

Binary Logistic Regression with Bootstrap. Method to analyze the relationship between demographic variables and psychological prices.**Ph.D. Julio César Cenicerros Angulo**

Professor, Department of Economic Sciences, Universidad De Occidente, Culiacán, México.

Abstract.

This study starts from the following research question, What is the level of discrimination of the variables age, gender and education level in the purchasing decision of consumers who selected the product (tuna) the criteria for psychological prices ?

The results obtained by the method of binary logistic regression with Bootstrap, are conclusive; the covariate gender buyer measured by Wald statistic is highly significant (12.96) with a Sig. (000). Discarding the variables age and education level buyers. Which means in practical terms that it is women who largely decided in favor of psychological prices. So, we have that the odd ratio is 2.47 with men.

Keywords: Psychological prices, binary logistic regression, Bootstrap.**JEL: M31; C12; D12.****Introduction.**

In recent years the study of psychological prices has been approached from different theoretical perspectives to know:

First, authors who have studied the issue of pairs prices, mentioned that the aim of fixing these prices is mainly to demonstrate quality, which is emphasized in highlight product attributes that are perceived by the consumer, as in the case of brands prestige of perfumes and cars, authors agree it; Kotler & Armstrong (2008) and Lamb, Hair & McDaniel (2011).

Second, there are those who have studied the influence of odd prices in consumer behavior, mainly those with termination 9, for example Schindler (2001) It mentions that a price finished in 9 means a discount in the price to the consumer and the opportunity to buy cheaper, the same way Shindler & Kibarian (2001) contributes through research the following: when it expressed at a price with a termination of 99, the individuals considered would not find a cheaper price. Similarly Anderson & Simester (2003) add that the effect can cause a termination price 9 is stronger in new products.

However, some authors and research showing that left digits in the price are those who truly determine consumer behavior, as in the case of the research cited by Lamb, Hair & Mc Daniel (2011) and a research cited Thomas & Morwitz (2005), in these research it concluded that what really change in consumer behavior at prices ending in 99 in relation to prices ending in zero is the change of the digits on the left and not the ending price, because the mind works very quickly and remembers little of what it sees and hears, to make this selection of information, a person just remember the numbers to the left of the

price because these correspond to those with the most monetary value; In this argument is where we can find the success of the strategy of "Just below", adds Beracha & Seiler (2013).

One finding in Denmark also shows that people tend to process numbers through a process from left to right (Olsen, 2011).

From another point of view, odd prices may have negative implications for consumers because it not allows them to justify for appear to be cheapest purchase, leading them to excessive consumption, this way, if the consumer can justify their purchase will continue to buy, according to Choi, Li, Rangan Chatterjee & Singh (2014). Following the above fact, it is proposed that regulatory standards are created to protect consumers from price manipulation strategies.

Third, from a cultural point of view the prices are set based on superstitions that are about numbers, for example in China in the practice of price fixing, fixing with 8 at the end which means good luck in that country.

However for this research the main objective is to analyze which variables demographic discriminate and, how operates the relationship between them in the purchase decision using the criteria of psychological prices. So the study is structured through the following research question:
What is the level of discrimination of the variables age, gender and education level in purchasing decisions among consumers who select the product with the criteria of psychological prices?

Similarly, although different authors with support in recent research has study how consumers develop perceptions of value in relation to the psychological price. However there are still variables together to analyze, such as age, gender and level of education of consumers when selecting products with psychological prices.

In the other hand, it is important for companies to know the effectiveness of this pricing strategy and how age and level of education can influence the perception of the product that may be a factor to determine whether the consumer decides to buy or not the product.

Review of the Literature.

As regards the designation of psychological price according (Folkertsma, 2001), it is considered if it ends in 9, these prices are used in cafes, bars and public transport. If we assume that 99 is the only psychological price between 0.80 and 1.00, the price of 1.89 euros converted and rounded to the next psychological price will increase in price of 15%.

The important thing is to analyze the way in how people process information we receive and categorize data; the mind works very quickly and remembers little of what it sees and hears, to make this selection of information, a person just remember the numbers to the left of the price that these correspond to those with the highest monetary value, this argument is where find it the success of the strategy just below that these digits at the end of the price not remember it easily. (Beracha & Seiler, 2013).

For example, prices ending in 0, 5 and 9 are represented on the market. In they finished in 9 offered two explanations; one, indicates the tendency of consumers to consider price as a round where get change, and the other is that consumers underestimate the price when it ends with 9 considering only the digits on the left through a mental process that selects the imperfect information. (Schindler & Kirby, 1997).

The effect of odd prices ending in 9 increased demand and the increase depends on the product being offering. The effect that the price ended 9 can cause is stronger in new products with which consumers have had few experiences in the past, that is, they have seen in a few previous occasions, for products where the consumer has experiences the effect it is lower. (Anderson & Simester. 2003).

True, there is limited empirical evidence that the digit at the end of price affect demand. Data and explanations do not say how consumers form the belief that ended on 9 transmits information favorable price increasing demand. The explanation seems to be that is the way consumers process information of price which is imperfect. (Anderson & Simester, 2003)

In another way, (Choi, Li, Rangan, Chatterjee, & Singh, 2014) if where you have two products with exactly the same features and one was set a price of \$ 99.99 and the other a price at \$100.00 even when logic and in practical terms this should not impact, research shows that consumers are more susceptible to choose and buy the product for \$ 99.99 even if the difference is \$ 0.01.

In another order of ideas, with regard to the hedonistic consumption, odd prices may have negative implications for consumers because it allows them to justify, by pretending to be cheaper, leading them to purchase excessive consumption, the consumer can justify purchase will continue to buy. (Choi, Li, Rangan Chatterjee, & Singh, 2014).

Quigley and Notarantonio in 1992 investigated the image of the products in its price ending with 00 comparing these prices with those ending in 99 or 98, what they found was that consumers tended to perceive a discount finished in 98 or 99 prices more than zeros finished, they did not find statistical evidence of a significant difference between a price of 98 with one of 99 the effect on the perception of these two numbers were the same. (Schindler, 2001).

Another interesting study on prices ending in nine, consists of five experiments to show how much influence these effects and why these prices have effects that are perceive lower than a penny and ending in zeros, this occurs only when the left digit is different as in \$ 2.99 and \$3.00, the effect also depends on the difference between the price at which a product is sold and the price of competitive, it has a greater effect when the difference is smaller, the effect of nine numbers at the end of the digits is not limited to prices. (Thomas & Morwitz, 2005).

In another study, using commercial papers 8 different shops, subjects were provided with the prices; One group was given the papers with prices finished in 99 and the other one paper with prices finished at 00, that is, for each person seeing an article with a price finished 99 was another seeing the same article with a price finished at 00, the price range was \$ 12 to \$ 500 dollars of products offered in catalogs women's clothing, men's clothing, furniture and shoes for women. (Kibarian & Schindler, 2001).

What we showed was that when a price is expressed in a termination of 99 individuals considered not find a cheaper price. In the high-end retailers set prices 99 does not favor quality image compared with prices ending in 00 (Kibarian & Schindler, 2001)

Finally, (Ceniceros, 2015) approach the topic of how gender determines the effectiveness of psychological pricing strategy to the method of proportion difference in 2 independent samples. In his study confirms decisively that this strategy is more effective in women than in men. The consequences obtained from the sample of 300 individuals who were presented as stimuli products (condensed milk) with integer price, even and odd, are conclusive; At first, the variables gender and consumer prices are

related categorically (.001 < .05). In short, of all valid cases in the sample of women (166), the proportion who selected the pricing strategy is $P_1 = 7048$. While, the total men (131), $P_2 = 0.4961$.

Materials and methods.

The methodology used in this study corresponds to the binary logistic regression analysis with Bootstrap. The study is basically quantitative of type conclusive and transversal. To do this, was selected (stratified probability sampling method) and finally interviewed 297 consumers in the city of Culiacan, Sinaloa, México. They were presented as experimental stimuli foodstuffs (tuna) with different price levels; some whole and one psychological. Processing and analysis of data was performed using the SPSS statistical software. V.19.

Results.

This section presents the main results in the estimation of binary logistic regression model, as well as general information we have:

Table 1. Bootstrap Specifications

Sampling Method	Simple
Number of Samples	1000
Confidence Interval Level	95.0%
Confidence Interval Type	Percentile

Table 2. Case Processing Summary

Unweighted Cases ^a		N	Percent
Selected Cases	Included in Analysis	297	100.0
	Missing Cases	0	.0
	Total	297	100.0
Unselected Cases		0	.0
Total		297	100.0

a. If weight is in effect, see classification table for the total number of cases.

Table 3. Dependent Variable Encoding

Original Value	Internal Value
no	0
yes	1

Table 4. Categorical Variables Codings.

		Frequency	Parameter coding			
			(1)	(2)	(3)	(4)
Age	18 - 26 years	84	1.000	.000	.000	.000
	27 - 35 years	83	.000	1.000	.000	.000
	36 - 44 years	57	.000	.000	1.000	.000
	45 - 53 years	40	.000	.000	.000	1.000
	> 53 years	33	.000	.000	.000	.000
Educa_level_cat	Elementary Education	66	1.000	.000		
	Middle Education	66	.000	1.000		
	Higher Education	165	.000	.000		

Table 5. Classification Table^{a,b}

Observed			Predicted		
			Pric_Stra_food		Percentage Correct
			no	yes	
Step 0	Pric_Stra_food	no	0	115	.0
		yes	0	182	100.0
Overall Percentage					61.3

a. Constant is included in the model.

b. The cut value is .500

Once submitted the information summarized in building the model, we proceed immediately to see the results obtained in SPSS V.19, considering the Bootstrap treatment.

Table 6. Variables in the Equation.

	B	S.E.	Wald	df	Sig.	Exp(B)
Step 0 ^a Constant	.459	.119	14.852	1	.000	1.583

a. Variable(s) entered on step 1: Age, Gender, Educa_level_cat.

Table 7. Bootstrap for Variables in the Equation.

		Bootstrap ^a				
		B	Bias	Std. Error	Sig. (2-tailed)	95% Confidence Interval
						Lower Upper
Step 0	Constant	.459	.005	.123	.002	.223 .724

a. Unless otherwise noted, bootstrap results are based on 1000 bootstrap samples

Table 8. Variables not in the Equation.

		Score	df	Sig.
Step 0	Variables			
	Age	5.177	4	.270
	Age(1)	3.909	1	.048
	Age(2)	.001	1	.971
	Age(3)	.392	1	.531
	Age(4)	.270	1	.604
	Gender	13.432	1	.000
	Educa_level_cat	3.417	2	.181
	Educa_level_cat(1)	2.534	1	.111
	Educa_level_cat(2)	.199	1	.656
Overall Statistics		19.808	7	.006

Table 9. Omnibus Tests of Model Coefficients.

		Chi-square	df	Sig.
Step 1	Step	20.232	7	.005
	Block	20.232	7	.005
	Model	20.232	7	.005

Table 10. Model Summary.

Step	-2 Log likelihood	Cox & Snell R Square	Nagelkerke R Square
1	376.252 ^a	.066	.089

a. Estimation terminated at iteration number 4 because parameter estimates changed by less than .001 for split file \$bootstrap_split = 0.

Table 11. Hosmer and Lemeshow Test.

Step	Chi-square	df	Sig.
1	5.000	8	.758

Table 12. Contingency Table for Hosmer and Lemeshow Test.

		Pric_Strat_food = no		Pric_Strat_food = yes		Total
		Observed	Expected	Observed	Expected	
Step 1	1	14	16.603	13	10.397	27
	2	20	15.972	9	13.028	29
	3	13	14.299	16	14.701	29
	4	14	13.219	16	16.781	30
	5	14	14.150	22	21.850	36
	6	10	8.944	16	17.056	26
	7	8	10.027	23	20.973	31
	8	7	8.198	22	20.802	29
	9	9	7.650	21	22.350	30
	10	6	5.937	24	24.063	30

Table 13. Classification Table^a

		Predicted		
		Pric_Strat_food		Percentage Correct
		no	yes	
Step 1	Pric_Strat_food no	34	81	29.6
	yes	22	160	87.9
	Overall Percentage			65.3

a. The cut value is .500

Considering the three variables of interest; Age, gender and educational level of the respondents, it follows that the predictive power of the model is limited because as shown in Table 13 were correctly classified 65.3% of cases.

Table 14. Variables in the Equation.

	B	S.E.	Wald	df	Sig.	Exp(B)	95% C.I. for EXP(B)	
							Lower	Upper
Step 1 ^a			4.541	4	.338			
Age								
Age(1)	-.881	.486	3.292	1	.070	.414	.160	1.073
Age(2)	-.583	.483	1.455	1	.228	.558	.216	1.440
Age(3)	-.398	.508	.613	1	.434	.672	.248	1.818
Age(4)	-.265	.532	.249	1	.618	.767	.270	2.178
Gender	.908	.252	12.969	1	.000	2.479	1.512	4.062
Educa_level_cat			.698	2	.705			
Educa_level_cat(1)	.225	.339	.442	1	.506	1.253	.644	2.436
Educa_level_cat(2)	.205	.310	.435	1	.509	1.227	.668	2.254
Constant	.413	.453	.833	1	.361	1.512		

a. Variable(s) entered on step 1: Age, Gender, Educa_level_cat.

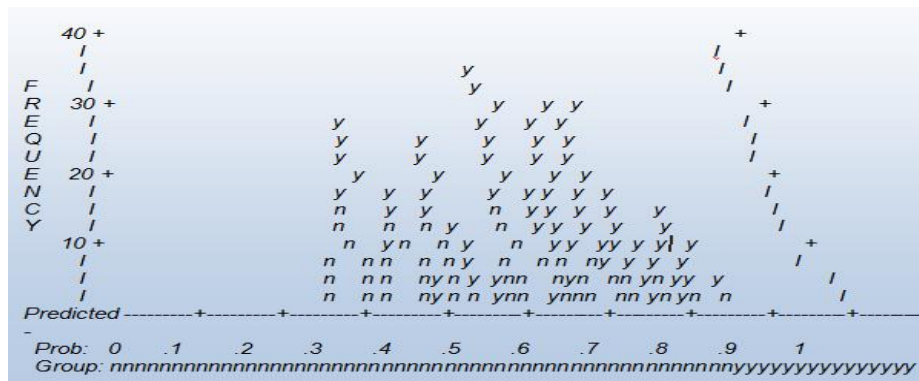
Table 15. Bootstrap for Variables in the Equation.

	B	Bootstrap ^a					95% Confidence Interval	
		Bias	Std. Error	Sig. (2-tailed)			Lower	Upper
Step 1								
Age(1)	-.881	-.025	.538	.076			-1.931	.094
Age(2)	-.583	-.019	.518	.233			-1.703	.392
Age(3)	-.398	-.024	.556	.452			-1.603	.644
Age(4)	-.265	.006	.568	.612			-1.385	.882
Gender	.908	.015	.259	.001			.446	1.459
Educa_level_cat(1)	.225	.029	.358	.516			-.436	.948
Educa_level_cat(2)	.205	.000	.309	.505			-.379	.832
Constant	.413	.024	.497	.381			-.492	1.480

Table 14. Variables in the Equation.

	B	S.E.	Wald	df	Sig.	Exp(B)	95% C.I. for EXP(B)	
							Lower	Upper
Step 1 ^a			4.541	4	.338			
Age								
Age(1)	-.881	.486	3.292	1	.070	.414	.160	1.073
Age(2)	-.583	.483	1.455	1	.228	.558	.216	1.440
Age(3)	-.398	.508	.613	1	.434	.672	.248	1.818
Age(4)	-.265	.532	.249	1	.618	.767	.270	2.178
Gender	.908	.252	12.969	1	.000	2.479	1.512	4.062
Educa_level_cat			.698	2	.705			
Educa_level_cat(1)	.225	.339	.442	1	.506	1.253	.644	2.436
Educa_level_cat(2)	.205	.310	.435	1	.509	1.227	.668	2.254
Constant	.413	.453	.833	1	.361	1.512		

Figure 1. Step umber: 1 Observed Groups and Predicted Probabilities.



Predicted Probability is of Membership for yes. Symbols: n – no, y – yes. Each Symbol Represents 2.5 Cases. The Cut Value is .50

Discussion.

The results conclusively show that the variables of interest built into the model is just the kind of buyer who discriminate in relation to making purchasing decisions using the psychological price. So, we need to estimate the binary logistic regression model with gender Bootstrap buyer measured by Wald is highly statistically significant (12.96) with a Sig. (000). Which means in terms of practical decisions that women who largely decide in favor of psychological prices. Notice how the reason of advantage is 2.47

times over men. (Table 14). Similarly, when using the Bootstrap process for a size of 1000 replicates the results are confirmatory. (See Table 15). Thus, from different methodologies, i.e. both proportions test for two samples (Ceniceros, 2015), as binary logistic regression with Bootstrap research objectives are achieved by demonstrating and women is most effective strategy psychological prices. Once achieved these results in the future will be of interest to know the factors that determine them preference for psychological prices.

References.

- [1] Anderson, E. T., & Simester, D. I. (2003). Effects of \$9 Price Endings on Retail Sales:. *Kluwer Academic Publishers*, 93-110.
- [2] Beracha, E., & Seiler, M. J. (2013). The Effect of Listing Price Strategy on Transaction. *Springer Science+Business Media*, 237-255.
- [3] Cenicerros, J.C. (2015). Strategy Odd and Even Prices and its Effect on Female Buyers. *International Journal of Science and Research*, 1081- 1084.
- [4] Choi, J., Li, Y. J., Rangan, P., Chatterjee, P., & Singh, S. N. (2014). The odd-ending price justification effect: the influence. *Academy of Marketing Science*, 545-557.
- [5] Folkertsma, C. (2001). The Euro and psychological price: Simulations of the worst-case scenario. *De Economist*, 1-22.
- [6] Kotler, P., & Armstrong, G. (2008). *Principios de Marketing*. Madrid: Pearson Educacion S.A
- [7] Lamb, C. W., Hair, J. F., & McDaniel, C. (2011). *Marketing*. Cengage Learning.
- [8] Olsen, A. L. (2011). The politics of digits: evidence of odd taxation. *Springer Science+Business Media*, 59-73.
- [9] Schindler, R. M. (2001). Relative price level of 99-Ending prices: Image versus reality. *Kluwer Academic Publishers*, 1-9.
- [10] Schindler, R. M., & Kibarian, T. M. (2001). Image Communicated by the Use of 99 Endings in Advertised Prices. *Journal of Advertising*, 95-100.
- [11] Schindler, R. M., & Kirby, P. N. (1997). Patterns of rightmost digits used. *Journal of consumer research*, 192-201.
- [12] Thomas, M., & Morwitz, V. (2005). Penny Wise and Pound Foolish: The Left-Digit. *Journal of cosumer research*, 54-64.