

Summer 2012 Regression Analysis Project

The Influence of Oil Prices on the Public Transportation Habits

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In recent years the rising price of oil, but also indirectly affect the price of raw materials. Fuel-efficient money, many people began to change the weekday traffic habits by own car to public transportation so the increase in the number of people taking the MRT or cyclists. This study will use a simple linear regression to analyze the relationship between oil prices with the ridership counts of Taipei MRT.

Data selection

In this project, the data used the price of 95 unleaded gasoline from website of Bureau of Energy, Ministry of Economic Affairs in Taiwan¹. And the ridership counts of Taipei MRT from Taipei Rapid Transit Corporation website². Those data are monthly sample from January 2007 to August 2012, total 63 data. The study uses Excel software to analyze.

Methodology

The study use sample regression analysis to analyze the relationship between oil prices with the ridership counts of Taipei MRT. The sample regression model is as follow :

$$Y = \alpha + \beta_1 X$$

Where Y is response variable (ridership counts of Taipei MRT), X is predictor variable (oil price), α is intercept, β_1 is regression coefficient.

Results

First, I should to check that the oil price is a normal distribution then I can do the regression analysis. I use Q-Q plot (Figure 1) to simulate the distribution of ridership counts of Taipei MRT. It shows that the ridership counts of Taipei MRT is normal distribution.

¹ The website of Bureau of Energy, Ministry of Economic Affairs in Taiwan is <http://www.moeaboe.gov.tw/>

² Taipei Rapid Transit Corporation website is <http://www.trtc.com.tw> .

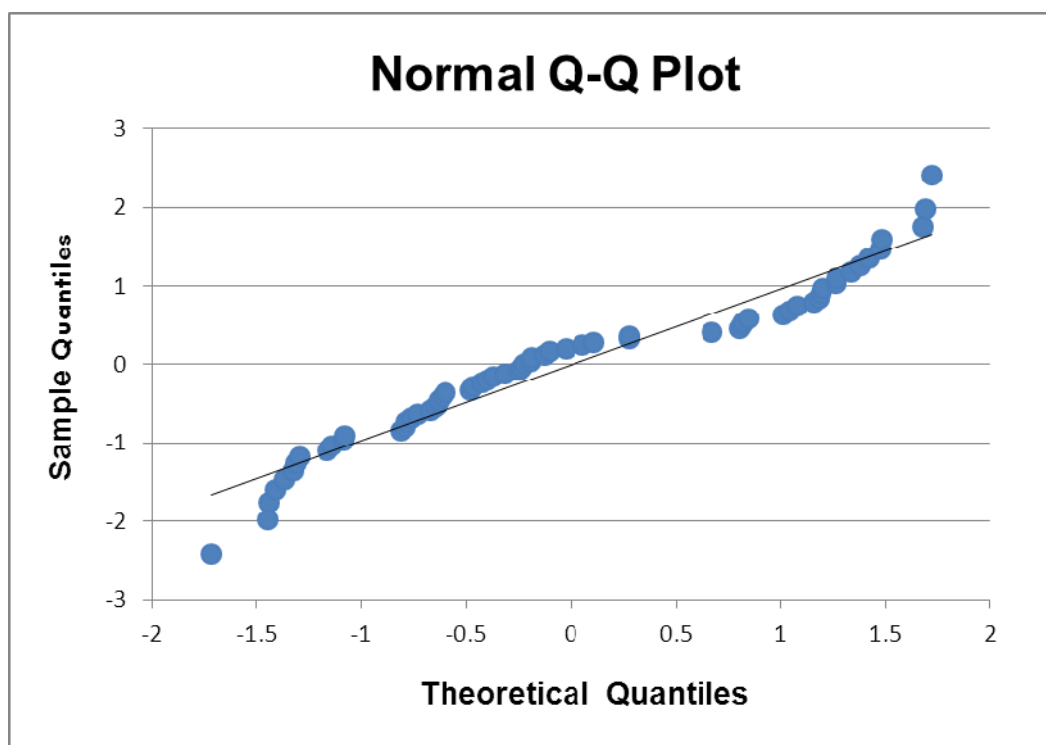


Figure 1. normal Q-Q plot of oil price

Second, I used F-test to test the null hypothesis:

$$H_0 : \beta_1 = 0$$

$$H_1 : \beta_1 \neq 0$$

I use Excel to do regression analysis for oil price (X) and the ridership counts of Taipei MRT (Y), then I can get following analysis tables:

ANOVA

	df	SS	MS	F	significance
Regression	1	6891.077	6891.077	31.81632	4.65E-07
Residual	61	13211.95	216.5894		
Total	62	20103.03			

	Coefficient	Standard Err	t Stat	P-value
Intercept	36.42441	17.75822	2.051129	0.044556
X variable	3.324871	0.589454	5.640595	4.65E-07

Regression Statistics	
Multiple R	0.585481
R Square	0.342788
Adjusted R square	0.332014
Standard Error	14.71698
Observation	63

The F statistic from ANOVA table is 31.816, more than $F_{0.05}(1,61) = 3.998$ with p-value is less than 0.05, so that it can reject the null hypothesis H_0 . The regression function is

$$Y = 36.4244 + 3.3249 X.$$

This model can be seen that when oil prices rose one NTD per liter, the ridership counts of MRT increase 33.249 thousand people.

Conclusion

According to the results of the regression statistics seen by the Adjusted R square explain the ability of this simple regression equation was 33.2%. Apparently in addition to the rise in oil prices, there are other factors that can affect the MRT patronage, may be influenced by increasing of a new route or some thing else, perhaps this is another research direction.

Appendix: raw data

month/year	price of 95 unleaded gasoline (NTD/Liter)	Taipei MRT average ridership everyday (10 thousand people)	month/year	price of 95 unleaded gasoline (NTD/Liter)	Taipei MRT average ridership everyday (10 thousand people)
Jan-07	25.92	110.6247	Jan-10	30.63	131.9886
Feb-07	26.83	105.1291	Feb-10	29.37	124.4220
Mar-07	26.93	116.6321	Mar-10	29.24	138.0331
Apr-07	27.63	111.4348	Apr-10	30.28	134.1728
May-07	27.55	112.6612	May-10	29.82	133.7869
Jun-07	28.20	109.9468	Jun-10	29.48	131.5997
Jul-07	29.45	115.5379	Jul-10	29.25	137.0680
Aug-07	29.10	112.3485	Aug-10	29.52	135.6201
Sep-07	28.50	110.0351	Sep-10	29.50	132.5350
Oct-07	29.80	115.0948	Oct-10	30.10	141.0568
Nov-07	30.70	121.4728	Nov-10	30.54	157.5920
Mar-08	33.50	123.9761	Dec-10	31.20	162.6351
May-08	34.60	122.8911	Jan-11	31.60	150.8687
Jul-08	36.10	124.6494	Feb-11	32.15	150.7771
Aug-08	33.45	128.4092	Mar-11	32.73	157.4786
Sep-08	31.10	116.4832	Apr-11	33.03	157.3507
Oct-08	27.13	127.6434	May-11	32.44	150.4946
Nov-08	22.50	125.0324	Jun-11	32.10	148.1293
Dec-08	21.15	128.8707	Jul-11	31.98	155.4978
Jan-09	22.48	112.1652	Aug-11	31.70	154.2135
Feb-09	23.30	129.4176	Sep-11	31.90	154.8007
Mar-09	24.15	125.1877	Oct-11	31.64	156.8150
Apr-09	25.33	124.7014	Nov-11	31.78	158.7907
May-09	26.34	121.7863	Dec-11	31.48	166.4559
Jun-09	28.35	121.8395	Jan-12	31.30	151.3243
Jul-09	28.35	132.6558	Feb-12	31.78	166.2837
Aug-09	29.28	122.2445	Mar-12	32.40	166.9721
Sep-09	29.08	127.4332	Apr-12	35.10	160.9292
Oct-09	29.44	130.4073	May-12	34.10	161.7133
Nov-09	30.80	131.8288	Jun-12	32.98	158.8700
Dec-09	30.30	141.0195	Jul-12	33.56	162.7631
			Aug-12	35.58	160.1655