Econometric analysis of the financial sustainability of Popular and Solidarity Economy organizations

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Abstract

The presence of unique economic events, such as the COVID-19 pandemic, tests the ability of organizations to survive and become stronger. In this context, the concept of financial sustainability becomes relevant to assess the vulnerability of organizations. This study evaluates the financial sustainability of popular and solidarity economy organizations in Ecuador, using an econometric approach. We used 479 cooperatives and 507 associations that met the necessary characteristics for the study. The econometric model was structured with the natural logarithm of the indicators of leverage, profitability, soundness and liquidity. The results reveal that financial sustainability in social and solidarity economy organizations is directly affected by the levels of indebtedness and profitability, as well as by the equity structure, which is the factor that most contributes to reducing financial vulnerability.

Keywords: Social and solidarity economy, Ecuador, financial sustainability, nonprofit, financial vulnerability, financial vulnerability.

DOI Number: 10.14704/nq.2022.20.13.NQ88136 **Neuro Quantology 2022; 20(13):1073-1081**

Resumen

La presencia de hechos económicos únicos como la pandemia producida por el COVID-19, ponen a prueba la capacidad de las organizaciones para sobrevivir y fortalecerse. En este contexto, el concepto de sostenibilidad financiera se vuelve relevante para valorar la vulnerabilidad de las organizaciones. Este estudio evalúa la sostenibilidad financiera de las organizaciones de la economía popular y solidaria del Ecuador, mediante una aproximación econométrica. Utilizamos 479 cooperativas y 507 asociaciones que cumplieron las características necesarias para el estudio. El modelo econométrico se estructuró con el logaritmo natural de los indicadores de apalancamiento, rentabilidad, solidez y liquidez. Los resultados revelan que la sostenibilidad financiera en las organizaciones de la economía social y solidaria, se ve afectada de forma directa por los niveles de endeudamiento y rentabilidad, así como por la estructura patrimonial, que se constituye en el factor que más aporta a reducir la vulnerabilidad financiera.

Palabras clave: Economía social y solidaria, Ecuador, sostenibilidad financiera, no lucrativo, vulnerabilidad financiera

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1. Introduction

Financial vulnerability is defined as reducing a nonprofit's operations in the face of an occasional economic shock (Tuckman and Chang, 1991Tumini & Wilkis, 2022). For their part, Barzaga et al. (2018) point out that vulnerability is related to the weaknesses and threats that constitute factors that significantly impact the occurrence of financial risk and conflict with the fulfillment of its objectives (Vaca & Orellana, 2020). This concept is complemented by the concept of financial sustainability proposed by Bowman (2011), who defines it as the capacity of an organization to face unfavorable economic situations in the short term and to strengthen its operating structure in the long term; similar arguments are proposed by De la Vega et al. (2015) Guerrero(2017), Macìas and Toala (2022).

In this context, a large part of the studies of financial vulnerability in nonprofit organizations has been addressed through the evaluation of financial indicators (1991) Chang and Tuckman (1994), Tevel et al. (2015) Searing (2018) Greenlee (2000), Keating et al. (2005) Frumkin and Keating (2011) Mazanec et al. (2022). In addition, derivations have also been developed, including perspectives and methodological approaches such as the proposal by Acosta and Betancourt (2014) or Marconatto et al. (2019).

Specifically, Ecuador presents a particular case by defining a set of organizations as part of the so-called social and solidarity economy and that can be defined as the set of resources, capacities and activities of the institutions that regulate the appropriation and disposition of resources in the realization of production, distribution, circulation, financing and consumption activities, carried out by workers, their domestic units (family and communal), and the specific organizations that occur by extension to achieve such ends (single-person and family enterprises, mutual aid networks, boards with economic management purposes, cooperatives and various associations) (Puerta and Gallardo, 2014).

For practical purposes, these organizations meet the characteristics of nonprofit institutions proposed by the IMF, i.e., "...they are legal or social entities, created to produce or distribute goods and services, but may not be sources of income, profit, or another financial gain for the institutional units that control them..." (International Monetary Fund, 2014).

In this line, the main objective of this article is to evaluate the financial sustainability of organizations of the popular and solidarity economy in Ecuador through an econometric approach that integrates the theoretical approaches of Tuckman and Chang (Tuckman & Chang, 1991) (Abraham, 2003), (Bowman, 2011) and (Greenlee & Trussel, 2000), and its structure begins with a description of the data sample used and the econometric model proposed; subsequently, the results obtained using the financial variables and the proposed econometric model are presented. Finally, the main conclusions that allow to discuss their implications can be observed.

Methodology

Type and design of research

The research approach was quantitative of an explanatory type; the database of the Superintendence of Popular and Solidarity Economy of Ecuador was used(2022), specifically the financial statements of the cooperative and associative sector for the year 2021 to evaluate financial sustainability through the proxy liquidity variable, which is an approximation to Bowman's (2011) proposal that analyzes the determinants of financial sustainability from the point of view of the different financial indicators belonging to the dimensions of profitability, leverage and soundness. They are also related to performance indicators KPI (Key Performance Indicator), whose financial format with statistical treatment is used to evaluate the success and performance of an organization, in the opinion of Sobati-Moghadam, S., & Fayoumi (2019), their result as a measure of effective management, ensures the permanence in the market of both cooperatives and associations.

Unit of analysis

The numerical data are cross-sectional and correspond to 479 non-financial cooperatives and 507 associative organizations, in both cases at the national level, allowing to identify of the results at the macro level in these two sectors of the Popular and Solidarity Economy; the log-log

model is used to determine the cause-effect relationships. Thus the data of the financial indicators are transformed to ln, therefore, in rates. The model is known as the Elasticities model (Gujarati and Porter, 2010). Table 1 shows the number of EPS organizations at the national level during 2021 that presented financial statements. The data cleaning consisted of eliminating those organizations that presented incomplete information, which consequently did not allow the construction of the financial indicators required for the processing and methodological development.

Table 1

Number of non-financial associations and cooperatives included in the study

Year 2021	Initial number on the SEPS records	Organizations eliminated	Organizations used in the analysis
Cooperatives	1189	710	479
Associations	3238	2731	507

Note: Database of the Superintendencia de Economía Popular y Solidaria (2022).

Data collection and processing techniques

A documentary analysis of the financial statements submitted by cooperatives and associations of the Non-Financial Sector of the Popular and Solidarity Economy was carried out for the information necessary for the calculation of the financial indicators of liquidity, equity indebtedness, internal leverage, external leverage, ROA, ROE, profitability in sales, soundness. Finally, as part of the data treatment, the study proceeded with the calculation of natural logarithms to the results of the indicators, thus ensuring a strictly monotonic increasing transformation, where effectively the transformed model is equivalent to the original model, obtaining solid results with an adequate interpretation of the coefficients, unlike other results that treat the original data without obtaining any warning signal that warns about the risk of making decisions based on models that do not adequately describe the trends of the point cloud (Ortiz Pinilla & Gil, 2014).

Estimates using the logarithmic transformation were obtained through a model:

$$Yi = \beta_0 X^{\beta 2} i\, e^{ui} \qquad (a)$$

where:

$$lnYi = ln\ \beta_0 + \beta_2\ ln\ X_i + u_i \text{ (b)}$$

If we write (a) as (b) $lnY_i = \beta_0 + \beta_1\ ln\ X_i + u_i$ where $\beta_0 = ln\ \beta_1$, this model is linear in the parameters β_0 and β_1, linear in the logarithms of the Y X variables, and is estimated by OLS regression. Because of this linearity, such models are called log-log, double-log or log-linear models. If the assumptions of the classical linear regression model are met, the parameters of $ln\ Y_i = \beta_0 + \beta_1\ ln\ X_i + ui$ are estimated by the Ordinary Least Squares method, considering that $Y^*_i = \beta^*_0 + \beta^*_1\ X^*_i + u_i$, *where* $Y^*_i = ln\ Y_i$ and $X^*_i = ln\ X_i$. and the OLS estimators obtained, $\beta^*_1, \beta^*\ \beta^*_{2\ldots}\ \beta^*_n$ will be the best linear unbiased estimators of β_1, β_2 ... β_n respectively.

The data processing was performed with specialized software to interpret the data econometrically and infer the results for the entire population.

Model proposed

The units of analysis correspond to the financial indicators of the cooperatives and associations of the EPS, whose model is applied separately because the latter reach higher sales levels by offering a diversity of goods and services that are indispensable for the population, such as those characterized within agricultural production, textiles, raw materials and inputs, among others. In contrast, the cooperatives refer exclusively to the transportation service that registers lower income due to the lack of issuing invoices; however, the movement of transactions for services is high. The basic model proposed is as follows.

Table 2

Log-log econometric model, data treatment and researcher's hypothesis

Model Cooperatives and Associations	$\boldsymbol{lnY_i} = \beta_0 + \beta_1 \ln X_i + \beta_2 \ln X_2 + \beta_3 \ln X_3 + \beta_4 \ln X_4 + \beta_5 \ln X_5 + \beta_6 \ln X_6 + \beta_6 \ln X_{6+} u_i$			
lnY_1	*Liquidity*	*Liq*	*Financial sustainability indicator variable*	
lnX_1	*Equity indebtedness*	*End_Pat*	*Liabilities/Equity*	$H_{1a:}$ B1 ‡0
lnX_2	*Internal leverage*	*Apa_int*	*Equity/Assets*	$H_{2a:}$ B1 ‡0
lnX_3	*External leverage*	*Apa_ext*	*Liabilities/Assets*	$H_{3a:}$ B1 ‡0
lnX_4	*ROA*	*ROA*	*Utility/Assets*	$H_{4a:}$ B1 ‡0
lnX_5	*ROE*	*ROE*	*Equity/ Assets*	$H_{5a:}$ B1 ‡0
lnX_6	*Profitability in sales*	*Ren_Vtas*	*Profit/Sales*	$H_{6a:}$ B1 ‡0
lnX_7	*Solidity*	*Solz*	*Assets/Liabilities*	$H_{7a:}$ B1 ‡0

4. Results

Table 3 shows that the ROA indicator of the EPS associations far exceeds the ROA of the cooperatives by 23 percentage points, and concerning the Return on Equity, the former organizations reach 6%. At the same time, the cooperatives also lag with an average of 0.74%; however, due to the high number of transactions of the cooperatives, although their income value is negligible, the real profitability cannot be estimated, as indicated due to the lack of invoicing records. Nevertheless, it is estimated that the associative sector, on average, will recover its invested capital in four years.

Table 3

Average of the main financial indicators of the cooperative and associative sector of the Popular and Solidarity Economy, period 2021

EPS Organizations	**Associations N =507**	**Cooperatives N=479**
Indicators	Media.	Media
Liquidity	3,12559508	3,824953349
Equity Indebtedness	0,46560488	0,200186071
Internal Leverage	0,20223455	0,576278881
External Leverage	0,10923055	0,115363005
ROA	0,23459923	0,004280294
ROE	0,06022943	0,007427469
Return on sales	4,94475352	0,011759212
Solidity	3,12559508	8,668290155

Log-Log Model

Pearson's correlation was used to evaluate the effect of financial variables on sustainability. The selection of variables took as a reference the theoretical proposals of Bowman (2011) Tuckman and Chan (1991) and Peláez et al. (2022). The liquidity indicator represents financial sustainability, and the variables soundness, equity indebtedness, internal and external leverage, ROE, ROA, and profitability over sales are evaluated with their respective financial indicators.

By obtaining the correlations and matching them with the relationships determined by the theory, the following results are reached and presented in Table 4, evidencing that cooperatives and associations, by having more indebtedness and any type of leverage both internal and external, obtain less liquidity, that can be translated into less stability (Gil-Leon et al., 2018) and therefore attempt to financial sustainability.

Table 4

Correlations between liquidity and other financial indicators of the HPS non-financial associations and cooperatives.

ASOCIACIONES		Liq	End_Pat	Apa_Int	Apa_Ext	ROA	ROE	Ren_Vtas	Solz
Liq	Correlación de Pearson	1	-,684**	,396**	-,748**	,125**	-0,046	,116**	,748**
	Sig. (bilateral) p=0,05 N =507		0,000	0,000	0,000	0,005	0,299	0,009	0,000
COOPERATIVAS NO FINANCIERAS		Liq	End_Pat	Apa_Int	Apa_Ext	ROA	ROE	Ren_Vtas	Solz
Liq	Correlación de Pearson	1	-,717**	,377**	-,767**	0,057	-0,067	,107*	,767**
	Sig. (bilateral) p=0,05 N =479		0,000	0,000	0,000	0,214	0,144	0,019	0,000
Relaciones esperadas entre Liquidez y los demás indicadores (Bowman & Abraham)									
Tipo de relación			-	+	-	+	+	+	+

Once the correlation between the financial indicators has been determined, the influence of the explanatory variables on liquidity is determined using the multiple OLS method, which also indicates which variables best explain sustainability.

Goodness of fit and ANOVA analysis

Table 5 shows, in the first instance, the goodness of fit of the model where R^2, as the coefficient of determination, denotes the proportion of variance of the dependent variable that is explained by the independent variables, thus 60.6% and 57.4% of the liquidity of the EPS cooperatives and associations is explained by the predictors in general raised in the model. The Pearson R correlation coefficient in both cases indicates a high degree of association in the model. The ANOVA analysis allows contrasting H0: Population value of R =0; H1: Population value of R≠0, where p= 0.000 <0.05 in both cases, i.e., H0 is rejected; consequently, the variables are linearly related, the model fits globally, besides pointing out that the F Test evaluates the explanatory capacity that the independent variables together have on liquidity as a financial sustainability ratio.

Table 5

Summary of econometric models

Modelo	R	R cuadrado	R cuadrado ajustado	Error estándar de la estimación	Estadísticos de cambio			ANOVA	
					Cambio en R cuadrado	gl1	gl2	F	Sig.
1 Cooperativas	0,778[a]	0,606	0,603	1,104367641	0,606	4	474	182,144	,000[b]
1 Asociaciones	0,757[a]	0,574	0,570	1,130445620	0,574	4	502	168,951	,000[b]

a. Predictores: (Constante), LN_SOLIDEZ, LN_ROA, LN_APA_INTERNO, LN_REN_VENTAS

b. Variable dependiente: LN_LIQUIDEZ

Coefficients

Once the correlation, non-collinearity and multicollinearity tests have been validated, where the latter proves the assumption of dependence between the regressor variables, since the VIF is less than 5 in all cases, the multiple linear regression model is constructed with the partial regression coefficients shown in Table 6 indicating the significance where the criterion that proves the specific hypotheses of this study is that sig=0.05; that is p<0.05.

Table 6

Coefficients of the multiple regression equations

	Coeficientes no estandarizados		Coeficientes estandarizados			Estadísticas de colinealidad
Cooperativas	B	Desv. Error	Beta	t	Sig.	VIF
(Constante)	-0,192	0,150		-1,280	0,201	
APALANCAMI_INTERN	-0,205	0,072	-0,100	-2,839	**0,005**	1,496
ROA	0,142	0,036	0,207	3,937	**0,000**	3,338
RENTA_VTAS	-0,117	0,038	-0,161	-3,042	**0,002**	3,353
SOLIDEZ	0,775	0,033	0,846	23,396	**0,000**	1,572
Asociaciones						
(Constante)	-0,228	0,124		-1,843	0,066	
LN_APA_INTERNO	-0,127	0,062	-0,075	-2,042	**0,042**	1,590
LN_ROA	0,100	0,027	0,137	3,698	**0,000**	1,622
LN_REN_VENTAS	-0,039	0,031	-0,046	-1,237	0,217	1,607
LN_SOLIDEZ	0,866	0,039	0,791	22,138	**0,000**	1,503

a. Variable dependiente: LN_LIQUIDEZ

b. Predictores en el modelo: (Constante), LN_SOLIDEZ, LN_ROA, LN_APA_INTERNO, LN_REN_VENTAS

The equations that determine the coefficients are the following for the cooperatives(1) and associations (2).

1.) *Ln Liquidity= -0.192 - 0.205Apa_In +0.142ROA- 0.117 Ren_Vtas +0.775Solz +u*
2.) *Ln Liquidity= -0.228 - 0.127Apa_In +0.1ROA- 0.039 Ren_Vtas +0.866Solz +u*

The positively and inversely related variables from the regression models coincide with the expected relationships proposed by the authors Bowman (2011) and Abraham (2003), except for the relationship between liquidity and ROE as one of the profitability indicators. Solidity in relative value has a greater influence on financial sustainability measured from the perspective of liquidity since as long as all variables are constant, the liquidity ratio of non-financial cooperatives on average increases by 0.77% due to the 1% increase in solidity; this value is significant at 0.05 where p-value turned out to be

p=0.000. For associations, liquidity increases on average 0.866% as the ratio of solidity, ceteris paribus internal leverage, ROA and profitability in sales increases by 1%.

Hypothesis Testing

H_{1a}: $\beta_1 \neq 0$ and H_{1c}: $\beta_3 \neq 0$ are not estimated since, in the multicollinearity tests, they presented a value higher than 10 in VIF, and regarding the other predictor variables, the results and significance as hypothesis test of the partial regression coefficients, are presented in Table 7 where the criterion is $p<0.05$ H_0 is rejected; consequently H_1 is accepted.

Table 7

Hypothesis testing

Research hypothesis	Cooperatives	Associations
H_{1b} : $\beta_2 \neq 0$	Accepts variable sig.	Accepts variable sig.
H_{1d} : $\beta_4 \neq 0$	Accepts variable sig.	Accepts variable sig.
H_{1e} : $\beta_5 \neq 0$	Accepts variable sig.	Accepts variable sig.
H_{1f} : $\beta_6 \neq 0$	Accepts variable sig.	Rejects variable sig.
H_{1g} : $\beta_7 \neq 0$	Accepts variable sig.	Accepts variable sig.

5. Discussion and conclusions

The development process of the popular and solidarity economy is directly linked to the promotion of entrepreneurship. However, not all the activities undertaken have been economically successful for the beneficiaries (Arias Casillas, 2018). Along the same lines, financial sustainability for profit and nonprofit organizations of resources can take advantage of opportunities and react to unexpected threats, maintaining general operations and a good performance and viability pattern (Bowman, 2011). In this context, this research results show that the cooperatives' ROA is not acceptable, negatively affecting their sustainability. In the case of the ROE indicator, as a control variable on sustainability, it is unfavorable for both cooperatives and associations.

Castillo and García (2013) point out that a company with a consolidated structure, with long-term payment capacity, which generates its resources and has liquidity in the short term, increases its chances of being successful; it also mentions that the profitability of companies comes from (a) its structure related to its capitalist condition over the cooperative society characteristic; (b) its size; (c) financial structure (based on own resources and liquidity); contrasting with our results, it is evident that the variables with statistical significance called solidity, internal leverage and ROA for both cooperatives and associations are predictors of financial sustainability measured by liquidity and, additionally the variable profitability in sales in the case of cooperatives.

Goddard et al. (2006), in the study to determine the variants that determine the profitability of companies, their results indicate that the leverage ratio of a firm and its profitability is negative. However, some companies have greater liquidity and are more profitable; the research resulted in a negative relationship between ROE and liquidity, contradicting the theory and relationship mentioned here. Likewise, Zambrano Farias et al. (2021) mentioned that according to some authors, factors such as the level of indebtedness, short-term liquidity and the size of the company have a strong and positively significant relationship with business performance, contrasting with the fact that the present study showed an inverse relationship between internal leverage and liquidity. Therefore, the model presented in this article can be used to predict the contribution of each indicator in reducing the financial vulnerability of Popular Solidarity Economy organizations and should be complemented with a rigorous analysis of the legal and economic environment surrounding them.

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