



**TOYOTA**  
*Let's Go Places*

TOYOTA: PREPARING FOR THE NEXT  
GENERATION CAMRY

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## 1- INTRODUCTION

### TOYOTA HISTORY

Toyota Motor Corporation began in 1933 as a division of the Toyoda Automatic Loom Works, Ltd. a Japanese manufacturer founded by Toyoda Sakichi. Ford and Chevrolet served as inspiration to Toyoda in many ways. When designing the original prototype vehicle it was decided to use common parts so that customers could use Ford and Chevrolet parts that were prevalent in Japan at the time. In 1934, Toyoda visited research facilities and universities and studied the automotive and machine tool industries, and benchmarked mass production processes. The Model A1 passenger car prototype was completed in May 1935.

In October 1936, the company name was changed from "Toyoda" to "Toyota" in conjunction with the adoption of the Toyota logo. On August 27, 1937 Toyoda Automatic Loom Works' Automotive Department was spun off and Toyota Motor Co., Ltd. was established as a new company. On October 31, 1957 Toyota Motor Co., Ltd. and Toyota Motor Sales Co., Ltd. reached an agreement and established Toyota Motor Sales, U.S.A., Inc., a California corporation. The Toyopet Crown was the first ever Japanese car sold in the United States.

In 1972 Toyota sold its one-millionth vehicle. By the end of 1975, Toyota surpassed Volkswagen to become the No. 1 import brand in the United States. Three years later, in 1978, Toyota won the "Import Triple Crown" by leading all import brands in sales of cars, trucks and total vehicles. Toyota's success continued, and in 1986, it became the first import automaker to sell more than one million vehicles in America in a single year, racking up sales of 1,025,305 cars and trucks.

Toyota Motor Corporation, became the largest automobile manufacturer in the world for the first time in 2008. Toyota's success continues and today manufactures a diverse line-up of vehicles all over the globe.

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#### TOYOTA PRECEPTS

On October 30, 1935 Toyoda released the "Five Main Principles of Toyoda." Since that time the Five Main Principles of Toyoda have been handed down to every Toyota Group company and serve as conduct guidelines for all employees.

- Always be faithful to your duties, thereby contributing to the Company and to the overall good.
- Always be studious and creative, striving to stay ahead of the times.
- Always be practical and avoid frivolousness.
- Always strive to build a homelike atmosphere at work that is warm and friendly.
- Always have respect for spiritual matters, and remember to be grateful at all times.

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#### MISSION STATEMENT

Seeking Harmony between People, Society and the Global Environment, and Sustainable Development of Society through Manufacturing (Toyota Motor Corporation, 2012).

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## GUIDING PRINCIPLES

### Guiding Principles at Toyota

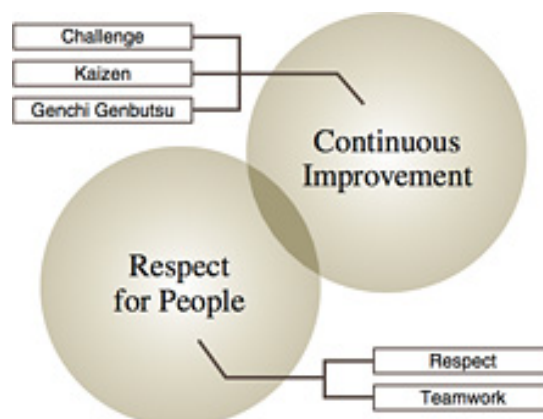
1. Honor the language and spirit of the law of every nation and undertake open and fair business activities to be a good corporate citizen of the world.
2. Respect the culture and customs of every nation and contribute to economic and social development through corporate activities in their respective communities.
3. Dedicate our business to providing clean and safe products and to enhancing the quality of life everywhere through all of our activities.
4. Create and develop advanced technologies and provide outstanding products and services that fulfill the needs of customers worldwide.
5. Foster a corporate culture that enhances both individual creativity and the value of teamwork, while honoring mutual trust and respect between labor and management.
6. Pursue growth through harmony with the global community via innovative management.
7. Work with business partners in research and manufacture to achieve stable, long-term growth and mutual benefits, while keeping ourselves open to new partnerships.

Established in January 1992, revised in April 1997 (Translation from original Japanese)

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## TOYOTA WAY

“The Guiding Principles at Toyota reflect the kind of company that Toyota seeks to be. The Toyota Way 2001 clarifies the values and business methods that all employees should embrace in order to carry out the Guiding Principles at Toyota throughout the company's global activities (Toyota Motor Corporation, 2012).”



**Rewarded with a smile  
by exceeding your expectations**

Toyota will lead the way to the future of mobility,  
enriching lives around the world with the safest  
and most responsible ways of moving people.

Through our commitment to quality,  
constant innovation and respect for the planet,  
we aim to exceed expectations and be rewarded with a smile.

We will meet challenging goals  
by engaging the talent and passion of people,  
who believe there is always a better way.



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**TOYOTA CAMRY**

The Toyota Camry was introduced in 1983 as a replacement for the Toyota Corona. The name "Camry" is an anglicized phonetic transcription of the Japanese word kanmuri, meaning "crown". Originally compact in size with a narrow-body, later Camry models have grown to a wide-body and fit the mid-size classification. The Camry is sold internationally, spanning multiple generations. All Camrys are built in Georgetown, KY, and Lafayette, Indiana. "It won acclaim from Consumer's Digest in 1986 as a "Best Buy", and has remained on the list since that time" (Toyota Motor Sales, U.S.A., Inc., 2014). In July 2013, Toyota Camry cumulative sales

reached 10 million units in the United States alone. Of the Camry models sold in the last 20-plus years, nearly two-thirds of them remain on the road today. Camry has been the best-selling car in America twelve times in the past thirteen years.

## COMPETITORS

To identify the Toyota Camry's competition, we looked at US sales data from 2002-2015. This information has been summarized in the table 1 below.

Make / Model	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	Sum	Sum Rank	Avg	Avg Rank
Toyota Camry	434,145	413,296	426,990	431,703	448,445	473,108	436,617	356,824	327,804	308,510	404,886	408,484	428,606	5,299,418	1	407,648	1
Honda Accord	398,980	397,750	386,770	369,293	354,441	392,231	372,789	290,056	311,381	253,599	331,872	366,678	388,374	4,614,214	2	354,940	2
Toyota Corolla/Matrix	259,732	325,477	333,161	341,290	387,388	371,390	351,007	296,874	266,082	240,259	290,947	302,180	339,498	4,105,285	3	315,791	3
Honda Civic	313,159	299,672	309,196	308,415	316,638	331,095	339,289	259,722	260,218	221,235	317,909	336,180	325,981	3,938,709	4	302,978	4
Nissan Altima	201,822	201,240	235,889	255,371	232,457	284,762	269,668	203,568	229,263	268,981	302,934	320,723	335,644	3,342,322	5	257,102	5
Ford Focus	243,199	229,353	208,339	184,825	177,006	173,213	195,823	160,433	172,421	175,717	245,922	234,570	219,634	2,620,455	6	201,573	14
Chevrolet Impala		267,882	290,259	246,481	289,868	311,128	265,740	165,565	172,078					2,009,001	7	251,125	6
Ford Fusion					142,502	149,552	147,569	180,671	219,219	248,067	241,263	295,280	306,860	1,930,983	8	214,554	12
Chevrolet Malibu	169,377		179,806	203,503			178,253	161,568	198,770	204,808				1,296,085	9	185,155	15
Ford Taurus	332,690	300,496	248,148	196,919	174,803									1,253,056	10	250,611	7
Hyundai Sonata									196,623	225,961	230,605	203,648	216,936	1,073,773	11	214,755	11
Chevrolet Cruze										231,732	237,758	248,224	273,060	990,774	12	247,694	8
Chevrolet Cobalt				212,667	211,449	200,620	188,045							812,781	13	203,195	13
Toyota Prius						181,221	158,884	139,682			236,659			716,446	14	179,112	16
Chevrolet Cavalier	238,225	256,550	195,275											690,050	15	230,017	9
Hyundai Elantra										186,361		247,912	222,023	656,296	16	218,765	10
Ford Mustang					166,530									166,530	17	166,530	17
Buick Century	163,739													163,739	18	163,739	18
Pontiac Grand Am			156,466											156,466	19	156,466	19
Pontiac G6	150,001													150,001	20	150,001	20

**Table 1.** Toyota Camry's Competitor Sales (GoodCarBadCar, 2015)

We ranked each car by sum of total sales and by average sales. We chose Honda Accord and the Ford Fusion as the competitors for our analysis. The Honda Accord was a logical choice. The Accord/Camry rivalry is as well-known as the competitiveness between Coke and Pepsi. The Honda Accord has been manufactured since 1976 and was the first car from a Japanese manufacturer to be produced in the United States. Conversely, the Ford Fusion is a recent release from Ford Motor Company making its first appearance in 2006 to replace the Ford

Taurus. We excluded the Toyota Corolla, Honda Civic, and the Ford Focus because we felt as if they represented a smaller size vehicle classification. We also decided to exclude Nissan Altima because we wanted to represent the foreign/domestic aspect of the relationship.

## COMPETITOR COMPARISONS

Not only did we want to look at what customers were complaining about in their Toyota's, we also wanted to look to see what the consumers were raving about in their competitors. To do this we needed to understand what the competitors had to offer. The Honda Accord boasted 4 different model types with 8 different engines choices, 8 color options, 6 trim options and 2 different wheel options. 2012 was the first year of the Accord coupe but since Toyota wasn't playing in that space with the Camry, we did not use any of the coupe data. In 2013 Honda added 2 new trim packages to bring it to the current 6.

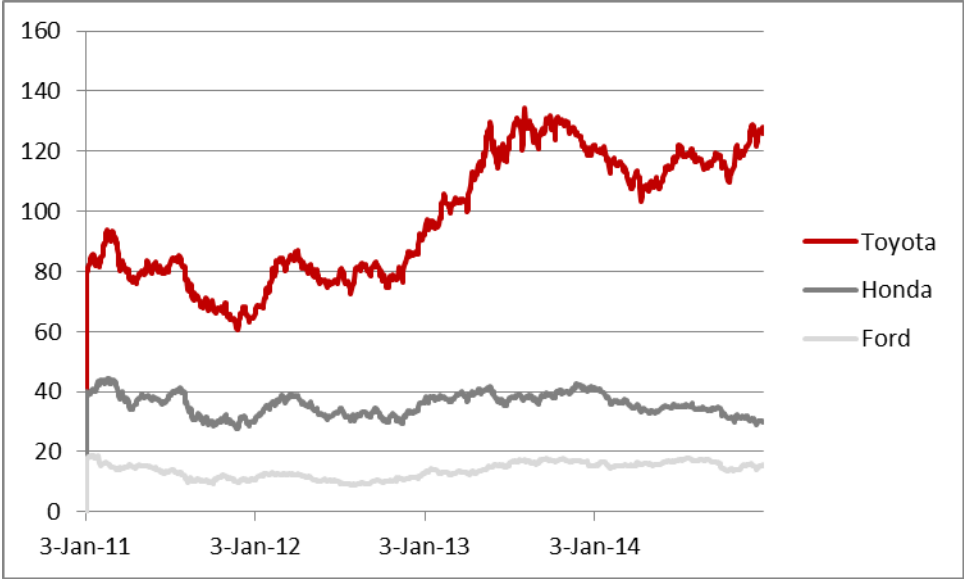
The Ford Focus has been a juggernaut in this class of sedans. The Focus current has 8 models to choose from with 5 different engine choices, 10 color options, 4 trim options and 11 different wheel options to chose from. In 2013 the focus went through a complete redesign of the entire car. This redesign included a longer wheel-base, new multi-link rear suspension and a bevy of technology and driver assistance based on sensors, cameras and radar. In 2014 the added the new 1.5 liter four cylinder engine option as well.

## STOCK PRICES

To begin our examination of the 3 companies, we began comparing the companies' performance on the New York Stock Exchange. As seen in the graph below (Figure 1) Toyota is dominate in this area. At the beginning of 2011 Toyota's stock prices was almost double that of



its top competitor, Honda, and quadruple that of Ford. At the end of 2014, it was four times higher than Honda and eight times higher than Ford.



**Figure 1.** Stock Prices Toyota, Honda, Ford (Yahoo Finance, 2015)

**PERCENT OF TOTAL SALES**

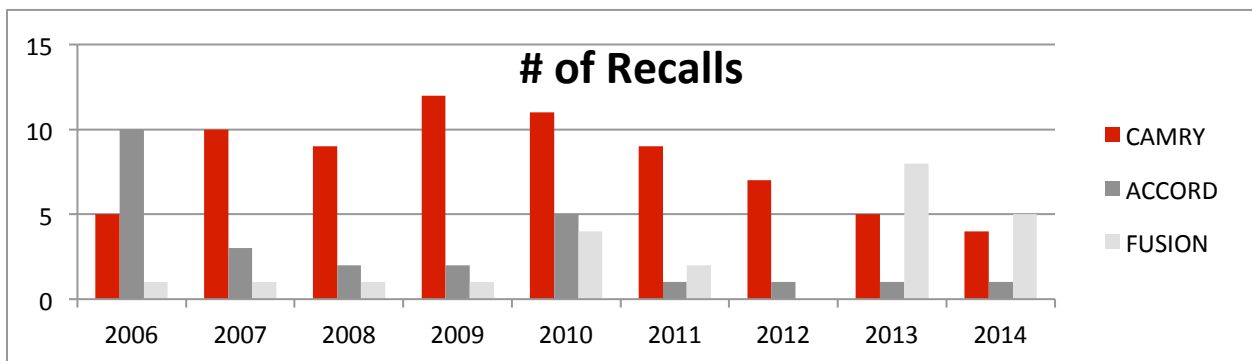
Next we looked at the percentage of sales each model contributed to the overall company sales (Table 2). Here we discovered that the Camry accounts for 18%-19%, the Honda Accord 21%-25%, and the Ford Fusion 11%-12% of total sales for their respective parent company.

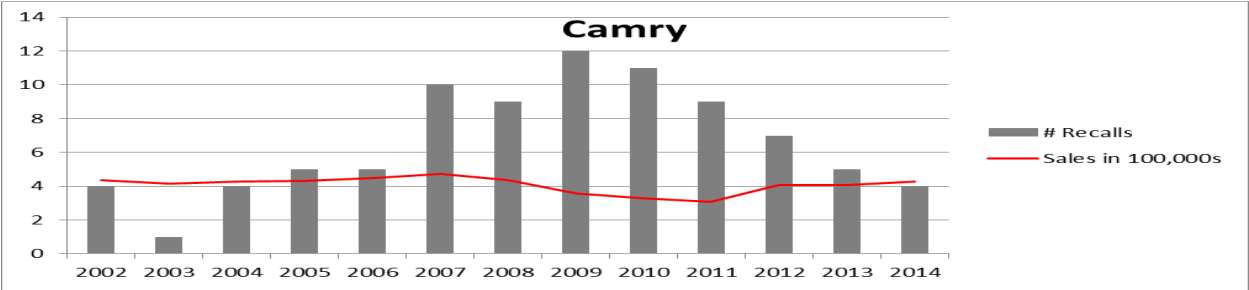
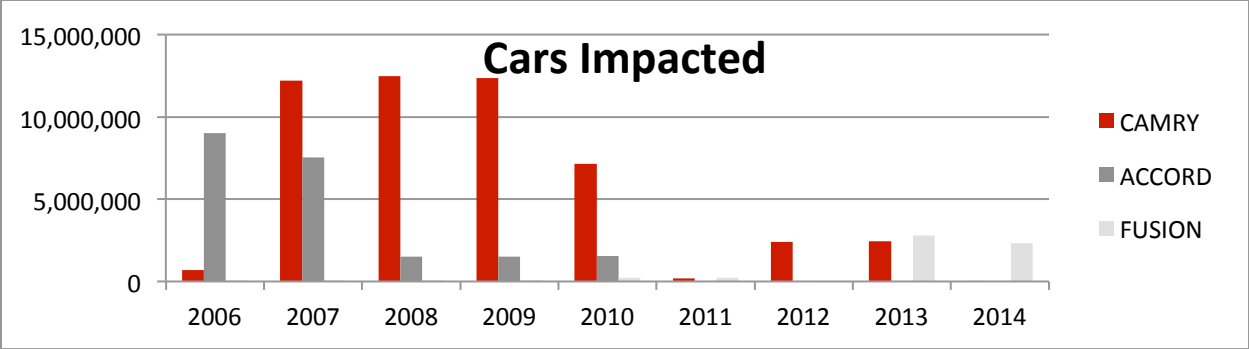
	Toyota MoCo U.S. Sales 2011	Toyota MoCo U.S. Sales 2012	Toyota MoCo U.S. Sales 2013	Toyota MoCo U.S. Sales 2014		Honda MoCo U.S. Sales 2011	Honda MoCo U.S. Sales 2012	Honda MoCo U.S. Sales 2013	Honda MoCo U.S. Sales 2014		FoMoCo U.S. Sales 2011	FoMoCo U.S. Sales 2012	FoMoCo U.S. Sales 2013	FoMoCo U.S. Sales 2014
	1,644,660	2,082,465	2,236,042	2,373,771		1,147,285	1,422,785	1,525,312	1,540,872		2,143,101	2,243,009	2,485,236	2,471,315
	Toyota Camry U.S. Sales 2011	Toyota Camry U.S. Sales 2012	Toyota Camry U.S. Sales 2013	Toyota Camry U.S. Sales 2014		Honda Accord U.S. Sales 2011	Honda Accord U.S. Sales 2012	Honda Accord U.S. Sales 2013	Honda Accord U.S. Sales 2014		Ford Fusion U.S. Sales 2011	Ford Fusion U.S. Sales 2012	Ford Fusion U.S. Sales 2013	Ford Fusion U.S. Sales 2014
	308,510	404,885	408,484	428,606		235,625	331,872	366,678	388,374		248,067	241,263	295,280	306,860
Percent of Sales	19%	19%	18%	18%		21%	23%	24%	25%		12%	11%	12%	12%

**Table 2.** Percent of Total Sales (GoodCarBadCar, 2015)

RECALL AND NUMBER OF CAR IMPACTED

Then we compared the number of recalls issued and the total number of cars impacted from the recalls from 2006-2014 (Figure 2). Toyota has issues almost three times the number of recalls than both Honda Accord and Ford Fusion during that timeframe. Overall, Camry recalls have impacted almost fifty million vehicles, Accord twenty-one million, and Fusion almost six million. Toyota Camry recalls spiked in 2007, remained high through 2010, and has been declining since. Toyota has always had a reputation for quality. It is known as a manufacturing company that others model and aspire too. This dramatic increase in recalls surprisingly has not had a visible impact on sales.





**Figure 2.** Recalls and Cars Impacted (US Department of Transportation, 2015)

**PRICING STRATEGIES**

As seen in the chart below, all three car models are priced in the \$20,000 - \$45,000 range. The basic gas models start in the lower \$20,000 range and the hybrid models start around mid \$20,000-\$30,000. Honda and Ford both offer an electric models the pricing on these models vary more than their gas and hybrid models. Models only reach the \$35,000-\$40,000 range with powertrain, trim and extra options. Gas and hybrid vehicle pricing is shown in table 3 below.

Camry		
<b>Gas</b>		\$24,460 - \$37,878
<b>Hybrid</b>		\$27,615 - \$36,297
Accord		
<b>Coupe</b>	<b>Gas</b>	\$24,595 - \$40,710
<b>Sedan</b>	<b>Gas</b>	\$22,925 - \$43,041
	<b>Hybrid</b>	\$30,125 - \$40,544
<b>Plug-In</b>		\$40,600 - \$41,480
Fusion		
<b>Gas</b>		\$22,935 - \$40,760
<b>Hybrid</b>		\$25,185 - \$38,615
<b>Energi</b>		\$33,900 - \$43,610

**Table 3.** Camry, Accord, and Fusion Pricing

## MARKETING STRATEGIES

Each Company handles their marketing strategies very differently. Toyota is marketing the Camry specifically. Their current campaign focus around the complete new redesigned Camry titled ‘One Bold Choice Leads to Another.’ We believe that Toyota uncharacteristically completed a mid cycle redesign in response to Ford’s strategy on the Ford Fusion. When Ford was designing the Fusion to replace Taurus the designers were told to create a mid-size car that could be priced in the same range as the Camry but looked and felt as if it were \$20,000 more expensive. Ad campaigns for the Ford Fusion at the time of release were ‘Random Acts of Fusion’ focusing on how the Fusion sets itself apart from the “bland competition” and ‘Not your Father’s Taurus’ as Ford tried to appeal to the millennials.

Overall Honda follows more of a “sit back and let the product speak for itself” marketing approach. In 2013, Honda campaigns were ‘Start Something Special’ a theme that spanned all models and retail advertising and ‘It Starts with You’ that stated that Honda understands what its customers want and need. Today Honda’s marketing campaign centers around customer

awareness of airbag recalls and urging customers to have this maintenance preformed immediately. Current, Honda ads are also highlighting sales promotions and incentives.

Fords current marketing emphasizes its brand more than a single model. The commercials concentrate on Fords commitment to fuel economy. A statement issued by Ford about its marketing strategy said, “We will highlight our vehicles features and attributes in our advertising and marketing, which includes fuel economy and fuel-saving technologies like EcoBoost and hybrids”.

**MILES PER GALLON COMPARISON**

For the gas models, all brands are fairly close. Toyota’s 4 cylinder engine receives 25 city, 35 highway and 28 combined MPG. Honda offers both a manual and automatic transmission 4 cylinder engine 24-26 city, 34-35 highway, and 27-29 combined MPG. Ford offers three 4 cylinder engines with and 22-25 city, 31-37 highway, and 25-29 combination MPG. It is important to note that Ford has had to downgrade their MPG rating twice in the past year, which has damaged their reputation and impacted their sales and growth in the market.

Toyota		Honda		Ford			
4 Cyl	4 Cyl - Manual	4 Cyl - CVT	2.5L i-VCT I-4 engine	1.5L Ti-VCT GTDI I-4 EcoBoost		2.0L Ti-VCT GTDI I-4 EcoBoost	
25/35/28 MPG	24/34/27 MPG	26/35/29 MPG	22/34/26 MPG	24/36/28 MPG		22/33/26 MPG	FWD
				25/37/29 MPG	Auto SS	22/31/25 MPG	AWD
<b>Toyota</b>		<b>Honda</b>					
6 Cyl	V-6 Manual	V-6 Automatic					
21/31/25 MPG	18/28/22 MPG	21/32/25 MPG					
<b>Toyota</b>	<b>Toyota</b>	<b>Honda</b>	<b>Ford</b>				
Hybrid	Hybrid	E-CVT	2.0L Atkinson-Cycle				
43/39/41 MPG	43/39/41 MPG	50/45/47 MPG	44/41/42 MPG				
<b>Honda</b>	<b>Ford</b>						
Plug in	2.0L Atkinson-Cycle I-4 Energi						
115 MPGe	95/81/88 MPGe						
47/46 /46 MPG	40/36/38 MPG						

**Table 4.** Miles per gallon comparison

## 2- RESEARCH PROBLEMS

Our goal is to predict the perfect next generation Toyota Camry. To do this, we compare consumer reviews of Camry and key competitors from Cars.com, a common, one of the largest, classified automotive sites.

**Problem 1:** Use text categorization topics to discover common themes of reviews

**Problem 2:** Use sentiment analysis to determine key terms associated with positive and negative reviews.

**Problem 3:** Perform regression analysis to discover which features (year, make/model, fuel type, reliability, comfort and value) are relevant in positively or negatively affecting the overall review.

## 3-ANALYSIS METHODS & RESULTS

### DATA AND DATA EXTRACTION

We looked to various sources for our data to use in our comparisons. These included Cars.com, Twitter, Consumer Reports and Edmunds.com to name a few. After much research and deliberation we decided to use the data from Cars.com as the main focus of our research. Cars.com boasted individual categories on important features of the cars: Comfort, Exterior Styling, Value for the Money, Performance, Interior Design, Reliability and an Overall rating. We felt that this delineation would be an important part of trying to have a comprehensive comparison between different manufactures and models of cars. To extract the data from

Cars.com we used various tools and technologies. We used Kumonolabs.com data extraction tools to get data from the website. We created multiple API's to extract the various different year models for the various different cars and different trim packages of those cars we wanted data for. This in and of its self posed unique challenges. Not all the data on the website is straightforward. For instance the Overall rating of the cars is not a count of stars but actually a shading over a background. We had to use custom CSS paths to be able to extract the width, in pixels, of the shading. When then had to use an algorithm to determine what the rating was based on the size of the shading. Other complications came from the fact that Cars.com uses java based pagination and not different URL's for different number of reviews. This had to be overcome as well in order to extract more than just the first page of reviews for each car and model. Once we extracted the needed data, we used both Python programs as well as some Java to format and clean up the data into Excel based files to be able to use with the SAS software for the various analyses we needed to perform.

EXPLORATORY ANALYSIS

Make and Model	Year	Gas					Hybrid						
		AvgRating	Performance	Exterior	Interior	Value	Reliability	AvgRating	Performance	Exterior	Interior	Value	Reliability
Ford Fusion	2012	4.44	4.24	4.58	4.44	4.38	4.5	5	4.86	4.86	4.86	4.57	4.86
	2013	3.98	3.83	4.59	4.2	3.89	3.89	4.28	4.23	4.83	4.5	4.13	4.35
	2014	4.67	4.44	4.82	4.51	4.49	4.72	4.88	4.81	4.81	4.69	4.63	4.81
Honda Accord	2012	4.33	4.33	4.33	4.25	4.29	4.7						
	2013	4.33	4.4	4.69	4.39	4.29	4.5						
	2014	4.55	4.53	4.64	4.53	4.56	4.67	4.41	4.24	4.76	4.51	4.16	4.57
Toyota Camry	2012	4.37	4.32	4.46	4.37	4.55	4.43	4.69	4.35	4.52	4.65	4.79	4.54
	2013	4.16	4.22	4.06	4.18	4.33	4.41	4.33	4.33	4.27	4	4.67	4.2
	2014	4.42	4.37	4.51	4.63	4.66	4.46	4.82	4.65	4.35	4.53	4.65	4.88

**Table 5.** Average Cars.com rankings

The table above (Table 5) shows mean scores of each user inputted attributes (average rating, performance, exterior, interior, value, and reliability) of Cars.com. The attributes have a 1-5 ranking. The 2014 Ford Fusion (gas) has the highest average rating, best exterior and reliability. The Toyota Camry (2014 gas) has the highest interior and value ranking. The 2013 Ford Fusion carried the lowest scores in nearly all categories.

TEXT CATEGORIZATION

To determine common themes of terms used by the reviewers, text categorization was used. Text categorization involves grouping terms commonly occurring together into topics. In our analysis unsupervised text categorization was used; therefore, the SAS software decided the topics (topics were not user generated). These terms in the topics were used to derive a common theme or category. The number of multi-termed topics was altered based on the

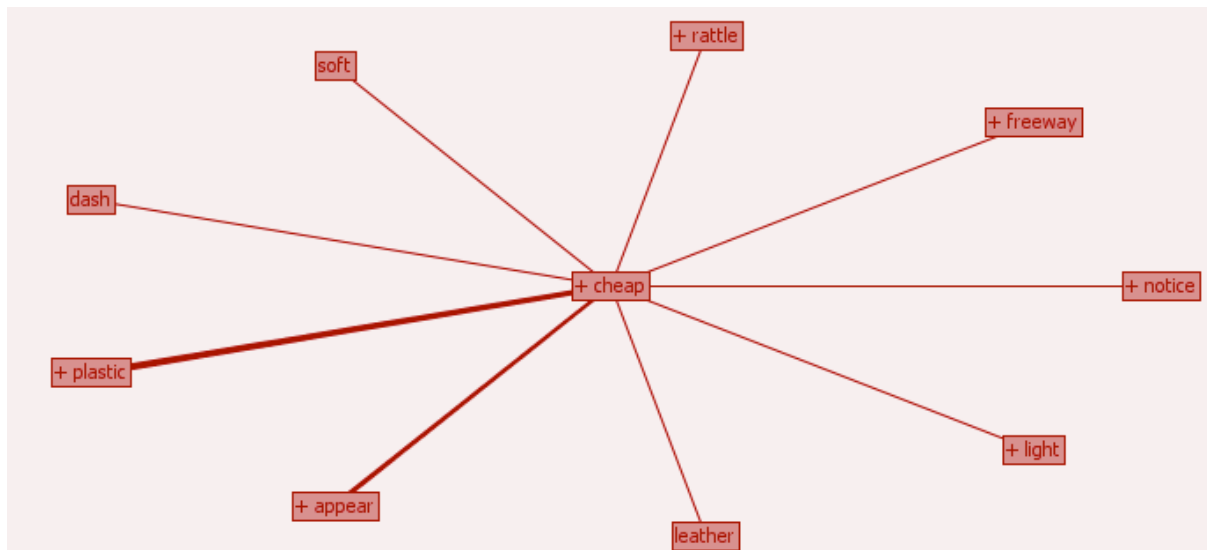


results: decreased if many topics carried similar themed terms or increased if topics appeared to be too broad. Five topics were found to be most suitable. This topic number was maintained throughout analysis so comparisons between the different makes could be made. Term weight was set to inverse document frequency and all other values were left as default.

First, reviewer remarks of the Toyota Camry were analyzed (Table 6). Toyota Camry owners write most their experience and value of their purchase (Topic 1) and also write about test-driving other cars (Topic 3). They enjoy the good gas mileage (Topic 2) afforded by the Camry. However, they do complain about its features and quality of components (Topics 4 and 5). Although text categorization does not inherently connect any positive or negative sentiment to the terms, using the interactive topic viewer allows direct connection from the terms to the review. Subsequent reading of the can reveal reviewers' overall attitude. In the case for topics 4 and 5, these reviews of seat, trunk dash, and plastic were mainly negative. Concept link plot was used to elucidate further relationships. For example the concept linkage for cheap is shown in Figure 3. The term *cheap* is most strongly related to plastic and appear (denoted by the thicker black lines). All the terms in this concept linkage plot seem acceptable to be connected to *cheap*. A *plastic* component can *appear cheap* and drivers may *notice* it *rattle* on the *freeway*. The *cheap* component can be located on the *dash[board]* and can be *soft*, *light*, or *leather*. This is one interpretation of the terms used together (based on reading the actual reviews).

Topic Name	Topic ID	Document Cutoff	Term Cutoff	Topic	Number of Terms	# Docs
Experience & Value (Brand Reliability)	1	0.173	0.051	camry,toyota,+purchase,+year, +car	67	46
Mileage	2	0.178	0.051	mileage,gas,mpg,gas mileage,+car	56	52
Test Driving Other Cars	3	0.170	0.051	+accord,test,honda, ford, car	71	40
Complaints about Quality	4	0.139	0.051	dash,+rattle,+appear,plastic,cheap	83	26
Complaints about Features	5	0.123	0.052	+seat, trunk,+door, rear, difficult	91	41

**Table 6.** Toyota Camry Text Categorization Topic Table



**Figure 3.** Concept Link Plot for *Cheap* (Toyota Camry)

Although this can yield insights on the Toyota Camry buyer as a whole, it is also useful to understand what appeals to the competitor’s buyers. To do this, positive reviews (average rating of 4-5) were filtered for each brand and categorized similarly. The multi-term topic

number was restricted to 5, which yielded the best, most distinct topics and allowed for direct comparison across brands. Interestingly, both the Ford Fusion and Honda Accord resulted in the same topics. This overview is shown in Table 7: the topic category is in bold, while characteristic terms for each car is shown under the category. Both positive Ford Fusion and Honda Reviews detailed reliability of brand, mileage, interior comfort, technological features, and steering & handling. Topics such as seat, passenger, trunk, ride, interior, and style all are synonymous with interior comfort. Further exploration of the topics within the reviews with the interactive topic viewer in SAS supplementary corroborated this. Tables 8 and 9 depict the full SAS output with document and term cutoff statistics. These tables also show the number of terms and documents in each category. For example, there are 51 terms related to Brand Reliability spanning 34 documents (reviews) for Ford Fusion reviews. The concept link plot for *interior* (Figure 4, Ford Fusion) is shown below Ford Fusion's text topic table. Reviewers are pleased with the Fusion's *interior sound system, leather*, and they think it is *comfortable*. The reviewers compare the interior to be luxurious. Honda Accord's concept link for *comfortable* is shown in Figure 5. *Comfortable* is connected to *ride, seat, quiet, leather, sound, sound system, and easy*. Overall Ford Fusion reviewers are pleased with the comfortable ride, seats, and sound system which (from further analysis from the reviews) is *easy* to operate.

Ford Fusion	Honda Accord
<b>1-Reliability of Brand</b>	
car, great, fusion, buy	honda, car, accord, buy, good
<b>2-Mileage</b>	
mpg, hybrid, mileage, car, trip	car, mileage, mile, mpg, great
<b>3-Interior Comfort</b>	
seat, passenger, trunk, power	ride, driver, interior, style
<b>4-Technological Features</b>	
sensor, side, camera, mph	camera, feature, blind spot, cruise
<b>5-Steering and Handling</b>	
steer, service, engine, well	transmission, power, curve, control

**Table 7.** Summary Table Competitor’s Similar Topic Categorization

Category	Topic ID	Document Cutoff	Term Cutoff	Topic	Number of Terms	# Docs
<b>Reliability of Brand</b>	1	0.64	0.182	+car,great,fusion,mileage,+buy	51	34
<b>Mileage</b>	2	0.567	0.175	mpg,+hybrid,mileage,+car,+trip	48	26
<b>Interior Comfort</b>	3	0.469	0.158	+seat,+passenger,trunk,+seat,power	58	19
<b>Technological Features</b>	4	0.544	0.15	+sensor,+side,+camera,mpg,mph	67	7
<b>Steering &amp; Handling</b>	5	0.45	0.139	+steer,+service,+engine,well,+sedan	55	10

**Table 8.** Ford Fusion Text Categorization (Positive Reviews) Topic Table

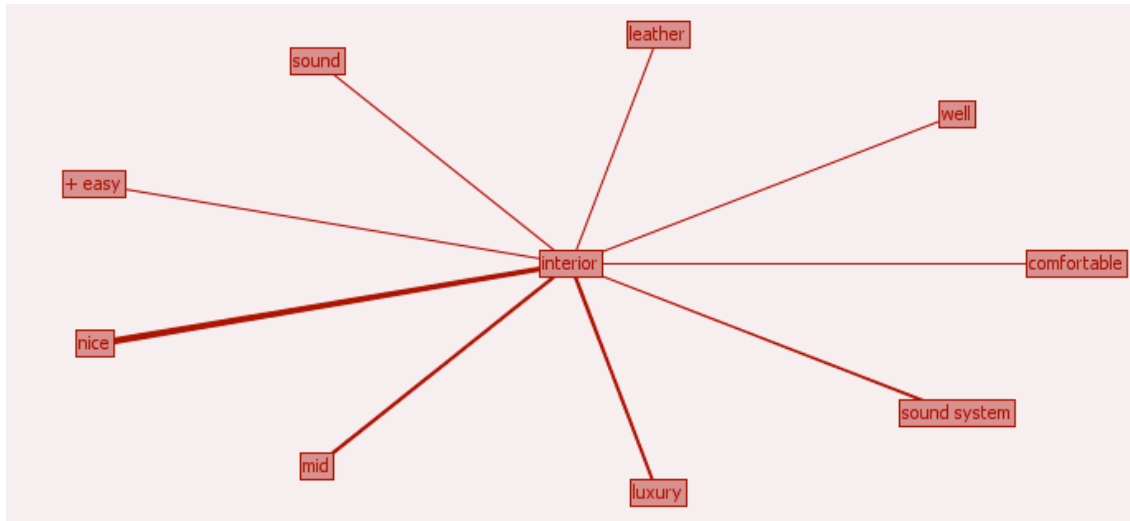
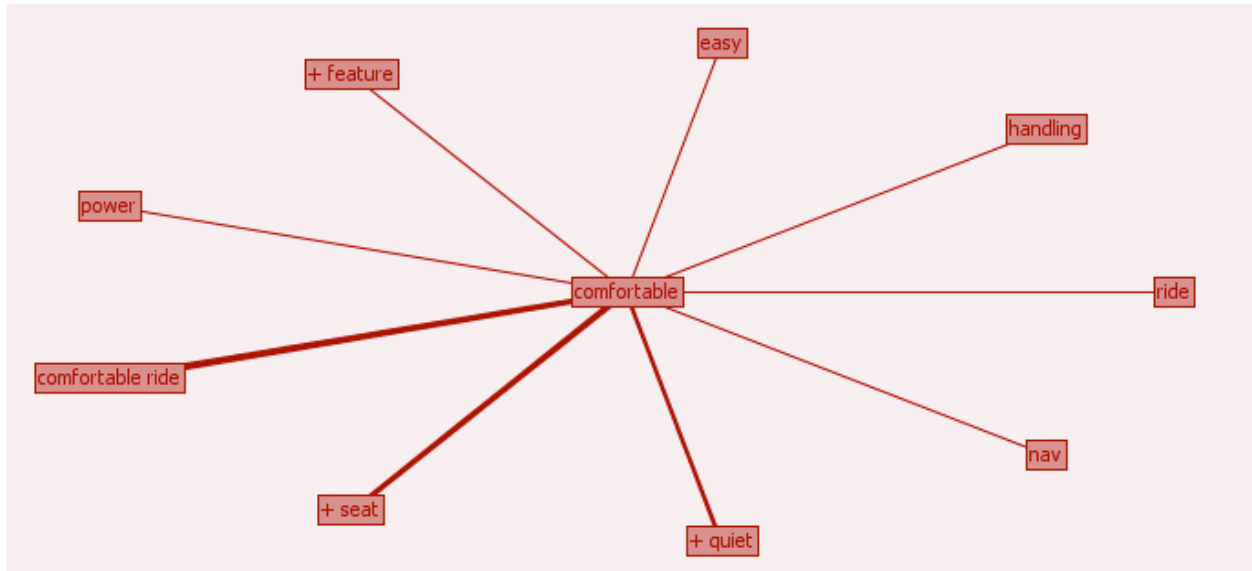


Figure 4. Concept Link Plot for *Interior* (Ford Fusion)

Category	Topic ID	Document Cutoff	Term Cutoff	Topic	Number of Terms	# Docs
Reliability of Brand	1	0.59	0.181	honda,+car,+accord,+buy,+good	52	32
Mileage	2	0.598	0.17	+car,mileage,+mile,mpg,great	53	27
Interior Comfort	3	0.496	0.166	Interior,ride,+feature,style,+driver	57	35
Technological Features	4	0.545	0.159	camera,+feature,blindspot,cruise,cruise control	77	17
Steering and Handling	5	0.532	0.148	transmission, power, control,driving,cruise	70	13

Table 9. Honda Accord Text Categorization (Positive Reviews) Topic Table



**Figure 5.** Concept Link Plot for *Comfortable* (Honda Accord)

## SENTIMENT ANALYSIS

It is useful to determine the sentiment or “attitude” of the terms or text written by the reviewers. This provides a richer understanding of the reviews’ meanings. Text categorization can oversee sentiment because sentiment is not just determined based on the inherent meaning of the term, but is also based on context. For sentiment analysis, each review is placed into different text documents and categorized into negative (average ratings 1 -2) or positive (average ratings 4-5) groups. SAS sentiment analysis algorithm classified the terms within the positive and negative groups. Sentiment analysis was completed for Toyota Camry, Honda Accord, and Ford Fusion reviews. The results of Toyota Camry are shown in the Table 10 below:

Toyota Camry			
positive		negative	
Term	Weight	Term	Weight
love	3194.99	paint	1325.28
feature	1572.48	fault	1269.34
quiet	1488.19	fire	1269.34
model	1450.91	refuse	1140.58

Hybrid	1356.78	rebuild	1140.58
best	1337.42	unusual	1140.58
style	992.803	drain	941.978
fuel	916.95	lemon	934.358
Great	915.728	chip	918.976
excellent	904.41	ice	855.288
reliable	901.538	vinyl	768.582
recommend	875.121	Paint	716.306
Accord	849.88	horrible rattle coming	680.674
performance	819.328	Constant correction	663.066
MPG	806.118	Oxidation	663.066
room	783.877	boat load of problems	663.066
Camry SE	781.452	dangerous	663.066
quality	692.731	Oxidation of paint	663.066
smooth	687.417	Constant	663.066
reliability	665.964	blame	663.066
safety	619.103	Alignment	663.066
Very	592.991	console box	635.095
space	563.922	rattle	635.095
enjoy	562.689	catch	635.095
impress	542.066	displease	635.095
air	539.789	console	635.095
fit	528.072	Complicated guidance system	609.391
right	526.891	complicated	609.391
speed	505.75	source	609.391
great gas mileage	487.161	guidance	609.391

**Table 10.** Top 30 Positive and Negative Terms of Toyota Camry Reviews

It is no surprise that *MPG, great gas mileage, space, reliability, smooth,* and are positive terms associated with Toyota Camry (based on previous the text categorization). Toyota buyers are displeased with certain features such as the *complicated guidance system, console, console box, and constant correction.* Most of the complaints center around the *paint: oxidation of paint,*

oxidation, and chip. There are also with noise from terms such as rattle and horrible rattle coming.

Ford Fusion			
Positive		Negative	
Term	Weight	Term	Weight
great	4019.58	plastic	2765.08
very	3401.12	LAST	2765.08
drive	3263.47	several Fords	2765.08
good	2588.53	owned	2765.08
mileage	2453.64	Reverse	2765.08
gas	2348.92	trans drops	2765.08
feature	1611.37	LAST Ford	2765.08
driving	1481.06	had major	1998.15
average	1318.33	NEVER	1998.15
MPG	1293.88	Nissan Altima	1798.22
vehicle	1177.97	adjustability	1798.22
recommend	1133.22	different sizes	1798.22
happy	1057.3	Altima	1798.22
handle	1048.5	proof	1740.18
style	1021.33	car worth	1740.18
SE	1014.57	bad ones	1740.18
month	995.65	engineering	1740.18
quiet	893.282	Rate	1254.47
fuel	887.864	flush	1254.47
smooth	864.156	ridiculous	1254.47
Love	855.879	Fusions	1254.47
interior	827.639	dealer test	1254.47
nice	789.213	scam	1254.47
system	781.459	unit	1083.72
week	755.286	Cheap	1037.41
speed	754.993	toyota	1037.41
highway	751.362	poor quality build	1037.41
engine	743.575	overflow	1037.41
Ford Fusion	712.556	better selection	1037.41
Great	635.631	junk yard	1037.41



**Table 11.** Top 30 Positive and Negative Terms of Ford Fusion Reviews

Ford Fusion reviewers (Table 11) are most happy with their mileage (common terms: *mpg, fuel, gas,*) and the car’s driving (common terms: *handling, speed, highway, engine, driving, quiet*). The negative reviews appear to focus around their frustration with buying or test driving the car and they mention other competitors. Terms suggesting this are *scam, cheap, dealer test, better selection, car worth, rate, Nissan Altima,* and Toyota. The reviewer also complain about the car’s body: *poor quality build, cheap, engineering, and plastic*.

Honda Accord			
Positive		Negative	
Term	Weight	Term	Weight
far	1353.35	restraint	1589.55
mpg	1307.91	imperfection	902.877
handle	1285.97	seat restraint starts	795.193
Love	1225.71	great but the seat	795.193
right	721.843	relief	795.193
amaze	630.512	fee	691.488
perfect	623.204	hurt	667.674
easy	581.68	bone	632.352
economy	540.197	multiple	602.118
room	514.242	waste gas	557.705
add	513.444	making good cars	557.705
lane	503.24	bone-shatter	557.705
Coupe	468.077	spine	557.705
run	462.543	one wrong	557.705
plenty	449.922	every imperfection	557.705
Great car	445.085	pedal	557.705
top	440.165	rock hard seats	557.705
previous	439.164	spine while sitting	557.705
dealership	438.957	road and rattle	557.705
Civic	426.923	same price	557.705
Good	393.657	gas pedal	557.705

control	389.653	lot of noise	557.705
always	389.307	much effort	557.705
navigation	382.276	gasket	494.255
space	364.3	head gasket	494.255
fun	359.933	nature	482.22
key	357.251	nail	482.22
backup camera	354.235	whistling sound	482.22
economical	352.872	consumer	482.22
keyless	349.31	shortly	482.22

**Table 12.** Top 30 Positive and Negative Terms of Honda Accord Reviews

Honda Accord reviewers (Table 12) are most happy with the car's spaciousness (*room, plenty, space*). They also like its technological features such as *backup camera, keyless/key, and navigation*. *Control, lane, and handle* are terms associated with the vehicles steering or handling. The major negative reviews have terms dealing with seat issues, specifically seat issues causing spine or back problems. The following are the terms: *seat restraint starts, rock hard seats, spine, bone-shatter, bone, hurt, great but the seat, and [seat] restraint*. This is a major negative and the next generation Toyota Camry should not mimic any of Honda Accords seats. Noise issues also are apparent with the Honda Accord.

<b>Model With Just Score Attributes</b>						
<b>Parameter Estimates</b>						
<b>Variable</b>	<b>DF</b>	<b>Parameter Estimate</b>	<b>Standard Error</b>	<b>t Value</b>	<b>Pr &gt;  t </b>	<b>Variance Inflation</b>
<b>Intercept</b>	1	-0.38084	0.09868	-3.86	0.0001	0
<b>Comfort</b>	1	0.291	0.02303	12.64	<.0001	2.15081
<b>Performance</b>	1	0.12075	0.02371	5.09	<.0001	2.1414
<b>Exterior</b>	1	0.02148	0.02706	0.79	0.4277	1.82982
<b>Interior</b>	1	0.08834	0.02571	3.44	0.0006	2.27147
<b>Value</b>	1	0.29242	0.0247	11.84	<.0001	2.82453
<b>Reliability</b>	1	0.26899	0.02618	10.28	<.0001	2.62858

**Table 13.** Score Attribute Model

Note that all of the variables on Comfort, Performance, etc. have positive parameter estimates and therefore effect the overall average rating positively with Value and Reliability having the greatest positive effect. Exterior is not significant.

<b>Model With Just Year Attribute</b>						
<b>Parameter Estimates</b>						
<b>Variable</b>	<b>DF</b>	<b>Parameter Estimate</b>	<b>Standard Error</b>	<b>t Value</b>	<b>Pr &gt;  t </b>	<b>Variance Inflation</b>
<b>Intercept</b>	1	4.55512	0.06254	72.84	<.0001	0
<b>Is2012</b>	1	-0.12219	0.0833	-1.47	0.1428	1.37925
<b>Is2013</b>	1	-0.34437	0.08953	-3.85	0.0001	1.37925

**Table 14.** Year Model

With 2014 as the reference year, both 2012 and 2013 have a negative estimate in comparison to 2014.

Model With Just Make & Model Attribute						
Parameter Estimates						
Variable	DF	Parameter Estimate	Standard Error	t Value	Pr >  t	Variance Inflation
Intercept	1	4.41615	0.05605	78.79	<.0001	0
IsFordFusion	1	-0.02876	0.08774	-0.33	0.7431	1.23428
IsHondaAccord	1	-0.00901	0.08218	-0.11	0.9128	1.23428

**Table 15.** Make and Model Regression

With Toyota Camry as the reference Make and Model, both the Ford Fusion and the Honda Accord have a negative estimate in comparison to the Toyota Camry.

Model With Just Fuel Attribute						
Parameter Estimates						
Variable	DF	Parameter Estimate	Standard Error	t Value	Pr >  t	Variance Inflation
Intercept	1	4.36491	0.0395	110.51	<.0001	0
IsHybrid	1	0.18509	0.08451	2.19	0.0288	1

**Table 16.** Fuel Model

With Gas as the reference fuel, Hybrid has a positive estimate in comparison to Gas.

Full Model						
Parameter Estimates						
Variable	DF	Parameter Estimate	Standard Error	t Value	Pr >  t	Variance Inflation
Intercept	1	-0.38859	0.10562	-3.68	0.0002	0
Comfort	1	0.28588	0.0232	12.32	<.0001	2.1902
Performance	1	0.12335	0.02374	5.2	<.0001	2.15359

<b>Exterior</b>	1	0.00989	0.02774	0.36	0.7217	1.92845
<b>Interior</b>	1	0.08789	0.0257	3.42	0.0007	2.27535
<b>Value</b>	1	0.30346	0.02539	11.95	<.0001	2.99317
<b>Reliability</b>	1	0.26455	0.02655	9.96	<.0001	2.71283
<b>Is2012</b>	1	0.00679	0.03886	0.17	0.8614	1.51725
<b>Is2013</b>	1	-0.03416	0.04081	-0.84	0.4028	1.44892
<b>IsFordFusion</b>	1	0.09309	0.04118	2.26	0.0241	1.40014
<b>IsHondaAccord</b>	1	0.04676	0.03937	1.19	0.2353	1.45841
<b>IsHybrid</b>	1	0.05114	0.03848	1.33	0.1842	1.06046

**Table 16.** Full Model

Note that when the full model is constructed, the relationship of 2012 to the reference year (2014) flips from negative to positive whereas 2013 stays negative. The relationship of both the Ford Fusion and the Honda Accord flips from negative to positive as well. There may be some other unknown multicollinearity issues or issues within year/model combinations that would explain the change in parameter estimates in the full model.

#### 4 – RECOMMENDATIONS & STRATEGY

The Honda Accord gets great reviews that reference the technological features whereas previous Toyota Camry models have some complaints about the features being complicated and difficult to use. Modeling the next generation Camry to have great feature, but having them be less difficult will be necessary.

Results from analyses conclude that a modern, stylish exterior of the Camry is desired. Thus, design is key. Also, Honda Accord reviews showed that many consumers complain of their seats

causing great back pain and discomfort. So, the next generation Camry must be comfortable, have great seating, be roomy and with plenty of storage space.

Some reviews of the Camry show that consumers complain of the cheap parts on the exterior of the car, many of which are easily broken off or make noise while driving. Paint chipping is an issue as well. Ensuring that the Camry is made of quality parts is key to upholding the value image of the car.

As far as fuel economy goes, a high miles per gallon score is likely to attract buyers over other brands. Camry buyers buy for value, the look, and reliability of the machine, so performance is less important than the other features.



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