Consumer Welfare and Indirect Utility Function;  
Empirical Analysis from Pakistan

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Abstract: This research study empirically examine the role of Indirect Utility Function on Consumer Welfare using annual time series data from 1977-2014 for Pakistan. The Augmented Dicky-Fuller (ADF) unit root test was applied to check the stationarity of the data, showed that variables are stationary at level. In analytical technique, the NLS and ARMA (Least Regression Analysis) method was operative through econometric views (E-Views) software. The result indicates that income of the consumer has significant and positive effect, while price of goods has significantly negative effect on the consumer welfare and utility in case of Pakistan. This study recommends that incremental efforts are required by the government to bring stability in the prices of goods, policies must aim and focus on provision of employment and income generating activities, control of income inequality and minimize income class disparities to maximization welfare of the individuals living in different regions and in societies of Pakistan.

Key words: Consumer Welfare - Indirect Utility Function - Augmented Dicky-Fuller (ADF) test - NLA and ARMA (Least Regression Analysis)

INTRODUCTION

Micro economics predominantly consists of two theories; the consumer and producer theory. The classical school of thought supports producer theory as stated “supply creates its own demand”. The Keynesian school of thoughts supports the consumer theory as stated “demand creates its own supply”. If vigilantly analyzed both theories are sturdily dependent with each other but consumer theory gain auxiliary importance and meditation, because producers itself consumer too, as they consume and demand for goods and services in order to gain utility. The solitary objective of the consumer theory is to maximize consumer satisfaction or consumer utility. Utility or satisfaction that consumer obtains depend on consumption of goods and services and, the consumption of goods and services depend upon the income and prices. This concept is known as Indirect Utility Function. The consumer utility is based on the income and price of goods; consequently, consumer utility estimates consumer behavior towards purchasing goods within their budget constrain. The budget constrains shows willingness and ability of consumer to buy the goods and service at a given level of income and prices of goods. The goods for which consumer has willingness to consume and the ability to pay determine welfare of consumers. The intact process in which the consumer takes decision concerning demand for goods keeping glance on his budget constrain for attaining of utility conclude the consumer behavior. Now a day’s behavioral economics is the most debating and provoking issue, as this subject matter are mostly related to day to day behavior and decision of the individuals.

The consumer welfare and consumer behavior are dependent on income of the consumer and price of the demanded goods. However, there are some utility based consumer welfare models that concentrate on the income effect and implement gratuitous and unprovoked restrictions on the price effect and its elasticity to demand. Notable literature exists on the restriction of the linear expenditure function (Price effect). Some well known studies regarding the concern issue were [1], (Rotterdam Model; 1965), [2-4]. An Almost Ideal Demand System was derived from the consumer theory to infer and precisely illustrate the consumer behavior and welfare by [5], extended the work of [1]. Almost Ideal Demand System
model were preferred over the Rotterdam and Translog Model. The main criticism on these models were that these models are generally developed and explaining the linear expenditure model and didn’t satisfy the main axioms of the consumer theory. Whereas, the Almost Ideal Demand System satisfies the axioms of the consumer choice as well as the non-linear model concerning to the Engle curve, consumer budget and satisfies homogeneity property.

The consumer demand for goods and buying behavior stanch with the pragmatic expenditure function consequent and derivative from the individual’s demand. In the long run the consumer welfare and Individual’s demand function varies with relative change in price of goods and services (Slutsky Equation). Therefore, the flexible demand function with relative price changes is desirable to observe the consumer behavior whilst deriving the consumer welfare from the individual’s demand functions. [6-7] worked on the flexible demand system articulated that restricted demand function is just succession of non-parametric demand function don’t have strong evidence of micro economic theory. They concluded that it is impossible to study the consumer behavior and welfare as well as to derive the consumer utility from the restricted demand function. Slutsky symmetry (1880-1948) is an important contribution deriving utility from the price change effect while keeping the income effect constant directly.

Though, income of the consumer is the most important element of the consumer theory. But this component is most volatile variable of the consumer welfare and demand as it varies from individuals to individuals, countries to countries and even among the earning group. The income elasticity too varies along with goods and income groups. Although income play an important role in the consumer demand, but it is very difficult to predict and estimate the consumer behavior and welfare without counting the relative price effect. The important contributions in this regard originated from the work of [5, 8, 9]. But still these studies gave more weight to working-lesser curve.

The working-lesser and Engle curve solitary via price effect couldn’t represent factual and realistic picture of the consumer behavior. It doesn’t intensively explain welfare of the consumer without considering the expenditure effect. Many researchers and economists follow a line of investigation which refocuses attention towards the income effect with an additional obsession of expenditure approach being obligatory for derivation of the consumer utility for some goods. Various literature are prompt in which the researchers analyzed that with income approach the expenditure approach is necessary for deriving the consumer utility from some goods not all isn’t it repetition of the previous line. Many studies have instigate strong evidence that Engle curve and working lesser curve doesn’t gave a precise representation of the consumer behavior in deriving the utility from some goods. The well known studies in this regard were [10-16].

This research study deriving the utility and consumer welfare, using the Marshallian Demand functions as indirect utility function and substituting it in utility equation. Earlier studies focused on Engle and working-Lesser curve. This study applies the Engle and working-Lesser curve as well as the relative price effect (Slutsky Equation) to observe the consumer behavior towards goods and welfare of the consumer obtained from consumption bundle of goods “X,” (i= 1………n). This study empirically examine the consumer welfare and indirect utility function for Pakistan, allowing the flexible demand system with stipulation of the price changes of goods “X,” and income of the consumer.

The Marshallian demand system incorporates both the income and price effect. This research study considering income of the consumer as well as prices of goods in order to derive consumer utility and welfare taking all other things (taste of the consumer, preference, seasonal variation, price of substitutes, class differences etc) as constant. The consumer welfare is taken as percentage share of consumption to GDP. It is assume that the consumer maximize their utility by consuming the bundle of good “X,” having some price “P,” bear by the consumer from the available income “M”. This phenomenon is known as Indirect Utility Function.

Objective of the Study: The basic objective of this research study is to derive and empirically assess the consumer welfare from indirect utility function. This study is an attempt to derive consumer welfare from Indirect Utility Function (IUF) in case of Pakistan.

Methodology of the Study
Area of this Research Study: This research study is conducted on Pakistan. Pakistan is a developing country located in south Asia having population of 190 million. The standard of living is not much satisfactory as the Human Development Index (HDI) is low. The consumer income has much variation due to high income inequalities as showing by Gini-Coefficient value of an average 30 from 1990-2014. The last two decades have experienced too much discrepancy in the prices of goods.
The income class differences are very high. High income group becomes rich to a large extent but sixty percent (60%) of the individuals are poor and falls in lower income group, if estimated on the basis of earning two dollars ($2) per day.

Data Analysis: This study consist on annual time series data covering the period of analysis from 1977-2014, because the data prior to 1977 are not available for the variables selected for this research study. The data are collected from the global economy data indicator, State Bank of Pakistan (SBP), Households Integrated Economics Survey (HIES), Pakistan Social and Living Standard Measurement (PSLM), World Development Indicator (WDI), Pakistan Bureau of Statistics and Economic Survey of Pakistan.

The Consumer Welfare Model: Consumer welfare is estimated from the consumption of goods. When the price of goods increases the welfare of the consumer falls and it raises as the income level of the consumer rises. In simple words, according to demand theory the consumer worse off if the price level increase and better off if the income level increases. Utility that the consumer obtained depends on consumption of goods and services and consumption of goods and services depend upon the income and prices. So, the welfare of the consumer estimated from the utility and utility from the consumption of goods (may be X). This concept is known as indirect utility function that depends on the income and prices.

Indirect utility function is obtained by substituting the Marshallian demand (X) function into the utility function.

\[
U = V(x_1, \ldots, x_n) \quad (2.1)
\]

\[
U = V(x_1^*(P, M), \ldots, x_n^*(P, M)) \quad (2.2)
\]

\[
U = U^*(P, M) \quad (2.3)
\]

As the income of the consumer increases other things remain constant, the purchasing power of the consumer also increases. So, indirect utility function (IUF) is monotonic increasing in income of the consumer. Now taking the partial derivative of equation (2.3) with respect to income (M) constant, That is;

\[
\frac{\partial U^*}{\partial M} = \frac{\partial U}{\partial X_1} \frac{\partial X_1}{\partial M} + \cdots + \frac{\partial U}{\partial X_n} \frac{\partial X_n}{\partial M} \quad (2.4)
\]

Equation (2.4) shows that utility (U) depend upon the consumption of good (X_i) and consumption of good (X_i) depend upon the income of the consumer (M). In equation (2.5) \( \lambda \) is the Marginal Utility, that is

\[
\lambda = MU = \frac{\partial U}{\partial X} = \frac{U_i}{P_i} \quad (2.5a)
\]

Taking \( \lambda \) common

\[
\frac{\partial U^*}{\partial M} = \lambda \left[ \frac{\partial U_i}{\partial X_i} + \cdots + \frac{\partial U_n}{\partial X_n} \right] \quad (2.6)
\]

\[
\frac{\partial U^*}{\partial M} = \lambda \left[ \frac{U_i}{P_i} + \cdots + \frac{U_n}{P_n} \right] > 0 \quad (2.5a)
\]

Demand for good is inversely proportional to the price level, if other things remain constant. As the prices of goods increases the demand for goods falls and the consumer feels worse off. So, indirect utility function (IUF) is monotonic decreasing in prices of the goods (X). Now taking the partial derivative of equation (2.3) with respect to Price (P) keeping the Income of the consumer (M) constant, That is;

\[
\frac{\partial U^*}{\partial P_i} = \left( \frac{\partial U_i}{\partial X_1} \frac{\partial X_1}{\partial P_i} + \cdots + \frac{\partial U_i}{\partial X_n} \frac{\partial X_n}{\partial P_i} \right) \quad (2.7)
\]

\[
\frac{\partial U^*}{\partial P_i} = \left( U_1 \frac{\partial X_1}{\partial P_i} + \cdots + U_n \frac{\partial X_n}{\partial P_i} \right) \quad (2.8)
\]

\[
\frac{\partial U^*}{\partial P_i} = \left( \lambda P_1 \frac{\partial X_1}{\partial P_i} + \cdots + \lambda P_n \frac{\partial X_n}{\partial P_i} \right) \quad (2.9)
\]

where

\[
U_i = \lambda \quad (2.9a)
\]

So,

\[
\lambda P_i = U_i \quad (2.9b)
\]

Taking \( \lambda \) common

\[It is define as “Change in Total utility due to one additional or extra unit of consumption of goods (X)”\]
As we know that 

\[ M = (P_1X_1 + P_2X_2 + \ldots + P_nX_n) \]  

(2.11)

Now consider 

\[ \frac{\partial M}{\partial P_i} = \partial\left(\frac{P_1X_1 + P_2X_2 + \ldots + P_nX_n}{\partial P_i}\right) \]  

(2.12)

\[ \frac{\partial M}{\partial P_i} = (X_1^*P_1 + X_2^*P_2 + \ldots + P_nX_n) \frac{\partial X_1^*}{\partial P_i} + (X_2^*P_1 + X_2^*P_2 + \ldots + P_nX_n) \frac{\partial X_2^*}{\partial P_i} + \ldots + (X_n^*P_1 + X_n^*P_2 + \ldots + P_nX_n) \frac{\partial X_n^*}{\partial P_i} \]  

(2.13)

\[ 0 = (X_1^*P_1 + X_2^*P_2 + \ldots + P_nX_n) \frac{\partial X_1^*}{\partial P_i} + (X_2^*P_1 + X_2^*P_2 + \ldots + P_nX_n) \frac{\partial X_2^*}{\partial P_i} + \ldots + (X_n^*P_1 + X_n^*P_2 + \ldots + P_nX_n) \frac{\partial X_n^*}{\partial P_i} \]  

(2.14)

\[ -X_1^* = P_1 \frac{\partial X_1^*}{\partial P_1} + P_2 \frac{\partial X_2^*}{\partial P_1} + \ldots + P_n \frac{\partial X_n^*}{\partial P_1} \]  

(2.15)

Substituting in eq (2.10) 

\[ \frac{\partial U*}{\partial P_1} = \lambda(-X_1^*) \]  

(2.16)

\[ \frac{\partial U*}{\partial P_1} = (-\lambda X_1^*) \]  

(2.16a)

So, equation (2.6) shows that consumer welfare is positively related with the income of the consumer and equation (2.16) showing that consumer welfare is negatively related with the price of the goods.

To estimate the consumer welfare and examine their behavior, the indirect utility function be used with substituting the Marshallian Demand function in to the utility equation derived from equation (2.6 & 2.16). The consumer welfare is taken as percentage share of consumption to GDP of Pakistan, the dependent variable. The independent variables selected for this research study are income of the consumer and prices of Goods taking all other things being constant. The theoretical equation of the consumer welfare for this study can be written as;

\[ \text{Consumer Welfare} = f(\text{Income of Consumer, Prices of Goods}) \]  

(2.17)

The econometric model followed by theoretical equation (2.17) for the consumer welfare is;

\[ \text{ConsumerWelfare} = \beta_0 + \beta_1(\text{Income}) + \beta_2(\text{Price}) + \mu \]  

(2.18)

The sign of the co-efficient of the estimators expected to be;

\[ \beta_1 > 0, \beta_2 < 0 \]

The linear with logarithmic form model applied for estimating the consumer welfare from indirect utility function. The variables are regressed through NLS and ARMA (Least Square) regression model run through econometric software E-Views (Econometric Views). The error term are supposed to be normally distributed with the white noise restriction estimated with the subsequent formula; \(\sigma^2 = \beta^2 \sigma^2 E(\mu) = 0\).

**Estimation Procedure and Results**

**Unit Root Test:** The unit root tests often pertain on time series data to find out the spurious relation, co-integrating factor or uni-variate relation exits or not in the data. But the imperative aim of operating the unit root test is to check the stationarity in time series data. Moreover, Unit root tests confer on selecting and applying the suitable analytical technique. In time series analysis there is vestiges wary about spurious relation in the data, for that reason, the researchers strongly recommends unit root test before applying analytical techniques for regression analysis. The most popular unit root test especially for large samples data is the Augmented Dicky-Fuller (ADF) test. As this research study consists of time series analysis, therefore, the data was checked through Augmented Dicky-Fuller (ADF) unit root test for the stationarity and selecting the precise tools for regression analysis. The results of the ADF unit root test are incorporated Table 3.1.

The unit root test results presented in Table 3.1 showing that the variables are stationary at level 1(0). The critical value of Augmented Dicky-Fuller (ADF) unit root is selected at 05% significance level. The stipulation where all variables are stationary at level, NLS and ARMA (Least Square) model are suggested as regression techniques for further analysis. For the estimation of the results between the dependent variable that is consumer welfare and the independent variables which are income of the consumer and prices of the goods, NLS and ARMA model is applied. The results of the regression analysis are given in Table 3.2.
The results obtained from the regression analysis of the consumer welfare model and indirect utility function is reported in Table 3.2. The recitation of the intact model is satisfactory showing by the statistics integrated from the NLS and ARMA regression analysis. The prob. (F-stat) value is (0.0000), while F-stat value is (711), viewing the premier association and nuance of the model. More than 95% deviation is illuminating the R² Squared value among the dependent and independent variables confirming the goodness of fit of the model. The Durbin Watson (DW) value is (1.86), slam to the preferred value, interpreting the negligible probability of Auto-correlation.

The results of the variables co-efficient originated from the regression analysis have significant (t-stat and prob. value of the coefficient of variables showing in Table 3.2) effect with true expected signs enhanced interpreting consumer welfare model developed for this research study with the assumed hypothesis.

The explanatory variable included in the study, income of the consumer has positive and significant value indicating momentous effect on the consumer welfare in case of Pakistan. The coefficient result of the consumer welfare revealed that one (1) percent increase in Income of the Consumer fetch Seventy-Six (76) glowing lustrous amend in the Utility and welfare of the consumer. This proves that income of the consumer is monotonic increasing in obtaining Utility and welfare of the consumer as assumed during the construction and deriving of the model from utility function by substituting the Marshallian’s Demand Function. The results of this research study is consistent with the study of [5], found that Engle curve is monotonic increasing in Utility of the consumer.

The coefficient of the price of goods has significant negative value, demonstrating the inverse relation with consumer welfare. If price of goods increases, the purchasing power of the consumer be falls, leading to decrease in the consumer utility and welfare. The results obtained by the study shows that one (1) percent increase in the price of goods brings twenty-five (25) percent decrease in consumer demands for goods. This decrease ultimately affects the utility and welfare of the consumer. It clarifies that price of goods are monotonic decreasing in the Utility and welfare of the consumer as supposed in the model.

The autonomous consumption has also significant and positive value, indicates that it has also positive effect on the utility and welfare of the consumer in case of Pakistan.

CONCLUSION

This research study attempted to briefly elucidate the consumer welfare from indirect utility function and deliberate the behavior of consumer responses towards the changes in income of the consumer and prices of goods for Pakistan. The study allows flexible demand system, where both price and income are included. These two are the important factors that effect, influence and change the decision of consumer towards buying behavior and demand for goods and service, ultimately leads to affect the utility and welfare of the consumer. However, the results of this research study revealed that income has more dominant effect than the prices of goods on consumer behavior and welfare.
REFERENCES