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Tesis

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# The impact of electronic commerce on the Peruvian firms' revenue

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| CHRONICLE | ABSTRACT |
|---|---|
| | Electronic commerce is a way of sale that has come to stay. It helps companies to overcome physical barriers, and in theory, it increases their sales. However, does electronic commerce have any impact on the firms' revenue? This research sought the answer by employing OLS and quantile regressions in a sample of 2164 Peruvian retail firms. The dataset was obtained through the INEI economic survey of 2019, which was the last one. For methodological purposes, electronic commerce was compared against the other sales channels employed by the studied firms. It was found that electronic commerce positively impacted the income in firms with more enormous revenues but was still low compared with traditional commerce forms.<br><br>© 2022 by the authors; licensee Growing Science, Canada. |

## 1. Introduction

It is possible to state that taking advantage of new technologies and methods can improve the possibilities of business success. Economic globalization and competitiveness made it possible for electronic commerce to offer cost reduction, primary geographical scope, shorter wait times, and more individualized marketing, among other benefits. Hence, electronic commerce became a necessity rather than a competitive advantage (Baršauskas et al., 2008). This commerce method allows buyers to get faster and easier transactions (Dębkowska, 2017). Hence, buyers can search and buy thousands of inventories in only seconds.

Of course, it will not be possible for e-commerce without information technologies. Indeed, the development of these technologies changed commerce forever. A significant growth allowed more people to become engaged in e-commerce, and this trend will continue to grow.

For instance, in Peru, internet businesses went from 85% in 2011 to more than 95% in 2019. It is noticeable that the Covid-19 pandemic boosted e-commerce to levels never seen before. Therefore, Peru leads the e-commerce growth in Latin America, being the electronics and device products that people buy the most (Redacción Gestión, 2022)

Clearly, companies still rely on other ways to sell their product and services. Theoretically, these transaction channels can be four: traditional, automatized, audiovisual, and e-commerce. Therefore, it is vital to question whether e-commerce sales significantly impacted the company's profits. It is also necessary to keep in mind that firms employ e-commerce differently. Moreover, some companies mix their sales strategies among the four transaction channels, and others only depend on e-commerce or do not employ it. Also, there are economic sectors where e-commerce is little compared with other financial activities or even inexistent. For example, according to (Instituto Nacional de Estadística e Informática, 2018), the hydrocarbon sector did not report any sales employing e-commerce, while the hospitality and retail sectors are the ones that lead in e-commerce sales.

Therefore, the e-commerce impact on business net profit will depend on the sector and its sales strategies. Hence, what is the effect of e-commerce on the profitability of the Peruvian retail industry? Consequently, this paper will analyze the impact of e-commerce on the profitability of the Peruvian retail sector in 2019. Data was gathered from the Peruvian Statistics agency or INEI, which ensured the data quality. Since this study will be longitudinal, we employed the Ordinary Least Square regressions along with Quantile regressions and the decomposition of the coefficient of variation. Those statistical analyses will provide a significant understanding of the e-commerce effect on profits in the presence of other sales strategies.

## 2. Literature review

### 2.1 Theoretical background

E-commerce is a concept that incorporates the actions of purchase, sales, and product and service transactions (Gunasekaran et al., 2002). Formerly, it was used solely for exchanges made through electronic means. Nonetheless, the internet's massification became a synonym for sales online. Besides, the electronic business quickly developed electronic payments by credit cards and PayPal. Also, e-commerce would not be as powerful as today if there were no efficient transport services in the case of products or audiovisual means in the case of services. These factors are significant concerns for businesses who want to keep pace to provide appropriate goods and services.

One significant advantage of e-commerce is its flexibility to be run by firms. A firm can do business-to-business transactions or sell its products and services directly to the customers (Bolumole, 2001). Inside those transactions, a firm can sell items with or without manufacturing them and delivering them to the customers or employ subscriptions in case of services. Hence, when a company can receive orders online, it can be stated that it applies to e-commerce (Falk & Hagsten, 2015). It is essential, though, that the current research will focus on those businesses selling directly to the customers.

Willis (2004) states that e-commerce benefits both producers and buyers. On one side, firms can make lower-cost transactions while buyers can select a broader range of products and services, surpassing the geographical barriers. Therefore, it can be expected that firms applying e-commerce as a sales strategy might increase their revenue margins. According to Duch-Brown et al. (2017), online commerce does not necessarily reduce prices but can reach customers who prefer the online channel over the traditional ones. Hence, customer quantity and sales can increase (Jelassi & Leenen, 2003). For instance, a joint demographical group who prefer online transactions is the young ones (Bergendahl, 2005). However, e-commerce can only have a substitution effect since the other sales channels might be reduced.

Also, in firms with a significant tradition in the market, online commerce can only represent a tiny percentage of their incomes; hence, the adoption of the possible sales growth because of e-commerce can be imperceptible. For instance, in Peru, only a bunch of companies in specific sectors relied on electronic commerce (Cámara Peruana de Comercio Electrónico, 2021)

Moreover, as stated before, e-commerce can be a cost saver compared to other traditional channels. However, it does not mean that it is cost-free. Indeed, there are costs in the implementation of e-commerce. For instance, the company might need to invest considerably in computers, servers, hosting services, and trained personnel in information technologies, among other costs. Also, the firm might need to implement a logistics area to deliver the products.

### 2.2 Sales Chanel

Acosta (2017)states that the sales channels, according to their transaction technology, can be four: traditional, automatized, audiovisual, and electronic channels. The conventional channel is the most common. It does not need almost any technology to carry out the transaction process. The automatized channel relies on a machine or a standardized service that requires technology. For instance, the process of opening a bank account or employing a vending machine to sell groceries. The audiovisual channel uses communication technology to reach the client. It operates tv or radio advertisements for publicity and phone calls as its way to contact the customer. Finally, electronic commerce employs information technologies to exchange products and services. The employment of the internet is different between the e-commerce and audiovisual channels. E-commerce cannot be possible without it, while the audiovisual medium can manage other ways to impact the customer. It is important to note that audiovisual and electronic channels need an efficient delivery to send the products to their clients.

Studies have been carried out about the effect of e-commerce on a firm's profitability in the banking sector. Pour & Yazdanifard (2011)found that e-commerce positively affected banks who implemented it along with simple online processes. They stated that efficient online banking reduced operational costs and time. In China, Chinyamakobvu (2011) found that the retailers who adopted e-commerce strategies had more profits than traditional retailers. Fárfan (2019) also found a positive relationship between e-commerce and the profitability of medical equipment firms in Peru. Moreover, she encountered that e-commerce boosted the firms' brand image.

Nonetheless, Nguyen (2022)encountered that also in China; e-commerce did not guarantee significant profits by itself. The firms needed to adopt measures in cost control, assets planning, corporative strategies, and brand building. Besides, it was recommended that firms adopt e-commerce to redefine their strategy in market positioning, intangible asset management, service, relationships with suppliers, and growth. Furthermore, Jovanovic et al. (2020) analyzed the effect of e-commerce on the performance of 439 European enterprises. Then, they found no direct relationship between e-commerce and a firm's

performance. However, they encountered that firms employing commercial websites and online marketplaces can experience higher sales. Lorca et al. (2019) used the size of 2544 Spanish businesses to analyze the effect of electronic commerce on those business revenues. They found that there was not any significant effect of electronic commerce on the surveyed firms. However, it might affect giant firms rather than small ones. Also, Pramono et al. (2020) studied the impact before and after implementing electronic commerce in nine retail companies listed on the Indonesia Stock Exchange. They found no significant differences between the previous e-commerce era and the post one. Therefore, it was stated that e-commerce did not significantly affect those firms' profitability.

Consequently, it is impossible to state that e-commerce has always had a significant effect on the profit of firms that applied it as a sales channel. Therefore, what is the case of Peruvian retail firms? Was there any effect of e-commerce on their profits? How big – or little- was it? The current research will answer these questions by analyzing a size of 2164 Peruvian retail firms.

## 3. Methodology

To answer the current research questions is necessary to carry out statistical analysis. Then, this study will use the Ordinary Least Square Regression analysis and a quantile study better to understand the results in the different firm sizes.

Consequently, the database employed was extracted from the Economic Survey carried out in 2019, which was the least held by the Peruvian statistical authority. The sample was a compound of 2164 firms. Regarding the variables employed in this study, the dependent variable was the net profit, while the independent variables were the four sales channels described in the previous section.

### 3.1 Empirical Methods

### 3.1.1 Ordinary Least Square Regression

Following Wooldrige (2010), an Ordinary Least Square Regression can be noted as: $Y_{it} = \beta_1 X_{it} + \propto_i + u_{it}$. Here, the dependent variable is $Y_{it}$. Additionally, $\beta_{1..i}$ contains the coefficients for each independent variable represented by $X_{it}$. In this regression, the unobserved effects and errors are noted as $\propto_i$ and $u_{it}$, respectively. As with every regression, the OLS model should follow the next assumptions: linearity, homoscedasticity, absence of multicollinearity, normal distribution, and specification. (Burton, 2020).

The F test analyzes the first condition. When the test result is as expected, it can be stated that the independent variables have a linear relationship with the dependent variable (Burton, 2020). Also, the homoscedasticity condition means there should be a constant value of the error variance. On the other hand, heteroscedasticity can make the OLS regression wrongly calculate the coefficient standard error (Yang et al., 2019). It is necessary to add that the application of Robust Standard Errors eliminates the heteroscedasticity issue (Stock & Watson, 2008). Moreover, only through the absence of multicollinearity can it be claimed that the OLS regression has stability and the regressors are not redundant. Consequently, the Variance Inflation Factor is the test to ensure this condition (Burton, 2020).

Although the normal distribution of the residual condition is essential for the parametric models, the so-called "central limit theorem" claims that as the sample gets larger, the sample distribution becomes a normally distributed one (Kwak & Kim, 2017). The final condition can prevent the omitted variable bias, suggesting that the effects are far from the selected variables. (Wooldrige, 2010).

### 3.1.2 Decomposition of the coefficient of determination

It is widely known that the coefficient of determination [$R^2$] explains how much the independent variable explains the effects of the dependent variable. Consequently, it is valid to ask for a means to know the impact of each regressor rather than the whole set. Hence, Huettner & Sunder (2012) provided a way to know it by employing the cooperative application game with utility transfer and Shapley's values. This value is essential to decompose the $R^2$, or the game payoff, among the game participants or the regressors (Serrano, 2007). This approach is valid when the regressors are not grouped, as in this case. If the independent variables were grouped, it would be necessary to employ Owen's value (Casajus, 2009). Therefore, Shapley's value is:

$$Sh_j(K, R^2) = \frac{1}{k!} \sum_{\pi \in \Pi(K)} R^2\big(P_j^\pi \cup \{j\}\big) - R^2(P_j^\pi)$$

In this equation, $\pi: K \rightarrow \{1, ... |K|\}$ belongs to the permutations of K. In other words, $\pi(j)$ represents the $j$ participator playing in the $\pi$ position. Furthermore, $\Pi (K)$ is the total permutations, $k!$, in $K$. For each $\pi$, the players who are before the player $j$ are represented by $P_j^\pi = \{j' \mid \pi(j') < \pi(j)\}$. In consequence $R^2\big(P_j^\pi \cup \{j\}\big) - R^2(P_j^\pi)$ will give the marginal contribution of each $j$, representing a particular player. Nonetheless, the payment will be zero if there is no marginal contribution of $j$. It is essential to remember that Shapley's value meets the assumption of efficiency, symmetry, and marginality (Serrano, 2007).

*3.1.3 Quantile regression*

As stated before, the current research will employ quantile regressions to know the effects on the enterprises' revenues. Hence, quantile regression is represented as: $y_i = \sum \beta_j^{(q)}.x_{ij} + \varepsilon_i^{(q)}$. Here, 0<q<1 represents the size proportion with lower values than the i-th quantile. Therefore, for each observation, the error, $\varepsilon_i$, will be: $\varepsilon_i^{(q)} = y_i - \sum_j \beta_j^{(q)} x_{ij}$. Consequently, a regression for the i-th quantile will be the result of min $[\sum_{i\in\{i:y_i>xi\beta\}} q|y_i - xi\beta| + \sum_{i\in[i:y_i>xi\beta\}}(1-q)|y_i - x'i\beta|$. The above equation can be resolved by linear regression equations as described by Hunter (). For the current research, the model will be:

$$Firm's\ revenue_i = \beta_0 + \beta_1 traditional_i + \beta_2 automatized_i + \beta_3 audiovisual_i + \beta_4 electronic_i + \propto_i + u_{it}$$

Consequently, the current research will gather and organize the sample data provided by INEI. Then, by using STATA, it will be used for descriptive statistics to get a first glance at the data provided. After that, the data will be analyzed using the OLS and the quantile regression. Next, the OLS regression assumptions will be studied to ensure the model's validity. Finally, it will be necessary to decompose the coefficient of variation to estimate the actual contribution of each sales channel focusing on electronic commerce in all the written regressions.

## 4. Results

**Table 1**

Descriptive statistics

| Measure | Profit | Traditional | Automatic | Audiovisual | Electronic |
|---|---|---|---|---|---|
| Mean | 1069.39 | 24296.11 | 255.20 | 3475.35 | 973.25 |
| Min | -12979.89 | 0.00 | 0.00 | 0.00 | 0.00 |
| Max | 119939.66 | 1532463.27 | 32378.11 | 666774.17 | 223752.79 |
| Dispersion | 16080.33 | 3.92 | 6.76 | 7.17 | 9.17 |

**Table 2**

Regression results

| Variables | Coefficient | Robust Standard Error | t | p>t | 95% Confidence Interval | | Shapley % |
|---|---|---|---|---|---|---|---|
| Traditional*** | 0.11 | 0.03 | 4.31 | 0.00 | 0.06 | 0.16 | 79.93 |
| Automatic*** | 0.11 | 0.03 | 3.72 | 0.00 | 0.05 | 0.17 | 7.09 |
| Audiovisual*** | 0.06 | 0.01 | 4.20 | 0.00 | 0.03 | 0.08 | 6.07 |
| Electronic | 0.01 | 0.02 | 0.69 | 0.49 | -0.03 | 0.06 | 6.92 |
| Constant*** | 4.44 | 0.20 | 22.64 | 0.00 | 4.06 | 4.83 | |

*** significant at 1%

**Table 3**

Post-test results

| Test/results | |
|---|---|
| **Multicollinearity - VIF** | |
| VIF | |
| 1.27 | |
| **Specification** | |
| t | p |
| 1.01 | 0.31 |
| **Appropriate functional form** | |
| F | p |
| 1.53 | 0.2 |

**Table 4**

Quantile regression

| Variables | Quantiles | | | | |
|---|---|---|---|---|---|
| | Q10 | Q25 | Q50 | Q75 | Q90 |
| Traditional | 0.04*** | 0.05*** | 0.05*** | 0.08*** | 0.08*** |
| | 11.71 | 11.20 | 11.20 | 9.06 | 9.06 |
| Automatic | 0.02*** | 0.02*** | 0.02*** | 0.01 | 0.01 |
| | 4.30 | 3.39 | 3.39 | 0.79 | 0.79 |
| Audiovisual | 0.01** | 0.01*** | 0.01*** | 0.02*** | 0.02*** |
| | 2.49 | 3.03 | 3.03 | 3.24 | 3.24 |
| Electronic | 0.00 | 0.00** | 0.01*** | 0.03*** | 0.03*** |
| | 0.51 | 2.65 | 2.65 | 3.89 | 3.89 |
| Constant | 6.79*** | 6.90*** | 6.90*** | 7.21*** | 7.21*** |
| | 239.73 | 211.83 | 211.83 | 108.81 | 108.81 |

***significant at 1%, **significant at 5%

Table 1 shows the descriptive statistics for the variables employed in the current research. The quantities in the regressors were expressed in thousands of dollars. Here it can be seen that any variable had a non-zero observation which meant the inexistence of an unbeatable sales channel. Furthermore, the traditional sales channel had the highest average, while the automatic one had the lowest. Moreover, there were firms with losses in the analyzed period. In Table 2, it can be seen the OLS regression for the whole model as well as the Shapley coefficient of variance decomposition. All the regressors but the electronic sales channel had a significant relationship with the net value. All of them had a positive relationship with the dependent variable. According to the variance decomposition coefficient, the most relevant channel was the traditional one since it explained about 79.93% of the whole model. The other two significant variables were similar in contribution to the coefficient of variance. Moreover, the overall coefficient of variance for the model was 87.14%. Therefore, it can be stated that the independent variables explained 87.14% of the effects of the dependent variable.

After the OLS regression was applied, it was necessary to perform additional tests to ensure the model's validity. Table 3 shows the test employed. Here, it can be noted that the VIF test reassures the inexistence of multicollinearity problems. More-over, according to the specification test, the model was correctly specified. Finally, the functional form test depicted that the model was appropriately built. Table 4 shows the quantile regression results for the analyzed variables. Those quantiles were classified according to the size of the firms' profits. Consequently, the quantile 10, which represents the 10% lowest firms' profits, had similar results to the OLS regression in Table 2 because it did not find any significant relationship between the electronic channel and the firm's profit. Only Quantile 25 and Quantile 50, which show the average firms' profit, encountered that all the regressors had significant relationships with the dependent variable. Nonetheless, for Quantile 75 and Quantile 90 regressions, it was portrayed that the automatic sales channel did not have a substantial connection with the dependent varia-ble.

## 5. Discussion

The current research findings can be divided into two: the one obtained through the OLS regression and the others received by the quantile regressions. In the first case, all the sales channels but Electronic had a significant positive relationship with the firm's profit. Additionally, with the help of the Shapley values, it was noted that the most important sales channel was the Traditional one and that there was no significant difference between the Automatic and Audiovisual sales channels. Something essential to remark is that the electronic sales channel did not significantly affect the firm's profit.

Consequently, this result does not match with the findings of Pour & Yazdanifard (2011)), Chinyamakobvu (2011), and Fárfan (2019) since all of them found that the electronic sales channel had a positive effect on the firm's profit. However, it coincides with the results of Nguyen (2022), Jovanovic et al. (2020), Lorca et al. (2019), and Pramono et al. (2020) because those studies encountered that electronic sales channel was not significant when trying to explain the firms' revenues.

On the other hand, the Quantile regression provides a better glance at the effect of electronic sales channels on the firm's profitability. According to those regressions, the impact of the electronic sales channel is more considerable as long as the firm's revenue increases. Therefore, for firms with little revenue, the effect of electronic sales is inexistent, but it starts being important from quantile 25 and keeps its importance until Quantile 90. The electronic sales channel's significant growth may also replace the automatic one. This statement might be based on the fact that when the intuitive sales channel starts declining through the quantiles, the electronic one begins to take more participation. Hence, it is possible to infer that little revenue firms trust automatic sales channels while the bigger ones trust the electronic sales channel. If we compare those results with the literature review, it could be stated that the quantile regressions match the research findings of Lorca et al. (2019).

## 6. Conclusions

The current analysis seeks to determine the importance of electronic commerce in the Peruvian firms' revenue that participated in the last economic survey. The financial sector of these firms was the commerce of goods and services. For a better pano-rama, conducting two models, the OLS and the quantile regressions, was necessary. For the first one, it was clear that elec-tronic commerce did not significantly affect the firms' revenue. Nonetheless, the quantile regressions showed that the effect of electronic commerce is inexistent in firms with little revenues but significant in firms with more enormous profits.

Consequently, it is possible to state that electronic commerce will significantly affect firms with more enormous revenues rather than those who struggle to stay alive. If electronic commerce helps to increase payments or revenues increase, electronic commerce participation needs to be studied.

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