ISSN: 2247-6172
Review of Applied Socio- Economic Research
(Volume 29, Issue 1/ 2025), pp.37-48
URL: http://www.reaser.eu
e-mail: editors@reaser.eu

Relationship between Shareholder Financial Health and Productivity in Ecuadorian Companies: An Analysis Based on Solow Residuals (2021-2022)

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Abstract. *This study investigates the relationship between the financial health of shareholders and the productivity of Ecuadorian companies during the post-pandemic period (2021-2022). Using panel data and the Solow residual method to measure productivity, greater shareholder financial health, measured through indicators such as sustained profit, shareholding, and return on assets, was found to be associated with greater business productivity. The results suggest that shareholders with a strong financial position can boost the efficiency and growth of companies by facilitating investments in technology, improving decision-making, and strengthening the alignment between the interests of shareholders and management.*

Keywords: Interests of Shareholders, Post-Pandemic, Productivity, Shareholder financial health, Solow Residuals.

JEL Codes: D24 – G32 – L25 – O47

1. Introduction

The relationship between shareholder financial health and corporate productivity has been the subject of increasing interest in economic and financial research. In a context of economic volatility and constant change, understanding how the financial characteristics of shareholders influence the efficiency and productive performance of companies is crucial. Productivity inside an organization can be significantly impacted by a shareholder's financial status or by the business's capacity to finance, invest, and manage resources. (Smith and others, 2022).

It has been demonstrated in recent years that companies with solid finances are better able to manage their resources, make more strategic choices, and address market difficulties. (Lee and Johnson, 2023). Utilizing Solow residuals, a method that provides a clear picture of residual efficiency and enables the evaluation of the portion of productivity that cannot be fully explained by the measured inputs is crucial for assessing productivity (Nguyen et al., 2021).

The time between 2021 and 2022 has been particularly important for Ecuadorian firms because of the COVID-19 pandemic's economic effects and changes in the world market.

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ISSN: 2247-6172
Review of Applied Socio- Economic Research
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Due to the particular difficulties these circumstances have presented for businesses and their investors, it is a good time to examine the relationship between shareholder wealth and corporate productivity (Martínez and Rodríguez, 2023).

Using Solow residuals as a productivity metric, this study attempts to explore the relationship between shareholder financial health and productivity in Ecuadorian businesses. By doing this, we hope to provide a current and pertinent viewpoint on how, in a post-pandemic environment, the financial circumstances of shareholders might affect the profitable operation of businesses.

2. Literature Review

The relationship between shareholder financial health and firm productivity has been an area of growing interest in economic research. The financial health of shareholders can be evaluated using a wide range of indicators, including return on assets, share ownership, and consistent earnings. Every one of these components influences how productive a business is. One of the most important indicators for evaluating the financial health of shareholders is sustained profit.

The long-term growth and stability of a corporation are contingent upon the provision of sustainable benefits (García and Pérez, 2022; Brown and Davis, 2023). Long-standing, profitable businesses can use their profits to create new goods and enhance current ones, boosting output and efficiency. Singh and Sharma (2023); Chavez et al. (2021). Companies with constant considerable earnings have the financial resilience to handle market volatility and make growth-oriented investments (Sánchez and Martínez, 2022; Kim et al., 2024).

Possession of shares affects productivity significantly in addition to long-term profit. The degree to which shareholders own and manage the business is referred to as shareholding. The classic outcome of ownership shares across holders is more strategic decision-making. Stakeholder engagement in managerial monitoring and decision-making can increase productivity and operational efficiency. When analyzing a company's financial health, the return on assets is important. This ratio measures how good a company is at turning its assets into sales. A high Return on Assets indicates better use of the resources by business and increased output. (Zhang and Lee, 2022; Smith et al., 2022).

A significant return on assets helps firms to improve operational efficiency, and increase productive capacity which are two key factors for them to create and sustain competitive advantage in the market (Nguyen et al., 2021; Kim et al., 2014). The interaction between these metrics and business productivity becomes even clearer when Solow residuals are used to measure residual productivity. Solow residuals allow us to evaluate the part of productivity that cannot be explained solely by traditional inputs, offering a more complete view of productive efficiency (Nguyen et al., 2021; Kumar et al., 2023). Companies with solid financial health, reflected in high sustained profits, significant shareholding and high return on assets, tend to exhibit greater residual efficiency in terms of productivity (Sharma and Kumar, 2023; López and Wang, 2023).

Recent literature has shown that better shareholder financial health, measured through these metrics, is associated with greater productive efficiency. According to this research, having a solid financial position helps businesses be more productive than they would be with traditional inputs. It also assures stability (Chen et al., 2023; Singh and Sharma, 2023). Financially stable firms can invest in

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operational and technological advances that increase productivity (Garcia et al., 2022; Kim et al., 2024).
Moreover, the financial stability provided by high and sustained profits and good shareholder ownership allows firms to better manage market uncertainties and adapt their strategies to improve efficiency (Brown and Davis, 2023; Martinez and Rodriguez, 2023). The literature has documented that these companies are more likely to make strategic investments in resources and technology that increase productivity (Chen and Zhao, 2022; Zhang and Lee, 2024).

The ability of companies to generate additional value beyond the explained inputs is key evidence of the effectiveness of their financial and operational practices. Companies with solid financial health show greater residual efficiency in their productivity, which is an indicator of their ability to optimize resources and processes (García et al., 2022; Singh and Sharma, 2023). This residual efficiency also reflects the company's ability to use its resources effectively to improve its productive performance (Nguyen et al., 2021; Kim et al., 2024).

According to recent research, productivity is significantly impacted by shareholders' financial health, and residual productivity metrics clearly show this impact. Research has shown that financially stable companies can boost productivity through technological investments and operational simplification. Sharma and Kumar (2023); Garcia et al. (2024).

The significance of financial stability for enterprises to optimize their output capacity is underscored by this study (Lee and Kim, 2022; Zhang and Lee, 2024).

In summary, the literature review indicates that shareholder financial health, measured through sustained profit, shareholding, and return on assets, has a significant impact on business productivity. Solow residuals provide detailed insight into how these financial metrics affect firms' residual efficiency (Nguyen et al., 2021; Kumar et al., 2023). The body of research supports the notion that stable financial standing boosts a company's ability to be productive, which is essential for preserving a competitive edge in the marketplace (Chen et al., 2023; Singh and Sharma, 2023).

3. Method

3.1. Research Design

To examine the relationship between shareholder financial health and productivity in Ecuadorian enterprises throughout the years 2021 and 2022, this study used a quantitative research approach employing panel data. The methodology is divided into two stages of analysis. In the first stage, productivity is estimated based on Solow residuals using a regression model for panel data. In the second stage, we evaluate how the financial health of the shareholder influences productivity measured through Solow residuals.

3.2. Population

The study population consists of all companies registered in Ecuador during the years 2021 and 2022. This population offers a full depiction of the business environment in the nation, with a large assortment of enterprises from all industries and sizes.

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3.3. Sample

In the two phases of the investigation, two distinct samples were used for the analysis:

1. **First Stage:** 521 Ecuadorian firms were included in the sample. At this point, Solow residuals were used in a panel data regression model to estimate productivity. The dependent variable in this model was TOTALIncome (company income), while the independent variables included FIXED ASSETS (capital) and NumberEmployed (labor).

2. **Second Stage:** In this stage, a regression model for panel data was used with a sample of 459 companies per year (2021 and 2022). In this model, the dependent variable was ProductivitySolow (PD), while the independent variables considered were Shwealth (shareholder financial health), OwnerShare (shareholder participation), Sharebenroa (profitability) and Sharebenefmnet (earned profit).

3.4. Information Gathering

Information was gathered from secondary sources, including official firm websites and publicly accessible data from Ecuador's Superintendency of Companies, Securities, and Insurance. The data used pertains to the years 2021 and 2022 and was obtained from publicly available yearly financial reports and business records. Below is a table with a description of each variable used in the study and how it was measured:

Table 1. Variables used in the study

Variable	Description	How it was measured
TOTAL income	Total income of the company in one year.	Measured from companies' annual financial reports.
FIXED ASSETS	Capital invested in fixed assets of the company.	Extracted from the companies' general balance sheets.
Number of Employees	Total number of company employees.	Obtained from annual reports and employment reports of companies.
ProductivitySolow	Productivity is measured through Solow residuals.	Calculated from the regression model for panel data.
Shwealth	The financial health of the shareholder.	Measured using a dummy variable that indicates 1 if there was a sustained presence of utility in the period analyzed.
OwnerShare	Shareholder participation in the company.	Measured as the percentage of stock ownership in the company.
Sharebenroa	Company profitability is measured by return on assets (ROA).	Calculated from the relationship between net profit and total assets.
Sharebenefmnet	Profit obtained by the shareholder.	Measured as the net profit attributed to shareholders in financial reports.

Source: Resource Created by the Authors

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Review of Applied Socio- Economic Research
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3.5. Data Analysis

Data analysis was carried out in two different stages, using STATA software for the estimation of regression models.

1. First Stage:

At this stage, a panel data regression model was constructed to estimate productivity using Solow residuals. The model is specified as follows:

$$\text{ProductivitySolow}_{it} = \beta_0 + \beta_1 \text{FIXED ASSETS}_{it} + \beta_2 \text{CantEmployees}_{it} + \epsilon_{it} \quad (1)$$

where:

- **ProductivitySolow** $_{it}$ is the productivity of firm *i* at time *t* , measured by the Solow residuals.
- **FIXED ASSETS** $_{it}$ is the capital invested in fixed assets.
- **CantEmployees** $_{it}$ is the total number of employees.
- β_0 is the intercept.
- β_1 and β_2 are the coefficients of the independent variables.
- ϵ_{it} is the error term.

This model allowed us to estimate the residual productivity not explained by capital and labor.

2. Second Stage:

At this stage, a regression model was built for panel data for the years 2021 and 2022, with the following specification:

$$\text{ProductivitySolow}_{it} = \beta_0 + \beta_1 \text{Shwealth}_{it} + \beta_2 \text{OwnerShare}_{it} + \beta_3 \text{Sharebenroa}_{it} + \epsilon_{it} \quad (2)$$

Where:

- **ProductivityJustow** $_{it}$ is the productivity measured by the Solow residuals.
- **Shwealth** $_{it}$ is the financial health of the shareholder, measured by a dummy variable.
- **OwnerShare** $_{it}$ It is the shareholder's participation in the company.
- **Sharebenroa** $_{it}$ is the profitability of the company, measured by the return on assets (ROA).
- **Sharebenefmnet** $_{it}$ is the benefit obtained by the shareholder.
- β_0 is the intercept.
- β_1 , β_2 , β_3 , and β_4 are the coefficients of the independent variables.
- ϵ_{it} is the error term.

$$w_{it} = \beta_0 + \beta_1 \text{Shwealth}_{it} + \beta_2 \text{OwnerShare}_{it} + \beta_3 \text{Sharebenefit}_{it} + \beta_4 \text{Sharebenefmnet}_{it} + \epsilon_{it} \quad (3)$$

w_{it} is the productivity measured by the Solow residuals.

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d financial of the shareholder, measured by a dummy variable.

shareholder participation in the company.

company profitability, measured by return on assets

s the profit obtained by the shareholder.

s coefficients of the independent variables.

This model allowed us to explore how financial health metrics and shareholding affect productivity measured through Solow residuals. Both stages of the analysis were performed using STATA software, which facilitated the estimation of the regression models and the analysis of the data. The results obtained were interpreted to identify patterns and significant relationships between the variables of interest and the productivity of the companies.

4. Results

Table 2. Model estimating Solow residual productivity

Number of obs	=	521
F(2, 518)	=	407.26
18 Prob > F	=	0.0000
15 R-squared	=	0.6113
Adj R-squared	=	0.6098
16 Root MSE	=	7.2e+07

IncomeTOTAL	**Coef.**	**Std. Err.**	**t**	**P>t**	**[95% Conf.**	**Interval]**
Number of Employees	47234.46	3,579,534	13.20	0.000	40202.27	54266.65
FIXED ASSETSSN	.6261102	.031216	20.06	0.000	.5647847	.6874358
_cons	1.46e+07	3859738	3.78	0.000	7002577	2.22e+07

Source: The author's calculation using the data

Table 2 shows a multiple linear regression that estimates productivity based on Solow residuals. It can be seen that the global statistical value is 707.26 and the p-value is 0.0000, that is, the p-value is <0.05, which indicates that at least one of the variables is significant.
On the other hand, the coefficients show a positive relationship, that is, if the number of employees increases, total income will increase and if fixed assets increase, income will also increase. In both variables the value p<0.05, this indicates that the production factor variables are significant in determining productivity. It is important to mention that the standard errors of this regression represent productivity using the Solow model.

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Table 3. Shapiro Wilk normality test

Variable	obs	W	V	z	Prob>z
PRODUCTIVI~D	918	0.651	203,404	13,116	0.000
P.S	918	0.709	169,975	12,673	0.000
incomeemployment	918	0.505	288,995	13,983	0.000
incomeact~s	918	0.292	412,770	14,863	0.000
ownershare	918	0.837	95,343	11,247	0.000
sharebenef~t	918	0.547	264,351	13,763	0.000
sharebenroa	918	0.417	340,014	14,384	0.000

Source: The author's calculation using the data

Table 3 indicates that the analyzed variables do not follow a normal distribution, according to the Shapiro-Wilk normality test. The W statistic, the critical values of the z test, and the p values (Prob>z) for all variables consistently show that the null hypothesis of normality is rejected. This suggests that the data are not symmetrical and are not evenly distributed around the mean. This conclusion should be kept in mind since certain tests and procedures involve assumptions about normalcy. It should also be kept in mind when evaluating the findings of future statistical analyses. When dealing with non-normal distributions, it may be helpful to take into account alternatives or data transformations.

Table 4. Defining Time Series Data

Panel	variable:	expediente	(strongly balanced)
Time	variable:	43period,	2021 to 2022
Delta: 1 unit			

Source: The author's calculation using the data

'Panel variable' refers to the use of panel data, which are observations made over a long period on a number of different entities or individuals. The variable now used as a panel variable is called 'Docket'. 'Very balanced' means that for the given period, the number of observations for each entity (or panel member) is equal. 'Period' is the time variable, and covers the years 2021-2022.

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Table 5. Modified Wald test for heteroscedasticity in the fixed effects regression model where Y= Productivity of Solow residuals.

P.S	Coef.	St.Err.	t-value	p-value	[95% Conf	[Interval]	Next
Shwealth	1747627.5	3497480.6	0.50	.618	-5125591.4	8620846.5	
Ownershare	1.034e+13	1.016e+14	0.10	.919	-1.894e+14	2.101e+14	
Sharebenroa	2275087.7	5453627.7	0.42	.677	-8442334.8	12992510	
sharebenefmnet	-1366086.1	9209081.2	-0.15	.882	-19463694	16731521	
constant	-7.831e+12	7,700e+13	-0.10	.919	-1,592e+14	1.435e+14	

Mean dependent var	444024.576	SD dependent var	80671451.449
R-squared	0.002	Number of obs	918
F-test	0.281	Prob > F	1,000
Akaike crit. (AIC)	33026.061	Bayesian crit. (BIC)	33045.349

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

H0: sigma(i)^2 = sigma^2 for all i
chi2 (459) = 1.1e+25
Prob>chi2 = 0.0000

Source: The author's calculation using the data

Table 5 indicates a chi-square (chi2) statistic of approximately 1.1e+25 with 459 degrees of freedom. Since the associated p-value (Prob>chi2) is 0.0000, the null hypothesis is rejected at a conventional significance level of 0.05. This suggests the presence of heteroscedasticity in the model residuals. When heteroscedasticity problems occur, they are corrected by applying a robust model that corrects the standard errors.

Table 6. Linear regression, standard errors corrected by heteroscedastic panels - Productivity Solow residuals

Group variable: file	Number of obs	=	918
Variable time: period	Number of groups	=	459
Panels: heteroskedastic (balanced)	Obs per group:		
Autocorrelation: no autocorrelation	min	=	2
	Avg	=	2
	Max	=	2
Estimated covariances = 459	R-squared	=	0.0366
Estimated autocorrelations = 0	Wald chi2(4)	=	37.47
Estimated coefficients = 5	Prob > chi2	=	0.0000

Het-corrected						
P.S	**Coef.**	**Std. Err.**	**z**	**P>z**	**[95% Conf.**	**[Interval]**
shwealth	3.03e+07	6766907	4.48	0.000	1.71e+07	4.36e+07
ownershare	1.73e+07	7503728	2.30	0.021	2581965	3.20e+07
sharebenroa	-5.09e+07	2.36e+07	-2.16	0.031	-9.72e+07	-4693211
sharebenefmnet	4.99e+07	3.31e+07	1.51	0.132	-1.50e+07	1.15e+08
_cons	-3.70e+07	8046611	-4.59	0.000	-5.27e+07	-2.12e+07

Source: The author's calculation using the data

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(Volume 29, Issue 1/ 2025), pp.37-48
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Table 6 shows a regression, this indicates that the variable pd is significantly related to the explanatory variables included in the model, with an R-squared of 0.0366, which suggests that the explanatory variables explain a small but significant proportion of the variability in the dependent variable. The Wald chi2(4) test for homoscedasticity suggests that there is heteroscedasticity in the model errors, and therefore the standard errors have been corrected to account for this heteroscedasticity.

In the panel regression analysis with correction for heteroscedasticity, the results indicate that the variables "shwealth" and "ownershare" have statistically significant effects on the productivity of Solow residuals ("pd"), with positive and negative coefficients, respectively. These results suggest that an increase in "shwealth" is associated with a significant increase in productivity, while an increase in "ownershare" is related to a significant decrease. The variable "sharebenroa" also significantly and negatively influences "pd". However, the variable "sharebenefmnet" shows a significant coefficient, but with a p-value of 0.132, indicating some uncertainty in its relationship with productivity.

5. Discussion

The results of the study provide a detailed view of how shareholder financial health and other variables impact productivity in Ecuadorian companies. In the first stage, the regression model for panel data estimates productivity based on Solow residuals, showing that both FIXED ASSETS (capital) and NumberEmployed (labor) have a significant impact on TOTALIncome (company income). The positive and significant coefficients for these variables indicate that an increase in fixed assets and the number of employees is associated with an increase in total income. This finding confirms that production factors, as predicted in the Solow model, are fundamental in explaining productivity (Solow, 1956; Mankiw et al., 1992).

However, the first-stage regression also reveals that the standard errors of the regression represent productivity as measured by the Solow model, suggesting that residual productivity, that is, productivity not explained by capital and labor, remains an important part of the analysis. This underlines the relevance of considering residual productivity as a key metric in the evaluation of business efficiency (Hall, 1988; Olley and Pakes, 1996).

In the second stage of the analysis, the regression model for panel data shows that the variables Shwealth (shareholder financial health), OwnerShare (shareholder participation), Sharebenroa (profitability) and Sharebenefmnet (earned profit) have different effects on productivity measured through Solow residuals (Solow Productivity or PD). Normality analysis using the Shapiro-Wilk test reveals that the variables do not follow a normal distribution, which may indicate the need to perform additional transformations of the data or apply robust techniques that fit the distribution of the residuals (Shapiro and Wilk, 1965; Welsch and Kuh, 1977).

The presence of heteroskedasticity, confirmed by the Wald test, suggests that the variability of the errors is not constant, which may affect the validity of statistical inferences. Correcting for heteroskedasticity in the regression shows that Shwealth has a significant positive effect on productivity, indicating that higher shareholder financial health is associated with higher productivity. In contrast, OwnerShare has a significant negative effect, suggesting that greater

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Review of Applied Socio- Economic Research
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shareholder participation is related to a decrease in productivity. These results are consistent with literature suggesting that ownership structure can affect decision-making and operational efficiency (Jensen and Meckling, 1976; La Porta et al., 2000).

The Sharebenroa variable also shows a significant negative effect on productivity, which could indicate that higher profitability does not always translate into higher residual productivity, and may be associated with an overestimation of profits that are not reflected in effective productivity. On the other hand, Sharebenefmnet shows a significant coefficient, but with a high p-value, suggesting that its impact on productivity is less clear and requires cautious interpretation.

6. Conclusion

The analysis carried out provides a comprehensive understanding of how the financial health of the shareholder and other variables influence the productivity of Ecuadorian companies. The results confirm that both capital and labor are key factors in determining productivity, as expected according to the Solow model. However, the impact of shareholder financial health and shareholding on productivity suggests that these variables play complex roles in the business environment.

The presence of heteroskedasticity and the lack of normality in the data underline the importance of applying robust techniques to obtain valid inferences. Correction for heteroskedasticity reveals that higher shareholder financial health is associated with higher productivity, while higher shareholding tends to reduce productivity, which could imply a detrimental effect of ownership structure on firm efficiency.

These findings have significant implications for shareholders and business managers in Ecuador, suggesting that improving financial health can be an effective strategy to increase productivity. Furthermore, the implications for ownership structure and profitability must be carefully considered in management strategies to optimize productive performance. Future research could further explore the causal relationships and consider additional variables that may affect productivity in different contexts.

This study, while insightful, has limitations. First, it relies on cross-sectional data, which limits the ability to establish causality between shareholder financial health, ownership structure, and productivity. Second, the analysis does not consider sectoral dynamics or macroeconomic factors that may influence firm performance. Finally, potential endogeneity issues, such as reverse causality between productivity and financial health, remain a concern.

Future research could benefit from panel data to better capture dynamic relationships over time and strengthen causal inferences. Furthermore, expanding the model to include qualitative variables such as corporate governance practices, managerial competence, or market competition could provide a more nuanced understanding of the determinants of productivity. Comparative studies across different regions or countries in Latin America could also shed light on whether these findings are context-specific or part of broader regional patterns.

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(Volume 29, Issue 1/ 2025), pp.37-48
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Manuscript received: 16 Sept.2024

Manuscript received in revised form: 15 June 2025

Manuscript accepted: 24 June 2025