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The Undergraduate Economic Review

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The Undergraduate Economic Review

Abstract

The Undergraduate Economic Review is the Illinois Wesleyan University Economics Department's newest endeavor. It is an on-line journal meant to compliment the Park Place Economist, but reach out to more students. The Undergraduate Economic Review accepts articles from students at different colleges and universities across the United States.

Why are Foreign Manufactured Cars Gaining Market Share in the US Market?

Adrien J. Gatesman

I. INTRODUCTION

For more than a decade the domestic market share of US car manufacturers has been decreasing and the car industry is becoming more and more competitive. Foreign cars are no longer just luxury cars, such as Mercedes, BMW, and Lexus. Currently, Toyota, Nissan, and Honda are becoming best sellers in the practical and affordable automobile market and are consistently increasing their market share while the Big Three - Chrysler, GM, and Ford - are losing theirs. An article from *The Detroit Free Press* (2005) stated that the combined market share of GM, Ford, and Daimler Chrysler was at an all time low of 60% in 2004. Currently, Toyota, Honda, and Nissan

are the top three foreign competitors with market shares of 13.1%, 10.8%, and 6.6% respectively (*Standard and Poors* 2004). These statistics are the basis of this research. This

paper uses six different cars from the upper middle segment of *Ward's Automotive Yearbook* — Impala, Sebring, Taurus, Accord, Altima, and Camry — to determine if there are specific features of the foreign cars, which the American cars lack that have helped foreign manufacturers gain market share.

In the search for an explanation to this problem, this paper reviews previous research, then explains the theory, the empirical model including the data set, analyzes the results, and offers any conclusions that can be made conclusions. With correct

data, this paper should be able to predict market share of individual cars using specific demand variables. Car manufacturers can then use these conclusions to determine what the consumer values and what they need to do to increase market share.

II. LITERATURE REVIEW

There is limited research in this area. The lack of literature could be due to the fact that private companies carry out this type of research. In these cases, the information is not publicly accessible. However, literature exists which supports the need for this research.

An article about the Profit Impact of Market Strategy (PIMS) program, for example, found a correlation between

quality and market share while researching profitability. The empirical model for the PIMS program was the PAR-ROI model, which uses a company's return-on-invest-

ment as the dependent variable and other market characteristics and "strategy dimensions" as the independent variables (Buzzell 2004).

Although critics noted that quality was a subjective variable, Buzzell defended it by responding "...But the only alternative that comes to mind would require that all of the participants conduct customer satisfaction surveys using standardized methods." (Buzzell 2004) My research takes the PIMS findings correlating quality and market share a step further to see which quality variables in the automobile indus-

"Foreign cars are no longer just luxury cars. Currently, they are becoming best sellers in the practical and affordable automobile market and are consistently increasing their market share."

try influence market share. Instead of using an aggregate quality variable in my research, quality is broken down into specific variables that have been measured by standardized methods from each of the sources.

The model in my paper uses safety, warranty, reliability, price, place of production, and gas mileage as quality variables. Price is included in the regression as a control and marketing variable. It is listed as one of the four basic Principles of Marketing in all of the major marketing textbooks. Price can reflect quality (Berman and Evans), however, hopefully by using six cars with similar price ranges there will be little correlation between price and other variables. A *Standard and Poors* article (2004) includes changes in style, engineering, safety, price of gas, and quality as factors that go into buying a car. Safety will be included as a quality variable, and reliability will go into the “engineering” variable. Instead of including the price of gas, since it is the same for each person, gas mileage will be included for each car.

Business Week (2001) states that American cars are lower quality than foreign cars. “Try as it might, the US auto industry can’t shake its karma for shaky quality – even though its cars and trucks are better than ever.” (*Business Week* 2001) The article goes on to show that the problem with the American cars starts with the engineers. Factories make the cars the way they are supposed to be made, but that is the problem. The materials and the design of the car are poor quality. US manufacturers also end up spending more in warranty costs than foreign manufacturers. This article supports the hypothesis that American cars are losing market share because they are lower quality.

III. THEORY

This research is based on Lancaster’s Theory of Consumption, which operates under two assumptions: 1) characteristics of goods are consumed 2) utility is a function of bundles of characteristics of goods (Burk 1968). To summarize, Lancaster believes people consume characteristics of complex goods. Therefore, if someone drinks a glass of milk,

milk is the input, but the person is really consuming the flavor and the thicker, more filling, substance of milk. In this model, the set of characteristics is the set of quality variables the consumer chooses: i.e. safety ratings and reliability ratings. The alternatives are the competing cars in that market segment. The

graph to the right is an example of how Lancaster’s Theory of Consumption relates to automobiles.

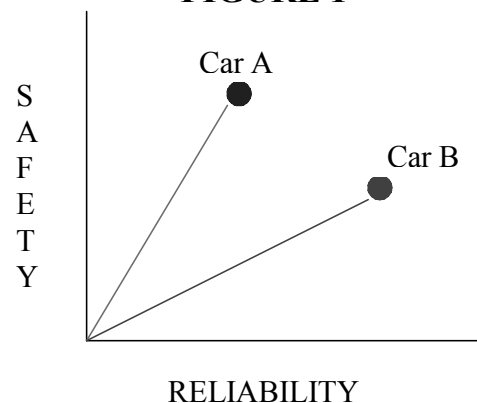
There are two points on the

graph. One point is Car A’s mix of characteristics between reliability and safety, the other point is Car B’s mix between safety and reliability. The buyer of Car A values safety over reliability, and vice versa for Car B. This theory will test which, if any, of these characteristics are most important to the general consumer. If specific characteristics are found to be important, American car manufacturers will have a better idea of what their cars lack and why they are losing market share.

A basic assumption for this paper is a consumer obtains more utility with the higher quality car he/she buys. Since consumers are utility maximizers, they will buy the best quality car. Quality is represented by specific characteristics such as: safety, warranty, gas mileage, and reliability. Therefore, these variables will reveal what makes a “quality” car and what consumers value most. The six cars are taken from the same segment of *Ward’s* and therefore have similar price range and similar dimensions, but the prices still vary. There is always the chance that price may be the only variable consumers care about, so

“Quality is represented by specific characteristics such as; safety, warranty, gas mileage, and reliability.”

FIGURE 1



the sticker price of each car must be included. Most likely though, consumers buy cars for reasons other than price alone.

Market share is the dependant variable and defined by the following equation:

$$\text{Market Share} = (\# \text{ of } x \text{ cars sold} / \text{total } \# \text{ of cars sold in the segment}) \times 100$$

(where, x is the type of car, Camry, Impala, Sebring, etc.)

Ward's Automotive Yearbook divides the cars into different segments based on length of the vehicle and price range. It then calculates the market share of the car for that segment. The six cars for this research were taken from the upper middle segment, which includes cars between 180 and 199 inches long with price between \$19,000-\$25999 as the new car sticker price.

The cars are taken only from the upper middle segment of Ward's to find the characteristics important to people buying this size car. For example, a person buying a small car may not find safety as important as price if they really need a car. Taking the cars from the same segment should control for price as well since most of the prices are similar.

Hypothesis: Lancaster's theory should hold true for cars. People should value the individual characteristics of the cars they buy, and it is these characteristics the foreign cars have and the American cars lack that may explain why the Big Three are losing market share.

IV. EMPIRICAL MODEL

The empirical model is the standard OLS model. The regression has % market share of the segment as the dependent variable and the following independent variables: price, country of production, safety, warranty, reliability, and gas mileage.

Price is the sticker price of the most basic model, although consumers may not actually pay the sticker price. High quality cars may sell closer to sticker price, while lesser quality cars may sell at significant discounts. Unfortunately, it would be extremely difficult, if not impossible, to determine the exact selling price of a car. This data is the most standardized data available for price.

Price is a control variable. It may be that the cheapest car is the one gaining market share, but hopefully this research will have more profound con-

clusions. Even though the selected cars are in the same segment of *Ward's* and they have the same price range, their prices are still not exactly the same. For comparison purposes, the price of the most basic model is used, without extra options. This ensures the comparison of the standard quality of the car the factory produces and not the extra options.

Another variable is country in which the cars are produced. This is a dummy variable. Many car manufacturers are using "Made in America" to sell their cars. "Several automakers, both domestic and foreign, are draping themselves in red, white, and blue with advertising campaigns and corporate messages to trumpet their commitment to building vehicles in America and hiring US workers." (*Detroit News* 2004) This variable may be significant for the Big Three and Toyota and Honda who have domestic factories.

The safety variable comes from www.autos.msn.com, which uses the National Highway Traffic Safety Administration ratings. The NHTSA tests most new cars in a full front crash at 35 mph. The cars receive separate ratings for the passenger side and the driver side. To simplify the data, the lowest score is recorded. It turns into a case of "a chain is only as strong as the weakest link."

The warranty of the vehicles is important to people because it lowers repair costs. The length of the warranty could be a deciding factor between cars with similar prices and styles. This information also comes from www.autos.msn.com. Four out of the six cars have the same 3-year or 36,000 mile warranty. Nissan and Toyota have a power train warranty for 60 months or 60,000 miles. The website gives information for these warranties only until 1999 and 1998, respectively. However, since it is a dummy variable, and these two cars are the only cars that have it, I will assume the warranties were the same throughout the years. This eliminates potential missing data problems.

Also from www.Autos.msn.com is the reliability rating. This rating is included in the regression because it serves as a substitute to repair cost or as an "engineering" variable. If reliability is good, then the quality is good and repair costs should be minimal. The website's reliability rating is basically a standardized check plus or minus rating for each aspect of the car: transmission driveline, brakes, engine, steering and suspension, heating and air conditioning, starting and charging, and accessories. It gives an

TABLE 1
Mean Values for Each Model

Data Source	Ward's	Ward's	autos.msn.com	autos.msn.com	autos.msn.com
Car	Automotive	Automotive	autos.msn.com	autos.msn.com	autos.msn.com
	Market Share	Price	Safety	Reliability	Gas Mileage
Chevy Impala	4.49	18400.70	4.23	3.60	19.80
Chrysler Sebring	1.00	18340.56	4.17	4.75	20.67
Ford Taurus	8.09	18406.00	4.40	4.70	19.22
Honda Accord	8.81	16922.10	4.00	4.44	24.30
Nissan Altima	3.29	15931.00	3.69	5.00	22.75
Toyotal Camry	8.70	17651.80	4.00	4.40	22.45

overall reliability score out of a possible five for each model year. This variable will be a dummy variable as well for each rating a car receives. The lowest reliability rating a car received is a 3. Dummy variables are then assigned for a car that received a rating of 4 or 5.

Gas mileage may or may not be an important variable. Recently gas prices have hit record highs of \$2.16 a gallon (Knight-Ridder 2004). There have been no records of decreasing gas-guzzling SUV sales even with the high gas prices. However, the variable is included in this research just in case it might be a factor in some consumers' decisions. Most of these cars should be around the same gas mileage though, since they are from the same segment.

Market share lagged one year will also be included in the regression. This variable is important because it can explain the popularity of each specific car. As the market share increases, the car is seen more frequently on the road, and that in itself can be a promotion for the car. Also, as the market share increase every year, if one of the other variables gets a worse rating, it will take a bit longer to reduce the market share of the car since it is already so popular.

The equation is:

$$\% \text{ Market share} = \beta_1 - \beta_2 \text{ price} + \beta_3 \text{ safety} + \beta_4 \text{ reliability} + \beta_5 \text{ gas mileage} + \beta_6 \text{ warranty} + \beta_7 \text{ Market Share lagged} + \beta_8 \text{ US}$$

Coefficients of all the variables except price should have a positive sign. The coefficient for price should have a negative sign because holding everything else constant, as it increases, the market share for that car should

decrease. However, as safety, reliability, and warranty increase, the market share for the car should also increase. These are variables/characteristics the consumers should value enough to make him/her buy the car.

The mean values for each car are in Table 1, and the actual data set, of 276 observations, is in the appendix. One can see that the safety and reliability ratings are somewhat high and relatively similar for each of the cars. These similar ratings do not allow for much comparison. However, market share and price have more variation between the models.

V. RESULTS

Most of the coefficients have the expected sign that theory suggests. The regression seems to explain most of the variation in market share, but there were only a few significant variables. The lagged market share variable is the most significant, and then gas mileage, followed by price. The safety dummy variable for four stars is significant to the .06 level. The results are presented in Table 2.

TABLE 2
Results

R- Squared	.772			
Variable	Coefficient	Significant	T-Statistics	
Constant	-16.844	.003	-3.118	
Warranty	1.009	.201	1.299	
Price	.001	.032	2.226	
Gas	.358	.026	2.306	
Market Share Lagged	.610	.000	6.273	
Reliability Lagged 4	1.134	.243	1.185	
Reliability Lagged 5	1.35	.159	1.434	
Safety 3	-.882	.138	-1.512	
Safety 4	.806	.065	1.896	
Safety 5	.007	.991	.011	
Produced in US	1.392	.250	1.167	

There were two variables that do not have their predicted sign: price and safety 3. Price should have had a negative sign. The coefficient for price is very small, but the sign is still positive. One explanation for this deviation from the hypothesis is that the price is increasing throughout the years due to inflation, but the market share is also increasing due to popularity (market share lagged). It appears that as price increases, the market share increases, but one is not increasing because of the other. Another regression run with a deflated price calculated using the CPI for given years, yielded a coefficient of .000, which would explain that price is not a factor when buying a car. However, that regression only had one significant variable: market share lagged. Another explanation might be that the cars with a higher price signal that they are better quality, therefore consumers buy them hoping they are getting a better car.

The safety 2 variable is the base for the safety dummy variables. According to the results, a score of three has a negative impact on market share, a score of 4 has the largest positive effect on market share, where as a score of 5 has a very minimal effect. These results can mean that a safety score of 4 is most valued by consumers, and the extra star for a score of 5 is not worth it for manufacturers to strive for. In the same way, when compared to a 2, manufacturers should not try and to get the extra star for a score of 3 because it does not pay off unless they are going to attain the score of 4. It may actually hurt the manufacturer if they spend the money to get their car 3 stars instead of 2.

Market Share lagged one year is the most significant variable. This shows that the popularity of the car increases each year due to the popularity in the last year. The cars are seen on the roads year after year and that is an important promotion. Each successive year, the market share will increase due to popularity. This variable may also be important if a car has a bad rating for another variable. For example, if the safety rating decreases one year, but the car is already very popular, that bad safety rating will not have as large an effect on the market share because the car is very popular and well-known already. If the car is made safer the next year, there will be very little fluctuation in market share. However, if the safety of the vehicle is poor year after year, eventually, the market share will decrease. If a brand new model has a bad safety rating, the car may not sell any models because people are scared to buy it, and it does not

have the support of previous years' popularity.

Gas Mileage is the second most significant variable at the .026 level. This variable could be significant because, as stated earlier in the paper, gas prices have been increasing; therefore gas mileage may be more important to consumers. However, it could also be significant because it is one of the only variables, along with market share, that has variations in its values.

The safety rating of 4 is only significant at the .06 level, but considering these results, that is fairly significant. It also has a higher coefficient than the safety rating of five. Since the safety dummy variables are compared to a safety rating of 2 one would think that a safety rating of five would offer a higher increase in market share than a safety rating of 4, but apparently the fifth star does not matter that much. It could be that four stars are good enough for the consumer and the car manufacturers have figured it out because the average safety rating according the descriptives is a 4.16. Although, it could be because the small data set does not contain many 5 star safety ratings. There may not be many five star ratings because it is a small data set, or it could be due to the lack of cars with five star safety ratings.

There may also be some problems with the country of production variable. The only company that does not produce any cars in the US is Nissan. Since it is a dummy variable, and Nissan is the only one that is different, that variable may have picked up things that are specific to Nissan that do not necessarily have to do with place of production.

VI. CONCLUSION

This paper sought to determine which characteristics were most important to consumers when buying a car and whether or not the foreign cars had these characteristics and American cars lacked them. Just by looking at the data, one can see that currently the Toyota Camry and Honda Accord, two foreign cars, have the highest market share. Unfortunately, this paper does not determine exactly why that is. One can conclude that it is *not* due to most of the variables in this regression.

Although gas mileage was a very important variable, it is difficult to believe that most people buy a car based on the gas mileage, especially when most of the cars have similar gas mileage. Market share lagged one year was the most significant variable and offers the explanation that popularity is the key to

increasing market share. Once the company can get innovators to try the car, the imitators will jump on the bandwagon causing an annual increase in market share. The question then becomes how do car manufacturers gain popularity if it is not with safety and reliability?

Safety and reliability ratings may not matter that much to the average consumer. Maybe what matters is that the car appears “cool” or as a good brand image. Variables for these characteristics are very difficult to find. There was the *Consumer Reports* overall score that *may* have included some aspects of image, but for the most part it was explained as style and comfort, so there was still no legitimate reason to add it to the regression after most of the other variables were insignificant.

Maybe the data set was too small. There could have been more cars added to the regression or even more years. This data set was chosen to try to control for size of the cars and to make sure they could each be considered substitutes, but maybe cars from all different segments of *Ward's Automotive Yearbook* could have been analyzed. The consumer will still choose the set of characteristics most important to him/her.

There are also discrepancies in the actual data. Each car has different versions with slightly different names. From year to year the data for price and gas mileage was specific to each version; however the market share, safety, and reliability were ratings for that general model. I collected data for all Honda Accords, but gas mileage and price were for the Honda Accord EX Coupe. Although this is not a major problem, because most of the specific models had similar gas mileage, it is worth noting. There was no other alternative either since this data was the most specific data I could find.

Cars change from year to year as well. They are remodeled, renamed, or modified slightly. Very rarely does a car stay exactly the same from year to year. That is the whole point of introducing new cars every year – changing and improving them from the last year. It is difficult to say whether the increase in market share is due to one thing that may have become standard on the next years car. For example, if the 2000 Impalas did not have sun-roofs and had a market share of 4.1, but the next year offered sun-roofs standard on all cars and the market share increased to 5.2, it is hard to tell how much of the increase was due to the sun-roofs. It could be exten-

sive and very time consuming, but further research may be done to test whether certain standard options increase a cars market share.

A performance variable would have been a valuable addition to this equation, however I could not find a sole performance variable. *Consumer Reports* has an overall rating, which includes performance, but it also includes safety and gas mileage. This variable may cause colinearity problems with the specific safety and gas mileage variables. This was a smart decision, because after analyzing the results one can conclude the variable would not have made much difference.

Further research could also be done to test whether or not there is a bias from the source of the ratings. I took the ratings from www.autos.msn.com. This website may or may not mean as much to consumers as *Consumer Reports*. Although MSN takes the safety rating from the NHTSA, maybe people do not look to those safety ratings as much as they rely on the credibility of *Consumer Reports*.

Overall, the results explain that these safety, reliability, warranty, and place of production variables are not reasons consumers buy cars. The quality variables used show a correlation to market share, as noted in the PIMS research, but are not significant. Therefore, new quality variables could be used in the future research, such as standard options (AC, leather interior, sunroof, etc). The American cars may be poorer quality than foreign cars, as the literature showed, but the quality those articles describe lies in variables this regression does not have.

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