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Measuring Revealed Preference Hypothesis of the Theory of Consumer Behaviour Using Roy's Identity: A Case Study of Oriade LGA of Osun State, Nigeria

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Abstract

The paper examines whether the Roy's identity is applicable to the measurement of revealed preference hypothesis in Oriade LGA of Osun State, Nigeria using iteration technique. The paper revealed that Milo, a brand of beverages is most preferred because a greater percentage of the households consume Milo. In terms of preference, Bournvita came second preferred while Nescafe was least favoured. The iteration result shows that expenditure on Milo and Bournvita was positive and significant for total expenditure on beverages. However, the consumption of Nescafe proved insignificant. The iteration result finally shows that convergence takes place meaning that the Roy's identity is applicable in the measurement of the revealed preference of the 120 households considered in the paper. The paper concludes that producers of beverages should increase the supply of Milo and Bournvita to the area while the producers of Nescafe should endeavour to find out why their product was least favoured.

Key words: Revealed preference; Roy's identity; Iteration; Applicable and convergence

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INTRODUCTION

The Neo-classical model of consumer behaviour is one of the most fundamental economic models which its use in microeconomics has never been so general. In the nineteen century, its main justification according to introspective reasoning is its plausibility. However, in recent time, the analysis of the theory of consumer behaviour is at the centre of economics.

As a Neo-classical theory, it postulates that consumers have preferences that can be represented by a well defined utility function. The implication of this hypothesis is the symmetry of the matrix of substitution terms. However, the Roy's identity and the Slutsky restrictions are often rejected by empirical demand studies on microeconomic data (Blundell, Pashardes, & Weber, 1993).

1. DERIVATION OF THE ROY'S IDENTITY

The Roy's identity is derived from the indirect utility functions to enable researchers prove the consistency of the Roy's identity with utility maximization of the consumers. From the indirect utility function, we assume $V_1 = P/Y$. Thus, the budget constraint is written as:

$$1 = \sum v_1 q_1. \quad (1)$$

Where, V_i = Normalized Price, P = Actual Price and Y = Income.

We then transform to normalise prices in which nothing is lost in income and prices because optimal solution are homogeneous of degree zero. The utility function $U = f(q_1, q_2 \ldots q_n)$ together with Equation (1) above gives the following first – order condition for utility maximization:

$$fi - \lambda vi = 0. \quad (2)$$

Ordinary demand function is obtained by solving Equation (2) which gives

$$q_1 = D(v_{1\ldots n}). \quad (3)$$

The indirect utility function g ($V_{1...}$, V_n) is therefore defined by:

$$U = f\{D_1(V_{1...}, V_n)...D_n(V_{1...}, V_n)\} = g(v_1, \ldots v_n). \quad (4)$$

Equation (4) gives the maximum utility as a function of normalized prices. The direct utility function therefore describes preferences independent of market phenomena. The indirect utility function reflects the degree of optimization and market prices. When the composite function rule is applied, we have:

$$g_i = \sum f_1 \frac{\partial q_i}{\partial v_i} = \lambda \sum_{i=1}^{n} \frac{v_i \partial q_i}{\partial v_i} \quad i = 1, \ldots n. \quad (5)$$

The second equalities is based on Equation (2).

The partial differentiation of equation (1) with respect to (5) yields:

$$\sum_{i=1}^{n} \frac{v_i \partial q_i}{\partial v_i} = -q_i \quad i=1,\ldots n, \quad (6)$$

Which we present as:

$$q_i = -\frac{q_i}{\lambda}, \ \mathrm{I} = 1, \ldots n. \quad (7)$$

Equation (7) above is called Roy's identity. Here, optimal commodity demands are related to the derivatives of the indirect utility function and the optimal value of the lagrangian multiplier which is the marginal utility of income (Henderson & Quandt, 2003).

The rejection may be the consequence of non existence of a utility function that is compatible with the data used. This can occur where there are non- rational individuals in the sample at the aggregate level and when all individuals are rational at the individual level. This rejection may not be represented by a utility function. Secondly, the rejection of the theory may be as a consequence of bad functional specifications which economists have recently tried to develop more complex and general parametric specifications in the analysis of consumer behaviour. For example, Banks, Blundel and Lewbel (1997) proposed the quadratic Almost Ideal Demand System to include non-linear income terms. Thus, demand system extends the Translog model of Christensen, Jorgenson and Muellbauer (1980), which only allow for linear terms.

If there must be real progress in the knowledge of the theory of consumer behaviour, the model and data to be used must be well or precisely stated. Thus, aggregate data are always considered as an unavoidable approximation (Houthakker & Taylor, 1970) to this end, Hicks (1956), pointed out that the theory of demand "proceeds by postulating an ideal consumer, who by definition is only affected by current market condition". The behaviour of actual consumers need not "always satisfy the test of consistency". However, to assume that the representative consumer acts like an ideal consumer is a hypothesis that is worth testing. This is the vacuum we intend to fill in this study as effort in this environment is rarely considered in Nigeria where Oriade LGA in Osun State is located.

The objective of this paper is to investigate whether the application of the Roy's identity is consistent with utility maximization of the consumer under revealed preference theory of consumer behaviour or not. The paper is divided into five sections. Section one introduces the study. Section two discusses the theory of revealed preference. Section three presents the translog model which shows the consistency of the Roy's model, section four presents analysis and discussion of results while section five concludes the study.

2. THE REVEALED PREFERENCE THEORY

In 1871, Walras, Jevons and Menger started a new research programme concerning consumer behaviour. Their main goal was to give foundation for the much used law of demand by stating that the demand curves do not slope upward. This analysis became known as the traditional theory of consumer behaviour: assuming utility maximizing behaviour and given additive utility function, prices and income, they proved the theorem of the first law of Gossen (the equi-marginal principle) and the law of demand.

Hicks and Allen (1934) were dissatisfied with the implied measures of cardinal additive utility function and went ahead to introduce the ordinal approach of the theory of consumer behaviour which uses the indifference curve as a tool of analysis. They developed a general utility function, deducing the Slutsky equation where the price effect on quantity demanded was divided into substitution – effect and income effect. The sign and magnitude of the income effect and the price effect was uncertain. However, they proved restrictions on the substitution effect: the substitution matrix which consist the partial derivatives of the demand for goods with respect to their prices was proved to be symmetric and negative semi-definite matrix. From their result, they derived the sign of the income effect with the condition that the good is non inferior.

As a further step in the development of the theory of consumer behaviour Samuelson (1938a, 1938b, 1948, 1950) Tried to prove the results of Hicks and Allen from observable statement only in terms of the methodology of operationism. He took market behaviour as starting point and introduced the weak axiom of revealed preference. He successfully proved the symmetry and negative semi-definiteness of the substitution matrix in the case of two goods.

Houthakker (1950), finished the work of Samuelson when he proved the result of Hicks and Allen for an arbitrary number of goods by using the strong axiom of revealed preference. Thereafter, Debrew (1959), Uzawa (1960), Chipman et al. (1971) began to set theory approach and Lancaster (1966) introduced the theory of Characteristics to complete the axiomatization of the theory of consumer behaviour.

The theory of revealed preference is one of the few economic models that can be used to confront a

theoretical hypothesis when real data are involved. We can therefore determine the consistency of the consumer with the neo-classical model of consumer behaviour when the consumer's purchases are examined (Feverier & Visser, 2003). To this end, the revealed preference theory approach to test for consistency with utility maximization is spelt out.

According to Varian (1982), whose work was based on previous works of Koo (1963), Dobell (1965), Afriat (1967) and Warshall (1962) assumes that:

Let $q^i = (q^i_1, q^i_2, \cdots q^i_m)$ represent the vector of quantities of goods bought in period I and $p^i = (p^i_1, p^i_2, \cdots p^i_m)$ the vector of the corresponding prices. There exist T observations of the prices and quantities (p^i, q^i), $i = 1, 2 \ldots T$. The revealed preference theory informed that:

a) q^i is directly revealed and preferred to q^j, written as $q^i \, R^o \, q^j$, *if* $p^i \, .qi^L \geq p^i \, . \, p^j$ where $p^i . \, q^j$ is the inner product of the vectors p^i and q^j.

b) q^i is revealed and preferred to q^j, written as q^i R q^j, if there exist some sequence $q^i \, q^a \, q^b \ldots q^g$ such that $p^i . q^i \geq p^i \, q^a$, $p^a \, q^a \geq p^a . \, q^b$, $\ldots p^g \, q^g \geq p^g . \, q^j$. R which is the relation is called or known as transitive closure of the relation R^0.

A set of data satisfied the Generalized Axiom of Revealed preference (GARP) if $q^i \, R \, q^i$ implies $p^i . \, q^i \leq P^j . \, q^i$. (Bankett & Serletis, 2008).

This axiom permits multi-valued demand function whereas the more common strong axiom of Revealed Preferences [$q^i \, R \, q^j$ and $q^i \neq q^j$ implies not $q^j \, R \, q^i$] requires single valued demand function (Varian 1982, p.947). Thus Varian showed that a set of data is consistent with the model of utility maximization if and only if it satisfies the Generalized Axiom of Revealed Preference.

The consistency of the data with the GARP by constructing a T by T matrix A whose element *aij* is equal to 1 if $p^i . \, q^i \geq p^i . \, q^j$ (i.e if $q^i \, R^o \, q^j$) and 0 otherwise. The transitive closure R can be computed using the Warshall algorithm modified by Varian. This algorithm creates a matrix B whose element bij is equal to 1 (ONE) if $q^i \, R \, q^j$ but if the algoritm create a matrix B whose element *bij* equal O it shows inconsistency. A violation of GARP is obtained if $bij = 1$ and $p^j \, . \, q^j > p^j \, . \, q^i$.

A researcher must be very careful in applying the test of revealed preference when real data is used because a small difference between the costs of two bundles may be enough to reject the neo-classical model of consumer behaviour. This is due to the fact that the vector prices are approximation of the values that the consumer is faced with. If possible, a nearly optimizing behaviour is more appropriate for an individual consumer. It is therefore worthwhile to use a weaker test.

It can be said that q^i is directly revealed and preferred to q^j if the cost of q^i is significantly different from that of q^j, formally written as $q^i \, R^o \, q^j$ if $ep \, . \, q^j \geq p^i \, q^j$ where $O \leq e \leq 1$.

e = Afriat efficiency index. For instance if $e = 0.8$, then the cost of bundling q^i must be 25% greater than that of bundle q^j so that q^i is directly preferred to q^j. A similar error should be allowed for GARP violation.

It can also be confirmed whether the data is consistent with a near optimizing behaviour by constructing a matrix A whose element *aij* is equal to 1 if $ep^i \, . \, q^i \geq p^i \, . q^j$ and 0 otherwise. The transitive closure is computed as before, using the Warshall algorithm. A violation of weakened GARP is obtained if $bij = 1$ and $ep^j \, . q^j > p^j \, . \, q^j$.

In term of the power of the test, it is important to analyze, the data used for the study before checking for consistency with preference maximization. This is necessary because a budget intersection is required to find violations of GARP. Hence, every chosen bundle that exhausts the budget is consistent with GARP and the power of the test is zero.

Bronars (1987) calculates the approximate power of the test by using random consumption data which exhaust the budget set. He discovered that per capita data provide more information than aggregate ones. The variation in real per capita expenditure in U.S. over the period 1947-1978 provides a powerful test of preference maximization (Mattei, 2003).

The budget set intersection is therefore a necessary condition if a violation of the GARP is required. The researcher would estimate the power of the test by calculating the number of budget set intersections. The budget set intersection will be between period t and r for good I

$$\frac{\underline{Y_t}}{\underline{P_{jt}}} > \frac{\underline{Y_r}}{\underline{P_{ir}}} \quad \text{and for good } j \; \frac{\underline{y_t}}{\underline{p_{ir}}} < \frac{\underline{Y_r}}{\underline{p_{ir}}} \quad \text{(or vise versa)}$$

Where Y_t is total expenditure in period t. the budget set intersections are expressed as a percentage of the maximum number of these 2×2 comparisons which is (½).

For the purpose of this work we assume a dataset of N individuals and that there are S situations for each individual. We further assume that there are K goods and let $P_s = (P_{is}, \ldots_{pks})$ and $q_s = (q_{is \ldots} q_{ks})$ denote the $K \times I$ vectors of prices and associated quantities purchased by a consumer in situation S. let *qs* and *qt* be two bundles of goods with $s,t \, e(I \ldots, S)$ and consider following definitions:

a) q_s is directly revealed preferred to q_t, written $q_s \, p0q_t$, if $p's \, q_s > P'S \, q_t$.

b) q_s is reveal preferred to q_t written $q_s R \, q_t$, if there exists a sequence of bundles $(q_u, \, q_v \ldots \, q_w)$ such that $p'sqs \geq p'squ$, $p_u q_u \geq p'_u \, q_v \ldots \, p'_w q_w \geq p'wqt$.

Varian (1982) introduced the Generalized Axiom of Revealed Preference (GARP): By definition, A set of observations (p_s, q_s), $S \in \{1, \ldots\ldots 1 \, S\}$ satisfies GARP if:

$\forall (s, t) \in \{1 \ldots\ldots, s\}$, $q_s \, R \, q_t$ implies not $q_t \, p^o q_s$

The equivalence between GARP and the existence of a utility function that rationalizes the data is shown by Afriat (1967) and Varian (1982). From proposition, A set of observations (p_s, q_s), $S \in \{1 \ldots\ldots, S\}$ satisfied GARP

if there exsits a utility function U (continuous, concave and monotonic) that rationalizes the data, that is, verifies $u(q_s) \geq u(q)$ for all q such that p'$_s$ $q_s \geq p'_s q$. To test whether the set of observation of an individual is compatible with GARP, Varian uses or described Warshall's algorithm. This algorithm is quick and easy to program.

Samuelson introduced the revealed preference theory into economics in 1938 as a result of the criticisms leveled against the cardinal and the ordinal utility approaches which measure utility in utils and the use of indifference curve respectively. The revealed preference has gained popularity since then. The revealed preference hypothesis has since then become a major breakthrough in the theory of demand by establishing the law of demand directly on the basis of the revealed preference axiom without the use of indifference curves and their restrictive assumptions (Koutsoyiannis, 1983).

The revealed preference hypothesis operates with four major assumptions. They include:

a) Rationality: The assumption of rationality belief that the consumer is rational because he prefers bundles of goods that contain more quantities of the commodity.
b) Consistency: The consumer is assumed to be consistent such that when he chooses bundle *A* at the time when bundle *B* is available, he will not choose bundle *B* at any other time in which bundle A is available.
c) Transitivity: Transitivity assumption shows that in any particular situation, if *A>B* and *B>C*, then *A>C* in any situation or circumstance.
d) The revealed preference axiom: This assume that any collection of good chosen at a given budget, reveals, the consumer's preference for that particular collection and the chosen bundle is revealed to be preferred among all other alternative bundles available with respect to the budget constraint. Hence, the chosen basket of goods maximizes the utility of the consumer under the revealed preference hypothesis (utility maximization).

According to Henderson and Quandt (2003) the revealed preference theory does not require the consumer to rank his preferences or give other information about his taste but allows the prediction of the consumers behaviour without specification of an explicit utility function once he conforms to some simple axioms which include consistency of his choice, independence of tastes on choices over time, taste remained unchanged and that the consumer is rational in the Pareto sense, by preferring more goods to less. With respect to the above, the consumer's existence and nature of their utility function can be known by observing their choices (behaviour) at the various market prices among commodity bundles (Koutsoyiannis, 1983).

A critical look at the theory shows that it can prove the existence and convexity of the indifference curve under weaker assumptions than the previous theories. It also provides the basis for the cost of living and their uses in judging changes in consumer welfare when price changes. This theory works under two axioms, the weak and the strong axiom of revealed preference. In addition it has been proved that the revealed preference has a negative substitution effect (Henderson & Quandt, 2003).

3. THE TRANSLOG MODEL

This section describes how the translog demand system is used to determine the consistency of the utility maximization of the revealed preference with the Roy's identity.

The paper considers the translog demand system that was introduced by Christensen Jorgenson and Lau (1975).

Let m's denote the budget level of individual I in situation *S*, and $v^iks = p^iks/M^is$ and $W^iks = p^iks/M^is$ the normalized price and the budget share of good *K*. in situation *S* for individual *I*, $S \in \{1, \ldots, S\}$, $K=1,\ldots K$, $I=1, \ldots, N$.

When the value of the indirect translog utility function for individual *I* in situation s has a strictly positive value for corresponding optimal quantities for all *K* (an interior solution), an application of Roy's identity implies that the budget share equals w^iks (Christensem, Jorgenson and Lau, (1975)) and Fevrier and Visser (2003).

$$\frac{W^iks = \alpha^ik + \sum_{j=1}^{k=1}\beta kj^{log}(V_{ijs}^i)}{\sum k = \alpha^ik + \sum_{k=1}^{k}\sum_{j=1}^{k}\beta kjlog(V_{js}^i)} \quad . \qquad (8)$$

Where, $a^i k$ and bkj are scalar parameter representing the preference parameters of the indirect utility function. This preference parameter does not vary with the situation-specific indexes. This shows that the preference structure for a given individual remained constant. In addition, the α^ik differs over individuals while p_{kj} is assumed constant.

It is necessary to normalize the parameters in the above share equation because they are identified up to a multiplicative constant. A convenient normalization is $\sum_{k=}^{k}$ $\alpha^1{}_k = -1$ for all *j*. At this point, we impose the homogeneity restriction such that $\sum_{k=1}^{k}\beta_{kjk} =$ for all *j*

It is further assumed that the parameter $\alpha^i{}_k$ is of the form

$$\alpha^i{}_{kI} = \alpha_0 k + \alpha^i ik\, zi + \varepsilon^i k \,.$$

Where, $\alpha_0 k$ = scalar parameter, $\alpha^i{}_k$ = a vector of parameters, *Zi* = a vector containing the observed characteristics of individual *I,* $\varepsilon^i{}_k$ = a scalar random variable (this represents the effect of all omitted characteristics of individual I on the budget share of good *k*), $\varepsilon^i{}_{1,\ldots}\varepsilon^i{}_k$ are independent from *zi* and all normalized prices $V^Lii,\ldots v^iks$.

With the normalization specified, the homogeneity, assumption and the chosen form *aik*, the budget share equation in equation 8 becomes.

$$-w^{i}_{ks} = \alpha ok + \alpha ikz^{i} + \sum^{k}_{j=i} \beta kj \log (V^{i}_{js}) + \varepsilon i/k. \quad (9)$$

When at least one of the observed quantities q^{i}_{ks} equal to zero for an individual *I* in situation *s*, the non-negativity constraints are binding, it means the application of Roy's identify is inappropriate. Hence, the budget share W^{i}_{ks} is not defined as written in Equation (9) above.

Neary and Roberts (1980) asserts that there exists a vector of normalized virtual prices which exactly support the observed quantities q^{i}_{ks} , that is, there exist virtual prices that is equal to $v^{i}ks$ if the purchase quantity of good k is non zero and smaller than $v^{i}ks$ such that non-negativity constraints are no longer binding. Once the virtual prices are calculated for the translog model, a resulting Roy's identity evaluated at the virtual prices yields a share equation indicated below:

$$-w^{i}_{ks} = \alpha 0k = \alpha ikzi = \sum^{k}_{j=1} \beta kj \log (vj(z^{i}, v^{i}_{is}, \Theta) + \varepsilon k (\varepsilon^{i}, r^{i}, \Theta). \quad (10)$$

Where, *Vj* (.) is the function containing the vectors, $Z^{i}, v^{i}s = (v^{i}_{is}, \ldots viks)$, θ= vector containing all parameters of the demands system, that is, *α'ik*, and *βkj* for all *j*, *k* - =1, …, *k*.

The function *vj* (.) depends on the regime r^{i}_{s}. The scalar variable *vj* (.) indicate which products are purchased and which ones that are not purchased by individual i in situation *S*, such that r_L take the values $1,2,3,\ldots 2^{k} - 1$ (the regime where all products are purchased and so on).

In Equation (10), ε_k(.) is a function with e^{I} and *q* as its arguments. Its form depends on the demand regime r^{i}_{s}. The conditional expectation $E(\varepsilon K, \varepsilon^{i}, rs^{i}, \theta / Z^{i}, v^{i}s, r^{i}s)$ depends on r^{i}_{s}. However, this conditional problem can be circumvented by transforming the share Equation (10), so that all variables are measured as a deviation from appropriate defined means.

3.1 Estimation Method

The estimation of the demand system is not too direct or straight forward where experimental data are involved because experimental samples may contain many individuals with zero expenditures on one or more products in given situation (Corner Solutions). Lee and Pit (1986) proposed an estimation method of using the concept of virtual prices. This method contains the means of transforming the binding non negativity constraint into non binding constraints. Their method requires the calculation of multiple integrals where the number of integrals must be equal to the number of goods not purchased. In recent time, advances in simulation methods allow for precise approximations of highly dimensional integrals. The empirical implementation of their approach remained complex.

As a result of the complexity of the Lee and Pit (1986) approach this paper adopts the iterative least squares procedure proposed by Blundell and Robin (1999) cited in Fevrier and Visser (2003). The iterative method also employed the use of the concept of virtual prices. The method is much easier to implement because it avoids the evaluation of multiple integrals. The method estimates each demand equation separately. As a further advantage of the procedure, it is not necessary to fully specify the distribution of the error terms in the demand system.

The translog demand system to be estimated is share equation (10),

k=I ,… *k* as mentioned earlier. The share equations are transformed to wipe out the regime specific constraints. The unknown parameters can then be estimated by applying the iterated linear least squares method as proposed by Blundell and Robin (1999).

The iterated method is applicable when the demand systems possess a conditional linearity property that is, when each share equation is linear in parameters conditional on some functions of the explanatory variables and parameters of interest. This situation explains why the homogeneity hypothesis was made in order to make Roy's identity tractable. When the homogeneity restrictions are not imposed, Roy's identity evaluated at the virtual prices leads to a share equation that is untractable when compared with equation 10. The share equation becomes a ratio in which both the numerator and denominator depend on the error term. Consequently, the statistical inference can no longer be based on simple regression techniques.

At this point, the researcher estimates iteratively each share equation separately by ordinary least squares. He gives an initial value q^{0} for *q*, OLS regression is applied to each share equation, $^{q}(1)$ will be obtained from the OLS estimates, and the iteration is repeated until numerical convergence. When there is convergence it means that the determination of utility maximization under revealed preference is consistent with the application of Roy's identity. Conversely, where there is no convergence, it means utility maximization under revealed preference is not consistent with the application of Roy's identity.

3.2 Data Source

The paper collect primary data from 120 households resident in Ijebu–Jesa, Erin–Oke, Ipetu–Ijesa, Ikeji – Arakeji, Ikeji–Ile and Owena–Ijesa in Oriade Local Government area of Osun State, Nigeria for the period 2000-2012. Data were collected on household consumption or purchase of Bournvita, Milo and Nescafe from twenty households in each of the towns of earlier mentioned using quota sampling technique.

4. DISCUSSION OF RESULTS

Figure 1 shows that 45% of the households preferred Milo or purchased Milo from the three brands of beverages examined making it the most preferred product. Closely

followed by Bournvita which 43% (percent) of the consumers purchased or consumed. Lastly, Nescafe was chosen by 12% of the chosen population. The result therefore shows that Milo is most preferred in all situations. It is the chosen brand whenever the three products are available thereby satisfying the assumptions of revealed preference theory.

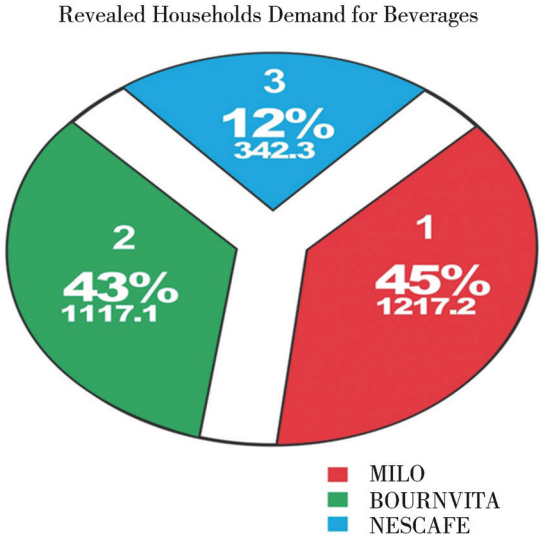

Figure 1
The Consumers Preferences

Table 1
Regression Analysis

Variable	Coefficient	Std.error	*t*- statistic
C	0.785498	0.311585	2.553319
EB	0.386400	0.127881	2.870612
EM	0.556457	0.439657	2.402911
EN	0.531502	2.833822	0.046404
(r-squared)	0.6597a23	F- Statistic	=5.816338
Adjusted R.squared	0.546297	DW	=1.745699
Max iterations	=5,000	Convergence	$=1\times10^{-8}$

Note. Dependent variable: TEEXP, Method: Least squares, Sample: 2000-2012, Included Observation:13, Authors Computation, (2014).

Table 1 shows that the coefficient of determination *R*-square of 0.659723 shows that the independent variables account for about 66 percent variation in the dependent variable (TEEXP). Expenditure on Bournvita (EB) by all the households came up with a coefficient of 0.386400 showing that it has positive influence on total expenditure of the 120 households and a significant value of 2.870612 at 5% level of significance. The result indicates that expenditure on Bournvita will increase if the total income of the 120 households increases and consumers will consume more Bournvita. This is because household expenditure depends on their income.

On the other hand, expenditure on Milo (EB) came up with a positive sign with the coefficient value of 0.556457 showing positive relationship between total expenditure (TEEXP) and expenditure on Milo (EM) .It also has a positive significant t-value of 2.402911at 5 percent level of significance. This also indicates that expenditure on Milo (EM) will increase if total income of the 120 households increases provided that their taste remained unchanged and Milo will be retained as the most preferred beverages to the consumers . However, expenditure on Nescafe (EN) came up with a positive sign and a positive coefficient of 0.531502 but with a positive insignificant t-value of 0.046404 indicating that it has no impact on total expenditure of the 120 households considered in this paper. This also corroborates the fact that few of the households purchased Nescafe for consumption and spend very small amount on the product.

The *F*-statistics of 5.816338 shows that the coefficients of all the independent variables are jointly significant at ten percent (10%) level of significance and the model is adjudged to be good and relevant. The Durbin –Watson (DW) which is 1.745699 shows that there is no serial correlation in the model.

The result also showed that iteration take place up to the 5,000 maximum differencing of the model and convergence take place with the value 1×10^{-8}. This result therefore shows that consumers maximize their utility in Oriade local government area of Osun State in Nigeria using the Roy's identity even though the level of maximization may be low. This result definitely informed that consumers maximize their utility in Nigeria using the Roy's identity. Hence, the Roy's identity is applicable to Nigeria.

CONCLUSION

This paper shows that the revealed preference theory can be used to test for the behaviour of individual households in Oriade local government area of Osun State, Nigeria. With efficient algorithms as proposed by Varian and Afriat and that it is possible for a large data set of individual observations to test whether a consumer or group of consumers are consistent with utility maximization using the Roy's identity.

Using the translog and the iterative procedure, the result of the three types of beverages used in this paper shows that the 120 households revealed that the Roy's identity is applicable to utility maximization of the consumers in Nigeria vis-à-vis Oriade Local Government area in Osun State. This is because the iteration result converges. Hence there is consistency.

RECOMMENDATION

We therefore recommend that producers of beverages in Nigeria should supply more quantities of Milo and Bournvita to towns and villages in Oriade local government area of Osun State because the findings of this

paper revealed that the taste of the households favoured the consumption of the two products while the producers of Nescafe should endeavour to intensify efforts to finding solution to why their product could not break into the markets in Oriade local government area of Osun State.

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