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Impact of Diversification on the Efficiency of Ethiopian Commercial Banks: Bankers' Perspective

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Abstract
The study explores the relationship between diversification and financial stability in Ethiopian commercial banks. Data was gathered via a census survey utilizing a Likert scale questionnaire. The study employed a descriptive and explanatory design utilizing a quantitative research methodology. An ordinal logistic regression analysis was used to investigate how Ethiopian commercial bankers view the relationship between diversity and efficiency. The findings reveal that sectoral diversification, income diversification, investment diversification, and intellectual capital efficiency are significant predictors of bank efficiency. However, deposits, assets, and geographical diversifications have some reducing effects. The study recommends practical diversification strategies and adequate investments in intellectual capital to enhance banks' efficiency.
Keywords: Diversification, Efficiency, Bankers, Commercial Banks, Ethiopia.
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1. Introduction

Like several other profit-making institutions, the banking sector is anticipated to induce revenues profitably through efficient, effective portfolio utilization of obtainable capital resources to create certain wealth and deliver on the shareholders' anticipation of maximum returns on their investments. Financial intermediation is the core role of banks to a great extent and is often defined as the receipt of funds from units with surpluses within the type of varying deposit accounts to increase units experiencing deficits through lending and advances at different prices. Banks should be aligned with the circle of economic and social development of a nation in their mandate to perform their core functions of intermediation (Ngware et al., 2020). Diversification decisions in banks are typical as a result of the character of the banking business. Banks diversify across business segments like retail, wholesale, or treasury and spread their sources of liabilities, asset exposures, and income types across customer groups, industry sectors, and geographies. While the more granular diversification decisions have regulatory and policy norms to follow, less guidance is accessible for creating segment diversification. Diversification strategy is one of the essential subjects of the finance literature and crucial for a bank as an establishment. Banks can diversify their credit portfolio to extend financial stability and reduce credit portfolio risk (Turkmen & Yigit, 2012). Rop et al. (2016) found that banks that regularly buy shares raise their performance and provide the enabling environment to accelerate financial growth. The study concluded that buying shares was the most critical factor contributing significantly to financial performance, followed by Real estate investment, Insurance Investment, and Government Securities.

Ndungu and Muturi (2019) found that geographical diversification had statistically significant and positive influences on the competitiveness of commercial banks in Kenya. On the other hand, income diversification has a significant negative effect, while asset diversification has no significant impact on the competitiveness of banks. Adesina (2021) conducted a study on how diversification affects the performance of commercial banks by considering human capital efficiency as a mediating variable and found that higher diversification reduces bank performance while higher levels of human capital efficiency are positively related to bank performance. The study also found that the performance-reducing effects of diversification decrease as bank human capital efficiency improves.

Turkmen and Yigit (2012) investigated the relationship between credit diversification and the performance of Turkish banks. Return on Assets and Return on Equity are used to measure performance, and the Hirschman Herfindahl Index (HHI) is used to measure banks' diversification. The number and amount of credits are employed as control variables. The findings of the study revealed that diversification has a significant effect on return on assets and return on equity. Intellectual capital is an essential intangible asset that can contribute to achieving organizational objectives in most organizations, including the banking sector, despite few studies being conducted

about the impact of diversification on financial stability and efficiency in the banking sector by considering intellectual capital's facilitating effect in particular to developing countries context, the results of studies conducted are mixed in different countries. Moreover, different studies have explored the relationship between diversity and efficiency in the banking industry, specifically in developing nations, using different diversification schemes and methods all of them using secondary data. Although few scholarly works are found in developing countries like Malaysia, Indonesia, Kenya, Ghana, Bangladesh, and Ethiopia such as (Ngware et al., 2020; Rop et al., 2016; Ndungu & Muturi, 2021; Adesina, 2021; Turkmen & Yigit, 2012; Asmare & Worku, 2018), these studies used different variables and methodologies as well as inconsistent findings about the effect of diversity on efficiency across various countries. In this regard, exploring the impact of diversification on the efficiency of banks is very important for an emerging economy country like Ethiopia, where the government highly dominates the financial sector. The government of Ethiopia has taken small steps towards liberalizing its tightly controlled financial sector by granting licenses to foreign-owned banks such as Kenya's Equity Bank and Kenyan Central Bank, enabling them to create representation offices in the country of more than 115 million people (www.financial times.com accessed,2022). The Ethiopian banking system comprises the National Bank of Ethiopia, a state-owned development bank, a government-owned commercial bank, and 29 private commercial banks. The NBE oversees banks and financial organizations, while the Development Bank supports economic growth and job creation. Commercial banks focus on generating profits through offering fundamental banking services. They enable the transfer of funds from savers to borrowers by offering deposit and loan services, brokerage services, creating job opportunities, and fostering investment, economic stability, and growth. Therefore, the finding of this study is believed to benefit the banking sector in identifying the role of business diversification in enhancing financial stability and efficiency, thereby reducing risk. Furthermore, this study is expected to forward policy and regulatory implications for the government and policymakers to facilitate the financial system, which can smooth the development and stability of the country's economy. Likewise, this study will be used as input for future researchers seeking further studies on the same issue, particularly in developing countries. As a result, detailed compressive research incorporating more diversification schemes (income, asset, geographical, Sectoral, Investment, and deposit diversification) is found to be critical, particularly for a developing country like Ethiopia. Consequently, this study tries to investigate the impact of diversification and intellectual capital efficiency on banks' efficiency based on empirical evidence collected from bank top-level management.

2. Objective of the Study

This study aims to investigate how diversification and intellectual capital efficiency impact the efficiency of commercial banks in Ethiopia from the perspective of bankers.

3. Literature Review

Banks are vital to the financial system. They directly lend to corporations and securitize and issue covered bonds for long-term investment. The cost of capital is affected by their securities affiliates underwriting company debt securities utilizing the banks' balance sheets and participating in derivatives markets like swaps and certificates of deposits (OECD, 2013). Companies worldwide are changing methods to fulfill customers' wants and retain loyalty. Industry competitiveness can be affected by diversification. Diversity analysis emphasizes risk and output. Diversifying investments reduces risk for investment organizations (Chirani and Effatdoost, 2013). In practice, diversification involves risk transfer between institutions. Recent financial system reforms are noteworthy. Deregulation encourages institutions to diversify beyond typical corporate operations. New financial sector advances offer diversity (Wagner, 2006). Business diversification appears to be more widespread than skeptics think (Kenny, 2020).

When building a diverse portfolio, "Don't put all your eggs in one basket." Diversification evaluates investment numbers and relationships. Diversification makes sense when a company's main business stagnates. Diversified companies must assess industrial conditions and create business plans. Firm and market diversification are international diversification methods. Despite the difficulties of creating and managing so many plans, these tactics are more competitive. Risk-taking may grow as a result of aggressive diversification measures (Berger et al., 2010; Kannan & R. Saravanan, 2012; Le, 2018). Diversification is key to portfolio construction. Because of this, many institutional investors hold alternative assets. Variety was defined and key criteria for evaluating a strategy or asset's portfolio diversification benefits were discussed. Important features. Diversification generally boosts a portfolio's Sharpe ratio. Asset diversification risk and return are unclear. Risk-adjusted return should increase with portfolio diversification. Risk-reward strategies are preferable to those that neglect expected returns. Long-term equilibrium, not time, determines diversity. Diversity does not support skill-based methods. Diversity advantages can be contextualized by scenario analysis. In addition, it can evaluate our response to negative risks and anticipate cash needs (Cheung,2014).

Idiosyncratic risks can threaten a bank's financial stability and efficiency, thus diversification is essential. Diversification raises systemic risk and bank profitability and efficiency, which can cause real economic

downturns, according to studies. Bank diversification may benefit undeveloped nations more than off-balance sheet and on-balance sheet activity. Banwo et al. (2019) discovered that diversification reduces idiosyncratic risk and increases systemic risk. A regulatory environment that supports bank-firm loan interactions can boost financial stability and diversification. Diversification can assist banks in balancing social losses from excessive risk distribution during economic downturns with the social costs of preventing defaults during booms. Commercial banks must diversify to reduce risk and improve performance. It reduces systemic risk and bank failure. Innovation methods can improve financial performance by helping banks overcome resource constraints and develop new market actors. Diversification can improve loan applications, operational efficiency, and costs (Tasca & Battiston, 2012; Kryg, 2020). Diversification can worsen conflicts of interest and agency difficulties, raising expenses. Innovative banks rely heavily on intangible assets. Banks have diversified into typical sectors due to fierce competition and declining interest income from financial liberalization and deregulation. Bank performance improves with income diversification, hence banks should diversify non-interest income. Nations without strong competition authorities should prioritize competition concerns since market efficiency and progress depend on it. To ensure financial stability, diversification should be encouraged during booms and limited during recessions. Effective capital regulation and diversification decrease systemic risk and increase excess value and efficiency (Khan et al., 2020).

Industrial value generation was dominated by mass production. Many workers did low-paying jobs to produce as much as possible because quantity defined worth. Knowledge content, not production, gives value to goods and services. Knowledge workers add value, not numbers. The present economy values knowledge-based goods and services overproduction. Previously, product and service value was based on raw materials and labor, but now it is driven by intellectual content (Pulić, 2008). Professional bankers boost banks, per Armenta (2007). Third-world countries lack financial specialists. Financial liberalization hurts economic growth. The study urged rising governments to address banking sector availability and demand-side challenges. Bank asset quality depends more on structural and human capital efficiency than capital-employed efficiency. Talents, competence, exposure, knowledge, innovation, initiatives, and others help banks improve loan assets. Management strategies, credit and other legislation, internal controls, and IT infrastructures affect bank loan assets, according to Asare et al. (2021). Based on the existing literature the following research hypotheses are formulated in an alternative hypothesis format.

3.1 Hypotheses of the Study

A hypothesis is a preliminary statement regarding the expected result of a research study that can be validated or invalidated through data analysis. Therefore, the research hypotheses in this study are formulated in an alternative hypothesis structure.

H_1: Income diversification has a significant effect on the efficiency of commercial banks
H_2: Asset diversification has a significant effect on the efficiency of commercial banks
H_3: Geographic diversification has a significant effect on the efficiency of commercial banks
H_4: Investment diversification has a significant effect on the efficiency of commercial banks
H_5: Sectorial credit diversification has a significant effect on the efficiency of commercial banks
H_6: Deposit diversification has a significant effect on the efficiency of commercial banks
H_7: Intellectual capital efficiency has a significant effect on the efficiency of commercial banks

4. Data and Methods

For the analysis, STATA Version 15 software was used to perform an ordered logistic regression analysis to examine the bankers' perspective on the diversification, financial stability, and efficiency nexus in Ethiopian commercial banks. For data analysis, the weighted average of the Likert scale response for each aspect of diversification, intellectual capital efficiency, financial stability, and efficiency given by 232 respondents were used. Primary data, collected by a questionnaire with a five-point Likert scale, is used. For data analysis purposes, the ordinal data collected via a five-point Likert scale is scaled using weighted averages or means, and the mean and standard deviation of responses are used for tabular descriptive analysis purposes. The cross-section of the weighted average response of Likert scale data of similar questions combined into a single variable is determined by adding each response's numerical value and then dividing it by the respondent number. To rank the diversification, intellectual capital efficiency, financial stability and efficiency, mean value responses were changed to a fixed choice response format designed to measure opinions. The following scale measurement was used regarding mean scores, which is similar to the ranking value employed by (Ola-awo et al., 2021), (Musonda & Rakolote, 2022) and (Badiora & Oresanwo, 2022), (Shiang et al., 2023). The ranking scales are 1 = strongly disagree ($\geq 1.00 \leq$ and <1.80), 2 = Disagree (≥ 1.81 and ≤ 2.60), 3 = Neutral (≥ 2.61 and ≤ 3.40), 4 = Agree (≥ 3.41 and ≤ 4.20), and 5 = Strongly agree (≥ 4.21 and ≤ 5.00). The resulting cross-sectional weighted average score is then used ordered logistic regression analysis to investigate the impact of diversification on financial stability and efficiency of banks.

4.1 Model Specifications

To select the suitable model, we must be aware of the scale of measurement for the dependent variable. The researcher utilized an ordered response model for variables using a 5-point Likert scale. Respondents were asked to indicate their level of agreement with how each diversification scheme impacts banks' efficiency. Respondents were asked to provide their perspectives using a five-point Likert scale. The level of agreement about diversification schemes' impact on financial stability and efficiency was assessed using a Likert scale ranging from 1 to 5, signifying different extents of effects. The agreement levels for intellectual capital efficiency, financial stability, and efficiency were assessed using a Likert scale ranging from 1 to 5, signifying degrees of disagreement and agreement. Based on the provided information, we can assign codes ranging from 1 to 5 to the dependent variable. The variable's responses are ordered outcomes or polychotomous responses. Since the dependent variable has no cardinal meaning, least squares regression will suffer from shortcomings such as predicted probabilities outside the unit interval. Instead, order response (ordinal outcome) models will suit the problem. The central idea behind the ordinal outcomes is that the dependent variable has a response of m ordered categories, where m=1, 2, 3, 4 and 5, that there is a clear ranking among the categories. However, the numerical values assigned to each category do not necessarily show their cardinal difference (Greene, 2012).

Let the underlying regression model be;

$$Y_i = \beta' X_i + u_i \qquad \text{where i=1,2,3,…,n}$$

Where Y is the response variable, X is a set of explanatory variables, and u is the residual. Y is a latent variable (cannot be observed) underlying the observed responses, but we know which of the m categories it belongs to (we only know when it crosses thresholds). It belongs to j^{th} category if:

$$Y_i = j \qquad \text{if } \mu_{j-1} < Y_i \leq \mu_j \qquad \text{where } i = 1,2,3,\dots,n; \qquad j = 1,2,\dots,m$$

Given the cutoff points μ_i, the choice rule (observed value Y^*) is:

$$Y_1^* = 1 \qquad \text{if } Y_i \leq \mu_1$$
$$Y_1^* = 2 \qquad \text{if } \mu_1 < Y_i \leq \mu_2$$
$$Y_1^* = 3 \qquad \text{if } \mu_2 < Y_i \leq \mu_3$$
$$Y_1^* = 4 \qquad \text{if } \mu_3 < Y_i \leq \mu_4$$
$$Y_1^* = 5 \qquad \text{if } Y_i > \mu_4 = \mu_5$$

The probability that observation i will select alternative j is:

$$p_{ij} = p(y_i = j) = p(\mu_{j-1} < y_i^* \leq \mu_j)$$
$$= F(\mu_j - x_i'\beta) - F(\mu_{j-1} - x_i'\beta)$$

Where $F(.)$ the cdf could be normal cdf or logistic cdf.

Using the generic representation, the respective probabilities for the five categories are derived as follows:

$$pr(y_i = 1) = F(\mu_1 - x_i'\beta)$$
$$pr(y_i = 2) = F(\mu_2 - x_i'\beta) - F(\mu_1 - x_i'\beta)$$
$$pr(y_i = 3) = F(\mu_3 - x_i'\beta) - F(\mu_2 - x_i'\beta)$$
$$pr(y_i = 4) = F(\mu_4 - x_i'\beta) - F(\mu_3 - x_i'\beta)$$
$$pr(y_i = 5) = 1 - F(\mu_4 - x_i'\beta)$$

In this study, financial stability and efficiency are the functions of the seven independent variables. This model is adopted to examine the effects of the six diversification schemes and intellectual capital efficiency on banks' financial stability and efficiency. The diversification schemes are geographic diversification, income diversification, asset diversification, investment diversification, sectoral diversification, deposit diversification, and intellectual capital efficiency. Banks' efficiency is considered a dependent variable in this study. Based on works of literature, the following variables are chosen as explanatory variables.

Eff=f(GD,ID,AD,INVD,SD,DD,IC)

Where;

Eff= Efficiency
GD=Geographic Diversification
ID = Income Diversification
AD = Asset Diversification
INVD= Investment Diversification
SD = Sectoral Diversification
DD =Deposit Diversification
IC=Intellectual Capital Efficiency

5. Results and Discussion

5.1 Diagnostic Tests

5.1.1 Test of Reliability and Validity

The purpose of a reliability test is to evaluate the consistency and stability of measurements obtained with a

particular instrument, scale, or test over time and under various settings. A Cronbach's Alpha value above 0.70 is considered acceptable for research purposes, although higher values are preferable, especially for scales used in high-stakes situations. The questionnaire's reliability was tested using Cronbach Alpha, with a Cronbach's Alpha value of 0.839, indicating good internal consistency reliability. To ensure the validity of the instruments used in this study, the constructs in the questionnaire are adopted from previous studies (Pulić, 2008; Kitisya, 2016; Rahman and Akhter, 2021), so the issue of validity is satisfied by using those studies, and secondary data is also used for triangulation.

5.1.2 Test of Multicollinearity

The multicollinearity test is conducted using the variance inflation factor and the Pearson correlation analysis. VIF values above 5 or 10 are often considered problematic, suggesting high multicollinearity. The multicollinearity test result indicates that none of the variables has VIF values exceeding 5, indicating that multicollinearity is not a severe issue. The mean VIF across all variables is 1.84, further supporting the relatively low multicollinearity conclusion. Gujarati and Porter (2009) state that a correlation coefficient exceeding 0.8 between two regressors signifies a severe multicollinearity issue. The Pearson correlation analysis showed a maximum correlation of 0.715 between two independent variables. This result further supports the conception that multicollinearity is not a significant problem.

5.1.3 Test of Proportional Odds Ratio

The approximate likelihood-ratio test determines if the odds ratios for several response variable categories are equal. This test is critical when considering ordered logistic regression models. The likelihood ratio test result revealed that the chi-square statistic is 81.45 with 63 degrees of freedom and the p-value. The p-value of 0.0589 is more than the conventional significance level of 0.05, suggesting there is not enough evidence to reject the null hypothesis. Based on this test, there is no substantial evidence indicating that the odds ratios vary among response categories.

5.2 Diversification and Efficiency

The following table shows the ordered logistic regression result on the impact of diversification on banks' efficiency. The ordered logistic regression is employed to determine the effect of diversification and intellectual capital efficiency on the efficiency of commercial banks. The primary data was collected from bank top-level management using a 5-point Likert scale questionnaire.

The above table presents the ordered logistic regression result of the impact of diversification and intellectual capital on the banks' efficiency. The ordered logistic regression result for Geographic diversification (G.D.) with a coefficient of 0.887 and a standard error of 0.254 is positive and statistically significant. It suggests that a one-unit increase in geographic diversity is associated with an increase in the log odds of being in a higher Efficiency category by approximately 0.887, holding other variables constant. This coefficient is statistically significant ($p < 0.05$). Hence, there is strong evidence to reject the null hypothesis, accept the alternative hypothesis, and conclude that geographic diversification has a significant positive effect on the efficiency of commercial banks.

The coefficient of Income diversification (ID) is approximately 0.826 with a standard error of 0.410. It suggests that a one-unit increase in income diversification is associated with an increase in the log odds of being in a higher Efficiency category by approximately 0.826, holding other variables constant with a statistically significant coefficient ($p < 0.05$). Hence, the study provides strong evidence to accept the alternative hypothesis and conclude that income diversification has a significant positive effect on the efficiency of commercial banks. The regression result also revealed that asset diversification (AD) has a coefficient of approximately 0.261, with a standard error of 0.336. It suggests that asset diversity is not statistically significant ($p > 0.05$), meaning there is not enough evidence to conclude that asset diversification significantly affects the likelihood of being in a higher Efficiency category, holding other variables constant. As a result, the study failed to reject the null hypothesis. It is concluded that asset diversification has no significant effect on banks' efficiency. The regression result further indicated that the investment diversification (INVD) coefficient is approximately 3.322, with a standard error of 0.587. It suggests that a one-unit increase in investment diversification is associated with a significant increase in the log odds of being in a higher category of efficiency by approximately 3.322, holding other variables constant ($p < 0.05$). As a result, substantial evidence suggests that the alternative hypothesis should be accepted rather than the null hypothesis. Consequently, the study concluded that the efficiency of investment diversification has a significant and favourable impact on commercial banks' efficiency.

Sectoral credit diversification(SD): reveals that the negative coefficient of(-0.303) indicates that higher levels of sectoral credit diversification are associated with lower efficiency odds. However, its effect is not statistically significant at the 0.05 level, indicating that sectoral credit diversity does not significantly affect efficiency. As a result, there is no sufficient evidence to reject the null hypothesis, and the alternative hypothesis is rejected. Regarding deposit diversification(DD), the result of this variable's ordered logistic regression indicates a coefficient of 1.207 with (p=012). For a one-unit increase in deposit diversification, the log odds of being in a higher category of Efficiency increase by approximately 1.21 units, holding all other variables constant. Hence,

sufficient evidence exists to reject the null hypothesis, and the alternative hypothesis is accepted instead. Accordingly, it is concluded that deposit diversification has a substantial positive effect on banks' efficiency.

Concerning the efficiency of intellectual capital, the outcome of the ordered logistic regression, presented in Table I, reveals that the coefficient (2.02, $p < 0.001$) is positive and statistically significant. With all other variables held constant, the log probabilities of being in a higher category of Efficiency rise by around 2.02 units for every one-unit increase in intellectual capital efficiency. This is the case whenever all other variables remain unchanged. The fact that this is the case suggests a substantial association between higher levels of intellectual capital efficiency and increased bank efficiency. Considerable evidence implies that the alternative hypothesis is accepted rather than the null hypothesis. The study's findings led the researchers to conclude that the efficiency of intellectual capital has a significant and positive impact on the efficiency of commercial banks.

Generally, The study examines the impact of diversification and intellectual capital on the efficiency of commercial banks. Geographic diversification shows a significant positive effect, with a one-unit increase in geographic diversity increasing log odds of being in a higher efficiency category. Income diversification also indicates a positive impact, with a one-unit increase in income diversification increasing the likelihood of being in a higher efficiency category. Investment diversification shows a significant positive effect. Deposit diversification has a substantial positive impact on efficiency. Intellectual capital efficiency is positively and statistically significant, with a one-unit increase in intellectual capital efficiency increasing the log probabilities of being in a higher efficiency category. The study concludes that the efficiency of intellectual capital has a significant and positive impact on the efficiency of commercial banks. Asset diversification and Sectoral credit diversification show no significant effect. As an additional point of interest, the value of the pseudo-R-squared is found to be 0.129 in Table I. Within the logistic regression model context, this value represents the fraction of the result variable's variability that can be attributed to the predictor variables. Consequently, the pseudo-R-squared value is 0.129, indicating that approximately 12.9% of the variability in the outcome variable is attributed to the predictor variables included in the model under consideration.

The table above presents the marginal effect of all predictor variables on the banks' efficiency being in category 3, along with p-values representing the significance level. The marginal effect analysis for geographic diversification revealed that ($dy/dx = -0.008$) ($P = 0.039$). According to this, the predicted probability of being in category 3 decreases by about 0.008 for every unit increase in geographic diversity, and the p-value indicates that this effect is statistically significant at the conventional level ($p < 0.05$). The estimated marginal effect of income diversification on the probability of the bank efficiency being in category 3 shows a value of ($dy/dx = -0.007$), with $P > .05$. This means that for every one-unit increase in income diversity, the predicted chance of efficiency being in category 3 goes down by about 0.007. However, this effect is not statistically significant at the standard level ($p > 0.05$), as shown by ($p = 0.105$).

The marginal effect of asset diversification revealed that ($dy/dx = -0.002$) ($P > 05$). This marginal effect reveals that the predicted probability of being in category 3 decreases by about 0.002 for every unit increase in asset diversity, but the p-value indicates that this effect is not statistically significant at the conventional level of significance. The marginal effect analysis for investment diversification indicated that ($dy/dx = -0.029$) ($P = 0.022$). This suggests that a one-unit increase in asset diversification is associated with a decrease of approximately 0.029 in the probability of Efficiency =3, holding other variables constant. In this case, the p-value (0.022) is less than 0.05, indicating that this effect is statistically significant at the 0.05 significance level. In contrast, the result for sectoral credit diversification with the values of ($dy/dx = 0.003$) and ($P = 0.503$) suggests that a one-unit increase in sectoral credit diversification is associated with an increase of approximately 0.003 in the probability of financial stability=3, holding other variables constant. However, its effect is not statistically significant at the 0.05 significance level.

The marginal effect for deposit diversification is ($dy/dx = -0.010$) and ($P = 0.073$), indicating that a one-unit increase in sectoral credit diversification is associated with a decrease of approximately 0.010 in the probability of Efficiency =3, holding other variables constant. However, its effect is still not statistically significant at the 0.05 significance level. The study further found that the marginal effect of intellectual capital efficiency revealed that ($dy/dx = -0.017$) ($P = 0.045$). According to this, the predicted probability of efficiency being in category 3 decreases by about 0.017 for every unit increase in intellectual capital efficiency, and the p-value indicates that this effect is statistically significant at the conventional level.

The table above displays the marginal effect of each predictor variable on banks' efficiency in category 4, along with their corresponding p-values indicating significance. Examining the marginal effect for geographic diversity showed a dy/dx value of 0.048 with a significance level of ($P = 0.007$). The data suggests that the likelihood of being in category 4 rises by approximately 0.048 for each unit rise in geographic diversity. The p-value confirms that this impact is statistically significant at the standard threshold of $p < 0.05$. The calculated marginal effect of income diversification on the probability of the bank efficiency being in category 4 is 0.045, with a p-value of 0.068. For every one-unit rise in income diversity, the likelihood of efficiency falling into category 4 increases by around 0.045. The effect is not statistically significant at the standard level ($p > 0.05$),

indicated by (p = 0.068).

The marginal effect of asset diversification revealed that (dy/dx = 0.014) (P > 05). This marginal effect shows that the predicted probability of being in category 4 increases by about 0.014 for every unit increase in asset diversity, but the p-value indicates that this effect is not statistically significant at the conventional level of significance. The marginal effect analysis for investment diversification showed that (dy/dx = 0.180) (P = 0.001). This suggests that a one-unit increase in asset diversification is associated with an increase of approximately 0.180 in the probability of efficiency =4, holding other variables constant. In this case, the p-value (0.001) is less than 0.05, indicating that this effect is statistically significant at the 0.05 significance level. In contrast, the result for sectoral credit diversification with the values of (dy/dx = -0.016) and (P = 0.507) suggests that a one-unit increase in sectoral credit diversification is associated with a decrease of approximately 0.016 in the probability of efficiency =4, holding other variables constant. However, its effect is not statistically significant at the 0.05 significance level. The marginal impact of deposit diversification is (dy/dx = 0.066) and (P = 0.035), indicating that a one-unit increase in deposit diversification is associated with a decrease of approximately 0.010 in the probability of efficiency being in category 4, holding other variables constant. Its effect is statistically significant at the 0.05 significance level. The study also found that the marginal effect of intellectual capital efficiency revealed that (dy/dx = 0.110) (P = 0.008). According to this, the predicted probability of efficiency being in category 4 increases by about 0.110 for every unit increase in intellectual capital efficiency; the p-value indicates that this effect is statistically significant at the conventional level.

6. Conclusion

The study examines the impact of diversification and intellectual capital on the efficiency of commercial banks. The pseudo-R-squared value of 0.129 indicates that approximately 12.9% of the variability in the outcome variable is attributed to the predictor variables included in the model under consideration. Geographic diversification shows a significant positive effect, with a one-unit increase in geographic diversity increasing the log odds of being in a higher efficiency category. Income diversification also indicates a positive impact, with a one-unit increase in income diversification increasing the likelihood of being in a higher efficiency category. Asset diversification is not statistically significant, and the study fails to reject the null hypothesis. Investment diversification has a significant positive effect on efficiency, with a one-unit increase in investment diversification increasing the log odds of being in a higher efficiency category. Sectoral credit diversification has no significant effect. Deposit diversification has a substantial positive effect on efficiency, with a one-unit increase in deposit diversification increasing the log odds of being in a higher efficiency category. Intellectual capital efficiency is positively and statistically significant, with a one-unit increase in intellectual capital efficiency increasing the log probabilities of being in a higher efficiency category. Asset diversification and sectoral credit diversification show no significant effect.

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Table I: Ordered Logistic Regression

Efficiency	Coef.	St.Err.	t-value	p-value	[95% Conf	Interval]	Sig
Geographic Diversification	.887	.254	3.49	0	.389	1.385	***
Income Diversification	.826	.41	2.02	.044	.023	1.63	**
Asset Diversification	.261	.336	0.78	.437	-.398	.919	
Investement Diversification	3.322	.587	5.66	0	2.171	4.473	***
Sectoral Diversification	-.303	.451	-0.67	.501	-1.186	.58	
Deposit Diversification	1.207	.479	2.52	.012	.268	2.146	**
Intellectual Capital	2.019	.615	3.28	.001	.814	3.225	***

Mean dependent var	3.943	SD dependent var	0.411
Pseudo r-squared	0.129	Number of obs	232
Chi-square	128.711	Prob > chi2	0.000
Akaike crit. (AIC)	900.965	Bayesian crit. (BIC)	959.559

*** *p<.01, ** p<.05, * p<.1*

Source: STATA regression result, (2024)

Table II: Marginal effects after ologit y = Pr(Efficiency==3) (predict, outcome(3))

variable	dy/dx	Std.Err.	z	P>z	[95%	C.I.]	X
GD	-0.008	0.004	-2.060	0.039	-0.015	-0.000	4.517
ID	-0.007	0.004	-1.620	0.105	-0.016	0.001	3.935
AD	-0.002	0.003	-0.760	0.446	-0.008	0.004	4.140
INVD	-0.029	0.013	-2.290	0.022	-0.053	-0.004	3.928
SD	0.003	0.004	0.670	0.503	-0.005	0.010	4.159
DD	-0.010	0.006	-1.790	0.073	-0.022	0.001	4.134
IC	-0.017	0.009	-2.000	0.045	-0.035	-0.000	4.087

Source: STATA regression result, (2024)

Table III: Marginal effects after ology y = Pr(Efficiency==4) (predict, outcome(4))

variable	dy/dx	Std.Err.	z	P>z	[95%	C.I.]	X
GD	0.048	0.018	2.680	0.007	0.013	0.083	4.517
ID	0.045	0.025	1.830	0.068	-0.003	0.093	3.935
AD	0.014	0.019	0.760	0.447	-0.022	0.051	4.140
INVD	0.180	0.054	3.320	0.001	0.074	0.287	3.928
SD	-0.016	0.025	-0.660	0.507	-0.065	0.032	4.159
DD	0.066	0.031	2.110	0.035	0.005	0.126	4.134
IC	0.110	0.041	2.650	0.008	0.028	0.191	4.087

Source: STATA regression result, (2024)