CHARACTERISTICS OF INDONESIAN HOUSEHOLD’S LIVING EXPENDITURE

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Abstract
The aim of this study is to estimate and analyze the characteristics of Indonesian household expenditure on goods and services, for example food, clothes, household utensils, housing, medical care, education, oil and transportation, gas, electricity and communication. Linear Expenditure System (LES) model and seemingly uncorrelated regression (SUR) estimation method were applied. This study has some conclusions. First, if ones have more incomes, they will proportionally allocate them for housing, oil and transportation, education, food, and medical care. Second, medical care, education and communication are categorized as superior or deluxe commodities. Third, the approximation of minimum living expenditure to survive is Rp 147.236 for a household per week.

Keywords: Living expenditure, Linear Expenditure System (LES), Seemingly Uncorrelated Regression (SUR)

Abstrak

Kata Kunci: pengeluaran hidup, Linear Expenditure System (LES), Seemingly Uncorrelated Regression (SUR)


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INTRODUCTION

Identifying the characteristics of living expenditure becomes very important for decision making of policy analysis. Living expenditure is strongly related to the demand characteristic of basic need. Elaine (1999) notes that there are 5 factors affecting food decisions made by individual consumers i.e. food availability, cultural factors, psychological factors, lifestyle factors and food trends. By assuming unchanged household preferences, the change of minimum expenditure can easily found by multiplying the minimum good \( x_i^o \) by its own price and then summing up them.

However, the current financial crisis seems to have affected consumers’ attitudes in many countries. The economic uncertainty and insecurity have led consumers to take decisions minimizing their costs, even for basic needs, such as food quantity and quality. In a period of inflation and unemployment, consumers are more likely to change the composition of their expenditures. (Barda and Sardinou, 2010). Furthermore, the household behaviour of expenditures on food is directly related to the household size. As expected, previous studies have estimated that there exists a positive relationship between the number of members in a household. (Kostakis, 2012)

In evaluating a household’s well-being, one must not be limited to the household’s actual welfare status today, but must also account for the household’s prospects for being well in the future, and being well today does not imply being well tomorrow (Baiyegunhi, LJS, and Fraser, 2010). Secondly, understanding vulnerability is also important from an instrumental perspective. Because of the many risks household face, they often experience shocks leading to a wide variability in their endowment and income.

All econometric studies of demand are related to the three basic objectives of econometrics, i.e. (1) structural analysis, (2) forecasting and (3) policy evaluation (Griffiths et al., 1993; Intriligator et al., 1996; Gujarati, 2000). First, the structural analysis is connected with the use of an estimated econometric model for the quantitative measurement of economic relationships. Many researches of demand focus on some aspects of structural analysis, particularly the estimation of the impacts of the change in prices and income on the quantity demanded, as measured by elasticity. Second, forecasting concerns with the use of an estimated econometric model to predict quantitative values of certain variables outside the sample of data actually observed. Many researches of demand are oriented toward forecasting, in particular forecasting quantities, and/or prices of specific commodities in either the short or the long period. Third, policy evaluation is related to the use of an estimated econometric model to choose between alternative policies. Researches of demand are sometimes oriented toward policy evaluation, in particular, the impact of policies (such as taxes and subsidies) that may affect markets for consumer goods. From the estimated demand function, it is possible to predict the impacts of taxes or subsidies on the quantities demanded, welfare changes, for example (Widodo, 2006).

The idea of standard of living of Indonesian households relates to various elements of household’s livelihood and varies by income. By using Linear Expenditure System (LES), characteristic of living expenditure can be explained. It is stated that \( x_i^o \) represents the minimum good consumed by household and \( pX^o \) the minimum expenditure to which the household is committed (subsistence expenditure) (Stone 1954).

This paper aims to analyze the characteristics of Indonesian living expenditure and to approximate minimum living expenditure to survive. In this paper, the groups consist of (1) Food, (2) Clothes, (3) Household utensils, (4) Housing, (5) Medical Care, (6) Education, (7) Oil and Transportation, (8) Gas, (9) Electricity and (10) Communication. The rest of this paper is organized as follows. Section 2 describes the characteristics of living expenditure under LES. The methodology is presented in Section 3. Results and analysis are described in Section 4. Finally, several conclusions are presented in Section 5.
Theoretically, a household’s demand for goods and services is a function of prices and income (by the definition of Marshallian demand function). The problem of the household is to choose quantity of goods and services that maximize its utility function subject to the given budget constraint. Therefore, some changes in income and prices of goods and services will directly affect the number of goods and services demanded. This section describes a utility function, which derives the linear expenditure system (LES), and shows formulas of elasticities under the LES.

In this paper, we assume that Indonesian households have a utility function following the more general Cobb-Douglas (CD) for a simplicity reason. Stone (1954) makes the first attempt to estimate an equation system incorporating explicitly the budget constraint, namely the linear expenditure system (LES). Klein and Rubin (1948) formulate the LES as the most general linear expenditure system (LES). Klein and Rubin (1948) for goods and services is a function of prices and income (by the definition of Marshallian demand function). The problem of the individual household is to choose the combination of $x_i$ that can maximize its utility $U(x_i)$ subject to its budget constraint. Therefore, the optimal choice of $x_i$ is obtained as a solution to the constrained optimization problem as follows:

$$\text{Maximize } U(x_i) = \sum \alpha_i (x_i - x_i^o)$$

Subject to: $\mathbf{p} x_i \leq M$. Where $\sum \alpha_i = 1$ and $x_i^o > x_i^o > 1$. Furthermore, $\mathbf{p}$ is the product operator and $x_i$ is consumption of commodity $i$. Then $x_i^o$ and $a_i$ are the parameters of the utility function. $x_i^o$ is minimum quantity of commodity $i$ consumed and $\alpha \{1, 2, 3, \ldots, n\}$. $\mathbf{p}$ is a row vector of prices and $\mathbf{X}$ is a column vector of quantity of commodity $i$, while $M$ is income.

Solving the above optimization problem, we can find the Marshallian (uncompensated) demand function for each commodity $x_i$ as follows:

$$x_i = x_i^o + \frac{a_i \left( M - \sum_j \mathbf{p}_j x_j^o \right)}{\mathbf{p}_i \sum_j a_j} \text{ for all } i \text{ and } j$$

Where: $i \{1, 2, 3, \ldots, n\}$

$$j \{1, 2, 3, \ldots, n\}$$

Since the restriction that the sum of parameters $a_i$ equals one, $\sum a_i = 1$, is imposed, Equation (2) simply becomes:

$$x_i = x_i^o + \frac{a_i \left( M - \sum_j \mathbf{p}_j x_j^o \right)}{\mathbf{p}_i \sum_j a_j} \text{ for all } i \text{ and } j$$

Equation (3) can be also reflected as the linear expenditure system as follows:

$$\mathbf{p}_i x_i = \mathbf{p}_i x_i^o + a_i \left( M - \sum_j \mathbf{p}_j x_j^o \right) \text{ for all } i \text{ and } j$$

Equation (4) shows that the expenditure on good $i$, denoted as $\mathbf{p}_i x_i$, can be divided into two components. The first component is the expenditure on a certain base amount $x_i^o$ of good $i$, which is the minimum expenditure to which the consumer is committed (subsistence expenditure), $\mathbf{p}_i x_i^o$ (Stone, 1954). Samuelson (1948) interprets $x_i^o$ as a necessary set of goods resulting in an informal convention of viewing $x_i^o$ as non-negative quantity.
The restriction of \( x^o \) to be non-negative however is unnecessarily strict. In fact, the utility function is still defined whenever \( x_i - x_i^o > 0 \). Thus, Pollak (1968) argues that the interpretation of \( x^o_i \) as a necessary level of consumption is misleading. Allowing \( x^o_i \) to be negative provides an additional flexibility in the possibility of price-elastic goods. The usefulness of this generality in price elasticity depends on the level of aggregation at which the system is treated. The broader is the category of goods, the more probable is the price elastic. Solari (in Howe, 1974:13) interprets negativity of \( x^o_i \) as superior or deluxe commodities.

In order to preserve the committed quantity interpretation of the \( x^o_i \) when some \( x^o_i \) are negative, Solari (1971) redefines the quantity \( \sum p_i x^o_i \) as augmented supernumerary income (in contrast to the usual interpretation as supernumerary income, regardless of the signs of the \( x^o_i \)). Then, by defining \( n^* \) such that all goods with \( i \in n^* \) have positive \( x^o_i \) and goods for \( i \notin n^* \) are superior with negative \( x^o_i \), Solari interprets \( \sum p_i x^o_i \) as supernumerary income and \( \sum p_i x^o_i \) as fictitious income. The sum of "Solari-supernumerary income" and fictitious income equals augmented supernumerary income. Although somewhat convoluted, these redefinition allow the interpretation of 'Solari-supernumerary income' as expenditure in excess of the necessary to cover committed quantities. From this analysis can be classified the type of goods services. If the minimum quantity of good \( (q^o_i) \) has positive value, it can be classified as basic need goods. On the other hand, if the value is not positive, it means that the good is not basic needs.

The second component is a fraction \( a_i \) of the supernumerary income, defined as the income above the "subsistence income" \( \sum p_i x^o_i \) that is needed to purchase a base amount of all goods. The sum of coefficients \( a_i \) equals one to simplify the demand functions. The coefficients \( a_i \) are referred to as the marginal budget share, \( a_i / \hat{a}_i \). They indicate the proportions in which the incremental income is allocated. From this analysis can be classified the type of goods services. If the marginal budget share \( (a_i) \) has positive value, it can be classified as no inferior goods. On the other hand, if the value is not positive, it means that the good is inferior.

**RESEARCH METHOD**

To estimate the coefficients and constants in the LES model requires data on prices, quantities, and incomes. This paper uses panel secondary data. The source of data refers to Susenas (Survei Sosial Ekonomi Nasional, National Survey of Social and Economy) that is published by BPS (Badan Pusat Statistik, Statistics Bureau of Indonesia) in July 2009 and March 2010. The analysis covers 33 provinces in Indonesia. Data of income and quantity are available on Susenas. Data of price can be estimated by divide income with quantity. It is not a good price but a weighted commodity price. The province average is used to break away different structure of data (July 2009 and March 2010). The unit of data is in household per week.

The estimation of a linear expenditure system (LES) shows certain complications because while it is linear in the variables, it is non-linear in the parameters, involving the products of \( a_i \) and \( x^o_i \) in Equation systems (3) and (4). There are several approaches to estimate the system (Intriligator et al., 1996).

The first approach determines the minimum quantities \( x^o_i \) based on extraneous information or prior judgments. Equation system (4) then implies that expenditure on each good in excess of the minimum expenditure \( p_i x^o_i - p_i x^o_i \) is a linear function of supernumerary income, so each of the marginal budget shares \( (a_i) \) can be estimated by applying the usual single-equation simple linear regression methods.

The second approach reverses the first one by determining the marginal budget shares \( a_i \) based on extraneous information or prior judgments (or Engel curve studies,
which estimate \( a_i \) from the relationship between expenditure and income. It then estimates the minimum quantities \( (x^*) \) by estimating the system in which the expenditure less the marginal budget shares time income \( (P, X - \alpha X) \) is a linear function of all prices. The total sum of squared errors -over all goods as well all observations- is then minimized by choice of the \( X^* \).

The third approach is an iterative one, by using an estimate of \( a_i \), conditional on the \( X_i^* \) (as in the first approach) and the estimates of the \( X_i^* \) conditional on \( a_i \), (as in the second approach) iteratively so as to minimize the total sum of squares. The process would continue, choosing \( a_i \) based on estimate \( X_i^* \) and choosing \( X_i^* \) based on the last estimated \( a_i \), until convergence of the sum of squares is achieved.

The fourth approach selects \( a_i \) and \( X_i^* \) simultaneously by setting up a grid of possible values for the \( 2n-1 \) parameters (the \(-1\) based on the fact that the sum of \( a_i \) tends to unity, \( \sum_{i=1}^{n} a_i = 1 \)) and obtaining that point on the grid where the total sum of squares over all goods and all observations is minimized.

This paper applies the fourth approach. The reason is that when estimating a system of equation seemingly unrelated regression (SUR), the estimation may be iterated. In this case, the initial estimation is done to estimate variance. A new set of residuals is generated and used to estimate a new variance-covariance matrix. The matrix is then used to compute a new set of parameter estimator. The iteration proceeds until the parameters converge or until the maximum number of iteration reached. When the random errors follow a multivariate normal distribution these estimators will be the maximum likelihood estimators (Judge et al., 1977).

Rewriting Equation (4) to accommodate a sample \( t=1,2,3,\ldots,T \) and \( 10 \) goods yields the following econometric non-linear system:

\[
\begin{align*}
\hat{P}_i, X_i - \hat{P}_i, X_i^* - \alpha_i \left( M - \sum_j P_j, X_j \right) - c_i, \\
\hat{P}_i, X_i - \hat{P}_i, X_i^* - \alpha_i \left( M - \sum_j P_j, X_j \right) - c_i, \\
\vdots \\
\hat{P}_i, X_i - \hat{P}_i, X_i^* - \alpha_i \left( M - \sum_j P_j, X_j \right) - c_i \\
\end{align*}
\]

for all \( i \) and \( j \)

Where: \( e_{it} \) is error term equation (good) \( i \) at time \( t \).

Given that the covariance matrix

\[
E[e_i e_j] = \xi
\]

where \( e_i = (e_{i1}, \ldots, e_{iT}) \) and \( x \) is not diagonal matrix, this system can be viewed as a set of non-linear seemingly unrelated regression (SUR) equations. There is an added complication, however. Because \( \sum P, x = M \) the sum of the dependent variables is equal to one of the explanatory variables for all \( t \), it can be shown that \( \sum e_{it} = 0 \) and hence \( x \) is singular, leading to a breakdown in both estimation procedures. The problem is overcome by estimating only 9 of the ten equations, say the first nine, and using the constraint that

\[
\sum_{i=1}^{9} \alpha_i = 1
\]

to obtain an estimate of the remaining coefficient \( a_{10} \) (Barten, 1977).

The first equations were estimated using the data and the maximum likelihood estimation procedure. The nature of the model provides some guides as to what might be good starting values for an iterative algorithm. Since the constraint the minimum observation of expenditure on good \( i \) at time \( t (x_{it}) \) greater than the minimum expenditure \( X_{io} \) should be satisfied, the minimum \( x_{it} \) observation seems a reasonable starting value for \( X_{io} \) in iteration process.

Also the average budget share, \( \bar{T} \sum P, x_{i0} / \sum M_i \)

is likely to be a good starting value for \( a_i \) in the iterating process (Judge et al., 1982). It is because the estimates of the budget share \( a_i \) will not much differ with the average budget share.

**RESULT AND ANALYSIS**

Table 1 describes the estimates of the
LES for the Indonesian household. There are two components of living expenditure that can be analyzed from LES’s result, i.e. minimum quantity and marginal budget share.

The unit of minimum quantity is in quantity unit. From the value minimum quantity, it can be concluded that food, clothes, household, utensils, housing, oil and transportation, gas, and electricity are basic need commodities (positive value). Baiyegunhi (2010). On the other hand, medical care, education, and communication are not basic need commodities (non positive value) for surviving. In fact, many people can be survival without education and communication expenditure. Because of poverty, many people can’t access education and standard medical care. For poor people, standard (formal) medical care can be substituted by traditional medical care. It is cheaper than standard medical care. On the other hand, poor people can access standard medical care and education with several subsidy programs from government, even can be zero cost.

From the value of marginal budget share (positive), it can be concluded that all of commodities are non inferior good. It means that if the income increase will affect the increase of consumption (quantity of good). From the rank of marginal budget share value, it can be concluded that housing, oil and transportation, education, food, and medical care are the most important expenditure if household get additional income.

### Table 1. Minimum Quantity and Marginal Budget Share of Indonesian Household

<table>
<thead>
<tr>
<th>Component of Expenditure</th>
<th>Minimum Quantity</th>
<th>Marginal Budget Share</th>
</tr>
</thead>
<tbody>
<tr>
<td>Food</td>
<td>1.49</td>
<td>0.14</td>
</tr>
<tr>
<td>Clothes</td>
<td>0.78</td>
<td>0.06</td>
</tr>
<tr>
<td>Household utensils</td>
<td>0.90</td>
<td>0.04</td>
</tr>
<tr>
<td>Housing</td>
<td>1.89</td>
<td>0.24</td>
</tr>
<tr>
<td>Medical Care</td>
<td>-5.95</td>
<td>0.07</td>
</tr>
<tr>
<td>Education</td>
<td>-12.41</td>
<td>0.14</td>
</tr>
<tr>
<td>Oil and Transportation</td>
<td>0.49</td>
<td>0.20</td>
</tr>
<tr>
<td>Gas</td>
<td>1.12</td>
<td>0.02</td>
</tr>
<tr>
<td>Electricity</td>
<td>5.21</td>
<td>0.02</td>
</tr>
<tr>
<td>Communication</td>
<td>-0.23</td>
<td>0.06</td>
</tr>
</tbody>
</table>

1.00

Source: Susenas, July 2009 and March 2010, BPS, authors’ calculation

### Table 2. Minimum Household’s Living Expenditure

<table>
<thead>
<tr>
<th>Component of Expenditure</th>
<th>Minimum Expenditure</th>
<th>Share</th>
</tr>
</thead>
<tbody>
<tr>
<td>Food</td>
<td>99,314</td>
<td>67.43%</td>
</tr>
<tr>
<td>Clothes</td>
<td>3,110</td>
<td>2.11%</td>
</tr>
<tr>
<td>Household utensils</td>
<td>4,137</td>
<td>2.81%</td>
</tr>
<tr>
<td>Housing</td>
<td>15,725</td>
<td>10.68%</td>
</tr>
<tr>
<td>Medical Care</td>
<td>0</td>
<td>0.00%</td>
</tr>
<tr>
<td>Education</td>
<td>0</td>
<td>0.00%</td>
</tr>
<tr>
<td>Oil and Transportation</td>
<td>10,658</td>
<td>7.24%</td>
</tr>
<tr>
<td>Gas</td>
<td>9,653</td>
<td>6.55%</td>
</tr>
<tr>
<td>Electricity</td>
<td>4,692</td>
<td>3.19%</td>
</tr>
<tr>
<td>Communication</td>
<td>0</td>
<td>0.00%</td>
</tr>
<tr>
<td>Total</td>
<td>147,289</td>
<td>100.00%</td>
</tr>
</tbody>
</table>

Source: Susenas, July 2009 and March 2010, BPS, authors’ calculation
Minimum living expenditure can be estimated from the multiplication of minimum quantity and weighted price of commodity except medical care, education, and communication (These are not basic need goods).

Tabel 2 describes the detail of household's minimum living expenditures (in Rupiah per household per week). Based on the value, the rank of component expenditure are food, housing, oil and transportation, gas, electricity, household utensils, and clothes. More than 50 percent of minimum expenditure is allocated for food. Total of minimum living expenditure is Rp 147.289 for a household per week.

CONCLUSIONS

This paper analyses estimates and analyses the characteristics of Indonesian household’s living expenditures. Linear Expenditure System (LES) model and see mingly uncorrelated regression (SUR) estimation method is applied on this analysis.

Appendix: Estimation Result of the LES

System: SUR0910
Estimation Method: Seemingly Unrelated Regression
Date: 01/18/13   Time: 20:13
Sample: 1,66
Included observations: 66
Total system (balanced) observations 660

One-step final coefficients from consistent one-step weighting matrix
Convergence not achieved after: 1 weight matrix, 6 total coef iterations

<table>
<thead>
<tr>
<th>Coefficient</th>
<th>Std. Error</th>
<th>t-Statistic</th>
<th>Prob.</th>
</tr>
</thead>
<tbody>
<tr>
<td>C(1)</td>
<td>1.486113</td>
<td>0.121456</td>
<td>12.23580</td>
</tr>
<tr>
<td>C(11)</td>
<td>0.136837</td>
<td>0.007843</td>
<td>17.44684</td>
</tr>
<tr>
<td>C(2)</td>
<td>0.776448</td>
<td>0.432916</td>
<td>1.792837</td>
</tr>
<tr>
<td>C(3)</td>
<td>0.904492</td>
<td>0.203060</td>
<td>4.496208</td>
</tr>
<tr>
<td>C(4)</td>
<td>1.891098</td>
<td>0.436760</td>
<td>4.329813</td>
</tr>
<tr>
<td>C(5)</td>
<td>-5.952276</td>
<td>2.473099</td>
<td>-2.406808</td>
</tr>
<tr>
<td>C(6)</td>
<td>-12.40575</td>
<td>2.408910</td>
<td>-5.149944</td>
</tr>
<tr>
<td>C(7)</td>
<td>0.488726</td>
<td>0.183638</td>
<td>2.661353</td>
</tr>
<tr>
<td>C(8)</td>
<td>1.17996</td>
<td>0.168410</td>
<td>6.698547</td>
</tr>
<tr>
<td>C(9)</td>
<td>5.207845</td>
<td>0.657974</td>
<td>7.914972</td>
</tr>
<tr>
<td>C(10)</td>
<td>-0.233791</td>
<td>0.231663</td>
<td>-1.009189</td>
</tr>
<tr>
<td>C(12)</td>
<td>0.064251</td>
<td>0.003444</td>
<td>18.65582</td>
</tr>
<tr>
<td>C(13)</td>
<td>0.094665</td>
<td>0.002636</td>
<td>31.25830</td>
</tr>
<tr>
<td>C(14)</td>
<td>0.241063</td>
<td>0.006864</td>
<td>35.17635</td>
</tr>
<tr>
<td>C(15)</td>
<td>0.071116</td>
<td>0.002490</td>
<td>28.55729</td>
</tr>
<tr>
<td>C(16)</td>
<td>0.137825</td>
<td>0.004389</td>
<td>31.40017</td>
</tr>
<tr>
<td>C(17)</td>
<td>0.204620</td>
<td>0.004549</td>
<td>44.97695</td>
</tr>
<tr>
<td>C(18)</td>
<td>0.024468</td>
<td>0.002040</td>
<td>11.99492</td>
</tr>
<tr>
<td>C(19)</td>
<td>0.021278</td>
<td>0.001187</td>
<td>17.91962</td>
</tr>
<tr>
<td>C(20)</td>
<td>0.059014</td>
<td>0.001317</td>
<td>44.81084</td>
</tr>
</tbody>
</table>

Determinant residual covariance 7.51E+76
R-squared 0.887902
Adjusted R-squared 0.867521
S.E. of regression 8877.028
Durbin-Watson stat 1.464172

Mean dependent var 55371.70
S.D. dependent var 24389.00
Sum squared resid 4.33E+09
S.E. regression 1.40E+10
Sum squared resid 1.260593
Durbin-Watson stat 1.260593
Food, clothes, household, utensils, housing, oil and transportation, gas, and electricity are basic need commodities. Medical care, education, and communication are not basic need commodities. All of the commodities are non inferior commodities. Increases in income (above supernumerary income) will be proportionally allocated more for Housing, Oil and transportation, Education, Food, and Medical care.

Second, Medical care, Education, and Communication are superior or deluxe commodities. The approximation of minimum living expenditure to survive is Rp 147,236 for a household per week with the dominant proportion if food.

REFERENCES


Duddy Roesmara Donna, Characteristics of Indonesian Household’s Living Expenditure


