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THE EFFECT OF COVID-19 ON REVENUE DIVERSIFICATION, PROFITABILITY AND RISK OF BANKS IN ZAMBIA

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ABSTRACT

The aim of this study was to evaluate the effect of the COVID-19 pandemic on revenue diversification and performance of banks in Zambia. The study was quantitative in design. Herfindahl Hirschmann Index measures for each bank to account for diversification between interest and non-interest activities were constructed, while the Risk Adjusted Return on Average Assets to measure bank profitability and the Z-Score to measure bank income volatility were computed. SPSS's One-way repeated measures ANOVA was then used to analyse panel data from 16 of the 18 commercial banks in the country.

The study concluded that there was no statistically significant difference in bank revenue diversification following the outbreak of COVID-19 in Zambia. With respect to bank performance, the study found that there was a statistically significant increase in bank profitability as measured by RAROAA in the aftermath of the pandemic. Similarly, the study found that there was a statistically significant increase in bank income volatility following the COVID-19 pandemic.

Although bank profitability increased in the pandemic era, income volatility also increased thereby, exposing banks in the country to insolvency risk. The policy implication is that the Bank of Zambia should encourage banks to diversify their non-interest income sources to enhance their capacity to withstand major disruptions caused by natural and man-made disasters.

KEYWORDS: *Bank revenue diversification, COVID-19, Income volatility, Risk adjusted return on assets, Zambia.*

1. INTRODUCTION

The aim of this study was to evaluate the effect of the COVID-19 pandemic on revenue diversification and performance of banks in Zambia.The research question that guided this study was: *To what extent has the COVID-19 pandemic affected revenue diversification and performance of banks in Zambia?*

This study is important because it establishes the extent to which the COVID-19 pandemic affected revenue diversification and performance of banks in Zambia. Prior to the pandemic, Kayombo (2021) established that although non-interest income diversification improves profitability and reduces income volatility of banks in Zambia, these institutions had continued to divest their non-interest income activities over the previous decade. Therefore, if the COVID-19 pandemic significantly impacted bank revenue diversification, then banks' performance could be adversely affected. Findings from the study should be useful to bank regulators and managers as they plan for future COVID-19 outbreaks and similar pandemics.

To answer the research question above, the specific research objectives that we sought to addresswere:

RO1: Establish the effect of COVID-19 pandemic on bank non-interest income diversification in Zambia.

RO2: Evaluate the effect of the COVID-19 pandemic on profitability of banks in Zambia.

RO3: Assess the effect of the COVID-19 pandemic on income volatility of banks in Zambia.

To address these research objectives, we constructed Herfindahl Hirschmann Index (HHI) measures for each bank to account for diversification between interest and non-interest activities. With respect to bank performance, we used the Risk Adjusted Return on Average Assets (RAROAA) to measure bank profitability and the Z-Score to measure bank income volatility. We then used one-way repeated measures ANOVAin SPSS to analyse panel data for 2018, 2019, 2020 and 2021 from 16 of the 18 commercial banks in the country.

Based on our findings, we conclude that there was no statistically significant difference in bank revenue diversification following the COVID-19 pandemic in Zambia.In other words, banks in the country did not significantly diversify their income sources in response to the COVID-19 pandemic.With respect to bank performance, our study found that there was a statistically significant increase in bank profitability as measured by RAROAA in the aftermath of the pandemic.Similarly, our study found that there was a statistically significant increase in bank income volatility following the COVID-19 pandemic.

The remainder of the paper is organised as follows. Section 2 provides a brief review of the prior literature, while the methodology and dataset are described in Section 3. Empirical results are presented in Section 4, and Section 5 offers concluding remarks.

2. LITERATURE SURVEY

The COVID-19 pandemic has caused serious disruption in business operations world over and across all sectors. Being central in all economic activities, the banking sector has not been spared by the effects of the pandemic. This section provides a review of the literature regarding the

effect of the COVID-19 pandemic on bank revenue diversification, profitability, and income volatility.

2.1 COVID-19 PANDEMIC AND BANK REVENUE DIVERSIFICATION

Over the years, banks have gradually increased their product portfolio by diversifying into non-traditional banking services such as insurance,commissions, fees, and foreign exchange transactions. The positive correlation between bank non-interest income diversification and profitability is well established in the banking literature,be it in developed countries (Johnson and Meinster, 1974; DeYoung and Rice, 2004), emerging economies (Sanya and Wolfe, 2011; Meslier, Tacneng and Tarazi, 2014) and developing countries (Senyo, Olivia and Musah, 2015; Ammar and Boughrara, 2019; Kayombo, 2021; Addai, Tang and Agyeman, 2022).

Prior to the pandemic, there was evidence of reduced revenue diversification by banks in Zambia (Kayombo, 2021). However, in the post-pandemic era, there is no evidence of research carried out to establish the extent to which banks diversified their revenue sources in the country.

Although some researchers have suggested that banks that were functionally diversified (reliance on non-interest income) prior to/and or around the outbreak of COVID-19 withstood the negative effects of the pandemic better than their specialised peers (Ochenge, 2022; Simoens and Vennet, 2022; Taylor, 2022), only a handful of studies have been carried out to determine the extent to which banks diversified their non-interest income sources in direct response the pandemic (Kozak, 2021; Li *et al.*, 2021; Le *et al.*, 2022). These studies have concluded that non-interest income diversification cushions banks from the negative effects of the pandemic.

2.2 COVID-19 PANDEMIC AND BANK PROFITABILITY

Studies on the effect of COVID-19 on banks' profitability have revealed different results. Many studies have concluded that the COVID-19 pandemic enhanced banks' profitability by forcing them to diversify their revenue sources (Li *et al.*, 2021; Kozak and Wierzbowska, 2022; Le *et al.*, 2022), thereby increasing income streams.

The second strand of the literature contends that the COVID-19 pandemic had a negative impact on profitability (Elnahass, Trinh and Li, 2021; Katusiime, 2021; Tarawneh *et al.*, 2021; Xie *et al.*, 2021; Taylor, 2022). This could be attributed to continuous lockdowns, restrictions in movement of people, reduced/halted production, sagging demand for goods and services, and barriers in international trade, all of which resulted in reduced economic activity (Gazi *et al.*, 2022).

Thirdly, other researchers concluded that the effect of the pandemic on bank profitability depended on various factors such as size of the bank (Kozak, 2021; Xie *et al.*, 2021; Gazi *et al.*, 2022). In this regard, larger banks were more profitable than smaller ones. Other factors that affected banks' profitability included non-performing loan rates, the amount of liquid assets, the proportion of hedging capital (Katusiime, 2021; Gazi *et al.*, 2022), size of a country's GDP (Xie *et al.*, 2021), and the level of IT spending (Dadoukis, Fiaschetti and Fusi, 2021). In the case of Ugandan banks, Katusiime (2021) found that bank profitability was to a large extent negatively and significantly affected by non-performing loans, market sensitivity risk, and liquidity, while the Treasury Bill interest rate and lending rates had a significant positive effect on bank profitability in the short run.

2.3 COVID-19 PANDEMIC AND BANK INCOME VOLATILITY

Although some studies have been carried out to establish the effect of COVID-19 pandemic on stability of the banking sector in general, there is a dearth of literatureon the impact of the pandemic on bank income volatility, an important measure of bank performance. Elnahass, Trinh and Li (2021), for example, found that the pandemic had detrimental impacts on financial stability in terms of default risk, liquidity risk and asset risk. Other studies have reached similar conclusions (Dadoukis, Fiaschetti and Fusi, 2021; Demirgüç-Kunt, Pedraza and Ruiz-Ortega, 2021; Kozak, 2021).

With respect to bank income volatility in the pandemic era, only one study by Tran *et al.* (2022) seems to have addressed this topic. The study revealed that the pandemic increased bank income volatility. Various interventions applied to address the effect of the pandemic on human life had a negative impact on the bank's performance causing increased earnings volatility. The specific factors includereduced loan growth and asset quality, and lower earnings ratio.

3. DATA AND METHODOLOGY

We provide a description of the data and data sources used in the study in this section. We also define the measures we adopted to measure bank revenue diversification, profitability and risk. Lastly, we describe the empirical model used.

3.1 DATA AND SOURCES

We collected data for this study from the country's central bank, the Bank of Zambia (BoZ). The data comprised bank level financial statements and extracts from individual banks' prudential returns.These data were adequate for us to compute bank revenue diversification, profitability, and income volatility.

The BoZ provided anonymized data for all the 18 banks in the country. However, we analysed data for 16 banks as two of the banks did not have data for all the years covered by the study. The 16 banks accounted for 98% of total bank net income and 98.6% of total bank average assets, hencewe considered the samplelarge enough to represent characteristics of the sector.

3.2 DIVERSIFICATION MEASURES

As is customary in many similar studies, we constructed Herfindahl Hirschmann Index (HHI) measures for each bank to account for diversification between interest and non-interest activities (Stiroh, 2006; Mercieca, Schaeck and Wolfe, 2007; Sanya and Wolfe, 2011; Meslier, Tacneng and Tarazi, 2014). In general, the higher the HHI is, the lower the level of diversification, and vice versa. We then used the formula belowto calculate the revenue HHI (HHI_{REV}) for each bank:

$$HHI_{REV} = (NON/TOP)^2 + (NET/TOP)^{2,}$$

in which case NON, TOP and NET respectively represent non-interest income, total operating revenue, and net interest income.

3.3 RISK-ADJUSTED PERFORMANCE MEASURES

With respect to assessing the effect of COVID-19 on bank performance, we used the Risk Adjusted Return On Average Assets (RAROAA) to measure bank profitability and the Z-Scoreto measure income volatility as recommended in the literature (Chiorazzo, Milani and Salvini,

2008; Paltrinieri *et al.*, 2020). Stiroh (2006) defines RAROAA as "average profits divided by the standard deviation of profits", which implies profits per unit of risk. Accordingly,we calculated the RAROAA by dividing the return on average assets (ROAA) by its standard deviation.

With respect to risk, our study focused on income volatility as a measure of bank risk. We therefore, used the Z-Score to determine earnings volatility. Having been proposed by Altman in 1968 (Altman, 1968),the Z-Score has been used by many researchersto assess bank income volatility (Stiroh, 2006; Mercieca, Schaeck and Wolfe, 2007; Paltrinieri *et al.*, 2020). Measured by the number of standard deviations a bank is from insolvency, Stiroh (2006) posits that the Z-Score is a substitute for insolvency risk.

We considered the Z-Score to be reliable for measuring bank risk because its computation integrates profitability (mean level of bank profits) and equity (mean equity ratio) characteristics. The accuracy of the Z-Score is also very high in predicting bankrupty at between 80 – 90% (Altman, 2000).

In line with previous studies, we used the following formula to calculate the Z-Score for each bank (Stiroh, 2006; Mercieca, Schaeck and Wolfe, 2007; Paltrinieri *et al.*, 2020):

$$\text{Z-Score} = \frac{\text{ROAA + capitalisation}}{\text{SDROAA}}$$

wherein ROAA stands for Return On Average Assets, while SDROAA is its standard deviation. Capitalization represents the equity to assets ratio (or capital ratio). Empirically, the higher the Z-Score the greater the bank's stability, with a Z-Score of 1.81 being considered the minimum safe level (Altman, 2000). We have outlined the variable definitions we used in the study in Table 1 below.

TABLE 1 VARIABLE DEFINITIONS

Variable	Proxy	Definition
Panel A: Dependent Variables		
RAROAA	Risk adjusted return on average assets	Return on average assets divided by the standard deviation of return on average assets.
Z-Score	Z-Score	The Z-Score is a substitute for insolvency risk, measured by the number of standard deviations a bank is from insolvency.
Panel B: Diversification Variables		
HHI_{REV}	Herfindahl Hirschmann Index	Measures degree of diversification between interest and non-interest income.
NON	Non-interest income	Income generated from non-bank lending activities.
TOP	Total operating revenue	Non-interest income plus net interest income.
NET	Net interest income	Total interest income minus total interest expense.
Panel C: Bank-specific variables		
NIR	Non-interest income ratio	Non-interest income divided by total income.

Adapted from (Ammar and Boughrara, 2019)

3.4 DATA ANALYSIS

After computing the variables namely HHI, RAROAA and Z-Score for the sample data, we used One-way repeated measures ANOVA to test for any differences in means among individual banks'revenue diversification and performance during the period around the outbreak of COVID-19 (i.e., the year just before, during and after the outbreak) that we could attribute to the COVID-19 pandemic. According to Denis (2019), such a design, in which "subjects are measured repeatedly across conditions or time, are known as within-subjects designs or repeated measures". Accordingly, we analysed the data on each of the three variables namely, revenue diversification, profitability and income volatility using SPSS' General Linear Model Repeated Measures function.

Although there were three dependent variables, we did not find the Multivariate Analysis of Variance (MANOVA)technique suitable because our dependent variables were not related (Pallant, 2020). We therefore, carried out separate ANOVA tests on each variable. To overcome the increase in Type I error that arises when several One-way repeated ANOVA tests are carried out, we incorporated a Bonferroni adjustment in each test.

The null hypothesis (H_0) is that the population means are equalthroughout the period in respect of each of the dependent variables, implying that the intervention i.e., COVID-19 pandemic, did not affect the dependent variables. Accordingly, we designed threesets of hypotheses as shown below:

(i) Revenue diversification as measured by the HHI

H_0: $\mu_{2018} = \mu_{2019} = \mu_{2020} = \mu_{2021}$

H_1: $\mu_{2018} \neq \mu_{2019} \neq \mu_{2020} \neq \mu_{2021}$

(ii) Profitability based on RAROAA

H_0: $\mu_{2018} = \mu_{2019} = \mu_{2020} = \mu_{2021}$

H_1: $\mu_{2018} \neq \mu_{2019} \neq \mu_{2020} \neq \mu_{2021}$

(iii) Income volatility measured by Z-Score

H_0: $\mu_{2018} = \mu_{2019} = \mu_{2020} = \mu_{2021}$

H_1: $\mu_{2018} \neq \mu_{2019} \neq \mu_{2020} \neq \mu_{2021}$

where μ = population mean in terms of revenue diversification, profitability, and income volatility respectively in the two years prior to the outbreak of COVID-19 in the country (i.e., 2018 and 2019), and thereafter (i.e., 2020 and 2021).

The alternative hypothesis (H_1) is that the related population means are not equal (i.e., at least one mean is different to another mean). The implication is that if we reject the null hypothesis, then we can assume that COVID-19influenced banks' revenue diversification, profitability, and income volatility, respectively.

4. EMPIRICAL RESULTS

4.1 MODEL ASSUMPTIONS

Pallant (2020) outlines assumptions that apply to parametric tests in general. These include dependent variables measured on a continuous scale, use of random sampling, independence of observations, and normally distributed populations from which samples are drawn. For the results of repeated measures ANOVA to be valid, the five specific assumptions that must be metare dependent variables measured on a continuous scale, approximately normally distributed dependent variables, sphericity, no significant outliers and that the independent variable should consist of at least two categorical 'related groups' or 'matched pairs'(Lund Research Ltd, 2018).

The dependent variables in our study i.e., HHI, RAROAA and Z-Scores are all continuous variables, while the independent variable consisted of three categories of data covering the pre and post COVID-19 pandemic era. We have discussed the rest of the assumptions under the relevant section below.

4.2 EXTENT OF BANK REVENUE DIVERSIFICATION IN ZAMBIA

The hypothesis we tested here was in relation to whether the COVID-19 pandemic had a statistically significant effect on bank revenue diversification in Zambia i.e.:

H_0: $\mu_{2018} = \mu_{2019} = \mu_{2020} = \mu_{2021}$

H_1: $\mu_{2018} \neq \mu_{2019} \neq \mu_{2020} \neq \mu_{2021}$

We tested the data for normality using the "Analyse Descriptive Statistics Explore" function in SPSS. As shown in Table 2 below, results of the Kolmogorov-Smirnov statistic, which assesses the normality of the distribution of scores, gives non-significant scores (sig. value of more than .05), indicating normality (Pallant, 2020).

Additionally, there is no evidence of outliers as there areminimal differences between the means (2018: 54.75; 2019: 57.88; 2020: 57.81; 2022: 58.88) and the 5% trimmed means (2018: 24.28; 2019: 57.69; 2020: 57.46; 2022: 58.75) respectively.

TABLE 2: HHI TESTS OF NORMALITY

Tests of Normality						
	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
2018 HHI (measured in %)	.193	16	.113	.841	16	.010
2019 HHI (measured in %)	.178	16	.185	.909	16	.112
2020 HHI (measured in %)	.208	16	.063	.864	16	.022
2021 HHI (measured in %)	.133	16	.200*	.949	16	.480
*. This is a lower bound of the true significance.						
a. Lilliefors Significance Correction						

Our One-way repeated measures ANOVA as shown in Table 3 below indicates that all four multivariate tests (i.e., Pillai's trace, Wilks' lambda, Hotelling's trace, and Roy's largest root) have a *p*-value greater than 0.05 (i.e., sig. of 0.065). We therefore,accept the nullhypothesisand conclude that there is no statistically significant difference in bank revenue diversification following the COVID-19 pandemic.In other words, banks in Zambia did not diversify their income sources in a significant way in response to the COVID-19 pandemic.

TABLE3: HHI MULTIVARIATE TESTS

Multivariate Tests[a]							
Effect		Value	F	Hypothesis df	Error df	Sig.	Partial Eta Squared
HHI	Pillai's Trace	.415	3.080[b]	3.000	13.000	.065	.415
	Wilks' Lambda	.585	3.080[b]	3.000	13.000	.065	.415
	Hotelling's Trace	.711	3.080[b]	3.000	13.000	.065	.415
	Roy's Largest Root	.711	3.080[b]	3.000	13.000	.065	.415
a. Design: Intercept Within Subjects Design: HHI							
b. Exact statistic							

The Mauchly's Test of Sphericity in Table 4below shows that the test of sphericity at 0.14 is not statistically significant. This implies that we have no reason to doubt the assumption of sphericity; therefore, we can interpret the univariate effects without violating the assumption of sphericity (Denis, 2019).

TABLE 4: HHI MAUCHLY'S TEST OF SPHERICITY

Mauchly's Test of Sphericity[a]							
Measure: Diversification							
Within Subjects Effect	Mauchly's W	Approx. Chi-Square	df	Sig.	Epsilon[b]		
					Greenhouse-Geisser	Huynh-Feldt	Lower-bound
HHI	.545	8.319	5	.140	.756	.898	.333
Tests the null hypothesis that the error covariance matrix of the orthonormalized transformed dependent variables is proportional to an identity matrix.							
a. Design: Intercept Within Subjects Design: HHI							
b. May be used to adjust the degrees of freedom for the averaged tests of significance. Corrected tests are displayed in the Tests of Within-Subjects Effects table.							

Just like the multivariate tests in Table 3above, all the univariate tests in Table 5, with a *p*-value of more than 0.05 (sig. of between 0.35 and 0.98), do not support rejection of the null hypothesis, suggesting that the HHI population meanis the same in 2018, 2019, 2020 and 2022. Therefore, the COVID-19 pandemic could not have influenced banks to diversify their revenue sources beyond the pre-COVID-19 levels.

Furthermore, the pairwise comparison shown in Table 6 below strengthens the case for not rejecting the null hypothesis, as the significance levels between all the years is more than 0.05, even after the Bonferroni adjustment for multiple comparisons.

TABLE 5: HHI UNIVARIATE TESTS

Tests of Within-Subjects Effects							
Measure: Diversification							
Source		Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
HHI	Sphericity Assumed	153.172	3	51.057	3.117	.035	.172
	Greenhouse-Geisser	153.172	2.269	67.499	3.117	.051	.172
	Huynh-Feldt	153.172	2.695	56.838	3.117	.041	.172
	Lower-bound	153.172	1.000	153.172	3.117	.098	.172
Error(HHI)	Sphericity Assumed	737.078	45	16.380			
	Greenhouse-Geisser	737.078	34.038	21.654			
	Huynh-Feldt	737.078	40.423	18.234			
	Lower-bound	737.078	15.000	49.139			

The inability of banks in Zambia to diversify their revenue sources in a significant manner in the aftermath of the COVID-19 pandemic could be attributed to inadequate time and/or resourcessince most of them had reduced their non-interest income activities during the ten years prior to 2018 (Kayombo, 2021).For example, while net interest income increased by 85% from 2019 to 2021, non-interest income grew at a slower pace of 78% during the same period (Bank of Zambia, 2022a). Additionally, the economic downturn that resulted from the pandemic could have prevented banks from diversifying their revenue sources as many supply chains were disrupted.

Pairwise Comparisons						
Measure: Diversification						
(I) HHI	(J) HHI	Mean Difference (I-J)	Std. Error	Sig.[a]	95% Confidence Interval for Difference[a]	
					Lower Bound	Upper Bound
1	2	-3.125	1.136	.089	-6.574	.324
	3	-3.062	1.507	.361	-7.638	1.513
	4	-4.125	1.732	.185	-9.383	1.133
2	1	3.125	1.136	.089	-.324	6.574
	3	.063	1.074	1.000	-3.199	3.324
	4	-1.000	1.678	1.000	-6.096	4.096
3	1	3.063	1.507	.361	-1.513	7.638
	2	-.062	1.074	1.000	-3.324	3.199

	4	-1.062	1.324	1.000	-5.084	2.959
4	1	4.125	1.732	.185	-1.133	9.383
	2	1.000	1.678	1.000	-4.096	6.096
	3	1.063	1.324	1.000	-2.959	5.084
Based on estimated marginal means						
a. Adjustment for multiple comparisons: Bonferroni.						

TABLE 6: HHI PAIRWISE COMPARISONS

4.3 PROFITABILITY

We tested the effect of COVID-19 on bank profitability in Zambia via the two hypotheses below:

H_0: $\mu_{2018} = \mu_{2019} = \mu_{2020} = \mu_{2021}$

H_1: $\mu_{2018} \neq \mu_{2019} \neq \mu_{2020} \neq \mu_{2021}$

An inspection of the RAROAA computations identified outliers in three banks that had negative RAROAA in at least one year. We generated histograms in SPSS that confirmed these RAROAA as outliers. As proposed by Tabachnick, Fidell and Ullman (2019, p.63) we removed these banks from the analysis before running the tests.

We tested the data for normality,and as shown in Table 7 below; results of the Kolmogorov-Smirnov statistic, which assesses the normality of the distribution of scores, gives non-significant scores (sig. value of more than 0.05), indicating normality.

TABLE 7: RAROAA TESTS OF NORMALITY

Tests of Normality						
	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
2018 RAROAA	.191	13	.200*	.867	13	.047
2019 RAROAA	.159	13	.200*	.846	13	.025
2020 RAROAA	.223	13	.075	.891	13	.099
2021 RAROAA	.109	13	.200*	.958	13	.722
*. This is a lower bound of the true significance.						
a. Lilliefors Significance Correction						

With respect to the effect of the COVID-19 pandemic, our analysis indicates that all four multivariate tests (i.e., Pillai's trace, Wilks' lambda, Hotelling's trace, and Roy's largest root) have a *p*-value less than 0.05 (i.e., sig. of 0.044) suggesting that there is a statistically significant difference in the profitability means of the banks as measured by the RAROAA during the years 2018 to 2021 (see Table 8 below). The Partial Eta Squared of 0.539indicates that 54% of the variability in the RAROAA means was caused by effects of the COVID-19 pandemic. We, therefore, conclude that the RAROAA means for 2018, 2019, 2020 and 2021 are different in the population from which we drew the data. Given that the most significant event/ intervention

during this time was the outbreak of COVID-19 in 2020 in the country, we suggest that the pandemic affected banks' profitability.

TABLE 8: RAROAA MULTIVARIATE TESTS

Multivariate Tests[a]							
Effect		Value	F	Hypothesis df	Error df	Sig.	Partial Eta Squared
RAROAA	Pillai's Trace	.539	3.891[b]	3.000	10.000	.044	.539
	Wilks' Lambda	.461	3.891[b]	3.000	10.000	.044	.539
	Hotelling's Trace	1.167	3.891[b]	3.000	10.000	.044	.539
	Roy's Largest Root	1.167	3.891[b]	3.000	10.000	.044	.539
a. Design: Intercept Within Subjects Design: RAROAA							
b. Exact statistic							

The Mauchly's Test of Sphericity in Table 9 below shows that the test of sphericity at a significance level of 0.001is statistically significant. However, as recommended by Tabachnick, Fidell and Ullman (2019, p.269) we decided to rely on the Greenhouse-Geissertest (Sig. 0.028 as shown in Table 10), one of the significance tests that is adjusted for violation of the assumption to address the issue of sphericity.The Sphericity Assumed test in the Within-Subjects Effects Table, with a statistically significant result of 0.005 also gave us comfort regarding the data satisfying the sphericity assumption.

TABLE 9: RAROAA MAUCHLY'S TEST OF SPHERICITY

Mauchly's Test of Sphericity[a]							
Measure: Profitability							
Within Subjects Effect	Mauchly's W	Approx. Chi-Square	df	Sig.	Epsilon[b]		
					Greenhouse-Geisser	Huynh-Feldt	Lower-bound
RAROAA	.144	20.796	5	.001	.486	.536	.333
Tests the null hypothesis that the error covariance matrix of the orthonormalized transformed dependent variables is proportional to an identity matrix.							
a. Design: Intercept Within Subjects Design: RAROAA							
b. May be used to adjust the degrees of freedom for the averaged tests of significance. Corrected tests are displayed in the Tests of Within-Subjects Effects table.							

The additional evidence from Table 10 below enables us to reject the null hypothesis, since the Greenhouse-Geisser, a more conservative test, which guards against a potential violation of sphericity, has a *p*-value of less than 0.05 (Sig. = 0.028).

TABLE 10: RAROAA TESTS OF WITHIN-SUBJECTS EFFECTS

Tests of Within-Subjects Effects							
Measure: Profitability							
Source		Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
RAROAA	Sphericity Assumed	39.240	3	13.080	4.985	.005	.294
	Greenhouse-Geisser	39.240	1.457	26.931	4.985	.028	.294
	Huynh-Feldt	39.240	1.607	24.419	4.985	.024	.294
	Lower-bound	39.240	1.000	39.240	4.985	.045	.294
Error (RAROAA)	Sphericity Assumed	94.452	36	2.624			
	Greenhouse-Geisser	94.452	17.485	5.402			
	Huynh-Feldt	94.452	19.283	4.898			
	Lower-bound	94.452	12.000	7.871			

To establish the stage at which the RAROAA means became statistically significantly different, we generated the pairwise comparisons (see Table 11 below) from SPSS. Post hoc analysis with a Bonferroni adjustment revealed that the means were statistically significant between 2020 and 2021 (sig. 0.015) at the 95% confidence level. This suggests that the outbreak of COVID-19 in 2020 in the country enhanced bank profitability in Zambia.

TABLE 11: RAROAA PAIRWISE COMPARISONS

Pairwise Comparisons						
Measure: Profitability						
(I) RAROAA	(J) RAROAA	Mean Difference (I-J)	Std. Error	Sig.[b]	95% Confidence Interval for Difference[b] Lower Bound	Upper Bound
1	2	-.166	.286	1.000	-1.067	.734
	3	-.090	.440	1.000	-1.477	1.297
	4	-2.087	.791	.130	-4.582	.408
2	1	.166	.286	1.000	-.734	1.067
	3	.076	.573	1.000	-1.731	1.883
	4	-1.921	.922	.355	-4.826	.985
3	1	.090	.440	1.000	-1.297	1.477
	2	-.076	.573	1.000	-1.883	1.731
	4	-1.997*	.585	.031	-3.842	-.152
4	1	2.087	.791	.130	-.408	4.582
	2	1.921	.922	.355	-.985	4.826
	3	1.997*	.585	.031	.152	3.842
Based on estimated marginal means						

*. The mean difference is significant at the .05 level.
b. Adjustment for multiple comparisons: Bonferroni.

The findings in this studyregarding bank profitability seem unique. For example, in other jurisdictions, strategies implemented to counter the effects of the COVID-19 pandemic,such as diversification of revenue sourcesenhanced bank profitability (Li *et al.*, 2021; Kozak and Wierzbowska, 2022; Le *et al.*, 2022), but in the case of Zambia, banks did not diversify their revenue sources in a significant manner. In fact, statistics obtained from the Bank of Zambia showed that the aggregate non-interest income ratio dropped from 31% in 2017 to 27% in 2021 (Bank of Zambia, 2022b). Furthermore, all macroeconomic indicators such as GDP growth rate, interest rate, exchange rate, unemployment rate, and default rate became negativeduring the pandemic. For example, GDP growth rate dropped from to 4% in 2018 to -2.8% in 2020 before picking up to 3.6% in 2021, the rate of inflation escalated from 7.2% in 2018 to 22.1% in 2021, while the currency depreciated by 48% in the same period (Bank of Zambia, 2022). Bank returns would therefore be expected to decline.

However, Zambian banks employed other strategies to remain resilient during the pandemic. For example, the 2021 best performing bank in terms of marketleadership in profitability, deposits, and clientnumbersin the country claims to have delivered superior performance through rigorousinnovation in structuring deals, positive transaction trajectory and optimal management of costs (Zanaco, 2022). With respect to the banking sector overall, the Bank of Zambia (2022a) attributes the significant improvement in profitability to increasein net interest income (47% from 2020) and non-interest income (40% from 2020), and reduced provisions for impairments occasioned by upgrading of local currency debt by Fitch in April 2021 (Non-Performing Loan Ratio down to 5.8% in 2021 from 11.6% in 2020).

In line with Katusiime (2021)'s finding that bank profitability in developing countries was cushioned by the high yields on Government Securities such as treasury bills, Zambian banks' profitability benefited significantly from interest income earned on Government Securities. Due to reduced net Government spending, enhanced disbursements under the BoZ Targeted Medium-Term Refinancing Facility (TMTRF), and settlement of bonds, liquidity among banks remained high, with liquidity ratio and liquidassets ratios at 56.3% and 46.6%, respectively (Bank of Zambia, 2022a). This enabled banks to invest in Government Securities which accounted for 37% of all interest income (up by 40% from 2020). Therefore, despite the lull in economic activity and lack of income diversification, banks in Zambiaused their improved liquidity to earn more interest income from Government Securities, thereby enhancing their returns.

4.4 RISKNESS OF BANKS IN ZAMBIA

We tested the effect of COVID-19 on bank income volatility in Zambia via the two hypotheses below:

H_0: $\mu_{2018} = \mu_{2019} = \mu_{2020} = \mu_{2021}$

H_1: $\mu_{2018} \neq \mu_{2019} \neq \mu_{2020} \neq \mu_{2021}$

An inspection of the Z-Score computations identified outliers in three banks,one of which had negative scores. We generated histograms in SPSS that confirmed these Z-Scores as outliers. As proposed by Tabachnick, Fidell and Ullman (2019, p.63) we removed these banks from the analysis before running the tests.

We tested the data for normality, and as shown in Table 12 below, results of the Kolmogorov-Smirnov statistic, which assesses the normality of the distribution of scores, gives non-significant scores (sig. value of more than 0.05), indicating normality.We further assured ourselves that the Z-Score distribution was normal by comparing the respective "Means" against the "5% Trimmed Means" statistics which showed negligible differences.

TABLE 12: Z-SCORE TESTS OF NORMALITY

Tests of Normality						
	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
2018 Z-Score (based on ROAA)	.150	13	.200*	.935	13	.397
2019 Z-Score (based on ROAA)	.133	13	.200*	.936	13	.409
2020 Z-Score (based on ROAA)	.157	13	.200*	.960	13	.750
2021 Z-Score (based on ROAA)	.200	13	.159	.927	13	.313
*. This is a lower bound of the true significance.						
a. Lilliefors Significance Correction						

Our One-way repeated measures ANOVA indicates that all four multivariate tests (i.e., Pillai's trace, Wilks' lambda, Hotelling's trace, and Roy's largest root) have a *p*-value less than 0.05 (i.e., sig. of 0.022). The Partial Eta Squared of 0.601 suggests that about 60% of the variability in the Z-Score means was caused by COVID-19, the major intervening event during the period under review. We therefore, reject the null hypothesis and conclude that there is a statistically significant difference in bank income volatility following the COVID-19 pandemic. In other words, there is evidence to suggest that banks in Zambia experienced statistically significant volatility in their income because ofthe COVID-19 pandemic.

TABLE 13: Z-SCORE MULTIVARIATE TESTS

Multivariate Tests[a]							
Effect		Value	F	Hypothesis df	Error df	Sig.	Partial Eta Squared
Z_Score	Pillai's Trace	.601	5.028[b]	3.000	10.000	.022	.601
	Wilks' Lambda	.399	5.028[b]	3.000	10.000	.022	.601
	Hotelling's Trace	1.508	5.028[b]	3.000	10.000	.022	.601
	Roy's Largest Root	1.508	5.028[b]	3.000	10.000	.022	.601
a. Design: Intercept Within Subjects Design: Z_Score							
b. Exact statistic							

Although the Mauchly's Test of Sphericity in Table 14 below shows that the test of sphericity at a significance level of 0.000 is statistically significant,we decided to rely on the Greenhouse-Geisser test (Sig. 0.004 as shown in Table 15), one of the significance tests that is adjusted for violation of the assumption to address the issue of sphericity. The Sphericity Assumed test in the Within-Subjects Effects Table, with a statistically significant result of 0.000 also gave us comfort regarding the data satisfying the sphericity assumption.

TABLE 14: Z-SCORE MAUCHLY'S TEST OF SPHERICITY

Mauchly's Test of Sphericity[a]							
Measure: Income_Volatility							
Within Subjects Effect	Mauchly's W	Approx. Chi-Square	df	Sig.	Epsilon[b]		
					Greenhouse-Geisser	Huynh-Feldt	Lower-bound
Z_Score	.125	22.280	5	.000	.511	.572	.333
Tests the null hypothesis that the error covariance matrix of the orthonormalized transformed dependent variables is proportional to an identity matrix.							
a. Design: Intercept Within Subjects Design: Z_Score							
b. May be used to adjust the degrees of freedom for the averaged tests of significance. Corrected tests are displayed in the Tests of Within-Subjects Effects table.							

To establish the stage at which Z-Score means became statistically significantly different, we generated the pairwise comparisons (see Table 16 below) from SPSS. Post hoc analysis with a Bonferroni adjustment revealed that the means were statistically significant between 2019 and 2021 (sig. 0.017), at the 95% confidence level. This suggests that the outbreak of COVID-19 in 2020 in the country influenced bank income volatility.

The study revealed an increase in income volatility attributable to the COVID-19 pandemic. This could be attributed to several factors which include an increase in credit impairments, high operating expenses, and a significant increase in non-performing loans (NPLs) in 2020 (Absa Bank Zambia PLC, 2021; Bank of Zambia, 2021). In addition, the lock-downs due to the pandemic caused reduced activity levels across different economic sectors. Consequently, banks recorded a high level of liquidity. This led to loss of income in that funds were either invested on a short-term basis or not at all.

TABLE 15: Z-SCORE TESTS OF WITHIN-SUBJECTS EFFECTS

Tests of Within-Subjects Effects							
Measure: Income_Volatility							
Source		Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Z_Score	Sphericity Assumed	316.594	3	105.531	8.733	.000	.421
	Greenhouse-Geisser	316.594	1.534	206.323	8.733	.004	.421

	Huynh-Feldt	316.594	1.715	184.608	8.733	.003	.421
	Lower-bound	316.594	1.000	316.594	8.733	.012	.421
Error (Z_Score)	Sphericity Assumed	435.051	36	12.085			
	Greenhouse-Geisser	435.051	18.413	23.627			
	Huynh-Feldt	435.051	20.579	21.140			
	Lower-bound	435.051	12.000	36.254			

In 2021, some of the factors cited above reversed, resulting in higher earnings. For example, while the NPL ratio increased from 8.9% in 2019 to 11.6% in 2020, the ratio dropped to 5.8% in 2021 (Bank of Zambia, 2021, 2022a). At the same time, the level of economic activity increased resulting in real GDP rising to 3.6% in 2021 after contracting by 2.8% in 2020. Consequently, Return of Assets (ROA) dropped from 3.3% in 2019 to 2.1% in 2020, but increased to 5.2% in 2021, while the movement in Return on Equity (ROE) was 16.5% in 2019, 12.9% in 2020 and 35.1% in 2021.

Our conclusion that banks' income volatility increased significantly is consistent with the findings of Tran *et al.* (2022) who noted that interventions to address the COVID-19 pandemic drastically affected bank revenues and expenses. The Bank of Zambia, for example, observed that the change in the work environment increased operating expenses of various local banks, which subsequently raised the cost to income ratio (Bank of Zambia, 2022a).

TABLE 16: Z-SCORE PAIRWISE COMPARISONS

Pairwise Comparisons						
Measure: Income_Volatility						
(I) Z_Score	(J) Z_Score	Mean Difference (I-J)	Std. Error	Sig.[b]	95% Confidence Interval for Difference[b]	
					Lower Bound	Upper Bound
1	2	.235	.489	1.000	-1.308	1.778
	3	-3.772	1.655	.250	-8.988	1.445
	4	-5.537*	1.400	.011	-9.951	-1.123
2	1	-.235	.489	1.000	-1.778	1.308
	3	-4.006	1.676	.205	-9.291	1.278
	4	-5.772*	1.548	.017	-10.651	-.892
3	1	3.772	1.655	.250	-1.445	8.988
	2	4.006	1.676	.205	-1.278	9.291
	4	-1.765	1.007	.630	-4.939	1.408
4	1	5.537*	1.400	.011	1.123	9.951
	2	5.772*	1.548	.017	.892	10.651
	3	1.765	1.007	.630	-1.408	4.939

Based on estimated marginal means
*. The mean difference is significant at the .05 level.
b. Adjustment for multiple comparisons: Bonferroni.

5. CONCLUSION AND POLICY IMPLICATIONS

5.1 CONCLUDING REMARKS

The aim of this study was to evaluate the effect of the COVID-19 pandemic on revenue diversification and performance of banks in Zambia. In particular, the study sought to establish the effect of COVID-19 pandemic on bank non-interest income diversification as measured by the HHI, profitability as measured by RAROAA, and income volatility as measured by the Z-Score. Based on our findings, we conclude that there was no statistically significant difference in bank revenue diversification following the COVID-19 pandemic in Zambia.In other words, banks in Zambia did not significantly diversify their income sources in response to the COVID-19 pandemic. With respect to bank performance, our study found that there was a statistically significant increase in bank profitability as measured by RAROAA in the aftermath of the pandemic. Similarly, our study found that there was a statistically significant increase in bank income volatility following the COVID-19 pandemic.

5.2 POLICY IMPLICATIONS

This study has revealed that banks in Zambia did not diversify their revenue sources in response to the COVID-19 pandemic. In fact, the banks were on a path of income concentration prior to the pandemic (Kayombo, 2021). This is despite the evidence in the literature which suggests that banks which had diversified their revenue sources withstood the pandemic betterthan their specialised peers (Ochenge, 2022; Simoens and Vennet, 2022; Taylor, 2022), and that banks that diversified their revenue sources in response to the pandemic performed better than those that did not (Kozak, 2021; Li *et al*., 2021; Le *et al*., 2022).

Although bank profitability increased in the pandemic era, income volatility also increased thereby, exposing banks in the country to insolvency risk. Therefore, the Bank of Zambia should encourage banks to diversify their non-interest income sources to enhance their capacity to withstand major disruptions caused by natural and man-made disasters. This could be done by setting minimum non-interest income ratios for the sector.

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