*Data and Metadata*. 2025; 4:1195
doi: 10.56294/dm20251195

ORIGINAL

# Ratios determining of microenterprise profitability: An analysis based on multilinear regression models

## Ratios determinantes de la rentabilidad microempresarial: Un análisis basado en modelos de regresión multilineal

Luis Pedro Román Palma[1], Teodoro Reyes Fong[2], Walter Danilo Leiva Mardones[3], Robinson Dueñas Casallas[4]

[1]Central University of Chile, Faculty of Economics, Government and Communications, Santiago, Chile.
[2]University of Colima, Faculty of Accounting and Administration, Colima, Mexico.
[3]Santo Tomás University, School of Administration, Santiago, Chile.
[4]Faculty of Economic Sciences, New Granada Military University, Bogotá, Colombia.

**Cite as:** Román Palma LP, Reyes Fong T, Leiva Mardones WD, Dueñas Casallas R. Ratios determining of microenterprise profitability: an analysis based on multilinear regression models. Data and Metadata. 2025; 4:1195. https://doi.org/10.56294/dm20251195

**Submitted:** 11-12-2024 **Revised:** 19-04-2025 **Accepted:** 13-09-2025 **Published:** 14-09-2025

**Editor:** Dr. Adrián Alejandro Vitón Castillo

**Corresponding Author:** Luis Pedro Román Palma

## ABSTRACT

**Introduction:** to determine the best multilinear regression model(s) of the Return on Assets and the Return on Equity of microenterprises in the commune of San Bernardo de Santiago de Chile; to strengthen their competitiveness in the industry, contributing to the strengthening of public policy in the sector, the source of information was the Mayor's Office, Directorate of Productive Development; Local Economic Development and College of Accountants
**Method:** an analysis of financial ratios was developed, using predictor variables according to economic sector and size, consolidating 29 financial ratios derived from the balance sheets and income statements of the last 5 business years, discriminating collinearity by Pearson correlation and variance inflation factor (VIF> 10), then a normality analysis was developed through the Kolmogorov-Smirnoff and Shapiro - Wilk tests. generating 8 multiple linear regression models, evaluating the metrics R2, adjusted R2, F and P-Value Statistics, MAE (mean absolute error) RMSE (mean square error), to relate the measures of profitability.
**Results:** 6 of the 8 models present high degrees of prediction, performance and level of adjustment, demonstrating statistical soundness of the ROA and ROE indices for the financial performance of microenterprises, segmented by sector and size, defining the impact of long-term debt, working capital, current amount, DuPont and acid index on profitability.
**Conclusions:** the study constructed 6 statistically robust and highly predictive regression models to define the financial variables with the highest degree of impact on microenterprise profitability.

**Keywords:** Microenterprises; Financial Ratios; ROA; ROE; Lineal Regression Models.

## RESUMEN

**Introducción:** determinar el(los) mejor(es) modelo(s) de regresión multilineal del Retorno sobre los activos y el Retorno sobre el Patrimonio de las microempresas de la comuna de San Bernardo de Santiago de Chile; para fortalecer su competitividad en la industria, contribuyendo al fortalecimiento de la política pública del sector, la fuente de información fue la Alcaldía, Dirección de Desarrollo Productivo; Desarrollo Económico Local y Colegio de Contadores.

**Método:** se desarrolló un análisis de ratios financieros, utilizando variables predictoras según sector económico y tamaño, consolidando 29 ratios financieros derivados de los balances y estados de resultados de los últimos 5 ejercicios comerciales, discriminando colinealidad mediante correlación de Pearson y factor de inflación de varianza (VIF> 10), luego se desarrolló un análisis de normalidad a través de las pruebas de Kolmogorov-Smirnoff y Shapiro - Wilk, generando 8 modelos de regresión lineal múltiple, evaluando las métricas R2, R2 ajustado, F y P-Value Statistics, MAE (error absoluto medio) RMSE (error cuadrático medio), para relacionar las medidas de rentabilidad.
**Resultados:** 6 de los 8 modelos, presentan altos grados de predicción, rendimiento y nivel de ajuste, demostrando solidez estadística de los índices ROA y ROE para el desempeño financiero de las microempresas, segmentados por sector y tamaño, definiendo el impacto de la deuda a largo plazo, capital de trabajo, monto actual, DuPont y índice ácido en la rentabilidad.
**Conclusiones:** el estudio construyó 6 modelos de regresión estadísticamente robustos y altamente predictivos, para definir las variables financieras con mayor grado de impacto en la rentabilidad microempresarial.

**Palabras clave:** Microempresas; Ratios Financieros; ROA; ROE; Regresión Lineal.

## INTRODUCTION

The analysis of the state of the art and the international studies consulted as the basis of this research allows us to establish of the micro-enterprises is a topic of interest in emerging economies, given that they constitute the majority of the business fabric and contribute to local economic growth and development, being for Latin America, a contribution of 25 % to the gross domestic product compared to Europe whose contribution reached 56 %, without mentioning the contribution to job creation[1,2] and in the Chilean context they represented 43 % of employment for the year 2024.[3]

Accordingly, it is considered that the growth and development of microenterprises is a priority for state authorities in the formulation of public policies throughout Latin America and the Caribbean, where SMEs constitute 99,5 % of the companies in the region and 9 out of 10 are microenterprises, generating 60 % of formal productive employment. They also have a significant productivity gap, since they contribute only a quarter of the total value of the region's production, due, to a large extent, to the lack of knowledge in the different areas of management, especially in the financial context. In this sense, it is the OECD that, aware of this reality and priority, collaborates with the region to strengthen the formulation of public policies related to microenterprises that aim at sustainable economic growth.[4] A topic that stands out on the agenda of different forums and presidential forums where organizations such as the G20, the Global Association for Financial Inclusion (GPFI) and the B20, have established collaborative groups.[5]

In general, the literature mentions various factors that affect the performance of microenterprises, such as the regional contexts in which they operate, the competition they face, the managerial fragility they have, the achievement of economies of scale to strengthen their positioning and competitiveness and sustainability,[6,7,8],management of the risk associated with uncertainty,[9] limited access to credit and leverage to boost their profitability,[10,11,12,13] limited knowledge and training of the financial techniques and tools associated with organizational management,[14] cause the need to understand in greater detail the origin and trend of financial management to enhance the results in their microenterprise management.[15,16,17,18]

The present study was born from an immersion of the researcher's doctoral thesis[19] that defined the degree of technical efficiency in the financial management of microenterprises in the commune of San Bernardo, through a non-parametric inferential statistical study, which was presented to the authorities and community actors for the strengthening of public policy.[20] identifies the best multilinear regression models to strengthen the management of Return on Assets and Return on Capital using predictor variables according to the economic sector and size that allows microenterprises to achieve greater positioning and competitiveness in the market, inherent to the sector and the size of the object of study.

Therefore, this study lays the foundations to develop more research related to this topic through an economic and financial x-ray of this productive sector and that its application and immersion in local and regional markets acquires relevance at the national and international level, especially in Latin America, to promote growth, competitiveness, sustainability and the sustainability of microenterprises in the productive promotion and economic development of the region.[21]

## METHOD

The study has a type of observational research,[22] where the researcher is obliged to systematically observe the phenomenon without intervening in it, a fundamental element for descriptive and exploratory studies that seek to characterize phenomena without direct manipulation. The universe of the Study was all the micro-

enterprises in the commune of San Bernardo in the Metropolitan Region of Santiago de Chile, which have up to 9 collaborators in the organization and/or have sales not exceeding 2 400 U.F. per year,[23] formalized before the Internal Revenue Service of Chile, not listed on the stock exchange, reaching a sample of 84 organizations, "classified in terms of size and level of annual billing" (table 1), 50 from the commerce sector and 34 from the services sector

**Table 1.** Micro Enterprise Classification / Sales Level

| Typology Microenterprise | Annual sales | | | | | |
|---|---|---|---|---|---|---|
| | From (UF) | Until (UF) | From ( $ ) | Until ( $ ) | From (USD $) | Until (USD $) |
| No Sales | 0 | 0 | $ 0 | $ 0 | $ 0 | $ 0 |
| Microenterprise 1 ($M_1$) | 1 | 800 | $ 39 173 | $ 30 747 216 | USD$ 976,80 | USD$ 32 083 |
| Microenterprise 2 ($M_2$) | 801 | 1600 | $ 31 377 573 | $ 62 676 800 | USD$ 32 123 | USD$ 64 165 |
| Microenterprise 3 ($M_3$) | 1601 | 2400 | $ 62 715 973 | $ 94 015 200 | USD$ 64 206 | USD$ 96 248 |

The information was collected from highly supervised institutions with high levels of transparency, accountability, and ethical responsibility, such as the Mayor's Office and the College of Accountants of the municipality of San Bernardo. The data for were prepared by consolidating financial accounting information from microenterprise balance sheets and income statements, using panel data, for the last five fiscal years. The data was calculated using 29 generally accepted ratios, classified in various ways: Liquidity, Debt, Activity, and Profitability.

To optimize the stability and accuracy of the models, the $R^2$, adjusted $R^2$, F-statistics and P-value, MAE (mean absolute error) and RMSE (root mean square error) coefficients were evaluated through Pearson correlation estimation post VIF (figure 1). Highly correlated KPIs were then discriminated by the variance inflation factor (VIF) using the VIF > 10 elimination criterion.

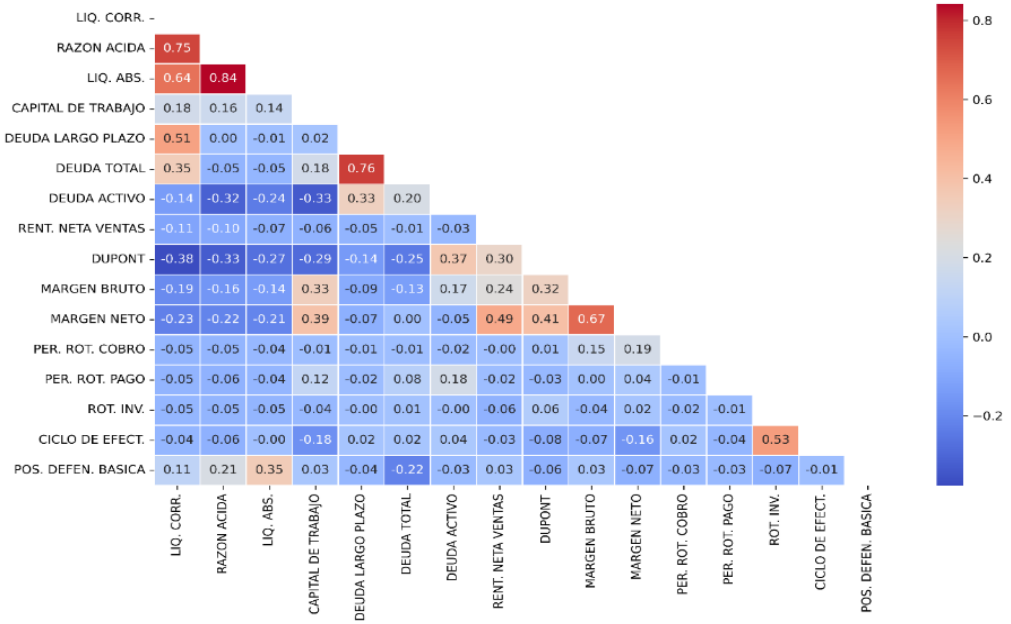


**Figure 1.** Triangular Pearson Correlation Heatmap (post VIF)

After that, a normality analysis of residues was developed using the Kolmogorov-Smirnoff and Shapiro-Wilk tests, generating 8 multiple linear regression models, to relate the ROA and ROE, according to economic sector (services and commerce) and organizational size (M1 - M2 - M3). It should be noted that, in order to maintain statistical robustness, the M3 segment was excluded because it had less than 6 organizations and thus determined the 5 best predictor variables of each model of those defined in the axes of the triangular Pearson Correlation Heatmap (post VIF), indicated above. Continuing with the study, the dependent variables were defined as return on assets (ROA) and return on equity (ROE) and the multiple linear regression models were specified in the general and particular form with equations (1), (2) and (3) indicated:

**General Model**

$$Yi = \beta_0 + \beta_1 X_{1i} + \beta_2 X_{2i} + \cdots + \beta_k X_{ki} + \varepsilon_i (1)$$

Where:
Yi: Dependent Variable (ROA o ROE).
$X_{ki}$: Independent Variables (Financial Ratios).
$ß_k$: Estimated Coefficients.
$ε_i$: Error term.

*Particular Models*

$$ROA = \beta_0 + \sum_{i=1}^{5} \beta_i Var_i + \varepsilon_i \quad (2)$$

$$ROE = \beta_0 + \sum_{i=1}^{5} \beta_i Var_i + \varepsilon_i \quad (3)$$

Where:
$ß_0$: Coefficient.
$ß_i$: Coefficients for each predictor variable (i=1,..,5).
$Var_i$: Predictor Variables.
$ε_i$: Error term.

In this framework, the linear estimators for the five best independent variables have been defined as $ß_1$, $ß_2$, $ß_3$, $ß_4$ and $ß_5$, the constant $ß_0$ and the error term represented by ε-i, to finally evaluate linearity using residual graphs, normality of errors through QQ Plots graphs and homoscedasticity condition using the Breusch-Pagan test.

Equation (4) considers the statistical significance of each coefficient using Student's t-test and for the adjustment of each model, we have proceeded according to the coefficient of determination result of the equation (5):

$$Rt = \frac{\widehat{\beta_J}}{SE(\widehat{\beta_J})} \quad (4)$$

$$R^2 = 1 - \frac{SSE}{SST} \quad (5)$$

Where:
t: Student's t-test.
$ß_j\hat{}$: Estimated Coefficient.
$SE(ß_j\hat{})$: Standard Error of the Estimated Coefficient $ß_j\hat{}$.
SSE: Sum of Squared Errors.
SST: total sum of squares of the deviations from the mean.

To validate the robustness of the regression models, we proceeded to contrast the F statistic and its associated p-value, evaluating the null hypothesis that all coefficients are equal to zero. In this framework and for the validation of the fit, the analysis derived from the Mean Absolute Error (equation 6) and Root Mean Square Error (equation 7) was incorporated, which represent the absolute mean error between the observed values and the square root of the mean square error, providing a more demanding view of the model's accuracy. respectively.

$$MAE = \frac{1}{n} \sum_{i=1}^{n} |y_i - \widehat{y_i}| \quad (6)$$

$$RMSE = \sqrt{\frac{1}{n} \sum_{i=1}^{n} (y_i - \widehat{y_i})^2} \quad (7)$$

Where:
MAE: Mean Absolute Error.
RMSE: Root Mean Square Error.
$y_i$: Actual value observed at position i.
$\hat{y_i}$: Value predicted by the model at position *i*.
n: Total number of observations.

Both metrics, together with the $R^2$ statistic and its significance, made it possible to evaluate the degree of fit and the predictive capacity of the models, where the results of these analyses are presented in tables 3 and 5, where both the global fit metrics ($R^2$, adjusted $R^2$, MAE, RMSE, F, p-value) and the variables with the greatest impact on the profitability of the microenterprise.

**Literature review**

The literature review shows that financial ratios have been established as key variables in the correlation of financial performance and micro-business objectives[24,25,26] as well as in the diagnosis of the state of the art of economic and financial management of these smaller productive units,[27,28] and show their impact on the KPIs of sales, turnover, profitability, laying the foundations for their management in the corporate strategy. The study by Dueñas Casallas R and other authors "recommends the use of ROA and ROE KPIs under adjusted models for a more accurate analysis of financial ratios, as they adequately explain the variability of each indicator and are suitable for evaluating management and efficiency".[29]

Micro-business viability and profitability has become a relevant field of study due to its implications in the global economic fabric[7,30] however, very few studies have been developed to detect and/or mitigate the financial difficulties of this sector,[31,32] or to delve into advanced statistical models that would allow inferring micro-business financial management behaviors and thereby strengthen the sustainability of these smaller productive units. In this scenario, some studies [33,34] have used advanced statistical methods such as least squares, structural models[35] applied to micro-enterprises, to analyze profitability, liquidity, leverage, demonstrating that those units with greater liquidity and lower debt levels had greater probabilities of operational profitability, key strategic variables for financial performance, determination of strategy, sustainability and competitiveness of the same.[21,36,37]

As indicated, multiple linear regression models and time series are proposed as key tools to infer the relationship between qualitative variables (location, size, structure, educational level)[38,39,40,41] and quantitative variables (financial ratios) in the economic-financial performance, evaluating the relationship between debt, profitability and financial management. In accordance with the above, it has been possible to corroborate that[42,43,44] the use of multiple linear regression models with financial ratios continues to be a valuable methodological technique to infer financial management behaviors, given that the management resulting from the different financial ratios influences the strengthening, sustainability, viability and organizational profitability of microenterprises.

## RESULTS

The table 2 states the summary of the metrics of each of the models, which declares the main statistical indicators that allow establishing the significance of the models developed in microenterprise financial management.

**Table 2.** Summary of Models Metrics

| SECTOR | TAM | Ratio | MAE | RMSE | $R^2$ | $R^2$ ajustado | F Statistic | P Value |
|---|---|---|---|---|---|---|---|---|
| Commerce | Micro 1 | ROE | 0 | 0 | 1,0000 | 1,0000 | 20371162 | 0 |
| Commerce | Micro 1 | ROA | 6,9024 | 8,1008 | 0,9331 | 0,9242 | 104,6733 | 0 |
| Commerce | Micro 2 | ROE | 13,708 | 18,5472 | 0,6819 | 0,5229 | 4,288 | 0,0382 |
| Commerce | Micro 2 | ROA | 11,372 | 14,7819 | 0,716 | 0,574 | 5,0428 | 0,0251 |
| Services | Micro 1 | ROE | 2,0802 | 3,7842 | 0,9957 | 0,9942 | 689,6963 | 0 |
| Services | Micro 1 | ROA | 1,5001 | 2,0877 | 0,9977 | 0,9969 | 1280,7939 | 0 |
| Services | Micro 2 | ROE | 8,9955 | 11,8992 | 0,8463 | 0,7364 | 7,706 | 0,0091 |
| Services | Micro 2 | ROA | 6,2249 | 8,146 | 0,8047 | 0,6652 | 5,7679 | 0,02 |

As indicated above, the models that present the best predictive performance with a good level of fit are defined for ROE, commerce Sector, with an $R^2$ and an Adjusted $R^2$ of 1, then follows ROA, Services / $Micro_1$ sector, which exhibits an $R^2$ equivalent to 0,9977 and an MAE of 1,50, indicating an excellent predictive capacity

of the model, in third instance appears ROE, Services sector, with an $R^2$ equivalent to 0,9957 and an MAE of 2,08, which also declares a high degree of prediction in the model and finally this ROA, commerce sector - $Micro_1$, with an $R^2$ of 0,9331 and an RMSE of 8,10 points, which predicts high prediction accuracy of the model. Then there are ROE, Services sector, $Micro_1$; ROA, Services sector, $Micro_2$, ROA, commerce sector, $Micro_2$ and ROE, commerce sector, $Micro_2$, which declare acceptable levels of prediction considering the associated sample size and $R^2$ cut-off level of 0,80. The table 3 indicates that the variables considered in the development of the aforementioned models are defined as:

**Table 3.** Definition of Variables

| Variable | Definition | Variable | Definition |
|---|---|---|---|
| CT | Working Capital | LC | Current Liquidity |
| DA | Debt Asset | MB | Gross Margin |
| DLP | Debt Asset | MN | Net Margin |
| DT | Total Debt | PRC | Collection Rotation Period |
| DUP | Dupont | RA | Acid Ratio |
| LA | Absolute Liquidity | | |

Tables 4, 5, 6 and 7 show the results of the different multiple linear regression models developed and their impact on ROA and ROE, for the services and trade sectors according to size and productive sector, which allow us to observe the sign, magnitude and relevance of the ß coefficients in the performance/performance of microenterprises

**Table 4.** Sector Services/Size Micro $_1$ / Regression Models

| **Services sector- micr$_o$1** |
|---|
| ROE=1,9683+0,0·DLP+98,4309·DUP+0,0·MN-0,0·MB-0,0·CT |
| ROA=3,7151-0,0·DLP+99,1559·DUP+0,123·DT-1,0951·DA-0,0346·LC |

It is observed that the Dupont factor (DUP) consistently emerges as the main explanatory variable, exerting a positive and highly significant impact on both Return on Equity (ROE) and Return on Assets (ROA), with coefficients of +98,4309 and +99,1559, respectively. The ROE equation reveals that the other predictor variables included in the model have practically no effect, indicating that the return on equity is almost exclusively determined by the components of the Dupont analysis in this segment.

On the other hand, the ROA model introduces greater complexity, showing that although Total Debt (TD) has a marginally positive effect, variables such as Debt to Assets (DA) and Current Liquidity (LC) exert a negative impact, suggesting that higher leverage or liquidity can decrease the profitability of the company's assets. Taken together, these models confirm the preeminence of the Dupont model in explaining key indicators of financial and asset returns.

**Table 5.** Sector Services/Size Micro 2 / Regression Models

| **Services sector - micro$_2$** |
|---|
| ROE=78,1856+2495,0986·LC -2503,5369·RA+7,9355·LA +0,0·CT +0,0·DLP |
| ROA=60,6189-373,7328·LC +367,5587·RA +5,802·LA +0,0·CT +1,1302·DLP |

The ROE model declares a greater contrast between current liquidity (LC) with a positive influence of the order of (+2495,0986) in contrast to the Acid Ratio (RA) with coefficients equivalent to (-2503,5369), manifesting an inverse relationship of magnitude. Meanwhile, the ROA model declares an equivalent behavior, since the Acid Ratio (RA) ratio has a positive influence with (+367,5587) points and current liquidity (LC) in a significant negative way amounting to (-373,7328). In this scenario, absolute liquidity (LA) and long-term debt (LTD) have a positive and marginal influence, confirming that microenterprise profitability is highly influenced by the structure of current assets.

In the Commerce / Micro 1 sector, the preponderance of the Dupont ratio (DU) can be observed as the main explanatory variable of profitability in these smaller production units, where the incidence of this Ratio indicates a coefficient of +100,00 which infers that the profitability of equity is almost exclusively responsible for the management of this variable.

| **Table 6.** Sector Commerce/Size Micro 1 / Regression Models |
|---|
| **Commerce sector - micro1** |
| ROE= -0,00,0·PRC+100,0·DUP-0,0·CT+0,0·MN-0,0·MB |
| ROA= 13,6255-0,0·PRC+81,1255·DUP-1,5702·DA+0,416·DT-0,2939·DLP |

Regarding ROA, Dupont, although it is initially seen as a significant explanatory variable with a coefficient of +81,1255 and total debt with a marginal positive influence equivalent to +0,416, debt over assets (DA) and long-term debt (DLP) are configured with a negative influence on the return on assets with coefficients equivalent to (-1,5702) and (-0,2939).

| **Table 7.** Sector Commerce /Size Micro $_2$ / Regression Models |
|---|
| **Commerce sector - micro$_2$** |
| ROE= 57,6769-2,9583·LC+1,0445·RA+3,6288·LA-0,0·CT+ 0,0·DLP |
| ROA= 47,8958-3,1654·LC+1,9175·RA+3,4248·LA-0,0·CT-0,0·DLP |

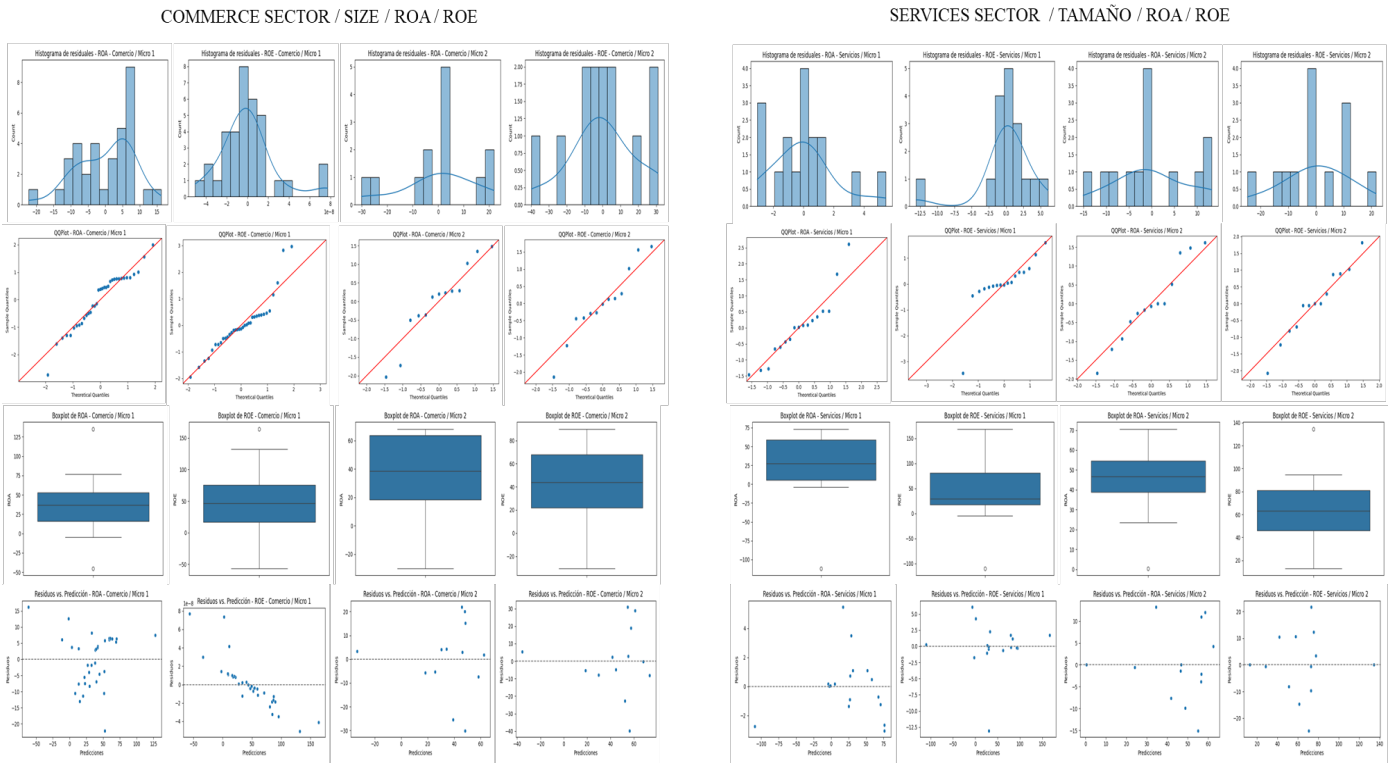


**Figure 2.** Regression Model Graphs

Regression models for Return on Equity (ROE) and Return on Assets (ROA) in the Commerce / Micro 2 segment demonstrate that profitability is mainly influenced by liquidity variables, although with opposite effects. Both equations reveal that Acid Ratio (RA) and Absolute Liquidity (LA) exert a consistent positive impact on profitability indicators, with LA showing a comparatively greater influence.

In this scenario, current liquidity (LC) is negatively and significantly associated with both ROE and ROA, suggesting that an excess of illiquid current assets (such as inventories) reduces the company's efficiency. The Working Capital (TC) and Debt Term (DLP) variables, although they remain in the model due to their belonging.

Consequently, with the declared results, figure 2 summarizes the behavior of the ROA and ROE ratios of each of the models built and their 5 best predictor variables, according to Histogram, QQ Plot Graphs, Box Plot Graph and Model Validation via residual graph, duly segmented into the sectors of Commerce, Services, Size and ROA and ROE ratios.

It can be noted, in particular terms, that the incidence of these ratios in the models is declared in table 8, considering that 1 is the ratio with the greatest incidence and 5 is the one with the least incidence in the management of micro-business ROA/ROE.

**Table 8.** Incidence of ratios in Models

| Sector / size | Ratio | Const. | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|---|---|
| Services / Micro$_1$ | ROE | 1,9683 | DUP | DLP | MN | MB | CT |
| | ROA | 3,7151 | DUP | DA | DT | LC | DLP |
| Services / Micro$_2$ | ROE | 78,1856 | RA | LC | LA | CT | DLP |
| | ROA | 60,6189 | LC | RA | LA | DLP | CT |
| Commerce/ Micro$_1$ | ROE | 0,0000 | DUP | PRC | CT | MN | MB |
| | ROA | 13,6255 | DUP | DA | DT | DLP | PRC |
| Commerce/ Micro$_2$ | ROE | 57,6769 | LA | LC | RA | CT | DLP |
| | ROA | 47,8958 | LA | LC | RA | CT | DLP |

## DISCUSSION

The findings of this study confirm that the application of multiple linear regression, using the variance inflation factor (VIF) and Pearson's correlation, have allowed, due to their adjusted $R^2$ and $R^2$ coefficients, to build robust models[33] to determine the main financial indicators that impact the profitability of microenterprises[21] with a segmented approach by sector and size demonstrating the importance of the ratios of Long-Term Debt, Working Capital and Current Liquidity in explaining the behavior of ROE and ROA.

The results are consistent with various international studies[24,45,46] that highlight that the application of econometric models allows validating the behavior of ROA and ROE in microenterprises, validating the methodological statistical construct presented, as well as the predictive capacity of the models developed to define the best variables to determine the profitability of the microenterprise. considering the local sectoral dynamics.

The findings were contrasted with other studies maded in Mexico,[47] Costa Rica,[38] that highlight that the use of financial indicators and the application of econometric models in this productive sector, allow to define in the first instance, the economic and financial symptomatology of its microenterprise management as well as, the main opportunities for improvement in their operational and financial management, minimizing their operational and financial risk, strategically strengthening the behavior of ROA and ROE.[24,45,48]

Should be noted that according to video interviews carried out in the field, it is considered that this study demonstrates to the owners of these productive units that, having management tools and techniques applied in their respective microenterprises allows them to establish financial techniques and tools to establish a management model that promotes growth, strengthening, sustainability, sustainability, competitiveness of its productive units contributing to local economic development.

That according to graphic video evidence, it demonstrates to the owners of these productive units that having management tools and techniques applied in their respective microenterprises allows them to establish financial techniques and tools to establish a management model that promotes the growth, strengthening, sustainability, sustainability, competitiveness of their productive units, contributing to local economic development.

The results reinforce international studies[20] that affirm that information-based management[43,44] and the strengthening of public policy[30,49,50] would allow, in the first instance, to report a higher and better local average profitability[45] in accordance with the structure of economic and financial equity of the microenterprise.[7,20] Providing the key elements, variables and components and basis for this task,[36,41,44] which are aimed at strengthening the sustainability and sustainability of these productive units, as well as inviting the generation of certain instances to contribute with new lines of research related[51] to this productive sector and, consequently, contribute to the community authorities, actors and economic agents involved in the development of local and regional productive development.[52,53]

## CONCLUSIONS

This study developed a methodological strategy that is considered statistically robust for analyzing corporate profitability based on multiple financial indicators. Variable precision and refinement techniques were implemented, considering statistical criteria such as multicollinearity (measured through the VIF) and information redundancy between equivalent accounting metrics. Within this framework, the combination of Pearson correlation analysis, severe collinearity detection, and multiple linear regression allowed for the construction of explanatory models for both ROE and ROA, theoretically adjusted to the study's objective.

It can be concluded that 6 of the 29 indicators analyzed, Long-Term Debt (DLP) 87,5 % share; Working Capital (TC) 75 % and Current Liquidity (LC) 62,5 % and Dupont, Acid Ratio, and Absolute Liquidity with 50 %, are the variables that best predict the financial behavior of ROA and ROE, in both sectors and sizes. It can be stated that the 5 most frequent predictor variables that best define the behavior of microenterprise ROA and ROE within the regression models are: Long-term debt management, Working capital, Current liquidity, Dupont, and Acid ratio.

According to the results, all the models demonstrate statistical significance with p-values ≤ 0,05, which allows us to reject the null hypothesis, H-0. which states that "All regression coefficients should be equal to zero". In this scenario, the goodness of fit of the models, defined in $R^2$ and adjusted $R^2$, the coefficients reveal heterogeneity in the proportion of the explained variance, where the services sector declares a better overall fit than the commercial sector, which is estimated to be explained by the sectoral reality, stability of the financial ratios due to exogenous macroeconomic or cultural factors. , the mean absolute error (MAE) and mean square error (RMSE) metrics declare the high degree of accuracy in the prediction of the models developed, where the services sector shows a lower degree of error than the trade sector, due to the lower degrees of volatility of the assets

The models, components and methods presented are consistent with the explanatory statistical configuration of related studies, where they declare their predictive capacity, where ratios such as liquidity, indebtedness, asset turnover present a positive relationship in ROA and/or ROE, highlighting the need for a holistic strategic vision of organizational management. In this context, it is observed that leverage does not affect profitability, especially ROA; however, size and liquidity are considered precursors to the profitability of microenterprises.

The study made it possible to build robust regression models of the financial performance of microenterprises with a segmented approach by sector and size, demonstrating, in the first instance, a high predictive capacity and accuracy, defining the importance of the interpretation of financial ratios in the organizational management of the microenterprise and in particular of the most relevant predictor variables in the behavior of the ROA and ROE of the microenterprise to minimize operational and economic and financial risks to optimize the growth and development of microenterprises

**Limitations**

The results are tailored to local reality, and while they are considered replicable at the regional and international levels, data collection and availability are a limitation in this type of study

**Future studies**

It is estimated that future studies should be aimed at inferring degrees of operational risk, the impact of training and banking on profitability, as well as measuring micro-enterprise intangible capital through the application of non-linear econometric models, time series, exploratory factor analysis, using financial ratios, which would undoubtedly allow it to be proposed as a base input in public policy in favor of micro-enterprise economic growth and development.

## ACKNOWLEDGEMENTS

My sincere acknowledgements to the University of the Americas, to Dr. Teodoro Reyes Fong for their technical and methodological guidance and to Dr. Walter Leiva Mardones for his contributions in data and systems, to the Members of the Tribunal and Expert Evaluators for their valuable comments and suggestions to my postdoctoral research, to the journal SJR Data and Metadata for the scientific review, methodology and their recommendations for the publication of this article, thank you very much to all of them for everything.

## BIBLIOGRAPHIC REFERENCES

1. Quingco JG, Leonoras CS. The Economic Impact, Contribution, and Challenges of Micro Business Enterprises to the Local Development. PSSJ. 2020 Jan 2;2(2):107–22

2. Chikerema L, Makanyeza C. Enhancing the performance of micro-enterprises through market orientation: Evidence from Harare, Zimbabwe. Glob Bus Organ Excell. marzo de 2021;40(3):6-19

3. Ferrada M. Seventh Microentrepreneurship Survey (EME 7). Ministry of Economy, Development and Tourism. 2023. https://www.economia.gob.cl/2023/06/16/septima-encuesta-de-microemprendimiento-eme-7.htm

4. OECD, CAF Development Bank of Latin America. Latin America and the Caribbean 2019: Policies for Competitive SMEs in the Pacific Alliance and Participating Countries in South America. OECD; 2019. https://www.oecd.org/es/publications/america-latina-y-el-caribe-2019_60745031-es.html

5. OECD. SME and Entrepreneurship Policy in Brazil 2020. OECD; 2020. (OECD Studies on SMEs and Entrepreneurship). https://www.oecd.org/en/publications/sme-and-entrepreneurship-policy-in-brazil-2020_cc5feb81-en.htm

6. Haro-Sarango A, Lopez-Solis Ó. Sustainability, the utopia of microenterprises: an evaluation from the financial perspective. Rev Multidiscip Núcleo Pesqui E Ext. https://revistas.uneb.br/plugins/generic/

pdfJsViewer/pdf.js/web/viewer.html?file=https%3A%2F%2Frevistas.uneb.br%2Findex.php%2Frevnupe%2Farticle%2Fdownload%2F13807%2F10287%2F45250

7. Annual Productivity Report 2021. National Commission for Evaluation and Productivity. https://cnep.cl/informes-anuales-de-productividad/informe-anual-de-productividad-2021

8. Mungaray-Lagarda A, Aguilar-Barceló JG, Osorio-Novela G. Rethinking the purpose of micro enterprises in developing countries: evidence for mexico. J Dev Entrepreneurship. 2016 Sept;21(03):1650019

9. Roy MA, Wheeler D. A survey of micro-enterprise in urban West Africa: drivers shaping the sector. Dev Pract. 1 de agosto de 2006;16(5):452-64

10. Belás J, Vojtovič S, Ključnikov A. Microenterprises and Significant Risk Factors in Loan Process. Econ Sociol. marzo de 2016;9(1):43-59

11. Modigliani F, Miller MH. The Cost of Capital, Corporation Finance and the Theory of Investment. Am Econ Rev. 1958;48(3):261-97.

12. Alex DP, Jamith PRJ, Manuel BGL. Microenterprise Perspective: Competitiveness And Financing. 2022;298-319.

13. Singh K. Economics and financial sustainability in microfinancing: do investment flows toward developing countries, rural areas, microenterprises and female borrowers foster institutionalization? Stud Econ Finance. 2024. https://www.emerald.com/insight/content/doi/10.1108/SEF-08-2024-0474/full/html

14. Ruiz Corrales M, Flores-Castillo LA, Ravina-Ripoll R, Tobar-Pesentez L. Innovation and training as enhancers of the social profitability generated by microenterprises. Univ Politec Sales Ecuad. 2021;27(2):1-12.

15. Uwingabiye G, Nouwoue G. Is repeated borrowing better at improving MSMEs' performance and profitability? A PAMF-CI case study from cote d'Ivoire. J Dev Eff. 2 de enero de 2022;14(1):19-33.

16. Audretsch DB, Cunningham JA, Kuratko DF, Lehmann EE, Menter M. Entrepreneurial ecosystems: economic, technological, and societal impacts. J Technol Transf. abril de 2019;44(2):313-25.

17. Barrera-Verdugo G. Impact of self-perceptions, social norms, and social capital on nascent entrepreneurs: a comparative analysis by level of economic development in Latin American countries. J Innov Entrep. diciembre de 2021;10(1):41.

18. Román Palma LP. Technical efficiency of microenterprise financial ratios: non-parametric intersectoral inferential statistical study, San Bernardo, Santiago. CAPIC Rev. 10 de junio de 2017; 15:109-22.

19. Román Palma LP. MICROENTERPRISE ECONOMIC AND FINANCIAL X-RAY - An intersectoral inferential statistical study applied to microenterprises in the commune of San Bernardo, Chile [Tesis Doctoral]. [México]: Unviersidad de Las Américas y el Caribe; 2023.

20. Dini Marco, Stumpo Giovanni. Mipymes in Latin America A Fragile Performance and New Challenges for Development Policies. ECLAC; 2020. Available in: https://repositorio.cepal.org/server/api/core/bitstreams/2c7fec3c-c404-496b-a0da-e6a14b1cee48/content.

21. A. Ramírez-Urquidy M, G. Aguilar-Barceló J, Portal-Boza M. The Impact of Economic and Financial Management Practices on the Performance of Mexican Micro-Enterprises: A Multivariate Analysis. Rev Bus Manag. julio de 2018;20(3):319-37.

22. Sabino C. El proceso de investigación. Episteme; 2014.

23. Ministerio de Economía, Fomento y Turismo Boletin-Revision-Clasificacion-Estatuto-Pyme.2014, Available in: https://www.economia.gob.cl/wp-content/uploads/2014/04/Boletin-Revision-Clasificacion-Estatuto-Pyme.pdf

24. Zambrano FJ, Sanchez Pacheco ME, Martínez Mayorga RX, Guarnizo Crespo SF. Determinants of the

financial profitability of microenterprises: a cross-sectional study for the trade sector. Univ Soc [Internet]. 14(56). Available in: https://rus.ucf.edu.cu/index.php/rus/article/view/3493.

25. Párraga Franco SM, Pinargote Vázquez NF, García Álava CM, Zamora Sornoza JC. Financial management indicators in small and medium-sized enterprises in Ibero-America: a systematic review. Dilemmas Contemp Educ Politics Values. 2021 March 1; Available in: https://www.dilemascontemporaneoseducacionpoliticayvalores.com/index.php/dilemas/article/view/2610.

26. Pollack J, Adler D. Skills that improve profitability: The relationship between project management, IT skills, and small to medium enterprise profitability. Int J Proj Manag. julio de 2016;34(5):831-8.

27. Ferrer Dávalos RM. Analysis of the administrative needs of microenterprise managers in Paraguay. Acad Rev Investig En Cienc Soc Humanidades.23 de febrero de 2021;8(1):1-14.

28. Padilla MC. Análisis financiero. 1ra edición. Ecoe Ediciones; 2014.

29. Dueñas Casallas R, Crespo Soler C, Ripoll Feliu VM, Álvarez Moreno CA. Evaluation of management and efficiency in highly complex public hospitals in Colombia: A statistical and financial analysis of KPIs. Journal of Infrastructure, Policy and Development. 2025 Jan 21;9(1):10927.

30. Amato S, Candio P. Enhancing micro-enterprises performance: The role of the regional environment. Strateg Change. noviembre de 2024;33(6):445-61.

31. Blanco-Oliver A, Pino-Mejías R, Lara-Rubio J. Modeling the Financial Distress of Microenterprise Start-Ups Using Support Vector Machines: A Case Study. Innovar. 1 de febrero de 2014;24(1Spe):153-68.

32. García Carvajal S, Dueñas Casallas R. Qualitative aspects in SMEs and the new management challenges in the face of IFRS. Acad Virtualidad. 21 de julio de 2016;9(2):108-20.

33. Escobar De La Cuadra YM, Vargas Ortiz OG, Villegas De La Cuadra SJ. Impact of Financial Indicators on Sectoral Economic Performance: A Comparative and Predictive Analysis Based on Multiple Regression Models. Cienc Lat Rev Científica Multidiscip. November 29, 2024;8(6):92-108.

34. Soni H, Chitta S, Pathak D. Assessing Financial Health in Small Businesses: A Structural Equation Modeling Study. REICE Rev Electronics Research In Economic Sciences. December 13, 2023;11(22):30-50.

35. Zunckel S, John Nyide C. Capital structure of small, medium and micro enterprises: major factors for a developing economy. Probl Perspect Manag. 6 de mayo de 2019;17(2):124-33.

36. Acemoglu D, Restrepo P. Artificial Intelligence, Automation and Work [Internet]. Cambridge, MA: National Bureau of Economic Research; 2018. Report No.: w24196. Available in: http://www.nber.org/papers/w24196.pdf.

37. Rodriguez Arrieta GA, Cano Lara ED, Ruiz Velez AL. Competitiveness in microenterprises in Manta 2019. Rev San Gregor. 29 December 2019. http://revista.sangregorio.edu.ec/index.php/REVISTASANGREGORIO/article/view/1141

38. Esparza-Aguilar JL, Soto-Maciel A, De La Garza-Ramos MI, San Martín-Reyna JM. Financial performance and socio-emotional wealth in small and medium-sized family and non-family businesses. Tec Empres. January 18, 2021;15(2):02-16.

39. Ács ZJ, Autio E, Szerb L. National Systems of Entrepreneurship: Measurement issues and policy implications. Res Policy. abril de 2014;43(3):476-94.

40. Fitriyah, Hermawan A, Sudarsono N. The Impact Of Financial Literacy, Financial Attitudes And Financial Behaviour On MSMEs Growth. Int J Sci Technol Manag. 30 de noviembre de 2023;4(6):1560-6.

41. Enríquez Díaz LR, Hernández Ocampo SE. R Relationship between capital structure and profitability of microenterprises in the construction sector of Loja-Ecuador. Tesla Rev Científica. 19 de noviembre de 2024;4(2):e414.

42. Zambrano-Farías FJ, Rivera-Naranjo CI, Quimi-Franco DI, Flores-Villacrés EJ. Explanatory factors of the profitability of microenterprises: A study applied to the trade sector. INNOVA Res J. November 25, 2021;6(3.2):63-78.

43. Wooldridge JM, Wadud M, Lye J. Introductory econometrics: Asia pacific edition with online study tools 12 months. Cengage AU; 2016.

44. Baltagi BH, Baltagi BH. Dynamic panel data models. Econom Anal Panel Data. 2021;187-228.

45. Zambrano Farías FJ, Sánchez-Pacheco ME, Correa-Soto SR. Analysis of profitability, indebtedness and liquidity of microenterprises in Ecuador. Retos. 23 de septiembre de 2021;11(22):235-49.

46. Portal Boza M, Feitó Madrigal D, Bernal Escoto BE. Evaluation of economic and financial management in Mexican microenterprises. FAEDPYME Int Rev. 3 de octubre de 2016;5(8):20-31.

47. Flores Sanchez EM, Rodriguez Bates AM, Flores Delgado JA. Risk determination for manufacturing micro-companies in Mexico. AE. 2019 Sept 30;34(87):149–76.

48. Ghosh C, Guha S. Determinants of profitability of the microenterprises led by women micro entrepreneurs: evidence from Mumbai slums. Int J Entrep Small Bus. 2015;24(4):455.

49. Dueñas Casallas R, Crespo Soler C, Ripoll Feliu VM, Álvarez Moreno CA. Management and efficiency in highly complex public healthcare: an analysis of financial ratios and non-parametric statistic. Data and Metadata. 2024 Dec 31;3:.630.

50. Salas-Muentes ND, Zambrano-Zambrano EJ. Financial management and its impact on the profitability of Manabi commercial microenterprises. Ecuador. Gestio Prod Rev Electrónica Cienc Gerenciales. 1 de enero de 2025;7(12):55-69.

51. Zainol NR, Al Mamun A, Hassan H, Muniady R. Examining the effectiveness of micro-enterprise development programs in Malaysia. J Int Stud. 10 de junio de 2017;10(2):292-308.

52. Reyes Parga MA, Orjuela Ramírez DF. The institutional approach in entrepreneurship research in Latin America.: A semi-systematic literature review. Cuad Adm. 2 de noviembre de 2023. https://revistas.javeriana.edu.co/index.php/cuadernos_admon/article/view/36859.

53. Kamruzzaman D. Impact of the Financial Factors on Return on Assets (Roa). DIU J Bus Entrep. 30 de junio de 2019;12(01):50-61.

## FINANCING

The author did not receive funding for the development of this research.”.

## CONFLICT OF INTEREST

The authors declare that there is no conflict of interest.

## AUTHORSHIP CONTRIBUTION

*Conceptualization:* Luis Román Palma.
*Data curation:* Luis Román Palma, Walter Leiva Mardones.
*Formal analysis:* Luis Román Palma.
*Research:* Luis Román Palma.
*Methodology:* Luis Román Palma - Teodoro Reyes Fong.
*Project management:* Luis Román Palma.
*Resources:* Luis Román Palma.
*Software:* Luis Román Palma, Walter Leiva Mardones.
*Supervision:* Luis Román Palma, Teodoro Reyes Fong.
*Validation:* Luis Román Palma, Teodoro Reyes Fong.
*Display:* Luis Román Palma, Teodoro Reyes Fong.
*Drafting - original draft:* Luis Román Palma.
*Writing - proofreading and editing:* Luis Román Palma, Teodoro Reyes Fong -Robinson Dueñas Casallas.