The price elasticity of the demand and revenue increase for some dairy products of the Mexican economy exported to United States of America

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Abstract
Price elasticity of demand (PED) is used to analyze in quantitative terms how the market of a given product adapts or adjusts to variations in the price of the same. The objective of this study was to estimate PED and its impacts on the variation of income (VI) of five traditional dairy products from Mexico, such as Oaxaca cheese (quesillo), Cotija cheese, goat curd (cuajada), cajeta (milk caramel) and chongos (sweet cheese). The data was obtained from the Foreign Agriculture Service (FAS), the United States Department of Agriculture (USDA) (1998-2018 period) through the tables provided and published on the Internet (secondary data). In this study, the arc method was applied to calculate PED and VI = ((Pf * Qf * 100) / (Pi * Qi)) - 100. The five products analyzed had a relatively elastic demand price in most of the years; on the contrary, the variation in income had positive and negative values, without a definite trend. It is concluded that there are no clear impacts of the PED on the sales revenue of the afore mentioned products; aspect that contradicts the theory of PED and its impact on income.
Key words: Agri-food markets, food demand and prices, agricultural profitability, international agribusiness.

Resumen
La elasticidad precio de la demanda (EPD) se utiliza para analizar en términos cuantitativos cómo se adapta o ajusta el mercado de un determinado producto a las variaciones en el precio del mismo. El objetivo de este estudio fue estimar EPD y sus impactos en la variación del ingreso (VI) de cinco productos lácteos tradicionales de México, como el queso Oaxaca (quesillo), queso Cotija, cuajada de cabra (cuajada), cajeta (caramelo de leche) y chongos (queso dulce). Los datos se obtuvieron del Servicio de Agricultura Extranjera (FAS), del Departamento de Agricultura de Estados Unidos (USDA) (período 1998-2018) a través de las tablas que proporcionó y se publicaron en Internet (datos secundarios). En este estudio, se aplicó el método de arco para calcular EPD y RI = ((Pf * Qf * 100)/(Pi * Qi)) - 100. Los cinco productos analizados tuvieron un precio de demanda relativamente elástico en la mayoría de los años; por el contrario, la variación del ingreso tuvo valores positivos y negativos, sin una tendencia definida. Se concluye que no existen claros impactos de la EPD sobre los ingresos por venta de los productos mencionado; aspecto que contradice la teoría de la EPD y su impacto en el ingreso.
Palabras clave: Mercados agroalimentarios, demanda y precios de alimentos, rentabilidad agrícola, agro comercio internacional.

Introduction

There are two groups of consumers in the United States whose consumption habits greatly favor the export of Mexican foodstuffs to that country. The first is made up of the community of Mexican origin that lives in the United States and the other, by a growing group of Americans increasingly interested in Mexican food. Mexican Americans spend $ 2.6 billion each year on supermarket food. Demographic data released by the last US census confirms that the Hispanic population in the United States is growing strongly. This census revealed that, in 1997, there would already be around 30 million Hispanics in the United States, which translates into an increase of 31 percent since 1990. The number of Mexican-Americans in that country has steadily increased, reaching 61 percent of the total Hispanic population. (11). For 2019, of a population of almost 57 million Latinos in the US, more than 63% are of Mexican origin, that is, more than 36 million people. This includes Mexican immigrants residing in the United States and Americans who, in the census, identify themselves as of Mexican origin (25). Mexico was placed as the first trading partner of the United States in the first half of 2019 (14). Mexico is one of the main trading partners of the U.S. together Canada and China. The commercial exchange between both nations has had an exponential growth over the years, although it should be noted that during the term of NAFTA, Mexico always sold to the United States more than it bought. (22).

One of the methodologies that help quantify important aspects in the market is the PED. The elasticity measures the degree of sensitivity of one variable before the change in another, id est, it is the inherent or own capacity of things to respond to external stimuli (7). The price elasticity of demand is a measure that quantifies the percentage variation in the quantity demanded in the face of changes in the price along the demand curve (10). It is used to analyze in quantitative terms how the market of a given product adapts or adjusts to variations in the price of the same. Then, the price elasticity of demand tells us the percentage variation that the quantity demanded of a good will experience if its price increases by 1% (13). The coefficient of price elasticity of demand is defined as the percentage variation of the quantity demanded of the i-th good before the percentage variation of the price of the it-h good. Expressed in other terms, it is the relation that exists between a relative variation of the quantity demanded and a relative variation of the price (3).

The coefficient of price elasticity of demand is a measure that is independent of the units in which the quantities and prices are expressed, that is, that the units cancel each other when calculating the elasticity coefficient, the units in which they are measured, both the price and the quantity demanded are in dollars, euros, yen, tons, kilos, liters, barrels and so on., they are both in the numerator and in the denominator and cancel, arriving to obtain a new coefficient. This facilitates the comparison among the price elasticities of the demand for different goods or for the same product in different periods of time or places, where the monetary units in which the prices are expressed do not matter, or the physical units in which the quantities they are measured (13).

Table 1. Summary of the effects on the price elasticity of the demand for a 1% increase in the price. Adapted from Parkin and Loría (18).

E_d value	Terms of demand elasticity	If the price	The quantity demanded	Total income
0	Perfectly inelastic	Increase 1%	Does not change	Increase by 1%
		Decreases 1%	Does not change	Decrease by 1%
$0 < E_d < 1$	Relatively	Increase 1%	Decrease less than 1% 1%	Increase by less than 1%
		Decrease 1%	Increase less than 1%	Decrease by less than 1%
$E_d = 1$	Unitary elastic	Increase 1%	Decrease by 1%	It does not change
		Decreases 1%	Increase by 1%	It does not change
$\infty > E_d > 1$	Relatively	Increase 1%	Decrease more than1%	Decrease by less than 1%
		Decrease 1%	Increase more than 1%	Increase by less than 1%
∞	Perfectly elastic	Increase 1%	Decrease to zero	Decrease to zero
		Decrease 1%	Increase more than1%	Increase more than 1%

The coefficient of PED has three typical cases: a) when the quantity demanded varies in the same percentage as the price and, therefore, the coefficient is equal to one. In this case, when the price elasticity of the demand is equal to one, it is called unit elasticity; b) when the quantity demanded varies by a percentage greater than the percentage variation of the price and therefore the coefficient is greater than one. When the price elasticity of demand is greater than one, demand is elastic and c) when the quantity demanded varies in a smaller percentage than the percentage variation of the price and, therefore, the coefficient is less than one. When the price elasticity of demand is less than one, demand is classified as inelastic (3).

The revenue increase from the sale of a good is the same at the price of the good multiplied by the quantity sold. When a price changes, so does the revenue increase. However, a decrease in the price does not always results in a decrease in revenue increase. The change in revenue increase depends on the demand elasticity as follows: If the demand is elastic, the revenue increase rises, if the demand is inelastic, the revenue increase decreases and if the demand has unit elasticity, the revenue increase does not change (18). This can be seen in Table1.

Oaxaca cheese is one of the cheeses that enjoy the greatest favor of consumers in Mexico, both in the popular classes and those with higher incomes. It is made in several states of the Republic, both in the center and in the southeast. It is sold, without packaging, the same in popular markets as in supermarkets or self-service stores, with better presentation and preservation (28). A unique Mexican product derived from cow's milk is the “quesillo”, also known as "Oaxaca cheese" or "string cheese". The manufacture of this cheese is carried out by subjecting the curdled milk to a kneading process with hot water. In Mexico the quesillo has an important preference at the table of millions of homes, although that taste is not limited to the interior of the country. The volume sold abroad is incipient, although the amount of sales exceeds 7 million dollars per year in 2016 (20).

The Oaxaca cheese, quesillo or string cheese, consists of a white and soft cheese of Mexican origin. Its place of origin is in the state of Oaxaca, specifically in the region of the central valleys. Due to its excellent melting qualities, quesillo is often used as a base for flamed cheese, an appetizer popular in Mexican restaurants, consisting of melted cheese and red chorizo. It is also used in the making of “quesadillas”. It is a spiced pasta cheese, which can be made into strands; it is made with a mixture of fresh milk and sour milk and has a particular feature the melting process that allows to stretch the dough and thus form strips that are rolled into a ball for Oaxaca cheese. It is made with cow's milk and it is made with whole milk, it allows obtaining a quesillo of more appreciated flavor, while with skimmed milk a quesillo of remarkable flavor is obtained only for the knowledgeable palates. It is known nationally and even abroad. This is a cheese little or nothing known in Europe although it is and very much in Mexico itself and in Central America where it begins to be produced quite intensely, especially for its export to the United States, where it has enough acceptance due to eating habits of its population (29). An export product must meet the desirable characteristics indicated in the regulations or standards for its production. It is important that the variability among different producers and within each producer does not vary much and the products fulfill the requirements in the legislation.

de Oca Flores et al (4) carried out a study in the area that forms the population of Aculco that has 37 cheese factories, of which 34 produce Oaxaca cheese, of which 11 (32.35%) producers who use raw milk were selected to collaborate with this study. The fat content shows differences between cheeses and there is also variability between samples collected from the same producer. It is important to note that although some cheeses collected and analyzed meet the minimum specification of the legislation (18%), some samples contained less than that. The protein content shown less variability among productions of the same cheese maker, but with differences between producers and no sample meets the minimum protein content required by legislation (28%). The variability in moisture content among cheese producers and within the same dairies was small, but highlights that all samples meet the maximum required moisture (48%). The acidity and salt content among producers and among samples from the same producer were also variable. These results show the variability of the Oaxaca cheese in an

important area of Mexico, also they did not meet the requirements for protein content.

"Cotija" cheese, a Mexican product that is easily identified as an aged cheese with a characteristic (salty) flavor and strong smell, cylindrical in shape and weighing approximately 20 kilograms. Its elaboration is based mainly on cow's milk through a process of artisan pressing and ripening that takes several months (minimum three) (22). The basic composition of the “cotija” cheese will be as follows: Maximum humidity 36%, Minimum Grease 23%, Minimum protein 25% and 10 liters of milk in each kilo of “cotija” cheese. The Cotija Region of Origin cheese must have a minimum of three months of life within the geographical area protected by this brand, considering the beginning of its life after the withdrawal of the press and the cheese will keep its traditional cylindrical presentation, of large format, whose dimensions are on average: 40 cm. in diameter and 18 cm. of height, with weight of around 20 kg; corresponding to the most common size and weight (1). The Cotija can be classified as hard cheese, pressed, not cooked, matured; it is made with raw cow's milk, whole or slightly skimmed milk; of dual-purpose cattle (zebu/pardo-swiss, holstein-zebu). It has a friable paste (crumbly, suitable for grating), something acidic and with a high percentage of salt. When it is well matured it has a nice yellowish-white color and a pronounced flavor-aroma. The Cotija is a product that enjoys prestige not only regionally but at the national level (28).

The curd or cuajada is a dairy derivative obtained from the coagulation of milk. Its consistency is creamy. The process for obtaining the by-product begins by incorporating cuajo or rennet (animal or vegetable) into the pasteurized goat's milk. Although the curd is part of the first phase of cheese making, in some countries like Spain, it is consumed as a traditional typical dessert to which sugar, honey or some fruits can be added (21).

Cooked curd of goat milk in the home provides the person with calcium, proteins, fats, vitamins and trace elements. The use of goat curd can provide the body with many necessary elements. The composition of whole milk goat curd per serving (125 g) is as follow: 6.0 g proteins (54 and 41 g recommendations men and woman per day, respectively); 6.6 g fats (100-117 and 77-89 g; 8.4 g carbohydrates (375-413 and 288-316 g); 271 mg potassium (3500 and 3500 mg); 224 mg calcium (100 and 1000 mg) and 164 mg phosphorus (700 and 700 mg), energy 118 kcal (3000 and 2300 kcal), saturated fatty acids 4.09 g (23-27 and 18-20 g), monounsaturated fatty acids 1.84 g (67 and 51 g) (8)

The cajeta or milk caramel is considered one of the oldest desserts; delicious agro-food crafts, which owes its name in the case of Mexico, to the cylinders made of sheets of tejamanil, called cajetes and to the use of goat's milk as the main input. The milk production of goats in the country reached 162.3 million litres in 2017 and entities such as Guanajuato, Coahuila, Durango and Jalisco, lead the national milking (23). The Mexican “cajeta” is a traditional candy made mainly based on milk, sugar and glucose, is identified by its characteristic smells and flavours, with a variety of presentations; is a direct consumer product with an approximate shelf life of 180 days after packing kept at room temperature, and

under adequate storage conditions (27). Vera-López et al., (25) indicated that the commercial trademark "Coronado" of Cajeta presented values of 4.21 ± 0.57, 4.61 ± 0.26, 4.32 ± 0.91, 4.61 ± 0.53 and 4.12 ± 0.45 for appearance, taste, color, texture and smell, respectively, while for chemical analysis it had values of 4.75, 24.0, 1.69 and 54.0 of proteins, humidity, ash and reducing sugars, respectively. While myfitnesspal (15) indicated 100 g of Cajeta de Celaya has 354 calories, 70 g carbohydrates, 7 g fat and 5 g proteins.

Zamoran chongos, apart from fulfilling a nutritional function, also has an exquisite taste on the palate. Many authors call this product a cheese, due to the similarity of its process to that of this one, although with its variants. On the other hand, it is difficult for the consumer to take it this way, since when tasting it, the first sensation that reaches the brain is of sweetness (2). Zamoran chongos, according to their bromatological composition and manufacturing process, can be classified as an atypical artisan cheese made from whole cow's milk, unpasteurized. This product has a high moisture content and the quality of being sweet, by the addition of sugar (10-15%) which favors further lengthening of shelf life in addition to its pleasant taste, it is a cheese that includes spices (cinnamon and vanilla) that give it the exquisite aroma and dessert flavor, which turns out to be attractive for consumption. From the point of view of the consumer, it can be classified as a fresh cheese, which does not ripen; and usually found in a can; unusual practice in other types of cheeses, but in particular this prolongs the shelf life (average 2 years or more) and retains its organoleptic properties (5),

According to mentioned it above the following hypothesis is proposed:

Ho: The price elasticity of the demand has not an impact on revenue increase through the years for each of the five dairy Mexican products (Oaxaca cheese, (quesillo or strand cheese), Cotija cheese, goat curd, cajeta (milk caramel) and chongos (sweet cheese)).

Ha: The price elasticity of the demand does have an impact at least one year for each of the five dairy Mexican products (Oaxaca cheese, (quesillo or strand cheese), Cotija cheese, goat curd, cajeta (milk caramel) and chongos (sweet cheese)).

The objective of this study was to estimate price elasticity of demand and its impacts on the variation of income of five traditional dairy products from Mexico, such as Oaxaca cheese (quesillo), Cotija cheese, goat curd (cuajada), cajeta (milk caramel) and chongos (sweet cheese)..

Materials and methods

In order to estimate the price elasticity of the demand and revenue increase of Oaxaca cheese, Cotija cheese, goat curd, cajeta and chongos, it is necessary to gather the information of exports in dollars and volume in metric tons of these five products. These data were got from Foreign Agriculture Service (FAS), the United States Department of Agriculture (USDA) (6) for 1998-2018 period through the tables it provided and published on Internet (Secondary data). Using the data, the elasticity matrix was built up, which is what will be uses in the analysis. This

elasticity matrix is elaborated based on the reference export price in dollars for each MT and the volume exported in TM.

As it was indicated before, the price elasticity of demand has three special cases but specifically is of five types such as (a) Perfectly elasticity demand, (b) Perfectly inelasticity demand, (c) Unity elasticity demand (d) Relatively elasticity demand and (e) Relatively inelasticity demand. The measurement of perfectly elastic and perfectly inelastic demand is not possible. But the unity, relatively elastic or greater than unity and relatively 'inelasticity or less than unity elasticity of demand are measured with the help of following five methods: a) Total expenditure: b) Percentage or proportionate; c) Point elasticity; d) Arc elasticity and e) Income method (9). In this study, the arc method was applied.

It is indicated that exports expressed in millions of dollars will be considered as the overall average price by which these product were acquired (since the price at which the products of export are negotiated and acquired, they are It is used to analyse in quantitative terms how the market of a certain product adapts or adjusts to variations in the price of the same accounted for in millions of dollars, besides that said prices vary according to a change in the real exchange rate) and the record of tons of export will be equal to the average annual quantity demanded of these goods. Based on this, the calculations were developed according to the formula of the price elasticity of the demand of a product.

The price elasticity of demand can be estimated as follows:

$$E_d = \frac{\Delta\%Q}{\Delta\%P} \qquad (1.1)$$

$$E_d = \frac{\frac{\Delta Q}{Q_1}}{\frac{\Delta P}{P_1}} = \frac{P_1}{Q_1} x \frac{\Delta Q}{\Delta P} = \left(\frac{P_1}{Q_1}\right) x \left(\frac{Q_2 - Q_1}{P_2 - P_1}\right) \qquad (1.2)$$

Where: P_1 = Initial price, P_2 = Final price, Q_1= Initial quantity and Q_2 = Final quantity

It must be pointed out that for the use of the formula above it is necessary to know the quantities demanded at the different prices, but with all the other factors that influence the demand of constant consumers (ceteris paribus or remaining the rest constant) (12, 13).

Total income (TI) can be defined as the unit price multiplied by the quantity demanded, since this is the quantity of income received by any seller in a product, who charges a unit price equal to P, multiplied by the total of units sold, Q. (TI = P * Q) (13). The revenue increase (RI) can be calculated in both initial and final state, using the equation the total income formula as follow (17):

$$RI = \frac{(P_2.Q_2.100)}{P_1.Q_1} - 100 \qquad (1.3)$$

Where: P_2, P_1 Q_2 and Q_1 as above.

The data of exports and volume of the five products were introduced in the Excel software for processing and analysing and to estimate the price elasticity of the demand and revenue increase, both parameters were checked using on line calculators: (12) and (17), respectively. Graphs were built up with Excel software. Pearson's correlation coefficients were calculated between elasticity price of demand and revenue increase and between exported volume and export reference price using years as the common variable. They were calculated for all five Mexican products. The significance of Pearson´s correlation coefficients was determined at 0.01 or 0.05 level of probability.

Results and Discussion

Once the theory about the price elasticity of demand is explained and how the matrices have been built, the analysis of the products which are part of the study are shown below.

Oaxaca cheese

The price elasticity of demand of other cheese including Oaxaca cheese varied considerably, since in some years its demand is relatively elastic and in others relatively inelastic (Table 2), but PED was mostly elastic (PED > 1) (16 years) than inelastic (only last year) and was equal to unity in three occasions. These data suggest that the propensity of its demand is relatively elastic through the period of the last 20 years, since it is above unity in most years (The demand for a good is elastic when the reaction of consumers to a change in price is significant), this indicated that in the face of price variations, the quantity demanded of Oaxaca cheese is affected in higher proportion than the price. It is interesting that in three years PED was equal to unity, that means when the price diminishes the amount demanded rises but the total expenditure continue constant; then the elasticity of demand is called equal to unity. Table 1 shows the revenue increase; it was negative for 11 years. A negative revenue increase means that the income is actually dropping, but it was positive during eight years. For year 200, the RI was not possible to be estimated. When the demand is relatively elastic, the quantity effect predominates over the price effect, which has the affectation of increase the revenue increase as can be seen in Table 2 (positive revenue increase) when the elasticity was elastic and when demand is relatively inelastic, the quantity effect is lower than the price effect, so that a price increase causes a reduction in revenue increase as can be seen in Table 2 (negative revenue increase) when the elasticity was inelastic.

Table 2 shows the relation of exported volume and export referential price, as it can be seen the export referential price had an lowest in year 2013 (2520.6 US$/MT) and highest in 2011 and 2012 (5165.3 and 5168.8 US$/MT) and the exported volume was highest in 2005 (467.7 MT) and the lowest exported volume occurred in 1999, 2000 and 2003 (0, 20.1 and 17,5 MT, respectively). In the periods 2000-2003 and 2011-18, except 2015 and 2016, exported volume has been relatively low but this has been offset by higher export reference prices.

Table 2. Price elasticity of the demand, revenue increase and other economic variables of other cheese including Oaxaca cheese (Quesillo or string cheese) exported to United States of America from Mexico.

	Years 1999-2008									
Variable †	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
ERP(US$/MT)		3247.6	4842.5	4606.9	2520.6	3305.1	3320.5	4169.2	4423.7	4577.0
EV (MT)		20.1	41.2	51.0	17.5	239.8	467.7	326.5	300.9	285.2
PED	1.00	1.00	1.75	4.26	1.67	6.42	138.59	1.57	1.38	1.57
RI (%)	-100.00		205.64	17.76	-81.23	1696.77	95.95	-12.35	-2.22	-1.93
	Years 2009-2018									
Variable †	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
ERP(US$/MT)	3907.6	4328.4	5165.3	5168.8	4926.2	4537.9	4262.2	3778.1	3967.8	4604.1
EV (MT)	243.4	195.4	104.7	96.8	115.8	157.7	236.9	206.2	96.4	106.4
PED	1.00	2.14	3.43	115.76	3.72	3.73	6.41	1.15	14.82	0.66
RI (%)	-27.14	-11.08	-36.06	-7.48	14.01	25.45	41.10	-22.85	-50.90	28.07

† ERP: Export reference price; EV: Exported volume; PED: Price elasticity of the demand and RI: Revenue increase. ERP and EV are from FAS (2019).

Cotija cheese

Cotija cheese has an erratic demand during period 1999-2006 period and it can be noted that there was not exported volume in the period 2001-2006. There was quite distorted behaviour and certainly the data began to make sense from 2008. In general, since 1999, the elasticity was above the unit in ten years (elastic) and below in two years (inelastic), and only in three years the elasticity was equal to unit. From 2002 to 2006 it was not possible to calculate the elasticity and from 2002 to 2007 was not possible estimate the revenue increase. These data suggest that elasticity was mostly elastic (Table 3).

Price elasticity is used by companies mainly to establish and evaluate the pricing strategy. Understanding if the products or services are elastic or inelastic is, therefore, an important step in establishing the prices. If the pricing strategy already exists, the price elasticity of demand is a concept to consider before raising (or lowering) the price of the goods or services. For example, increasing prices by decreasing demand could increase the profit margin per sale, but could be detrimental to the overall income. If people lower prices to increase demand, people should evaluate whether the company has the capacity to handle additional orders and calculate the costs associated with the increase in supply.

Table 3 shows the revenue increase; it was negative in five years and positive in eight years. As it was stated before, a negative revenue increase means that the income is actually dropping. Table 3 shows the relation of exported volume and export referential price, as it can be seen the export reference price was highest in 2015 (8706.0 US$) and the lowest was at the beginning of the study (1999, 2885.5 US$/TM and 2000, 2469.0 US$/TM). The exported volume was highest in year 2018 (218.3 TM) and lowest in 2007 (1.0 TM). In 2017 and 2018, export reference prices had been relatively low, but this had been offset by high export volume.

Table 3. Price elasticity of the demand, revenue increase and other economic variables of processed cheese, not grated or powdered including Cotija cheese exported to United States of America from Mexico.

	Years 1999-2008									
Variable †	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
ERP(US$/MT)	2885.5	2469.0							6616.5	7103.8
EV (MT)	36.9	17.9							1.0	26.1
PED	1.00	4.46	1.00						1.00	26.08
RI (%)		-58.49	-100.00							2702.22
	Years 2009-2018									
Variable †	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
ERP(US$/MT)	7220.1	6857.0	4680.0	4401.8	5483.9	6888.1	8706.0	5309.6	3369.5	3277.9
EV (MT)	62.0	70.4	129.6	186.2	149.1	144.2	107.2	184.4	185.8	218.3
PED	50.19	2.46	1.57	5.85	1.01	0.15	1.26	1.09	0.02	5.84
RI (%)	141.44	7.84	25.64	35.13	-0.24	21.48	-6.04	4.91	-36.06	14.30

† ERP: Export reference price; EV: Exported volume; PED: Price elasticity of the demand and RI: Revenue increase. ERP and EV are from FAS (2019).

Cajeta (milk caramel)

The demand for cajeta (milk caramel) was very interesting. It was relatively inelastic for during three years (in year 2001 was almost was equal to 0 meaning that the demand is totally independent of the price. No matter how the price fluctuates, persons purchase the same amount of the product) and for 17 years the demand was elastic (Table 4). These data suggest that elasticity for cajeta is mostly elastic, there are several factors that determine the elasticity of demand at a given time. Here are some factors that make demand tend to be more elastic: a) Goods with more and better substitutes have a more elastic demand than goods that lack substitutes; b) In the long term the requirements are more elastic than in the short term and c) The goods in which the consumer spends an important part of his budget usually have a more elastic demand than those in which the portion of the expenditure is insignificant

Table 4 displays the revenue increase; it was negative in six years and positive in 14 years. The highest RI was in 2001 (105.56%) and the lowest in 2003 and 2007 (-29.40 and -38.09%, respectively. A positive number means the revenue augmented, while a negative result means that the revenue decayed. The greater the percentage, the solider the enhancement or reduction. That's not the complete picture, nevertheless. Most often, a business puts revenue on its income statement when the money is earned. Table 4 shows the relation of exported volume and export referential price, as it can be seen the export reference price was highest in 2001 (4153.4 US$/TM) and it remained under 3000 US$/TM during the period 2003-2018. The exported volume was highest in 2006 (862.9 TM) and it remained between 500 and 710 TM in the period 2007-2018. The export reference prices were maintained almost without variation except in the period

2000-2002 and 2011 suggesting that export reference price of cajeta is stable through time.

Table 4. Price elasticity of the demand, revenue increase and other economic variables of cajeta (milk caramel) exported to United States of America from Mexico.

	Years 1999-2008									
Variable †	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
ERP(US$/MT)	3025.8	3387.9	4153.4	3184.0	2883.1	2819.2	2836.1	2574.5	2682.5	2565.2
EV (MT)	158.9	158.7	266.1	590.5	460.4	527.4	739.1	862.9	512.7	700.4
PED	2.76	0.01	2.49	2.87	2.50	6.05	55.94	1.60	12.39	6.92
RI (%)	33.50	11.83	105.56	70.12	-29.40	12.01	40.98	5.98	-38.09	30.64
	Years 2009-2018									
Variable †	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
ERP(US$/MT)	2685.1	2751.4	2539.5	2599.5	2589.1	2651.8	2648.9	2594.9	2665.9	2529.8
EV (MT)	608.1	662.2	632.5	673.2	559.2	706.8	583.5	602.0	598.6	654.9
PED	3.09	3.49	0.57	2.67	46.15	9.75	174.67	1.52	0.21	1.71
RI (%)	-9.12	11.59	-11.84	8.95	-17.27	29.46	-17.54	1.07	2.16	3.82

† ERP: Export reference price; EV: Exported volume; PED: Price elasticity of the demand and RI: Revenue increase. ERP and EV are from FAS (2019).

Cuajada (curd) of goat

The demand for cuajada (curd) of goat presents a relatively elastic trend (17 years) despite having relatively inelastic demand in three years (Table 5), the last five years EPD was elastic, that is, in front of variations in the price, the quantity demanded of the product varies something in percentage terms. For example, in 2016, the elasticity was 2.17, that means that quantity demanded varied twice percent. For the inelastic elasticities the changes in the price do not affect so much the quantity demanded of the goat cuajada, remaining almost equal through the years studied. A product is considered to be relatively inelastic when the price elasticity of demand is below an absolute value on 1. This indicates that if the price of the product changes by 1%, the response in the quantity demand is less than 1%. The demand curves for inelastic goods are relatively stepe in slope (9). The cuajada had mostly elastic demand, that mean relatively minor changes in price cause relatively big changes in amount demanded of a product. In other words, amount is very responsive to price. Amount changes a lot in answer to minor changes in price.

Table 5 displays the revenue increase; it was negative in seven years and positive in 13 years. Revenue growth is the upsurge (or reduction) in a business's sales from one period to the next. Displayed as a percentage, revenue growth shows the upsurges and reductions over time recognizing tendencies in the company. Growth depends on the company, the industry, and the economic situation. A growth rate of 10 percent a year, sustained over time, is remarkably good, only about 10 percent of global companies sustain an annual growth rate in

revenue and earnings of at least 5.5 percent over ten years while also earning their cost of capital.

Table 5. Price elasticity of the demand, revenue increase and other economic variables of fresh cheese, and substitutes for cheese, not content cow milk including goat curd (cuajada) exported to United States of America from Mexico.

	Years 1999-2008									
Variable †	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
ERP(US$/MT)	4103.1	5173.0	4814.3	4535.9	4281.7	4629.2	4948.6	4939.7	5269.7	5814.0
EV (MT)	52.7	37.6	75.9	134.7	18.5	95.7	194.3	233.1	307.1	309.2
PED	6.08	1.45	9.40	9.38	26.31	17.33	10.20	100.86	4.24	0.07
RI (%)	-17.99	-10.05	87.86	67.21	-87.04	459.28	117.04	19.75	40.55	11.08
	Years 2009-2018									
Variable †	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
ERP(US$/MT)	5840.8	5614.5	5511.3	5842.9	4345.3	5880.3	6030.2	5866.7	5947.3	6065.1
EV (MT)	253.2	292.2	315.6	306.8	377.3	633.5	907.2	963.0	808.1	545.3
PED	43.30	3.62	4.15	0.48	0.70	1.69	14.12	2.17	12.82	19.80
RI (%)	-17.73	10.93	6.02	3.06	-8.54	127.22	46.85	3.27	-14.93	-31.18

† ERP: Export reference price; EV: Exported volume; PED: Price elasticity of the demand and RI: Revenue increase. ERP and EV are from FAS (2019).

Table 5 shows the relation of exported volume and export referential price, as it can be seen the exported volume increased from all period of study (except years 2003, 2009 and 2017-2018). The highest exported volume was in 2016 (963.0 TM) and the lowest in 2003 (18.5 TM). The lowest export referential price occurred in 1998 (4103.1 US$/TM) and the highest in 2018 (6065.1 US$/TM)

Chongos

The demand for chongos was a relatively elastic one during 15 years, inelastic in only two years, unitary in two years (2001 and 2012), unit elasticity in two years and in 2006 cannot be estimated (Table 6). These data suggest that elasticity of chongos was mostly elastic. The demand for unit elasticity means that the percentage of variation in the price and quantity demanded are the same, although in the opposite direction: if the price increases (decreases), for example, 20%, the quantity demanded decreases (increases) by 20%. If the demand is inelastic or rigid, it means that the percentage of variation of the quantity demanded is less than the percentage of variation of the price: for example, given an increase in the price of 20%, the demand decreases by 10%. In addition, the closer to zero the absolute value of the price elasticity, the more insensitive or inelastic is the demand for the good in question, as the elasticity in year 2001. Elastic demand, meanwhile, indicates that the percentage of variation of the quantity demanded is greater than the percentage variation of the price: a 20% increase in the price results in a decrease in the quantity demanded of, for example, the 40% and the higher the absolute value of elasticity, the more sensitive or elastic the demand. Relatively price elasticity of demand means that relatively minor changes in price

produce relatively great changes in amount demanded. In other words, amount is very responsive to price. More specifically, the percentage change in amount is larger than the percentage change in price. Relatively elastic demand happens when purchasers can select from among a big number of very close substitutes in consumption. The demand curves for elastic product are relatively flat in slope (9). For years 2001 the elasticity was almost cero (0.08). Perfectly inelastic demand, corresponding to the zero value when the variation in the price does not produce any variation in the quantity demanded, which always remains constant.

Table 6 displays the revenue increase; it was negative in seven years and positive in 11 years and in two years was not possible to calculate it. There was a high value of revenue increase in year 2018 (259.23%). Table 6 shows the relation of exported volume and export reference price. In the last two years, the exported volume was very low as compared to period 1998-2014, but this reduction was compensating for the high export reference price. The highest export reference price was in 2014 (4079.7 US$/MT) and the lowest in 1998 (2131.3 US$/TM). The export reference price had a trend to increase from 1998 to 2014.

Table 6. Price elasticity of the demand, revenue increase and other economic variables of chongos exported to United States of America from Mexico.

	Years 1999-2008									
Variable †	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
ERP(US$/MT)	2131.3	2155.0	2398.5	2109.9	2325.2	2476.2	2459.0	2764.4	2556.5	2989.0
EV (MT)	115.6	126.0	127.1	76.8	131.9	82.7	115.6	155.9	135.8	163.1
PED	4.23	7.79	0.08	3.85	5.44	7.29	47.60	2.54	1.76	1.17
RI (%)	53.25	10.21	12.27	-46.85	89.27	-33.23	38.81	51.61	-19.44	40.42
	Years 2009-2018									
Variable †	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
ERP(US$/MT)	3478.5	3408.9	3649.6	3944.5	3689.7	4079.7			3646.7	3643.2
EV (MT)	93.1	143.8	114.8	118.9	159.5	85.4			4.7	16.9
PED	3.61	21.18	3.29	0.45	4.37	6.03	1.00		1.00	1176.41
RI (%)	-33.57	51.37	-14.53	11.94	25.48	-40.80	-100.00			259.23

† ERP: Export reference price; EV: Exported volume; PED: Price elasticity of the demand and RI: Revenue increase. ERP and EV are from FAS (2019).

According to Paz Soldán y Villarroel (19) the products showing a relatively elastic demand, means that they have substitute goods, that is, there are goods in the international market that can replace them (not necessarily in the short term, since market adjustments require a time and do not occur automatically. If it is multiplied the price of a good by its quantity demanded and bought, it has the revenue increase of the company. This revenue increase of a company varies by virtue of the price elasticity; in favor it does so when the change in the price of the demand produces a greater quantity demanded. And on the contrary, when there is a change in the price that does not produce or decreases the quantity demanded. In the first case it is talked about elasticity and in the second one about

inelasticity, which can be translated into more or less elasticity for the company. From the point of view of the producer, what she/he is interested in knowing is the number of units she/he stops selling when the price of the good she/he offers increases. Hence, the importance for companies to know the elasticity of the demand price of their products, since with this data they will be able to predict how intensely the price variation can affect their sales. Knowing the elasticity of demand for products knows the effect that variations in their price will have on their sales, crucial to be prepared and make the corresponding adjustments with the intention of placating the possible negative impacts.

The price elasticity of demand for a good depends on several factors, but considering that one of the main determinants of demand is the preference of consumers, it will be impossible to establish a universal rule that objectively explains the factors that affect the intensity of these changes. The price elasticity of demand depends on the existence of substitute goods; nature of good, proportion of income spent on the good and period of time considered, The elastic demand price in most years in this study could be explain partially because the more substitutes a good has, more elastic will be your demand. Demand for goods of first necessity is inelastic and demand for luxury goods is elastic. The elasticity is inelastic for goods that consume a small proportion of consumer income and elastic for goods that consume a large proportion of income and in general, the price elasticity of long-term demand is greater than the short-term elasticity.

Table 7 shows the Pearson´s correlation coefficients of all five traditional Mexican products when elasticity was elastic between elasticity price of demand and income using years as the common variable. It can be seen that there was a not significant ($p > 0.05$) relationship between both factor for Oaxaca cheese, cotija cheese and chongos. However, the association for cuajada was positive and highly significant ($p \leq 0.01$) and the association for cajeta was negative and significant ($p \leq 0.05$), in the first case means that when price upsurges (or decreases) also rises (or diminishes) income and in the second case when export reference price upsurges (or decrease) decrease (or increase) income. They are directly and indirectly proportional. For the other three products when price increases (or decreases) does not have a defined trend or vice versa. The association for both factors in cajeta is in agreement with the elasticity price of demand theory (18)

Table 7. Pearson´s correlation coefficients (r) between export reference price (ERP) with income and exported volume (EV) of five traditional Mexican products exported to United States of America from Mexico in the period 1998-2018 when elasticity was eleastic.

	Oaxaca cheese	Cotija cheese	Cajeta	Cuajada	Chongos
Oaxaca cheese	0.053 & -0.116 †				
Cotija cheese		0.214 & -0.188			
Cajeta			-0.415* & -0.639**		
Cuajada				0.813** & 0.807 **	
Chongos					0.179 & -0.272

** Highly significant ($p \leq 0.01$). * Significant ($p \leq 0.05$). r´s without ** and * are not significant ($p > 0.05$). † First r´s are between ERP and income and second r´s are between ERP and EV.

Table 7 displays the Pearson´s correlation coefficients of all five traditional Mexican products between exported volume and export reference price using years as the common variable. It can be seen that there was a not significant ($p > 0.05$) relationship between both factors for Oaxaca cheese, cotija cheese and chongos, However, the relationship for cajeta y cuajada was negatively and positively, respectively highly significant ($p \leq 0.01$). In the case of cajeta, the relationship was inversely proportional, this means that when export reference price upsurges (or decreases) also diminishes (or rise) exported volume, but in the case of cuajada the association was directly proportional, this means that when export reference price increases (or decrease) also increases (or decreases) exported volume. For the other three products (Oaxaca cheese, cotija cheese and chongos) when export reference price increases (or decreases) the exported volume does not have a defined trend or vice versa. These results suggest that for cajeta, when export reference price increases, the USA importers acquire less cajeta volume to compensate the higher prices and for cuajada, when export reference price increases, the Mexican exporters sell more cuajada and get more income, situation very profitable for them.

Conclusion

The five products analyzed have a relatively elastic demand price in most of the years, on the contrary the revenue increase had positive and negative values, without a defined trend.

There was a not significant correlation between export reference price of demand and income for Oaxaca cheese, cotija cheese and chongos and positive and highly significant for cuajada and negative and significant for cuajada. There was a not significant correlation between exported volume and export reference price for Oaxaca cheese, cotija cheese and chongos but negatively and positively highly significant for cajeta and cuajada, respectively.

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