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Article

Automobile Variety in Emerging Countries: A Comparative Study between Brazil and USA

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Abstract: A high range of product is referred as an alternative to better reach specific customer needs. By the other hand, an increase in product portfolio may result in a reduction of company's operational performance. In the automotive sector, there is an increasing number of options available to customers, even though recent studies indicate low association between product variety and sales volume in some markets. In the Brazilian market, the car still has a limited amount of customization options compared to the levels provided in developed countries, like the United States. This study compares the association between the current variety in Brazilian and American cars with sales volume in each country. Through a Spearman correlation analysis, the results indicate a greater association between sales and external variety in the Brazilian market ($\rho=0.642$) than in the United States ($\rho=0.330$). This result indicates that the increasing car variety in the Brazilian market may not be advantageous, since higher levels of variety, as seen in the United States, are less associated with the sales volume.

Keywords: Product variety, automotive industry, external variety, Spearman correlation.

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1. Introduction

The mass production system started by Henry Ford with the Model T, in 1908, was an important milestone for the automotive industry. This production system allowed the American customers to acquire products that were only focused on the wealthy population. However, customers' tolerance to the non-fulfilling of their needs in automobiles is dwindling. When customers became more selective and exigent, the automotive industry had to rethink their production strategies to offer more variety [1, 2]. This wider range of offered products is an attempt by the car companies to meet customers' needs [3–5]. The major auto companies usually provide more customization options of its products with a variety of items such as body, engine, external paint, internal and external finishes and optional parts [6]. A company's ability to customize its products tends to stimulate the amount of sales and the competitiveness between companies [3, 7]. Increasing the options of attributes for a product is a strategy for competitiveness since its objective is to satisfy customers accordingly to their personal desires and necessities. This strategy has an important tradeoff between satisfying customers' desires and the operational cost of raising product variety in company's internal processes [8–10].

The definition of finding the appropriate level of variety in the product consists of a balance between marketing and production efficiency [11, 12], and its impacts on sales are not established in the literature [12, 13]. The variety level that a company should offer to its customers is still an important question [14, 15]. Low association levels were verified, at the automotive industry, between the attributes' variety in cars and car sale. An earlier study about the European automotive market verified that in 2002 the correlation between the available car options and the sales volume was $\rho=-0.23$, which indicates that the high number of options wasn't correlated to sales volume in that market [16]. A similar study carried in Brazil reached a $\rho=0.43$ correlation [2].

This study investigates the relationship between product variety and the volume of car sale. From this point, its objective is to compare the available varieties at the United States and Brazil and relate the number of options with the sales volume. The comparison between this two markets is due the fact that the United States have the most traditional car market in the world and Brazil is an emergent market that shows a significant growth in sales these past years. The results can be used to fit the available car options in emergent markets like India, South Africa, Mexico, China and other developing countries.

2. Materials and Methods

2.1. Mensuration of Automobile Variety

There are different approaches in literature to define and explore the product variety in different ways [13]. According to an economic view, this variety is a result of companies' initiative to develop a strategy of differentiation in the market, and analyzed according to its effect on individual customer behavior in the market balance and development of society [14]. Another way is to study the effect of variety from the company's management vision, focusing on product design, marketing and operations performance [15]. Following this view, the product variety is defined as the number of different products available to customers [3]. From this definition, the variety of product can be analyzed from the chain of the company or the market value. The view from the company, called internal variety, is the way the production arrangement is arranged to produce a variety of products directly related to organizational flexibility and manufacturing [17]. A variety related to the market, called external variety, indicates the quantity of products or configurations available to customers [17], and the type of range most studied in the literature [18].

Pil and Holweg [16] classified the product variety in static and dynamic and MacDuffie et al. [17] classified it in fundamental, intermediate or peripheral. Each of these classifications addresses the product variety in different ways but they are not necessarily exclusionary from each other.

This study is aimed to analyze, within the automotive industry, the external variety available in the market in a perspective point of product range, following the proposal of other studies in the literature [2, 13, 16, 18]. The external product variety can be measured by many methods. The simplest alternative is identifying how many different products are in the production process [19], is recommended for cases of products with low complexity [11]. Another more elaborate proposal is the multiplication of the customization options available to the consumer [20] (Eq. (1)):

$$V = (\text{body})x(\text{engine and gear})x(\text{paint and internal finishes})x2^{(\text{factory optionals})} \quad (1)$$

However, this calculation method still tends to present inaccurate results, since there may be restrictions on derivative models that would not be properly accounted for by multiplying the customization options [13, 16, 18]. From this problem, it is recommended to take into account the restriction of options in models such as the exterior colors and interior finishes restricted to a version of the model. In the automobilist scenario, this procedure was developed initially by MacDuffie Sethuraman and Fisher (1996) [17] and improved by il and Holweg (2004) [16]. It has been used in other studies to measure the external variety of products [2, 13, 18, 21–24] (Eq. (2)).

$$x_{ij} \cdot b_{ij} \cdot 2^{c_{ij}} - \sum_{i=0}^n \sum_{j=0}^m R_{ij} \quad (2)$$

where:

n= Number of models

m= Number of body options

a= Combination of engine and transmission options

b= Combination of interior trim and exterior paint

c= Optional available

R_{ij}= Restrictions of options by combination of model and body

The model version is considered (i= 1 to n) and the model's body (j= 1 to m). For every combination of model and body (i_n x j_m) there will be an amount of combinations of engine and transmission (a_{ij}) and a combination of interior trim and exterior paint (b_{ij}). The optional parts that will be available to customize the car are considered in a combination based in model and body (c_{ij}). At the end the amount of restrictions is calculated by R_{ij} for every combination of model and body (i_n x j_m). These restrictions can be from as many different ways as possible, like the impossibility of a sunroof in a convertible or optional parts that are available only for specific models or categories [13, 16, 18].

2.2. Data Collect

In order to gather the sales information in the Brazilian and American markets, data was collected from specialized websites. The Brazilian sales volume were collected based on the number of vehicles that were licensed in the year of 2013 from the National Federation of Auto-Vehicles Distribution [25]. For the American market, data was collected from the specialized website in the subject [26]. The automobile variety data were collected from the manufacturers' website, following other studies about this subject [16]. The sample used for the Brazilian market corresponds to 94.35% of its licensed vehicles in 2013. The American market sample is responsible to 90.01% of sales in 2014 (Table 1).

Table 1. Sample description.

	Brazil	EUA
Number of analyzed models (Ford- Fiesta, Edge, Explorer, Focus, Fusion/ GM- Spark, Cruze, Malibu, Equinox, Tahoe, Silverado/...)	118	120
Number of analyzed manufacturers (Ford, GM, Fiat, VW, Citroen, Peugeot, Renault, Audi, Chery, Jac, Honda, Nissan, Toyota, Land Rover, Mitsubishi, Suzuki, Hyundai, Kia)	18	27
Sample's percentage of licensed vehicles in 2013 in Brazil	94.35%	-
Sample's percentage of sales in 2014 in USA	-	90.01%
Sample's volume of sales for every analyzed model	3,377,610	15,010,778

The analyzed vehicles are distributed into segments on a very distinct way when we compare the Brazilian and American markets. While the Brazilian market has a high number of intermediate vehicles and

a higher availability of economy vehicles, the results shows that the American market has a greater preference for SUV's, as it is shown in Table 2. The samples data are available at Appendix A for the American market and at the Appendix B for the Brazilian market.

Table 2. Size of analyzed samples (models).

	Country	Total	Economy	Intermediate	Full Size	Commercial	SUV
n (Sample)	BRA	118	16	38	26	17	21
	USA	120	8	24	30	10	48

2.3. Statistical Methods

A comparison between automobile variety in the American and Brazilian markets will be analyzed. A previous analysis identified that the data is not normally distributed from a Kolmogorov-Smirnov test ($KS < 0.05$). From this point a non-parametric analysis was performed. A Mann-Whitney median test is recommended due to the objective of this study. This test is used to identify differences in a data central tendency when they are not well represented by a normal distribution [27].

The association level is then checked between the product variety available and sales volume. Since data is not a normal distribution, a Spearman's non-parametric correlation was selected to check the association level [27], as in other studies [28, 29]. The statistical analysis was calculated using the statistical package SPSS® v.21.

3. Results and Discussion

The analyzed vehicles are distributed between segments in a different way in Brazilian and American markets. While the Brazilian market has a greater number of intermediate models and a greater availability of economy models, the sample indicates that American customers have a higher preference for SUV's.

From Table 3, is possible to see that the American market has a higher automobile variety when compared to the Brazilian market in every segment. The results of the Mann-Whitney comparative test confirm this perception, presenting significate values ($p\text{-value} < 0.001$) to total variety and for every analyzed segment. This result confirms previous studies that showed comparative studies based in data descriptive statistics [18].

Table 3. Mann-Whitney median test for automobile variety in USA and Brazil.

			USA	Brazil	p-value
Segment	Total	Average (Std. Dev)	9.08E+39 (4.88E+20)	5.84E+05 (5.84E+05)	0.000**
	Economy	Average (Std. Dev)	1.33E+12 (3.08E+12)	2.66E+06 (6.94E+06)	0.000**
	Intermediate	Average (Std. Dev)	4.88E+20 (2.39E+21)	5.72E+04 (2.23E+05)	0.000**
	Full Size	Average (Std. Dev)	8.25E+14 (4.51E+15)	3.81E+05 (1.89E+06)	0.000**
	Commercial	Average (Std. Dev)	1.09E+41 (3.45E+41)	9.55E+04 (2.79E+05)	0.000**
	SUV	Average (Std. Dev)	7.47E+23 (4.45E+24)	2.22E+02 (5.95E+02)	0.000**

* Significate to 5%/ ** Significate to 1%

The association level between the available variety and sales volume for both markets, American and Brazilian, can be seen in Table 4. As expected, the sales volume in United States are higher as its automobile variety is also higher, however the sale is not always correlated to the available variety. It is also possible to verify the ratio between number of options (product variety) and sales volume and this ratio is higher in USA when compared to Brazil. This result shows that the number of options to customize the vehicle per sold unit is much higher in the American market when compared to the Brazilian. The evaluation of the association level between variety and sales volume identify that it is significate (p -

value<0.000) in both markets but the association in the Brazilian market ($\rho=0.642$) is higher than the association in the American market ($\rho=0.330$). When the automobile segments are analyzed independently, significant association (p -value<0.05) were identified only for the Brazilian market as in the following cases: economy vehicles ($\rho=0.755$; p -value=0.001), intermediate ($\rho=0.514$; p -value=0.001), full size ($\rho=0.411$; p -value=0.037) and commercial ($\rho=0.862$; p -value<0.000). No significant correlation was identified for the SUV segment in both markets.

Table 4. Spearman's correlation between vehicle variety and sales volume.

Segment	Country	n	External Variety (average)	Sales (USA 2014 / BRA 2013) (average)	Variety/Sales	Spearman's Correlation (ρ)	p value
Total	BRA	118	5.84E+04	28,623.80	2.04	0.642**	$p<0.000^{**}$
	USA	120	8.86E+39	121,054.66	7.32E+34	0.330**	$p<0.000^{**}$
Economy	BRA	16	2.50E+06	76,817.60	32.54	0.755**	$p=0.001^*$
	USA	8	1.33E+12	66,850.25	1.99E+07	0.303	$p=0.465$
Intermediate	BRA	38	4.70E+06	20,695.80	227.10	0.514**	$p=0.001^{**}$
	USA	24	4.88E+20	117,005.42	4.17E+15	-0.094	$p=0.663$
Full size	BRA	26	3.19E+06	25,149.30	126.84	0.411*	$p=0.037^{**}$
	USA	30	8.25E+14	130,955.10	6.30E+09	-0.109	$p=0.558$
Commercial	BRA	17	9.55E+04	31,023.70	3.08	0.862**	$p<0.000^{**}$
	USA	10	1.09E+41	250,891.00	4.34E+35	0.408	$p=0.242$
SUV	BRA	21	2.12E+02	10,013.50	0.02	-0.042	$p=0.856$
	USA	48	7.48E+23	105,447.58	7.09E+18	0.005	$p=0.970$

*significant to 5%/**significant to 1%

A descriptive analysis of product variety related to the different segments allows to observe that some attributes vary in a close way in both markets and in every segment. By the other hand, some attributes are offered in higher quantity by the American market, as shown by Table 5. The most evident differences can be checked in attributes as number of models, external paint and optional internal and external parts, which always shows a higher number of options in the American market.

Table 5. Descriptive analysis of product variety per segment.

Attributes	Country	Total	Economy	Intermediate	Full Size	Commercial	SUV
n (sample)	BRA	118	16	38	26	17	21
	USA	120	8	24	30	10	48
Body	BRA	1.06 (0.25)	1.18 (0.40)	1.00 (0.00)	1.00 (0.00)	1.31 (0.48)	1.00 (0.00)
	USA	1.27 (0.92)	1.00 (0.00)	1.00 (0.00)	1.00 (0.00)	4.00 (1.41)	1.00 (0.00)
Door options	BRA	1.08 (0.27)	1.19 (0.40)	1.00 (0.00)	1.00 (0.00)	1.35 (0.49)	1.00 (0.00)
	USA	1.07 (0.25)	1.13 (0.35)	1.08 (0.28)	1.00 (0.00)	1.30 (0.48)	1.00 (0.00)
Models	BRA	3.71 (2.79)	3.25 (2.59)	3.66 (2.80)	3.19 (1.67)	4.82 (3.86)	3.90 (2.96)
	USA	5.31 (3.20)	5.75 (4.40)	6.17 (4.51)	5.13 (2.37)	5.80 (3.71)	4.81 (2.51)
Engine	BRA	1.48 (0.60)	1.62 (0.62)	1.47 (0.65)	1.50 (0.50)	1.47 (0.72)	1.38 (0.50)
	USA	1.40 (0.69)	1.25 (0.46)	1.25 (0.44)	1.30 (0.60)	2.10 (0.74)	1.42 (0.74)
Transmission	BRA	1.58 (0.63)	1.31 (0.48)	1.71 (0.61)	1.65 (0.48)	1.65 (0.86)	1.38 (0.67)
	USA	1.36 (0.54)	1.50 (0.53)	1.71 (0.55)	1.17 (0.38)	1.40 (0.52)	1.27 (0.45)
External Paint	BRA	6.61 (2.73)	7.19 (2.71)	7.31 (2.86)	6.61 (2.08)	5.82 (2.86)	7.19 (3.06)

	USA	9.11 (3.15)	8.38 (1.30)	9.50 (2.65)	9.20 (2.37)	1.00 (7.67)	8.79 (1.29)
Interior Trim	BRA	2.42 (2.27)	2.12 (2.47)	2.89 (1.46)	2.57 (2.02)	1.82 (1.07)	3.14 (3.81)
	USA	2.63 (2.18)	1.88 (1.13)	3.50 (3.19)	2.60 (2.25)	1.90 (1.10)	2.48 (1.65)
Optional Interior	BRA	2.01 (2.95)	2.44 (3.95)	2.28 (1.46)	1.73 (2.60)	3.24 (3.15)	0.57 (0.93)
Parts	USA	8.74 (5.95)	6.63 (4.07)	8.54 (8.23)	8.37 (4.94)	11.50 (6.80)	8.85 (5.02)
Optional	BRA	1.13 (2.38)	1.75 (3.62)	2.26 (3.14)	0.96 (2.00)	2.18 (2.86)	0.19 (0.68)
Exterior Parts	USA	10.24 (9.00)	6.00 (4.24)	9.42 (8.01)	7.17 (4.86)	17.60 (8.62)	11.75(10.84)
Average (Standard Deviation)							

The Spearman's correlation analysis between the offered number of attributes (variety) and the sales volume in each segment (total, economy, intermediate, full size, commercial and SUV) is presented in Table 6. The significant correlation values are highlighted in this table. When the correlation value presents significant and positive, it is reasonable to assume that the number of options for this analyzed attribute in this market segment is significantly associated (p -value <0.05) to the number of sales. This result is an indication that the number of offered options is adequate to the market. The highest correlation value is for the number of optional exterior parts ($\rho=0.866$; p -value <0.01), indicating that the number of options for this attribute is the one that contributes most for vehicles sales among all the analyzed attributes.

The highest correlations ($\rho<0.7$) are most present in the Brazilian market. There are seven significant correlations identified, specifically in attributes as model options, interior trim, transmission and optional internal parts. Among the highest correlations there is only one occurrence in the American market, the number of dealer customization parts.

Table 6. Spearman's correlation analysis between variety and sales per segment.

Segment	Country	Total	Economy	Intermediate	Full Size	Commercial	SUV
n (sample)	BRA	118	16	38	26	17	21
	USA	120	8	24	31	10	50
Body	BRA	0.361**	0.515*	-	-	0.302	-
	USA	0.044	-	-	-	0.699*	0.107
Models	BRA	0.414**	0.704**	0.756**	0.276	0.300	0.758**
	USA	0.150	0.275	0.216	0.197	0.398	-0.133
Engine	BRA	0.418**	0.570*	0.379*	0.447**	0.475	0.422**
	USA	0.394**	0.203	0.310	0.162	0.576	0.406**
Gas Type	BRA	-0.086	-	0.032	-0.099	-0.147	-0.073
	USA	0.454**	-	-	-	0.667*	0.300*
Transmission	BRA	0.155	0.378	0.218	0.080	0.241	0.788**
	USA	0.079	0.237	-0.221	0.045	0.128	0.248
External Paint	BRA	0.184*	0.470	0.079	0.147	0.519*	-0.175
	USA	0.086	0.256	-0.385	-0.182	0.155	0.261
Interior Trim	BRA	0.216*	0.706**	0.398	0.103	0.317	-0.065
	USA	-0.138	0.309	-0.380	-0.391*	0.463	0.090
Optional Interior	BRA	0.467**	0.774**	0.230	0.589**	0.317	-0.072
	USA	-0.105	-0.157	-0.267	-0.237	-0.229	-0.075
Optional Exterior	BRA	0.559**	0.866**	0.410*	0.406*	0.363	-0.074
	USA	0.032	-0.039	-0.329	-0.136	0.040	0.033
Dealer	BRA	0.510**	0.541*	0.051	0.511**	0.430	-0.168
Customization	USA	0.357**	0.865**	0.716**	0.622**	0.223	0.189

*significant to 5%/**significant to 1%

4. Conclusion

The objective was to verify the association between automobile variety offered by the American and Brazilian markets and the sales volume in those countries. 118 models were analyzed in the Brazilian market and 120 in the American. This sample corresponds to 94.35% of sales in Brazil in 2013 e 90.01% in the American market in 2014. The final results indicated that the external variety presented much higher values in the American market when compared to the Brazilian (p -value <0.001). The correlation analysis between external variety and the sales volume presented as positive and significant for the Brazilian market ($\rho=0.642$; p -value <0.000) and the American ($\rho=0.330$; p -value <0.000). This results are an indication that Brazil offers a variety of vehicles that are more appropriate to its market than the USA.

The correlation results analysis between the number of options and the sales volume for the different automobile segments, the commercial segment in Brazil presented the highest association level. This result indicates that, among every automobile segment analyzed, the commercials in Brazil are the ones that are more adequate to its offered variety and sales volume.

The analysis allows us to observe each attribute's variety associated to every segment. These results indicate which attributes should be offered in a higher variety, for each segment. For example, for economy cars, the attributes which its variety options are more associated with sales volume are: optional exterior parts, optional interior parts and models, for the Brazilian market. However, for the same segment in the American market, the attribute that is more associated with sales volume is the dealer customization parts.

Lastly, this type of analysis can be very useful as a support for a decision while the product is being planned and designed or when its necessary to decide the variety level to offer for a certain vehicle model that is being developed.

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Appendix A – American Market Data

Manufacturer	Model	2014 Sells	Average Price	Cumulative %	Number of models
Ford	F-150	753851	\$42,832.50	4.52%	48419062153216
Chevrolet	Silverado	529755	\$47,372.00	7.70%	109013311004310000000000
Ram	1500	439789	\$41,967.50	10.33%	954815742048
Toyota	Camry	428606	\$30,234.50	12.90%	14764474368
Honda	Accord	388374	\$31,508.50	15.23%	121081167872
Toyota	Corolla	339498	\$21,510.00	17.27%	10267656192
Nissan	Altima	335644	\$29,658.50	19.28%	242665652224
Honda	CR-V	335019	\$31,848.50	21.29%	17179869184000
Honda	Civic	325981	\$24,275.50	23.24%	1862270976
Chevrolet	Cruze	273060	\$24,670.00	24.88%	13212090368
Toyota	RAV4	267698	\$29,749.00	26.49%	1040187392
Chevrolet	Equinox	242242	\$33,302.00	27.94%	130045981168239000
Hyundai	Elantra	222023	\$22,300.00	29.27%	254976
Hyundai	Sonata	216936	\$28,610.00	30.57%	671744
GMC	Sierra	211833	\$47,008.50	31.84%	9017831035687870000000000000
Nissan	Rogue	199199	\$29,880.50	33.04%	13494787244032
Chevrolet	Malibu	188519	\$29,051.50	34.17%	823572561920
Jeep	Cherokee	183786	\$51,055.00	35.27%	3023728
Nissan	Sentra	183268	\$21,818.50	36.37%	95026151424
Jeep	Cherokee	178508	\$32,044.50	37.44%	581504
Jeep	Wrangler	175328	\$33,412.50	38.49%	1531520
Volkswagen	Jetta	160873	\$20,567.50	39.45%	286
Ford	Connect	43210	\$26,302.50	39.71%	170753135738880
Subaru	Forester	159953	\$30,097.50	40.67%	46373638861779900000000000
Kia	Optima	159020	\$29,482.50	41.63%	153984
Toyota	Tacoma	155041	\$33,609.00	42.56%	681289187328
Toyota	Highlander	146127	\$39,445.50	43.43%	2390753280
BMW	4-Series &	142232	\$53,447.50	44.28%	87051370233856
Chevrolet	Impala	140280	\$34,321.50	45.13%	42885800001536
Subaru	Outback	138790	\$32,586.50	45.96%	11673330234144300000
Chrysler	Country	138040	\$35,197.50	46.79%	13760
Dodge	Caravan	134152	\$29,989.50	47.59%	91136
Chrysler	200	117363	\$27,445.00	48.29%	67112
Lexus	RX	107490	\$51,585.00	48.94%	83978354688
Mazda	3	104985	\$23,640.00	49.57%	5439488
Mazda	CX-5	99122	\$28,982.50	50.16%	8912896
Dodge	Charger	94099	\$49,782.50	50.73%	792576
Dodge	Journey	93572	\$29,132.00	51.29%	72832
Dodge	Dart	83858	\$21,430.00	51.79%	42992512
Dodge	Durango	64398	\$43,022.50	52.18%	709704
Dodge	Avenger	51705	\$23,000.00	52.49%	687864
Dodge	Challenger	51611	\$45,930.00	52.80%	5118208
Toyota	Tundra	118493	\$47,144.50	53.51%	2251099734016
GMC	Terrain	105016	\$34,673.00	54.14%	21143630076969000
Chevrolet	Traverse	103943	\$43,556.00	54.76%	69128495061532700
GMC	Acadia	83972	\$44,137.50	55.26%	87565176456364400000

Subaru	Impreza	83488	\$23,904.00	55.76%	157625986957967000
Chevrolet	Tahoe	97726	\$63,833.00	56.35%	30602055448697800000000000
Chevrolet	Sonic	93518	\$21,204.50	56.91%	8769888208896
Chevrolet	Camaro	86297	\$44,387.00	57.43%	8982803840499710
Chevrolet	Express	79352	\$44,259.50	57.90%	9415990289229970000000
Mercedes-Benz	C Class	75065	\$70,320.50	58.35%	11718294177359500000000
Nissan	Frontier	74323	\$29,430.00	58.80%	40132174413824
Lexus	ES	72508	\$44,905.00	59.23%	37580963840
	XV				
Subaru	Crosstrack	70956	\$27,078.50	59.66%	2674012278751230
Mercedes-Benz	E-Class	66400	\$95,616.50	60.06%	24704377008685100
Acura	MDX	65603	\$55,595.00	60.45%	76279718688587800
Chevrolet	Suburban	55009	\$63,352.50	60.78%	645488830885540000000000
Cadillac	SRX	53578	\$49,066.00	61.10%	2939992057993970000000
Chrysler	300	53382	\$40,622.50	61.42%	96768
Mazda	6	53224	\$28,445.00	61.74%	802816
BMW	5 Series	52704	\$76,132.50	62.06%	1187802906624
Subaru	Legacy	52270	\$27,937.50	62.37%	234881024
Lexus	IS	51358	\$45,972.50	62.68%	54089744384
BMW	X5	47031	\$76,095.00	62.96%	107717779783680
Mercedes-Benz	M Class	46726	\$59,500.00	63.24%	10715294137359500000000
Acura	RDX	44865	\$45,184.50	63.51%	72567767433216
Audi	Q5	42420	\$53,072.50	63.76%	117571584
GMC	Yukon	41569	\$62,339.50	64.01%	2534207176256260000
Chevrolet	Spark	39159	\$15,864.00	64.25%	1032192
Audi	A4	38679	\$42,715.00	64.48%	497811456
Infiniti	Q50	36899	\$47,375.50	64.70%	761856
Chevrolet	Captiva	35368	\$23,900.00	64.91%	5765988308855400000000
Mercedes-Benz	GLK-Class	35000	\$43,500.00	65.12%	2593529383731940000000000
Ford	Fusion	306860	\$29,761.50	66.96%	16861249536
Ford	Escape	306212	\$28,293.00	68.80%	14860594184192
Ford	Focus	219634	\$22,119.00	70.12%	37111722934272
Ford	Explorer	209994	\$43,689.00	71.38%	107545991577600
Ford	Edge	108864	\$37,979.00	72.03%	2165133279232
Ford	E-Series	103263	\$36,276.50	72.65%	2411677600456900000
Ford	Mustang	82635	\$35,160.00	73.14%	32403619840
Ford	Fiesta	63192	\$21,338.50	73.52%	1855458115584
Ford	Taurus	62629	\$32,866.50	73.90%	653171490816
Ford	Expedition	44632	\$53,234.00	74.17%	89123255746560
Nissan	Versa	139781	\$16,893.00	75.00%	12616466432
Nissan	Pathfinder	79111	\$39,527.50	75.48%	253403070464
Nissan	Maxima	50401	\$38,792.00	75.78%	1358954496
Nissan	Murano	47301	\$39,072.50	76.06%	109521666048
Nissan	Juke	38184	\$27,400.00	76.29%	25649413695209500
Volkswagen	Passat	96649	\$29,077.50	76.87%	188
Volkswagen	Golf	33675	\$22,960.00	77.07%	154
Hyundai	Santa Fe	107906	\$37,397.50	77.72%	1884176
Hyundai	Accent	63309	\$16,880.00	78.10%	5376
Hyundai	Tucson	47306	\$29,357.50	78.39%	73728
Jeep	Patriot	93462	\$25,680.00	78.95%	3825664
Jeep	Compass	61264	\$27,139.00	79.31%	25368576
Honda	Odyssey	122776	\$41,234.50	80.05%	1799591297024

Honda	Pilot	108857	\$43,526.00	80.70%	474989023199232
Honda	Fit	59340	\$21,109.00	81.06%	159383552
Kia	Soul	145316	\$22,770.00	81.93%	23822336
Kia	Sorento	102520	\$37,170.00	82.54%	60915712
Kia	Forte	69336	\$21,795.00	82.96%	356352
Kia	Sportage	42945	\$28,022.50	83.22%	1916928
Kia	Rio	35933	\$18,374.50	83.43%	28672
Toyota	Prius	136040	\$35,187.00	84.25%	57344
Toyota	Sienna	124502	\$39,694.50	84.99%	40108032
Toyota	Prius Sedan	122738	\$32,828.50	85.73%	73400320
Toyota	Prius C	40570	\$23,547.00	85.97%	1425408
Toyota	Prius V	30762	\$29,818.00	86.16%	6815744
Toyota	4Runner	76906	\$42,386.00	86.62%	402849792
Toyota	Avalon	67183	\$38,929.00	87.02%	52428800
Buick	Enclave	62300	\$48,133.50	87.40%	8584986789675010
Buick	Lacrosse	51468	\$37,620.00	87.70%	336855080
Buick	Encore	48892	\$29,169.50	88.00%	1258291200
Buick	Verano	43743	\$24,820.00	88.26%	393232
Chevrolet	Corvette	34839	\$77,492.50	88.47%	2943365139765660000
Lincoln	MKZ	34009	\$41,871.50	88.67%	340644593664
BMW	X3	33824	\$51,397.50	88.88%	1844682752
Fiat	Fiat 500	33708	\$20,752.50	89.08%	52076032
Mini	Cooper	31385	\$29,305.00	89.27%	1337569089329040000
Infiniti	QX60	31192	\$49,895.00	89.45%	11010048
Cadillac	CTS	31115	\$49,895.00	89.64%	157118464
Cadillac	Escalade	30522	\$88,005.00	89.82%	16035840
Mitsubishi	Outlander Sport	31054	\$27,135.00	90.01%	1228800

Appendix B – Brazilian Market Data

Manufacturer	Model	2013 Sells	Average Price	Cumulative %	Number of Models
Ford	Fiesta	136,711	\$10,148.48	3.82%	40
Ford	New Fiesta Hatch	8,498	\$14,996.97	4.06%	1728
Ford	Ecosport	66,097	\$20,906.06	5.90%	7200
Fiat	Novo Uno	184,362	\$8,951.52	11.05%	23555211264
Volkswagen	Fox	113,699	\$12,545.45	14.23%	11890851840
Fiat	Palio	177,014	\$11,256.06	19.17%	22020096
Volkswagen	Gol	255,057	\$12,466.67	26.30%	44660948992
Citroen	C3	33,669	\$14,390.91	27.24%	384
Ford	Focus	20,825	\$22,572.73	27.82%	5184
Renault	Clio	29,911	\$7,696.97	28.66%	2016
Ford	Fusion	9,562	\$33,771.21	28.92%	1728
Ford	Fiesta Sedan	29,048	\$11,178.79	29.73%	90
Ford	Focus Sedan	7,172	\$24,239.39	29.93%	256
Citroen	C3 Aircross	9,358	\$18,087.88	30.20%	1536
Citroen	C3 Picasso	6,582	\$15,906.06	30.38%	2400
Citroen	C4	4,216	\$17,618.18	30.50%	256
Fiat	500	7,281	\$16,457.58	30.70%	8400
Fiat	Bravo	9,060	\$19,253.03	30.95%	61341696
Fiat	Doblo	10,512	\$18,100.00	31.25%	184320
Fiat	Doblo Cargo	5,986	\$13,981.82	31.41%	98304
Fiat	Ducato	12,734	\$26,360.61	31.77%	32768
Fiat	Fiorino	12,434	\$11,924.24	32.12%	65536
Fiat	Idea	23,450	\$15,113.64	32.77%	12386304
Fiat	Linea	7,531	\$18,190.91	32.98%	9216
Fiat	Palio Weekend	15,554	\$13,740.91	33.42%	1441792
Fiat	Punto	40,407	\$15,492.42	34.55%	29491200
Fiat	Siena	129,825	\$9,842.42	38.17%	90112
Fiat	Strada	122,902	\$13,631.82	41.61%	311427072
GM	Agile	30,120	\$13,671.21	42.45%	64
GM	Celta	74,647	\$7,875.76	44.53%	24
GM	Classic	86,936	\$7,996.97	46.96%	32
GM	Cobalt	59,685	\$15,118.18	48.63%	7200
GM	Cruze HB	22,463	\$22,754.55	49.26%	224
GM	Cruze Sedan	26,525	\$23,390.91	50.00%	384
GM	Montana	46,707	\$11,648.48	51.30%	192
GM	Onix	122,333	\$10,072.73	54.72%	24576
GM	Prisma	61,301	\$13,163.64	56.43%	3456
GM	Sonic	7,487	\$16,557.58	56.64%	864
GM	Sonic Sedan	5,708	\$18,481.82	56.80%	10
GM	Spin	41,983	\$15,633.33	57.97%	1728
Peugeot	207	10,385	\$9,966.67	58.26%	4
Peugeot	207 Sedan	4,534	\$11,269.70	58.39%	12
Peugeot	208	20,729	\$14,315.15	58.97%	1512

Peugeot	308	10,931	\$19,845.45	59.27%	576
Peugeot	408	4,634	\$21,057.58	59.40%	256
Renault	Duster	50,221	\$18,136.36	60.81%	62208
Renault	Fluence	13,878	\$22,469.39	61.19%	1344
Renault	Kangoo	5,160	\$12,110.61	61.34%	192
Renault	Logan	23,036	\$10,771.21	61.98%	1536
Renault	Master	10,009	\$29,095.45	62.26%	720
Renault	Sandero	102,514	\$12,042.42	65.12%	216832
Volkswagen	Amarok	24,191	\$33,696.97	65.80%	1204224
Volkswagen	Cross Fox	16,228	\$16,363.64	66.25%	180224
Volkswagen	Golf	13,785	\$17,971.21	66.64%	2162688
Volkswagen	Jetta	14,350	\$24,375.76	67.04%	18432
Volkswagen	Kombi	25,221	\$15,180.30	67.74%	4
Volkswagen	Polo Sedan	8,187	\$16,646.97	67.97%	4915200
Volkswagen	Space Fox	16,324	\$16,459.09	68.43%	115200
Volkswagen	Tiguan	5,598	\$35,075.76	68.58%	2688
Volkswagen	Voyage	89,759	\$13,133.33	71.09%	3221225472
Volkswagen	Saveiro	72,370	\$13,142.42	73.11%	7864320
Citroen	C4 Picasso	1,704	\$26,481.82	73.16%	20
Citroen	C4L	3,055	\$21,436.36	73.25%	1400
Citroen	Jumper	2,847	\$26,772.73	73.33%	4
Fiat	Freemont	3,873	\$30,375.76	73.43%	160
Ford	Edge	3,242	\$43,936.36	73.52%	175
GM	Captiva	2,512	\$30,512.12	73.59%	8
GM	Tracker	2,388	\$22,784.85	73.66%	40
GM	Trailblazer	3,284	\$46,027.27	73.75%	112
Volkswagen	Space Cross	3,983	\$18,763.64	73.86%	2304
GM	Camaro	1,108	\$64,693.94	73.90%	4
Peugeot	3008	1,308	\$28,481.82	73.93%	32
Volkswagen	Fusca	1,364	\$26,803.03	73.97%	39424
Volkswagen	Passat	1,046	\$35,803.03	74.00%	1152
Ford	Ranger	22,077	\$31,951.52	74.62%	95256
Honda	City	29,243	\$17,572.73	75.43%	576
Honda	Civic	60,970	\$22,709.09	77.14%	360
Honda	CRV	8,272	\$32,559.09	77.37%	72
Honda	Fit	40,637	\$17,195.45	78.50%	432
Hyundai	HB20	122,320	\$13,677.27	81.92%	6912
Hyundai	HB20S	35,382	\$16,254.55	82.91%	80
Kia	Cerato	6,060	\$20,121.21	83.08%	40
Kia	Picanto	4,353	\$12,090.91	83.20%	144
Kia	Sorento	3,241	\$40,878.79	83.29%	56
Kia	Soul	1,291	\$20,878.79	83.32%	20
Kia	Sportage	9,438	\$32,106.06	83.59%	108
Nissan	Frontier	15,592	\$33,921.21	84.02%	384
Nissan	Livina	9,542	\$14,466.67	84.29%	648
Nissan	March	24,255	\$10,648.48	84.97%	300

Nissan	Sentra	6,750	\$20,557.58	85.16%	144
Nissan	Versa	20,730	\$13,257.58	85.74%	54
Suzuki	GVitara	3,788	\$27,693.94	85.84%	1512
Suzuki	Jimny	1,553	\$18,178.79	85.88%	198
Toyota	Corolla	54,103	\$24,162.12	87.40%	648
Toyota	Etios HB	34,801	\$12,042.42	88.37%	144
Toyota	Etios Sedan	27,236	\$12,736.36	89.13%	12
Toyota	Hilux	42,625	\$36,312.12	90.32%	31104
Toyota	Hilux SW4	12,354	\$45,769.70	90.66%	900
Toyota	Rav4	4,362	\$36,484.85	90.79%	360
GM	S10	54,251	\$23,981.82	92.30%	9600
Land Rover	Discovery	1,590	\$72,696.97	92.35%	1700
Land Rover	Evoque	6,606	\$78,757.58	92.53%	6732
Land Rover	Freelander	1,761	\$49,969.70	92.58%	14080
Audi	A3	1,025	\$29,969.70	92.61%	24
Audi	A4	1,674	\$48,454.55	92.66%	832
Audi	Q3	1,607	\$54,515.15	92.70%	324
Chery	Celer	1,913	\$12,118.18	92.75%	8
Chery	QQ	3,109	\$7,515.15	92.84%	8
Chery	Tiggo	1,456	\$15,757.58	92.88%	5
Jac	J2	5,591	\$10,300.00	93.04%	7
Jac	J3	4,317	\$11,512.12	93.16%	5
Jac	J3 Turin	3,055	\$12,027.27	93.24%	5
Jac	J5	1,311	\$15,754.55	93.28%	6
Jac	J6	1,470	\$18,360.61	93.32%	5
Mitsubishi	ASX	10,115	\$29,693.94	93.60%	512
Mitsubishi	Outlander	4,376	\$37,875.76	93.73%	216
Mitsubishi	Lancer	5,788	\$25,300.00	93.89%	320
Mitsubishi	Pajero	16,510	\$59,239.39	94.35%	192