Risk Performance on Financial Assessment of Insurance Firms in Egypt

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Abstract The subject matter of this study is the analysis of the relationship between risk assessment and firm size on financial performance. The population encompasses thirty-nine listed insurance firms in Egypt during the period 1999 – 2019, whereas a sample of nineteen insurance companies was selected. The financial assessment is a dependent variable, while the independent variable is risk assessment. This study used general linear multivariate analysis and descriptive statistics. The article is an attempt to investigate the relationship between risk assessment and firm size on financial assessment of insurance sector in Egypt. The results indicate that there is significant positive linear relationship between standard deviation of return on equity, standard deviation of return on asset, and natural logarithm of total assets with return on equity. Moreover, there is significant positive linear relationship between standard deviation of return on equity, standard deviation of return on asset and natural logarithm of total assets where on return on asset. Therefore, there is significant positive linear relationship between standard deviation of return on equity and standard deviation of return on asset on liquidity. Nevertheless, there is a negative relationship between natural logarithm of total assets.

Keywords Financial Assessment, Risk Assessment, Natural Logarithm of Total Assets

1. Introduction

Insurance industry, as a financial intermediary, presents

two functions of economics compensation and financing in conjunction with taking risks assessing risk is a very important factor which insurance attend to achieve their financial performance.

Insurance sector, as an integral part of Egyptian economic, is heavily regulated than elsewhere in regard to liquidity constraints and investment channels. So, the regulations contributed to limited ability to maximize profitability in Egypt. However, the positive side of these regulations mitigated the side effects of the financial crisis that plagued the world economy in 2008 and coved-19 in recent years.

Previous studies on risk performance are almost rare in Egypt, while the studies on financial performance in different economic sectors have been increasingly published. So, this study as applied in insurance sector, highlights the relationship between risk performance and financial performance where financial performance represents the firm's efficiency in using their resources to build profits. The liquidity variable was selected beside profitability because of its importance in insurance industry.

2. Literature Review

2.1. Insurance Industry

Several studies were conducted to investigate the effect of risk management on financial performance in insurance industry. Arif A. Wani & Showket A. Dar [3] research findings, by using multiple linear regression model to

investigate relationship between risks on financial performance, indicate that there is an insignificant relationship between them, also the study determined the important factors which have an effect on financial performance such as capital management risk size of firm, solvency risk, liquidity risk volume of firm, and underwriting risk in life insurance companies in India. Also, in line with this study, Ibrahim M. Fali & Lateef Olumide M. [8], by using linear regression model, concluded that insolvency risk has a positive significant relationship with return on asset, but there is a negative insignificant relationship between liquidity risks with return on asset of listed insurance companies in Nigeria. On the other hand, Kokobe SA& Gemechu D [12] used correlation matrix to investigate the relationship between risk management techniques; the study findings indicated that the risk management has an influence on financial performance measured by return on equity where risk management measured by (loss preventions and control – loss financing and risk avoidance) in insurance companies in Ethiopia. In consistence with the previous study, L. Paige Fields & et al [13] by using ordinary least square analysis, conducted a comparison study on (513) companies representing (66) countries; the findings denote that risk taking measured by (capital value of leverage and capital value of solvency) has a negative relationship with liability standards index; also creditors right has negative relationship with risk taking of non-life and life insurers; but the composite insurers, investors protection and the disclosure index have negative relationship with risk taking; while for all insures, government quality has a positive relationship with performance. Dejan S. Drljača (32) presented the risk assessment matrix model which is a combination of qualitative and quantitative approaches to determine the degree of risk level and ranking the results show that these model has ability to measure risks of insurance firms (market risks, liquidity risk, default risk and counterparty), and other significant risks in insurance companies. Whereas Saleh M. Eladly [31] examined the relationship between sources allocations measured by (capital ratio and assets structure) on financial assessment measured by (ROE – ROA – liquidity), his study revealed that the relationship is significantly positive associated with sources allocations and risk performance in insurance companies in Egypt; however, the result is consistent with asymmetric information approach cited by Greenwald, Bruce and Stiglitz, Joseph E (43) , concurring with the asymmetry approach. Also, J. David Cummins & David W. Sommer (36) presented a simultaneous equation methodology based on option pricing model to investigate the relationship between capital and portfolio risk of insurance firms; they elucidated that capital has a positive effect on risk; moreover, they provided evidence that managerial incentive support in determining capital and risk in insurance industry. Yet, Richard D. MacMinn (40) article highlighted the corporate risk management in

insurance industry; the findings reveal a partial synthesis of insurance and finance. Besides, it shows that investors can hedge the pure risk, also the hedging increases value and corporate account change incentives. However, risk management theory provides some indications when tools should be used. Contrary to asymmetry approach, Selim Mankai & Aymen Belgacen (41) used simultaneous equation model to examine the relationship between capital, reinsurance and risk adjustment; they concluded that there are positive and significant relationships between control variables, performance and capital, but a negative one associated with cost of capital, while capital is positively significant associated with risk taking. Nevertheless, Yu-Luen Ma & Yayuan Ren [30] paper investigated the relationship between insurers risk (operational performance risk) and institutional ownership on financial performance measured by (return on asset and cumulative abnormal return); the findings denote that there is a negative relationship between institutional ownership measured by (ratio of equity owned) and financial performance of insurers during the financial crisis of 2008, whereas the relationship between institutional ownership with risk is positive. To test collective risk model in insurance cited by Zlata Djuric (39) The purpose of this study is to present the advantages and disadvantages of collective risk model in insurance based on stochastic process; the advantage of this model is that it indicates a wide range of modifications, modeling and simulation of events that may occur, while its disadvantage is the limited applicability in the practical business. In line with this study, Ognjen Vukovic (38) presented operation risk model and used Monte Carlo method to construct operational risk model in insurance industry; the contributions of this paper are the construction of operational risk model, the application of R code in operational risk modelling, and the tools needed for operational risk models specializing in insurance and distribution used in operational risk models. To examine risk on efficiency, Gene C. Lai & et al (35) used data envelopment analysis stochastic frontier, and the findings indicate that business strategy and organizational structure have a significant relationship with efficiency, where there is relationship between firm size risk taking, financial leverage and market on profitability and efficiency. Finally, in accordance with asymmetry information approach cited by Jing Ai & et al [10], they designed enterprise risk management quality program based on linear model, found there is positive significant relationship between enterprise risk management on return on asset in property casualty insurers; nevertheless, they found an insignificant relationship between size, business line diversification, capitalization (policyholder surplus / admitted asset), commercial (total premium written in commercial line) and risky assets on return on assets. To evaluate risk management, Fei Ma (33) studied Chinese insurance firms and presented several recommendations

that encourage insurance firms in China to abide by using of insurance resources, the control of proportion and the form structure of insurance firms, and risk management. As for Ferren Alwie & et al (34), he used credible tail value at risk model to estimate individual and group risks, and also demonstrate numerical simulation based on health insurance claims data; however, credible TVaR provide risk measure and information of losses value located in right tail. In line with this study, Jekaterina Kuzmina & et al. (37) used copula approach to measure portfolio's conditional risk in insurance firms, the findings indicate that approach is proper to satisfy regulatory requirements and internal risk management standards.

2.2. Banking Sector

Another stream of studies was directed to investigate the effect of vitality of return on equity and vitality of return on assets with financial assessment in banking sector. Alalade S. Yimka & et al [2] used a panel least square model to examine the relationship between credit risks on financial performance in commercial banks in Nigeria, the findings show that there is a positive effect of (ratio of non-performing loans and advance / provision for loans) and (advance losses) with return on equity, whereas there is a negative impact of ratio of provision and advances to total loans and advances on return on equity. In concur with this study, Bimo A, Tejo1 & Dewi Hanggraeni [5] used panel data analysis model to investigate the relationship between financial assessment and credit risk in Indonesia commercial banks. The study concluded that the credit risk measured by non-performing loans has a significant relationship with return on equity; however, credit risk has an insignificant effect on return on assets, while there is a statistical effect of liquidity and firm size on (ROA, ROE). On the other side, Ghulam Saghir & E. Tabassam C [7] paper revealed that credit risk has a negative significant association with financial performance, while liquidity has an insignificant relationship with return on equity; besides, the relationship between earning assets to total assets ratio and net equity to total ratio has an insignificant effect on financial performance. But Jean B. Harelimana [9] used multiple regression analysis to determine risk management factors, and investigate the relationship between risk management and financial performance; the study reveals that there is relationship between risk management measured by (liquidity risk, operation risk, credit risk and default loans) and financial performance measured by (return on assets) in Unguka bank in Rwanda. However, the study cited by Jowhar Massoudie [11] investigated the effect of financial risk and financial assessment on commercial banks used the ordinary least square technique; the results indicated that the overall model used in this paper is highly significant, and it is found that there is relationship between credit risk, cash management, budget estimate and cash planning have a

positive and significant relationship with financial performance. Lemaa B, Zeleke & Sindhu [14] studied on Ethiopian commercial banks. They find there is a statistical effect of net interest margin capital adequacy ratio, firm size and non-performing loans on return on asset. However, loans to deposit ratio, exchange rate, inflation rate have an insignificant effect on return on asset. Regarding to return on equity, it has a significant relationship with non-performing loans, loans loss provision ratio and capital adequacy ratio, but has an insignificant relationship with loans to deposit ratio, exchange rate ratio and inflation rate. Leonora H. Rudhani & Driton Balaj [15], with different variables, but in line with the previous results, the researchers used linear regression analysis to investigate the relationship between liquidity risks measured by (current asset to total asset, liquid liability and loans deposit) on Return on Equity and Return on Asset as independent variable to measure financial assessment. The findings elucidate that liquidity risk is associated with financial assessment in Kosovo commercial banks. In consistence with this result, Nasratullah Noori [17] analyzed risk practice on Malaysian commercial banks, and the conclusions of his study indicate that credit risk and market risk have a significant impact on financial performance; however, the interest rate and liquidity risk have an insignificant impact on financial performance. With different variables to measure risk management, Olayinka ERIN & et al [19] adopted panel data analysis to investigate the impact of risk governance measured by (board risk committee _size /enterprise risk management _index/ chief risk officer _presence) on financial performance measured by (return on asset); the findings indicate that chief risk officer _presence, enterprise risk management and board risk management _index have a positive and significant effect on return on asset, but board risk _size has a negative relationship with return on asset in Nigerian financial sector. On the contrary of asymmetry information approach, Peter Karugu Kahihu & et al [20] findings denote that risk measured by (interest rate and financial leverage) have a positive statistical effect of return on equity, while another risk like foreign exchange has a negative statistical association with financial assessment, but the risk of inflation has an insignificant relationship with financial performance microfinance institutions in Kenya. Besides, Ramazan Ekinci1 & Gulden Poyraz [21] study findings of Turkish deposit banks denote that the relationship between credit risk measured by (non-performing loans), and financial assessment measured by (return on asset and return on equity) is a negative relationship. In consistence with asymmetry information approach, Ravi Prakash Sharma P. [22] paper revealed that risk management measured by (default rate and capital adequacy) have a significant association with return on asset, while cost per loans asset has an insignificant relationship with return on asset of the commercial banks in Nepal. Nevertheless, contrary to

asymmetry information theory, Robert Mironga Siriba [23] adopted the multiple regression model to investigate the impact of credit risk on financial performance; the study findings denote that non-performing loans and loss provision have an insignificant relationship with bank profitability, but the relationship between loans and advances has a significant effect on bank profitability of commercial bank in Kenya. Also, Samuel Gameli Gadzo & et al. [24] research elucidate that operational risk, which is measured by (banks leverage and portfolio concentration), has a negative statistical effect on financial assessment, and credit risk has a statistically negative relationship with financial performance. Besides, Suleiman A. S. Aruwa & Abdullahi O. Musa [25] study investigated the relationship between risk components on the financial performance; the study infers that operational and interest rate have a negative relationship with financial performance measured by (return on asset), but credit risk, measured by (non-performing loans ratio), has a negative association with financial performance of Deposit Money Banks in Nigeria. In line with theory of asymmetry information, Walter Gontarek & Yacine Belghitar [28] research results found that board-level risk appetite has a positive significant relationship with performance in bank holding companies and risk. The added value of this study is the identifying of the significance of risk governance practice upon the bank performance and risk taking in US banks. On another hand, to evaluate bank performance, Yu-Chuan Chen & et al [29] in his article presented data envelopment analysis (DEA) model to evaluate bank performance; the empirical findings of this paper showed that (DEA) model estimates an efficiency of bank holding companies, and by using data envelopment analysis as a technique to evaluate the financial performance on average financial holding companies banks a better performance is attained in different businesses. Besides, data envelopment analysis model is comparatively strictly less than DMUs in efficiency.

2.3. Other Sectors

Other evidences to analyse the relationship between risk assessment and financial performance are cited by Ahmad Abdel Rahim & et al [1] who used multi regression analysis to investigate the impact of liquidity risk and solvency on financial performance measured by (return on asset and earning per share); the findings indicated that the financial assessment is a statistically associated with size, liquidity and solvency of Jordanian manufacturing firms on Amman Stock Exchange. Recently, Claudia Champagne & et al. [6] used conditional probability model to evaluate the impact of pension fund freeze on return and risk. It was found that there is an insignificant relationship between pension fund freeze on systematic risk, but significantly reduced short-term residual risk.

However, Nicoleta B. –Misu & et al [18] adopted panel vector autoregressive model to analyze the impact of risk factors on financial performance in European firms; the study revealed that liquidity financial leverage and productivity have a positive effect on financial assessment (ROE and ROA), while asset turnover and solvency have a statistically significant and positive relationship with return on equity, but the productivity has a negative effect on return on asset during crisis. However, on the contrary of the theory, Michael Adusei [16] presented a model to examine the impact of liquidity risk on financial performance in (73) countries; the study findings indicate that liquidity risk and credit risk have negative association with financial performance. However, size, leverage, financial development, political stability and government effectiveness have a positive relationship with financial performance which measured by (operating revenue / financial expenses + loans loss provision expenses + operating expenses). According to Sylvester Senyo Horvey & Jacob Ankamah [26], the study results elucidate that enterprise risk management has a positive and statistically significant associated association with return on equity, return on asset and Tobin Q as dependent variables measured financial assessment of both financial and non-financial firms in Ghana; regarding control variables, firm size and efficiency have a negative association with return on equity and Tobin Q, although efficiency was insignificant but ownership has a positive relationship with financial performance of both financial firms and non-financial firm. As for Thitima Chaiyakul [27], who used multiple regression analysis, the research results denote that bankruptcy measured by (Z-score) and the size of firm positively affect return on equity, return on asset and Tobin Q, while liquidity and capital structure have a statistically significant relationship with financial performance, inflation has an insignificant relationship with financial performance in firms listed on Stock Exchange of Thailand. On the other hand, Bimbin P. Chepkemoi, Steve Ndung's & Julius Kahuthia [4] study reveals indicated that financial leverage has a significant positive relationship with financial performance of non-bank financial institutes in Kenya. Moreover, the results show that the interest risk has a strong effect on financial performance by using Hausman and LM tests.

3. Methodology and Variables Description

The subject matter of this study is the analysis of the relationship between risk assessment and firm size on financial performance, wherefore this article used general linear multivariate analysis and descriptive statistics to analyze the relationship between the study variables consistent with Walter Gontarek & Yacine Belghitar [28].

They used the multivariate analysis and descriptive statistic. The main objective of paper is to examine the relationship between risk performances on financial performance of insurance sector in Egypt. This part provides the method used in empirical investigation, the data collected from financial reporting (balance sheets – income statements) which are issued by the Financial Regulatory Authority in Egypt over the period 1999- 2019. However, the sample of this article include nineteen Egyptian insurance companies which were selected based on availability of data during the study period

3.1. Variables Development and Measurement

Most of prior studies used Return on Equity and Return on Asset to measure financial assessment as sited on Sylvester Senyo Horvey & Jacob Ankamah [26], Lemaa B, Zeleke & Sindhu [14], Thitima Chaiyakul [29], Samuel Gameli Gadzo & et al [22] and Ramazan Ekinci & Gulden Poyraz [19] but this study measured financial performance by ROE, ROA and liquidity

3.2. Risk Performance Measurement

Standard deviation of return on equity and standard deviation of return on asset are measured financial assessment, as stated in Yu-Luen Ma & Yayuan Ren [30] and Samuel Gameli Gadzo & et al [24]

3.3. Model

This paper includes three dependent variables: return on equity, return on asset and liquidity

Where independent variables are

- Financial risk measured by Standard deviation of return on equity (X_1)
- Operating risk measured by standard deviation of return on assets (X_2)
- Firm size measured by Natural of logarithm of total assets (X_3)

$$ROE = \beta_0 - \beta_1 SD X_1 - \beta_2 SD X_2 - \beta Ln X_3$$

$$ROA = \beta_0 - \beta_1 SD X_1 - \beta_2 SD X_2 - \beta Ln X_3$$

$$L = \beta_0 - \beta_1 SD X_1 - \beta_2 SD X_2 - \beta Ln X_3$$

$$L = \text{liquidity}$$

Risk assessment variables	Abbreviation	How to calculate the variables
Standard deviation of return on equity	SD ROE	$SD ROE = \sqrt{\frac{(ROE - (ROE)^-)^2}{N-1}}$
Standard deviation of return on asset	SD ROA	$SD of ROA = \sqrt{\frac{(ROA - (ROA)^-)^2}{N-1}}$

Financial performance variables

$$ROE = \text{Profits} / \text{Equity}$$

$$L = \text{Short Term Assets (Cash + Deposit + S. T. Loans + Treasure Bills)} / \text{Total Assets}$$

$$ROA = (\text{Earnings before interest and tax}) / \text{Total Assets}$$

Control variable

$$\text{Firm size} = \text{Natural logarithm of total asset (Ln } X_3)$$

4. Hypothesis

To analyse the relationship between risk performance and firm size on financial performance, this paper formulated the following null hypothesis.

1. Standard deviation of return on equity has no statistically impact on financial assessment of insurance firms in Egypt which is measured by (Return on Equity and Return on Asset)
2. Standard deviation of return on asset has a statistically influence of financial assessment of insurance firms in Egypt measured by return on equity and return on asset
3. Firm size has no statistically influence of financial assessment of insurance firms in Egypt

5. Analysis and Empirical Results

This part presents an analytical and empirical results of the multivariate regression model that are tested to examine the relationship between risk assessment measured by standard deviation of return on equity and standard deviation of return on assets with financial performance measured by return on equity, return on assets and liquidity, firstly to test the normality distribution. This paper used Jarque–Bera test of research variables, second multivariate model and associated tests.

Table 1. The summary of Descriptive statistics

Constructs	Mean	Median	Maximum	Minimum	Std. Dev.	Skewness	Kurtosis	Jarque-Bera	Probability	Observations
Return on equity	0.141387	0.139345	0.507055	-0.240730	0.147195	0.097829	2.924681	0.730745	0.693938	399
Return on asset	0.031490	0.029635	0.094744	-0.034713	0.025771	0.103827	2.785590	1.481153	0.476839	399
Liquidity	0.075641	0.055424	0.259331	-0.123388	0.067471	0.665255	2.929317	29.51362	0.001***	399
Standard deviation of ROE	0.015071	0.012385	0.045481	4.67E-05	0.011002	0.761013	2.702422	39.78458	0.001***	361
Standard deviation of ROA	0.055933	0.047164	0.159188	0.000747	0.039497	0.708424	2.702375	34.67197	0.001***	361
Natural logarithm of Total Asset	13.17246	13.09940	16.78653	9.422380	1.537752	0.260876	2.731510	5.724175	0.057149	397

*** P value is $\geq (0.001)$.

5.1. The Values of Jarque–Bera Test

Form figures shown in table (1), it elucidated Mean on the average (.0639044), Median on t average (2.07606), Standard deviation on the average (0.2572), Skewness on the average (3.1871) and Kurtosis on the average (0.54888) and Jarque-Bera on the average (18.601). The figures shown in the table explain descriptive statistics for risk assessment as independent variables and financial assessment as dependent variables

5.2. Univariate Detection

Values of both lower quartile Q_1 and upper quartile Q_3 are calculated. Then, the inter quartile range $IQR = Q_3 - Q_1$ is computed and finally the values less than $(Q_1 - 1.5IQR)$ and those higher than $(Q_3 + 1.5IQR)$ are excluded. The presence of some outliers and extremes for each variable separately is identified; then those outliers are omitted. based on Box-and-Whisker Plots and by using transform command, missing values linear interpolation are replaced to complete these missing values through the statistical program

5.3. Multivariate Detection

By using the Mahalanobis D^2 measure, the relationship between two and more variables is analyzed, which often uses multivariate analyses, a multivariate evaluation of

each observation across a group of proxies.

From table above outputs, it reveals that the normality distribution of return on equity Y_1 , and return on asset Y_2 by using the Jarque-Bera test at a significant level $\leq (0.05)$. On the other hand the research variables in terms of liquidity Y_3 , STROE x_1 , and ST ROA X_2 are not normally distributed, since the significant of Jarque-Bera statistic is greater than (0.05).

The coefficient of Pearson skewness for all research variables is $\leq (1)$, which indicates that the data are insignificantly skewed.

5.4. Group Unit Root Test

The covariance is calculated for return on equity Y_1 return on asset Y_2 , liquidity Y_3 , liquidity y_3 as dependent variables where independent variables, (X_1) standard deviation of return on equity, X_2 standard deviation of return on asset and (X_3) firm size through the following statistical techniques: Augmented Dickey-Fuller (ADF), Philips–Perron (PP), and Im, Pesaran and Shin W-stat (IPSW). The covariance is computed as follows.

Output from table (2) denotes that stationary of the time series of the return on equity Y_1 , return on asset Y_2 , liquidity (Y_3) , standard deviation of return on equity (X_1) , standard deviation of return on asset X_2 and natural logarithm of total assets $LN X_3$ at level 1 $\sim (0)$ based on the constant level, through the following criteria: LLC, IPSW, PP, and ADF, at $p \geq (0.001)$.

Table 2. the test of Group unit root for study variables from 1999 to 2019

Method	Statistic	Prob.**	Cross-Sections	Obs
Null: Unit root (assumes common unit root process)				
Levin, Lin & Chu t*	-11.9254	0.0000	5	1982
Null: Unit root (assumes individual unit root process)				
Im, Pesaran and Shin W-stat	-14.5945	0.0000	5	1982
ADF - Fisher Chi-square	229.555	0.0000	5	1982
PP - Fisher Chi-square	306.462	0.0000	5	1986

*** P value is $\geq (0.001)$.

5.5. Co-integrating Equation Model

To test the existence of long-run equilibrium relationship between non-stationary time series variables in terms of ROE (Y_1), ROA (Y_2), liquidity (Y_3), ST ROE (X_1), and STROA(X_2), this study used Engle–Granger Co-integration test as follows:

Table 3. Co integrating Model for the study variables

Variables	tau-statistic	Prob.*	z-statistic	Prob.*
Y_1	-7.429426	0.001***	-110.3400	0.001***
Y_2	-8.441604	0.001***	-121.2173	0.001***
Y_3	-7.924797	0.001***	-123.2739	0.001***
X_1	-8.629023	0.001***	-125.6120	0.001***
X_2	-8.825419	0.001***	-128.8063	0.001***
$Ln x_3$	-5.661452	0.001***	-56.90290	0.001***

*** P value is $\geq (0.001)$.

Based on the results in Table (3), it can be revealed long-term equilibrium relationships among (Y_1 , Y_2 , Y_3) as dependent variables and (X_1 , X_2 , $Ln x_3$) as independent variables during the study period, due to the Tau-statistic, and z-statistic, at a significant $\geq (0.001)$

5.6. The Correlation Matrix

Output from table (4) reveals that there is a significant positive linear association between dependent variables

Y_1 , (Y_2), and (Y_3) with (X_1), X_2 and $Ln x_3$, as independent variables at a Significant level less than (0.05)

5.7. GLM Multivariate Analysis

This presents a general linear model to test of variance for more than one dependent variable by factor covariates one or more. The process of GLM by dividing the population into groups. This model tests null hypotheses regarding to influence of factor variables on the means of various groupings of a joint distribution of dependent variables. The study examined interaction between variables and the impact of individual factors. Besides, the influence of interactions between covariate and covariates with factors. Variables are specified as covariates based on regression analysis.

Table (5), it reports that:

- By using multivariate tests, it is indicated that the overall effect of the covariates related to x_1 , x_2 , $Ln x_3$, on the dependent variables related to the y_1 , y_2 , and y_3 , at a significant level less than (0.001).
- The partial eta squared of the covariate variables in terms of x_1 , x_2 , $Ln x_3$ and the interactions between x_1 x_2 and $Ln x_2$ account for (0.057-0.212-0.210-0.013) of the variation in the total dependent variables, i.e., from the medium effect to large effect, finally to small effect.

Table 4. The matrix of Pearson correlation to test a significant linear correlation between the constructs of both independent and dependent variables

Constructs	Return on equity (Y_1)	Return on asset (Y_2)	Liquidity (Y_3)	Standard deviation of ROE X_1	Standard deviation of ROA (X_2)
ROE Y_1	1				
ROA Y_2	0.633***	1			
L (Y_3)	-0.0390	-0.048	1		
STD ROE(X_1)	0.349***	0.418***	0.146**	1	
STD ROA (X_2)	0.671***	0.482***	0.115*	0.555***	1
$Ln x_3$	0.375***	0.169***	-0.175***	-0.245***	0.082

*** P value is $\geq (0.001)$. ** Probability at $\geq (0.01)$. * Probability at $\geq (0.05)$.

Table 5. Multivariate tests in terms of Pillai's Trace, Wilks' Lambda, Hotelling's Trace and Roy's Largest Root

Multivariate Tests							
Effect		Value	F	Hypothesis df	Error df	Sig.	Partial Eta Squared
Intercept	Pillai's Trace	.225	37.635 ^a	3.000	390.000	.000	.225
	Wilk's Lambda	.775	37.635 ^a	3.000	390.000	.000	.225
	Hotelling's Trace	.289	37.635 ^a	3.000	390.000	.000	.225
	Roy's Largest Root	.289	37.635 ^a	3.000	390.000	.000	.225
x ₁	Pillai's Trace	.057	7.913 ^a	3.000	390.000	.000	.057
	Wilk's Lambda	.943	7.913 ^a	3.000	390.000	.000	.057
	Hotelling's Trace	.061	7.913 ^a	3.000	390.000	.000	.057
	Roy's Largest Root	.061	7.913 ^a	3.000	390.000	.000	.057
x ₂	Pillai's Trace	.212	35.051 ^a	3.000	390.000	.000	.212
	Wilk's Lambda	.788	35.051 ^a	3.000	390.000	.000	.212
	Hotelling's Trace	.270	35.051 ^a	3.000	390.000	.000	.212
	Roy's Largest Root	.061	35.051 ^a	3.000	390.000	.000	.212
Inx ₃	Pillai's Trace	.210	34.510 ^a	3.000	390.000	.000	.210
	Wilk's Lambda	.790	34.510 ^a	3.000	390.000	.000	.210
	Hotelling's Trace	.265	34.510 ^a	3.000	390.000	.000	.210
	Roy's Largest Root	.265	34.510 ^a	3.000	390.000	.000	.210
x ₁ *x ₂ *Inx ₃	Pillai's Trace	.013	1.717 ^a	3.000	390.000	.163	.013
	Wilk's Lambda	.987	1.717 ^a	3.000	390.000	.163	.013
	Hotelling's Trace	.013	1.717 ^a	3.000	390.000	.163	.013
	Roy's Largest Root	.013	1.717 ^a	3.000	390.000	.163	.013

Table (5), it reports that:

- By using multivariate tests, the overall effect of the covariates related to x₁, x₂, Inx₃, on the dependent variables related to the y₁, y₂, and y₃, at a significant level less than (0.001).
- The partial eta squared of the covariate variables in terms of x₁, x₂, Inx₃ and the interactions between x₁ x₂ and Inx₂ account for (0.057-0.212-0.210-0.013) of the variation in the total dependent variables, i.e., from the medium effect to large effect, finally to small effect.

Table 6. Tests of between - subject's effects

Source	Dependent Variable	Type III Sum of Squares	Df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	y ₁	4.814 ^a	4	1.206	126.962	.000	.564
	y ₂	.081 ^b	4	.020	43.863	.000	.309
	y ₃	.089 ^c	4	.022		.001	.049
Intercept	y ₁	.913	1	.913	96.084	.000	.197
	y ₂	.007	1	.007	15.271	.000	.037
	y ₃	.109	1	.109	24.883	.000	.060
x ₁	y ₁	.110	1	.110	11.629	.001	.029
	y ₂	.010	1	.010	20.537	.000	.050
	y ₃	.001	1	.001	.142	.707	.000
x ₂	y ₁	.970	1	.970	102.128	.000	.207
	y ₂	.008	1	.008	18.154	.000	.044
	y ₃	.004	1	.004	.860	.354	.002
lnx ₃	y ₁	.934	1	.934	98.333	.000	.201
	y ₂	.011	1	.011	24.075	.000	.058
	y ₃	.047	1	.047	10.791	.001	.027
x ₁ *x ₂ *lnx ₃	y ₁	.049	1	.049	5.125	.024	.013
	y ₂	.001	1	.001	1.389	.239	.004
	y ₃	4.34E-005	1	4.34E-005	0.10	.921	.000
Error	y ₁	3.724	392	.009			
	y ₂	.182	392	.000			
	y ₃	1.723	392	.004			
Total	y ₁	16.397	397				
	y ₂	.656	397				
	y ₃	4.083	397				
Corrected Total	y ₁	8.548	396				
	y ₂	.263	396				
	y ₃	1.812	396				

From table (6), the researcher revealed that:

- The covariate Variables Standard deviation of Return On Equity X₁, Standard deviation of Return On Asset X₂, natural logarithm of total asset lnX₃ and the interactions between x₁ x₂ and lnX₃ explain (5-56.4%) from total variation of dependent variables in terms of Return On Equity Y₁, Return On Assets Y₂, and Liquidity Y₃.
- There is a significant effect of the covariate Variables in terms of x₁, x₂, and lnX₃ on the dependent variables in terms of y₁, and y₂, at a significant level less than (0.001).

1. Coefficient of determination = .564, adjusted coefficient of determination = .560
2. Coefficient of determination = .309, adjusted coefficient of determination = .302
3. Coefficient of determination = .049 adjusted of coefficient of determination = .039

From table (6), the researcher revealed that:

- The covariate Variables ST ROE(X_1), STROA (X_2), natural logarithm of total assets ($\ln X_3$) and the interactions between $x_1 x_2$ and $\ln x_3$ explain (5-56.4%) from total variation of dependent variables in terms of ROE (Y_1), ROA (Y_2), and Liquidity Y_3 .
- There is a significant effect of the covariate Variables in terms of X_1 , X_2 , and $\ln x_3$ on the dependent variables in terms of (Y_1), and (Y_2), at a significant level less than (0.001).

5.8. Parameter Estimates

According to the Multiple Regression model using ordinary least squares, the outcome from above table reports

1. There is a significantly positive linear relationship between (X_1) standard deviation of return on equity when $\beta = 3.424819$, (X_2) standard deviation of return on asset when $\beta = 2.62624996918$ when $P = (0.001)$ and natural logarithm of total assets when $\beta = 0.0340068336731$, with return on equity (Y_1) a probability $\geq (0.0259)$.
2. There is a significantly positive linear associated risk assessment measured by (X_1) standard deviation of return on equity when $\beta = 0.909990054837$, (X_2) standard deviation of return on asset when $\beta = (0.244324942181)$ and natural logarithm of total assets where $P = 0.00375909529112$ with return on asset, at a probability = (0.001).
3. There is a significant positive linear relationship between (X_1) standard deviation of return on equity when $\beta = 0.235872881803$, (X_2) standard deviation of return on asset when $\beta = (0.163836007351)$ on liquidity; however, there is a negative relationship between and natural logarithm of total assets when $P = (-0.00761283181416)$

The results of this study are consistent with theory of risk return, namely there is direct relationship between risk and return. That theory is known as efficient market theory, also in line with Lagat F. Kiprop [42] and Thitima Chaikyul [27], who found a positive relationship between risk and financial performance but on contrary with Yu - Luen Ma & Yayuan Ren [30] which found a negative

relationship between institutional ownership measured by (ratio of equity owned) and financial performance of insures during the financial crisis of 2008, but the relationship between institutional ownership with risk is positive, and the results consistent with asymmetric information approach Greenwald, Bruce and Stiglitz, Joseph E (43).

5.9. The Coefficient of Determination

The covariate independent Variables (X_1), (X_2), and firm size X_3 the interactions between X_1 , X_2 and $\ln X_3$ explain ((5-56%)) this ratio from total variation of ROE (Y_1), return on assets(Y_2), and liquidity y_3 . As dependent variables

5.10. F Test

The reason for F test to examine the significance of the model in ability to predict, based on the results of the multivariate model the value of "F test" is significant at $\geq (0.05)$, then result indicates that covariate standard (X_1), (X_2), and firm size $\ln X_3$ the interactions between (X_1) and (X_2) have been effected on the level of dependent variables in terms of ROE(Y_1), ROA(y_2), and liquidity y_3 .

5.11. T-test

There is a significant positive impact of the covariate Variables SDROE(X_1), SD ROA (X_2), and firm size $\ln x_3$ on the dependent variables return on equity (Y_1), and return on asset (Y_2), at a probability $\geq (0.001)$, however there is a significantly negative impact of interactions among (X_1), (X_2) and $\ln x_3$ on the dependent variables (Y_1) y_1 , where $P \geq (0.05)$. There is no significantly impact of covariate Variables in terms of (X_1), (X_2), and interactions among (X_1), (X_2) and $\ln x_3$ on the dependent variable liquidity (Y_3), where $P \leq 0.05$

There is a positively significant influence of the covariate Variables SDROE (X_1) and SDROA on asset (X_2) on the dependent variables return on equity (Y_1), and return on asset (Y_2), where $P \geq (0.01)$, however there is a negatively significant influence of interactions between SDROE (X_1) and SD ROA (X_2) on the dependent variables in terms of Y_1 , and Y_2 , where $P \geq (0.001)$. , There is an insignificant influence of covariate Variables in terms of SD ROE (X_1), ST ROA (X_2), and the interactions between SD ROE (X_1) and SDROA (X_2) on the dependent variable liquidity (Y_3), where $p \geq (0.05)$.

Table 7. Analysis of regression to measure impact of the covariate on the dependent variables

1-regression analysis to examine impact of the covariate of $x_1, x_2, \ln x_3$, the interactions between $x_1 x_2$ and $\ln x_2$ on the dependent variables in terms of y_1					
Variable	Coefficient	Std. Error	t-Statistic	Prob.	VIF
X_1	3.074693	0.907362	3.388608	0.001***	4.156388
X_2	2.626250	0.260569	10.07889	0.001***	4.417724
$\ln x_3$	0.034007	0.003425	9.928236	0.001***	1.150120
$X_1 * x_2 * \ln x_3$	-2.135617	0.955094	-2.236028	0.0259*	9.317182
C	-0.470354	0.047931	-9.813089	0.001***	--
R ² =56.4% F-test= 127.1 Sig=0.001*** AIC = -1.81 SC= -1.76 HQC= -1.79 RMSE=0.096 U= 0.25 DW=1.84 JB=99.2 SIG=0.001 BG=0.029 SIG=0.97 Heteroskedasticity Test :BPG F-test=0.743 Sig=0.563 Ramsey RESET Test F test=0.984 Sig=0.32					
$Y_1 = 3.07469293978 * X_1 + 2.62624996918 * X_2 + 0.0340068336731 * \ln x_3 - 2.13561693439 * X_1 * X_2 * \ln x_3 - 0.47035432778$					
2- regression analysis to examine the effect of the covariate $x_1, x_2, \ln x_3$, and the interactions between $x_1 x_2$ and $\ln x_3$ on the dependent variables in terms of y_2					
X_1	0.909990	0.200493	4.538763	0.001***	4.156388
X_2	0.244325	0.057576	4.243515	0.001***	4.417724
$\ln x_3$	0.003759	0.000757	4.966729	0.001***	1.150120
$X_1 * x_2 * \ln x_3$	-0.246495	0.211040	-1.168002	0.2435	9.317182
C	-0.041982	0.010591	-3.963933	0.001***	--
R ² =31% F-test= 44.1 Sig=0.001, AIC = -4.82 SC= -4.77 HQC= -4.80 RMSE=0.021 U= 0.28 DW=1.63 JB=2.72 SIG=0.257 BG=0.904 SIG=0.41 Heteroskedasticity Test :BPG F-test=2.07 Sig=0.084 Ramsey RESET Test F test=3.7 Sig=0.055					
$Y_2 = 0.909990054837 * X_1 + 0.244324942181 * X_2 + 0.00375909529112 * \ln x_3 - 0.246495039685 * X_1 * X_2 * \ln x_3 - 0.0419821323686$					
3- regression analysis to examine effect of the covariate $x_1, x_2, \ln x_3$, the interactions between $x_1 x_2$ and $\ln x_3$ on the dependent variables in terms of y_3					
X_1	0.235873	0.617416	0.382032	0.7026	4.156388
X_2	0.163836	0.177305	0.924035	0.3560	4.417724
$\ln x_3$	-0.007613	0.002331	-3.266290	0.0012	1.150120
$X_1 * x_2 * \ln x_3$	0.064782	0.649895	0.099681	0.9206	9.317182
C	0.162210	0.032615	4.973472	0.001***	--
R ² =4.9% F-test= 5.04 sig=0.001*** AIC = -2.58 SC= -2.53 HQC= -2.57 RMSE=0.066 U= 0.37 DW=1.75 JB=50.2 SIG=0.001 BG=2.52 SIG=0.06 Heteroskedasticity Test :BPG F-test=1.59 Sig=0.17 Ramsey RESET Test F test=3.82 Sig=0.051					
$Y_3 = 0.235872881803 * X_1 + 0.163836007351 * X_2 - 0.00761283181416 * \ln x_3 + 0.0647820724583 * X_1 * X_2 * \ln x_3 + 0.162209604044$					

5.12. VIF Values

Variance inflation factors are statistically used to measure multicollinearity. Multicollinearity is a problem when variance inflation factors exceed 10. Other viewpoints consider the value of the variance inflation factors should not exceed 4 or 5. From the table above, the value of $VIF \geq 4$, based on this result there is no multicollinearity problem.

5.13. The Jarque-Bera Test

Since the significance value of the Jarque-Bera test statistic (<0.05), null hypothesis is not accepted (H_0): Errors are normally distributed.

Since the coefficient of Pearson skewness is $\geq (1)$ or greater than or equal (-1) , this result elucidated that data is not significantly skewed.

5.14. Theil's Inequality Coefficient U

This test is used to measure the accuracy of the estimates of the fixed effects model. The range of Theil's inequality coefficient U (0 to 1), where zero indicates a perfect fit. Since value ranges between 0.25 and 0.37, this result indicates the goodness of fit of the model, at a percent of $\leq (72\%)$ the first two models.

5.15. The Durbin-Watson Test Statistic

This test to investigate the interaction between risk assessment and financial performance in insurance firms in Egypt, when Non-autocorrelation when a value near 2; when a value toward 0 refers to positive autocorrelation; while a value toward 4 refers to a negative autocorrelation., the null hypothesis is accepted Since the test statistic value (1.63-1.84) was greater than DU

5.16. Breusch-Godfrey Serial Correlation LM Test

The BG significance value is (≥ 0.05), then the null hypothesis (H_0) is accepted: there is no serial correlation up to lag order P (2)

5.17. Heteroskedasticity Test

It is revealed that a level of significance for the tests: F-statistic, Obs * R-squared, Scaled explained SS is $\leq (0.05)$, which indicates the acceptance of the null hypothesis which provides for the Homoskedasticity of error term.

5.18. Ramsey RESET Test

Since significance value of T-statistic, F-statistic, Likelihood ratio test statistic (≥ 0.05) then the null hypothesis (H_0) is reject: The functional form is correct. No variable is omitted.

5.19. Recursive Estimation

Figure 1 illustrate CUSUM test. The result shows the instability of parameters because cumulative sum appears

outside area between two critical lines, according to cumulative sum of the recursive residual this option illustrates cumulative sum together with 5%

5.20. Leverage

Leverage score calculated as $(L + 1) / N$ where L is measured X_1, X_2 and X_3 as independent variables using in the model where N is observations. Leverage scores 2 to 3 times this value. This means Observations with high leverage. All centered leverage values are less than leverage score $3(L + 1) / N$, will pull the regression line towards it when observation with high leverage.

5.21. Cooks Distance

All cooks distances are presented below the threshold index $4/n$.

5.22. Mahalanobis D^2

The significance value of the Mahalanobis D^2 test statistic (≥ 0.001). Based on this result, null hypothesis is (H_0): data is normally multivariate distributed, and regression model does not contain multivariate outliers.

Figure 1. Cumulative Sum Control Chart

The above figure illustrate CUSUM test according to cumulative sum of the recursive residual. This option plots the cumulative sum together with the 5% critical lines. The result shows the parameter instability if the cumulative sum goes outside area between two critical lines.

6. Conclusions

This study used general linear multivariate analysis and descriptive statistics to investigate the relationship between risk assessments on financial performance of insurance sector in Egypt ; data was collected form financial reporting (balance sheets – income statements) which is issued by the Financial Regulatory Authority in Egypt over the period 1999- 2019, whereas the sample included nineteen Egyptian insurance companies which were selected according to the availability of data during the study period . The study findings indicate that:

1. There is a significant positive linear relationship between standard deviation of return on equity when $\beta = 3.424819$, and standard deviation of return on asset when $\beta = 2.62624996918$ when $P = (0.001)$, and natural logarithm of total assets when $\beta = 0.0340068336731$, with return on equity, at a probability $\geq (0.0259)$.
2. There are significant positive linear relationships between standard deviation of return on equity when $\beta = 0.909990054837$, standard deviation of return on asset when $\beta = (0.244324942181)$, and natural logarithm of total assets where $P = 0.00375909529112$ on return on asset, at a probability $= (0.001)$.
3. There are significant positive linear relationships between standard deviation of return on equity when $\beta = 0.235872881803$, standard deviation of return on asset when $\beta = (0.163836007351)$ on liquidity; however, there is a negative relationship between and natural logarithm of total assets when $P = (-0.00761283181416)$.

However, this study is in line with asymmetry information approach which was developed by Greenwald, Bruce and Stiglitz, Joseph E (43) who have proved that as a consequence firms will act in a risk averse manner, .

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