ECONOMETRICS PROJECT
ECON-620

SALES FORECAST FOR

SUBMITED TO:
LAURENCE O'CONNELL

SUBMITTED BY:
POOJA OZA: 0839378
NISHTHA PARIKH: 0852970
SUNNY SINGH: 0368016
YULIYA INOZEMYSEVA: 0817808

TABLE OF CONTENTS

INTRODUCTION TO THE COMPANY

BMW was established in the year 1917. It is now one of the largest care manufacturer in the world. Today with BMW, MINI and Rolls-Royce brands, it possesses three of the strongest premium brands in the car industry. The group also has a strongest market position in the motorcycle sector and operates a successful financial services business. The company aims to generate profitable growth and above average returns by focusing on the premium segments of the international automobile markets. With this in mind, a wide ranging product and market offensive was initiated in 2001, which has resulted in the BMW group expanding its product range considerably and strengthening its worldwide market position.

BMW'S focus on engineering excellence allied to leading-edge design continues to drive successful, profitable expansion. In 2007 BMW sales increased by 8%, Mini by 18% and Rolls-Royce by 26% with, for the first time ever, over 1000 of the super luxury cars being produced in one year. To further this growth, a host of new models is being launched, including the Mini Clubman and the new sport utility vehicle, the BMW X6 - the world's first SUV coupe. While the Clubman reinvents views on vehicle access, the X6 is an excellent example of BMW innovation at work. It combines the safety and convenience of a four-wheel-drive with the on-road performance of a sports car and is designed to appeal to the driver who enjoys a commanding driving position, but also savors the characteristics of a sports car. With its stretched coupé silhouette and pronounced performance design, underpinned by hybrid engine options, as previously achieved with the X5 and the X3 in allied markets, the X6 is the latest instance of BMW changing perceptions of what a car should provide – for its passengers and its driver alike. At its heart, it restates an aspiration for driving that is both exclusive and yet also available to the mass market.

Along with the examples above, much of the money has gone into the car maker's Efficient Dynamics programme aimed at making engines more efficient, improving aerodynamics, reducing weight and capturing energy during braking. As the numbers clearly show, BMW is a mass market player but one that successfully uses focused innovation to build and maintain the aspirational driving experience for many. Through a constant stream of consumer informed innovations, the company has moved ahead of its peers and future sustained and profitable growth is widely predicted.

CORPORATE FACT

BMW aligns with 2 targets:

1) To be profitable
2) Enhance long-term value in times of change

This applies to technological,

FINANCIAL DATA

Total Assets	178.35
Total Equity	15.07
Operating Income	8.68
Net Income	20.21
Revenue	136.26

MULTIVARIATE REGRESSION MODEL

- The main purpose of a multivariate regression model is to establish the comprehension of the relationship between one or more independent variables and a dependent variable.
- It describes the effect of change in the value of independent variables on the value of the dependent variable.
- The regression model/analysis is a boon to the science of '*Forecasting*'
- In this case we shall use the multivariable regression model to forecast the sales of BMW.

INDEPENDENT VARIABLES

EXPLANATION

- Price: The price of vehicles produced by BMW company can the best independent variable to be used in the model since it can demand or sale of any product revolves mainly around the theme of its pricing.

- Income: Another important independent variable here is average household income. This factor largely helps in the determination of people's purchasing power and thus can help forecast the sales efficiently.

- Advertising: The business arena today not only functions and prospers because of effective ad creation but also relies hugely on advertising. Every industry spends billions of dollars to advertise their products and it's the number one factor that can attract customers or change and maintain brand loyalty.

- Gross Domestic Product (GDP): represents the market value of all the finished goods produced in the nation. Since BMW is an American Multinational, its contributions to the national GDP cannot be undermined.

- Prices of Substitutes: is an important factor that helps to generate the sales forecast of BMW. The substitute company that we have chosen is GM. The prices of GM automobiles can best serve in establishing a connection with the BMW prices and thereby be useful in estimating the sales forecast of BMW.

DATA COLLECTION

Data is collected based on quarterly time period for the past three years.

X1 = average price of vehicle (in dollars)
Average price of vehicle are calculated by quarterly revenue divided by quarterly sale with data from BMW Motor income statements and Bloomberg terminal.

X2 = average advertising expenses (in dollars)
Average advertising expenses are collected from BMW annual report advertising budget information.

X3 = annual GDP (in dollar)
Annual GDP is from bureau of economic analysis.

X4 = average median household income (in dollars)
Data is collected from United States Census Bureau

X5 = major competitor GM's vehicle (in dollars)
Average price of vehicle are calculated by quarterly revenue divided by quarterly sale with data from GM income statements and Bloomberg terminal.

MULTIVARIATE REGRESSION ANALYSIS SUMMARY

	Y	X1	X2	X3	X4	X5
Period	Sales	Price	Advertising	GDP	Income	GM Price
03/31/10	178239	162,108	975,000,000	14,373,800,000,000	50,816	167,416
06/30/10	170695	190,773	875,000,000	14,579,900,000,000	50,816	170,371
09/30/10	160375	172,047	775,000,000	14,694,000,000,000	50,816	197,432
12/31/10	190191	158,945	1,000,000,000	14,865,300,000,000	50,816	164,544
03/31/11	208714	148,711	1,025,000,000	14,978,500,000,000	50,054	175,171
06/30/11	190505	175,722	1,000,000,000	15,080,700,000,000	50,054	182,845
09/30/11	172040	180,441	875,000,000	15,250,700,000,000	50,054	177,262
12/30/11	205895	158,387	1,025,000,000	15,477,100,000,000	50,054	162,107
03/30/12	219717	138,929	1,100,000,000	15,507,900,000,000	45,018	163,422
06/29/12	204296	162,563	2,987,000,000	15,672,600,000,000	45,018	151,212
09/28/12	170978	188,165	2,909,000,000	15,812,500,000,000	45,018	178,725
12/31/12	209166	174,139	6,523,000,000	15,812,500,000,000	45,018	159,958
03/29/13	231127	154,936	3,285,000,000	15,812,500,000,000	45,018	149,949

Y = 67368 - 0.88X1 + 2.65E - 06X2 + 1.79E - 08X3 + 1.71X4 - 0.51X5

Where,
Y = the quantity of the cars demanded per quarter
The constant value of Y intercept = 67368
X1 = average price of vehicle (in dollars)
X2 = average advertising expenses (in dollars)
X3 = annual GDP (in dollar)
X4 = average median household income (in dollars)
X5 = major competitor GM's vehicle (in dollars)
Coefficients of the X variables measuring the impact of the variable on the demand of the BMW vehicle
Coefficients of the X variables measuring the impact of the variables on the demand of the BMW vehicle sales
B1= -0.881805961
B2 = 2.65246E-06
B3 = 1.78935E-08
B4 = 1.706864593
B5 = -0.514854704

REGRESSION STATISTICS	
Multiple R	0.938496601
R Square	0.880775869
Adjusted R Square	0.795615776
Standard Error	9841.931763
Observations	13

ANOVA

	df	SS	MS	F	Significance F
Regression	5	5009103238	1001820648	10.34258929	0.003925259
Residual	7	678045345.8	96863620.84		
Total	12	5687148584			

REGRESSION MODEL OUTPUT

	Coefficients	Standard Error	t Stat	P-value	Lower 95%	Upper 95%	Lower 95.0%	Upper 95.0%
Intercept	67368.10847	266959.5265	0.252353266	0.80801749	-563890.862	698627.0789	-563890.862	698627.0789
Price	-0.881805961	0.231514946	-3.808851112	0.006637827	-1.429251817	-0.334360104	-1.429251817	-0.334360104
Advertising	2.65246E-06	2.83428E-06	0.935848311	0.380504619	-4.04956E-06	9.35448E-06	-4.04956E-06	9.35448E-06
GDP	1.78935E-08	1.14976E-08	1.55627222	0.163597668	-9.29414E-09	4.5081E-08	-9.29414E-09	4.5081E-08
Income	1.706864593	2.336302637	0.730583687	0.488758585	-3.817613279	7.231342465	-3.817613279	7.231342465
GM Price	-0.514854704	0.294840563	-1.746213949	0.124277538	-1.212041851	0.182332442	-1.212041851	0.182332442

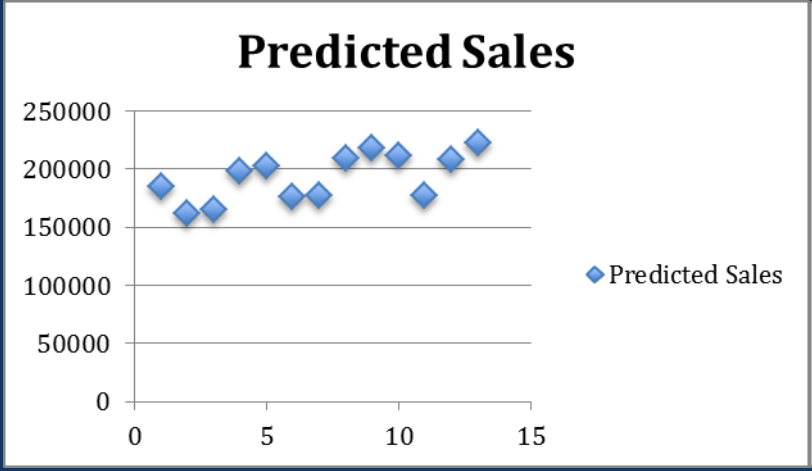
MODEL DIAGNOSTICS

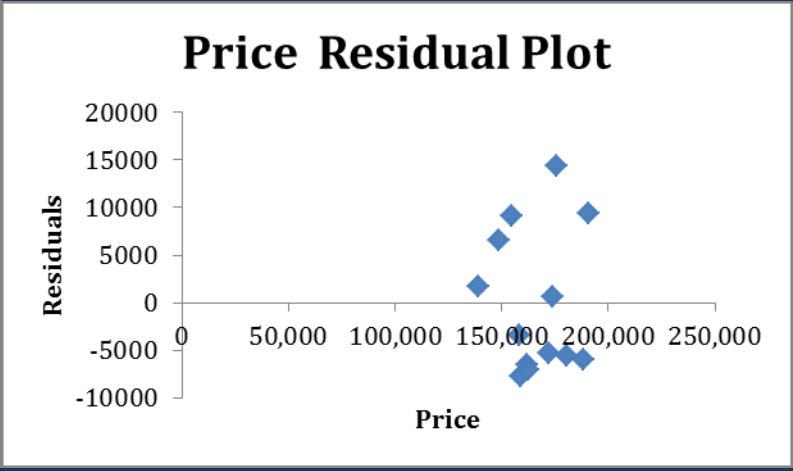
- The standard error is defined as the square root of the variance of the regression coefficient.
- The t-statistic is known as the coefficient estimated latter divided by the standard error.
- Generally a t-statistic greater than 2 (or less than -2) suggests that the coefficient estimated is absolutely significant with >95% confidence
- A t-statistic on the contrary which is greater than 1.68 (or less than -1.68) will always convey that the coefficient is significant with at least >90% confidence.
- These confidences will threshold for t-statistics that are higher especially for small sample sizes.
- The R-Square statistic suggests the percent of the total variation in the dependent variable explained by the independent variables, i.e., nothing but model's overall "goodness of fit."
- R-squares in case of cross-sectional models are generally lower than R-squares for those of the time-series models.
- Increase is number of independent variables = increase in R square.

RESIDUAL OUTPUT

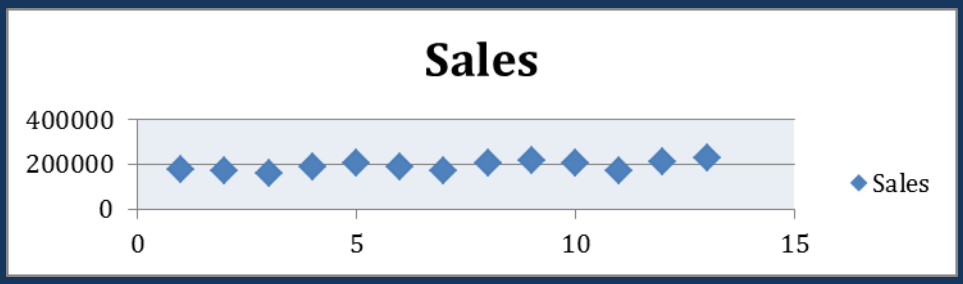
Observation	Predicted Sales	Residuals
1	184744.8785	-6505.878505
2	161369.0121	9325.987892
3	165725.897	-5350.896967
4	197873.3373	-7682.33731
5	202217.8093	6496.190747
6	176209.905	14295.095
7	177634.1704	-5594.170398
8	209333.1426	-3438.142631
9	217968.5263	1748.473749
10	211366.1776	-7070.177626
11	176922.0247	-5944.024709

GRAPHS & EXPLANATION



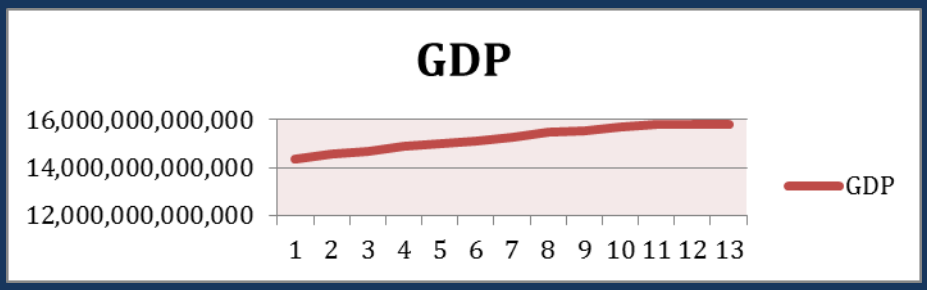


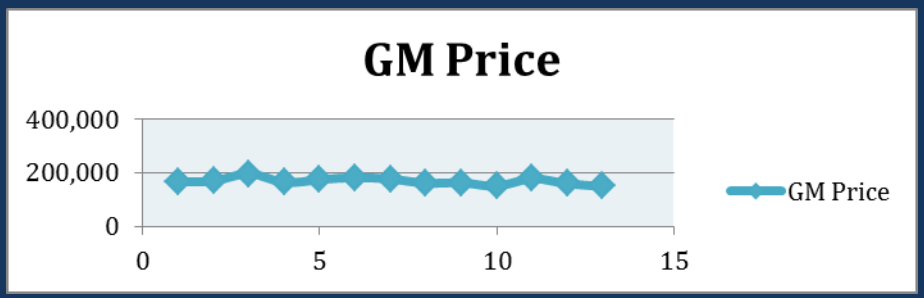
- Price: The coefficient is -0.881805961. Hence for every unit increase in Price, there is a 0.881805961 unit decrease in sales estimated keeping all other variables constant.
- Advertising: The coefficient is 2.65246E-06; therefore for every unit increase in advertising activity, there is a 2.65246E-06 times increase in sales forecasted; keeping all other variables constant.
- GDP: The coefficient is 1.78935E-08 which suggests that any unit increase in GDP results in 1.78935E-08 times increase in the sales to be predicted having kept all other variables constant.
- Income: The coefficient is 1.706864593 which suggests that any unit increase in household income results in 1.706864593 times increase in the sales to be predicted having kept all other variables constant.
- GM Price (Substitute): The coefficient is -0.514854704. Hence for every unit increase in the GM Price, there is a 0.514854704 unit decrease in sales estimated keeping all other variables constant.


Sales
400000
200000
0
0
5
10
15
Sales


Price
400,000
200,000
0
0
5
10
15
Price


Advertising
8,000,000,000
6,000,000,000
4,000,000,000
2,000,000,000
0
1 2 3 4 5 6 7 8 9 10 11 12 13
Advertising


GDP
16,000,000,000,000
14,000,000,000,000
12,000,000,000,000
1 2 3 4 5 6 7 8 9 10 11 12 13
GDP

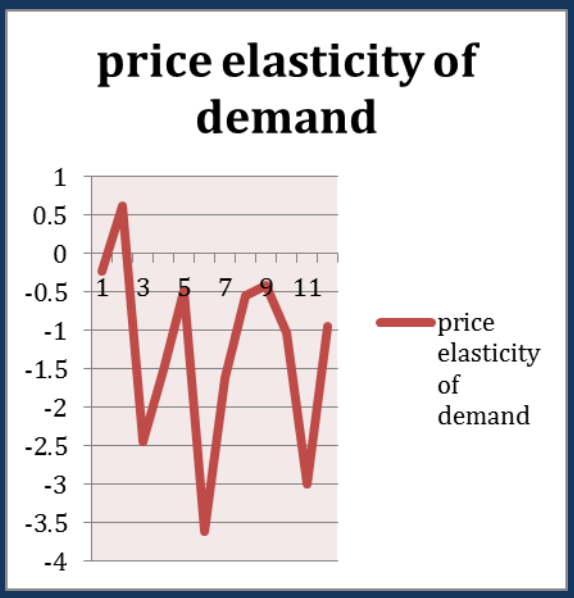

GM Price
400,000
200,000
0
0
5
10
15
GM Price

PRICE ELASTICITY OF DEMAND

- Is the measure of the relationship between a change in the quantity demanded of a specific good and a change in its price.
- Is generally used in determining price sensitivity.
- Formula : Price Elasticity of Demand = % Change in Quantity Demanded / % change in Price

PRICE ELASTICITY AS PER THE MODEL

Price Elasticity of Demand
-0.239359927
0.615929191
-2.441306005
-1.512595566
-0.48032694
-3.609267689
-1.610056955
-0.546444957
-0.412576564
-1.035539984
-2.996344136
-0.952111882



INTERPRETATIONS AND CONCLUSION

- PED as per the model calculated above is less than 1 for all quarters.
- This suggests that the price elasticity of demand for BMW vehicles is relatively inelastic.
- Which means that changes in prices have a relatively small effect on the quantity of BMW cars demanded.
- Good sign for BMW.

- This assigns value to the product more than the pricing.
- Increase in prices might affect the demand but the chances as per the PED depicted by the model are relatively lower.
- BMW has established a good reputation.
- Has become an eye candy for the customers who will not give up on the brand in spite of changes in the prices.
- BMW has successfully maintained Brand Loyalty.
- The product is seen as a necessity and thereby would be demanded in spite of prices being high.
- People with more income certainly would prefer to buy BMW vehicles however same shall be the case with the people with relatively lower income.
- Necessity more than luxury.

ECONOMIC IMPLICATIONS TO BUSINESS POLICY

- Besides the PED factor that we just noticed above, of BMW, the demand for BMW vehicles or any car brand in general would depend on-
  I. Population
  II. Economic Distribution
  III. Environmental Consciousness
- Moreover, these implications are affected by some of the crucial factors like,
  I. Advertising
  II. Quality
  III. Manufacturing Processes
  IV. Large scale global operation
  V. Efficient Functioning.
- BMW should thus focus on its crucial elements which help to maintain Brand Loyalty in customers
- BMW has been investing appropriately in its advertising activities and should continue to do so.
- The quality of the products should be maintained and enhances with the help of the company's first-rate infrastructural aspects

- Also BMW has been environmentally conscious and has now been rolling out ecofriendly hybrid cars and should work on it and gradually increase pace in ecofriendly production.

- BMW pricing strategy as compared to other car manufacturers is considered as an advantage which should be effectively nurtured.

- This brand specific inelasticity maintained by BMW Company is built on the excellence attained in various manufacturing process which should be maintained.

- The pricing should always be in line with household income even though chances of the income affecting the company are relatively thin.

- BMW focusses on global distribution and market should be comprehensively enhanced so that it eventually stands chances to increase its global shares in the cross national ever expanding market scenario.

- The analysis suggest that there is a good trend established by BMW increasing at a slower pace owing to current economic factors but the possibility of an increase in this pace is inevitable.

- Some of the factors related to BMW business policies largely revolve around the themes of:-
  I. Innovation
  II. Technological Advancement
  III. Productivity
  IV. Safety

REFERENCES

1. Bloomberg Terminal
2. http://research.stlouisfed.org/fred2/
3. http://wiki.answers.com/Q/Is_the_demand_for_a_particular_brand_of_car_like_a_Chevrolet_likely_to_be_more_or_less_price_elastic_than_the_demand_for_all_cars
4. http://people.duke.edu/~rnau/regex.htm
5. http://canmedia.mcgrawhill.ca/college/olcsupport/bowerman/2ce/OptionalContent/bow02371_OLC_12_13.pdf
6. http://www.ats.ucla.edu/stat/stata/output/reg_output.htm
7. http://www.talkstats.com/showthread.php/37480-Price-Elasticity-based-on-log-regression
8. http://answers.yahoo.com/question/index?qid=20091025024945AABgbVC
9. http://www.udel.edu/johnmack/frec834/regression_intro.htm
10. http://www.statsoft.com/textbook/multiple-regression/