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Do Car Reviews Matter?: An Econometric Analysis on the Influence of Car Reviews on Car Sales in the U.S. Auto Market

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Abstract

This thesis aims to find if car reviews influence car sales in the U.S. auto market through an econometric analysis. Since there is no free data source that conveniently provides car sales, car reviews, and control variables in a spreadsheet, a data set was constructed by collecting data from various sources. Review data was collected from *U.S. News and World Report*, a free source that used advertisements and press cars, and *Consumer Reports*, a non-free source that displays no advertisements and buys the cars it tests. Sales data was collected from *GoodCarBadCar.com*. Control variable data was collected from the *Environmental Protection Agency* for fuel economy data and *Edmunds.com* for horsepower data and pricing data. Once the data set was collected, two separate econometric models were built; one to investigate if *U.S. News and World Report* influenced sales, and one to see if *Consumer Reports* influenced sales. It was found that both *U.S. News and World Report* and *Consumer Reports* influenced car sales in the U.S. auto market. Other notable results were that U.S. consumers prefer larger cars over smaller cars, were indifferent on fuel economy, preferred cheaper cars, were indifferent on horsepower, and preferred American brands. Having extra data available, two more regressions were created to directly compare *U.S. News and World Report's* influence on cars sales to *Consumer Reports'* influence on car sales. The results suggested that *U.S. News and World Report* had a stronger influence on cars sales than *Consumer Reports*. This is surprising because other literature suggests that consumers prefer review sources that buy their own cars and display no advertisements since they felt those sources were bias free. The thesis concludes that media corporations looking to write car reviews may want to provide them for free, rely on advertising revenue, and use press cars for reviews since sources with those characteristics seem to have a stronger influence on car sales. Auto manufacturers may want to concentrate on obtaining positive reviews, specifically from sources like *U.S. News and World Report*, concentrate on selling larger car models, and concentrate on making cars more reliable and enjoyable to drive if they want to increase their car sales. This thesis uses a unique data set to perform a regression that has not been performed before, which builds off of previous literature and leaves room for further research on how car reviews influence car sales.

Contents

1. Introduction

The United States auto market is home to a wide range of car manufacturers who each sell many different models of vehicles. Indeed, some car manufacturers sell up to thirty-nine different car models ("Model List for Chevrolet"), which can make the process of buying a new car a daunting task to consumers not familiar with this market. Fortunately, there are organizations which conduct tests on these cars, and publish their results for consumers to read in reviews. This industry has grown from magazines, TV, and radio shows to the Internet with websites that publish new review articles and videos daily (see for example *caranddriver.com*). There is a lot of information available on the Internet regarding cars, and is being steadily consumed by society. This begs the question: do these car reviews actually influence decision making when purchasing cars, or are consumers making these decisions based on other factors?

This paper aims to answer this question through an econometric analysis of how car reviews influence cars sales and using regressions performed on the top auto review sources against manufacturer reported car sales data. This methodology is important because it is one of the most direct ways to see how these reviews affect sales. Accordingly, this analysis will provide empirical evidence for auto manufacturers and review organizations to in fact see how strongly these reviews affect the automotive market.

Car Reviews and Rational Actors: Maximizing Utility

If consumers do not like to include car reviews when making purchase decisions, does this mean that consumers would be considered irrational? Sure, consumers could be making uneducated decisions that could result in problems later on in ownership, but at the same time is it irrational to maximize utility? If a consumer likes a car because of the brand or styling, it maximizes their utility, which should be considered rational despite the car being poorly reviewed. Also, some wealthy individuals may not find it worth their time to do research before purchasing a new car, as spending their time to do the research may cost more than the car. Therefore, conclusions based on rationality must be made with caution.

There are many potential reasons why consumers would not follow these reviews. Brand loyalty is a strong phenomenon in the U.S. (Culver 2015), which is why certain brands outsell others despite reviews. Secondly, many consumers may not be willing to pay for reviews and would perhaps rather act off of arguably less reliable free sources or buy cars based on raw specifications (horsepower, MPG, etc). Thirdly, there could be consumers who do not do any research at all when buying a car, as they just need something that "gets the job done". All of these factors could cause car reviews to not affect sales.

Analyzing Auto Reviews

This research aims to answer whether auto reviews affect the U.S. auto market by examining U.S. auto sales and reviews from the year 2014. In the U.S., there are

many different sources of car reviews, both free and subscription sources, and sources in print and on-line. Therefore, sources used in this regression should capture the reviews that U.S. consumers are most likely to read and trust before buying a car. These sources should also cover many different aspects of cars that are important to different consumers such as performance, safety, appearance, and reliability.

Specifically, one review source used in this paper is *Consumer Reports* magazine; it is an American magazine that is both on-line and in print that requires a paid subscription. A digital subscription costs $26 for one year ("Choose your digital subscription to ConsumerReports.org"), while a one year print subscription costs $29 ("Subscribe to Consumer Reports Magazine"). It publishes reviews on many consumer products, including cars, based on results from its testing laboratory and survey research center ("Our Mission" 2015). The magazine does not allow advertising, buys every product it tests, and is a non-profit organization. It is estimated to have 7 million subscribers for both on-line and print editions. For cars, it has its own testing track in which it conducts a variety of tests, such as performance, safety, and comfort tests. It also collects survey data on car reliability and consumer satisfaction. It provides objective and measured tests which are reflected in written reviews and review scores ("Consumer Reports" 2015). This source represents reviews that consumers would ostensibly pay for and trust because of a perceived lack of bias due to being ad-free and not accepting test cars.

The other review source used is *U.S. News and World Report*, an American media company that publishes reviews, rankings, and analyses on different products and services ("U.S. News and World Report" 2015). For its car reviews, it is not so much a source as it is an aggregation of the top automotive review sources in the U.S., such as *AutoTrader*, *Automobile Magazine*, *Car and Driver*, *Consumer Guide*, *Edmunds*, *Kelly Blue Book*, *MotorTrend*, and *Popular Mechanics*. The editors of *U.S.*

News and World Report assign a score to each car review from each review source, and then average these scores for every car ("About U.S. News & World Report" 2015). For each car, they report critics' rating, performance, interior, cost to own, safety, JD Power reliability, and an overall score. *U.S. News and World Report's* reviews are available for free on-line, as are the reviews from the sources it uses. This means that its reviews and sources are widely available for U.S. consumers to use, and it accounts for those that prefer not to pay for reviews. The downside to these reviews is that manufacturers provide free test cars to many of these sources, which leads to a perceived bias among consumers since the manufacturer is thought to be offering kickbacks for a positive review or the test car could be modified to perform exceptionally well during a test drive (Elton 2009). Also, these sources, including *U.S. News and World Report*, allow advertisements from auto manufactures ("About U.S. News & World Report" 2015), potentially creating a further sense of bias since auto manufacturers pay these sources to display the advertisements.

Consumer Reports and *U.S. News and World Report* were chosen because they comprise the majority of car reviews published in the U.S., both on the Internet and in print. *Consumer Reports* is one of the most trusted sources due to its perceived lack of bias from consumers because it does not accept "freebies" (Elton 2015), though it is the only source which is not available freely. This represents customers who are willing to pay for reviews. *U.S. News and World* report represents almost all of the other review sources which are available freely on the Internet. Having both types of sources will allow more questions to be answered, such as which source has a stronger effect on the U.S. auto market. Overall, this means that the data to be used will have a wide exposure among those who are looking to buy a new car or those who are just browsing car reviews for enjoyment. Because of the significance of both of these review sources, data collected from these sources should be reliable and allow

for meaningful analyses about the U.S. auto market.

Automotive Data

The car sales data is provided by each auto manufacturer in their annual investor reports. 2014 sales data was collected from *GoodCarBadCar.com*, for 280 different car models, with 223 *Consumer Reports* reviews, and 272 reviews from *U.S. News and World Report*; 148 of those reviews were performed on the same cars. All of this data, other than *Consumer Reports*, is freely available to the public on-line. *Consumer Reports'* historical test scores can usually be collected from public library archives. Additionally, data for car pricing, horsepower, and miles per gallon were collected from *Edmunds.com*.

To date, this type of methodology regression has not been performed before in the automotive literature. The required data had to be collected from many different sources, which then needed to be compiled into a spreadsheet so that analysis could be performed on the data. Because it was not feasible to collect all of this data by hand, a program was devised in Java to collect data from the different sources. Even then, there were occasional errors that made it into the dataset spreadsheet[1], which required combing though the data, debugging programs, and often manually making corrections. Because *Consumer Reports'* historical test scores were only available in print, it had to be manually collected. Once the data was loaded into the analysis program, multiple analyses were performed with different combinations of variables to create two final statistically significant regressions. Then, the data was further

[1]For example, there are different ways websites name cars: one website may say "BMW 3 Series", another would use "BMW 3-Series", and even "BMW 3_Series". These slight naming changes would make a program think data for this car was unavailable. This was easily fixed once the data was looked through and the error was found, but there are many other car names that caused the same issue.

edited by making new variables to better explain results. Accordingly, this paper will contribute to the existing literature by testing a regression that has not yet been performed, collecting data that is not easily attainable, and laying groundwork for future research on this topic.

2. Literature Review

There has been considerable research done on how consumers make choices based on reviews, how they are affected by life influences, how they think of perceived biases, and how they do research. This paper will use such research to explain the results from regressions that will be performed, by using the conclusions drawn in other research to help explain the results. This, in turn, will allow this paper to offer a unique regression based analysis, while drawing upon and further contributing to the existing automotive research.

Studies on Car Reviews

The most relevant work to this thesis is by Dewenter and Heimeshoff (2013), which investigates how the German auto market reacts to expert reviews. It included an econometric analysis that examined how a leading German car review magazine, *AutoMotor&Sport Magazine*, influenced car sales by studying vehicle registration data over six years. They created a model that was calculated by a static OLS model and dynamic OLS model that would analyze how *AutoMotor&Sport Magazine's* reviews affected German car sales. In this paper, with 21,230 observations, reviews were found to have a significant effect on car registrations; a one percent increase in test scores roughly translated into a 0.04 to 0.06 percent increase in new car registrations per month. This number is considered small when compared to the number of new cars registered from certain large manufacturers, but nevertheless the result is statistically significant because the test variables' p values are statistically significant on the 10,

5, and 1% level. However, since the effect is small, it could mean the results are insubstantial. However, this is important because it means that the German auto market is affected by car reviews, which suggests the U.S. market could be too. One shortcoming is that the research is based on only one review source, which is not available in the U.S.

Akdeniz, Calatone, and Voorhees (2014) directly looked into how car reviews affected the U.S. auto market. Part of their research investigated how car brand reviews affect how consumers perceived the quality of the brand's cars. Using *Consumer Reports*, which provides overall reviews for each brand, they found an increase in ratings from review sources lead to an increase in the perception of vehicle quality.[2] This means that U.S. consumers *do* in fact pay attention to review sources when making decisions, as it does affect their view on the product's quality. But even so, does this increase in perceived quality mean that consumers will actually buy these cars?

While the focus of this paper is new cars in the U.S., there has been useful research done on how the U.S. used car market is affected by reviews. Specifically, Hollenbacher and Yerger (2001) studied the relationship between *Consumer Reports'* reliability ratings and used car pricing. This study is important because in assessing whether if the U.S. used car market is influenced by data released from a leading automotive review source, they found that reliability does affect the depreciation rate of used cars. For example, a car *Consumer Reports* marked as "avoid" due to poor reliability, would have a high yearly depreciation rate compared to cars with average or excellent reliability. This effect was most noticeable in the subcompact and compact vehicle segments, which may possibly be explained by the types of buyers these segments attract (For example, a "selection effect"). Subcompact/compact car

[2]This quality perception data was collected from Harris Interactives Equitrend, which consists of on-line survey data with 20,000 to 45,000 consumers aged 15 years or older to determine their perceptions of over 1000 brands across 35 product categories.

buyers are considered more "rational" consumers because they are focused on purchasing a reliable vehicle, as opposed to luxury car buyers who are more concerned with luxury features and performance. Irregardless, this is an interesting perspective on how to research car sales, because different car classes may attract different types of buyers with unique purchasing habits.

While there is evidence that reliability matters in the used car market, it is questioned whether the market is paying attention to *Consumer Reports'* reliability data, or whether the market automatically adjusts the price regardless of *Consumer Reports*. Yerger (1996) aimed to find this out. To test this, he studied vehicle pricing data and compared it to the release of *Consumer Reports'* reliability data. Yerger's conclusion is that the market adjusts vehicle prices before *Consumer Reports* releases their own results. In other words, the results from *Consumer Reports* did not affect vehicle pricing, as prices had already adjusted before the results were released. Yerger states these results could have been attributed to a small sample size; nevertheless, the results of the market adjusting prices before *Consumer Reports* releases its data undermine the importance of car reviews and allude that consumers get information from other sources; through word of mouth, or maybe another source that reports reliability data.

The Effect of Reviews on Consumers

While there has been a lot of research done on how car reviews affect different car markets, it is also important to consider how many people look at these reviews sources and whether they trust them enough to make a decision based on the provided information. In Derosier's thesis (2013), customers at dealerships were interviewed after they purchased a vehicle. They were asked about what research they did before

buying the car, and if they used a journalistic source how creditable they thought it was. Sixteen people were interviewed, and only four of them consulted a journalistic resource to help them with their purchase. The twelve who did not use a journalistic source primarily made their decisions on the basis of:

- Money concerns (financing)
- Enticements (advertisements and deals)
- Prior relationships with the brand or dealer
- Life circumstances (practicality and how the car to fits the customer's life)
- Vehicle characteristics (comfort, safety, interior dimensions, reliability, performance, and appearance)

Those who used journalistic sources also used the same reasoning as listed above, but they had strong opinions on the different journalistic sources they used. Review sources that relied heavily on instrumented tests (i.e., performance numbers) were claimed to be the least helpful when buying a car, as many of the customers said that these tests simply did not apply to what they would be using the car for. He also found that sources with poorly designed websites were considered not valuable to consumers.

As for credibility, it was found that sources such as *Kelly Blue Book* were rated the most creditable by consumers, while *YouTube* reviews were considered the least creditable. What makes consumers think a source is creditable is the age and the credentials of the author who wrote the review. Sources considered the least creditable are sources that received cars directly from manufactures as press cars, which lead to suspicions of collusion. Accordingly, this thesis provides an excellent analysis on

what a consumer is thinking when researching a car, and why one source may have a more significant effect on sales than another.

Unfortunately, the sample size of the research is small and the interviewer was only allowed to interview customers specifically selected by the dealerships for this study, not a random sample. While this undermines the credibility of the results, the overall thesis does provide useful insight into what consumers think about when buying a new car and what they think about different review sources.

Studies on Product Reviews

Aside from the credibility of sources, another area to examine is how on-line reviews affect sales. Zhu and Zhang (2010) studied how on-line reviews affect the sales of video games; they ran a regression on how *GameSpot.com* reviews for video games affected game sales for games released between 2003 and 2005.[3] They found that popular video games were not influenced by ratings, as those games achieved high sales despite any rating. Rather, less popular video games, specifically more niche video games, were strongly affected by on-line ratings. This was explained by less information being available for these less popular games, and therefore prospective buyers relied more on reviews. This could possibly be applied to U.S. auto market, because there are very popular cars that have high sales and there are less popular cars that have significantly lower sales because they are designed for a more niche market. Similar to Zhu and Zhang's findings, less popular car models could end up being affected more strongly by reviews, specifically on-line reviews, since there is less information available about the smaller brands.

Another study that looked at how reviews affect sales is by Friberg and Grnqvist

[3]The game sales data was provided by National Purchase Diary, a market research firm.

(2012). They researched how wine reviews, collected from tabloids, newspapers, and magazines, affected the sales of wine in Sweden between 2002 and 2007. The sources used were those with the top Swedish market share, meaning that the reviews had the largest exposure to the Swedish public, and the wine sales data collected represented 95% of wines sold. Using a regression, they found that a positive review increased the sales for that type of wine by 5.2% one week after publication, which continued for up to 20 weeks after the review went public. They also found a neutral review raised wine sales by 1.2% after being published, which continued for up to four weeks afterwards. Negative reviews had a very small negative affect in sales, which was found to be counter balanced by the positive effect of even being reviewed. In all, the effect of a positive or neutral review increased wine sales, while negative reviews do not affect wine sales at all. The effect of a positive review is stronger for medium to highly priced wines, which could be explained by people only being more cautious when buying more expensive wines. It was also found that the review sources mattered; reviews from tabloids had a weaker effect than the other sources. This can be explained by the prestige factor that it is considered less prestigious to rely on tabloid reviews for wine than other sources. This study is important because it shows how positive and neutral reviews do have an effect in the Swedish wine market, which could relate to other markets such as the U.S. auto market. Positive reviews might make a huge difference on cars, but negative reviews may not. Another key point to consider is how more expensive wines are more strongly affected by positive reviews, which could point to differences in the U.S. auto market among different car classes. It is also important to consider that while wine reviews did affect wine sales, the effect of 0-5% is relatively small in magnitude.

Variation Among Consumers

What type of people that read these reviews is another important consideration that could help explain the results of the regression that will be done. Sabatini (2016) conducted a survey to see the differences in car buying habits for people who considered themselves car enthusiasts versus those who did not.[4] The survey returned 4977 respondents, 71% of which considered themselves a car enthusiast and 29% considered themselves not a car enthusiast. Notable statistics of how respondents gathered information when purchasing a car include:

- 63% of enthusiasts used car-shopping websites while 54% of non-enthusiasts did
- 56% of enthusiasts used car-news websites while 42% of non-enthusiasts did
- 68% of enthusiasts used car magazines while 32% of non-enthusiasts did
- 48% of enthusiasts used *Consumer Reports* while 56% of non-enthusiasts did
- 57% of enthusiasts used car maker websites while 54% of non-enthusiasts did
- 42% of enthusiasts used dealerships while 56% of non-enthusiasts did

(Sabatini 2016: 24)

These results show what type of people prefer what sources. One observation is that most car enthusiasts used car magazines as an information source, which is what *U.S. News and World Report* mainly consists of, while most non-enthusiasts used *Consumer Reports*. This comparison shows a stark contrast between what types of people use these sources, and can be used to explain why one source may be more

[4]The survey was sent to all subscribers of *Hearst Magazines*, the publisher of *Car and Driver* magazine.

significant than the other. More notable statistics include purchase priorities among the respondents:

- Price was a priority to 88% of enthusiasts versus 94% of non-enthusiasts
- Quality Reputation was a priority to 84% of enthusiasts versus 83% of non-enthusiasts
- Exact Make and Model was a priority to 88% of enthusiasts versus 71% of non-enthusiasts
- Styling was a priority to 82% of enthusiasts versus 70% of non-enthusiasts
- Comfort was a priority to 86% of enthusiasts versus 88% of non-enthusiasts
- Safety was a priority to 76% of enthusiasts versus 87% of non-enthusiasts

The top priority among both types of respondents is *price*. This agreement between both types of consumers means that price should have a significant effect on sales in the regression. The other categories should follow suit, as both types of respondents felt they were equally important.

One possible trend that may also merit consideration is brand *loyalty*. Brand loyalty is a trait exhibited by consumers who will repeatedly buy cars from the same brand, because they have had positive experiences with the brand in the past, despite what reviews may say. Lambert-Pandruad, Luarent, and Lapersonne (2005) studied to see if this theme is more common with the elderly. To study this, they collected survey data that asked about the car most recently bought, the previous car owned, owned brands and models considered, dealers visited, satisfaction, and customer demographics. Based on these variables, the constructed a regression that examined whether age influenced repeated brand purchasing and found age has a strong impact on repeated brand purchasing:

- 42% of buyers 39 and younger bought the same brand and 61% considered their previously owned brand
- 54% of buyers between 40 and 59 bought the same brand and 73% considered their previously owned brand
- 66% of buyers between 60 and 74 bought the same brand and 80% considered their previously owned brand
- 72% of buyers between 75 and older bought the same brand and 83% considered their previously owned brand

(Lambert-Pandruad, Luarent, and Lapersonne 2005: 102)

These results show that older customers are more likely to purchase from a car brand that they recently owned and exhibit stronger brand loyalty relative to younger customers. As of 2013, the U.S. population was comprised of 14.1% of people of the age 65+ (Administration on Aging 2015). This is a significant portion of the U.S. population who may be looking to buy a new car. Because this group exhibits strong brand loyalty, traces of brand loyalty may appear in the regression and could be more significant than car reviews.

An alternate source that customers may go to when deciding what type of car to buy is their or acquaintance's past experience with brands. Research by May (1969) analyzed if a customer repurchasing a car from the same brand or changing brands was affected by the customer's past with brands. To test this, May interviewed 387 household heads in the St. Louis, Missouri area about the three last cars they owned. It was found that:

- 73% of people who owned or family owned the same brand of car three times in a row bought the brand again

- 64% of people who owned or family owned the same brand of car two times in a row bought the brand again
- 57% of people who owned or family owned the same brand of car, bought a different brand, then came back to that brand bought the brand again
- 43% of people who owned or family owned two different brands, and then the brand of their current vehicle bought the brand again

(May 1969: 63)

This analysis shows that those who owned the same brand multiple times in the row were most likely to repurchase that brand. This inference means two things: 1) People are very likely to rely on their history with a brand when making the decision of what brand car to buy next. 2) That brand loyalty is strong among car owners. The downside of this study is its relatively small number of observations and that it is limited to an area that could have specific buying patterns that are different from the rest of the country. Nevertheless, this study shows how important previous experiences and brand loyalty is when customers purchase a new car.

Role of the Internet

One of the biggest changes to gathering information in recent history has been the Internet. It can provide large amounts of information in an instant, which changes how people conduct research. One area this has impacted is how people do research when buying a new car. Ratchford, Lee, and Talukdar (2003) used survey data to see how car research changed from 1990 to 2000 by asking various questions to people who used the Internet to assist in buying a car: demographic questions, what car was purchased, how they researched it, and how long they spend researching. They

found, for those who used the Internet, an average of a 3.5 hour drop in the time spent searching for information in 2003 versus 1990 using the Internet as a tool. This result was explained by the ease of finding vehicle specifications and finding information from the dealer, rather than driving to the dealer to get the information. The use of the Internet allowed consumers to more efficiently gain information, while allowing dealerships to more efficiency communicate to the consumer. It is important to note that this study was done at a relatively early time of the Internet, as the Internet has grown substantially between 2003 and 2016. If this analysis was repeated again in 2016, the gains from the Internet may be greater than seen in the original analysis. This ease of gaining information may allow consumers to obtain more information when making a car purchase decision, and may lead to a stronger reliance on car reviews, specifically free on-line reviews.

As already demonstrated, there is a wide range of different literature that pertains to the topic of how car reviews affect the U.S. auto market. While there currently is no study that attempts to find how car reviews affect car sales in the U.S. auto market, the methodologies, results, and conclusions from these various studies can be used to interpret the results from the regressions that will be performed. Including interpretations from these studies will allow the regression to better connect to the existing literature, and allow for better explanations of its results.

3. Data

In order to see if reviews do in fact affect car sales in the U.S., data was to be collected on car sales in the U.S. from *Goodcarbadcar.com*, combined miles per gallon data collected from the *Environmental Protection Agency*, pricing data and specifications data collected from *Edmunds.com*, and ratings collected from *Consumer Reports* and *U.S. News and World Report*. The data needed to be prepared in such a way that a regression could be created and analyzed. Accordingly, collecting data from *Edmunds.com*, *Goodcarbadcar.com*, the *EPA*, *Consumer Reports*, and *U.S. News and World Report* was all done through a program that copied the data from each individual website and into a file that could be inserted into a statistical analysis program for analysis. *Consumer Reports* data had to be copied manually from *Consumer Reports* magazines into a spreadsheet, that way it could be statistically analyzed on a computer. This processes was the limiting factor in the analysis, as the process of manually copying data takes a long time; as a result only 2014 data was collected for this regression.

Variables collected include:

- sales: The number of sales for a car model in 2014, collected from *Goodcarbadcar.com*.
- lnsales: The natural logarithm of sales. The log is used to convert the variable into a percent, making it easier to interpret.
- economy: Equals 1 if a car is in the economy car class, 0 otherwise.

- sedan: Equals 1 if a car is in the sedan car class, 0 otherwise.
- hatch_wagon: Equals 1 if a car is in the hatchback or wagon car class, 0 otherwise.
- suv: Equals 1 if a car is in the suv car class, 0 otherwise.
- pickuptruck: Equals 1 if a car is in the pickuptruck car class, 0 otherwise.
- usnewscriticsrating: The critics' rating for a car, as reported by *U.S. News and World Report*. The score is out of 10, 1 being poorly rated and 10 being well rated.
- usnewsperformance: The performance rating for a car, as reported by *U.S. News and World Report*. The score is out of 10, 1 being poorly rated and 10 being well rated.
- usnewscosttoown: The cost to own rating for a car, as reported by *U.S. News and World Report*. The score is out of 10, 1 being poorly rated and 10 being well rated.
- usnewsjdpowerreliability: The *JD Power* reliability Rating for a car, as reported by *U.S. News and World Report*. The score is out of 5, 1 being poorly rated and 5 being well rated.
- usnewsoverall: The overall rating for a car, as reported by *U.S. News and World Report*. This is an average of all the scores from *U.S. News and World Report*. The score is out of 10, 1 being poorly rated and 10 being well rated.
- crroadtest: The *Consumer Reports* road test score for a car. Cars are rated on a scale of 100, with a 100 being a perfect car.

- crownersatisfaction: The *Consumer Reports* satisfaction score for a car, as collected from its surveys. Cars are rated on a scale of 5, with a 5 being completely satisfying to owners.

- crpredictedreliability: The *Consumer Reports* predicted reliability score for a car, as estimated from its surveys from current owners. Cars are rated on a scale of 5, with a 5 having excellent reliability.

- crtopforyear: A dummy variable that indicated if the car was selected as a top car for 2014 by *Consumer Reports*.

- mpg: Representes the combined mpg from the *EPA's* website for a car.

- baseprice: Represents the base price of a car, as reported by *Edmunds.com*.

- adjbaseprice: Represents baseprice/1000. This was done so the variable represents increments of $1000, rather than a single dollar

- horsepower: Represents the horsepower of a car with the standard engine option, as reported by *Edmunds.com*.

- adjhorsepower: Represents horsepower/100. This was done so the variable represents increments of 100 horsepower, rather than a single horsepower

- japanese: Equals 1 if a car is manufactured by a corporation based in Japan, 0 otherwise.

- korean: Equals 1 if a car is manufactured by a corporation based in Korea, 0 otherwise.

- domestic: Equals 1 if a car is manufactured by a corporation based in the United States, 0 otherwise.

- european: Equals 1 if a car is manufactured by a corporation based in Europe, 0 otherwise.

These variables are all included in the dataset and are used in the upcoming regressions to determine if car reviews affect car sales. The variables that do not include review data or sales data serve as control variables in the regression.

Table 3.1: Summary Statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
year	220	2014	0	2014	2014
sales	220	71054.49	100749.8	196	753851
lnsales	220	10.28636	1.542339	5	14
crroadtest	182	72.14286	12.74273	20	99
crreccomen~d	220	.4045455	.4919231	0	1
cravoid	220	.1090909	.3124642	0	1
crtopforyear	220	.0454545	.2087739	0	1
cdtop10	220	.0363636	.1876202	0	1
mpg	220	27.44091	16.11577	13	124
baseprice	220	34200.47	19044.03	11990	136500
rear	220	.2727273	.4463774	0	1
awd	220	.0954545	.2945119	0	1
leatherseats	220	.3636364	.4821427	0	1
horsepower	220	228.7727	82.25477	66	449
crprice	182	37009.99	16239.37	14770	105110
crmpg	182	25.30495	12.61069	13	111
crpredicte~y	147	3.278912	1.163264	1	5
crownersat~n	152	3.572368	.8734644	2	5
usnewsover~l	212	7.928302	.5315193	6.3	9.4
usnewscrit~g	212	8.138208	.8579722	5.1	9.6
usnewsperf~e	212	7.702359	.7350043	5.4	9.5
usnewsinte~r	212	7.673113	.6004609	6	9.2
usnewscost~n	197	8.45736	.9290708	3.9	9.6
usnewssafety	174	9.099425	.6644131	5.7	10
usnewsjdpo~y	206	3.286408	.7177266	2	5
economy	220	.0954545	.2945119	0	1
sedans	220	.4045455	.4919231	0	1
hatch_wagon	220	.0681818	.2526325	0	1
suv	220	.3909091	.4890669	0	1
pickuptruck	220	.0409091	.1985313	0	1
japanese	220	.3818182	.4869403	0	1
korean	220	.0727273	.2602805	0	1
domestic	220	.2818182	.4509112	0	1
european	220	.2636364	.4416092	0	1

Table 3.1 is a summary of all the data collected for the thesis. Note that not all of the data was used in the final regressions, and this table only includes data collected from 2014.

4. Methodology

In order to see if reviews from *Consumer Reports* and *U.S. News and World Report* affect car sales in the U.S. auto market, a regression will be performed separately for each source. This regression will allow it to be seen if reviews affect sales and if there is a difference between how each source affects the U.S. auto market. Each regression will use control variables that are assumed to the affect sales of a car, not including car reviews. Also, each regression will have the natural logarithm of sales as the dependent variable since this regression is trying to show what influences car sales. Regressions will be judged on the significance of individual variables, as each variable has to have a reason for being included in the regression, and the overall regression F statistic. Even though a variable may be significant, it still may be judged on the size of its effect, as a very small effect might mean there is no effect.

U.S. News and World Report Regression

This regression will see if reviews from *U.S. News and World Report*, which includes various free car review sources, affected car sales in the U.S. auto market in 2014.

The hypothetical regression will be:

$\text{lnsales}_i = \beta_0 + \beta_1 * \text{sedans}_i + \beta_2 * \text{hatch\_wagon}_i + \beta_3 * \text{SUV}_i + \beta_4 * \text{pickuptruck}_i + \beta_5 * \text{usnewscriticsrating}_i + \beta_6 * \text{usnewsjdpowerreliability}_i + \beta_7 * \text{mpg}_i + \beta_8 * \text{adjbaseprice}_i + \beta_9 * \text{adjhorsepower}_i + \beta_{10} * \text{japanese}_i + \beta_{11} * \text{korean}_i + \beta_{12} * \text{european}_i + \varepsilon_i$

The *U.S. News and World Report* variables usnewscriticsrating and usnewsjdpow-

erreliability are expected to be positive, which means a higher rating is hypothesized result in more sales. Performing this regression should state whether or not *U.S. News and World Report* reviews have an influence on car sales in the US auto market.

Consumer Reports Regression

This regression will see if reviews from *Consumer Reports*, which is the only source that is not free, affected car sales in the U.S. auto market in 2014.

The hypothetical regression will be:

$\text{lnsales}_i = \beta_0 + \beta_1 * \text{sedans}_i + \beta_2 * \text{hatch\_wagon}_i + \beta_3 * \text{SUV}_i + \beta_4 * \text{pickuptruck}_i + \beta_5 * \text{crroadtest}_i + \beta_6 * \text{crownersatisfaction}_i + \beta_7 * \text{crtopforyear}_i + \beta_8 * \text{mpg}_i + \beta_9 * \text{adjbaseprice}_i + \beta_{10} * \text{adjhorsepower}_i + \beta_{11} * \text{japanese}_i + \beta_{12} * \text{korean}_i + \beta_{13} * \text{european}_i + \varepsilon_i$

The *Consumer Reports* variables crroadtest, crownersatisfaction, and crtopforyear are expected to be positive, which means a higher rating is hypothesized "to" result in more sales. Performing this regression should state whether or not *Consumer Reports* reviews have an influence on car sales in the US auto market.

Control Variables

Three groups of control variables will be included in each regression to account for other influences on car sales including car size, specifications, and brand country. Each of these groups have different variables that could positively or negatively affect sales in the U.S. auto market, and will be hypothesized as such.

A set of control variables that will be used to measure car class and size are economy, sedans, hatch_wagon, pickuptruck, and SUV. Economy was not included in

the regression as it will be used as the baseline variable in which the other four will be compared to. It is hypothesized that the U.S. auto market prefers larger vehicles, such as SUVs and pickup trucks. Therefore, all other variables, sedans, hatch_wagon, suv, and pickuptruck, will have a positive coefficient because they are predicted to sell more.

Three control variables based on car specifications are meant to represent the desirability of more horsepower, better fuel economy, and a cheaper car: horsepower, mpg, and adjbaseprice respectively. The sign for adjhorsepower and mpg is hard to predict, because while it may be more desirable to have a car with more horsepower or mpg, the recent drop in U.S. gasoline prices makes lower mpg cars with more horsepower a more viable option to consumers, but the national push for more fuel efficient cars with less horsepower should make cars with higher mpg and less horsepower more desirable. A positive sign for adjhorsepower and mpg is expected, because buyers *should* desire a car with more horsepower and mpg, all things being equal. A negative sign for adjbaseprice is expected, because the U.S. auto market should desire cheaper cars, as more people can afford these.

The last group of control variables is the location of where corporation is based. This is to control for a consumer preference of brands from certain countries. Domestic will be held as a baseline to which the other countries will be compared to. All other brand countries, Korean, Japanese, and European, are hypothesized to be negative because Domestic should have a stronger brand loyalty than foreign brands, since American cars are hypothesized to sell better in the U.S.

5. Results

There will be a specific focus on the regressions' F statistic (overall correlation), and each variable's p value (variable significance) versus its economic importance. If a variable is considered important, but has high P value[5], it will stay in the regression because it is considered important to the regression.

[5]A high P value suggests that the variable is insignificant

U.S. News and World Report Regression

Table 5.1: Output of *U.S. News and World Report* Regression

Number of obs =	148
F(12, 135) =	16.98
Prob > F =	0.0000
R-squared =	0.6014
Adj R-squared =	0.5660
Root MSE =	.85706

lnsales	Coef.	Std. Err.	t	P>|t|
sedans	1.346734	.3238393	4.16	0.000
hatch_wagon	.9086794	.3899869	2.33	0.021
suv	1.704812	.3346114	5.09	0.000
pickuptruck	1.824335	.4682468	3.90	0.000
usnewscriticsrating	.749374	.0931143	8.05	0.000
usnewsjdpowerreliability	.2590335	.115694	2.24	0.027
mpg	-.0124459	.0090376	-1.38	0.171
adjbaseprice	-.0456713	.0107822	-4.24	0.000
adjhorsepower	-.3047356	.2105605	-1.45	0.150
japanese	-.4696379	.1813586	-2.59	0.011
korean	-.270812	.2810142	-0.96	0.337
european	-.8660677	.2513279	-3.45	0.001
_cons	5.082547	1.009765	5.03	0.000

The regression in Table 5.1 is valid because it has a low P value for the F statistic, near 0[6], and almost all variables fit a significance level of around 5% (P value must be below this if it is significant). MPG, adjhorsepower, and Korean, the only variables that do not fall in a 5% significance level, are kept because MPG is an important specification to consider when buying a car, adjhorsepower is a big factor when buying a car, and Korean is important to keep with the other brand country variables. Overall, the variables in the regression explain some of the factors of sales in the U.S. auto market.

For car class, the hypothesis is supported that larger cars would sell better than

[6]A low P value for the F statistic suggests that the overall regression is significant.

smaller cars. This is evident because of the coefficient signs for each variable being positive. On average, sedans sell 134.7% better, hatchbacks/wagons sell 90.9% better, SUVs sell 170.4% better, and pickup trucks sell 182.4% better than economy cars in the U.S.

For specifications, there was a negative trend of coefficients for each variable. For each increase in MPG, a car sold 1.2% worse. This result does not support the hypothesis, and while the coefficient is very small, but significant, this could be explained with the drop of gas prices in 2014. The baseprice variable supported the hypothesis with a negative coefficient. For every $1000 extra a car cost, it received 4.6% less sales. For the horsepower variable, it did not support the hypothesis as a car sold 30.5% less, for every 100 extra horsepower. This could be explained by an emphasis on fuel economy, as cars that are more fuel efficient normally have less horsepower.

For brand countries, the hypothesis was supported that foreign brands would sell less than domestic brands. This result is evident by the negative coefficient for each variable. A car with a brand that is Japanese will sell 47% less, Korean will sell 27.1% less, and European will sell 86.6% less than a domestic brand.

Finally, and most importantly, the hypotheses for the review variables are supported. The variables usnewscriticsrating and usnewsjdpowerreliability both have positive coefficients, which means positive reviews increase sales in the US auto market. For every extra point a car gets in the usnewscriticsrating, it sells on average 74.93% better. For every extra point a car gets in the usnewsjdpowerreliability, it sells on average 25.9% better. These results could be interpreted as sales are influenced by car reviews in *U.S. News and World Report*.

Consumer Reports Regression

Table 5.2: Output of *Consumer Reports* Regression

Number of obs =	148
F(13, 134) =	10.80
Prob > F =	0.0000
R-squared =	0.5118
Adj R-squared =	0.4644
Root MSE =	.95213

lnsales	Coef.	Std. Err.	t	P>|t|
sedans	.980749	.3784957	2.59	0.011
hatch_wagon	.5404888	.4473698	1.21	0.229
suv	1.404204	.3742672	3.75	0.000
pickuptruck	1.605694	.5263905	3.05	0.003
crroadtest	.0269266	.0093028	2.89	0.004
crownersatisfaction	.2814128	.1120002	2.51	0.013
crtopforyear	.6696537	.3545506	1.89	0.061
mpg	-.0193407	.0103423	-1.87	0.064
adjbaseprice	-.0462044	.0117168	-3.94	0.000
adjhorsepower	-.4117527	.2340129	-1.76	0.081
japanese	-.6919645	.2013879	-3.44	0.001
korean	-.6154784	.3190661	-1.93	0.056
european	-1.180015	.2796643	-4.22	0.000
_cons	10.00369	.8022906	12.47	0.000

The regression in Table 5.2 is valid because it has a low P value for the F statistic of close to 0, and almost all variables fit a significance level of 5%. MPG, adjhorsepower, and Korean, three of the five variables that do not fall in a 5% significance level, are kept because they are considered economically important, as explained in the *U.S. News and World Report* regression section. Hatch_wagon is kept because the analysis of car size would be incomplete without all of the car size variables. Crtopforyear is kept because it is marginally significant. Overall, the variables in the regression explain some of the factors of sales in the U.S. auto market in a slightly different way

than in the *U.S. News and World Report* regression.

For car class, the hypothesis is supported that larger cars would sell better than smaller cars. This result is evident because of the coefficient signs for each variable being positive. On average, sedans sell 98.1% better, hatchbacks/wagons sell 54% better, SUVs sell 140.5% better, and pickup trucks sell 160.1% better than economy cars in the U.S.

For specifications, there was a negative trend of coefficients for each variable. For each increase in MPG, a car sold 1.9% worse, this does not support the hypothesis. The baseprice variable supported the hypothesis with a negative coefficient. For each $1000 extra a car cost, it received 4.6% less sales. For the horsepower variable, it did not support the hypothesis as a car sold 41.2% less, for every 100 extra horsepower.

For brand countries, the hypothesis was supported that foreign brands would sell less than domestic brands. This is evident by the negative coefficient for each variable. A car with a brand that is Japanese will sell 69.2% less, Korean will sell 61.5% less, European will sell 118% less than a domestic brand.

Finally, and most importantly, the hypothesis for the review variables is supported. The variables crroadtest, crownersatisfaction, and crtopforyear all have positive coefficients, which means positive reviews increase sales in the US auto market. For every extra point a car received in the crroadtest variable, it sells on average 2.69% better. For every extra point a car received in the crownersatisfaction variable, it sells on average 28.14% better. Each car that is a crtopforyear car received on average 66.97% better sales than a car that is not. These results could be interpreted as sales are affected by car reviews from *Consumer Reports*.

U.S. News and World Report versus *Consumer Reports*

Table 5.3: Output of *U.S. News and World Report* Regression

Number of obs =	**148**
F(11, 136) =	**12.60**
Prob > F =	**0.0000**
R-squared =	**0.5047**
Adj R-squared =	**0.4647**
Root MSE =	**.95189**

lnsales	Coef.	Std. Err.	t	P>|t|
sedans	**1.291435**	**.3614644**	**3.57**	**0.000**
hatch_wagon	**1.022984**	**.4316021**	**2.37**	**0.019**
suv	**1.814761**	**.371366**	**4.89**	**0.000**
pickuptruck	**2.00635**	**.5191799**	**3.86**	**0.000**
usnewsoverallscore	**1.038026**	**.1966201**	**5.28**	**0.000**
mpg	**-.0120166**	**.0100326**	**-1.20**	**0.233**
adjbaseprice	**-.0490169**	**.0116284**	**-4.22**	**0.000**
adjhorsepower	**-.201651**	**.2338208**	**-0.86**	**0.390**
japanese	**-.5161807**	**.1970958**	**-2.62**	**0.010**
korean	**-.1851876**	**.3112659**	**-0.59**	**0.553**
european	**-.6511952**	**.2753407**	**-2.37**	**0.019**
_cons	**3.585546**	**1.683581**	**2.13**	**0.035**

Table 5.4: Output of *Consumer Reports* Regression

Number of obs =	148
F(11, 136) =	10.82
Prob > F =	0.0000
R-squared =	0.4668
Adj R-squared =	0.4237
Root MSE =	.98764

lnsales	Coef.	Std. Err.	t	P>|t|
sedans	1.056232	.3919791	2.69	0.008
hatch_wagon	.624804	.4633385	1.35	0.180
suv	1.495096	.3872527	3.86	0.000
pickuptruck	1.857401	.5408822	3.43	0.001
crroadtest	.0369329	.0091701	4.03	0.000
mpg	-.0118866	.0104144	-1.14	0.256
adjbaseprice	-.044851	.011991	-3.74	0.000
adjhorsepower	-.3428652	.2408258	-1.42	0.157
japanese	-.5893034	.2062508	-2.86	0.005
korean	-.5858645	.3308337	-1.77	0.079
european	-1.022811	.2850587	-3.59	0.000
_cons	9.755709	.8145297	11.98	0.000

Tables 5.3 and 5.4 are two regressions designed to directly compare *U.S. News and World Report's* effect on sales to *Consumer Reports'* effect on sales. It is done by comparing usnewsoverallscore to crroadtest because these variables are the most representative of each source. All of the control variables are kept the same for an accurate comparison. It was found that for every extra point a car gets in the usnewsoverallscore, sales were increased by 103.8%. For every extra point a car gets in the crroadtest, sales were increased by 3.7%. It is important to note that these variables use different scales; usnewsoverallscore is on a scale of 10, while crroadtest is on a scale of 100. With the results adjusted to have crroadtest on a scale of 10, for every extra point a car gets in the crroadtest, sales were increased by 37% as compared to 103.8% from usnewsoverallscore. This suggests that *U.S. News and World Report*'s

reviews have a larger effect on sales than *Consumer Reports'* reviews.[7]

[7]One may be concerned that *Consumer Reports* road test score range is much larger than that of *U.S. News and World Report* overall score, which could make these coefficients incomparable. This large range for *Consumer Reports* road test score is caused by two observations with very low ratings from *Consumer Reports*. Tests with those observations excluded have shown that the results remain unchanged.

6. Discussion

As stated in the results, car reviews from *U.S. News and World Report* and *Consumer Reports* do appear to have affected 2014 car sales in the U.S. auto market. Many aspects of these results can be explained by making comparisons to previous literature on the auto market. These comparisons will allow the regression to be further analyzed and to see how it contributes to the literature relating to this topic.

This regression is complemented by Dewenter and Heimeshoff's (2013) study, as it creates a stronger case for car reviews affecting the auto market. As stated earlier, they found that the German magazine *AutoMotor&Sport* positively influenced car sales, with a one point score increase rising sales by 0.04 to 0.06% in the German car market. This effect is weaker than the results from both *U.S. News and World Report* overall score and *Consumer Reports* road test score in the regression. The magazine *AutoMotor&Sport* is not free and requires a subscription, similarly to *Consumer Reports*. These results can lead to a couple of hypotheses: that U.S. consumers pay attention to reviews more than German consumers, *AutoMotor&Sport* may not be the most popular review sources that consumers use in Germany, or there are cheaper and free review sources in the U.S. than there are in Germany that consumers can use.

This regression also supports the work done by Akdeniz, Calatone, and Corhees (2014) that found that an increase in brand rating by *Consumer Reports* lead to a perceived increase in quality by consumers in the U.S. auto market. Here, the findings follow suit, with cars that received higher ratings attracted more sales in the U.S. auto

market. Both of these studies are in agreement that U.S. consumers pay attention to *Consumer Reports* and are influenced by its reviews.

Findings from Hollenbacher and Yerger (2001), however, are not supported by this paper's findings that car reviews do appear to affect the U.S. auto market. In their study, it was found that reliability data from *Consumer Reports* affected the depreciation of cars on the U.S. used car market. In the regression performed in this paper, however, it was found that *Consumer Reports* reliability very weakly (if at all) affected new car sales in the U.S. auto market[8], rather it was significantly affected by the *JD Power* reliability score. New car sales and used car depreciation could be considered very different areas of the auto market, so maybe *Consumer Reports* reliability should affect both markets in very different ways. So while both studies disagree on how *Consumer Reports'* reliability scores affects the U.S. auto market as a whole, they both do agree that *Consumer Reports* affects it.

The findings from the regressions also do not agree with Yerger's study in 1996, where it was found that the used car market adjusted prices before *Consumer Reports* released reliability data, making it seem like *Consumer Reports* reliability data affected sales. The regressions performed in this paper suggest that while car reviews were not the only determinant of sales, reviews like *Consumer Reports* did play a sizable part in affecting new car sales.

The findings presented here also conflict with the work done by Derosie (2013). In his thesis, customers interviewed stated that the least helpful reviews were those that relied heavily on instrumented tests and the least credible were the sources that received press cars from manufactures. But the data shown here suggests that *U.S. News and World Report* affected car sales more than *Consumer Reports*. *U.S. News*

[8] *Consumer Reports* reliability score does not appear in the regression because the effect was negative and very statistically insignificant.

and World Report is an aggregation of many free on-line reviews, which either rely heavily on instrumented tests, like *Car and Driver* and *Road and Track*, or receive press cars directly from the manufacturer, like *Autoweek*, *Car and Driver*, and *Road and Track*. Consequently, if people say they trust those types of sources the least, why did they use them the most when deciding what car to buy, especially when there are sources like *Consumer Reports*?

The regression agrees with conclusions from the survey conducted by Sabatini in 2016. It was found that *Consumer Reports* was only used by about half of the survey respondents, while larger majority used car-shopping websites and car-news websites. This result was reflected in how *U.S. News and World Report* affected sales more than *Consumer Reports*. It was also found that pricing was a large priority when searching for a new car, as every extra thousand dollars a car cost lead up to a 4.9% drop in sales. The results from the survey help explain the coefficients and effect of the variables from both regressions.

Brand loyalty was tested in the regression by grouping each brand by its corporate location (Domestic, Japanese, Korean, and European), and testing if any country received more sales than the others. It was found in both regressions that being a domestic brand generated a significant increase in sales when compared to Japanese, Korean, and European brands. This result can be explained by the results in the study May (1969), when it was found that people are more likely to stick with brands that they or their family have owned in the past. Because this study takes place in the U.S., domestic brands are likely to be more prevalent, increasing people's exposure to these cars and therefore suggesting people will be more likely to stick with the domestic market. This exposure could explain why domestic brands on average outsell foreign brands. Because the regression was not designed to test all

possible brands[9], individual brand loyalty could not be tested.

The effect of the Internet could also explain why free on-line sources, such as *U.S. News and World Report*, have a stronger influence than non-free sources, such as *Consumer Reports*. In research done by Ratchford, Lee, and Talukdar (2003), they found that the Internet reduces the amount of time needed to search for information, such as when researching a new car. Because of this ease of information, consumers could probably quickly find free sources that answer their questions, rather than purchase *Consumer Reports* to answer all of their questions. This speed of finding information reduces the need for consumers to purchase *Consumer Reports*, and could explain why reviews from *U.S. News and World Report* have a stronger influence on auto sales.

While it has been demonstrated that reviews affect car sales in the U.S. auto market, it is surprising in that the results suggest *Consumer Reports* does not have as much as an effect as *U.S. News and World Report*, specifically when comparing crroadtest to usnewsoverall. While some of the preexisting literature offers reasons for this unexpected result, such as costs and the Internet, there is also preexisting literature as to why this should not be the case, such as credibility. Maybe this result could be because *U.S. News and World Report* is an aggregation of many other sources, but it was expected that *Consumer Reports* road test scores would have more influence because of its perceived credibility and history of reviewing everything since 1936. These results could lead to interesting future research comparing these sources against each other in more depth.

[9]There are around 40 different brands in the U.S. auto market, which means in order to test brand loyalty, a separate regression would have to be analyzed.

7. Contribution

This regression and its results are a large contribution to the existing literature in a number of ways. First of all, this type of regression has not been performed before, which therefore required the data to be collected and then to analyzed. Second, this regression also provides useful information for media corporations that produce car reviews in the U.S. Finally, it provides useful information for auto manufacturers looking to boost sales through car reviews.

The data collection and analysis is a large feat on its own. The data of car sales and reviews is not conveniently available in a file that can be used or manipulated. Instead some necessary data was available through on-line HTML tables, some in standard HTML web pages, and some only in print. In order to get the data from HTML tables and web pages, a program was devised to find the desired data on the table or web page, and collect it. For data available only in print, such as *Consumer Reports*, it had to be manually copied from the magazines into a table. As a result, collecting the data and running analyses on it is a large contribution to this topic because it was not available otherwise.

Media corporations that produce car reviews can gain insight from this paper to help make business decisions. It was suggested in the results that free review sources gain more exposure than subscription review sources. This was exemplified when *U.S. News and World Report's* overall score had a larger effect on sales than *Consumer Reports'* road test score. This means that if a media corporation wants to have wide exposure of its car reviews and generate large advertising revenue, free is the way to

go. Despite consumers claiming that they prefer sources that do not have advertising and do not accept press cars, the results indicate that they based their decisions on review sources that displayed advertisements and accepted press cars.

Should *Consumer Reports* stop charging subscription fees for its on-line car reviews and rely on advertisement revenue and press cars? There are four reasons why this should not happen. First, if *Consumer Reports* did this, it would alienate its core customers, which could potentially drop its exposure and therefore revenue. Second, *Consumer Reports'* mission is to avoid bias through being advertisement free and not accepting freebies for *all* of its reviews, breaking this commitment for one product may lead to negative press for all of its different product reviews. Third, reliance on advertisements would expose *Consumer Reports* to outside pressure from auto manufacturers. Fourth, as a non-profit organization, *Consumer Reports* has no incentive to increase its revenue if it covers its costs with its current subscription fees. However, while *Consumer Reports* should not comprise its mission, a new entrant to the car review market may find it advantageous to not charge subscription fees for on-line car reviews, rely on advertisement revenue, and use press cars for tests.

For auto manufacturers, these results mean four things. First is that car reviews *do* matter, as the results indicated that positive reviews lead to higher sales. This means that auto manufacturers need to be selling cars that will gain positive reviews if they want to boost sales. Second, since *U.S. News and World Report* had a stronger effect on sales than *Consumer Reports*, auto manufacturers should be concerned with making sure that they gain positive reviews from sources that comprise *U.S. News and World Report*. This suggests that auto manufacturers may want to concentrate on making sure the press cars that they send to review sources perform outstandingly, as the sources that comprise *U.S. News and World Report* rely on press cars. Third, because the data indicated that larger cars sell better than smaller cars, auto manu-

facturers may want to concentrate on introducing more large car models in the U.S. auto market to boost sales. Fourth, auto manufacturers may want to concentrate on making their cars more reliable and more enjoyable to consumers, because the data indicates that cars with higher reliability ratings and higher consumer satisfaction ratings sell better. With this information, a car manufacturer can better understand where to allocate its resources in order to boost sales.

In summary, this paper provides contributions to the literature on this topic, to media corporations that produce or are considering producing car reviews, and to auto manufacturers looking to boost their sales in the U.S. auto market. With this research, auto manufacturers and media corporations will better learn what consumers look for in their car reviews, which will improve the U.S. auto market as a whole.

8. Conclusion

Do car reviews affect car sales in the U.S. auto market? The analysis finds that car reviews *do* influence car sales, despite factors like brand loyalty, non-free reviews, consumers buying cars based off of specifications, and those who make uninformed purchases. It was also found that free sources, of which *U.S. News and World Report* is comprised of, seem to have a stronger influence than non-free sources, like *Consumer Reports*. While this may at first be surprising, considering *Consumer Reports* is supposed to be considered the bias free source, it could be explained by the Internet allowing information to be found faster. For example, consumers can use multiple free sources to answer their car research questions, rather than buy a *Consumer Reports* magazine.

Another interesting finding is that not all aspects of the reviews were significant enough to be included in the regression. This suggests that consumers only relied upon part of the reviews to make their decisions. In *U.S. News and World Report*, performance ratings, cost to own ratings, and safety ratings were not significant. Perhaps consumers do not care much about performance in their cars, since it may not reflect on their everyday use of the car. Also, consumers may use ratings information from other sources; for example, safety information from the *Insurance Institute for Highway Safety* rather than *U.S. News and World Report* and reliability from *JD Power* rather than *Consumer Reports*.

While it may seem that the answer to rationality is that consumers are rational because they do use car reviews to help themselves buy cars, this still may not be

completely true. The regression suggests that consumers do rely on factors like brand country, which should not matter, because a rational consumer should be indifferent as long as a car is rated well. There some factors that could not be captured in this regression to measure rationality, like styling, which could raise other questions on rationality, like the utility a well styled car brings to its owner. While it can be said that the regression showed signs of rationality among consumers, there are still discussions that could be had on some of the results.

One of the most important things about this paper is its contribution. It fills a void in the literature on the topic of car reviews, which can be used as a basis for further research. It also informs media corporations what consumers look for in car reviews, and how they can increase their exposure to car consumers. For auto manufacturers, it helps them understand ways to increase sales in the U.S. auto market through the press and market opportunities. This research, and research like it, contributes to improving the U.S. auto market by providing information to the producers, rather than the consumers.

Overall, there were very interesting results from the regression performed that answered a lot of questions: What specifications matter when buying a new car, how much does price affect sales, does the brand country matter, will people buy based off of horsepower, is the U.S. auto market concerned with fuel economy, do Americans still prefer large cars, and finally do car reviews affect car sales? The answers to these questions build off a lot of preexisting literature on this topic, and leave room for others to build off of this research and take it further. With this information, car review sources and auto manufacturers can make better informed decisions.

9. Future Research

There are some interesting questions that were going to be answered in this paper, but had to be removed for the sake of time. Yerger in 1996 looked at if the U.S. used car market was actually affected by *Consumer Reports* predicted reliability data, or data released before the *Consumer Reports* data was released. It was found that the market had adjusted before the *Consumer Reports* magazine was released. This same logic could be applied to the U.S. new car market, using some of the same data used for this regression. Do car sales differ after *Consumer Reports'* yearly auto review magazine is released, or is there little to no change?

Another area that could be researched is how car reviews affect brands by size. Zhu and Zhang in 2010 found that small video game titles were more affected by online reviews, than larger title which were not affected at all. Are brands like Toyota or Ford less affected by reviews than smaller brands like Volvo or Fiat in the U.S. auto market?

The same logic could be applied to reviews by car class. There is some literature that discusses how different car classes attract different car buyers which pay attention to different factors when buying a car, and will therefore rely on different reviews or specifications. For example, a luxury car buyer may look at different factors than an economy car buyer. This was touched upon by Hollenbacher and Yerger in 2001. Are different car classes affected by reviews equally?

This regression looked at how reviews in general affected sales, but the same could be done by breaking up the reviews into different categories, such as positive

or negative. Analyzing how these reviews affect sales could lead to interesting results as well.

Another way to analyze U.S. auto sales is through consumer demographics. Pandruad, Luarent, and Lapersonne in 2005 found that older car buyers exhibited stronger brand loyalty. What other interesting trends could be found if sales could be broken down by customer age when applied to the same regression as in this paper?

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