Profitability, Customer, Operations, And Logistics Management in MSMEs During The COVID-19 Pandemic

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Abstract

This study analyzes the effects of customer management and operations/logistics management with suppliers on the profitability of micro, small, and medium enterprises (MSMEs) during the COVID-19 health crisis in Costa Rica. The researchers collected data between February and May 2021 and used a multinomial regression model to test their theoretical model. The results indicate that higher perceived problems in customer-firm relationships and operations/logistics management significantly impact the profitability of MSMEs. Notably, small and medium enterprises are more affected in terms of profitability than microenterprises when facing more significant issues in customer management. The study underscores the importance of enhancing operational capacity during crises and highlights the need for managers to acquire new competencies to face future adverse scenarios.

Keywords: MSMEs; profitability; customer relationship management; operations and logistics management; COVID-19.

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1. Introduction

In March 2020, the declaration of COVID-19 as a global pandemic prompted governments to implement measures to contain its spread. These actions resulted in worldwide economic consequences (Jawad et al., 2021; Song & Zhou, 2020). Micro, Small, and Medium Enterprises (MSMEs) were particularly affected, facing supply, demand, and financial market challenges due to the pandemic's impact. These pandemic challenges reduced revenues for half of global MSMEs and a third of firms facing a mere one-month cash flow, resulting in temporary closures and increasing unemployment rates (OECD, 2020).

The pandemic's influence on MSMEs was exacerbated by preexisting issues, as Cowling et al. (2020) demonstrated. These issues included a lack of internal resources, funding constraints, business informality, and restricted decision-making structures. MSMEs represent around 90% of global businesses and contribute 50%-70% of employment opportunities, so they are the "lifeblood" of the global economic system (Lin et al., 2022; OECD, 2017).

Consequently, research exploring the impact of the COVID-19 pandemic impact on MSMEs has gained academic interest, with scholars adopting several perspectives (Cowling et al., 2020; Dai et al., 2021; Lu et al., 2020; Pedauga et al., 2022). Some research areas during the health crisis were technological adaptability (Ganlin et al., 2021; Guo et al., 2020), risk and crisis management (Grondys et al., 2021; Kukanja et al., 2020; Sánchez-Báez et al., 2023), and innovation in business models (Bivona & Cruz, 2021; Clauss et al., 2022).

However, the research on MSMEs and crisis management is not new, highlighting previous studies conducted in different crisis contexts. Carbó-Valverde et al. (2016) explored alternative credit forms used by SMEs during the economic crisis in Spain, while Marino et al. (2008) investigated SMEs perceptions of strategic alliances during the Asian crisis. Simón-Moya et al. (2016) evaluated the survival rates of SMEs during economic crises against periods of growth.

Despite the widespread research generated in recent years about SMEs and the crisis context, studies have yet to assess the impact of the COVID-19 pandemic on the operational management and profitability of MSMEs in the Latin American context. Thus, this research aims to fill that knowledge gap by examining the effect of customer and supplier management on the profitability of Costa Rican MSMEs during the health crisis. This research analyzed 282 valid observations of Costa Rican MSMEs from the Ibero-American Observatory of SMEs (FAEDPYME, 2022), collected between February and May 2021. The data were obtained through virtual surveys with telephone follow-up and processed using multinomial regression techniques in STATA software.

The findings revealed that as perceived problems in customer and supplier management increased, profitability was negatively impacted. However, when considering firm size as a moderating factor, the negative impact on profitability varied concerning challenges in customer management. This finding highlights the differentiated response capacity of small businesses in managing customer-firm relationships during a health crisis.

Unlike previous studies that identified customer and supplier management as positive moderators of profitability (Hong Duong & Ha, 2021; Waqas et al., 2022), this research provides new knowledge by examining these factors in the context of crises. As a result, this research contributes to understanding MSME's performance and crisis management from a developing country's perspective. The study's

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novel approach includes managers' perceptions regarding commercial and logistic aspects, offering a microeconomic perspective on the impact of COVID-19 compared with previous sectorial and macroeconomic approaches.

The article is organized as follows. The second section describes the theoretical basis. The third section discusses the sources of information, variable selection, and data processing methodology. Subsequently, the fourth section presents the main results of the models. The fifth section presents a discussion and compares with previous research. Finally, the sixth section provides conclusions, limitations, and future research avenues.

2. Literature review and hypothesis

2.1. Relationship between customer management and MSME performance

From a market orientation perspective, companies prioritize building deep and sustainable customer relationships (Rahimi & Kozak, 2017; Vorhies et al., 2011). This trend aligns with the customer relationship management (CRM) approach, encompassing strategies, activities, and technologies that oversee interactions with current and potential customers, integrating the efforts of several departments (Giannakis-Bompolis & Boutsouki, 2014; Winer, 2001).

Payne & Frow (2005) emphasize that CRM facilitates grasping unmet needs and co-creating value with customers. This idea leads to enhanced customer satisfaction (Valmohammadi, 2017), enhanced customer loyalty (Hong-Kit Yim, Anderson & Swaminathan, 2004), and greater economic value from the customer portfolio overtime (Nenonen & Storbacka, 2016).

Multiple studies have confirmed the positive correlation between customer management and firm performance (Chang, Park & Chaiy, 2010; Reinartz, Krafft & Hoyer, 2004; Wang & Feng, 2012). This relationship has been explored across dimensions such as profitability and costs (Buttle, 2002; Coltman et al., 2011; Krasnikov et al., 2009), customer knowledge management (Chaithanapat et al., 2022), sales process efficiency (Haislip & Richardson, 2017), customer attitude (Chang, Wong & Fang, 2014), and customer management (Foltean et al., 2019; Josiassen et al., 2014).

Despite these benefits, implementing CRM presents challenges involving financial investments, organizational capabilities, customer-aligned culture, and coherent information systems (H. H. Chang, 2007; Reinartz et al., 2004; Y. Wang & Feng, 2012). In addition, Soltani et al. (2018) and King & Burgess (2008) highlight these factors as decisive for CRM success.

Implementing and managing customers creates challenges for SMEs due to limited resources, capabilities, and knowledge compared with larger corporations (Bharati & Chaudhury, 2009). Furthermore, SMEs face scale disparities, constrained customer bases, cash flow issues, and limited market influence (Krajnajova et al., 2015), hindering customer attraction and retention efforts.

Fairlie and Fossen (2021) recently identified high fixed costs and market knowledge gaps as characteristic features in the context of SMEs. Pandemic-induced difficulties further hindered CRM execution, damaging customer-firm ties and affecting profitability. During the pandemic context, recent studies reveal that in the presence of danger or risk, strong emotions or hope and fear can suddenly change consumer behavior (Kim et al., 2022; Szymkowiak et al., 2021), negatively impacting SME customer-firm relationships among ongoing strategies.

In this regard, Cerdá Suárez et al. (2023) identify that during the COVID-19 pandemic, small and medium-sized companies accelerated market innovation and adjusted product and service portfolios. Many firms reported negative results during the health crisis, highlighting the importance of investment, market orientation, and planning in crisis management. Euromonitor International's (2022) global survey confirms a change in purchasing behavior due to customer management challenges pre-pandemic and during the crisis. An assessment of 2019-2021 across 40 countries indicates less efficacy of customer loyalty programs in boosting sales conversion (2019: 29.6% and 2021: 26.2%) and a rise in customers delaying purchases (2019: 17.5% and 2021: 20.5%).

The health crisis amplified constraints that hamper MSMEs' customer management. From this evidence, our paper proposes the following hypothesizes:

H1: The greater the difficulty in managing customer relationships, the more negative the impact on the profitability of MSMEs during the COVID-19 pandemic.

H2: Company size positively moderates the effect between difficulties managing customer relationships and the negative impact on the profitability of MSMEs during the COVID-19 pandemic.

2.2. Relationship between operations and logistics management and MSME performance

Operations and logistics management are crucial elements of supply chain management (SCM) (Banbury, 1975; Beamon, 1999). This approach emphasizes the integration of supply chain actors and their internal processes to enhance product and service distribution efficiency through mutual collaboration (Arend & Wisner, 2005; Barusman & Habiburrahman, 2022; Lummus & Vokurka, 1999; Nakano, 2020). From a demand perspective, SCM practices have gained acceptance due to shorter product life cycles and delivery time pressures (Lockamy, 2012; Söderberg & Bengtsson, 2010a). From a supplier standpoint, SCM implementation relates to a competitive environment, vulnerable supply chains, and minimized sourcing mistakes (Lee, 2021; Tanco, Jurburg & Escuder, 2015).

Several authors have established positive links between SCM practice adoption and SME performance (Koh et al., 2007; Li et al., 2006). Such connections rely on cost reduction, enhanced profitability, business skill development, and customer service benefits (Arabshahi & Fazlollahtabar, 2020; Barusman & Habiburrahman, 2022; Gunasekaran,

Patel, & McGaughey, 2004; Khalil, Khalil & Khan, 2019; Lee, 2021). Against SCM benefits in SMEs, studies reveal SME challenges in contrast to larger companies: (1) concentrated value chains limit SME negotiating power (Vaaland & Heide, 2007), (2) large companies resources enable quicker supply chain response than SME, damaging SME-supplier relations (Juergensen et al., 2020), and (3) larger firms perceive SME relationships as replaceable (Arend & Wisner, 2005).

Following this argument, Wang, Zhang & Goh (2018) found that firm size positively moderates the impact between GCS sustainable practices and economic performance, with a more significant effect on larger companies. Research findings suggest that focusing only on SME economic enhancement might disregard technical and administrative gaps, leading to opposite economic, social, and environmental outcomes.

An alternative approach to firm size effect on GCS includes firm maturity as an indicator of SME performance. This argument is supported by Söderberg and Bengtsson (2010), who identified a positive connection between firm maturity, GCS performance, and financial performance. The relationship is explained by accumulated knowledge, facilitating process optimization over time for improved financial performance. Aligned with earlier findings, Arend (2006) concludes that SMEs with greater commitment to SCM "harvest" the experience gained through learning and create a more extensive network of contacts, allowing them to improve their performance compared to SMEs with less experience.

During the COVID-19 crisis, studies suggest that implementation of GCS in SMEs was hindered by a lack of specialized workforce, limited financial access, reduced supply chain control, inventory issues, and digitalization constraints (Tanco et al., 2015; Koh et al., 2007; Fairlie & Fossen, 2021). In a pandemic context, scholars found that resilient SMEs exhibited high working capital and diversified customer-supplier networks, in contrast to SMEs with low cash flow and high dependence on few partners (Marconatto et al., 2022). This scenario, coupled with limited customer portfolio diversification and scarce income sources, constrains reinvestment capacity and increases supplier procurement challenges.

The pre-pandemic weak position of SMEs deepened negative results during the crisis. From this evidence, our paper proposes the following hypothesizes:

H3: The greater the difficulty in managing the operations and activities of the supply chain with suppliers, the greater the negative impact on the profitability of MSMEs during the COVID-19 pandemic.

H4: Firm size positively moderates the effect between difficulties in managing operations and activities of the supply chain with suppliers and the negative impact on MSMEs' profitability during the COVID-19 pandemic.

3. Methodology

3.1. Sample and data

The study employed data gathered by the Ibero-American Observatory of Small and Medium Enterprises from February to May 2021. The Ibero-American Observatory aims to enhance regional knowledge of SMEs, supporting economic and strategic decision-making (FAEDPYME, 2022). The observatory's database gathered information from 9,300 MSMEs across 15 Latin American countries. Data collection involved a virtual survey strategy, followed by telephone follow-ups, targeting firm managers or owners.

This study used 499 observations from Costa Rican MSMEs (adhering to OECD employee criteria). Nonetheless, because of dependent variable characteristics, 217 observations were excluded. This exclusion covered cases where managers reported no economic impact from the health crisis, positive effects, or missing values. Consequently, the research's final sample included 282 observations.

Appendix 1 displays key descriptive statistics and correlations from the sample. Regarding owner characteristics, most were male (mean = 0.61, SD = 0.49, CV = 0.80), and a significant proportion had university education (mean = 0.65, SD = 0.48, CV = 0.74). The MSMEs under study averaged ten years in operation, between 2 to 64 years.

3.2. Variables

Dependent Variable

The dependent variable, the adverse impact of COVID-19 on profitability, was assessed through a questionnaire by FAEDPYME (2022). The questionnaire employed a 5-point Likert scale, ranging from 1=very low to 5=very high, to assess the manager's perception. The scale was reversed to indicate the negative impact, from 1=very high negative impact to 5=very low negative impact. The inclusion of this variable is supported by different researchers who confirm the pandemic's economic repercussions on MSMEs (Cowling et al., 2018, 2020; Donthu & Gustafsson, 2020; García Pérez de Lema et al., 2021).

Independent variables

The chosen independent variables were customer management and operations and logistics management with suppliers. Data were gathered from the FAEDPYME questionnaire for customer management, employing Exploratory Factor Analysis (EFA). A factor emerged from four items: (1) price reductions, (2) extended payment deadlines, (3) increased order cancelations, and (4) elevated losses from nonpayment. Managers assessed each item on a 5-point Likert scale, ranging from 1=less problematic to 5=very high problematic in managing customer relations. EFA results confirmed factor reliability (KMO=0.736, Cronbach's Alpha=0.74). This construct's formation aligns with extensive research on customer management's performance impact (Coltman et al., 2011; Petr et al., 2021), tied to market orientation's relevance in crises (Petzold et al., 2019).

Regarding the second variable, the FAEDPYME questionnaire assessed manager perceptions of (1) supply chain impact, (2) tightened supplier conditions, and (3) operational changes needed. Managers evaluated each item on a 5-point Likert scale, ranging from 1=least perceived problematic to 5=most perceived problematic. EFA validated the factor reliance (KMO=0.604, Cronbach's Alpha=0.66). This second construct is supported by prior research on Covid-19's supply chain effects and firm crisis responses (Craighead et al., 2020; El-Baz & Ruel, 2021; Sodhi & Tang, 2021), linked to supplier challenges for MSMEs (Melnyk et al., 2021).

Control variables

The research models incorporated four control variables. First, firm age was assessed using the natural logarithm of years in operation since establishment, explained from past research indicating the significance of maturity and experience (Bird & Zellweger, 2018; Calabrò et al., 2017; Cowling et al., 2018).

Second, the company sector was categorized (1 = trade, 2 = services), aligning with the local MSME classification (Ministry of Economy, Industry and Commerce, 2019). This classification reflects sector-based variations in networking, innovation, and resource management (Cowling et al., 2020; Eggers et al., 2013), justifying its inclusion.

The third variable measured was manager gender, categorized dichotomously (0=female, 1=male), consistent with prior studies (Hoang et al., 2021; Ishfaq et al., 2022; Lafuente-González & Leiva, 2022). Fourth, manager education was a dichotomous variable based on the presence of higher education (0=no university education, 1=university education), following past research that identified educational impact on export performance and growth (Bird & Zellweger, 2018; Brouthers & Nakos, 2005), introducing potential diverse results.

As a moderating factor, firm size was incorporated, measured by collaborators following the OECD's MSME criteria. Hence, 1 = microenterprise (1-9 collaborators), 2 = small enterprise (10-49 collaborators), and 3 = medium enterprise (50-249 collaborators). Honjo and Kato (2022) underline the importance of analyzing MSMEs of different sizes, generating possible findings according to different stages of development and maturity.

3.3. Data Analysis

Given the ordinal categorical nature of the dependent variable, a multinomial regression model, as established by Greene (2003), was employed in this study. This modeling approach has been used to evaluate managerial perceptions of operational management (Betton et al., 2021; Saraf et al., 2022). This model is applied to understand how customer management, supplier logistics, and operations management influence the degree of negative effects on MSME profitability due to COVID-19.

The model operates on a latent regression structure, expressed as $yi = x'i\beta + \varepsilon i$. Here, y signifies the dependent variable, denoting response categories for the degree of negativity concerning COVID-19's adverse impact. The x represents the predictor vector, encompassing customer management and logistics and operations management with suppliers, alongside control variables such as firm age, sector, manager gender, and education. These variables determine the discrete order of each observation, with β being the estimated parameter vector and ε representing the error term, adhering to a logistic distribution. The index i refers to the number of MSMEs within the study.

The ordered multinomial model enables an intricate analysis of COVID-19's impact on profitability probabilities, considering explanatory variables. This approach provides many analytical options for researchers. The model allocates each response category of the dependent variable (j=1, 2,...,5) as follows

$$y=0 \text{ if } y^* \leq 0$$
$$y=1 \text{ if } 0 < y^* \leq \mu 1$$
$$y=2 \text{ if } \mu 1 < y^* \leq \mu 2$$
$$\dots$$
$$y=J \text{ if } \mu J\text{-}1 \leq y^*$$

In this context, μJ represents the dependent variable's cut-off point for categories (j=1, 2, ..., 5).

Lastly, using the Average Marginal Effect (AME) is noteworthy. Because coefficients from the ordered logistic regression model merely indicate the direction of predictor effects on the dependent variable, AME offers a more comprehensive understanding of the average probability change caused by variable adjustments across sample observations (i). This method facilitates the interpretation of the independent variable magnitudes.

4. Results

Appendix 1 presents the correlations and descriptive statistics for the data. The correlation analysis revealed positive associations among certain control variables, such as firm size, educational level, and age, aligning with previous research. In contrast, negative correlations emerge when investigating the interaction between independent and dependent variables. For instance, the relationship between COVID-19's impact on profitability and customer management issues demonstrates a negative correlation, whereas operational and logistic management issues exhibit negative correlations with suppliers.

After that, an ordinal multinomial model was employed to examine the proposed hypotheses. This approach includes a base model and a full model. The base model assesses the relation of independent variables, control variables, and their impact on the dependent variable—specifically, the adverse effect of Covid-19 on profitability. In contrast, the full model includes variables from the base model and introduces the influence of interaction with firm size.

Before interpreting the results, multicollinearity in models was assessed using the Variance Inflation Factor (VIF), getting values below 10 (e.g., base model = 1.07, full model = 1.16). This value conforms to the established statistical criterion indicating the absence of multicollinearity

(Hair et al., 2010). In addition, the Wald test was conducted to evaluate the models, identifying statistically significant results different from zero (base model = 29.76, full model = 38.15). This value underscores the significance of the variables and the model's goodness of fit, aligning with the optimal statistical criterion outlined by Wald (1943).

Furthermore, an assessment of changes in goodness of fit was performed using nested models and Pseudo R2.

4.1 Base Model

Upon assessing the findings in Table 1 of managerial characteristics, an inverse relationship between the impact on profitability and education becomes evident. This finding suggests that the elevated educational level of the manager correlates with reduced probabilities of facing a more negative impact on profitability (coefficient = -0.108, p < 0.005). For the manager's gender, no statistically significant correlation was identified. This data implies that gender does not affect profitability to a greater or lesser extent during a health crisis. This argument is supported by the results of several authors (Espinosa-Méndez & Inostroza-Correa, 2022; Hoang et al., 2021; Ishfaq et al., 2022). The outcomes in Table 1 indicate the absence of statistically significant associations between firm age and size and harmful impact on profitability. In contrast, MSMEs in the service sector were more affected than those in the commerce sector (coefficient = 0.099, p < 0.05).

About the independent variables and their explanatory effects, it was identified that the greater the problems in customer management (coef= 0.068, p < 0.01) and the greater the problems in the management of operations and logistics with suppliers (coef=0.059, p < 0.01), the greater the chance of a negative impact on the firm's profitability.

Table 1

Ordered Probit Model: results of base model

Covariates	Marginal effects (dependent variable: negative impact of COVID-19 on firm profitability)				
	1	2	3	4	5
Gender (male=1)	0.032(0.0426)	0.005(0.0072)	-0.002(0.0035)	-0.009(0.0126)	-0.025(0.0339)
Education(1=university)	-0.108(0.0449)**	-0.018(0.0085)**	0.008(0.0057)	0.032(0.0140)**	0.086(0.0362)**
Firm age	-0.019(0.0253)	-0.003(0.0044)	0.001(0.0020)	0.006(0.0075)	0.016(0.0203)
Sector					
Commercial	0.104(0.0681)	0.018(0.0099)*	-0.008(0.0100)	-0.031(0.0212)	-0.084(0.0483)*
Services	0.099(0.0441)**	0.017(0.0083)**	-0.007(0.0056)	-0.029(0.0136)**	-0.080(0.0357) **
Firm size	-0.057(0.0537)	-0.009(0.0091)	0.004(0.0049)	0.017(0.0161)	0.046(0.0424)
Operational and logistics management	0.059(0.0212)***	0.010(0.0039)***	-0.004(0.0030)	-0.017(0.0066)***	-0.047(0.0169)***
Customer management	0.068(0.0221)***	0.012(0.0045)***	-0.005(0.0033)	-0.020(0.0069)***	-0.055(0.0183)***
Goodness of fit statistics					
Log-likelihood Value	-429.4833				
Pseudo R2 (McFadden)	0.0376				
Wald chi2 test	29.76****				
Average VIF (min-max)	1.07(1.02 – 1.19)				
Number of observations	282				

Standard errors are presented in parentheses. Significance level: *p<0.10, **p<0.05, ***p<0.01

4.2. Full model

Table 1 reveals findings from the base model, confirming the irrelevance of gender, firm age, and size variables. However, it further validates the inverse association between higher education and profitability impact. From a statistical perspective, the presence of university-educated managers corresponds to an 11% lower likelihood of severe profitability setbacks.

Concerning MSME categorization by economic sector, the results highlight a more significant impact on service-sector companies than on commerce firms. Moreover, aligning with the base model, direct connections were reaffirmed between customer-company relationship challenges (coefficient = 0.050, p < 0.05), logistical challenges with suppliers (coefficient = 0.048, p < 0.05), and MSME profitability impact during the health crisis. Hypotheses 1 and 3 find support in the outcomes of Tables 1 and 2, respectively.

However, contrasting scenarios appear when evaluating the independent variables with the moderator variable's interaction. Based on the evidence, firm size does not moderate the relationship between logistics management and suppliers and the impact on profitability during the pandemic. Consequently, hypothesis 4 receives limited support. In contrast, firm size is significant for customer management issues (coef=0.108, p < 0.05), resulting in a 10.8% higher probability that MSMEs fall into the category with the greatest impact on profitability.

To complement the previous result, Figure 1 (Appendix 2) details the effects according to the firm's size. When MSMEs present slight problems in customer management, there is a lower probability that small and medium-sized companies will fall into the most adverse profitability scenario. Conversely, as customer-firm relationship problems increase, there is an 8.4% lower probability of falling into the least adverse scenario on profitability during the pandemic (5th category scale). Therefore, the results support hypothesis 2.

Table 2

Ordered probit model: results of full model

Covariates	Marginal effects (dependent variable: negative impact of COVID-19 on firm profitability)				
	1	2	3	4	5
Gender (male=1)	0.038(0.0422)	0.006(0.0070)	-0.003(0.0037)	-0.011(0.0127)	-0.030(0.0332)
Education(1=university)	-0.110(0.0444)**	-0.018(0.0084)**	0.009(0.0058)	0.033(0.0140) **	0.087(0.0356)**
Firm age	-0.022(0.0254)	-0.004(0.0043)	0.002(0.0022)	0.006(0.0076)	0.017(0.0201)
Sector					
Commercial	0.100(0.0679)	0.017(0.0099)*	-0.007(0.0098)	-0.030(0.0212)	-0.081(0.0484)*
Services	0.108(0.0446)**	0.018(0.0082)**	-0.008(0.0063)	-0.032(0.0140)**	-0.086(0.0352)**
Firm size	-0.060(0.0551)	-0.010(0.0090)	0.005(0.0054)	0.018(0.0167)	0.047(0.0426)
Operational and logistics management	0.048(0.0239)**	0.008(0.0041)*	-0.004(0.0029)	-0.014(0.0073)*	-0.038(0.0188)**
Customer management	0.050(0.0247)**	0.008(0.0045)*	-0.004(0.0029)	-0.015(0.0074)**	-0.039(0.0199)**
Operational and logistics management X size firm	0.065(0.0476)	0.011(0.0083)	-0.005(0.0048)	-0.019(0.0144)	-0.051(0.0377)
Customer management X size firm	0.108(0.0522)**	0.018(0.0093)*	-0.009(0.0064)	-0.032(0.0163)**	-0.085(0.0409)**
Goodness of fit statistics					
Log-likelihood Value	-426.8412				
Pseudo R2 (McFadden)	38.15****				
Wald chi2 test	0.0432				
Average VIF (min-max)	1.16(1.04 – 1.26)				
Number of observations	282				

Standard errors are presented in parentheses. Significance level: *p<0.10, **p<0.05, ***p<0.01

5. Discussion

Our research has effectively validated that increased difficulties in customer management, as well as in operations and logistics management with suppliers, negatively impact the profitability of SMEs amid the COVID-19 crisis. Our findings are consistent with prior research by Cao & Zhang (2011), Flynn et al. (2010), and Reinartz et al. (2004), who have, under different approaches, the effect of the independent variables on the firm's performance. However, when evaluating the moderating effect of firm size, the management of operations and logistics with suppliers is no longer significant in the model. This contrasting result, when considering the moderating variable, was not expected.

In addition, it is relevant to highlight the impact of the pandemic-induced logistics crisis, especially its disproportionate impact on MSMEs (Darmian & Farughi, 2022; Ramanathan et al., 2022). Throughout the health crisis, logistics resources were prioritized for medical requirements, leading to disruptions, shortages, and increased costs (McNeely, 2021; UNCTAD, 2022). Consequently, a comparative analysis by Notteboom, Pallis, and Rodriguez (2021) between the logistics consequences of COVID-19 and those of the 2008-2009 financial crisis revealed a faster negative influence of comparable intensity on all aspects of the supply chain. These results underscore the systemic nature of this phenomenon, which affects supply chain processes despite firm size.

Furthermore, the duality of external and internal activities could contribute to the research outcomes. Costa Rican MSMEs and local suppliers seem unable to rapidly restructure their supply chains due to limited bargaining power and high reliance on external actors. This observation is consistent with previous studies (Arend & Wisner, 2005; Vaaland & Heide, 2007).

In contrast, customer relationship management is an internal task of the firm. Pansari & Kumar (2017) and Palmatier et al. (2009) established that disparities in firm performance within customer-firm relationships primarily derive from the presence of trust, commitment, engagement, and mutual appreciation—domains delegated to MSMEs. Within the scope of customer relations, our results reveal further distinctions in the influence of customer management issues on profitability by firm size, which validates the moderating influence hypothesis. However, it is necessary to reflect on why small and medium-sized firms experienced more prominent effects than micro firms.

Multiple reasons could partly explain the results obtained: (1) the resilience of MSMEs as a function of firm size and (2) the nexus between firm size and customer management. Regarding the first argument, the results could be contextualized within the interaction between firm size, strategic resource acquisition and knowledge accumulation within MSMEs (Honjo & Kato, 2022; Jiménez-Jiménez & Sanz-Valle,

2011; Thorpe et al., 2005), where larger firms may manifest greater crisis resilience attributed to accumulated knowledge and experience (Audretsch & Belitski, 2021; Branicki et al., 2018). In congruence, Herbane's (2019) research highlights that as the size and age of MSMEs increase, the importance of avoiding and mitigating future crises from strategic and operational standpoints also increases, making these firms less susceptible to the impacts of crises compared to smaller firms.

Regarding the second perspective, the literature yields contradictory results. While some studies validate the impact of firm size on market orientation (Verhees & Meulenberg, 2004), others do not detect distinctions between MSME (Laforet, 2008) or even posit negative correlations between firm size and market orientation (Pelham, 2000). These divergent results are of particular interest because customer orientation constitutes a dimension of the market orientation construct (Lukas & Ferrel, 2000), which allows for a better understanding of customer management behaviors.

The results suggest that customer management, aligned with the CRM approach, is conceptualized as a dynamic capability during the pandemic, an ability of firms to assimilate or reshape resources and competencies in volatile environments (Teece, 2010). In this context, the findings of Clampit et al. (2021) indicate that the association between dynamic capabilities and performance is deeper in small firms than in large organizations. This effect is partly explained by stakeholder feedback, greater responsiveness, and fast development of alliances, critical factors for customer management. Moreover, Pelham's (2000) findings are consistent with this approach, stating that larger firms tend to underestimate the importance of competition, maintain greater distance from customers, and show less adaptability to emerging needs.

6. Conclusions

During the COVID-19 pandemic, MSMEs faced adverse effects on their profitability due to imposed health measures. To comprehend these impacts from an operational perspective, specifically in the context of a developing country, this study aimed to investigate the impact of customer management, operations, and logistics management with suppliers on MSME profitability. Drawing on theoretical frameworks related to MSME performance and crisis management, the study's key outcomes reveal that independent variables negatively influence profitability. However, different results emerge when the moderating effect of firm size is considered. In particular, small and medium-sized companies suffer a more pronounced decline in profitability due to customer management problems, unlike micro companies, which experience fewer financial consequences.

This study raises an academic dialogue on the operational aptitude of MSMEs to perform multifaceted functions during crises, considering external dependence and inherent adaptive capabilities. The results highlight the variable moderating effect of firm size on customer management challenges and their consequent negative impact on profitability.

From a management perspective, the results emphasize the importance of improving customer management practices and operations and logistics coordination with suppliers. These measures could alleviate severe profitability setbacks under adverse circumstances. Consequently, this perception has implications for resource allocation decisions made by MSME managers, extending to investment initiatives, training programs, and operational oversight. In addition, the results highlight the importance for MSMEs to promote agility and responsiveness in customer-business interactions during periods of crisis, which is particularly relevant for small and medium-sized enterprises. This idea requires an introspection of internal processes and a reassessment of operational improvements.

For institutions and policymakers, this study provides ideas for evaluating post-pandemic training and support initiatives for Costa Rican MSMEs essential to economic recovery efforts. In addition, the findings advocate strengthening sectoral interconnections that yield operational management benefits through collaborative initiatives (e.g., strengthening bargaining power, forming strategic partnerships, reducing external dependence, and mitigating systemic risks).

6.1 Limitations and Future Research Avenues

Certain limitations of this study need to be noted when interpreting its results; some of these constraints may be sources for future research. The reliance on managers' subjective perceptions introduces potential risks related to subjectivity. Although previous research supports using subjective indicators, this aspect must be considered. In addition, the study focuses exclusively on the service and commerce sectors, even though the effects of the pandemic vary across economic sectors. The incorporation of different sectors warrants further research. Broadening the scope of the research to cover other Latin American countries could allow for multilevel regression analysis to assess random effects across groups of countries.

Another possible avenue of research, taking advantage of the dataset used, is to explore further comparative analyses of groups of MSMEs facing different degrees of profitability loss. Using qualitative methodologies, such as case studies, could reveal the strategies adopted by companies, the organizational learning derived from pandemic experiences, and the transformation of such knowledge into capabilities to improve customer management. Subsequently, research into MSMEs' best customer management practices could strengthen their resilience in managing crisis-induced turnover.

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Appendix 1. Early-response bias test (temporal separation)

	t-test (absolute values)	Kruskal-Wallis test (chi2 values)
Profitability	0.224 (p-value = 0.815)	0.072 (p-value = 0.394)
Operat&Logistic Management	0.914 (p-value = 0.362)	0.072 (p-value = 0.395)
Customer Management	1.193 (p-value = 0.235)	1.439 (p-value = 0.234)
Firm age (ln years)	0.924 (p-value = 0.357)	0.480 (p-value = 0.489)
Gender (1= male)	1.982 (p-value = 0.048)	2.863 (p-value = 0.091)
Education (1=University)	-2.472(p-value = 0.013)	4.101 (p-value = 0.043)
Sector	2.107 (p-value = 0.035)	3.036 (p-value = 0.081)
Firm size (1=Small&Medium)	0.113 (p-value = 0.913)	0.005 (p-value = 0.942)

Significance level *p<0.10, **p<0.05, ***p<0.01

Appendix 2: descriptives and bivariate correlations

Variables	Mean	SD	min	max	(1)	(2)	(3)	(4)	(5)	(6)	(7)
(1) Gender	0.56	0.49	0	1							
(2) Education	0.65	0.48	0	1	0.013						
(3) Firm age	2.31	0.85	0.69	4.17	0.185****	0.015					
(4) Sector	1.87	0.91	0	2	-0.016	0.151***	0.067				
(5) Firm size	0.19	0.39	0	1	0.232****	0.149***	0.324****	0.030			
(6) Operational and logistics management	0.002	1.00	-2.04	2.52	-0.063	-0.024	-0.065	-0.047	-0.116**		
(7) Customer management	0.001	1.00	-2.31	2.50	0.007	-0.050	0.102**	-0.046	0.033	-0.001	
(8) Negative impact of Co-vid-19 on firm profitability	2.81	1.47	1	5	-0.024	0.185***	0.037	-0.069	0.105*	-0.162***	-0.187****

Appendix 3. Interaction between customer relationship management and firm size

Fig. 1a Relationship between customer management difficulties, firm size and negative impact of Covid-19 on profitability (estimated probability of "very strong negative" impact on profitability)

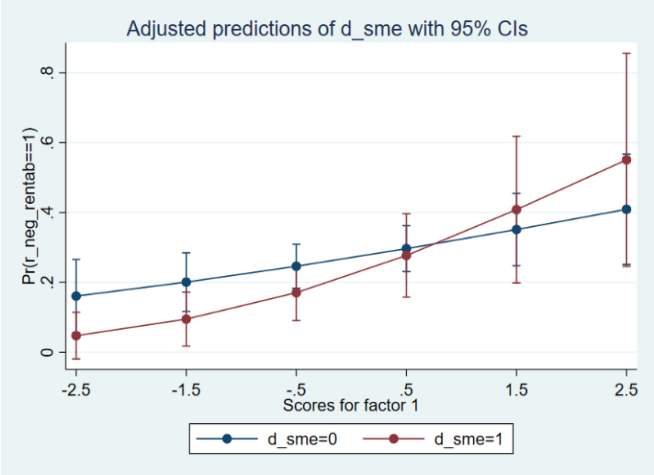


Fig.1b Relationship between customer management difficulties, firm size and negative impact of Covid-19 on profitability (estimated probability of "strongly negative" impact on profitability)

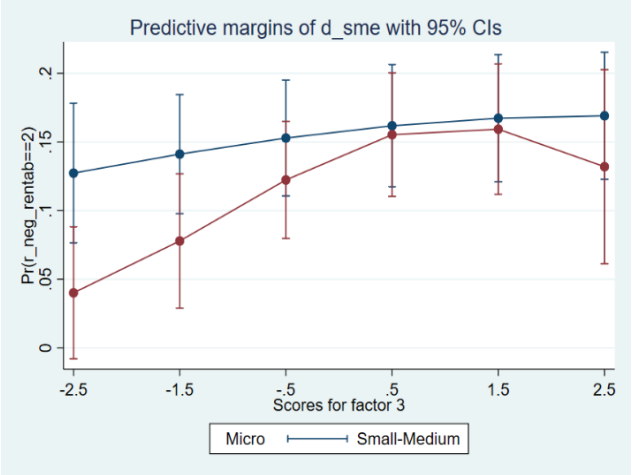


Fig.1c Relationship between customer management difficulties, firm size and negative impact of Covid-19 on profitability (estimated probability of "slightly negative" impact on profitability)

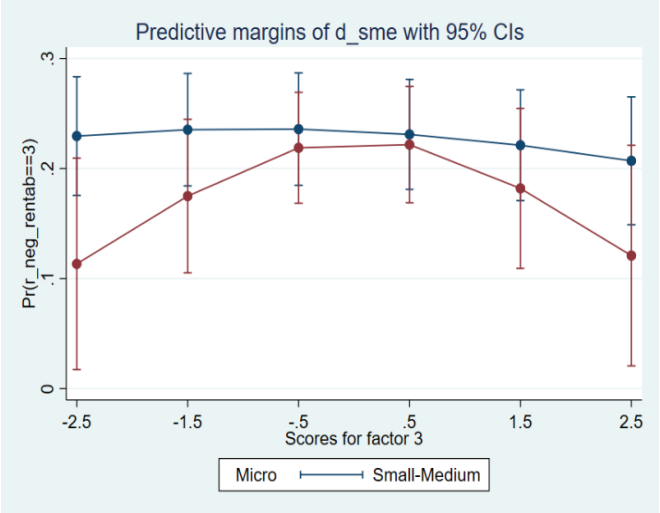


Fig. 1d Relationship between customer management difficulties, firm size and negative impact of Covid-19 on profitability (estimated probability of "low negative" impact on profitability)

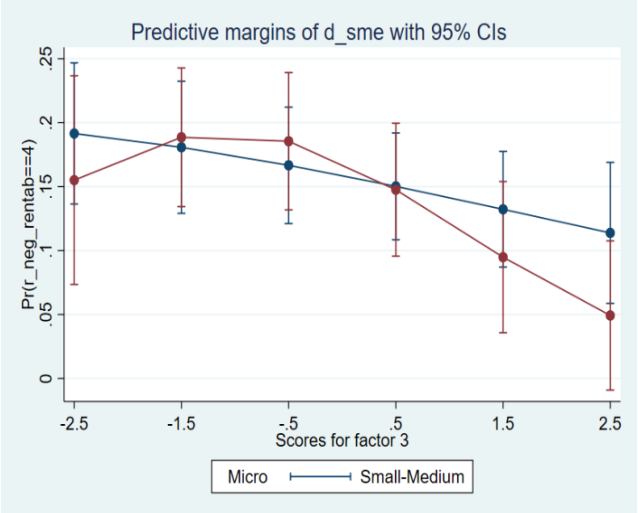
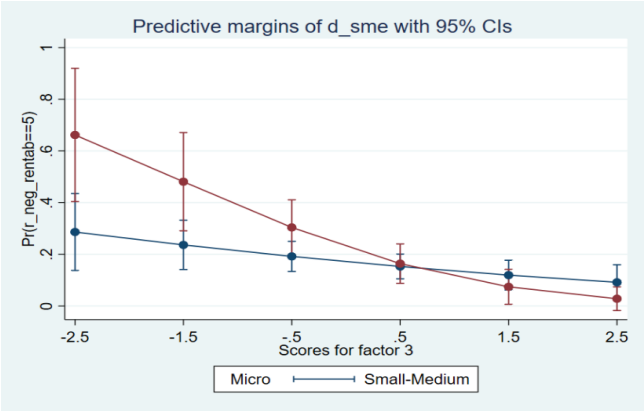


Fig.1e Relationship between customer management difficulties, firm size and negative impact of Covid-19 on profitability (estimated probability of "very low negative" impact on profitability)



Appendix 4: Ordered probit model results (coefficients)

Covariable	Base model (Table 1)	Full model (Table 2)
Gender (male=1)	*-0.100(0.1353)*	*-0.121(0.1351)*
Education (1=university)	*0.344(0.1448)***	*0.351(0.1445)***
Firm age	*0.063(0.0807)*	*0.069(0.0816)*
Sector		
Commerce	*-0.333(0.2079)*	*-0.323(0.2099)*
Services	*-0.317(0.1415)***	*-0.348(0.1433)***
Firm size	*0.182(0.1703)*	*0.193(0.1748)*
Operational and logistics management	*-0.187(0.0685)****	*-0.152(0.0771)***
Customer management	*-0.217(0.0726)****	*-0.159(0.0803)***
Operational and logistics management X Size firm		*-0.208(0.1526)*
Customer management X Size firm		*-0.346(0.1674)***
Cut 1	*-0.478(0.2254)*	*-0.474(0.2258)*
Cut 2	*-0.036(0.2254)*	*-0.031(0.2258)*
Cut 3	*0.582(0.2292)*	*0.593(0.2304)*
Cut 4	*1.100(0.2358)*	*1.121(0.2370)*
Goodness of fit statistics		
Log likelihood value	*-429.4833*	*-426.8412*
Wald (chi2) test	*29.76*****	*38.15*****
Pseudo R2(McFadden)	*0.037*	*0.043*
Average VIF (min-max)	*1.07(1.02 – 1.19)*	*1.16(1.04 – 1.26)*
Number of observations	*282*	*282*

Standard error is presented in parentheses. Significance level: *p<0.10, **p<0.05, ***p<0.01

Appendix 5. Results of hierarchical multiple regression models

Covariates	Model 1	Model 2	Model 3	Model 4
Gender (male=1)	*-0.087(0.1233)*	*-0.097(0.1222)*	*-0.092(0.1202)*	*-0.108(0.1194)*
Education (1=University)	*0.357(0.1251)****	*0.342(0.1238)****	*0.328(0.1252)****	*0.330(0.1242)****
Firm years	*0.034(0.0720)*	*0.041(0.0709)*	*0.061(0.0718)*	*0.063(0.0722)*
Sector				
Commerce	*-0.245(0.1851)*	*-0.309(0.1895)*	*-0.283(0.1835)*	*-0.270(0.1849)*
Services	*-0.241(0.1261)**	*-0.253(0.1248)***	*-0.274(0.1237)***	*-0.295(0.1238)***
Firm size (1= Small & Medium)	*0.242(0.1621)*	*0.198(0.1600)*	*0.179(0.1548)*	*0.186(0.1541)*
Operate&Logistic Management		*-0.164(0.0605)****	*-0.161(0.0585)****	*0.128(0.0662)**
Customer Mg			*-0.193(0.0609)****	*-0.145(0.0677)***
Operate&Logistic MgXFirm size				*-0.176(0.1316)*
Customer MgXFirm size				*-0.273(0.1356)***
Intercept	*-0.185(0.2002)*	*-0.148(0.1977)*	*-0.163(0.1976)*	*-0.165(0.1975)*
F test	*2.97****	*3.57****	*4.59*****	*5.21*****
R2	*0.055*	*0.080*	*0.116*	*0.131*
ΔR2		*0.026*	*0.035*	*0.015*
		*F=7.33****	*F=10.04****	*F=3.37***
VIF average (min - max)	*1.13(1.08 – 1.19)*	*1.12(1.03 – 1.19)*	*1.11(1.02 – 1.20)*	*1.18 (1.09 – 1.26)*
Number of observations	*282*	*282*	*282*	*282*

Robust standard errors are presented in parenthesis. Significance level *p<0.10, **p<0.05, ***p<0.01

Appendix 6. Relationship between Difficulties in Marketing Management, Firm size, and negative impact of Covid-19 on firm´s Profitability