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ISSN 2148-6697

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DISCRETIONARY CHOICES OF COMMERCIAL BANKS IN BANGLADESH: AN EARNINGS MANAGEMENT APPROACH

DOI: 10.17261/Pressacademia.2022.1540

JEFA- V.9-ISS.1-2022(1)-p.1-11

Niluthpaul Sarker¹, Anupam Das Gupta²¹Jagannath University, Department of Accounting & Information Systems, Dhaka 1100, Bangladesh.
niluthpaul@yahoo.com, ORCID: 0000-0002-9911-0706²University of Chittagong, Department of Finance, Chittagong-4331, Bangladesh.
anupam@cu.ac.bd, ORCID: 0000-0002-0094-4541

Date Received: December 22, 2021

Date Accepted: March 15, 2022

OPEN ACCESS



To cite this document

Sarker, N., Gupta, A. D., (2022). Discretionary choices of commercial banks in Bangladesh: an earnings management approach. Journal of Economics, Finance and Accounting (JEFA), 9(1), 1-11.

Permanent link to this document: <http://doi.org/10.17261/Pressacademia.2022.1540>

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ABSTRACT

Purpose- The study aims to trace out the factors contributing to earnings management practices in the commercial banks of Bangladesh.**Methodology-** The study used secondary data sources from the published audited annual reports of 32(Thirty-Two) commercial banks of Bangladesh from the year 2005-2018 of 425 observations. The study conducted preliminary diagnoses like normality, unit root, and Granger causality test to identify the data's nature and response. Moreover, the study performed the heteroscedasticity test, autocorrelation test, and fixed and random effect of the model to confirm the output's accuracy. Based on the above statistical diagnosis, the study has selected Robust Least Square (RLS) regression model to show the practice of discretionary choices in the banking sector of Bangladesh. Following Kanagaretnam et al.'s (2003), this study also derived discretionary and non-discretionary accruals from loan loss provisions.**Findings-** This study considered several factors like bank size ($SIZE_{it}$), loan to deposit ratio (L/DEP_{it}), non-performing loan to previous year's total loan ratio ($NPLR_{it-1}$), changes in non-performing loan to current total loan ratio ($\Delta NPL/TL_{it}$), and changes in total asset to total loan ratio ($\Delta TA/TL_{it}$) to show the effects on banks' earnings management. It is found that $SIZE_{it}$, $NPLR_{it-1}$, $\Delta NPL/TL_{it}$ and $\Delta TA/TL_{it}$ have a positive and significant ($p < 0.01$; $p < 0.05$) effect on Bank's discretionary choice. However, L/DEP_{it} positively affects earnings management but is statistically insignificant.**Conclusion-** Despite being a legal tool, earnings management is often involved with the controversy of being an unethical practice. However, there has been a lot of research on tracing earnings management in corporate firms based on discretionary and non-discretionary accruals. The study contributes to the existing literature and tries to explain the role of discretionary accruals in banks performance mostly in the submerged economy. Along with identifying significant variables, the study has tried to explain the implication of these findings suggesting some crucial steps that may help reduce the practice of earnings management as earnings management distorts the banks' financial position or any firm and misleads the investors.**Keywords:** Earnings management, discretionary accruals, panel data, commercial banks, Bangladesh.**JEL Codes:** C22, C23, G21

1. INTRODUCTION

Earnings management (EM) is concerned with the manipulation or alteration of recorded economic results of the company by the insiders to "mislead certain creditors" or "influence contractual results" [1]. Insiders may use their discretion to manipulate financial reporting to avoid adverse earnings realizations that may influence outsiders' decisions. According to Leuz, Nanda [2], the purpose of management exploiting profits is to boost their reputation in outsiders' eyes by supplying misleading financial records that conceal weaknesses in the firm's results.

Many researchers have conducted on EM in western countries' perspective. The study of Leuz, Nanda [2] found that economies with strict compliance have the lowest levels of earnings management, and Shen and Chih [3] also evaluated EM in forty-eight (48) countries and observed that managers exploit earnings in the majority of them.

Moreover, Yasuda, Okuda [4] found that banks' risks are negatively associated with their earnings management. It also demonstrates the outsiders' incorrectly reported earnings about Bank financial health. Furthermore, Adams, Hermalin [5] revealed that insiders benefit from handling these profits from tactful management. Again, Kanagaretnam, Lim [6]

demonstrated that auditors' experience mitigates banks' earnings management. Meisel [7] investigated earnings management in bank mergers and found evidence that it increased for banks, especially before the merger.

Abaoub, Homrani [8] divided earnings management studies for the banking sector into two categories: first, those looking at incentives concerning regulatory limits, and second, those looking at and evaluating earnings management calculations models. Eventually, earning management is addressed through Discretionary Accruals Management (DAM) and Real Activities Manipulation (RAM). DAM adheres to widely agreed-upon accounting principles and makes accounting decisions that aim to boost the firm's reputation [9]. Real Activities Manipulation (RAM) happens as administrators make decisions that affect the accounting performance by altering the timing or arrangement of transactions. Discretionary Accruals (DAs) are accounting accrual forms that focus on the first category. Bank executives can also deceive outsiders by manipulating financial data to satisfy shareholders [10]. There are many approaches for calculating discretionary accruals as an earnings management proxy, one of which uses the adapted Jones model, which Yasuda, Okuda [4] used with modifications appropriate for the banking industry. Furthermore, Meisel [7] used an updated Jones formula and a few other tweaks to measure banks' earnings management before the merger.

Earnings management has been referred to as opportunistic behavior if it successfully reaches the target number according to the company policy; moreover, if it can maximize the firm value, then EM is treated economically efficient [11]. If not affect the decision-making, earnings management would be good, but misinformed investors can sue the firm if the cost exceeds its benefits. Earnings management can be good by providing summarized information of the company to the shareholders, enhancing the firm's value; on the other hand, it can be bad due to poor governance, ignorance of shareholders, and moral hazards, thus diminishing the firm's value [11].

Therefore, there arise few research questions. These are: What are the factors that are responsible to influence the earnings management of the banking sector of Bangladesh? The discretionary choices of the management depend on several factors, i.e. internal and external. The study tried to show the effects of bank size, Outsider's influence, credit risk and assets structures on earnings management.

The study investigates the earnings management practices in Bangladesh's banking sector in the light of loan loss provision. The research theme is segregated into two (2) broad stages. The first section deals with discretionary and non-discretionary accruals, and the second section shows the factors affecting the banks' earnings management. There is limited scope for academic and institutional research in Bangladesh due to the scarcity of resources. However, economic development is not a random choice; rather, it will be effective in a homogeneous growth considering every aspect of the society. Therefore, the study's purpose is very straightforward and directly shows the effect of some bank-level variables on earnings management of the commercial banks in Bangladesh.

2. LITERATURE REVIEW

In EM literature, a distinct and important field of study differentiates "abnormal" from "normal" accruals by explicitly modelling the accrual method. Most of the research in accountings used "abnormal" accruals created by an accruals model to measure earnings efficiency. EM is most often debated for surrogate accruals abnormally to gain earning efficiency. The usual accruals are preordained to catch changes that represent actual results, while irregular accruals are unavoidable to apprehend distortions caused by the implementation of accounting rules or earnings management.

The expression "discretionary accruals" is also known as irregular accruals, seems to more synonymous with an intentional decision than a result of the measuring method or defect. These indicators are primarily appropriate for accounting analysts to explicitly locate issues with the accounting calculation scheme. The basic interpretation of accruals is that if the "normal" component is modelled correctly, the distinctive feature reflects a distortion of poor significance.

Discretionary accruals were the base point to distinguish earnings accounting. Mainly operational cash flow and gross accruals are the prime elements of earnings. Total accruals consist of discretionary accruals and non-discretionary accruals. The accrual portion of the accounting regulator levies in changing a firm's cash flows refers to the non-discretionary accruals. However, discretionary accruals are the portion of accruals that managers choose under the flexibility of accounting legislation in adjusting firms cash flows.

Healy [12] first implement discretionary accruals to address earning accounting. However, a doctrine explores discretionary accruals as a distortion of earnings by management, whereas non-discretionary accruals are presented as it is. Budgetary accruals also offer managers opportunities to exploit earnings due to their versatility [13].

Healy [12] further explained discretionary accruals as gross accruals by lagged total assets. It indicates zero probability of non-discretionary accruals. The author observed that motives of reward lead the administrators to use accruals. In 1986, DeAngelo believed non-discretionary accruals became random and used this peculiar behavior approach. The discretionary aspect of

accruals should be mirrored by the transition in overall accruals from the previous year to the current in detecting earnings control. It indicates non-discretionary accruals are expected to follow from year to year persistently.

DeAngelo [14] studied sixty-four (64) firms and observed managers' tendency to understate earnings before restructuring the organization through shares buyout.

Under Healy [12] and DeAngelo [14] strategy, both believed the non-discretionary accruals portion is constant and overall accruals can capture all earnings management operations. However, this statement is unlikely to be empirically descriptive. The effect of changes in economic circumstances from time to period should reflect the shift in the amount of non-discretionary accruals [15]. In comparison, Healy [12] and DeAngelo [14] opine that managers are intended to employ income adjusting tactics, either increasing or decreasing. However, they pinpointed all accruals as discretionary accruals and ignored non-discretionary accruals, theoretically incorrect due to misclassification.

Jones [16] proposed a linear regression model to address this constraint by acknowledging non-discretionary determinants. The author improvised revenue management using existing asset liabilities for non-discretionary accruals. Jones [16] advocated land, equipment and plant control for a non-discretionary ratio of depreciation expenditure. This is because working capital accruals are derived from revenue; however, depreciation accruals are based on land, factory, and related facilities. Later on, it is found that the calculation technique used by managers have exercised more unfavorable discretionary accruals to minimize revenue. Previous models validate a fair check for random samples that section accruals into discretionary and non-discretionary, limiting the power of testing. However, discretionary accrual has to be enormous compared to observed earnings [13]. Earnings were artificially distorted in the time-series model of Dechow [13]. When the mediated distortion reaches fifty (50%) percent of total assets, they reported that this method detects earnings management near the hundred (100%) mark. However, if the mediated manipulation represents five (5%) percent of total properties, this model can only detect less than thirty (30%) percent of the manipulation.

To enhance the power in measuring earning control, Dechow [13] modified Jones [16] model. Dechow [13] deducted adjustment in account receivables from the revenues change to prevent calculation errors where discretion is exercised to adjust non-cash revenues.

Peasnell, Pope [17] also advocate the cross-sectional Jones [16] Model to observe the capacity of earnings management. They claimed the rejection rates with the null of no earnings management could be as high as forty (40%) percent of the cases where earnings manipulation equals just two (2%) percent of total assets. The cross-sectional model's more significant influence in detecting EM may also result from model misspecification [18].

Moreover, implemented models are not signifying specific tests in the study firm-years witnessing severe financial results. Pragmatic research indicated earnings control actions dependent upon discretionary accruals would result in false inferences. Mainly two sources contribute to model misspecification. They are first omitting the operational cash flows. Managers tend to adjust earnings through shifting excessive operational cash flow to subsequent weak operating cash flows. In analysing operational cash flow portfolios, McNichols and Wilson [19] witnessed a negative association between systematic accounting discretion and operating cash flow. Nonetheless, certain companies could reduce income if the functional output is meagre. The fact is referred as 'taking a bath' technique. Association between EM and cash is evident in literature, and sometimes, cash flow adjustment is inevitable [20]. Dechow [13] observed a negative correlation between operating cash flow and discretionary accruals. The author also opined that budgetary accruals are contingent on cash flow activities. Therefore, the higher the operating cash flows, the lower the discretionary accruals choice of managers. Kasznik [21] incorporated the shift of operational cash flows into the Modified Jones [16] Model to monitor the impact of cash flow. Later, Dowlal and Barua [22] approached a similar model to establish budgetary accruals in reaching earning benchmarks. Shuto [23] also detected earnings control consistent with executive pay. Secondly, the model can even misinterpret without adjusting for severe earnings results. Kasznik [21] evidenced an association between a firm's earnings success and discretionary accruals.

Thereby, low productive businesses should opt for earning management in revenue increasing and/or income decreasing. Kasznik [21] addressed the correlated omitted variables results from earnings outputs. The author endorsed a Performance Adjust Technique (PAT) to adjust expected budgetary accruals by eliminating the impact of a firm's earnings performance. Based on earnings efficiency, projected discretionary accruals are sorted by percentile under this method. Again, earning performance is addressed through return on assets (ROA). After that, each observation's discretionary accruals subtract from the median of discretionary accruals of each percentile. This method address calculation errors and more accurate evidence on EM is obtained.

Kothari, Leone [24] added other changes, say incorporated return on assets as an external independent variable into the Modified Jones Model [13] to control a firm's output. Nevertheless, the performance-matched solution was adopted. They estimated performance-matched discretionary accruals by comparing the firm-year observation of the survey firm with the same sector and year's control firm. Therefore, the nearest ROA of the current year or prior year subtracted the monitoring firm's discretionary accruals from the sample firm's discretionary accruals. Even so, as the literature covering budgetary

accruals has progressed over the decades, the most effective methods have been derived from accounting for earnings control.

However, the darkest spot in earning management in this century is that it has found an association with massive accounting scandals. Agency theory illustrates individuals' rational behaviour who seek expected utility by ranking alternative actions against their desired outcomes. Finally, choose the best alternative action(s) to maximize the objective function. Therefore, the expected utility approach assumes rational behavior of individuals and explains their decision-making process also considers negative consequences of actions in the optimum decision-making process. It also narrates that beliefs are independent of tastes [25].

This postulates the involvement of factors that drive earnings management by impacting the firms' stock prices. Capital market movements do not affect earning management if the economic conditions of firms reveal from the stock prices. As stock prices do not mirror the firm value, thus earnings management become a relevant concern[11].

Third parties' involvement also observed an apparent relationship in earnings management. In decision making, accounting information is the relevant concern. Thus parties involved with the firm in investing and other decisions have prospective interest in business transactions directly or indirectly. They may also have concerns regarding the firm's operational structure. Thus, third parties involvement plays an active role in strategic management of firms and their resources to generate earnings [11].

The study summarized the different earnings management ambitions and classified them as black, white, or gray. White (beneficial) EM ensures transparency in reporting. However, debated practices are black and gray earnings management. The black (pernicious) denotes outright misrepresentation or intentional fraud, whereas the gray depicts the manipulation of statements within compliance boundaries.

Earnings management, managing earnings by selling the futile asset, acquiring new technology, and removing excess inventories sometimes require taking cash from the company's reserve to make earnings positive or to level the earnings [26]. Sometimes faster selling, altering product shipping schedule, slowing research and development cost facilitate earning management. Most often, earning management favours the major shareholders, ignoring the minor shareholders' interest.

Chinese commercial banks approach earning management through manipulation of loan loss system. To adjust profit smooth commercial banks manipulate the ready system for loan losses. Profit smooth plays an active role in stable stock price and steady profit that enhance investors' confidence. To project future earning capacity, managers set aside current surplus to extract upcoming loan losses. However, the management strategy could be a plan to manipulate the recent loan loss provisioning for future adjust to avoid significant fluctuation. Again avoiding the tax, commercial banks can present better income and changing reserve funds can smooth the income fluctuations [27].

Being a vital matchmaker of the economy, banks need to understand that discretionary factors are involved in reporting and profitability. Earnings management is not regarded as illegal as managers use accounting criteria and established regulations. However, analysts and agents should be concerned and understand it to pinpoint accurate risk perception. Bornemann, Kick [28] evidenced the practices of EM using a particularity system will not be applicable for all countries [29]

3. METHODOLOGY

Commercial banks' loan loss provision may be counted and drawn by earnings management. Smoothing a bank's profits, as previously mentioned, has been legalized due to the term Dynamic Provisioning, or forward planning provisioning, which was phased in under the BASEL III system in 2010 for the primary intention of helping banks to handle shocks during a recession. This study used a quantitative methodology, with secondary data gathered from audited annual reports of Bangladeshi commercial banks. It is an explanatory analysis that looks at the interaction between dependent and independent variables. The logical sequence of the study is explained below:

This study covers data from the year 2004 to 2018. The total number of observations made for the research is 457.

We address the earning management (EM) through discretionary loan loss provision. Definitions of other variables are:

Size = The natural logarithm of current assets of the banks.

L/DEP= Loan to deposit ratio.

Risk (NPLTL) =Non-performing loan to previous year's total loan ratio.

Δ NLP/TL = Change in non-performing loan to current total loan ratio

Δ TA/TL = Change in total asset to total loan ratio

3.1. Model Specification & Hypotheses

The study objectively works to show the discretionary choices of banks in the context of Bangladesh. The composition of discretionary accruals and non-discretionary accruals is generated from the choices of banks in the Loan-Loss Provision section. The analysis approach of Kanagaretnam, Lobo [30], of which the loan loss clause was divided into discretionary and non-discretionary portions—is being considered to empirically investigate the relationship between the discretionary component of the loan loss provision and earnings before taxes and provisions. We use the same calculation to determine the conditions that directly impact commercial banks' loan loss liability to smooth out their earnings. The determination of non-discretionary accruals allows obtaining the discretionary accruals. Therefore, we can develop the equation as:

$$LLP = DLLP + NLLP$$

Here, LLP = Loan Loss Provision

DLLP = Discretionary Accruals of LLP

NLLP = Non-discretionary Accruals of LLP

The model is homogeneous to the prior research conducted by Kim and Kross [31], Beaver and Engel [32], Beatty, Chamberlain [33]. The non-discretionary accruals can be estimated based on the equation (1):

$$LLP_{it} = \alpha_0 + \alpha_1 NPL_{it-1} + \alpha_2 \Delta NPL_{it} + \alpha_3 \Delta LOAN_{it} + \varepsilon_{it} \quad (1)$$

In the above equation, LLP_{it} indicates the Loan Loss Provision ratio during the period, NPL_{it-1} denotes the Non-Performing Loan ratio of the previous period, ΔNPL_{it} denotes changes of Non-Performing Loan ratio concerning the previous period. Finally, $\Delta LOAN_{it}$ denotes the change of loan and advances with the prior period deflated by beginning loans. Moreover, α_0 is the constant term, α_1 shows the positive effect of NPL_{it-1} to LLP_{it} as higher non-performing loan in the previous year bounds the management of the Bank to take more provision in the current year; α_2 also shows the positive effect of ΔNPL_{it} on LLP_{it} because the increment of non-performing loan also insists on taking more provision; finally, α_3 shows the positive effect of $\Delta LOAN_{it}$ on LLP_{it} as higher loan portfolio or whimsical approval of loan and advances allure to provide more provision in the year. In the regression equation, the study estimates the non-discretionary accruals (NLLP) by the effect of independent variables and the residual value responsible for finding the discretionary accruals (DLLP).

The next step is to find out the factors that affect the bank's earnings management or the management's discretionary choices. Before going to the final regression analysis, the study will check the preliminary diagnosis (Normality Check, Panel Unit Root Test, Ganger casualty Test, Heteroscedasticity Test, Serial-correlation Test, etc.) and will choose the best fitted approach to produce the final output. The study will also check the Fixed-Effect-Model (FEM) and Random-Effect-Model (REM) through Hausman Test. Based on the prior literature, the model of the study is given below:

$$EM_{i,t} = \alpha_0 + \alpha_1 SIZE_{i,t} + \alpha_2 L/DEP_{i,t} + \alpha_3 NPL_{i,t-1} + \alpha_4 \Delta NPL/TL_{i,t} + \alpha_5 \Delta TA/TL_{i,t} + \varepsilon_{i,t} \quad (2)$$

The variables description and explanation is presented in Definition of the Variable (Section 3.2).

Here, "i" represents number of cross-sections or banks and "t" denotes time period.

Relevant hypothesis of the study can be given as:

H₁: Ceteris paribus, Bank size has a positive effect on Discretionary choices of banks.

H₂: Higher bank liquidity increases the discretionary power of banks.

H₃: One-year lag of credit risk has a positive effect on the discretionary power of banks.

H₄: Incremental credit risk has a positive effect on the discretionary power of banks.

3.2. Preliminary Diagnosis

3.2.1. Normality Check

The study checked the normality of the variable Earnings Management (EM) through a histogram. The standard normal distribution has a bell-shaped density curve that justified the central limit theorem. The most common assumption in a normal distribution is that the violation of normality in the case where the observation is greater than 100 (N>100) is not a major issue. In reality, standard normal distribution should be followed in every case regardless of the sample sizes. In the study, we graphically examine and have found the graph shows the variable "EM" is normally distributed and satisfy the condition of linear regression model (The graph will be available on request to the authors).

3.2.2. Unit Root Test

The study conducted a panel unit root test based on statistical methods of Im, Pesaran and Shin (IPS) test (2003) that allows the cross-sectional dependence in the dataset. In most cases, data stationery is checked for the time dependence series whether the series has a stochastic trend or random walk with drift. The worst-case in unit root series is the inaccurate prediction of the outcome. However, several tests fit panel unit root tests like Levin, Lin and Chu test (2002), Im, Pesaran and Shin test (2003) and Fisher type unit root test, etc. In this study, we conducted Im, Pesaran and Shin (IPS) test to check the stationary of the dataset. The model showed the individual effect as given below:

$$\Delta Y_{i,t} = \alpha_i + \rho_i Y_{i,t-1} + \sum_{z=1}^{P_i} \beta_{i,z} \Delta Y_{i,t-z} + \varepsilon_{i,t} \dots (3)$$

In this model, the hypothesis is developed in the assumption of cross-sectional independence, where,

Null hypothesis: $H_0: \rho_i = 0; i = 1,2,3,\dots,N$
 Alternative hypothesis: $H_1: \rho_i < 0; i = 1,2,3,\dots,N_i; \text{ and}$

$\rho_i=0$ when $i = N_1+1,\dots,N; \text{ with } 0 < N_1 \leq N.$

Furthermore, the model satisfied the normality of the data as per the central-limit-theorem. The number of cross-sections (N) is more than the time period (t) and combined with more observations.

Hypothesis relevant to the Im, Pesaran and Shin (IPS) Unit Root Test:

Null Hypothesis(H_0): All panels contain unit roots;

Alternative Hypothesis (H_a): At least one panel is stationary.

From the examination of Im, Pesaran and Shin (IPS) Unit Root test, we observe all variables are significant at 1% level of significance in both ‘Individual Intercept’ and ‘Individual Intercept and Trend’. It means that the study rejects the null hypothesis, which assumes data are not stationary, rather accepting the alternative hypothesis that the panels are stationary in each case. In fact, Im, Pesaran and Shin (IPS) test is the modified version of Augmented Dicky Fuller test statistics and also follow the normal distribution.

3.2.3. Granger Causality Test

The study uses the Granger causality test for the panel data model. Though the Granger causality test is very common for time series data, it also used in panel data in a bivariate regression model. The bivariate regression form for the causality test is given below:

$$y_{i,t} = \alpha_0 + \alpha_{1,i} y_{i,t-1} + \dots + \alpha_{k,i} y_{i,t-k} + \beta_{1,i} x_{i,t-1} + \dots + \beta_{k,i} x_{i,t-k} + \varepsilon_{i,t} \dots (4)$$

$$x_{i,t} = \alpha_0 + \alpha_{1,i} x_{i,t-1} + \dots + \alpha_{k,i} x_{i,t-k} + \beta_{1,i} y_{i,t-1} + \dots + \beta_{k,i} y_{i,t-k} + \varepsilon_{i,t} \dots (5)$$

In the above model, “i” denotes the cross-sectional dimension and “t” denotes the time-series dimension of the panel. The study used the observations where $n > t$, meaning cross-sectional dependence panel observations. The Granger causality test shows that one data series causes one to forecast the others that best fit the regression model. The hypothesis is developed on:

Null Hypothesis: $H_0: X \text{ does not ganger causes to } Y.$
 Alternative Hypothesis: $H_1: X \text{ is ganger causes to } Y.$

The study found that most of the variables are ganger causes to other variables except for few cases. The significance level for the model is based on the 5% level. The results of the casualty test will be available on request to the authors.

3.2.4. Heteroscedasticity Test

The study checked the heteroscedasticity problem of the data series. Heteroscedasticity shows the uneven scatter of the residuals or errors. The assumption of ordinary least squares (OLS) illustrates the constant variance of residuals (homoscedasticity) derived from a population. However, Heteroscedasticity releases that assumption and is treated as a problem that needs to be addressed in estimation. In this study, we checked the heteroscedasticity “white” test for the model based upon the assumption that:

H_0 : The variances for the errors are equal (Homoscedastic).

H_1 : The variances for the errors are not equal (Heteroscedastic).

The Heteroscedasticity (White) test results have shown that F-statistic value 7.276811 and Probability of F (20,403) is 0.000. Also, the Probability of Chi-Square (20) is 0.000, which reject the null hypothesis that the model is homoscedastic.

3.2.5. Serial Correlation Test

This study opts for Breusch–Godfrey serial correlation LM test. This LM test validates systems with lagged dependent variables and diagonal residual autocorrelation (Validated, 2016). The study also checked the serial correlation of the data set whether the time series data are dependent on its lagged variables over time. The serial correlation LM test assumes a null hypothesis with no serial correlation. The higher test statistics will reject the null hypothesis of no serial correlation. The hypothesis of the test is given below:

H_0 : There is no serial correlation.

H_1 : There exists a serial correlation

From the Breusch-Godfrey Serial Correlation LM Test, it is found that the probability of F-statistics is 0.0000 against the F-statistics value 24.91230. Also, the Chi-square is less than 0.05 or 5%, which allows the null hypothesis to reject and accept the alternative hypothesis. Therefore, the data set has the problem of serial correlation in the residuals.

4. ANALYSIS AND FINDINGS

4.1. Descriptive Statistics

The study showed the descriptive statistics of 457 observations in Table 1. It is found that the average value (mean), standard deviation, minimum and maximum values are presented below. The study showed that the minimum value of EM is zero (0) with an average value of 0.0326 where the standard deviation is 0.0371. It indicates that banks practice lower discretionary power in their judgement. In bank size, the degree of variability is 1.0137, where the average value is trends to reach the maximum value. The study considers both the small and large banks in terms of their assets to evaluate their earnings management effects.

Table 1: Descriptive Statistics

Variables	N	Minimum	Maximum	Mean	Std. Deviation
EM	457	0.00	0.2161	0.0326	0.0371
SIZE _{it}	457	8.88	14	11.3324	1.0137
L/DEP _{it}	457	0.37	1.12	0.8233	0.1129
NPLTL _{it-1}	457	0.00	0.4459	0.0743	0.0844
ΔNPL/TL _{it}	457	-0.2831	0.3925	0.0082	0.0501
ΔTA/TL _{it}	457	-0.1810	1.3642	0.2230	0.1660

Loan and advances to deposit ratio range from minimum 0.00 to 0.2161 with an average value of 0.0326 and has a standard deviation of 0.0371. It is also found that the non-performing loan (NPLTL) rate has a mean value of 0.0743, which is significantly lower than the maximum value, which indicates a lower number of banks has high non-performing loan concentration. Furthermore, the variables ΔNPL/TL_{it}, ΔTA/TL_{it} have lower mean values with lower deviations

4.2. Univariate Analysis

Univariate analysis is the simplest form of statistical analysis. It works in research for both inferential or descriptive statistics. To assess correlation among the variables used in the model Pearson correlation matrix is being constructed in Table 2. The correlation coefficient of a sample is calculated by the sample correlation coefficient, which is denoted as “ r_{xy} ”. The formula for the Pearson sample correlation coefficient is given below:

$$r_{xy} = \frac{\text{Covariance of } xy}{SD \text{ of } x \times Sd \text{ of } y}$$

$$= \frac{\sum_{i=1}^n (x_i - \bar{x})(y_i - \bar{y})}{\sqrt{\sum_{i=1}^n (x_i - \bar{x})^2} \sqrt{\sum_{i=1}^n (y_i - \bar{y})^2}}$$

Where,

N is the sample size of x_i , y_i sample point

$$\bar{x} = \frac{1}{n} \sum_{i=1}^n x_i; \text{ same as } \bar{y}.$$

It can be expressed alternatively,

$$r_{xy} = \frac{\sum x_i y_i - n \bar{x} \bar{y}}{\sqrt{(\sum x_i^2 - n \bar{x}^2)} \sqrt{(\sum y_i^2 - n \bar{y}^2)}}$$

Here, x_i , y_i , \bar{x} , \bar{y} , and n are explained in the above equation.

The study checked the Pearson correlation test for the dataset. It is found that EM_{it} is positively correlated with $SIZE_{it}$, $NPLTL_{it-1}$, and are significant at 1% level. However, L/DEP_{it} and $\Delta TA/TL_{it}$ have a negative correlation with EM_{it} and also significant at 1% level. The correlation among the independent variables is less than 0.50, which shows the weak relation among them. Moreover, we didn't find any multicollinearity problem in the correlation matrix.

Table 2: Pearson Correlation Matrix

	EM	SIZE _{it}	L/DEP _{it}	NPLTL _{it-1}	ΔNPL/TL _{it}	ΔTA/TTL _{it}
EM	1					
SIZE _{it}	.235**	1				
L/DEP _{it}	-.302**	-.100*	1			
NPLTL _{it-1}	.653**	.051	-.390**	1		
ΔNPL/TL _{it}	.193**	.076	-.033	-.297**	1	
ΔTA/TTL _{it}	-.311**	-.406**	.213**	-.379**	.063	1

** and * Correlation is significant at the 0.01 and 0.05 level (2-tailed), respectively

4.3. Multivariate Analysis

Table 3 represents the fitness of the model using these variables and considering the residuals as well to examine the result, and it can be said after judging the value of t-statistics that this model is suitable for producing an unbiased result. It is found that $SIZE_{it}$ has a positive effect on EM_{it} , which is significant at 5% level. L/DEP_{it} has a positive coefficient of 0.0127, which is not significant. $NPLTL_{it-1}$ has a positive coefficient of 0.3859, which is significant at 5% level. It means that the one-year lagged NPLTL increase the power of management discretionary choices to hide probable losses. This will create the information asymmetry problem and make the market unstable. Coefficient of $\Delta NPL/TL_{it}$ and $\Delta TA/TL_{it}$ show positive significant value 5% level. The pooled regression results are given below:

Table 3: Pooled Regression Model for Discretionary Accruals of the Commercial Banks in Bangladesh (2003-2016)

Source	SS	df	MS	Observations	425
Model	0.3675	5	0.0735	F(5, 419)	174.26
Residual	0.1767	419	0.0004	Prob> F	0.0000
Total	0.5443	424	0.0013	Adj R-squared	67.14%
Variables	Coef	Std. Err.	P > t	[95% Conf. Interval]	
SIZE _{it}	0.0070	0.0011	0.0000	0.0048	0.0093
L/DEP _{it}	0.0127	0.0102	0.2110	-0.0073	0.0327
NPLTL _{it-1}	0.3859	0.0160	0.0000	0.3544	0.4175
ΔNPL/TL _{it}	0.3363	0.0222	0.0000	0.2927	0.3800
ΔTA/TL _{it}	0.0165	0.0081	0.0420	0.0006	0.0324
CONS	-0.0932	0.0167	0.0000	-0.1261	-0.0603

The study showed the pooled regression result in Table 3. Table 4 and Table 5 are constructed to examine whether Fixed-Effect-Model (FEM) or Random-Effect-Model (REM) is a better fit for the panel data. The conclusion of choosing the appropriate model is based upon the results of the Hausman test where $p < .05$, which indicates that FEM is appropriate. $SIZE_{it}$ is found insignificant in fixed-effect but significant in random-effect test at 1% level. L/DEP_{it} is found significant at fixed-effect test at 1% significance level but not-significant in the random-effect test. $NPLTL_{it-1}$ is significant in both fixed-effect and random-effect test at 1% level and the same result for $\Delta NPL/TL_{it}$. $\Delta TA/TL_{it}$ is found not-significant in both tests. Constants are significant in both tests at the 10% level at FEM test and at the 1% level at the REM test.

Table 4: Comparative Position of Discretionary Accruals in Fixed Effect and Random Effect

Variables	Fixed-effect	Random-effect
SIZE _{it}	0.0013 (0.0013)	0.0043*** (0.0012)
L/DEP _{it}	0.0316*** (0.0131)	0.0129 (0.0116)
NPLTL _{it-1}	0.3041*** (0.0208)	0.3525*** (0.0181)
ΔNPL/TI _{it}	0.2926*** (0.0211)	0.3191*** (0.0207)
ΔTA/TI _{it}	0.0007 (0.0076)	0.0090 (0.0075)
CONS	-0.0331* (0.0177)	-0.0573*** (0.0172)
Observations = 425 Groups = 32	R-squared	R-squared
	within 0.4387 between 0.8496 overall 0.6483 F(5,388) 60.65 Prob> F 0.0000	within 0.4306 Between 0.8723 overall 0.6717 Wald chi2(7) 470.59 Prob> F 0.0000

*** Significant at 1% level, ** Significant at 5% level, * Significant at 10% level

Hausman test statistics derive a straightforward high level of analysis from the large sample distribution. This distribution simplifies when one of the estimators compared are efficient under the proposed null hypothesis of Jerry Hausman in 1978. The study opts for Hausman statistics for instruments validity. If Hausman's statistics of samples depict greater value from the critical value, then statistical evidence rejects the null hypothesis of the correct specification. The results of the Hausman test for the section of FEM or REM are given below:

Table 5: Hausman Test for Selection of FEM/REM

Variables	Fixed effect (fe)	Random Effect (re)	Difference	Standard Error (SE)
SIZE _{it}	0.0013	0.0043	-0.0030	0.0006
L/DEP _{it}	0.0316	0.0129	0.0187	0.0061
NPLTL _{it-1}	0.3041	0.3525	-0.0485	0.0103
ΔNPL/TI _{it}	0.2926	0.3191	-0.0265	0.0043
ΔTA/TI _{it}	0.0007	0.0090	-0.0083	0.0011

b = consistent under Ho and Ha; obtained from xtreg

B = inconsistent under Ha, efficient under Ho; obtained from xtreg

Test: Ho: difference in coefficients not systematic

$$\text{chi2 (5)} = (b-B)'[(V_b-V_B)^{-1}](b-B)$$

$$= 46.88$$

$$\text{Prob>chi2} = 0.0000$$

In the above results, it is found that the Chi-square value is 46.88 with probability of 0.00 that rejects the null hypothesis "difference in coefficients not systematic" rather accept the alternative approach that will prefer Fixed-Effect-Model (FEM) for the final regression analysis.

Now, the study conducted to run the final regression to infer the results for generalization. The preliminary diagnosis and other ancillary test results dictate to use Robust Least Squares Regression Model (RLSRM) for the final output. The summary of the regression results is presented in Table 6. The coefficients of the variables SIZE_{it} has positive significant (at 1% level) effect on EM_{it}, which indicates that large banks (more assets) are intended to take more discretionary power in accruals. It also validates the presumption of the "Too big to fail" principle.

Table 6: Robust Least Squares regression model for Discretionary Accruals

Variables	Coef	Std. Err.	P > t	[95% Conf. Interval]	
SIZE _{it}	0.0070	0.0014	0.0000	0.0043	0.0098
L/DEP _{it}	0.0127	0.0131	0.3300	-0.0129	0.0384
NPLTL _{it-1}	0.3859	0.0373	0.0000	0.3126	0.4593
ΔNPL/TL _{it}	0.3363	0.0534	0.0000	0.2314	0.4413
ΔTA/TL _{it}	0.0165	0.0073	0.0240	0.0022	0.0308
CONS	-0.0932	0.0172	0.0000	-0.1271	-0.0593
Observations	425			F(5, 419)	34.53
R-squared	67.53%			Prob>F	0.0000

Therefore, it can be said that managers do consider total loan amount of the running year, the proportion of non-performing loan to total loan of last year, change in non-performing loan, change in total bank asset to total loan of current year before preparing loan loss proportion and increase in the amount of these variables increases earnings management (loan loss proportion). The loan to deposit ratio has positive earnings management but is not significant. However, NPLTL_{it-1}, ΔNPL/TL_{it}, and ΔTLA/TL_{it} have positive and significant (at 5% level) effect of bank earnings management (EM_{it}). In fact, banks use more discretionary power to allure the depositors and creditors as they are the only intermediary agent in the economy.

5. CONCLUSIONS

The banking sector plays a vital role in the development process of Bangladesh. However, any distortion or misappropriation in financial decisions will hamper economic growth and demise the future growing business trends. Though earnings management has already been a sophisticated tool for manipulating financial records, any wrong result or interpretation may lead to further controversy and failure to tax research. Earnings management is a practice to fabricate the company's financial position in front of the shareholders and investors, and conventional banks use the loan loss proportion for the same purpose rather than only for minimizing risks. Non-performing loans and change in non-performing loans are directly related to the earnings management process as the name indicates that the research has brought size of assets of the Bank and change in loan assets in the spot light. Judging these factors, one can realize whether a large amount of loan-loss provision is required or just an effort to manage earnings.

5.1. Scope for Further Research

As further research opportunities, similar research can be conducted by dividing the banks based on ownership like – private commercial banks, state-owned banks, multinational commercial banks, specialized banks like – agricultural banks etc., and assessing the results and differences. Further research can be taken involving different industries operating in various stages of the industry cycle on this topic. As long as there is information asymmetry, the scope of earnings management will always mislead the investors.

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MISSING ASPECTS OF THE RISK: SPEED AND DURATION

DOI: 10.17261/Pressacademia.2022.1541

JEFA- V.9-ISS.1-2022(2)-p.12-21

Gurol Baloglu¹, Kaan Ramazan Cakali²

¹Suzer Group, Istanbul, Turkey.

gurol@live.com, ORCID: 0000-0003-1093-2664

²Turkey Development and Investment Bank, Istanbul, Turkey.

kaanramazanc@gmail.com, ORCID: 0000-0003-4186-2291

Date Received: January 21, 2022

Date Accepted: March 24, 2022



To cite this document

Baloglu, G., Cakali, K.R., (2022). Missing aspects of the risk: speed and duration. Journal of Economics, Finance and Accounting (JEFA), 9(1), 12-21.

Permanent link to this document: <http://doi.org/10.17261/Pressacademia.2022.1541>

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ABSTRACT

Purpose- Risk assessment, risk prioritization and risk responding are vital steps in any risk management process. After risks are identified, traditional approach allows risk experts to define likelihood and impact factors for these risks. Thus, a risk severity can be defined, and risk prioritization can be considered under the budget constraints, i.e., cost of implementing remedial measures. On the other hand, recent events, like digitalization and pandemic, showed that evaluating only these two factors of the risk can be missing. Two important aspects of the risk are suggested to be considered: speed (velocity) and duration. In this study, these two elements are analyzed.

Methodology- In the study, following an introduction, COSO models and results of the literature review are analyzed. After a theoretical background and a literature review, a discussion on new aspects of the risk is started. Finally, an imaginary case is used to analyze risks including all aspects.

Findings- It is realized that in the academic literature, new aspects of the risk have not been addressed yet. This is the reason why these two aspects defined as missing. At the end, it is concluded that although speed and duration are elements, which directly affect the impact factors, at the same time, these are key determinants of the timing and structure of the risk responses. Additionally, continuous risk assessment can be beneficial for the entities to have more time to respond to the risks.

Conclusion- Depending on the findings, it is concluded that all aspects of the risk is needed to be analyzed during risk management processes. The originality of this study stems from the fact that it includes practical suggestions for integrating the concepts of speed and velocity, which are conceptually included into the frameworks. In addition, this study presents a perspective by associating the concepts of agility, resilience, and continuous risk assessment.

Keywords: Risk assessment, COSO, risk management, internal control, internal audit.

JEL Codes: G32, M42, M19

1. INTRODUCTION

The entities, while performing in a changing environment, face with some opportunities and threats. Since internal and external environment in which they operate are subject to a continuous change, these opportunities and threats can also potentially change. When the speed of this change somehow increases, predictability of the environment for the entities decreases. By nature, entities have some objectives in strategic and tactical levels and any factors, which have potentially adverse effects in achieving objectives, are called as risk.

Entities, in order to achieve their objectives, need proper actions and defining them highly depends on risk identification and risk assessment. Thus, identifying risks and assessing their potential effects are vital parts of the risk management process.

The most common criteria used in defining risks is the product of likelihood and impact levels. By estimating the potential consequences of the risk, risk experts try to analyze the needs for actions to achieve organizational objectives. Latest developments in risk management suggest that some other aspects can be used to define risk levels and actions to be designed.

The first part of this study aims to define these new aspects, which have been generally omitting in risk definition processes. In defining the new concept, a widely used framework, COSO, is preferred. After a literature review, a practical example is

proposed to integrate these new aspects into the processes. The study aims to connect these risk aspects with other newly defined concepts: agility, resilience, and continuous risk management.

First section defines the concepts. During the first sub-section under this first part, all elements of the risk are evaluated by considering a generally accepted framework, COSO. Second sub-section defines increasing importance of the elements which had been rarely addressed before Covid-19 pandemic. After this discussion, a literature review is performed to analyze how much other aspects of the risk, i.e., speed and duration, are used in academic studies. Last section is presented in two sub-sections. In the first one, a theoretical discussion is performed on the results of the COSO framework. Considering the results of this sub-section, an imaginary case is discussed to analyze all elements of the risk. Last part summarizes the conclusions.

2. MISSING ASPECTS: SPEED AND DURATION OF THE RISK

First part of the section summarizes COSO's speed and duration definition in its different versions. Second part explains increasing importance of the aspects, especially after the Covid pandemic.

2.1. Definition of Speed and Duration in COSO Framework

According to the Internal Control – Integrated Framework, which is published by the Committee of Sponsoring Organizations of the Treadway Commission, or with its very well-known name, COSO, determination of the significance level of the risks is an important part of the internal control framework. Assessing the significance of risk is an internal step in risk assessment process, just comes after the defining organizational objectives and identifying the risks. Since the latter step in internal control is deciding the proper response for the risks and the risk assessment step is a prerequisite for the latter one, together with the risk identification, defining the significance level for the risks is crucial to respond the risks.

The criteria used in the COSO model for defining the significance level of the risks are:

- Likelihood (or in another definition, probability)
- Impact, which is another very well-known criteria with the likelihood
- Speed (or velocity) of the risk (showing how contagious the risk is.), and finally,
- Duration of the impact, showing how persistence the risk is (COSO, 2013).

Both likelihood and impact are the common dimensions of the risk that have been using in risk assessment in practice. Multiplication of these two factors represents the riskiness level. The result gathering from this multiplication gives that a level of effect (impact) can be observed with a level of possibility (likelihood). If the likelihood can be represented as a percentage, it is generally called as probability (COSO, 2013).

In its full text, COSO defines the speed as the changes in the environment and the conditions. Probability of failing in managing the adaptability to the speed can be named as speed of the risk. The example given in the COSO document for the speed of risk is manufacturer's fail in adapting to the speed experienced in changes seen in customer preferences and regulatory environment (COSO, 2013). On the other hand, duration represents how long a risk can persist.

COSO, during its pages related with risk assessment, explains that the entities should consider the risk tolerance (COSO, 2013). But the actual level of the risk can be underestimated when these two aspects of the risk are not considered.

It is surprising to see that the COSO document, in its part in which risk assessment is explained, first defined these two aspects but during the rest of the document these aspects are not re-emphasized. In its previous version, Internal Control – Integrated Framework, issued in 1994, COSO considers only the first two aspects, significance and likelihood. The only thing that the initial version of COSO emphasized is that changing environment may need more attention during the risk assessment processes (COSO, 1994).

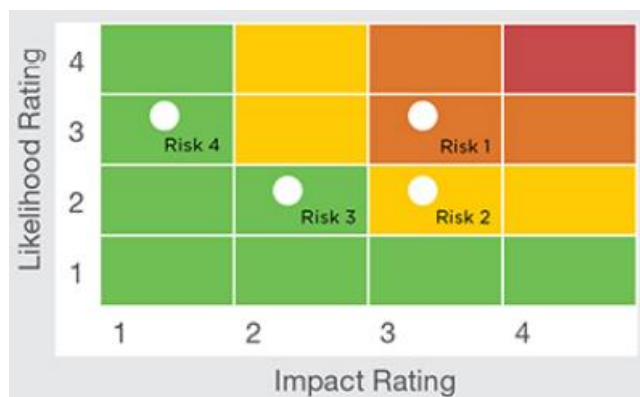
Another document, COSO Enterprise Risk Management: Integrating with Strategy and Performance, published in 2017, added new aspects to the risk. According to this document,

- adaptability,
- complexity,
- velocity,
- persistence, and
- recovery

should be taken into consideration in prioritizing risks (COSO, 2017). After an evaluation made on the risk, risk severity, i.e., combination of likelihood and impact, can be defined to be compared with the risk appetite. This latest version of COSO clearly states that a risk with higher speed or duration needs to be prioritized comparing with another risk with lower speed

or duration, even if both risks are considered equal in severity. Thus, in responding risks, both severity of the risk, and priority, i.e., comparative evaluation in velocity and persistence, should be considered (COSO, 2017). Therefore, risk responses can be determined by considering risk appetite, risk severity, risk prioritization, costs and benefits of risk responses, obligations and expectations and business context (COSO, 2017). A very common illustration for risk severity, a heat map, can be found in Figure 1.

Figure 1: Risk Severity in Heat Map



Source: COSO (2017)

Previous version of the COSO ERM model, Enterprise Risk Management – Integrated Framework, published in 2004, does not contain aspects of the risks other than likelihood and impact. In this model, although speed of responses is not commented, time horizon for risk assessment is defined as both short to mid-term and long term (COSO, 2004).

Considering different COSO versions, it is quite normal to conclude that although likelihood and impact are traditional elements in risk assessment, other aspects of the risk, velocity, and duration, are relatively new. After 2013, these aspects are started to be integrated into the models but in 2013 version, it could not be defined how these elements can be used in risk responses. Fortunately, 2017 version of COSO made it practically usable.

2.2. Increasing Needs for Defining Speed and Duration

Before 2019, the year in which earlier effects of the Covid pandemic is appeared, the major reason for dealing with the speed of risk was only the digitalization and there is no such a necessary reason to deal with duration of risk. In any consideration regarding speed of risk, digitalization has been evaluating as a factor that increase contagion of the risk. Customer dissatisfaction or any change in entities' reputation can be distributed rapidly as a result of increasing integration among the agents in the economy after digital transformation.

An additional and powerful effect is observed in the present day. Before it is realized at the end of 2019, the pandemic had been defining as an incident with low probability and medium effect, since the experience in pandemic had been indicating that this incidence can be only a regional case. However, Covid pandemic showed that any pandemic can have more effect than expected since its speed and duration can be more than estimated. Within a very short period, i.e., in months, the Covid pandemic spread over the earth and it has been standing for more than two years while this article has been writing. It becomes the root cause of the new economic situation over its side effects, i.e., decrease in economic activity due to the lockdowns, deterioration in the supply chain, increase in energy prices, and, finally, the inflation. If the velocity of the pandemic risk was insignificant, probably, it could be ended as a regional case with some limited effects. Similarly, if its effects were limited within only couple of months, means that the duration was limited, the consequences of the pandemic could be also minor comparing the current situation. Shorter period in risk exposure could be resulted with a quick recovery instead of deeper consequences.

Please consider the pre-pandemic era. How can you evaluate possibility of a pandemic case in your country? Perhaps, the answer will be 'very rare' since the historical information about the pandemic cases says that likelihood is very low. How can you evaluate the impact expected from a pandemic case? The most common answer will be probably low. But at the early stages of the pandemic, let say during March 2020, a limited information on what we faced with was known. Most of the risk experts failed to realize the speed of risk and to assess how the pandemic was contagious. Unfortunately, in a very short time, the virus spread to the different geographical areas and its speed was unreachably fast.

Now please consider that you are a risk expert in Europe, and you have been trying to analyze potential outcomes of a newly defined pandemic case in China to your businesses. The impact is unforeseeable since the duration of the pandemic has not been known yet. Thus, the risk responses cannot be easily determined unknowing if some long-term actions are needed

against the risk. It may be an early stage to design some costly long-term mitigating actions or defining some short-term precautions against the risk may be costly if additional controls need to be designed as risk remains.

Once the risk level is determined, a proper action should be defined against the risk. Generally, there is a weak basis to take actions against the low-impact and low-probability risks. This is called as risk acceptance. For other risks, it can be needed to be more active. In deciding the response, the cost of the remedial actions and the benefit against this cost should be evaluated. If the cost of mitigating the risk is much higher than the potential benefit, it can be decided to stop the activity. Otherwise, an action should be determined against the risk. This action can mitigate the risk by increasing control effectiveness or share it with another party accepting a transferring cost (COSO, 2017).

Even if the speed and the duration of the risk can be considered as the determinants of the impact of risk, each of them, by itself, continues to present some valuable information on the nature of the risks. The value of these two indicators comes from their effects on risk responses. It is quite normal to expect more agile responses against the risks with high level of speed and more long-term responses against the risks with high level of duration. Thus, the selection of the responses or the design of the controls, including the cost of controls, depends on speed and duration of the risk and defining the proper design is crucial to handle the risks.

Adding these two missing aspects to the risk assessment procedures can create some benefits for risk practitioners. Potential benefits are:

- Aligning with the speed of risk in responding it.
- Deciding on risk responses considering the time length needed to implement necessary actions.

Since the speed of risk can vary in time, risk experts can consider analyzing how quick a response needed to be generated against the risks. Especially for the risks with high severity, the action plans can be needed to be more agile to prevent adverse effects of the risks. Agility can be considered as an ability to adopt in changing environment and against newly appearing risks. Organizational agility needs increased awareness of changing environment. Thus, entities operating in high-speed changing environments need to monitor what is happening internally and externally. In other words, in traditional approach, although risk assessment is thought as an annual activity, it becomes a continuous process for these entities. Together with the shortening action periods, it results with more timely responses in risk management.

These were the potential roles of the first and second lines performing in the entities. On the other hand, another line, internal audit also needs to be more aligned with the organizational agility. Agility in internal audit can be achieved by continuous monitoring and risk assessment which are resulted with a dynamic audit plan, eliminating non-audit tasks with a lean approach focusing on the audit's real value, increasing the timeliness of reporting by continuous/immediate risk reporting and offering remedial actions aligned with speed of risk (Baloğlu, 2019).

Second benefit from adding new aspects of the risk is ability to decide on the responses considering the length of the time period in which the risk expected to continue. Thus, a response, let say a new control, can be designed only after realizing the period that the entity is expected to suffer from the risk and regarding costs of the implemented control. When a risk realized, if its effects last for a period longer than expected, the entity can be heavily damaged by the risk event. On the other hand, if the effects last for a shorter period than entity expected, risk response can be more costly than what is really needed.

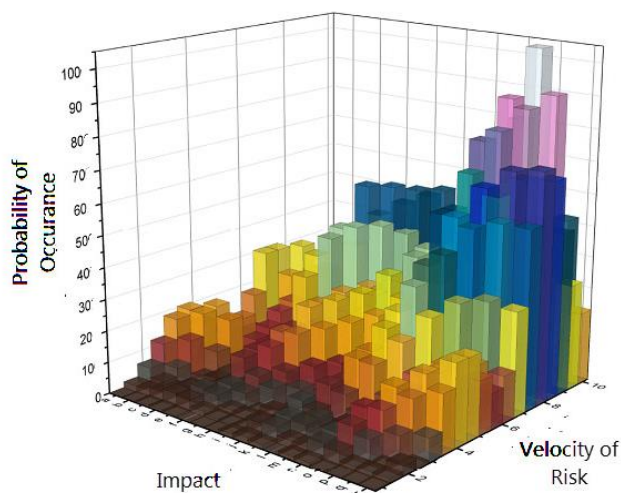
3. A LITERATURE REVIEW: HOW HAVE THESE ASPECTS BEEN MISSED?

In literature review, very limited number of studies related with these other aspects of the risk are found, while most of them cannot be defined as academic study considering their structure or scope.

Ramamoorti et.al (2019), in their study, emphasizes on that during the crisis, identifying and managing risks become an urgent issue. The researchers' claims that especially social media and internet allow fast exposures in the times of crises. In their consideration, time lag between a risk-driven crisis and decline in reputation of an entity is almost disappeared. Thus, velocity of risk become an important issue that should be taken into consideration by risk experts and internal auditors. The study concludes that, by adding velocity of risk, risk assessment becomes a three-dimensional practice, considering the existing traditional dimensions, likelihood and impact.

Nichols (2016), in his article published in LinkedIn, defines risk velocity as the time between when the first risk appears (which is also known as onset of risk) and when impacts are observed. It also visualizes three-dimensional risk map as illustrated in Figure 2, which is seen revolutionary comparing two-dimensional map presented in Figure 1.

Figure 2: Three-Dimensional Risk Map



Source: Nichols (2016)

Osundahunsi (2012), in his presentation, proposes a two-dimensional risk matrix with dimensions of risk severity, i.e., likelihood and impact, and risk velocity. Thus, he finds a usable heat matrix which considers both risk levels and response speeds required. This alternative in inserting risk velocity into risk assessment seems more aligned with COSO’s approach comparing with three-dimensional matrix. Two-dimensional alternative is shown in Figure 3. The values in matrix are found by dividing risk severity to risk velocity.

Figure 3: Two-Dimensional Risk Map with Risk Velocity

RISK VELOCITY (DAYS)	120	0.01	0.05	0.10	0.15	0.20	0.30	0.60
	90	0.01	0.07	0.13	0.20	0.27	0.40	0.80
	75	0.01	0.07	0.13	0.20	0.27	0.40	0.80
	60	0.02	0.10	0.20	0.30	0.40	0.60	1.20
	45	0.02	0.13	0.27	0.40	0.53	0.80	1.60
	30	0.03	0.20	0.40	0.60	0.80	1.20	2.40
	15	0.07	0.40	0.80	1.20	1.60	2.40	4.80
			1	6	12	18	24	36
PROBABILITY X IMPACT PROFILE								

Source: Osundahunsi (2012)

Hall (n/a), in his blog page, defines risk velocity as the time to impact. In his study, a 5-scale assessment is suggested to define velocity level and velocity is presented as an element which will be added to the probability before multiplying with the impact to find the risk score. So, the formula suggested is that Risk Score = Impact x (Probability + Velocity), which is quite different than what COSO stated.

Deloitte (2011), in its document, focuses on the term risk intelligence and, among others, lists ‘risk velocity understanding’ as an essential skill for a sound risk awareness. According to Deloitte, speed of risk response should be aligned with speed of risk onset.

Davis and Lukomnik (2009), in their article, state that when an entity faces with a newly emerging risk at the first time, a trade-off needs to be solved: understanding all details regarding the risk or responding as earlier as before the entity is affected. The article defines agility as the ratio calculated by dividing speed of response to risk velocity.

In academic literature, recent studies are reviewed, and it is observed that risk assessment methodologies used in these studies exclude speed and duration of risk. Although a number of the similar studies can be listed, some most remarkable ones from different application areas can be reported: Pascarella et.al (2021) performed a risk analysis in healthcare organizations and used only traditional aspects of the risk to make prioritization. In this study, 5-scale likelihood and impact scores are used both qualitatively and quantitatively. Palin et.al (2021), in its research on impacts of extreme weather on rail infrastructure, used a risk model in which only likelihood and impact factors are considered. Harrington et.al (2021) applies only likelihood and impact factors to decide on risks for pre-pandemic influenza strains. Rana and Pitroda (2021), in its study, emphasizes on only traditional aspects of the risk, while examining risk analysis and mitigation techniques used in Indian transportation industries. Amini and Jamil (2018), in its review study on risk assessment models in cloud computing, indicated that one of the models generally accepted, SEBCRA, uses likelihood and impact factors to prioritize the risks. Manthirathna, Rajini and Gowsiga (2019) uses only two traditional dimensions of the risk in analyzing Sri Lankan apparel manufacturing organizations' riskiness level. As it can be seen from the literature view, elements of the risk other than likelihood and impact are missing in the studies.

During the literature review, it is seen that the number of studies on two aspects of the risk is quite low and it is not possible to find any study on the duration of the risk. This is why we called these two dimensions as missed.

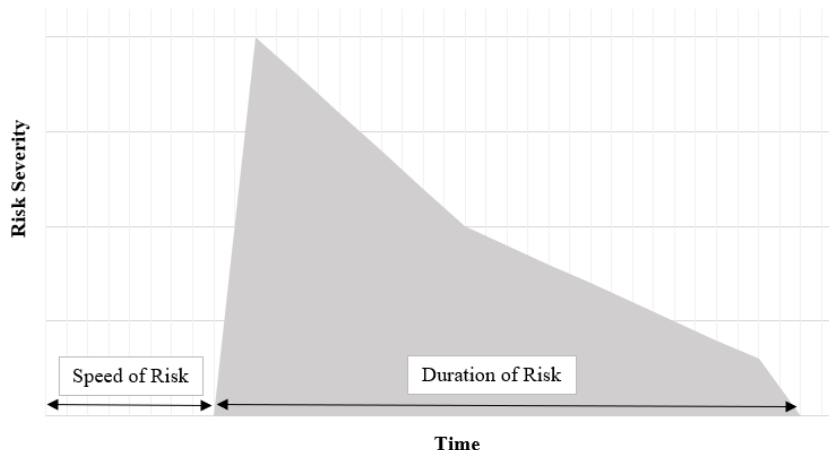
4. DISCUSSIONS

In this section, after a theoretical discussion, an imaginary case will be analyzed. In the first part, speed and duration contexts will be explained on the time-axis. All related definitions will be done in this part. Following this theoretical discussion, in the second part, an imaginary case will be presented to explain how all aspects of the risk can be considered during risk assessments.

4.1. Revisiting the Speed and Duration of the Risk

Considering COSO's theoretical framework and literature review results summarized above, it is thought that two aspects of the risk can be illustrated as Figure 4. This figure has an importance to determine risk responses.

Figure 4: Risk Velocity and Risk Duration



According to Figure 4, speed, or velocity, of risk can be considered as a period before risk exposure starts. The origin of the x-y presentation represents onset of risk and the starting point of risk severity on y axis represents the instant when the entity started to be affected by the risk. If this period is short, it is thought that the speed of risk is high, and that the entity may not have enough time to respond against the risk. If this period is long, speed of risk is low and the entity does not have to respond as urgent as in the case where the speed is high.

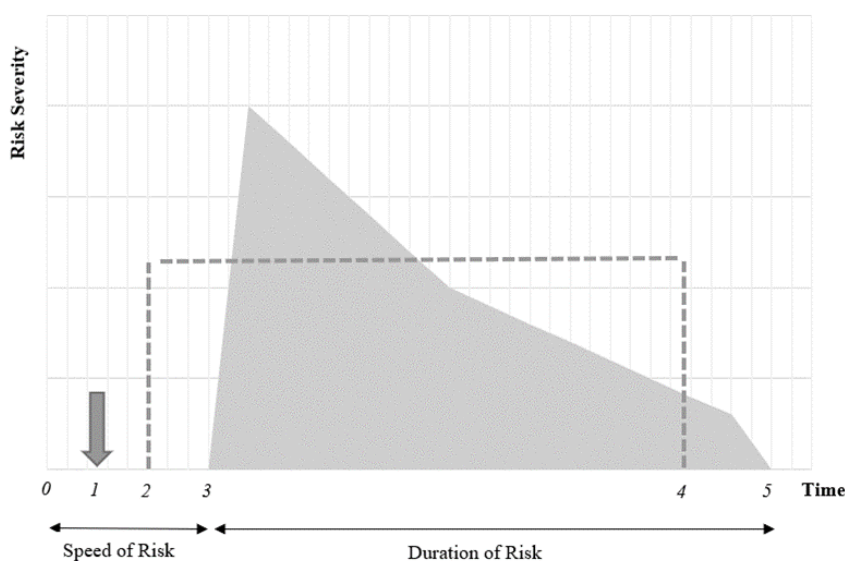
Second point that can be concluded from Figure 4 is related with the duration. Duration is the period starting from the first instant when the entity faces with the risk and ending with the last instant when suffered from it. If the duration is long, total risk impact is expected to be high. If the duration is short, total risk impact for the same risk can be low comparatively. The shape of the severity curve determines how the entity will be affected by a risk. Some risks may be harmful in earlier periods of their duration and as time passes, the adverse effects decrease. Some others stay constant during their durations.

Remaining may become more harmful as time passes. In Figure 4, we used an illustration which represents the first case. The shape of the curve is closely related with the duration.

One important distinction should be noted. Although speed is defined as the period starting at an instant when the risk is first realized and ending with an instant the risk is first affected the entity, timely recognition of the risk is crucial since earlier risk awareness can allow more time to respond. Thus, the instant first the risk is arisen can be a different instant than when first the risk is recognized. This increases the importance of the continuous risk assessment which requires awareness on internal and external environment instantly. Note that, only early recognition of the risk may not be enough for timely responding since implementation of the remedial actions may take some time depending on their structure. Thus, agility and continuous risk assessment are extremely close concepts.

In Figure 5, lifecycle of a risk is illustrated.

Figure 5: Lifecycle of a Risk and Response



As discussed before, on time axis, the point represented with '0' is the instant when the risk first appeared. The point '1' represents the instant when the entity first recognized the risk. The risk starts to affect the entity at point '3' and this effect lasts until the point '5' by decreasing in time. An instant representing with '2' shows the implementation of remedial action and this action lasts until the point '4'. Dotted area shows the response in a remediation form. Thus, the grey area within the dotted area represents control effectiveness, while white area in the dotted rectangular shows the over-control. Minimizing this white area inside the dotted rectangular is an issue of cost optimization in designing remedial actions. The grey area outside the rectangular represents the risk that cannot be eliminated by the entity. The figure can be used to have some conclusions: First, as '1' approaches to '0', an entity can find a longer period to respond the risk. Thus, any company needs to find ways to identify risks earlier. Continuous risk assessment is an effective way for timely recognition. Second, as '2' is getting closer to '1', this means that the response of the entity is implemented in a more agile way. Third, if the white area inside the dotted rectangular gets smaller, optimization of the cost of remediation is satisfied. Fourth, as the grey area inside the dotted rectangular is getting bigger, control effectiveness increases. The shape and magnitude of the dotted area can be determined by considering both effectiveness and cost of remediation. Fifth, as the grey area outside the dotted rectangular gets smaller, risk exposure, or residual risk level, decreases. Sixth, if the distance between '0' and '3' decreases, speed of risk decreases. Seventh, if the distance between '3' and '5' decreases, duration of the risk decreases. This is related with the resilience concept.

Note that, the analysis is made for a single risk, but entities face with high number of risks simultaneously. Thus, entities should respond all risks at the same time under a budget constraint, and this requires performing some trade-offs between the alternative responses. This is exactly what we called as portfolio view and this approach requires prioritization among the risk to define responses optimally.

4.2. Revisiting the Speed and Duration of the Risk

Considering the comments having from Figure 4 and Figure 5, the following exercise can be used to understand all aspects of the risk:

A company operating in tourism sector, let say a hotel, faces with risk of reservation cancellations by the guests from the neighbor country because of a regional turmoil experiencing in this country. This hotel performed a risk analysis before realizing this suddenly arising incidence and rated this risk with low probability and medium impact. Then the risk assessment result depends on traditional risk assessment methodology, which only uses likelihood and impact.

When the hotel first realized the risk, it rapidly switched to a broader approach and decided to consider other aspects of the risk. This time, the hotel needs to revise the existing risk rating after the new information it received and has some other elements to anticipate. The exercise that is needed by the hotel can be performed by using Table.1.

Table 1: An Alternative Risk Assessment Scale

Definition of Risk	Impact	Likelihood	Duration	Speed
Reservation cancellation due to a turmoil in a country	1 to 5	1 to 5	1 to 5	1 to 5

According to the table, all elements of the risk can be rated using a 1-to-5 scale. For example, impact can be depicted as a part of annual net income and the anticipated impact can be rated by using this criterion. For all elements, '1' represent the lowest number and '5' represents the highest value in the scale. While determining the impact level, the hotel will answer some questions like 'how many reservations are subject to cancellation?' and 'what will be the financial effect of these cancellations on annual net income?'. The latest question needs to be answered to rate impact in 1 to 5 scale, but before that annual net income amounts to be used in the scale need to be determined. Let say, the hotel is considering that if 0 to 10% of the annual net income is subject to be lost, then the rate for impact is 1, which is the lowest. If the effect is between 10% and 30%, the impact scale is 2. If it is between 30% and 50%, the scale is 3. If it is between 50% and 100%, the scale is 4. Finally, if it is more than 100%, the scale is 5. Let us imagine that the hotel, in its consideration, decided to choose 3 as an impact level.

Then the likelihood level for impact level needs to be anticipated to find severity of the risk. This is an important step, because risk management is considered as an activity in which a portfolio view is adopted. Portfolio view is an important adoption allowing prioritizing under the cost constraint. Since the resources of the entities are not unlimited and the profitability is vital, remedial actions, e.g., controls, can only be implemented under a cost constraint and if the entity assesses all risks in a portfolio view, in order to operate within its risk appetite, it can determine optimal solutions by prioritizing the risk. Thus, if the hotel is defined the scales that need to be used, let say, as 1-rare, 2-unlikely, 3-possible, 4-occasional, 5-likely, the meaning of this categorization to the hotel can easily be 'repeats once in 20 years cycle', 'repeats once in 10 years cycle', 'repeats once in 5 years cycle', 'repeats once in 2 years' cycle' and 'repeats each and every year' for the likelihood scales respectively. Let us accept that the anticipated level by the hotel for likelihood of the respective risk is 5 after newly received news.

Until this part of the discussion, it will not be wrong to say that the risk assessment procedure is traditional. Now, we will integrate other aspects into our consideration. The third element is duration. In our case, duration is an important element since it also determines the impact. If the hotel is anticipating the turmoil of the country will continue next year, the impact will be almost doubled, if any additional remediation cannot be implemented. Thus, the impact element will be changed by considering the duration. Alternatively, if the hotel expects this incident to be finalized in a very short time, the level of impact will also lower by comparing the first case. Duration is a concept which is highly related with the resilience. If the adverse effects from a risk become continuous, the entity will be less resilient against this risk. Thus, the recovery will be lasted longer. Considering purposes of the study, let us say that duration is expected to be long. Then the impact level will be revised, let say, to 4. Please note that, if the length of intervals determined for the impact scales are identical, then methodologically the rate of impact can be multiplied by the rate of duration to find results that are more comparable in a portfolio view. In our example, we prefer simply to increase impact factor without any calculation.

Besides, duration is not only related with the impact level, but it also determines the response. If the hotel expects that the crisis will be solved in a short time, then the remedial actions will be temporary. For example, the hotel will intent only to revise the capacity budget for the next couple of months while updating some expenditures. If the hotel anticipates that this crisis will last long, the actions against the risk will be probably more permanent, like entering into new markets to increase sales volume. In our case, since the duration is long, the hotel will take some actions to create alternatives for the markets which are expected to exit. Defining proper responses is crucial for both remediating risks and managing costs of actions efficiently.

The last one is speed of risk. As you may remember, speed of risk shows how fast the entity is expected to be affected by the newly arising risk. In our case, the speed is an important determinant. Let us say that the hotel is located in northern hemisphere and operating seasonally, only in summertime, and the turmoil is observed first in May. In this case, the speed will be fast, because the period remaining to start a new season will be short. Thus, the hotel will have a very limited time to respond to a newly arising risk. Contrarily, if the instant when first the turmoil is observed is, let say, in January, then the hotel will still have four months to find a solution against the risk. Thus, the speed will also be one of the determinants of the impact and depending on the instant when risk assessment is performed, impact grade may need to be updated as similar as

what is offered in duration aspect. In our example, let say that the impact is updated to 5 with the combined effect causes from both duration and speed.

Similar to duration, speed also determines the risk response. In our case, if speed is low, the hotel can evaluate to revise its agreements inserting a new statement regarding fines against cancellations. Alternatively, it can consider having an insurance contract to compensate potential revenue losses. When the speed is high, the hotel needs both to react promptly and to find other solutions suitable for eliminating short-term losses as much as the long-term ones. In this case, being agile in risk responding is a key factor to remediate adverse effects of the risk. Thus, the organizational agility should be satisfied. Examples of the suitable actions can be announcing new campaigns for last minute bookings, price discounts for prolonged stays, etc.

The result of the assessment containing all elements of the risk can be depicted under two scenarios as in Table 2.

Table 2: Risk Assessment Results

Definition of Risk	Impact	Likelihood	Severity	Duration	Speed
Scenario 1: Short Duration – Low Speed					
Reservation cancellation due to a turmoil in a country	3	5	15	2	2
Scenario 2: Long Duration – High Speed					
Reservation cancellation due to a turmoil in a country	5	5	25	5	5

Note that if other aspects of the risk are considered, the impact level is increased from 3 to 5 and risk severity is increased to 15 to 25. This is important to compare different risk definitions in severity to prioritize them and to allocate limited resources to respond them. Additionally, the type and timing of the responses will be determined under the consideration of duration and speed. Thus, the responses in two scenarios will be differentiated.

Increasing the level of impact by considering the levels of duration and speed, in our case, can be thought as a simple calculation which have no mathematical ground, so for implementing these effects on impact factor, a formulation can be generated. But note that, if this is the case, the ranges of the ranks that have been using in scales, need to be revisited. The easiest way to implement effects of duration and speed on impact is multiplying these factors. In this case, scales for duration and speed can be redesigned from a 1-to-5 scale approach to, let say, a 0-to-2 scale with narrower ranges. Thus, the risk levels can be calculated by the formula

$$\text{Riskiness Level} = \text{Impact} \times \text{Duration} \times \text{Speed} \times \text{Likelihood}$$

Note that duration and speed become factors of impact level. Let say, in 5-scale grade, severity is calculated as 15. Then, by taking other two aspects into consideration, if we decide that the riskiness level is 30, the duration/speed level jointly doubles the impact level. This representation of the risk will help risk experts to prioritize the risks within a structured scale. But please note that this does not mean that 1-to-5-scale elements are more important than 0-to-2 scale elements. This is only a numerical representation and the reason of taking identical scales for all elements in Table 1 is to prevent this kind of misunderstanding.

5. CONCLUSION

Until COSO defined the risk elements in its updated frameworks, the common usage of the risk assessment had been based on a traditional multiplication: likelihood x impact. However, the experiences gained, especially, from the digitalization and the pandemic showed that some other elements of the risks need to be defined. Besides others, COSO defined two new elements for the risk: speed (velocity) and duration. These new definitions have some advantages in comparing different risks with the same level of severity.

In this study, it is tried to analyze how these new elements can be implemented in practical examples. After using an imaginary entity, some conclusions are reached:

Beside of other factors, speed and duration, new aspects of the risk, are important determinants of the traditional risk element, the impact. It is quite normal to expect that both factors have a potential to affect impact factor in a positive relationship: increasing speed/duration means increasing impact.

While speed of risk is highly related with the organizational agility, duration of the risk relates with the resilience. Both of them need to be used in determining timing and structure of the risk responses.

In implementing portfolio view in risk management, in order to prioritize risks, a model that multiplies all factors of the risk can be used. But this time, determining the ranges will be critical.

Continuous risk assessment can be beneficial concept for the entities, which are operating in a rapidly changing environment.

Responsible parties in risk management process and assurance providers, including internal audit, need to consider all aspects of the risk for better results in responding risks. But note that adding new aspects of the risk into risk assessment process can increase complexity in decision-making steps and create additional burden of works. Thus, any entity that implements all aspects in risk assessment process needs to consider its objectives in risk assessment processes.

These two elements seem that somehow missed in literature since the number of studies on this topic is very limited and it is not easy to define existing studies as academic because of their scope and structure.

The aim of this study is to take attention on an issue, which is missed in literature. Further studies may focus on alternative implementations of risk aspects. In addition, integrating all aspects of the risk within risk management process can be a new research area for the studies.

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METaverse AND METaverse CRYPTOCURRENCIES (META COINS): BUBBLES OR FUTURE?

DOI: 10.17261/Pressacademia.2022.1542

JEFA- V.9-ISS.1-2022(3)-p.22-29

Hilmi Tunahan Akkus¹, Samet GURSOY², Mesut Dogan³, Ahmet Burak Demir⁴

¹Balikesir University, Savastepe Vocational School, Department of Wholesale and Retail, Balikesir, Turkey.

tunaakkus@balikesir.edu.tr, ORCID: 000-0002-8407-1580

²Burdur Mehmet Akif Ersoy University, Bucak ZTYO, Department of Customs Management, Burdur, Turkey.

sametgursoy@mehmetakif.edu.tr, ORCID: 0000-0003-1020-7438

³Afyon Kocatepe University, Bayat Vocational School, Department of Business Administration, Afyon, Turkey.

mesutdogan07@gmail.com, ORCID: 0000-0001-6879-1361

⁴Burdur Mehmet Akif Ersoy University, Institute of Social Sciences, Department of Customs Management, Burdur, Turkey.

burakdemir@mit.tc, ORCID: 0000-0002-1597-7928

Date Received: January 19, 2022

Date Accepted: March 27, 2022



To cite this document

Akkus, H.T., GURSOY, S., Dogan, M., Demir, A.B., (2022). Metaverse and metaverse cryptocurrencies (meta coins): bubbles and future? Journal of Economics, Finance and Accounting (JEFA), 9(1), 22-29.

Permanent link to this document: <http://doi.org/10.17261/Pressacademia.2022.1542>

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ABSTRACT

Purpose- Metaverse is one of the blockchain-based digital assets developed in recent years. The concept of metaverse refers to an alternative virtual universe in which individuals are represented by their avatars (virtual representation), they can create applications, socialize, buy and sell goods and services, and share. In addition, there are meta coins, i.e. local crypto coins, used in the metaverse. In this study, the concepts of metaverse and meta coin, which have become popular recently, are explained, and the existence of price bubbles in MANA, the meta coin of the Decentraland digital reality platform, which has the largest market value among meta coins, is investigated.

Methodology- The existence of price bubbles is investigated by the newly developed GSADF multiple bubble test.

Findings- According to the result of the analysis carried out with the GSADF test, the existence of price bubbles in MANA prices in different periods has been determined. Especially the bubbles that have formed in the recent period have been realized as a longer term. This situation shows the impression that significant speculative movements have occurred in the MANA token recently.

Conclusion- According to the findings, MANA prices are open to speculation. It is important for those investing or considering investing in MANA and other meta coins to consider the existence of bubbles in the respective token prices.

Keywords: Price bubbles, token, cryptocurrency, metaverse, meta coin.

JEL Codes: G11, G14, G15

1. INTRODUCTION

With the development of blockchain technology, new digital assets using blockchain technology have recently been developed. In addition to cryptocurrencies, especially Bitcoin, tokens, non-Fungible Tokens (NFTs), and the metaverse, whose popularity has increased rapidly after Facebook has changed its name to Meta, are blockchain-based digital assets developed in recent years. The interest in these assets is rapidly growing today, and the market value of the relevant digital assets is increasing in a similar way.

Metaverse is a concept created as a result of combining the words "meta", which means beyond and other, and "universe", which means the world. Although the word is translated directly as "beyond the universe, other universe, or another universe", metaverse is stated as "virtual universe, fictional universe, or online digital world" in literature and practice. The concept of metaverse is explained in detail in the second chapter.

Web 3.0, which we can call the last stage of the development of the internet, is another concept used together with the concept of Metaverse. In order to understand the metaverse phenomenon, it may also be useful to examine the developmental stages of the internet and the difference or change between these stages. Gonzalez (2021) describes the evolution of the web, which was invented in Switzerland by Tim Berners-Lee in the early 1990s, in three stages. Web 1.0 (Static Web) is the stage where the content on the Internet is predetermined, where people can make a website that they can browse, but cannot interact with it beyond leaving comments. Web 2.0 (Interactive Web) is the stage where people use

predetermined content, write small comments, and create content. Wikipedia, YouTube, WordPress, and Blogger are examples of the impact of the Web 2.0 stage on the world. Web 3.0 (Semantic Web) is the stage we are about to go through the Web 2.0 stage right now. Davies (2021) states that Web 3.0 refers to groups of projects supported by cryptocurrency, working together to create a decentralized internet services ecosystem, not any particular program. Web 3.0 draws attention to the internet architecture that allows users to do whatever they want without being dependent on any company or government. Stock and Blockchain NFT Academy (2022) states that Web 1.0 ranged from the 1990s to the early 2000s, and Web 2.0 is described as the period from the early 2000s to the present when large technology companies have controlled the most prominent online centers. Web 3.0, on the other hand, is the possible future version of the internet.

This study aims primarily to explain the concept of metaverse, meta coin, and meta coin markets, which have been popular very recently among blockchain-based digital assets. Additionally, it aims to investigate the existence of price bubbles MANA, the meta coin of the Decentraland digital reality platform, which has the largest market value among meta coins.

Price bubbles are price differences that cannot be explained by the fundamental value approach (Kıyılar and Akkaya, 2016: 231). The importance of price bubbles stems from the relationship between price bubbles and financial crises. Kıyılar and Akkaya (2016: 229) state that price bubbles play an important role in the formation of financial crises and that financial crises are triggered when price bubbles usually burst.

Information about the metaverse and metacoins is usually disclosed on news pages, news sites, or blogs. However, academic studies and empirical studies on the subject are very limited. It is thought that this study can contribute to the literature by explaining the concept of metaverse, which is very rare in the literature. In addition, revealing the existence of bubbles in the prices of MANA tokens used by the digital reality platform with the largest market value will be important for many stakeholders, especially investors. It is thought that this study will be the first in terms of investigating price bubbles in cryptocurrencies created for the metaverse. Although there have been many price bubble studies on cryptocurrencies to date, no studies investigating price bubbles in crypto coins have been found yet.

The sections after the introductory part of the study are as follows. In the second part of the study, the concepts of metaverse and meta coin are explained. In the third part of the study, literature explanations about price bubbles in cryptocurrencies are presented. In the fourth part, explanations about the method of the study are stated. In the fifth chapter, the data set and the findings obtained from the analyses are shared in tables. In the last part of the study, results and general evaluations are given.

2. METAVERSE AND METAVERSE CRYPTOCURRENCIES (META COINS)

In this section, the metaverse and metacoins, which have been revealed recently and whose full meaning and content are unknown by many, are explained in detail.

2.1. Concept of Metaverse

The concept of metaverse was first expressed in the science fiction writer Neal Stephenson's 1992 novel "Snow Crash", but the concept was previously defined as "cyberspace" in William Gibson's 1984 science fiction novel *Neuromancer* (evrimagaci.org, 2021).

As explained in the introduction, metaverse is a concept created as a result of combining the word "meta", which means beyond, other, or another, and "universe", which means the world or space. The word can be translated directly as "beyond the universe, other universe, another universe". However, there are more comprehensive and explanatory definitions of the metaverse in the literature. "The Metaverse can be defined as a multi-user real-time sandbox where individuals from all over the world can connect, live together, socialize and exchange value with each other through a network" (Corwen, 2021). The Metaverse is an alternate computer-generated world where people can share and interact as if they were in the real world. Today, the metaverse is a virtual space where people interact socially and economically using avatars (virtual representations) without experiencing real-world constraints such as time and distance. In this virtual world network, more people can interact by ignoring their cultural and language differences (Vernaza, Armuelles and Ruiz, 2012: 320-321). "The Metaverse is the post-reality universe, a perpetual and persistent multiuser environment merging physical reality with digital virtuality" (Mystakidis, 2022: 486).

Second Life, Fortnite, Minecraft, and Roblox are examples of cooperative and world-building games that incorporate metaverse features into their games. On these platforms, users can work in the virtual market, interact with others, participate in events and receive money for digital products and services (Clemens, 2022). Similarly, Clemens (2022) also explains that various versions of the metaverse have been produced by Hollywood through the non-existent fantasy universes used in movies such as Ready Player One, and Free Guy.

Virtual reality (virtual reality - VR) and augmented reality (AR) mentioned together with the metaverse are important technological tools that can be used in the creation of the metaverse concept.

2.2. Major Metaverse and Metaverse Coins

In every society and market in the metaverse world, different types of currencies are used, and shopping takes place in the same market (locally) with their own cryptocurrencies. As of December 2021, more than forty meta coins have been traded in the market.

First of all, clarifying the concepts of money and tokens in cryptocurrencies can make the subject easier to understand. Cryptocurrencies are divided into “coin” and “token”. Cryptocurrencies that have a blockchain of their own are called coins, but those that are traded on an existing blockchain that has been developed before are called tokens. However, regardless of this difference, the expression of coin can also be used instead of tokens, a habit left over from Bitcoin (Güven and Şahinöz, 2018: 85). On the other hand, tokens are also divided into fungible and non-fungible tokens. In Table 1 below, the subject is tried to be illustrated by explaining the differences between these two concepts.

Table 1: Comparison of Fungible versus Non-fungible Tokens

Fungible Token	Non-fungible Token
E.g., 1 USD dollar	E.g., John Lennon Limited Edition Postage Stamps
Interchangeable	Not interchangeable
Uniform (all are the same)	Distinct or unique
Divisible	Indivisible

Source: The Sandbox Whitepaper, 2020: 8.

Cryptocurrency and metaverse are built on the same technology (ie. blockchain), so cryptocurrencies will be the most popular form of payment in the metaverse world. Cryptocurrencies would be the simplest, most convenient and cheapest method of exchanging a global metaverse (Laeq, 2022). Many coins used in the metaverse universe are bought and sold. While some of these coins are much newer and not in demand, there are coins where commodities such as games and land-workplace are bought and sold. The following describes the three largest metaverse coins by market capitalization.

2.2.1. Decentraland Virtual Reality Platform Cryptocurrency: MANA

Decentraland is a digital real estate supported by the Ethereum blockchain, in which users or digital property owners can create applications, buy and sell goods and services, carry out other activities, and have a token called MANA for the realization of these activities (Ordano et al., 2017: 1). There are two digital assets on the Decentraland platform called LAND with non-fungible digital parcels and MANA, a fungible ERC-20¹ token that is burned to claim LAND and purchase in-world goods and services. (Ordano et al., 2017: 12). In this virtual reality platform, digital lands can be bought and sold in both the primary market and the secondary market.

2.2.2. Sandbox Virtual Reality Platform Cryptocurrency: SAND

The Sandbox metaverse is a play-to-earn (P2E) game built on the Ethereum blockchain. The Sandbox is a decentralized platform that allows gamers and creators to own a piece of the gaming virtual universe, participate in governance and economy, and create and enjoy a simple way to leverage their gaming time (The Sandbox Whitepaper, 2020: 44).

In the Sandbox metaverse, there are digital parcels denoted as LAND and in-world tokens denoted as SAND. SAND, an essential part of the Sandbox platform, is an ERC-20 token built on the Ethereum blockchain that serves as the basis for transactions on the Sandbox digital platform (The Sandbox Whitepaper, 2020: 9).

2.2.3. Axie Infinity Virtual Reality Platform Cryptocurrency: AXS and SLP

Axie Infinity metaverse, similar to the Sandbox metaverse described above, is a “P2E” game built on the Ethereum blockchain. Axie Infinity is a game universe filled with fascinating creatures called Axies that players can collect as pets. Players aim to fight, nurture, gather, grow and build kingdoms for the Axies. The Axie Infinity virtual reality platform has a player-owned economy where players can actually own, buy, sell and trade the resources they earn in the game through skilled gaming and contributions to the ecosystem. The platform includes cryptocurrencies called Axie Infinity Shard (AXS) and Smooth Love Potion (SLP), which are ERC-20 tokens (www.whitepaper.axieinfinity.com/axs).

3. LITERATURE REVIEW

There are many empirical studies investigating bubble price dynamics in cryptocurrency markets. An important part of these researches is to investigate the price formation in Bitcoin, as well as comparisons with digital currencies and national currencies. However, no study has been found investigating price bubbles in metaverse token cryptocurrencies. With this

¹ ERC20 is a set of rules that all tokens to be created on the Ethereum network must comply with. Thanks to these rules, tokens created on Ethereum can be easily loaded into electronic wallets that support these rules or used from wallets (Aksoy, 2018: 120).

aspect, it is hoped that the study will be a pioneering study. In this context, studies related to the subject are summarized below.

In terms of economy, the bubble; it is a deviation from basic values (Cox and Hobson, 2005). However, it is difficult to determine what the fundamental value is in cryptocurrencies (Kyrakis, Papadamou and Corbet, 2020). Phillips, Shi and Yu (2015a) and Phillips, Shi and Yu (2015b) defined the bubble as explosive price behavior. In this context, the authors have developed various statistical methods to determine explosive price behavior. Diba and Grossman (1988) performed a unit root test to detect explosive behavior in prices. To define bubbles as extensions of the Augmented Dickey-Fuller (ADF) test, Phillips, Wu and Yu (2011) and Phillips et al. (2015a), Phillips et al. (2015b) suggested methods named PWY and PSY, respectively, as abbreviations of the authors' names.

Corbet, Lucey and Yarovaya (2018), Bouri, Shahzad and Roubaud (2019) used the PSY method to identify bubbles in multiple cryptocurrencies. Corbet et al. (2018) examined Bitcoin and Ethereum cryptocurrencies and detected bubble behavior at the end of the sample period. Bouri et al. (2019) identified bubbles in seven cryptocurrencies and found that bubble periods in one cryptocurrency were associated with the presence of bubbles in other cryptocurrencies.

Cheung, Roca and Su (2015) and Su et al. (2018) found that the bubble date stamp in the Bitcoin price and the bubble periods coincided with major events affecting the Bitcoin market. Enoksen et al. (2020) examined which variables can predict bubbles in the prices of eight major cryptocurrencies. Specifically, in 2017 and early 2018, a period of multiple bubbles was identified for all eight cryptocurrencies. They determined that higher volatility, trading volume and transactions are positively correlated with the presence of bubbles in cryptocurrencies. Jalan, Matkovskyy and Poti (2022) analyzed the stock market performance of 43 companies that showed huge price increases during the COVID-19 period. As a result of the analysis, they determined that price bubbles are permanent. Apart from these studies, Cheah and Fry (2015), Fry and Cheah (2016) predicted cryptocurrency bubbles.

Although there is no study investigating price bubbles in metaverse tokens, there are performance studies on metaverse tokens. For example, Dowling (2022a) found limited volatility effects between the pricing of three NFTs and the biggest two cryptocurrencies. Nadini et al. (2021), analyzed the data of 4.1 million transactions of 4.7 million NFTs in terms of art, collection, games, metaverse and as a result; they revealed that users are specialized by category and that the most modified NFTs since July 2020 belong to the gaming industry. Aharon and Demir (2021) studied the relationship between the NFT market and other some financial assets using the TVP-VAR approach. As a result of the analysis, they determined that NFTs are independent of shocks from common assets and diversification is beneficial in times of crisis. Dowling (2022b) examined the pricing of real estate in Decentraland and found that the price series of these NFTs are associated with inefficiency and value increase. Vidal-Tomás (2022) analyzed the performance and dynamics of the new cryptocurrency, and as a result of the analysis, it was revealed that play-win and metaverse tokens are associated with positive performance in the long run.

4. METHODOLOGY

This study investigates whether a bubble has formed on the prices of MANA coin, which is the most demanded in terms of market capitalization in metacoin exchanges. However, it was run generalized Sup ADF (GSADF) test developed by Phillips et al. (2015). In addition, the detected bubble dates are also shared.

Phillips et al. (2011) used forward recursive right-tailed ADF unit root tests to test the existence of a bubble and determine the bubble's occurrence and expiration dates, using the SADF test, Phillips et al. (2015a, 2015b) developed the GSADF test using backward recursive right-tailed ADF unit root tests. The mentioned GSADF test is also referred to as the PSY method, as explained in the literature review section. The hypotheses of the GSADF test are shown below.

$H_0: \delta = 1$ (bubble has not formed)

$H_1: \delta > 1$ (multiple bubbles have formed)

The following recursive sliding regression equations are used to detect the presence of price bubbles in GSADF tests (Phillips et al., 2015a: 1047):

$$\Delta y_t = \hat{\alpha}_{r_1, r_2} + \hat{\beta}_{r_1, r_2} y_{t-1} + \sum_{i=1}^k \hat{\psi}_{r_1, r_2}^i \Delta y_{t-i} + \hat{\varepsilon}_t, \quad (1)$$

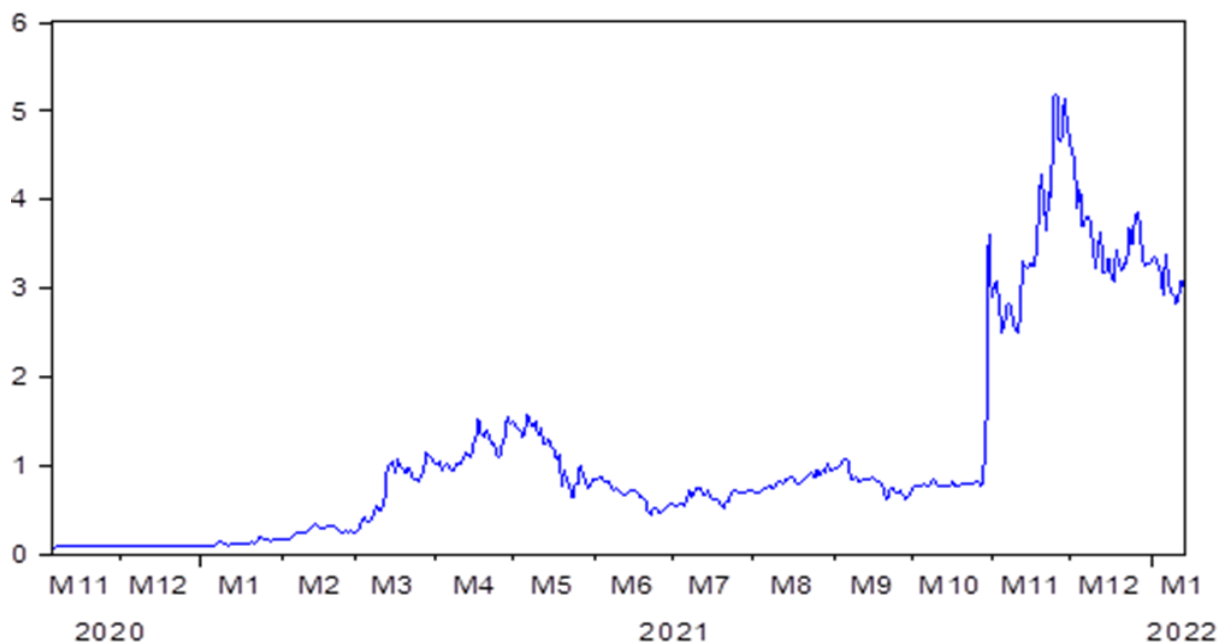
The GSADF statistics calculated based on Equation 1 are shown below (Phillips et al., 2015a: 1048-1049):

$$GSADF(r_0) = \sup_{\substack{r_2 \in [r_0, 1] \\ r_1 \in [0, r_2 - r_0]}} \{ADF_{r_1}^{r_2}\} \quad (2)$$

5. DATASET AND EMPIRICAL FINDINGS

The MANA token which is the meta coin of the Decentraland digital reality platform, is analyzed in terms of price bubble. The data set of the study was obtained from the address investing.com and consists of 435 daily observation values covering the periods 05.11.2020-13.01.2022. Figure 1 below shows the evolution of MANA prices for the relevant period graphically.

Figure 1: Price Chart of MANA



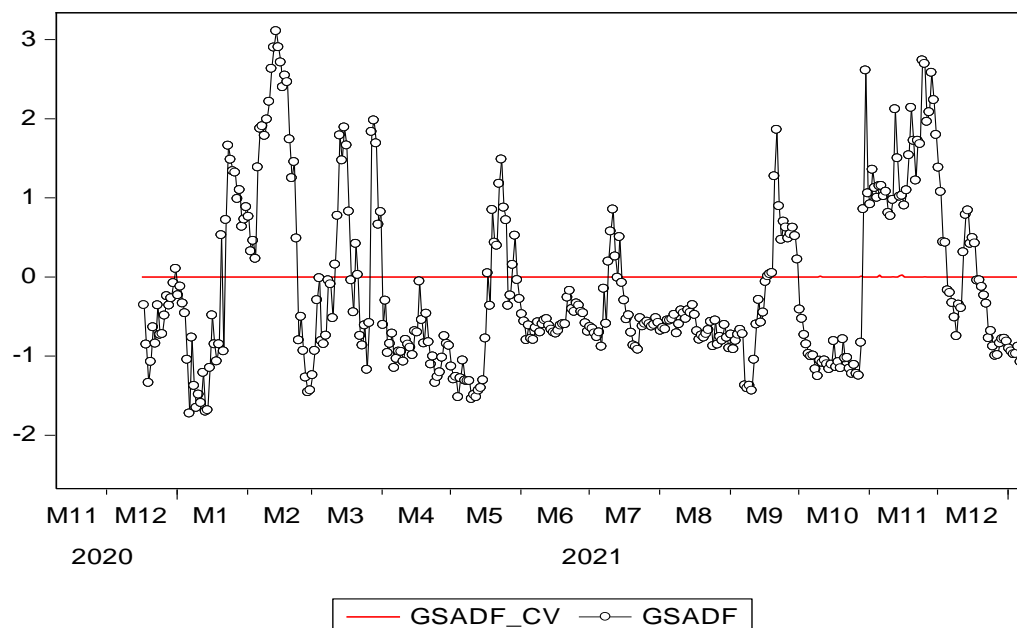
As seen in Figure 1 there are remarkable price increases of MANA price series. Especially after October 2021, there were high price movements. The test results of MANA, one of my metacoin cryptocurrencies examined in terms of bubble formation, are presented in Table 2 below.

Table 2: MANA GSADF Test Result

	GSADF Test Statistics	Critical Values		
		%1	%5	%10
MANA	19.48***	1.79	1.34	1.13

*** indicates statistical significance at the 1% level. Critical values were obtained from Monte Carlo simulation results with 2,000 replicates. The initial window width is taken as 25.

Figure 2 below shows the bubble formation periods graphically according to the GSADF test result.

Figure 2: Graphical Display of Price Bubble Formation Periods According to GSADF Test Results

According to the findings obtained from Table 2 and Figure 2, it shows bubble formations in MANA prices at the 1% significance level. The GSADF test statistics are above the GSADF critical value. After the existence of bubbles has been confirmed, these bubble periods are also presented in Table 3.

Table 3: Display of Bubble Dates and Durations by GSADF Test Result

Number	Start	Finish	Duration(day)
1	30.12.2020	01.01.2021	1
2	19.01.2021	21.01.2021	2
3	22.01.2021	24.01.2021	2
4	10.03.2021	18.03.2021	8
5	19.03.2021	22.03.2021	3
6	26.03.2021	01.04.2021	6
7	16.05.2021	17.05.2021	1
8	18.05.2021	25.05.2021	7
9	27.05.2021	29.05.2021	2
10	08.07.2021	12.07.2021	4
11	13.07.2021	14.07.2021	1
12	16.09.2021	30.09.2021	14
13	28.10.2021	04.12.2021	37
14	11.12.2021	17.12.2021	6

According to the results obtained from Table 3, 14 bubble periods were detected on the MANA price series. It is also observed that there are long-term price bubbles on the price series. The fact that the price bubble that started on 28.10.2021 continued for 37 days gives the impression that a serious speculative movement has taken place on the MANA token. In this direction, the bubble activity supports this findings that started on 16.09.2021 and lasted for 14 days.

6. CONCLUSION

Today, rapidly developing technology has paved the way for innovations in many fields. Undoubtedly, financial markets are one of the the forefront of these development areas. Especially the development of blockchain technology has carried many

established applications to different dimensions. The best examples of this situation are the metaverse and NFT markets, along with cryptocurrencies. Metaverse is a virtual reality platform where participants can produce and sell goods and services, as well as perform activities such as various applications, games, sharing, and their own local cryptocurrencies. For example, MANA in Decentraland metaverse, SAND in The Sandbox metaverse, AXS and SLP in Axie Infinity metaverse etc. cryptocurrencies are used.

Initially, this study investigate the metaverse and metacoins, which are not widely available in the literature, are explained, and then the bubble formations in the local currency MANA prices of Decentraland, which is the largest metaverse in terms of market capitalization. In this context, the presence of bubbles in MANA prices were analyzed by the GSADF bubble test. According to the results of the analysis, the existence of 14 different price bubble periods in the relevant period for the MANA price series has been determined. Accordingly, MANA prices are open to speculation. In this case, those who invest or plan to invest in MANA crypto money should take this fact into account.

For future studies, it can also be considered in terms of price bubbles meta coins other than MANA, which cannot be included in the analysis due to time constraints in this study. On the other hand, if price bubbles are detected as a result of bubble tests, the factors affecting the formation of bubbles can be investigated with binary preference models.

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FINANCIAL DEEPENING AND STOCK MARKET PERFORMANCE IN SELECTED SUB-SAHARA AFRICAN COUNTRIES

DOI: 10.17261/Pressacademia.2022.1543

JEFA- V.9-ISS.1-2022(4)-p.30-38

Edward Attah-Botchwey¹, David Mensah Awadzie², Williams Agbenyezi³

¹University of Professional Studies Accra, Department of Banking and Finance, Accra, Ghana.

edward.attah-botchwey@upsamail.edu.gh, ORCID: 0000-0003-1140-5786

²Accra Institute of Technology, ACCRA, Department of Accounting and Finance, Accra, Ghana.

davidawadzie@gmail.com, ORCID: 0000-0001-5532-2152

³University of Professional Studies Accra, Department of Banking and Finance, Accra, Ghana.

10113812@upsamail.edu.gh, ORCID: 0000-0003-2122-1518

Date Received: January 11, 2022

Date Accepted: March 21, 2022



To cite this document

Attah-Botchwey, E., Awadzie, D.M., Agbenyezi, W., (2022). Financial deepening and stock market performance in selected Sub-Saharan African countries. *Journal of Economics, Finance and Accounting (JEFA)*, 9(1), 30-38.

Permanent link to this document: <http://doi.org/10.17261/Pressacademia.2022.1543>

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ABSTRACT

Purpose- The study investigates the effect of financial deepening on stock market performance in selected Sub-Saharan African countries by determining the relationship that exist between financial deepening and stock market performance. Expansion in the financial services to reach out to the underbanked or unbanked in our society enables these individuals to assess banking services, thereby boosting economic activities.

Methodology- The study considers four selected countries in Sub-Saharan African over the period 2001 to 2019. Multiple regression analysis techniques were used with Seemingly Unrelated Regression (SUR) to analyse the data. SUR used in this analysis provides the lowest standard errors of the estimated parameters.

Findings- Ordinary Least Square (OLS) gives consistent results. However, it is not as efficient as the SUR method, which amounts to feasible generalised least squares with a specific form of the variance matrix. It solves the problem of endogeneity. The study conducted Augmented Dicky Fuller (ADF) test, Hausman test, and Bruce Pagan test to avoid any challenges associated with data normality.

Conclusion- The research finds out that broad money supply, a proxy for financial deepening, positively and statistically significantly impacted stock market performance in each of the four countries. It was recommended that all countries involved in this study and others implement policies that seek to enhance financial deepening in increasing broad money supply as a percentage of GDP. The increase in overall money supply allows for investment in productive sectors of the economy.

Keywords: Sub-Saharan Africa, seemingly unrelated regression, Augmented Dicky Fuller, investigates, ordinary least squares.

JEL Codes: E51, F21

1. INTRODUCTION

Many have misconstrued financial deepening with financial inclusion and access. Financial inclusion is the process of bringing the unbanked, underbanked, underserved, or unbanked population into the formal banking system through the use of ATMs, IT-Mobile Money Operability (Momo), Vodacash, and other means (World Bank Report, 2018). Financial inclusion is a method of offering banking and financial services to individuals. It aims to include everybody in society by giving them essential financial assistance regardless of their income or savings. Also, it focuses on providing financial solutions to the economically underprivileged. Financial access refers to financial services firms focusing exclusively on frontiers and emerging markets. It solely aims to create sustainable impact and maintain environmentally and socially responsible financing, governance, and advisory standards. According to Aizenmen (2005), a country's financial sector is the bedrock of its economic growth, and for that matter, care is paramount. It means it is necessary to open up a country's financial system to improve the financial institutions' profitability and operational efficiency. For this reason, financial sector managers have characterised the financial sector with regulations to monitor activities such as controlling the interest rate, weak banking structures, lack of transparency and inefficient risk management structures, and corporate governance issues, amongst others.

Shaw and McKinnon (1973) define financial deepening as enhancing the financial services tailored to all the levels in the society, thus increasing the availability and accessibility of financial services in an economy. Financial deepening can also be

referred to as the increase in the ratio of the money supply to the price index, which indicates that the liquidity level is high; hence more money is available in the economy. Thus more opportunities exist in that economy, thus, high growth rate and sustainability of the economy. For this, one could say the development of financial institutions leads to the growth of the economy. However, Ngede (2012) affirms that financial deepening amongst financial institutions enhances mobilisation, pooling, and channelling savings into a productive capital pool that enhances economic growth. In a supporting argument by (Gertler and Kiyotaki 2015), financial deepening also refers to the development of the financial system closely intertwined with economic development. Financial deepening has been predominantly viewed as a natural phenomenon in the context of economic development and a precondition of dynamic economic growth. Since the 1090s, there has been a correlation between open capital accounts and increased financial depth and economic expansion in economic literature. Chakraborty (2019) airs that the first group of monetary gurus to express financial deepening was Gurley and Shaw between 1955 and 1967. This pronouncement provided a wide range of changes in financial structure accompanying economic development. The changes include loosening credit constraints, more intensive use of external finance, fewer distortion in the credit market, and a general increase in financial activities.

The bedrock of every economy is its financial deepening as it plays an essential role in economic saving mobilisation and the growth of an economy. Financial deepening broadens its resource base, raises the capital needed to stimulate investment through savings and credit, and boosts its overall productivity as a whole. The design and implementation of effective interventions and programs in these selected countries' banking sector have led to continued growth in financial assets, with a direct contribution from financial intermediaries of a high per cent to the selected countries' GDP. However, economic growth in many countries has fluctuated over time, whether due to financial development or other factors. Therefore, it is essential to assess the effects of financial deepening and stock market performance on economic growth in these countries a. Several studies with mixed results have been conducted across countries to investigate the relationship between financial deepening and economic development. Some studies have used developed and developing cross-countries data sets (King and Levine, 1993). Other studies have used a sub-regional African approach (Nguena and Abimbola, 2013; Ndebbio, 2004). In individual African countries, such as South Africa (Jalil, Wahid, and Shahbaz, 2010); Nigerian (Onwumere, Ibe, Ozoh and Mounanu, 2012; Nzotta, 2009), findings suggested mixed results depending on financial deepening indicators employed.

Further research in Kenya by Odhiambo (2008), Wolde-Rufael (2009), Uddin, Sjö, and Shahbaz (2013), Onuonga (2014) have primarily focused on determining the direction of causality between financial deepening variables and economic growth, with varying conclusions on how both concepts affect each other. There have been many studies on financial deepening and economic growth but non on financial deepening and stock market performance. This study aims to provide further evidence by examining the financial deepening and stock performance in Sub-Sahara Africa between the period 2010-2020.

2. LITERATURE REVIEW

Chapter two reviews the literature on financial deepening and stock market performance. The chapter starts with the definition of concepts, theoretical and empirical studies, and a conclusion. Financial deepening (F.D.) is a term used by economists to refer to increasing financial services. It can refer to both a wider choice of services and better access for different socioeconomic groups. Financial deepening can affect both individuals' and societies' economic situations. For instance, a retired schoolteacher in the village has no idea how to use Mobil Money Operations (Momo), Automated Teller Machines (ATM), Online banking, and other financial deepening services. That has been made available and may better meet the teacher's demands. In another example, the fishmonger or the farmer who lives far in the hither land and does not know about financial deepening may have their produce go bad if customers or consumers are not readily available. They may find these services more appealing as 'heaven on earth as it will link them to customers across the regions and market sectors, solving their challenge. Levine (2005), as cited by (Linda & Bakang, 2014), defines financial deepening as the interaction among financial institutions, markets, and instruments to make mobilised funds available for productive investment by the borrowing section of the economy.

Financial deepening refers to the condition, costs, risks, quantity, and options available to potential borrowers become more favourable. It is the process that marks an improvement in quantity, quality, and efficiency of intermediary financial services (Sackey & Nkrumah, 2012). It is clear from the definitions that the financial gurus are only concerned with economic systems, the improvement of the quality and quantity of service, and the efficiency of the financial intermediary services. Financial deepening, in our view, refers to the vehicle of bringing together all savers, sellers, lenders and surpluses on one hand and spenders, buyers, borrowers and deficits on the other hand through middlemen called financial institutions. It is a way of diversifying risk. Quality and quantity refer to excellence and unique touch to service rendering to the international standard from the definition above. The amount relates to the expansion of financial activities across the length and breadth of the country.

However, the above services or activities cannot work independently but in a particular system called a financial system. An economic system is a set of institutions, such as banks, insurance companies, and stock exchanges, which permit the exchange of funds between borrowers and lenders, savers and spenders, surplus units and deficit units. Borrowers, lenders, and

investors exchange current funds to finance projects for consumption or productive investments and pursue a return on their financial assets.

Also, it is challenging to talk about financial deepening without financial development as they both intertwine. Financial development increases a country's resilience and boosts economic growth. Financial development means some improvements in producing information about possible investments and allocating capital, monitoring firms and exerting corporate governance, trading, diversification, management of risk, mobilisation and pooling of savings easing the exchange of goods and services. Financial development is often measured by financial depth, such as the stock of private credit and market capitalisation as a share of GDP. Such a measure focuses on the quantity aspect of economic development.

2.1. Theoretical Review

2.1.1. Theory of Financial Intermediation

Financial Intermediation theory advocates that financial intermediaries play a crucial role in the growth process by transferring financial resources from the net savers to net borrowers, thus influencing investment and economic growth. The theory suggests that financial intermediaries can overcome a market failure and resolve an information asymmetry problem by transforming the risk characteristics of assets. These asymmetries in credit markets arise because borrowers generally know more about their investment projects than lenders do. Information failures lead to specific transaction costs, and financial intermediaries appear to overcome these costs, at least partially. According to (Toby 1963 & Benston and Smith, 1976), the idea of transaction costs encompasses not only exchange or monetary transaction costs but searches monitoring and auditing costs. The work of Schumpeter (1912) supports the view that well-functioning financial intermediaries can promote overall economic efficiency. By pooling and allocating funds, financial intermediation fosters entrepreneurship and innovation, necessary components for economic development.

2.1.2. Theory of Financial Liberalization

Financial Liberalisation refers to liberalising the financial sector to create a favourable environment to increase the money demand in the economy. It is assumed to occur in two ways; (i) By increasing the financial resources to lead the supply-induced demand for money (ii) By creating a suitable environment to make investments in the economy. The theory of financial Liberalisation pioneered by McKinnon (1973) and Shaw (1973) advocates for the Liberalisation of the financial sector as an effective way to accelerate growth. The theory suggests that the Liberalisation of financial markets allows financial deepening, which reflects the increasing use of financial intermediation by savers and investors and the monetisation of the economy. In other words, domestic savings are increased by lowering financial market frictions, and foreign capital is attracted. The theory is based on the premise that the higher the actual interest rate, the greater the degree of financial deepening, the more savings. Financial saving will be allocated and invested more efficiently than if saving is invested directly in the sector in which it takes place, without financial intermediation (Thirlwall 2005). The McKinnon-Shaw theory of financial Liberalisation suggests a complementarity relationship between the accumulation of money balances (financial assets) and physical capital accumulation in developing countries, leading to economic growth.

2.1.3. Financial Repression Theory of Financial Deepening

McKinnon & Shaw (1973) compounded the financial repression theory. This theory recognised the need for a developed financial system that immensely contributes to economic growth. It focuses on financial structure policies that will lead to effective operation without any manipulation. The theory developers recognised that financial repression is associated with the low development of an economy. Nnanna and (1998) supported this assertion, and the economy is related to distorted interest rates, volatile inflation, low savings, low level of financial intermediation, and investment levels in an economy. In supporting argument by Nzotta and Emeka (2009), the financial repression policies are vital for the operation of the financial institutions since financial intermediation is essential in the growth of an economy. This theory initiated the development of financial deepening that influenced the financial aspect of financial performance.

2.1.4. Schumpeterian Theory of Innovation

This theory was developed by John Schumpeter 1934 which emphasised the need to incorporate entrepreneurship and innovation to order to capture the opportunities for value creation and expansion of the operations in the firm through having a calculated risk-taking, having proactive managers and leaders recognise opportunities through intellectual capital of entrepreneurs to maximise on the return on assets and expansion of the financial position of the firm. The theory recognises that technological improvement is one of the innovations that have expanded the business operation, thereby influencing profitability.

2.2. Empirical Literature Review

Studies both local and international have a rationale for the effect of financial deepening on stock market performance. Demirguc-Kunt and Huizinga (2000), on the impact of the financial deepening on the bank profitability considering the cyclical

movements, showed that the banks' profitability is correlated with the business cycle. Also, it showed that there was a positive correlation relationship between financial deepening and profitability. Hence, financial deepening was essential in the financial sector, which influences the performance of the banking sector. Bikker and Hu (2002) established their study on the impact of financial deepening on bank profitability, taking into account the cycle relationship in the United States. It was revealed that deepening the financial assets, increasing the credit facilities, and expanding the financial services influences the profitability of the commercial banks in the United States. Also, the study identified some common elements in the external environment as determinants of profitability, such as the size of the banks, the capital structure of the banks, risk management, and expenses management. The finding showed that there is a significant and positive relationship between size and bank profitability. Goddard (2004) studied the impact of financial deepening on the small and medium-sized banks to capital and profitability.

The study established little savings experienced in the small and medium-sized banks, leading to the slow growth rate of profitability. Thus, there was a need for risk management in the banking sector to influence the financial deepening inherent in the banking business. The study further recognised that poor quality of the financial services, low level of liquidity is the primary cause of the bank failures. (Ndebbio 2004) airs that financial deepening as catalyse of growth positively affects the country's per capita growth. It shows that primarily in every economy, financial deepening stands tall in terms of its positive effect on GDP and economic development in general. For this reason, financial service expansion should be encouraged amongst all Sub-Sahara Africa countries to include the unbanked and underbanked in our society hence boosting economic activities. Also, another study confirms a single long equilibrium relationship between financial deepening, growth, and a set of control variables as evidence points to a bi-directional causality between financial deepening and growth (Apergis, Filippidis & Economidou, 2007).

According to (Okoli 2010), examining the relationship between financial deepening and stock market returns and volatility in the Nigerian stock market found a negative association with conditional volatility in both models. Furthermore, financial deepening affects the stock market negatively in model 1 and positively in model 2. Moreover, the relationship between financial deepening and conditional volatility can be described as negative. And positive for Models 1 and 2, respectively. Evidence shows that financial deepening is essential for economic growth, as no country could do without it. Paramati (2011) conquers that financial deepening is a necessary causal factor of economic growth. However, the strength of the evidence varies across countries and across the proxies used to measure financial deepening. The causal relationships are also predominately long-term in nature. Therefore, government policies to promote financial deepening in these countries must be persistent and sustainable to foster economic development.

According to Ochanda (2014), credit accessibility and financial innovation had positive effects on the growth of SMEs. He concluded that financial deepening has a positive impact on the development of SMEs in Nairobi County in Kenya. As these activities form part of the country's nationwide economy, economic growth and GDP would also affect them. In a further study, ((Linda & Bakang, 2014) proxied financial deepening with liquid liabilities, credit to the private sector, commercial-central bank assets, and commercial bank deposits. It was concluded that financial deepening has a positive and statistically significant effect on GDP and the other.

Consequently, a study by (Alenoghena 2014) established that stock market capitalisation, limited money diversification involving credit to the private sector, and interest rate significantly impacted the country's economic growth during the study period. Further, it was revealed that they were not significant in explaining the trend in economic development; they exhibited a robust coefficient in the process. To support this argument (Alrabadi & Kharabsheh, 2016) conclude that there is no statistically significant effect of financial deepening on economic growth in the short run. However, the cointegration tests show a statistically significant long-run equilibrium relationship between the two variables regardless of the proxy used for financial deepening. Moreover, the Granger causality test shows a bi-directional causality between economic growth and financial deepening when the latter is measured by the amount of credit granted to the private sector. (Best, Francis & Robinson, 2017), studied financial deepening and economic growth in Jamaica.

The study focused on whether liquid bank reserves to bank assets ratio and domestic credit to the private sector as a percentage of GDP strengthen financial deepening on the real sector and spur economic growth in Jamaica. Their study covered 1980 and 2014 with three proxies for financial deepening. It was found that Jamaica should first concentrate on developing its financial sectors, which can spur higher levels of economic growth in the real sectors of the economy. On interest rate reforms, Odhiambo (2019) opines that financial deepening positively impacts Kenya's interest rate reforms and economic development. Annual time series data was used from 1968 to 2004 and cointegration, and correlation models were applied. In affirmation, (Okeya & Dare, 2020) reveal that financial deepening has a significant positive effect on stock market development in the long run but negatively affects Nigeria's short run. They employed the Augmented Dickey-Fuller unit root test, Johansen cointegration test, Vector auto-regression, and Vector error correction mechanism.

2.3. Conceptual Framework

A conceptual framework is a tool that shows the relationship between the dependent variable and the independent variable. Kombo and Tromp (2009). It, however, provides an understanding of the subsequent findings by showing the relationship between the variables. This study shows how financial deepening affects stock market performance.

Table 1: Conceptual Framework

Independent Variable	Dependent Variables	Control Variables
Financial Deepening (M2)	Stock Market Performance Stack Value in Trade	GDP GOVT TO

3. DATA AND METHODOLOGY

This chapter expounds on the type of methodology adopted by this study to address the intended objectives. It provides an in-depth description of the population and the sample size, the source of data, and the study's design, which comprises variables and their justification and the research model(s) used for the estimations. The study adopted a quantitative research approach which is generally associated with the positivist paradigm. The study involved a sample of four (4) countries in Sub-Saharan Africa with a reasonable number of data points of the selected variables during the study period. The countries include South Africa, Kenya, Nigeria, and Ghana. In Sub-Saharan Africa, South Africa is advanced in terms of the stock market, followed by Kenya, Nigeria, and Ghana being the least. However, Ghana, Kenya and Nigeria, and South Africa are relevant in the international dispensation.

For this reason, the researcher deemed to do this comparative study whether there will be any policy relevance (accept or reject of hypothesis). The independent variable will constitute broad money (M2), GDP per capita, government expenditure, and trade openness, while the dependent variable is made of the stock value in business. The study used the annual data of these selected countries over 19 years, ranging from 2001 to 2019. The study used the secondary data in the estimations to achieve the test for the objectives outlined in the introductory chapter. The data is obtained from three credible sources: the World Bank's Development Indicators (WDI), International Monetary Fund (IMF) database, and the various selected countries' stock exchanges for conformity. The research was conducted using Panel Data from 2001 to 2019. The study used a panel dataset from four (4) selected Sub-Saharan African countries

The Seemingly Unrelated Regression (SUREG) model, as advanced by Zellner (1962), was adopted to estimate the four models simultaneously as a system of equations. According to Cameron and Trivedi (2010), the SUR model consists of m linear regression equations for N individuals. The j th equation for an individual is:

$$Y_{ij} = X_{ij}' \beta_j + \mu_{ij} \quad (1)$$

Where, X_{ij}' is a column vector and the number of observations J is assumed to be significant, to do the analysis, we believe $J \rightarrow \infty$ since the number of equations M remains fixed. With all observations stacked, the model for the j th equation can be written as:

$$Y_j = X_j \beta_j + \mu_j \quad (2)$$

Where Y_i and μ_i are $M \times 1$ vectors, X_i is an $M \times k_i$ matrix, and β_i is a $k_i \times 1$ vector.

The researcher then stacks the m equations to give the SUR model as:

$$\begin{pmatrix} y_1 \\ y_2 \\ \vdots \\ y_m \end{pmatrix} \equiv \begin{pmatrix} x_1 & 0 & \dots & 0 \\ 0 & x_2 & \dots & \vdots \\ \vdots & \vdots & \ddots & 0 \\ 0 & \dots & 0 & x_m \end{pmatrix} \begin{pmatrix} \beta_1 \\ \beta_2 \\ \vdots \\ \beta_m \end{pmatrix} + \begin{pmatrix} \mu_1 \\ \mu_2 \\ \vdots \\ \mu_m \end{pmatrix}$$

In this way, the models that are to be estimated are displayed below:

$$SMKP_{it} = \delta_0 + \delta_1 FinD_{it} + \delta_2 Govt_{it} + \delta_3 GDP_{it} + \delta_4 TO_{it} + \varepsilon_{it} \quad (3)$$

$$SMKP_{it} = \alpha_0 + \alpha_1 FinD_{it} + \alpha_2 Govt_{it} + \alpha_3 GDP_{it} + \alpha_4 TO_{it} + \varepsilon_{it} \quad (4)$$

$$M2_{it} = \beta_0 + \beta_1 FinD_{it} + \beta_2 Govt_{it} + \beta_3 GDP_{it} + \beta_4 TO_{it} + \varepsilon_{it} \quad (5)$$

$$SMKP_{it} = \phi_0 + \phi_1 FinD_{it} + \phi_2 Govt_{it} + \phi_3 GDP_{it} + \phi_4 TO_{it} + \phi_5 YE + \varepsilon_{it} \quad (6)$$

$$M2_{it} = \kappa_0 + \kappa_1 FinD_{it} + \kappa_2 Govt_{it} + \kappa_3 GDP_{it} + \kappa_4 TO_{it} + \kappa_5 CE + \varepsilon_{it} \quad (7)$$

Where FinD is the financial deepening, SMTP is the Stock market performance, GDP is the Per Capital Gross Domestic Product, GOVT is the Government Expenditure, TO is the Trade Openness, YE is the Year effect and CE is the Country effects were used as dummy variables.

The financial deepening variable is proxied by M2, representing the monetisation variable or broad money stock and is defined by money and quasi-money (M2) as a percentage of GDP. The monetisation variable is designed to show the actual size of the financial sector of a growing economy. Therefore, this variable is expected to increase over time if the financial industry develops faster than the real sector on the one hand and decreases if the financial sector grows slower than the real sector. According to other researchers, board money stock as a ratio of GDP is used as a typical indicator of the financial depth of the economy (see Goldsmith, 1969; King and Levine, 1993a).

4. FINDINGS AND DISCUSSIONS

4.1. Descriptive Statistics

This section discusses the findings of the study using the econometric techniques discussed earlier. The discussions are boarded on descriptive statistics, pre-estimating tests, the Pearson correlation matrices of the various models, and a detailed dynamic panel result in analysis, emphasising the link between financial deepening and stock market performance.

Table 1: Result of Descriptive Statistics

	SMK	M2	FIND	GDP	GOVT	TO
Mean	69.69455	39.47946	49.12682	4.845820	12.67969	56.60847
Median	15.05339	34.35490	21.25696	5.238528	12.99592	55.92946
Maximum	352.1564	80.79989	160.1248	15.32916	21.29574	110.0459
Minimum	2.240000	11.30051	8.084343	-1.616869	0.951747	20.72252
Std. Dev.	100.2030	19.93705	54.46925	2.974570	5.547306	18.50248
Skewness	1.411163	0.774958	1.132071	0.583766	-0.106958	0.595715
Kurtosis	3.410745	2.330719	2.420152	4.744090	1.977844	3.538071
Jarque-Bera	25.75841	9.025560	17.29813	13.94911	3.453450	5.411921
Probability	0.000003	0.010968	0.000175	0.000935	0.177866	0.066806
Observations	76	76	76	76	76	76

Note: Financial deepening (FinD) is the enhancement of the financial services that are tailored to all the levels in the society, Stock Market Performance (kt) is the indicator of the stock market as a whole or a specific stock, broad money (M2) is a proxy of financial deepening which refers to funds and quasi-money as a percentage of GDP, Gross domestic product per capita (GDP) is the gross domestic product divided by the total population, Government expenditure (Govt) is referred to money spent by the public sector on the acquisition of goods and provision of services such as education, healthcare, social protection, etc. and Trade openness (TO) is the sum of imports and exports normalised by GDP.

The results of the descriptive statistics of the dependent and independent variables are shown in table 1 above. The descriptive statistics of the data are shown in six columns containing the variables SMK, M2, FIND, GDP, GOVT, and TO. SMK obtained a mean of 69.69% on the table, with a maximum of 352 and a minimum of 2.24%. The meaning of M2 is 39.48%, with a maximum of 80.80% and a minimum of 11.30%. FIND obtained a mean rate of 49.13%, a maximum of 160, and a minimum of 8.08%. The average GDP rate was 4.85%, with a high of 15.33% and a low of -1.62%. GOVT obtained a mean rate of 12.68%, with a maximum of 21.30% and a minimum of 0.95%. The mean of TO was 56.60%, with a maximum of 110, with a minimum rate of 20.72%.

4.2. Correlation Matrix

The performed correlation analysis measured the strength and the direction of the linear relationship between two variables. The correlation tests show a positive relationship between a dependent variable and all explanatory variables except GDP, which offers a weak negative relationship with SMKT.

Table 2: Result of Correlation Matrix

	SMKT	M2	FIND	GDP	GOVT	TO
SMKT	1.000000	0.916417	0.964924	-0.464116	0.758268	0.006837
M2	0.916417	1.000000	0.956252	-0.493132	0.894633	0.142117
FIND	0.964924	0.956252	1.000000	-0.456808	0.800728	0.039629
GDP	-0.464116	-0.493132	-0.456808	1.000000	-0.434724	0.123675
GOVT	0.758268	0.894633	0.800728	-0.434724	1.000000	0.237074
TO	0.006837	0.142117	0.039629	0.123675	0.237074	1.000000

4.3. Results of Validity and Reliability

The appropriateness and accuracy of the Seemingly Unrelated Regression (SUR) technique adopted are based on the validity of several tests. These test results are provided in tables 3 and 4 below. The order of integration was tested using Augmented Dickey-Fuller (ADF) (Dickey and Fuller, 1972) unit root tests. Unit root tests are conducted to verify the stationarity properties (i.e., absence of a trend and long-run mean reversion) of the time panel data to avoid spurious regression. The results show that stock market performance (SMTP) and GDP were stationary at a level (0.0358 and 0.0107 respectively) while broad money (M2) gave 0.0053, Government expenditure (GOVT), 0.0001, and trade openness (TO), 0.0003, which were all stationary at first difference.

Table 3: Augmented Dickey-Fuller (ADF)

	SMTP	M2	GOVT	GDP	TO
Level	0.0358**	0.935	0.3367	0.0107*	0.6159
1st Difference	-	0.0053**	0.0001**	-	0.0003**

Table 4: Hausman (1978) Specification Test

	Coef.
Chi-square test value	32.933
P-value	0

The Hausman test was performed to help choose whether to use the fixed or the random effect model in analysing panel data. When the p-value of the Hausman test was significant at 0, we reject the null hypothesis in favour of the alternative, which means that the fixed effect model is appropriate in this regard. From table 4 above, the p-stat of the Hausman test is statistically significant because $prob < 0.05$. We, therefore, resort to using the fixed-effect model in the subsequent analysis. The fixed effect model is also appropriate for studying variables that can change over time but are not likely to vary across entities. Given that macroeconomic variables are expected to change over time, this study has produced the best results to help make the needed policy recommendations.

Table 5: Breusch–Pagan Test

	Coef.
Chi-square test value	0.00
P-value	1.00

The study also conducted the Breusch–Pagan test of independence. According to Trevor Breusch and Adrian Pagan (1979), "the Breusch–Pagan test of independence examines the presence of heteroskedasticity. The Breusch–Pagan test was a chi-squared test with the test statistic distributed with k degrees of freedom theoretically; if the test statistic has a p-value below an appropriate threshold (e.g., $p < 0.05$), the null hypothesis homoskedasticity is rejected, and heteroskedasticity assumed.

From our test result, as shown in Table 5, the Breusch–Pagan test statistic of $\chi^2 = 0.00$ has a P-value = 1.0000. It means the test statistic is not significant, and thus, we fail to reject the null hypothesis of homoskedasticity. The overall fitness of the four models was also using the R-squared, resulting significantly throughout the four models, 0.857, 0.931, 0.945, and 0.975, respectively. Finally, the F Statistic of each of the four models is significant at 1%, as shown in Table 4.5 below. This is evident that the independent variables used in each of the four models are jointly significant and are appropriate.

Table 6: Main Results

VARIABLES	(SMTP) Model 1	(M2) Model 2	(SMTP) Model 3	(M2) Model 4
M2	7.073*** (0.380)		2.786*** (0.824)	
SMTP		0.135*** (0.00726)		0.0501*** (0.0148)
GDP	1.338 (1.643)	-0.215 (0.225)	1.329 (1.256)	-0.291* (0.166)
GOVT	-8.355*** (1.466)	1.264*** (0.156)	1.938 (1.674)	0.0979 (0.226)
TO	-0.479** (0.242)	0.0625* (0.0338)	0.0734 (0.515)	0.295*** (0.0594)
Constant	-82.99*** (18.10)	11.53*** (2.485)	-125.9*** (42.26)	-1.628 (6.009)
Year Effect	No	No	Yes	Yes

Country Effect	No	No	Yes	Yes
Observations	76	76	76	76
R-squared	0.857	0.931	0.945	0.975

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

The results show that broad money supply, a proxy for financial deepening, has a positive and statistically significant impact on stock market performance in each of the four models. This is in agreement with the study carried out by (Okeya & Dare, 2020). Their analysis confirmed that financial deepening has a significant positive effect on stock market performance in the long run but negatively affects the short run. From the table, a unit increase in broad money (M2) will increase stock market performance in model one by 7.073, model two by 0.135, model three by 2.786, and model four by 0.0501 in stock market performance 1% significant level all other things being equal. It is shocking to infer from the table that GDP has no statistically significant impact on stock market performance.

Government expenditure has a negative statistically significant impact on stock market performance in model one, positive and statistically significant coefficient in model two, respectively. A unit increase in government expenditure will decrease stock market performance by eight units in model one and increase stock market performance by 1.264 respectively at a 1% significant level holding other factors constant. It has largely agreed with the finding of (Okoli, 2010) who argued that financial deepening has no relation with government expenditure; therefore, both do not relate. Again, trade openness returned negative on the one hand and positive while being statistically significant coefficients in models one and four respectively but insignificant positive coefficients in models two and three.

Concerning year and country effects, table 4.4 shows neither year effect nor country effect for models 1 and 2. However, the results were different for models 3 and 4, indicating year and country, respectively. As inferred from the table, financial deepening reduced from 7.073 units to 2.786 from models 1 and 3, respectively. In the same vein, stock market performance has also witnessed a downward trend from 0.135 to 0.0501 between model 2 and model 4. Finally, trade openness has also increased from -0.479 to 0.295, showing a large positive significant change. It might result from the global economic crunch and selected countries' specific challenges through various financial reforms.

5. CONCLUSION, RECOMENDATIONS AND PUBLIC IMPLICATIONS

Although both trade openness and government expenditure determine the level of stock market performance, financial deepening predicts stock market performance better as it recorded the highest result in table 4.4 above. Conversely, GDP does not predict stock market performance in any of the four models specified. These results indicate that to predict stock market performance, one needs to consider the level of financial deepening first before any other variable. This variable is the most critical predictor of stock market performance in Ghana, Kenya, Nigeria, and South Africa. This is an explicit endorsement of literature as it confirmed in various studies that financial deepening is a catalyst of economic growth and a significant contributor to GDP.

From the findings above, the study recommends the following: Firstly, all countries involved in this study and other Sub-Saharan African countries should implement policies that seek to enhance financial deepening in the form of an increase in broad money supply as a percentage of GDP. The increase in overall money supply allows for investment in productive sectors of the economy. Secondly, to intensify policies that increase access and usage of financial services to include members of the public that were excluded from the formal banking system. This is because monetary deepening policies broaden the financial sector's scope of activity, increase traditional financial institutions' financial assets, and give economic agents more opportunities to save and invest. Thirdly, GDP does not significantly affect the performance of stock market performance in any of the models. Governments should invest less in GDP or diverse investments meant to boost GDP for more productive use. Again, because GDP relates negatively to all the variables, it is in the interest of economic growth that governments in the countries studied drop any attempt to boost GDP.

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