X- Pedientes Económicos, Vol. 6 (15), Mayo – Agosto 2022, pp. 36-47

An analysis of firm and industry effects on performance of small and medium-size Ecuadorian business

Un análisis de los efectos de la empresa y la industria en el desempeño de las pequeñas y medianas empresas ecuatorianas

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Fecha de recepción: 1/06/2022, Fecha de aceptación: 8/08/2022

Abstract

In this study will assess the impact of industry and firm effects on profitability of small and medium-size business in Ecuador using a Hierarchical Lineal Model. This study concludes that business strategy and the decisions made by top management teams are more important than the sector in which company operates.

Resumen

En este estudio se evaluará el impacto de los efectos industria y los efectos firma en la rentabilidad de las pequeñas y medianas empresas del Ecuador utilizando un Modelo Lineal Jerárquico. Concluyendo que la estrategia empresarial y las decisiones tomadas por los equipos de alta dirección son más importantes que el sector en el que opera la empresa.

Keywords: firm performance, industry effect, profitability, business strategy, multilevel methods.

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I. INTRODUCTION

Profitability is one of the most important indicators in business analysis since it allows companies to grow in the medium and long term. In addition, it is the indicator that managers seek to improve for the benefit of owners and shareholders, to visualize the success of their business and increase value creation. However, there is still debate as to which determinants are the most influential in business performance.

The traditional approach posits that industries' factors are a central determinant of firm performance. There are some researchers like Mason (1939) who said that exist a determinist association between market structure and profitability, or Bain (1968) who believe that barriers to entry or seller's concentration are important because he considered that performance is a function of the structural factors of an industry.

On the other hand, Nourse and Drury (1938) suggested that the influence of the company itself (e.g., the decisions made by top management team) will determine the firm's development and advantage, and do not depend solely on industry factors, as Hrebiniak & Joyce (1985) where they say that the adaptation of the organization is a function of the environment and strategic decisions. Hence, the contrary approach said that the firm performance is determined by organizational processes and firm's capabilities, like business strategy (Rumelt, 1991) and other perspectives about internal performance.

Furthermore, these theories could be conditioned by the characteristics of the country in which the company is located; for example, there will not be the same industry effects for a U.S. company as for a Latin American company. Other studies focused on the explanation of the effects on profitability in Latin American countries, such as Tarzijan and Eylerts (2010), concluded that at the country level, external debt, openness to international trade, country risk and foreign investment have a significantly negative impact on persistence of profits, so there are macroeconomic determinants that can influence the profitability of companies and cause different impacts.

Therefore, in this study will assess the impact of industry and firm effects on profitability of small and medium-size business in Ecuador and aims to contribute to the existing empirical literature in two different ways. First, we quantify the effects and their significance according to the level of analysis (firm or industry) using a Hierarchical Lineal Model (HLM) in order to nest data for better results. Second, we quantify the effect of being located in an Ecuadorian industry. It should be emphasized that we do not seek to find a causal inference due to the endogeneity problem that exists in any decision that a company may take, however the empirical analysis here is basically descriptive.

II. BACKGROUND

By the middle of 80s', Schmalensee (1985) did research trying to estimate the importance of firm, market, and market share differences in the determination of business unit profitability, concluding with an unexpected nonexistent of firm's effects (as we can see in the Table 1), even though it was utterly consistent with a significant intra-industry profitability difference. McGahan and Porter (1997) tried to examine the importance of year, industry, corporate-parent, and business-on specific overall profitability as well as profitability in specific economic sectors. They obtained similar results as Schmalensee (1985), providing evidence that industry effects are more important than firm effects. The industry impact lasted longer than business-specific or corporate-parent effects, which was consistent with the perception industry structure changes relatively slowly.

Both researchers provide information where the traditional theory holds true, It should be noted that this theory proposed that the profitability of an industry was determined primarily by the ability of firms to restrict rivalry among themselves. Also, in this theory it is believed that the increase in concentration of firms tends to increase total industry profits.

On the other hand, Rumelt (1991) discern about Schmalensee (1985) results, dividing the effects between stable and fluctuating. Rumelt's study found that corporate effects are minimal, stable industry effects are small, and stable business-unit effects are extremely large, also show that the most important sources of economic rents are business-specific in comparison with industry membership, which is a less important source and corporate parentage is irrelevant.

Hawawini et al. (2003) examined the impact of 'outliers' on firm and industry effects trying to explain the relative importance of industry versus firm effects, He also focused determining the significance of industry factors employing alternative measures of performance. He said that industry facts have little impact on firm performance regardless of the value with which measure performance. He was also suggested that different types of firms within an industry may interpret industry-specific facts differently.

Table 1.

Percentage of variance in firms' return on assets.[(a)(b)]

	Industry effects (%)	Firm effects (%)[(c)]	Unexplained variance (%)
Schmalensee (1985)	19.59	0.62	80.41
Rumelt (1991)	4.03	45.81	44.79
Roquebert et al. (1996)	10.2	55	32
McGahan & Porter (1997)	18.68	31.71	48.40
Hawawini et al. (2003)	8.1	35.8	52
Misangyi et al. (2006)	7.6	43.8	-

a) Adapted from Grant, R. M. (2021). with some modifications.
b) The rows do not sum 100% because the authors considerer other effects.
c) "Firm effects" combine business unit and corporate effects.

Additionally, Roquebert et al. (1996) attempted to explain the percentage of the variance of ROA corresponding to industry, firm, and strategic business unit (SBU) effects. In addition, they analyzed the research results of Schmalensee (1985) and Rumelt (1991). They concluded that intra-industry variance is larger than across industry variance, where the results are similar to Rumelt (1991). Likewise, they also suggest the existence of a corporate effect, and indicate that strategic management theory has an important role to play, since, in the general case, it could have a significant impact on the profitability of SBU. Other authors have also concluded in the same way, such as Mauri & Michaels (1998) where say that firm effects are more important than industry effects on firm performance, but not on fundamental strategies such as technology and marketing.

In addition, there is also debate as to whether industry can positively or negatively affect new firms. Some researchers, such as Singh et al. (1986) and Shepherd et al. show that new firm performance is largely, and usually negatively, affected by industry conditions. While Short et al. (2009) conclude that industry effects and industry membership are less important for the survival and sales growth of new firms than for established firms, and one of the relevant results is that size affects the performance of new firms, and that new firm financing is very important.

Finally, Misangyi et al.(2006) estimated the relative relevance of industry, corporate, and business segment effects on firm performance using multilevel analysis, concluding that business segment effects are the most important while industry and corporate effects are equally significant but explains to a lesser extent business' profitability. Among the findings regarding specific factors, industry concentration and munificence, as well as the resource environment offered by corporate parents, all had an impact on performance. These findings suggest that investigators should consider both industry and corporate environments when examining performance.

III. METHODOLOGY

3.1. Data and sample

Financial information used in this work has been collected through the Superintendencia de Compañías Valores y Seguros (SCVS)[2], and we made a database with the directory and financial statements of the Ecuadorian companies that were reported to be active between 2008-2019. From this information, we had an unbalanced panel of data, since not all of the 131,072 companies that were collected, were active during the entire period to be analyzed. On the other hand, we will focus only on small and medium-sized business, which, according to the SCVS classification through a resolution issued in 2011, are companies with a gross sales value of $100,001 to $5,000,000 per year. Also, we drop 15 business that did not contain the branch of activity. Then, we proceeded to calculate the return of assets (ROA), as this financial indicator helps us to identify the economic performance of each company. However, there were very atypical data, for two reasons. First, some companies made substitutions because they reported incorrect values in their financial statements and those changes are not reflected in their financial statements. Second, some companies reported very low values in total assets, which are not considered dynamically natural because of the abrupt change in

[2] The SCVS is the technical organization, that oversees and controls the organization, activities, operation, dissolution and liquidation of companies and other entities under the circumstances and conditions established by law.

their equity accounts. Thus, in order to correctly treat outliers, only data that were within ± 3 standard deviations of the mean ROA were taken into consideration. Therefore, only 48,474 companies were analyzed in this letter, with a total of 243,854 data. Moreover, the analysis of industry effects was based upon the primary 4-digits of International Standard Industrial Classification (ISIC) code with a total of 402 types of industries. Also, the descriptive statistics and the descriptions for each branch of activity (i.e., the 1-digit ISIC code) can be found in the Appendix section.

3.2. Analysis

The methodology generally used in this type of studies is the Variance Components Analysis (VCA) and the Analysis of Variance (ANOVA), due to results provide great support for the theory development of strategic management concepts. Nevertheless these 2 types of analysis assume independence between each of the observations. Whereby, these are not the models we are looking for in this analysis, because we consider that the profitability of a company, if it is nested over time and within the same company, would share the same effect and therefore they would be dependent on each other. Hence, the ideal model would be the Hierarchical Linear Model (HLM), as it helps us to solve this difficulty, because the HLM considers the non-independence between each observation.

In our HLM analysis, we took as reference the model created by Misangyi et al. (2006) and we adapt this model with respect to the data we were able to collect. Then, we define that our unit of analysis will be the individual ROA of each firm in each reporting period —which in this letter we call as business' ROA—. On the other hand, we need to define the hierarchical or nesting levels to identify the relationship between effects which in this case is a two-level model. Thus, defining these steps previously, we begin to estimate the unconditional model (i.e., the regression without predictors) with the objective of decomposing the variance of business' ROA over time and across firms.

$$ROA_{ti} = \beta_{0i} + \epsilon_{ti} \tag{1.a}$$

$$\epsilon_{ti} \sim N(0, \sigma^2)$$

$$t = 1, 2, \dots, T_i \rightarrow \text{time periods in firms}$$

$$i = 1,2, \dots, I \rightarrow firms$$

At first level, the business' ROA at time t in firm i is modeled as a function of business' ROA mean across time (β_{0i}), plus a time-level random error, (ϵ_{ti}). The HLM assume that the ϵ_{ti} is distributed normally with mean zero and variance σ^2, hence the variance *across time* is represent by σ^2, furthermore, this model assume that this variance will be uniform among the observations for each of the i firms.

$$\beta_{0i} = \lambda_{00} + \mu_i \tag{1.b}$$

$$\mu_i \sim N(0, \psi^2)$$

At second level the business' ROA mean across time is modeled as a function of grand mean of business' ROA (λ_{00}), plus a random part called *between-firms* residual, (μ_i). Where the μ_i is distributed normally with mean zero and variance ψ^2, thus the variance *between firms* is represented by ψ^2. Hence, the unconditional model at a combined equation would be as:

$$ROA_{ti} = \lambda_{00} + \mu_i + \epsilon_{ti} \tag{1.c}$$

In order to calculate the year effects, it is necessary to incorporate these effects at the time level of analysis.

$$ROA_{ti} = \beta_{0i} + \beta_{1t} * Year + \epsilon_{ti} \quad (2.a)$$

$$\beta_{0i} = \lambda_{00} + \mu_i \quad (2.b)$$

Where Year is a matrix of dummy variables coded for each of the years included in this study for each business, and β_{it} represents the impact of macroeconomic fluctuations. Now β_{oi} represents the business' ROA mean across time adjusted for year effects.

And to calculate the industry effects, it is necessary to incorporate these effects at the firm level of analysis.

$$ROA_{ti} = \beta_{0i} + \beta_{1t} * Year + \epsilon_{ti} \quad (3.a)$$

$$\beta_{0i} = \lambda_{00} + \gamma_{0j} * Industry + \mu_i \quad (3.b)$$

$$j = 1,2,\dots,J \rightarrow industries$$

Where Industry is a matrix of dummy variables coded for each of the industries included in this study for each business, also we included an index of industries to know how long the coefficient γ_{0j} is, which represents the industry effects, and ROA_{ti} , β_{oi} , β_{1t} , λ_{00} , ϵ_{ti} , μ_i have the same meaning.

Therefore, the model incorporating years effects at Level 1 at a combined equation would be as:

$$ROA_{ti} = \lambda_{00} + \beta_{1t} * Year + \mu_i + \epsilon_{ti} \quad (2.c)$$

And the model incorporating year effects at Level 1 and incorporating industry effects at Level 2 at a combined equation would be as:

$$ROA_{ti} = \lambda_{00} + \beta_{1t} * Year + \gamma_{0j} * Industry + \mu_i + \epsilon_{ti} \quad (3.c)$$

3.3. Results

We estimated the unconditional model (i.e., Equation 1.C) to determine the amount of variance that will be assigned to each type of effect. The variance of this model is decomposed into 2 components, the variance across time σ^2 and the variance between firms ψ^2, then we calculate the proportion of variance across time as: $\sigma^2/(\sigma^2 + \psi^2)$, and the proportion of variance between firms as: $\psi^2/(\sigma^2 + \psi^2)$, where the proportion of total variance in business' ROA that is produced over time is 61.37% which will be broken down into 2 parts (time and year effects), and the variance in business' ROA that is produced between firms is 38.63% which will be broken down into 2 parts (firm and industry effects). Those results can be observed in the Table 2.

Then, to capture the variance explained by year effects, we needed to estimate the Equation 2.C and compare the variance estimated at time-level in this model with the variance estimated at time-level in the unconditional model. We believe that by adding the dummy variables to explain the year effects, the variance at this level should be lower to have a positive effect, thus, the effect was calculated as: $(\sigma^2_{eq.1c} - \sigma^2_{eq.2c})/(\sigma^2 + \psi^2)_{eq.1c}$. Hence the year effects amount to 4.74% of total variance in business' ROA, also this effect refers to the factors occurring basically on the country where the business is located as inflation, foreign direct investment, country risk, among others, considering these impacts as macroeconomic

fluctuations, these effects are associated at the temporal level so we expected that if these factors are added the year effects should increase.

On the other hand, to calculate the time effects, that is considered to be a year-to-year variation, a subtraction is made between the variance over time and year effects, where we have that is the largest effect of the variance in the business' ROA with 56.63%.

Then, industry effects are obtained by comparing the reduction of the estimated business-level variance in the Equation 3.C with the estimated business-level variance in the Equation 2.C, considering that the variance at this level should be lower to have a positive effect, so the effect was calculated as: $(\psi^2_{eq.2c} - \psi^2_{eq.3c})/(\sigma^2 + \psi^2)_{eq.2c}$, thus, we observe that the total variance explained by industries' effects amount to 4.20% of total variance in business' ROA.

Table 2

HLM estimation of variance

	Variance estimate	Std.	[95% Conf. Interval]	
Unconditional model				
Level 1 variance across time	0.0109233***	0.0000358	[0.0108533	0.0109937]
Level 2 variance between firms	0.0068766***	0.0000743	[0.0067329	0.0070241]
Percentage of total variance across time	61.3672%			
Percentage of total variance between firms	38.6328%			
Model incorporating year effects at Level 1				
Level 1 variance across time	0.0100793***	0.0000332	[0.0100147	0.0101446]
Level 2 variance between firms	0.0078411***	0.0000806	[0.0076853	0.0080011]
Total variance explained by year effects	4.7416%			
Model incorporating year effects at Level 1 and industries' effects at Level 2				
Level 1 variance across time	0.0100876***	0.0000332	[0.0100228	0.0101528]
Level 2 variance between firms	0.0070892***	0.0000755	[0.0069441	0.0072373]
Total variance explained by industry effects	4.1958%			

The estimated variances in this model are statistically significant at the 0.01 significance level. In addition, to adjust the effects of time it is necessary to reducing the percentage of total variance across time that was estimated in the unconditional model by the total variance explained by year effects estimated in the Equation 2.C, obtaining an estimated time effect of 56.63%. Moreover, the firm effects, calculated by reducing the percentage of total variance between firms estimated in the unconditional model by the amount of the variance explained by industry effects estimated in the Equation 3.C, are estimated to be 34.44%. Finally, we replicated the same analysis but this time considering the standard deviation of each estimated variance, because Brush and Bromiley (1997) recommend using the estimated standard deviation when evaluating relative importance due to it is not linearly related to the percentage of variance explained. However, these results will only serve as a reference for the reader in this analysis.

The results obtained in the Table 2. show that firm effects are stronger than industry effects. Specifically, industry effects (estimated by 4.20%) represent a smaller amount of the total estimated variance, while firm effects (estimated by 34.44%) represent a greater amount. Furthermore, comparing our results with Misangyi et al. (2006), as can be seen in the Table 3, it could be said that the decisions made by managers play a fundamental role in both studies.

Moreover, comparing our result with Misangyi et al. (2006), we can see that year effects of USA companies are lower than the Ecuadorian companies, and this may be due to the fact that they are two countries with totally different economies.

Table 3.

Comparison of final HLM results

	Final HLM Results		Misangyi et al. (2006)	
Country	Ecuador		U.S.A	
Year's coverage	2008-2019		1984-1999	
Sectoral coverage	Small and medium-size business		All	
% of total	*Variance*	*Std. Dev.*	*Variance*	*Std. Dev.*
Time	56.63	(53.56)	47.8	(35.8)
Firms[(a)]	34.44	(41.94)	43.8	(45.3)
Industry	4.20	(2.30)	7.6	(14.3)
Year	4.74	(2.20)	0.8	(4.6)

(a) In Misangyi et al. (2006) results, firm effects are captured by the sum of business segment effects and corporate effects.

IV. CONCLUSION

Previous relevant literature has evidenced different conclusions that have tried to explain how company and industry effects can affect the profitability of a business have different conclusions according to the data they obtained and the model they applied. In this study we can contribute to the literature with 3 important points.

First, that business strategy is more important than the sector in which company operates. Second, we believe that macroeconomic fluctuations are more relevant in countries where there is greater uncertainty, such as Latin American or developing countries, however this effect influences a smaller amount. Third, a company will not obtain a higher profitability simply because it belongs to the most representative branch of activity in terms of annual gross revenues, but that it will depend on the capabilities of each company and the management carried out by top management team or the decision-makers.

The limitations of this work could be the accuracy of the data because some of the financial statements reported by the companies had inconsistencies. Another limitation may be the classification used by the regulator, since there may be other determinants that allow companies to be classified in a better way.

Future lines of research could be directed at finding which determinants are the most influential on firm effects so that managers focus more on the business strategies they should pursue or focus on new ways of approaching a firm's success and performance other than solely financial profitability. It would also be interesting enhance this work by adding more variables and interactions with the aim of finding which macroeconomic variables most affect the profitability of a business in a developing country.

Appendix

Appendix A

Description of Industries

Code	Description
A	Agriculture, livestock, forestry, and fishing.
B	Mining and quarrying.
C	Manufacturing industries.
D	Electricity, gas, steam, and air conditioning supply.
E	Water distribution; sewerage, waste management and sanitation activities.
F	Construction.
G	Wholesale and retail trade; repair of motor vehicles and motorcycles.
H	Transportation and warehousing.
I	Accommodation and food service activities.
J	Information and communication.
K	Financial and insurance activities.
L	Real estate activities.
M	Professional, scientific, and technical activities.
N	Administrative and support service activities.
O	Public administration and defense; compulsory social security schemes.
P	Teaching.
Q	Human health care and social assistance activities.
R	Arts, entertainment, and recreation.
S	Other service activities.
T	Activities of households as employers; undifferentiated activities of households as producers of goods and services for own use.

Appendix B

Descriptive statistics of industries

	Obs.	Mean of ROA	Std. Dev.	Min	Max
A	20,891	4.8942%	0.1185515	-54.3557%	66.3580%
B	2,503	5.2618%	0.1389265	-52.5300%	66.2854%
C	27,057	5.4781%	0.1116886	-53.7033%	65.8956%
D	1,004	5.5537%	0.122564	-47.4020%	66.3000%
E	1,024	7.5997%	0.1221929	-42.7398%	65.3881%
F	16,257	7.7185%	0.1339773	-53.6340%	66.3007%
G	68,641	5.5983%	0.1075582	-54.4350%	66.2442%
H	22,148	8.2226%	0.1431521	-54.0870%	66.2792%
I	6,905	4.6388%	0.1384535	-54.0758%	65.8214%
J	9,032	7.2459%	0.1505951	-54.5714%	66.0202%
K	3,340	8.7613%	0.1484167	-52.6590%	66.0414%
L	11,428	5.9943%	0.1150486	-53.7731%	66.3657%
M	25,172	8.7655%	0.1468472	-54.4944%	66.2650%
N	16,340	7.2261%	0.1405293	-54.3517%	66.2764%
O	18	7.6563%	0.1318759	-4.0862%	53.5492%
P	3,676	5.1224%	0.1400402	-53.9841%	65.6226%
Q	5,833	6.9715%	0.1353198	-53.9101%	65.9981%
R	952	5.6552%	0.1609978	-54.1948%	61.7497%
S	1,618	7.2101%	0.147707	-54.3792%	65.2255%
T	15	9.1663%	0.1796021	-15.9979%	59.6635%

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