© 2016 IJSRSET | Volume 2 | Issue 4 | Print ISSN : 2395-1990 | Online ISSN : 2394-4099
Themed Section: Engineering and Technology

A Comparative Analysis of the Effectiveness of Ceteris Paribus Assumption in Economic Models

Weeraratne N.C.
Department of Economics and Statistics, SUSL, BelihulOya, Sri Lanka

ABSTRACT

In general, an economist uses Ceteris Paribus assumption to explain the law of demand. Ceteris Paribus is Latin phrase and that generally used for saying "with other things being same or all other things remaining equal". But this assumption is not valid for every case in the law of demand. So this paper explains how to use Ceteris Paribus assumption effectively. When the pairwise correlation between contributing factors of demand (price, income, etc.) is comparatively low, Ceteris Paribus assumption can use to yield a substantive isolation.
Keywords: Ceteris Paribus, Correlation, Demand Function

I. INTRODUCTION

In Economics, Demand implies the quantity of a particular good or a service that consumers/buyers are willing to buy and able to buy at a given contributing factors in a given time period. The demand function is the function that represents the behavior of consumers. Consumer may be an individual or a group of buyers. There are two types of demand functions. That is individual demand function and market demand function. Individual demand function describes the behavior of a consumer and market demand function describes the behavior of market. The market demand function can be obtained by individual demand function summed horizontally. In other words, a Demand Curve is the graphical representation of the relationship between the contributing factors of a good and the quantity of that good consumer are willing to buy at a point in time. The behavior of a consumer is influenced by many factors. There are the price of the good, income of the consumer, the tastes and preferences of the consumer, the prices of related goods (compliments and substitutes), the period of time and a variety of other possible variables. Linear curves rarely exist in the real world. Most Demand Curves are non-linear. However, an individual's demand functions for a good (Good "X") might be written as follows:

$$Q_x = f_x(P_x, Income(I), Pref, P_{rg})$$

Where:

$Q_x = The\ quantity\ of\ good\ "X"$
$P_x = The\ price\ of\ good\ "X"$
$Income(I) = The\ income\ of\ the\ consumer$
$P_{rg} = The\ prices\ of\ compliments/substitutes$
$Pref = The\ tastes\ of\ the\ consumer$

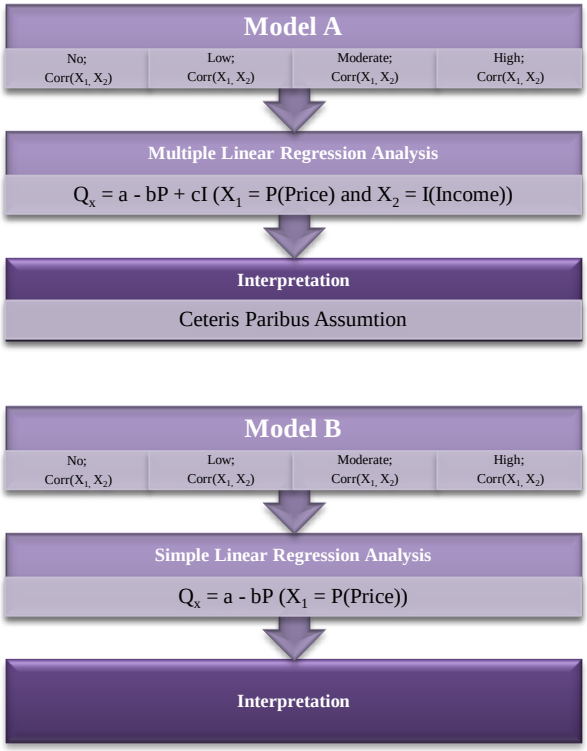
If there are multiple factors influencing the quantity of particular good, economists apply ceteris paribus assumption in order to segregate the effect that quantity of particular good has on the variable in the demand function, keeping all other factors unchanged. In other words, if an economists want to examine the effect of one (independent) variable (one contributing factor; the price of good, the income of the consumer, …, etc.) on another (dependent) variable (the quantity of good), economists need to ensure, through the ceteris paribus assumption, that the effect of other independent variables on the dependent variable is constant. In Law of Demand, generally ceteris paribus assumption used for saying "all other things remaining equal".

Research Problem

By ceteris paribus all other variables (other contributing factors) in a situation are independent of the dependent variable (the quantity of good) being examined in a single, isolated economic demand analysis. However, if the correlations between selected economic contributing factors are comparatively high, the ceteris paribus assumption makes erratic prediction.

II. METHODS AND MATERIAL

This study was mainly based on generated data. The observations of variables were generated from a multivariate normal distribution to accommodate the correlation of the variables.



Finally, compare the model A and model B to find the issue of ceteris paribus assumption.

III. RESULTS AND DISCUSSION

The behavior of a consumer is influenced by many factors. But in this research consider only the price of the good and income of the consumer as contributing factors of the Demand of particular good.

$$Q_x = a - bP_x + cI$$

Where:
$Q_x = The\ quantity\ of\ good\ "X"$
$P_x = The\ price\ of\ good\ "X"$
$Income(I) = The\ income\ of\ the\ consumer$

In general, the ceteris paribus assumption treats, that the effect of other independent variables on the dependent variable is constant. For instance, when we consider the relationship between price of good and quantity of good, that the effect of income of the consumer on the quantity of good is constant. It is usually hard to isolate all the different variables. But actually, there is some relationship between price of good and income of the consumer. In here, we take different correlation values to identify the issue of ceteris paribus assumption. Following results/findings were based on the different correlation values.

Table 1 : Summary Coefficients (b)

ID	Corr(P,I)	MLR Coefficients (b)	SLR Coefficients (b)
1	0.000	-10.00	-10.00
2	-0.011	-09.96	-10.00
3	-0.500	-09.22	-10.00
4	-0.857	-07.19	-10.00

According to the Table 1, If Correlation (Price, Income) = -.857, the demand function as follows,

$$Q_x = 112 - 7.19P_x + 0.0143I$$

The price at which a good is sold raises by one unit, ceteris paribus approximately the seven goods demanded declines. However mathematically, it should be equal to the Simple Linear Regression of Quantity of good and Price of good. But according to the above result it does not match. But if we take first model (Correlation (Price, Income) = 0.000), the demand function as follows,

$$Q_x = 122 - 10P_x + 0.0215I$$

The price at which a good is sold raises by one unit, ceteris paribus approximately the ten goods demanded declines. Sure enough, if we take Simple Linear Regression Analysis for this model price changes same as the Multiple Regression Analysis result.

Illustration (Corr(P,I) = 0.000)

```
> cor(Illustration_1)
          Qx          P          I
Qx 1.0000000 -0.9325048 0.2875215
P  -0.9325048 1.0000000 0.0000000
I  0.2875215  0.0000000 1.0000000
```

Model – MLR

```
> lm.r <- lm(Qx~P+I, data=Illustration_1)
> summary(lm.r)

Call:
lm(formula = Qx ~ P + I, data = Illustration_1)

Residuals:
    Min      1Q  Median      3Q     Max
-7.7937 -2.0426 -0.6749  2.3016  6.8251

Coefficients:
             Estimate   Std. Error t value  Pr(>|t|)
(Intercept) 121.649914  7.641921  15.919  9.37e-07 ***
P           -10.000000  0.885850 -11.289 9.57e-06 ***
I             0.021525  0.006184   3.481   0.0103 *
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’
1

Residual standard error: 4.852 on 7 degrees of freedom
Multiple R-squared:  0.9522,    Adjusted R-squared:
0.9386
F-statistic: 69.77 on 2 and 7 DF,  p-value: 2.382e-05
```

Model – SLR(Price)

```
> lm.r <- lm(Qx~P, data=Illustration_1)
> summary(lm.r)

Call:

lm(formula = Qx ~ P, data = Illustration_1)

Residuals:
   Min     1Q  Median     3Q    Max
-10.00  -3.75   0.00    3.75   10.00

Coefficients:
             Estimate  Std. Error   t value     Pr(>|t|)
(Intercept) 140.000     8.551      16.372    1.95e-07 ***
P           -10.000     1.369      -7.303    8.36e-05 ***
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’
1

Residual standard error: 7.5 on 8 degrees of freedom
Multiple R-squared:  0.8696,    Adjusted R-squared:
0.8533
F-statistic: 53.33 on 1 and 8 DF,  p-value: 8.365e-05
```

The price at which a good is sold raises by 1 unit, ceteris paribus approximately the 10 goods demanded declines. The income of a consumer rises by 1000 unit, ceteris paribus approximately the 22 goods demanded inclines. Sure enough, if we take Simple Linear Regression Analysis for this model separately price and income changes same as the Multiple Regression Analysis result.

The price of good is probably one of the most vital aspects that would determine the demand quantity of good. Lesser the price recorded in particular good, the better the demand quantity of good you will get. So when one unit of price of good is increased, demand quantity of good is decreased by approximately 10 goods.

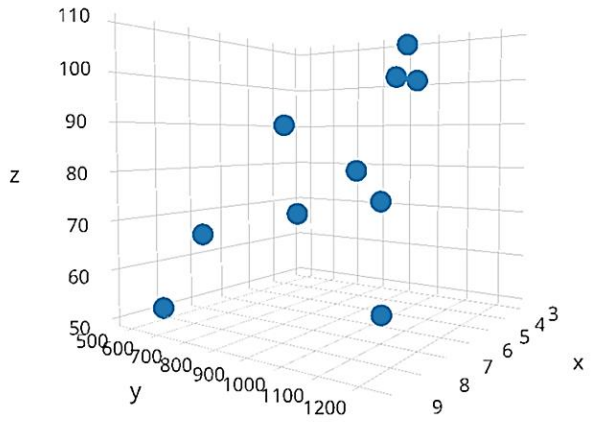


Figure 1: Scatter Plot of MLR

Model – SLR(Income)

```
> lm.r <- lm(Qx~I, data=Illustration_1)
> summary(lm.r)

Call:
lm(formula = Qx ~ I, data = Illustration_1)
Residuals:
    Min      1Q  Median      3Q     Max
-28.556  -9.694  -4.756  16.478  28.978
```

Coefficients:

	Estimate	Std. Error	t value	Pr(>|t|)
(Intercept)	61.64991	22.50820	2.739	0.0255 *
I	0.02153	0.02535	0.849	0.4205

Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 19.89 on 8 degrees of freedom
Multiple R-squared: 0.08267, Adjusted R-squared: -0.032
F-statistic: 0.7209 on 1 and 8 DF, p-value: 0.4205

Higher the income recorded in particular consumer, the better the demand quantity of good you will get. So when thousand unit of income of consumer is increased, demand quantity of good is increased by approximately 22 goods.

IV. CONCLUSION

Generally, if we add more contributing economic factors to our economic model (demand function) that are very useful for describing demand quantity of particular good. That means model can explain more of the variation in demand quantity of good. When compare to the Simple Regression Analysis, Multiple Regression Analysis is the most powerful model for predicting the demand quantity of good. Holding other things constant means there are no relationship between selected factor and all other factors. However if we take Multiple Regression model with many highly correlated explanatory variables, there is much difference between behavior of Simple Regression model and Multiple Regression model with Ceteris Paribus assumption. When the pairwise correlation between contributing factors of demand (price, income, …, etc.) is comparatively low, Ceteris Paribus assumption can use to yield a substantive isolation. In other words, if the correlation between two explanatory variable is comparatively very low, result of ceteris paribus assumption and Simple Linear Regression are approximately same. That means accuracy of ceteris paribus assumption is purely based on the pairwise correlation.

V. REFERENCES

[1]. Boutilier et al., 2003] C. Boutilier, R. Brafman, C. Domshlak, H. Hoos, and D. Poole. CP-nets: A tool for representing and reasoning with conditional ceteris paribus preference statements. Journal of AI Research, 2003.

[2]. Cartwright, Nancy. 2001. Ceteris paribus laws and socio-economic machines. In The economic world view: studies in the ontology of economics, ed. Uskali Mäki. Cambridge (UK): Cambridge University Press, 275-292.

[3]. Doyle, J., & Wellman, M. P. (1994). Representing preferences as ceteris paribus comparatives. In Decision-theoretic planning: Papers from the 1994 Spring AAAI Symposium, AAAI Press, Menlo Park (pp. 69–75).

[4]. Earman, J., J. Roberts, and S. Smith, forthcoming "'Ceteris Paribus' Lost", in a special Erkenntnis volume on ceteris paribus laws.

[5]. Niiniluoto, Ilkka. 1990. Theories, approximations, and idealizations. In Idealization I: general problems, eds. Jerzy Brzeziński, Francesco Coniglione, Theo A. F. Kuipers, and Leszek Nowak. Poznan Studies in the Philosophy of the Sciences and the Humanities, 16: 9-57.

[6]. Niiniluoto, Illka. 2002. Truthlikeness and economic theories. In Fact and fiction in economics: models, realism, and social construction, ed. Uskali Mäki. Cambridge (UK): Cambridge University Press, 214-228.

[7]. Persky, J., Retrospectives: Ceteris Paribus, Journal of Economic Perspectives, vol. 4, no. 2, 1990, pp. 187-193.

[8]. Pietroski, Paul, and Georges Rey. 1995. When other things aren't equal: saving ceteris paribus laws from vacuity. British Journal of the Philosophy of Science, 46 (1): 81-110.

[9]. Schlicht, Ekkehart. 1985. Isolation and Aggregation in Economics, Germany: Springer-Verlag Publisher

[10]. Simon, H., The Architecture of Complexity, Proceedings of the American Philosophical Society, vol. 106, no. 6, 1962, pp. 467-482. Stam, E., A Process Model of Locational Change: Implications for an Evolutionary Economic Geography, Applied Evolutionary Economics and the Knowledge-based Economy (A. Pyka and H. Hanusch, eds.), Edward Elgar, Cheltenham, 2006, pp. 143-165.