlated across entities suggesting presence of cross-sectional dependence.

Table 11: Summary of Wald test for Heteroskedasticity in Fixed effect (on equation 2,5 and 8 respectively)

Models	EPS	ROE	ROA
chi2	61.76	256.72	858.36
p-value	0.00	0.00	0.00

H_0: $\sigma_{(i)}^2 = \sigma^2$ for all i

Source: Authors' estimations based on STATA 13.0

According to the Chi-square and their corresponding p-values measured by modified Wald test for group-wise heteroskedasticity in the Fixed-effect model mentioned in the above table no. 11, the null hypothesis of holding constant error variance can be rejected and deduce that the aforementioned Fixed-effect model suffers from the problem of heteroskedasticity.

Table 12: Summary of the Output of Wooldridge Test for Autocorrelation (on equation 1,2 and respectively)

Models	EPS	ROE	ROA
F	140.138	37.103	9.859
p-value	.0000	0.0009	.0201

H_0: no first order autocorrelation

Source: Authors' estimations based on STATA 13.0

For examining whether the models suffer from the problem of 1st order autocorrelation, Woolridge (2002) test has been adopted for checking the presence of autocorrelation problem in the models mentioned above. As per the F-ratios and their corresponding p-values mentioned in above table no.12, we can reject the null hypothesis and conclude that all the three models suffer from 1st order autocorrelation problem.

Table 13: The Output of Multicollinearity Test

Correlation Matrix											
	UR	RND	SM	LQ	PMG	TNA	LV	SZ	GDP	INF	DSEX
UR	1										
RND	0.0848	1									
SM	0.0858	-0.4108	1								
LQ	0.3904	0.1791	-0.473	1							
PMG	0.1354	0.0926	-0.081	0.212	1						

TNA	0.1443	-0.086	0.2917	0.281	0.028	1					
LV	0.0465	0.4487	-0.581	0.029	0.007	-0.461	1				
SZ	0.4178	0.0133	-0.139	0.842	0.204	-0.08	0.3361	1			
GDP	0.0122	0.1357	0.008	0.069	-0.18	-0.063	0.0995	0.029	1		
INF	0.1011	-0.0345	-0.016	0.076	0.347	0.0466	0.1552	-0.03	0.55	1	
DSEX	0.0533	0.0052	-0.015	0.016	0.29	0.0095	0.095	-0.02	0.44	0.1655	1

Source: Authors' estimations based on STATA 13.0

According to the above table of pairwise correlation matrix among the explanatory variable, there is a high pairwise correlation between liquidity risk and size of the insurance company. But as the mean variance inflation factor (given in the appendix) of the models is less than 5, we conclude that the models do not suffer from the multicollinearity problem.

Table 14: Summary of The Output of LLC Unitroot Test

Variables	Adjusted t-value	P-value	Results
EPS	4.8035	1.0000	Non-stationary
ROE	-27.2239	0.0000	Stationary
ROA	-3.442	0.0003	Stationary
UR	-2.8905	0.0019	Stationary
RND	-2.0136	0.0220	Stationary
SM	-19.5175	0.0000	Stationary
LQ	-39.5016	0.0000	Stationary
PMG	-9.66	0.0000	Stationary
TNA	-4.4687	0.0000	Stationary
LV	-8.8453	0.0000	Stationary
SZ	-3.5152	0.0002	Stationary
GDP	3.1051	0.9990	Non-stationary

INF	-15.0329	0.0000	Stationary
DSEX	-0.9396	0.1737	Non-stationary

Source: Authors' estimations based on STATA 13.0

LLC unit root test standing for Levin-Lin-Chu unit root test has been conducted to know whether the mean, variance and covariance of series are stationary across time assuming the hypothesis consisting of H_0: The series is non-stationary, or it has a stochastic trend ($p>0.05$) and H_1: The series is stationary or has a non-stochastic trend ($p<0.05$). In the above table no.14 of previous page, the LLC Unit Root test the Output is given for all the dependent and independent variables. The Output shows that other than EPS, GDP and DSEX, all the variables contain stationary series.

Table 15: Summary of The Output of GMM Approach of Three Models (on equation 10, 11 and 12, respectively)

Generalized Method of Moment (GMM) Estimations			
Variables	**EPS**	**ROE**	**ROA**
L. EPS	0.02469		
L. ROE		0.466856***	
L. ROA			-0.12682
UR	-0.21553	3.364366***	-0.00318
RND	-0.09837	0.05335	-0.018
SM	-0.14379	0.371253	0.001974
LQ	-0.14465	0.143224	-0.00219
PMG	-0.8992	0.773713	0.077624
TNA	-5.9197573*	-2.56403	-0.02862
LV	4.4253487*	-3.9259984**	0.090812
SZ	-0.2828	-2.1748355***	-0.04187
GDP	-2.70069	31.767967***	-0.74238
INF	-4.65757	4.987466	-0.46683
DSEX	-0.57275	0.382857	-0.02891
_cons	7.36802	20.194507***	.72648276*
N	106	106	106
chi2	58.4692**	163.0807***	1.2306

legend: * p<0.05; ** p<0.01; *** p<0.001

Source: Authors' estimations based on STATA 13.0

We have adopted three econometric models followed by the last three equations mentioned above to measure the dynamic impact of economic factors on profitability measured with EPS, ROE and ROA considering one year lag of these dependent variables. According to the coefficients estimated by the one-step GMM approach, tangibility of assets and leverage are statistically significant at 5% level of significance under the 1st model. The lagged ratio of ROE, underwriting risk, size, and GDP are statistically significant at 0.1% significance level and constant and leverage significance at a 1% level of significance under the 2nd GMM model. In contrast, none of the economic factors is statistically significant in making changes in return on assets under the 3rd GMM model. However, as per the chi-square values of the three above models, all the economic factors included in the models are jointly statistically significant in explaining the variation in the respective dependent variable.

6. Conclusion

The main objective of this study was to look into the effect of economic variables on the profitability of the non-life insurance companies of Bangladesh based on the sample of seven insurance companies for the period of 2009-2020. Accordingly, this study has already accomplished the objectives and hypothesis set at an earlier stage to reveal the causation between insurance company's profitability measure with ROE, ROA along with EPS and several insurance-specific factors such as underwriting risk, reinsurance dependence, solvency margin, leverage, liquidity risk, premium growth, size of the company, tangibility of assets as well as macroeconomic factors such as GDP growth, inflation and stock market development considering the formation of several econometric models estimated with Pooled OLS, Cross-sectional GLS approach, Fixed-effect and Random-effect approach followed by dynamic panel data estimated with one-step system GMM approach. The estimated the Output of the models reveals that out of the three macroeconomic variables included in our model also investigated by Hailegebreal (2016) and Kaya (2015), only the stock market development index significantly positively affect the earnings per share of the insurance company at a 0.1% significance level which is a new contribution of this paper in the context of Bangladeshi non-life insurance industry and from the insurance-specific factors, only underwriting risk significantly affect the earnings per share at 5% significance level which is also supported by Datu (2016), Pervan and PavićKramarić (2010), Shiu (2004) and Adams and Buckle (2003) where the relationship shows a positive direction which contradicts with our expectation. On the other hand, there is no impact of the macroeconomic variable on return on equity. From the insurance-specific factors, leverage shows a significant positive impact on return on equity at 0.1% significance level also found by Christophersen and Jakubik (2014) and the size of the company is found statistically significant also espoused by Ullah et al., (2016) and Siddiqua and Parvin (2017) at 0.1% significance level showing both positive and negative impact under Pooled OLS along with Cross-sectional GLS and Fixed

Effect-approach respectively. However, some other insurance-specific variables also investigated by Hailegebreal (2016), Doumpos and Gaganis (2012), Feyen et al., (2011) and Shiu (2004) significantly affecting return on equity (ROE) at 5% significance level are solvency, liquidity risk, premium growth and tangibility of assets in which solvency margin and premium growth are showing an inverse relationship with return on equity which is not expected. On the other hand, liquidity risk and tangibility of assets are positively affecting both the return on equity and return on assets also supported by Doumpos and Gaganis (2012), Pervan and PavićKramarić (2010) and Feyen et al., (2011). Besides, leverage and size of the company are found statistically significant at 0.1% level of significance also supported by Hailegebreal (2016) and D'Arcy and Gorvett (2000) showing the positive and inverse direction of the relationship with the return on assets, respectively. At last, when we use the dynamic model one-step system GMM approach, it is found that only the one-year lag ratio of return on equity is statistically significant among the three lag values used in the GMM approach at 0.1% level of significance. Moreover, return on equity is also significantly positively affected by underwriting risk and GDP growth, where the constant is also statistically significant also espoused by Adams and Buckle (2003) at 0.1% level of significance. On the contrary, leverage and size are found to have a significant inverse relationship also found by Adams and Buckle (2003) and D'Arcy and Gorvett (2000) at 1% and 0.1% significance level respectively, with return on equity in this approach showing also that tangibility of assets and leverage have significant negative and positive impact respectively at 5% significance level on earnings per share which is also found by Siddiqua and Parvin (2017), Doumpos and Gaganis (2012), and Feyen et al., (2011). Surprisingly, none of the economic variables used in the model is statistically significant in affecting ROA; only the constant is significant at 5% level of significance. However, as per the chi-square values of the three above models, all the economic factors included in the models are jointly statistically significant in explaining the variation in the respective dependent variable. It is noteworthy that no significant impact is found between return on assets and any of the three Macroeconomic factors included in the model. Also, no significant relationship is found between the three measures of profitability and reinsurance dependence along with the inflation in the economy. However, other than the EPS, all the variables are jointly statistically significant in explaining 79.56% and 83.42% variation in ROE and ROA, respectively, under the Pooled OLS method as per the empirical output of this paper. Here is the research gap that this paper is seeking to fill by addressing this issue. This paper differs inherently from previous studies because it seeks to examine the panel as well as dynamic impact of macroeconomic variables along with firm-specific determinants on the performance measured with EPS, ROA and ROE of insurance companies in Bangladesh considering a large sample with more observations than previous investigations in Bangladesh.

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