The Effect of COVID-19 in the demand for dairy products in Ecuador: The case of Lacteos Santillán

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In the year 2020, life as we knew it was challenged by the COVID-19 pandemic. The virus, which began in the Chinese province of Wuhan in late 2019, quickly spreaded around the world, forcing countries to quickly take action to prevent, or at least slow down, the spread of the virus. Most of the actions taken by countries to slow down the spread of the virus had negative implications for businesses. For instance, lockdowns and reduced capacity in establishments, forced a change in the consumption patterns of the population early in the pandemic. Overnight, consumers demanded more processed food products with longer shelf life and less more perishable products such as produce, meats and dairy. Ecuador was no exception, and soon after the first case recorded in the country, on February 14th, the government declared a lockdown from March 12th to May 4th, which included the prohibition of mass gatherings, school attendance and the closure of borders. However, sectors such as health, agriculture, and food, were allowed to continue operating to prevent shortages in the country. While the impact of COVID-19 in the food sector has been well studied in developed countries, its impacts remain mostly unknow in Latin America. Therefore, using Lacteos Santillan as a case study, we explore the impact that COVID-19 had in the demand for dairy products in Ecuador.

Data and Methods

Data

Data for this research was obtained from the dairy company Lacteos Santillan, who generously made available their sales records for this project from January 2016 to December

2020. The data included the aggregated monthly sales of three lines of products: milk, yogurt, and cheese. Among the variables provided were price in US$ and volume in kilograms and liteand literss

To provide some background, Lacteos Santillan commercialices three brands of milk, which are Prasol, Gran Leche and Forty in presentations from 250 to 1000 ml. Three lines of cheeses, which are fresh, mozzarella and aged, in presentations from 450 to 700 g and several yogurt alternatives, in presentations ranging from 50 to 4000 ml. As would be expected, different presentations and brands are targeted at different market segments.
Additionally, three more variables were created for the analysis: time, quarter and COVID. The variable time is a correlative starting in one and increasing by one for each month in the data. The variable quarter indicates the quarter of the year, and the variable COVID is a dichotomous variable which indicates the months of the pandemic.

Empirical model

Five regression models were estimated for this research: one for milk, one for cheese and one for yogurt, using aggregated data of all presentations and brands. The two additional models were estimated for the milk brands of Prasol and Gran Leche. These two additional models were estimated in an attempt to correct for the positive and statistically significant price elasticity obtained in the aggregated milk model. However, as we discuss latter in the paper, the positive price elasticity has a quite interesting explanation. The empirical models were of the form:

$$\ln(sales_t) = b_0 + b_1 \ln(price_t) + b_2 time + b_3 Q_1 + b_4 Q_2 + b_5 Q_3 + b_6 COVID_t$$

Where:

$ln(sales_t)$ corresponds to the aggregated monthly sales for each line of dairy product, $\ln(price_t)$ corresponds to the average monthly price per kilogram and liter and liters, time is a correlative starting in one and increasing by one each month, Q_1, Q_2 and Q_3 and the first, second and third quarters of the year (October to December is the reference), $COVID_t$ is a dichotomous variable indicated the months of the pandemic and b_i for $i = 0, 1, \dots, 6$ are coeficients to be estimated.

Data manipulation, graphics and analysis were done using Microsoft Excel, R and JASP.

Percentage changes were estimated using the formula $(e^{B_1} - 1) * 100$.

Results and Discussion

Descriptive statistics

For each regression model, a total of 60 observation were available, corresponding to monthly observations for a period of five years. Prasol was the brand with highest sales volume, with a mean value of 5.67 thousand litters. This brand has the highest rotation in the company and is the original with which the company opened operations. In contrast, the product with the lowest sales volume was cheese, with a mean value of 2.32 thousand kilograms per month. Regarding price, cheese was the product with the highest mean value and the milk brand Gran Leche was the one with the lowest mean value (Table 1).

Analysis of the aggregated fluid milk brands

All three brands of milk were aggregated in this initial analysis, which were Prasol, Gran Leche and Forty. However, the Forty brand was included until 2017, as the brand was discontinued from the market in that year. This did not represent a reduction in the volume processed by Lacteos Santillan, as the milk used for that brand was distributed among the other

two brands. The estimated regression model produced unexpected results, as the price elasticity was positive, specifically with a value of 2.16%, suggesting that an increase in 1% in the price milk would results in an increase in sales of 2.16%, which contradicts the law of demand. While unexpected, this positive and elastic price elasticity can easily be explained by market factors not included in the analysis. For example, some dairy companies did close during the pandemic, in which case the demand was absorbed by the remaining dairy companies in the market, including Lacteos Santillan. Additionally, the company has experienced continued growth during the last few years, resulting in more sales volume (Table 2).

The coefficients corresponding to the year quarters suggest that sales are higher in all quarters than the last quarter of the year (October – December). However, only the coefficients of the first and second quarters were statistically significant. According to the time coefficient, fluid milk sales have grown at a monthly average of 0.81%. Finally, The COVID-19 coefficient suggests than milk sales were 14.56% lower during the months of the pandemic, which includes the period from February to December of 2020.

Due to the unexpected positive elastic price elasticity of the aggregated milk brands analysis, separate models were estimated for the Prasol and Gran Leche brands.

Analysis of the Prasol brand fluid milk

As with the aggregated analysis of the milk brands, a positive elastic price elasticity was obtained for the Prasol brand. It values suggest that an increase of 1% in price would result in an increase of 1.32% in the sales volume, which contradicts the law of demand. Even though this result is unexpected, can be easily explained by the upward trend in sales that the brand experienced during the last few years (Figure 1).

Quarter coefficients suggest that sales are higher all quarters than the last quarter of the year. However, none of the coefficients was statistically different from zero. The time coefficient suggests that sales have been increasing at an average monthly rate of 0.32%. Finally, the COVID-19 coefficient suggest that sales were 11.9% lower due to the pandemic (Table 2). Prasol is a brand that has target market medium and high socio-economic status, which is a segment of the market that could afford milk presentations of higher prices, such as those packed in tetra pack, which provides a longer shelf life and was preferred during the pandemic due to the need to stock food items (Reyes, 2020). In contrast, Prasol is sold in a polypropylene package.

Analysis of the Gran Leche brand fluid milk

According to the estimation results, the price elasticity of demand of the Gran Leche brand is negative and elastic, suggesting that an increase of 1% in the price would result in a decrease of 1.28% in the volume of sales. As with the Prasol brand, sales seem to be higher during all the quarters of the year with respect to the last quarter, however, none of the coefficients was statistically significant.

The time coefficient suggest that sales have been increasing at an average rate of 0.05% per month (Figure 2). Opposite to the Prasol brand, the COVID-19 coefficient suggests that sales were actually 39.9% higher due to the pandemic. This result could be attributed to the fact that during the pandemic, several companies went out of business in the region were this brand is commercialized, specifically in the city of Milagro. Additionally, in contrast to the Prasol brand, Gran Leche is targeted to a market segment of low and medium socio-economic status.

Analysis of yogurt

For the analysis of yogurt, all brand and package presentations were aggregated monthly for the analysis. According to the model, the price elasticity of demand of yogurt is negative and elastic, suggesting that an increase in price of 1% would result in a decrease in sales volume 4.83%. This result indicates that Ecuadorean consumer are much more responses to price change in yogurt than to milk, indicating that yogurt may be a luxury food item, while fluid milk is a basic food item.

The quarter of the year coefficients, suggest that yogurt sales are higher during the second quarter, with respect to the fourth; however, none of the quarter coefficients was statistically different from zero. The time coefficient suggests that yogurt sales have slowly been decreasing over time, at an average of 0.48% each month.

Finally, the COVID-19 coefficient suggests that sales were 3.05% lower due to the pandemic; however, this value was not statistically different from zero. Some of the decrease in sales could be result of the suspension of in person classes, especially at school level.

Analysis of cheese

As with yogurt, sales of all brands and package presentations were aggregated monthly for the cheese analysis. According to the model, the price elasticity of demand of cheese is negative and inelastic, suggesting that an increase of price in 1% would result in a decrease in sales volume of 0.3%.

As with all other models, no significant differences were found in the sales volume during the quarters of the year. The time coefficient suggests that cheese sales have been slowly decreasing over time, at a monthly average of 1.03%.

The COVID-19 coefficient suggests that sales were 3.26% lower due to the pandemic. This result could be attributed to the reduction in demand of cheese by fast food and eat out restaurants, which were closed at the beginning of the pandemic and then had to operate with limited capacity (Wolf, 2021).

Conclusions

Overall, it was found that the impact of COVID-19 in the sales of dairy products was heterogeneous, with increases, decreases and no impact depending on the type of product. This result is important, as other analysis have suggested that consumption of dairy products decreased overall in some Latin American countries (IFPRI, 2021).

In the case of milk, which is considered a necessity good, Ecuadorian consumers did not significantly reduced its consumption during the pandemic, instead, those that could afford it, transition to packing presentations that allowed for longer storage periods, such as tetra pack; which was convenient during the pandemic.

Overall, yogurt can be considered a luxury item, which is mainly consumed by individuals in the medium and high socio-economic status. While there could had been an interruption in the distribution of yogurts at the beginning of the pandemic, demand picked-up as the lockdown restrictions were lifted. That was not the case for cheese products, which did experience a slight decrease in sales. In the case of the Lacteos Santillan, brands are targeted to consumers in all socio-economics status.

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Table 1. Descriptive statistics.

Variable	n	Mean	S.D.	Min	Max	Units
Sales volume (ln)						
Prasol (milk)	60	5.67	0.15	5.30	5.99	Thousands of liters
Gran (milk)	60	4.90	0.26	3.38	5.40	Thousands of liters
Yogurt	60	4.71	0.12	4.40	4.87	Thousands of liters
Cheese	60	2.32	0.26	1.64	3.09	Thousands of kilograms
Price (ln)						
Prasol (milk)	60	-0.61	0.08	-0.70	-0.46	US $
Gran (milk)	60	-0.71	0.03	-0.73	-0.60	US $
Yogurt	60	0.15	0.01	0.13	0.19	US $
Cheese	60	1.55	0.11	1.28	1.74	US $
Q1	60	0.25	0.44	0.00	1.00	
Q2	60	0.20	0.40	0.00	1.00	
Q3	60	0.25	0.44	0.00	1.00	
Time	60	42.50	17.46	13.00	72.00	
COVID-19	60	0.18	0.39	0.00	1.00	

Table 2. Model coefficients.

	Milk (aggregate)			Prasol			Gran Leche			Yogurt			Cheese		
	Coefficient	S.E.	p	Coefficient	S.E.	p	Coefficient	S.E.	p	Coefficient	S.E.	p	Coefficient	S.E.	p
Intercept	7.51	0.31	0.00	6.36	0.48	0.00	3.86	0.98	0.00	5.65	0.27	0.00	3.30	0.50	0.00
Ln(Price)	2.16	0.41	0.00	1.32	0.63	0.04	-1.28	1.38	0.36	-4.83	1.44	0.00	-0.30	0.32	0.35
January-March	0.06	0.03	0.04	0.01	0.03	0.82	0.09	0.09	0.32	-0.04	0.03	0.23	-0.09	0.08	0.23
April-June	0.08	0.03	0.02	0.02	0.04	0.68	0.09	0.10	0.35	0.07	0.04	0.05	-0.05	0.09	0.53
July-September	0.04	0.03	0.15	0.00	0.03	0.93	0.02	0.09	0.79	0.04	0.03	0.20	-0.11	0.07	0.13
COVID-19	-0.16	0.05	0.00	-0.13	0.06	0.04	0.34	0.11	0.00	-0.03	0.04	0.47	-0.03	0.10	0.75
Time	0.00	0.00	0.94	0.00	0.00	0.13	0.00	0.00	0.83	0.00	0.00	0.00	-0.01	0.00	0.00

S.E.: Standard Error

Figure 1. Prasol brand sales over time.

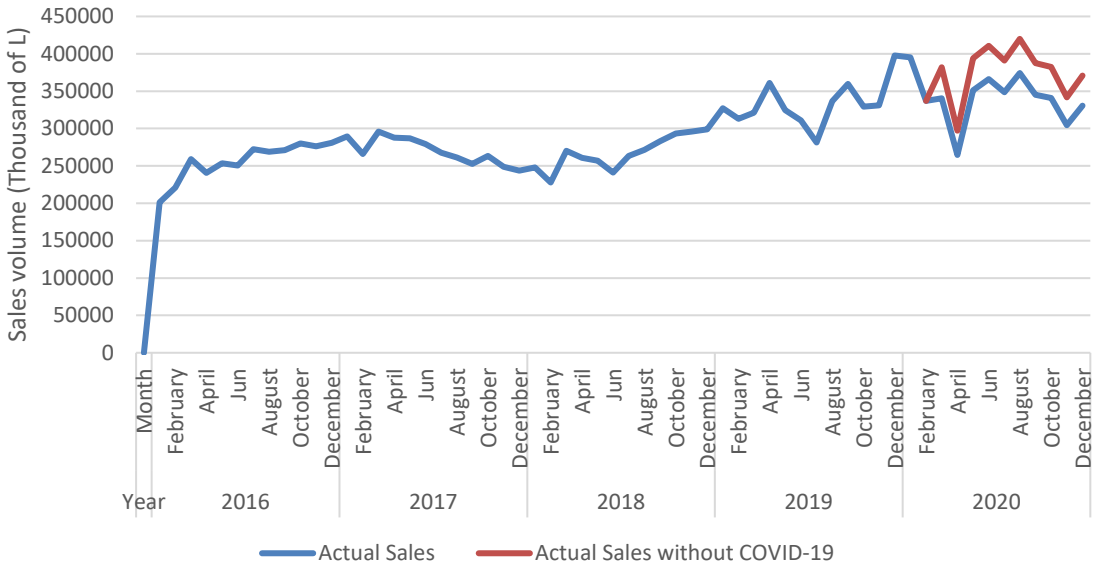

Figure 2. Gran Leche brand sales over time.