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VALUATION OF QUALITY ATTRIBUTES IN THE PRICE OF NEW ECONOMY CARS

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ABSTRACT

The purpose of this study is to value the quality attributes of economy car models, that is, vehicles with a 1000 cc engine. With the liberalization of the domestic automotive market, the sector has been experiencing a growing market development and technology expansion which allows for the sale of more varieties and types of vehicles, each with a wide range of options, accessories and comfort items available as options for consumers. Based on the available attributes for each item, the consumer will choose those he perceives as useful depending on his perception of usefulness and quality. Among the different methods of quality valuation, this paper explores the theory of hedonic prices. According to the model proposed, it is possible to identify that the brand is the main attribute of valuation in the composition of the price of economy cars. At this point, it is possible to observe the companies' actions in the attempt to reposition their products in the consumer's mind. In comparison with similar studies, it is possible to notice that economy cars have evolved in terms of accessory availability. These results can also contribute as a point of reference for the automakers to better plan the vehicle, giving priority to types of vehicles that are consistent with the preferences of their consumers.

***Key words**: Hedonic Prices, Vehicles, Valuation of Attributes.*

VALORAÇÃO DE ATRIBUTOS DE QUALIDADE NO PREÇO DE VEÍCULOS POPULARES NOVOS

RESUMO

O objetivo deste estudo é valorar os atributos de qualidade dos modelos de veículos de passageiros populares, isto é, com motorização de 1000 cc. Com a liberalização do mercado automobilístico nacional, o setor vem experimentando um crescente desenvolvimento do mercado e uma expansão tecnológica, que possibilitam a comercialização cada vez maior de mais variedades e tipos de veículos, cada qual com uma grande variedade de opcionais, acessórios e itens de conforto disponíveis para a escolha do consumidor. A partir dos atributos disponíveis para cada bem, o consumidor escolherá aqueles que ele perceba como úteis segundo sua percepção de utilidade e qualidade. Dentre as diversas formas de valorar a qualidade, este estudo explora a teoria dos preços hedônicos. De acordo com o modelo proposto, pode-se identificar que a

marca constitui o principal atributo de valor na composição dos preços dos veículos populares. Nesse ponto, notam-se ações das empresas no sentido de buscar um reposicionamento de seus produtos na mente do consumidor. Comparativamente com estudos similares, verifica-se que os veículos populares têm evoluído em disponibilidade de acessórios. Esses resultados ainda podem contribuir como balizamento para que as montadoras possam planejar melhor o veículo, priorizando os tipos de veículos consistentes com as preferências de seus pretendentes.

Palavras-chave: Preços Hedônicos, Veículos, Valoração de Atributos.

VALORACIÓN DE ATRIBUTOS DE CALIDAD EN EL PRECIO DE VEHÍCULOS POPULARES NUEVOS

RESUMEN

El objetivo de este estudio es valorar los atributos de calidad de los modelos de vehículos de pasajeros populares, o sea, con motores de 1000 cc. Con la liberalización del mercado automovilístico nacional, el sector viene experimentando un creciente desarrollo del mercado y una expansión tecnológica, que hacen posible la comercialización cada vez mayor de más variedades y tipos de vehículos, cada cual con una gran variedad de opcionales, accesorios e ítems de conforto disponibles para la elección del consumidor. A partir de los atributos disponibles para cada bien, el consumidor escogerá aquellos que él perciba como útiles según su percepción de utilidad y calidad. Entre las diversas formas de valorar la calidad, este estudio explora la teoría de los precios hedónicos. De acuerdo con el modelo propuesto, se puede identificar que la marca constituye el principal atributo de valor en la composición de los precios de los vehículos populares. En este punto, se notan acciones de las empresas en el sentido de buscar un reposicionamiento de sus productos en la mente del consumidor. En comparación con estudios similares, se verifica que los vehículos populares han evolucionado en disponibilidad de accesorios. Estos resultados todavía pueden contribuir como estimativa para que las montadoras puedan planear mejor el vehículo, dando prioridad a los tipos que estén de acuerdo con las preferencias de los consumidores.

***Palabras-clave**: Precios Hedónicos, Vehículos, Valoración de Atributos.*

1. INTRODUCTION

The 90's marked a transformation in the global automotive industry, which the literature generally refers to as the globalization of the automotive industry. Thus, companies have focused their strategies on competitive changes which include a greater differentiation of their products, associations, alliances, and especially, the globalization of their activities. As a result of this process, there is a greater integration of the international production system in the industry (CARVALHO, 2005). The search for geographic expansion of these companies lies in the maturity and saturation of the key markets in which they operate (SANTOS, 2001). The markets of core countries have an average annual growth below 2%, while growth in emerging countries, even more expressive, shows oscillations that are typical of these economies (MARIOTTO, 2003).

Similarly, in Brazil, the liberalization of the domestic market, with the gradual reduction of import tax rates and the influences provided by specific incentive policies, such as the agreements of Sectorial Chambers (1992 and 1993) and the automotive regime (1996-1999), influenced the performance of the Brazilian automotive industry over the decade. During this period, the country witnessed the direct investment of companies such as Honda, Audi, Daimler, Mitsubishi, PSA-Peugeot, Citroën, Renault, and Toyota, and more recently, Nissan and Hyundai. This massive and abrupt entry leads traditional automakers, already installed in the country, to reinvest in the expansion of their facilities and to open new plants (CAUCHICK MIGUEL, 2006).

As a result of this process, the industry experienced a growing market development and a technological expansion that allowed the sale of more varieties and types of vehicles, each with a wide range of options, accessories, and comfort items available as options to consumers.

During the government of Itamar Franco, the government showed interest in offering tax incentives for the production of economy cars, and the industry responded by offering models with engines of one liter. The overall change in the tax policy in the period led to a change in the mix of products offered by automakers. This led to a major improvement in small engines (75 HPs on average), causing these models to represent the largest market share, accounting for almost 69% of vehicles sold in 2002.

Subsequently, the government's efforts to promote the sale of non-economy cars through the tax reduction of higher powered vehicles, and the automakers' efforts to offer a wider range of engine led to a drop in the market share of economy cars. However, this type of vehicle still accounted for over 47% of total sales in the domestic market in 2008 and ended the first half of 2009 with the same proportion (ANFAVEA, 2010).

Even though a large part of the Brazilian market is composed of economy cars, this variable alone, though crucial, cannot explain the final sale price to the consumer. Potential consumers of the vehicles available have the perception of differentiating the several possibilities of characteristics, depending on what is considered a priority (ANGELO; FÁVERO, 2003). Thus, based on the available attributes for each item, the consumer will choose those he perceives as useful according to his perception of usefulness and quality. Therefore, cars become heterogeneous goods, each with its characteristic or set of individual characteristics and attributes that go beyond the vehicle itself, as consumers differentiate the relative usefulness of each one of these attributes by choosing those that enhance their function of use.

The classical economic analysis assumes that consumers and companies make their decisions within the assumption of economic rationality (full). Therefore, it is assumed that economic agents seek to assign values to some resources that have no market or even act differently in the analysis previously considered, based on the use of the revealed preference technique (SOUZA; AVILA; SILVA, 2007).

Thus, the purpose of this study is to value the quality attributes of economy car models, that is, vehicles with 1000 cc engine. In addition, it intends to point out the attributes that are more useful for consumers, offered by leading automakers installed in Brazil (GM, Ford, Volkswagen, Fiat) representing the largest share in the domestic market. Specifically, it intends to:

- *Establish key quality attributes relevant for the composition of the price in the automotive market in Brazil;*
- *Based on the valuation of the selected attributes, point out the most relevant in the composition of the vehicles' price.*

A common method used in the valuation of quality attributes is the one that considers the theory of hedonic prices. This method is characterized by obtaining implicit prices for attributes or characteristics of a good, for which there is no direct market, among which the quality degree assigned to the goods by the consumer stands out. It is based on the assumption that it is possible to assess the relative importance of each attribute by obtaining the value assigned by consumers to items incorporated into the vehicles due to the different models available in the market.

Following this introduction (item 1), we present the theoretical reference on the definition of quality and how it can be measured by using the theory of hedonic prices, which supports this research (item 2), followed by the methodology applied in the study (item 3) and the analysis of the main results (item 4). Finally, we describe the results (item 5) and the references used (item 6).

2. THEORETICAL REFERENCE

The consumer orders his several possibilities of consumption, and the way these possibilities are ordered describes the consumer's preferences. This set of goods that can be acquired by the consumer varies in the case of price and income variations (VARIAN, 2003). However, there may be other factors that influence the consumer's decision, among which the perception of quality stands out (LIMA, 2008). The consumer's perception of quality directly affects his preferences and how much he is willing to pay for something.

The term quality is currently among the most widespread ones within society, as well as inside the companies. However, there is still little understanding of what quality means and also certain confusion regarding the use of this word (TOLEDO, 2001). Such confusion may be justified by the subjectivism and the heterogeneity that its use involves. At this point, the term quality is used in such a broad and analytically heterogeneous manner that it is difficult to find a useful and complete definition at the same time.

According to dictionaries, quality can be generically defined as "a superior characteristic or distinguishing positive attribute that makes someone or something stand out compared to others".

Within this definition, a few aspects can be spotted:

- *Quality is an attribute or characteristic associated with someone or something (consumer);*
- *Quality enables a distinction, something that grants a differential to others.*

Nevertheless, within these observations, Toledo (2001) states that quality may be only observable through the characteristics of things or people. Therefore, it is not possible to directly identify quality, but it is possible to see it through characteristics, being a result of the reading that is made out from these observable attributes. Paladini (2005) considers this approach as the best quantitative assessment model of quality, because the quantitative differences of quality are observable in the good by its nature, diversity, or features.

Based on that, the concept of quality can be associated with the value attributed to the goods or service. For the consumer, the total value represents the set of benefits expected for a particular product or service (KOTLER, 2000). Thus, it is possible to consider that the quality attributes observable by the consumer will determine the value of the product and, together, price and quality perceived by the consumer will influence his buying decision.

Several methods to measure and obtain the value of differentiated goods or service can be found in the literature. A widely used and recognized method is the theory of hedonic prices. This method is characterized by obtaining implicit prices for specific attributes or characteristics of a good, among which the degree of quality attributed by consumer to a good stands out (ANGELO; FÁVERO, 2003). Hence, this method is supported by an econometric approach, making use of market information for this purpose.

Souza, Ávila and Silva (2007), among many other authors, attribute the creation of the hedonic prices concept to Waugh, in 1928. In his study, the author sought to measure the influence of quality factors on the price of vegetables in the Boston market, in the United States. For this end, he used the physical characteristics of vegetables, such as size, shape, color, maturation, among others, as quality parameters, so that the presence of one or another attribute could determine either a positive or negative variation in the price paid for the product. (LIMA, 2008).

However, the term hedonic was first used in the research of Court (1939). The author was also the first to make use of hedonic regressions for the definition of hedonic price indexes, using vehicles as examples. (AGUIRRE; FARIA, 1997). Only after 1961, however, was this technique emphasized in the literature, with the research of Griliches (1961). This author provided a wide dissemination of this technique, relating the effects of quality changes in products with the changes in the price of goods in the automotive industry, aiming to develop price indexes adjusted by quality changes.

Later on, Lancaster (1966) stood out for formalizing the theory of hedonic prices, becoming one of the predecessors and reference in the literature for the valuation of attributes or characteristics of goods by the consumers. According to the author, the goods or services are defined by the set of attributes they possess and the purchasing behavior of consumers is defined according to the usefulness arising from these attributes and characteristics. Therefore, according to this approach, which had already been mentioned in the research of Waugh (1928), the consumer will not decide for a good, but for a set of attributes that best fulfills his perspectives and maximize its use.

According to Lancaster (1966), the neoclassical theory does not consider the intrinsic properties of a good, so the consumer is only able to compare different goods, but not their properties or characteristics. However, the author points out that the consumer has a preference order for attributes. Such order is applied to economic goods from the moment the consumer is able to perceive, verify and organize these characteristics objectively.

Thus, the model of hedonic prices considers the heterogeneous goods, each of them seen as a collection of attributes. These attributes are treated as a different good, responding to their own implicit price, which are derived based on the market price information of similar substitute goods.

Many other authors, who base their work on Lancaster (1966) as a reference, started conducting studies on hedonic prices. Rosen (1974) was the first to use this type of research applied to the market. He formalized the theoretical foundations for the hedonic hypothesis in his study. The author presents supply and demand equations in which prices depend on the characteristics of a good. Thus, hedonic prices are defined as implicit prices of quality attributes of goods. These prices are revealed based on values observed in the market regarding differentiated goods and the specific number of characteristics associated with them. (LIMA, 2008). Therefore, according to this model, the competitive balance is quantified in a space of several dimensions with agents attempting to maximize their functions and use, and the balance will be achieved when buyers and sellers experience perfect relationships (SOUZA; AVILA; SILVA, 2007). Therefore, the balance status will occur when buyers and sellers find the adjustment for the prices of each characteristic found in the good. In the case of goods with the same attributes being offered to the consumer, the one with the lowest price will be chosen.

Therefore, taking into consideration the differentiation of products and attributes associated with each good, one may reach the implicit prices estimated from a regression analysis, where prices of products are estimated according to their characteristics. Besides Rosen (1974), other authors, such as Murray and Sarantis (1999), Fávero et al. (2006), among others, made use of that artifice in their research focusing on the automotive market.

It is possible to notice that the models of hedonic prices have been widely used to value the characteristics of vehicles. These models typically make use of classical regression analyses, in which there is a regression of the sales price of vehicles due to the measurement of their attributes, stipulating the market value of the characteristics of a good and referring to the quantification of the consumers' preferences in relation to the attributes of a certain product (FÁVERO et al., 2006). Therefore, the usefulness of a vehicle can be

determined depending on its characteristics and attributes, and the price is exogenously determined by the demand and shows how consumers assess the variety of attributes present in vehicles.

The specification of hedonic price models, when applied in a context to estimate marginal prices of attributes in the automotive market, requires that independent variables used relate to the attributes that produce and generate usefulness to consumers (FÁVERO et al., 2006). In his study, Trandel (1991) highlights that models that control a relatively low number of physical characteristics of cars are not sufficient to quantify the consumer's preference.

3. MATERIALS AND METHODS

According to Gil (1999), research can be defined as the formal and systematic development process of the scientific method. In its general sense, the method is the order that should be imposed on the different processes required to achieve an end or a desired outcome (CERVO; BREVIAN, 1983).

Among the several approaches found for valuation, the Theory of Hedonic Prices has been widely used in the literature as a theoretical tool to measure the influence of one or more characteristics in the observable price of goods. Using this method in this study allowed determining how much, in monetary terms, the different combinations of attributes in the vehicles could influence, in terms of increase or decrease, the selling price of a particular car. Such proposition proved to be adequate for the analysis of the influence of each pre-determined characteristic in the observable price of goods. Therefore, in this research, the estimated economic value of the quality attributes of vehicles will support this theoretical approach. Therefore, we expect to obtain the estimates regarding the buyers' propensity to pay.

To this end, the method of analysis consists of a multiple linear regression analysis, to be obtained through the ordinary least squares (OLS) method. This method seeks to relate a set of independent or explanatory variables $(X_1, X_2, X_3, ..., X_n)$ *to explained or dependent variables (Y).*

In the empirical model used, it is considered that the price of cars is a function of the characteristics related to the attributes and options available. Therefore, the price of a vehicle or any goods can be obtained from the analysis of a finite set of attributes or characteristics. Each attribute, separately, constitutes some form of the final price of the goods investigated. Therefore, the function of hedonic prices can be generally expressed by:

$$P(X_1) = P(X_1, X_{2,} .... X_n) \qquad (1)$$

Where:

$P(X_1)$ *corresponds to the prices observed in the market analyzed*

X_n *corresponds to the quality attributes available in the vehicles*

In general, the multiple linear regression model can be expressed by the following equation:

$$P_i = \alpha_0 + \alpha_1 X_1 + \alpha_2 X_2 + \alpha_3 X_3 + \alpha_4 X_4 + \alpha_5 X_5 + \alpha_6 X_6 + \alpha_7 X_7 + ... + \alpha_n X_n + \mu \qquad (2)$$

Equation (2) expresses that the value of vehicles can be considered as a function of their own characteristics. Thus, the Pi price of the i-th new car registered in the period is interpreted as the sum of expenses of each characteristic included in the vehicle, determined by the product between the number of characteristics X_n *and their marginal value or implicit price, represented by* α_n. *The theoretical expectation of the population parameters to be estimated by the ordinary least squares method suggests that the values to be found are all positive, considering a level of statistical significance of 5%.*

The relation shown in equation (2) is specified by the plus sign and the random variable μ has a normal probability distribution with zero mean and constant variance, that is, $\mu \sim N(0; \sigma^2)$. *The data were processed and subsequently analyzed through software SPSS 15.0*

The hedonic value of an attribute obtained by the model expressed in equation (2) represents the valuation caused by the addition of a particular

quality attribute in the vehicle. The method used in this study aims to estimate a market model for new vehicles, with 1000 cc engine, sold by four major automakers in the country in sales volume (Fiat, Ford, General Motors and Volkswagen). For the composition of the price, sixteen implicit characteristics described will be considered. These characteristics are independent variables used in the model and are described in Figure 1. These variables were incorporated in the form of dummies, where value 1 indicates the presence of a particular attribute, and 0 indicates its absence.

Figure 1: Definition of hedonic variables

Variable	Variable definition
X_1; X_2; X_3: Vehicle brand	- Fiat vehicles: $X_1=0$; $X_2=0$; $X_3=0$ - GM vehicles: $X_1=0$; $X_2=0$; $X_3=1$ - Ford vehicles: $X_1=0$; $X_2=1$; $X_3=0$ - VW vehicles: $X_1=1$; $X_2=0$; $X_3=0$
X_4: Metallic paint	Metallic paint = 1 ; No = 0
X_5; X_6 : Number of doors	- Hatchback vehicles (3 doors) $X_5=0$; $X_6=0$ - Hatchback vehicles (5 doors) $X_5=1$; $X_6=0$ - Sedan vehicles (4 doors) $X_5=0$; $X_6=1$
X_7: Steering assistance	Power steering = 1 ; No = 0
X_8: Light-alloy wheels	Light-alloy wheels = 1 ; No = 0
X_9: Air conditioner	Air conditioner = 1 ; No = 0
X_{10}: Power door locks	Power door locks = 1 ; No = 0
X_{11}: Power windows	Power windows = 1 ; No = 0
X_{12}: Trip computer	Trip Computer = 1 ; No = 0
X_{13}: Radio	Radio = 1 ; No = 0
X_{14}: Fog light	Fog light = 1 ; No = 0
X_{15}: Visibility (rear windshield wiper and defogger)	Visibility = 1 ; No = 0
X_{16}: Air Bag	Air Bag = 1 ; No = 0
X_{17}: ABS	ABS = 1 ; No = 0
X_{18}: Power side-view mirror	Power side-view mirror = 1 ; No = 0
X_{19}: Parking sensor	Parking sensor = 1 ; No = 0

Source: Prepared by the author.

Secondary data for the model construction refer to new vehicles, 2009 models, sold in São Paulo, manufactured by the automakers listed above. This data was obtained from the automakers' websites, consultation at the car dealership, and price list published in a specialized magazine. We conducted a cross-section, and the sample totals 194 vehicles. The information collected refers to the average price of vehicles sold in the city of São Paulo, the options available in the models analyzed, and the average price of the corresponding options. Data collection was conducted from April to July 2009.

4. ANALYSIS OF RESULTS

The market of new cars is going through a period of adjustments. The production intended for foreign

sales, which in 2005 accounted for 35% of the domestic production, closed 2008 at 22.8% and, in the first half of 2009, it fell to 14.5% (ANFAVEA, 2010). If, on the one hand, Brazilian automakers have been losing ground in the foreign market, on the other hand, the domestic demand remains accelerated. Tax incentives and the recovery of credit after the crisis caused the automakers to focus their efforts on the domestic market. According to the National Federation of Automotive Distribution, the first half of 2009 was the best in the history of the automotive industry in Brazil, reporting a 3% increase in comparison with the first half of 2008.

In this market, the share of economy cars, after reaching its peak in 2001, when it accounted for more than 78% of the automotive market, has shown a gradual decline year after year. Such decline can be partially explained by the use of a differentiated tax policy for vehicles with more powerful engines, automaker innovations, expanding the range of engine available, and the increasing of credit availability, making vehicles of increased power engine more accessible. Table 1 illustrates the evolution of this market.

Table 1: Domestic sales in the wholesale automotive market

Year	1000 cc vehicles	Total vehicles	Share
1990	23,013	532,906	4.32%
1991	67,299	597,892	11.26%
1992	92,529	596,964	15.50%
1993	242,511	903,828	26.83%
1994	540,925	1,127,673	47.97%
1995	602,098	1,407,073	42.79%
1996	703,118	1,405,545	50.02%
1997	880,119	1,569,727	56.07%
1999	625,445	898,584	69.60%
2000	775,454	1,075,832	72.08%
2001	919,207	1,176,557	78.13%
2002	820,135	1,163,717	70.48%
2003	707,426	1,082,332	65.36%
2004	742,005	1,263,447	58.73%
2005	728,776	1,365,449	53.37%
2006	874,736	1,559,309	56.10%
2007	1,032,730	1,991,550	51.86%
2008	1,058,460	2,226,315	47.54%
2009	551,928	1,176,157	46.93%

Source: ANFAVEA, 2010.

However, economy cars accounted for 48% of total car sales in 2008, showing the representation of that segment. Given this representation, all automakers keep at least three models with this engine.

This study was based on the base prices set by automakers in May 2009. We have only considered versions of economy cars with 1000 cc engine.

Table 2: Average interval of new economy cars (1000 cc.) in 2009

Automaker	Model	Minimum Price (R$)	Maximum Price (R$)	Average Price (R$)
Fiat	Mille	21,960.00	29,703.00	24,872.00
	Palio Fire	24,490.00	32,195.00	27,668.71
	Palio	28,790.00	34,904.00	31,657.71
	Siena Fire	28,790.00	32,501.00	28,881.03
	Siena	29,160.00	37,595.00	32,923.33
Ford	Ka	24,880.00	31,175.00	27,503.00
	Fiesta	27,895.00	36,890.00	31,478.00
	Fiesta Sedan	30,255.00	36,280.00	32,762.00
General Motors	Celta	24,963.00	31,975.00	28,142.39
	Classic	25,379.00	30,945.00	28,017.75
	Prisma	27,686.00	33,979.00	30,421.00
Volkswagen	Gol G4	24,630.00	29,260.00	26,775.83
	Novo Gol	27,590.00	33,200.00	29,771.25
	Fox	29,075.00	37,815.00	33,948.00
	Voyage	29,290.00	34,270.00	31,408.00

Source: Prepared by the authors.

Table 2 shows the price range of these vehicles, where the minimum price is applied to the vehicle without the addition of optional features and the maximum price is the highest amount reached by the combination of the vehicle attributes. The average price refers to the arithmetic mean of each model for the period, ranging from R$ 21,960.00 (Fiat Uno Mille) to R$ 37,815.00 (Volkswagen Fox).

Table 3 shows the results of the multiple regressions applied to the vehicles studied.

Table 3: Results of multiple regressions for new economy cars

	Linear model			Significance
	Average Price R$	Standard Error	t-student	Std. Error
AVERAGE PRICE	23,529.03	324,117	72,594	,000
VW	3,691.44	335,166	11,014	,000
Ford	2,829.03	475,244	5,953	,000
GM	1,663.81	411,614	4,042	,000
Sedan	1,696.35	267,788	6,335	,000
Hatch 4 doors	2,615.45	313,011	8,356	,000
Steering Assistance	3,431.52	290,642	11,807	,000
AC	2,295.34	305,036	7,525	,000
Trip computer	1,449.24	608,380	2,382	,018
Radio	1,205.07	310,579	3,880	,000
Fog light	1,627.94	523,750	3,108	,002
Air Bag	1,850.84	498,060	3,716	,000
ABS	2,061.65	482,785	4,270	,000
R^2	81.70%			

R^2 *adjusted*	80.50%
F *Calculated*	67.384
N	196 *observations*

Source: Prepared by the authors.

In this study, we chose to use the linear model. This choice is related to the advantage attributed to this model, which makes it easier to understand, as the results can be directly observed. The estimated parameters report the attribute's direct contribution value to the final price of the model. In addition, semi-logarithmic models are often structured to reduce the effect of price variability among the products. However, since this study focused on economy cars, the average prices among vehicles was not so disparate. Previous studies, such as those of Souza, Ávila and Silva (2007) also focusing on the segment of economy cars, show a very similar explanatory power between linear and semi-logarithmic models.

The explanatory power of the linear regression model indicates R^2 statistics (81.7%), adjusted R^2 (80.50%), being statistically significant (HAIR JR. et al., 2009).The general model significance, determined by F-ratio, seems to be satisfactory in achieving the figures presented (67.384).

According to the model, the variable representing the parking sensor item showed the least significance within the model (0.799), but this may also be related to the low availability of this item among economy cars, being available in only one model. The variables metallic paint and visibility, the latter being composed of the optional items rear windshield wiper and defogger, showed the lowest value in the final composition of the vehicle's price and significance greater than 5%. This result may be associated with the low cost of these items.

Other variables with significance level above 5% were: wheels, power door locks, and power windows. This result differs from that indicated by the model presented by Souza, Ávila and Silva (2007), where these characteristics indicated a significance of 5% and 1%, respectively, and increased relevance in the composition of the model. This fact can be partially explained by the evolution of economy cars, where these characteristics are no longer considered as optional, but are included as items that should be part of the initial accessories package offered by automakers.

For a significance level of 5%, the variable power side-view mirror is included in the model. An interesting aspect should be highlighted here. For economy car models, automakers tend to dissociate the package of optional items called "power-trio", which includes power windows, power door locks, and power side-view mirrors. According to the linear regression model, the power window and power side-view mirror accessories represent higher relevance in the composition of the vehicle's final price than the other item that makes up the "power-trio". Therefore, based on this measure, automakers can have a better overview of the market segmentation in order to realize the value created by the inclusion of these accessories.

The residual amounts arising from the estimated model do not compromise the performance of its formulation, as no violations were found in the confidence intervals for the variables listed in Table 3, pre-determined at approximately 1% for the respective test.

According to the model proposed, it is possible to notice that the optional item air bag indicates a considerable reduction when compared with the coefficient found in the studies of both Souza, Ávila and Silva (2007), and Fávero et al. (2006). This may be an indication of the changes introduced by Law No. 1825/07, approved in 2009. This regulation makes it compulsory to include the device on all models manufactured in the country, a fact that has caused automakers to gradually adapt their models. It has increased the demand for such device, leading to the appearance of a larger number of suppliers and enabling the expansion of the production scale of this item, causing a reduction in its cost, thus minimizing the impact on the final price of the vehicles.

Another aspect worth mentioning is the importance given to four-door hatchback vehicles in comparison with sedan vehicles. According to the model proposed, for the economy car segment, with 1.0 engine, four-door hatchback vehicles have a higher value (2,615.45) than sedan vehicles (1,696.35).

The model is still an attempt to measure the intangible value of the brand present in economy cars. According to Oliveira (2006), the brand takes on a critical successful character of most companies in the relentless pursuit of excellence in the business. Tavares (1998) adds that the brand represents a unique set of features that the company creates and seeks to maintain. Thus, the brand brings a series of attributes and features that generate value for the consumer. These benefits are functional, experiential and symbolic (TAVARES, 1998). In this sense, Aaker (1998) posits that the quality perceived by consumers is an intangible dimension, a general feeling reflected by the brand. Therefore, as pointed out by Oliveira (2006), car manufacturers have understood the importance of the issue to the consistency of their actions, the extent of their business and protection of the organization.

Within this context, it can be seen that, based on the linear regression model proposed in this paper, the Volkswagen brand appears as the most valued by buyers, and its cars are R$ 3,691.44 higher in price in comparison to vehicles manufactured by Fiat, a brand used as a reference. This fact is corroborated by Datafolha's Top of Mind research, where for 16 consecutive years, since its first issue, Volkswagen brand appears as the first car brand that comes to mind according to the respondents, showing that it is well-positioned in consumers' minds.

According to Oliveira (2006), this difference in Volkswagen's prices is mainly a result of consumer's loyalty to the company's products. Brand loyalty is a phenomenon that occurs when the attitudes of beliefs appear favorable to a particular brand, expressed in the purchasing behavior of the individual (TAVARES, 1998). In the automotive industry, which is undergoing a period of transformation with the entry of new competitors and the appearance of a wide range of models, the presence of Volkswagen brand loyalty, expressed by the increase that brand value represents in the final price of the vehicle, appears as a barrier to the entry of competitors, who try to innovate and add benefits to their products in order to acquire slices of the market share.

At the other extreme, Fiat, a brand used as a reference for the construction of the linear regression model, appears as the least valued by consumers of economy cars. According to a research conducted by NCBS – New Car Buyer Survey – (2001), the Fiat brand has a factor of generating great dislike in consumers. According to research results, in 2001, the percentage of consumers interviewed who had a dislike for the manufacturer was at least twice as much as that revealed for other brands. In other words, the data reported indicate that the dislike of Fiat is much higher than that for other manufacturers. For Rodrigues (2002), this perception is still a reflection of the image acquired by the company during its entry into the Brazilian market.

According to the author, Fiat started its operations in Brazil in 1976 with the intention of providing the market with small, inexpensive, and robust cars that could be purchased by the majority of the population. The market, hitherto closed to imports and dominated by Volkswagen, Ford, and GM, understood that Fiat provided an alternative to what was offered in the market, and had a good acceptance in the beginning.

However, a few technical difficulties with the first models generated negative impacts on customers that had acquired these vehicles, and consequently, adversely affected the market. Customers felt betrayed when they gave up the "status quo" to a new alternative brand, and then were caught by these drawbacks (RODRIGUES, 2002).

Therefore, it can be seen that the image built around the Fiat brand since its entry into the market has an effect on the market to this day. These factors may partly explain the substantial difference attributed to the brand value identified by the hedonic regression model for economy cars. The company has sought - by means of post-sale, restructuring, and brand repositioning actions, which include, among other actions, the change of logo - to dissociate today's products from the technical problems in the past, because according to the results presented in Table 3, the brand value may be the main component in the composition of the price of economy cars.

After brand, comfort items such as steering assistance and air conditioner, demonstrate great relevance in the prices of these vehicles (R$ 3,431.52 and R$ 2,295.34, respectively), followed by safety items such as air bag and ABS brakes.

The information considered in the formulated model serves as the basis to develop and design projects for new vehicles, as well as to redesign existing vehicles, depending on the inclusion or not of attributes which are more or less representative in the composition of the prices, and which are sensitive to what potential consumers perceive in terms of quality. In addition, it can be used as a means of prediction in order to contribute to the decision-making in business for monitoring the brand value.

These results can still contribute as a point of reference for the automakers to better plan the vehicle, from the project and prospection phases up to the launching phase, giving priority to the types of vehicles that are consistent with the preferences of their consumers. By knowing the contribution of each feature in the composition of the vehicle's price, the company is able to determine the minimum resources and technologies required by each project, also serving as guidance for the marketing policies of the brand.

5. *FINAL CONSIDERATIONS*

The results obtained for the hedonic pricing model for new economy cars confirm the explanatory power of this method applied to the automotive industry. The proposed model has a significant explanatory power. The attribute of greatest relevance in the composition of the price is related to the subjective perception of consumers: the brand. Following this attribute, the characteristics that have the greatest relevance are those related to comfort, steering assistance, and air conditioner and safety items, such as air bags and ABS brakes.

However, the results achieved do not necessarily indicate that the choice made by the consumer when purchasing a vehicle is based on the importance of each of the attributes listed for the composition of the model, but only the relevance that each feature influences the final price of the vehicle. This is a suggestion for future research, using a cross-section with marketing data or the satisfaction rate of buyers in order to find out the attributes preferred by consumers.

The proposed model can be used in the preparation and definition of product in the automotive industry, as well as in the adequacy of current product lines. It aims to describe the composition of the vehicles' prices based on the intrinsic values of attributes present in optional packages, progressing in comparison with other studies of the area in being an attempt to measure the brand value in the composition of the final price of vehicles.

The brand value measurement can be useful to indicate to the automaker the quality of its positioning in the market. This study may serve as a starting point for the comparison of further studies, involving brands of other manufacturers, in addition to other segments in the automotive sector.

In spite of presenting a high explanatory power of variables, the proposed model must be improved, seeking to identify other characteristics and attributes that can better explain the final price of the vehicles, in order to go further in the attributes available in the vehicles. Furthermore, this study was restricted to the segment of economy cars. Future research should include, as an object of study, other vehicle segments of the automotive industry, without being restricted to the construction of models focused on only one segment, but including also comparative studies between different segments. It is worth pointing out the importance of the systematic update, in order to obtain not only a result like the one achieved in this study, but also the one in which the set of variable components of the vehicle can be compared in monetary terms. Therefore, it should isolate the inflation effects in order to measure only the changes in quality and features of the vehicle.

Finally, the use of hedonic models provides a broad field for further studies, which may be extended to other fields and areas in the market where it is possible to identify and measure the attributes present in the composition of products.

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