

Constructing Indicators of Community Living Standards for Poverty Analysis in Sulawesi, Indonesia ; A Factor Analysis Based on Statistics “Potensi Desa”

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Key Words : *community living indicators, factor analysis, Indonesia, and poverty*

Abstract

This paper is concerned with the derivation of living standard indicators for the community using secondary village based data set. It examines several of the steps mainly using factor analysis as well as *z-score* transformation for index construction, and highlights some of the critical points, which should guide the analysis. Factor analysis is particularly useful in coping with huge data set ; awesome number of variables, mean while *z-score* transformation and additive summation index construction allows us to formulate the indicators. Validation test shows very strong correlation coefficients between constructed indices and the associate factor scores, thus this more practical method is sufficiently reliable for analyses. Some critical points are identified in dealing with this kind of secondary data, such as missing data and inconsistencies of original data coding, as well as the existing of negative association of the member variables of the index. Finally, there are five most important indicators for the community living standard in this region ; they are Consumption Rate of Durable Goods and Services, Rate of Luxurious Possession, Village Prosperity, Domestic Water Sources and Decease Occurrence. These five indices provide local specific characteristic for the community living condition in Sulawesi Region and therefore very appropriate for the poverty analysis particularly for this region.

1. Introduction

Poverty is one of the most long lasting problems of developing countries including Indonesia. Regardless the number of programs conducted by the government along with many international agencies, the result is far from expectation level. Thus, poverty analysis remains very important as an input into the policy making process.

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The very basic steps in a study of poverty is that finding and or constructing one or more indicators of living standards, preferably that is reliable and acceptable for the pertinent localities or regions (Hentschel and Lanjouw, 1996). They suggest that only after having the reliable indicators then ones should be able to differentiate the poor from non poor and so that “poverty profile” could be constructed properly.

Poverty problem is a multi-dimensional phenomenon that is not only characterized by lack of material consumption and resources, but also closely related to the psychological, education, health and sense of vulnerability to external events (Fakingham and Namazie, 2002). External events could be in the form of natural environment and/or socio-economic conditions. In economics, it is often associated with the inequalities and economic growth (Perkins *et al*, 2001). Thus, it is a complicated phenomenon and sometimes difficult to characterize them in a precise description. Accordingly, there are wide varieties of approaches to deal with this poverty problem. Having said these, we came to the idea of firstly understanding the regional poverty/prosperity problems, rather than trying to solve the problem without sufficient know how about the poverty state itself. In this case, we are going to establish a sound and reliable indicators for the target area of the study, which is Sulawesi Region in Indonesia. This region is situated in the central part of Indonesia where the Sulawesi Island and its surrounding small islands and it is estimated housed by about 20 million population.

In the following paper, we will explore in brief application of factor analysis in order to identify several indicators of the living condition for the community as a characterization of the poverty situation in Sulawesi Region of Indonesia. Then, we will present alternative index construction, conduct validation test as outputs of this work. So after highlighting some critical points, we should expect the analysis is useful in conducting further analysis in line with poverty alleviation programs as well as formulation of policies for this region in particular and for other regions as well.

Based on the above viewpoints and the need to contribute to the policy formulations for communities that are more prosperous and better living conditions in the region especially and for Indonesia in general, thus, we initiate this study.

2. Study Objectives

The general objectives of this work are to characterize the living condition of the households in Sulawesi Region Indonesia in terms of village determinants by using index construction procedures. More specifically, the aims of this study can be break downed as

follows :

1. Identifying suitable indicators to characterize communities' living condition using secondary village-based data in Sulawesi Region.
2. Introducing a more practical method in constructing indicators of living condition by making used the household data.
3. Testing and validating the practical method introduced by comparing the results with the standard factor score outputs
4. Addressing critical points and indicator suitability for poverty characterization of the society in the village level.

3. Review of Previous Studies

The World Bank Group (1999) insists that poverty is a multi-dimensional phenomenon ; it ranges from inability to satisfy basic needs, lack of control over resources, lack of education and skills, poor health, malnutrition, lack of shelters, poor access to water and sanitation, vulnerability to shocks, violence and crime, lack of political freedom and voice. Thus, it is a very complex phenomena, and could be untouchable to the some extends, such as what Adaboya, a poor Ghanaian have said, *"Poverty is like heat ; you cannot see it ; you can only feel it ; so to know poverty you have to go through it"* (World Bank, 2000).

Pradhan *et.al.* (2000) identify six dimensions of the poverty as follows ; (1) Current consumption expenditure deficit (CCED) poverty, (2) Insecurity poor or vulnerability, (3) Prospects poor, (4) Access poor, (5) physically disadvantage poor, and (6) socially disadvantage poor. They suggest that due to the complexity of the dimensions, not only income and consumption should describe the poor situation but also there are some non-economic dimensions. These six poor dimensions imply that poor access to the socio economic sources as well as physical and social disadvantages could be good sources of being poor.

Under-estimating poverty problem as a simple "low-income condition" is considerably the main cause of so many efforts and approaches seem to be too simplistic—especially along the implementation stages—to tackle the poverty problems. Since even income poverty is complicated enough to be understood, even though it is generally accepted that access to *education, health and family planning* remained one of the most important instruments to alleviate poverty, including by the World Bank. As a result, partial approaches all too often fail to meet their objectives. Coulombe and McKay (1994) and Ferreira (1999) suggest rducing urban-rural inequalities first to cope with the poverty

problems. Khalid Saeed (1999), he criticizes that most policies in the past even nowadays regarding the poverty alleviation “*addresses the symptoms instead of the organizational arrangement that create the symptoms*”. It is well known however, what is a so-called sector-ego syndrome. Hence, integrated interdepartmental responsibility should be institutionalized for multidimensional approaches (Gany *et al*, 1997). Thus, the first thing needed is to identify the multi dimensionality of the poverty and the need to deal with the *ones creating the symptoms* or the roots of the poverty itself.

In addition to the institutional concerns, taking into account regional and local diversities are very important in a country like Indonesia with tremendous geographic and socio-cultural differences across the country. Addressing local or regional characteristics and structures of those elemental characteristics composing the poverty complexity should be in the first hand for instance by identifying local-relevant poverty indicators before dealing with the poverty problems in the regions. Thus, the first step to deal with this poverty problems seems to be the identification of relevant local-indicators of the household living standards.

4. Research Methodology

This research is a study of secondary analysis or secondary analysis of survey data (Kiecolt and Nathan, 1985). In this case, the data set is acquired from Indonesian Central Statistic Agency (BPS) namely “Potensi Desa”, 1996, an output of the Economic Census. It contains a wide range of information for every village in Indonesia, such as topography, demography, social economic activities, institutions, transportation and communication means, education, health, village government etc. After doing data cleaning, verification and recoding, the final data set consists of 361 original variables plus 86 composed—combination of original—variables (Kawamura, 2002). Therefore, that total variables are 445 variables against 6,649 cases/villages in the Sulawesi Region rural areas. Therefore, this data set is expected providing sufficient multi-dimensional information.

Data analysis employs *factor analysis and additive summation index construction* utilizes SPSS V. 10.5, 2003 to execute these statistical procedures. *Factor analysis* is widely used to identify underlying variables or factors that explain the pattern of correlation within a set of observed variables. Beside that, this analysis is often used in the data reduction, by identifying a small number of factors, which explained most of the variance observed in a much larger number of manifest variables. In this case, rather than dealing with poverty equations consist of hundreds of explanatory variables, much nicer to have

just tens of variables representing those hundreds ones. Index construction as a continuation of factor analysis employs additive summation method. Before taking the average values of those involved variables, all variables that fall into a same factor is standardized such as using *z-score* transformation as follows :

$$Z\text{-score} = (X_i - \bar{X})/SD$$

Where, X_i is an observation of the i^{th} case in a variable

$\bar{X}$ is a mean of variable X

SD is Standard deviation of variable X

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In this analysis, the procedure consists of three main steps as follows :

1. Calculation of variable communality using Principle Component Analysis (PCA) as an extraction method. In this case, variables with communality coefficient (h^2) less than 0.50 are excluded, so the common factors can explain at least 50% of the variance of the remaining variables. These extracted variables used in the next run until all variables satisfied the communality coefficient above.
2. Estimation of factor loadings and extraction of factors/components. Here, using the PCA to extract factors or components and then to construct component matrix by all variables, which are satisfied the communality criteria. The extracted factors are the factors with eigenvalues are greater than one, so the variances of the extracted components/factors are greater than one.
3. Factor loading rotation using Varimax Method in order to make the loadings more interpretable. Rotating methods make the loadings either large or small, not in-between for each factor.

In the following sections, we employ factor analysis in exploring the 42 variables of community living conditions. The procedure of data reduction and factor analysis used in this study more or less following the method used by Kawamura (1978). The summary of over all research procedures and methods is shown in the following Figure 1.

5. Data Set Construction

The data set is obtained from the database called “Potensi Desa” for the year 1996. Central Statistic Agency (BPS) of Indonesia provides the database. The agency conducts surveys and census in a regular basis through out the country. In the case of Potensi Desa statistics, the agency uses “Desa” or village as an observation unit. In Indonesia, desa is the smallest administration unit of the governmental system.

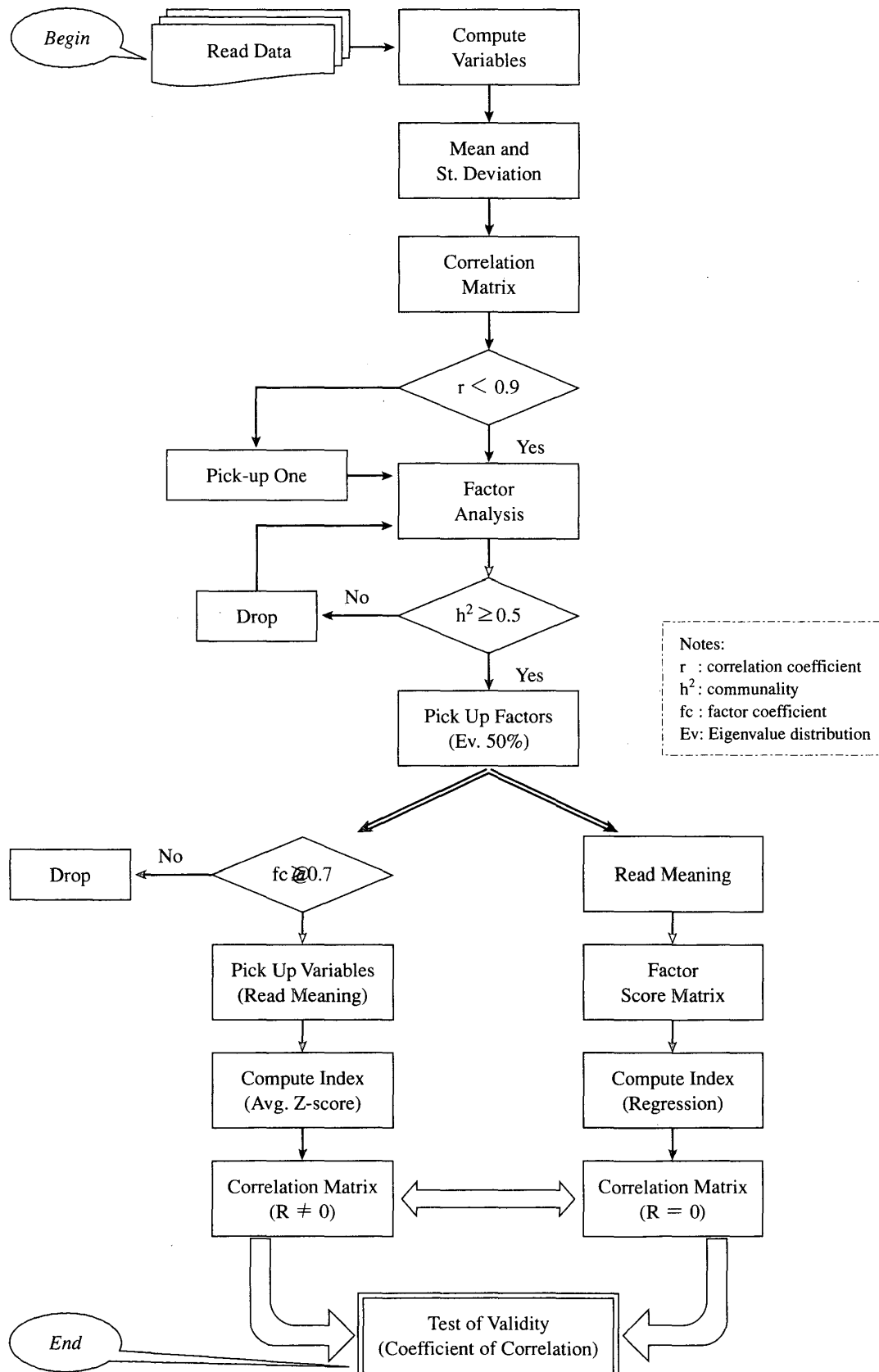
The data set consisted of massive information ranging from general information of administration to geographic and demographic situation, including environment and housing condition, social, cultural and economic activities and facilities, education, entertainment, health, transportations, and communication facilities. Over all information consists of 12 data-blocks as follows :

1. Place
2. General data of Desa/Kelurahan
3. Demography, Environment, Housing and Settlement
4. Education
5. Social and Culture
6. Recreation and Entertainment
7. Health
8. Transportation and Communication
9. Area and Its Utilization
10. Economic
11. Finance of Desa/Village
12. Data of Village Head

The data set consists of as many as 413 items for each desa. So the data matrix size depended upon the number of desas in the region that is being observed (number of cases or rows) times 413 (matrix column). For instance, South Sulawesi province consists of 2,883 desas, the data matrix is 2,883 by 413. Therefore, for Sulawesi Region that consisted of four provinces—north, central, south and southeast—the data matrix size is 6,649 by 413. North Sulawesi Province consists of 1,481 desas, Central Sulawesi is 1,394 desas, and South Sulawesi is 2,883 desas, while Southeast Sulawesi is 891 desas.

Based on information/data in the original data set, there is some information that seems irrelevant with the study. For instance, there is desa identity such as administrative location of the desa—province, kabupaten/county, and kecamatan/district—, name and

Figure 1. Flowchart of Analysis Methods for the Indicator Construction



area changes, as well as personal information of the desa heads. Beside that, there are “too detail” information such as source of water, soil, air, and sound pollution, and year by year of receiving IDT Aid. In addition, there are several important information unfortunately have to be dropped out from the list. Among the reasons are data are not available in all cases or all are missing/blank in at least one province, such as number of two and three wheel vehicles (Variable 368) are all missing in North Sulawesi Province, number of stack houses is not available in North and South East Sulawesi Provinces. Therefore, after carefully reviewing the relevant information needed, as well as the availability of the data, it is selected 361 items as variable candidates.

Among the 361 items, we identify as many as 29 variables for the household level, which provide information based on the household conditions.

a. Data Cleaning and Verification

The original data set, after carefully reviewed, unfortunately consisted of several awkward data entry that might be caused by mistyped during the data entry process or misinterpretation of the questionnaires during data collection activities. Therefore, data verification and cleaning is important before employed in the analysis.

Due to the size of the data set, we do data cleaning for each province, since the structure of the data set is same for all provinces. The procedure is first trying to find awkward numbers especially for the data that should contain certain range of numbers. For instance, the yes or no question, the data entry should only consist of “1” for “yes” and “2” for “no” answers, as the way data is coded. In the case of North Sulawesi for instance, under the Variable 370, we identify that all numerical figures ranging from 21 to 50,310 instead of being “1” or “2”. In order to justify this, we need to use information from Variable 370 to Variable 375. If at least one of these variables contains information in the pertinent case, then Variable 370 should be coded “1” (“yes” answer, means that this area includes in the previous survey). On the other hands, there are many data entry using the previous variable information, however, the next information is not consistent with the previous one. For instance, the first answer stating that “no survey has been done regarding the prosperity households in this village” (Variable 370), the following variable is “number of pre-prosperity (poor) households” (Variable 371), then, there is a figure of the poor households in the data entry which should be left blank (data not available).

In order to facilitate data cleaning procedure, the original data reviewed by running one-way descriptive statistic analysis to show the variance, standard deviation, range, mean, minimum and maximum values. Using this result is very useful. For instance

simply by observing the range value ones could recognized suspected variables that consisted of awkward figures, especially the variables that is provided by certain number of options such as “yes or no questions” (2 options) or for instant 1 to 5 choices (5 options) then the range has to be from “1 to 5”.

In a data set, not available data or missing data always create a big problem. There are 70 variables of the 361 items consist of missing data. In order to manage this missing data, the best way is by contacting the data source to provide us the data. However, since this data construction proceed through collecting the data from every village/desa to kecamatans/districts, then through the kabupaten BPS offices, before going to the provincial BPS offices, then coming to the BPS in Jakarta. Therefore, it is tremendously difficult to reach the data collectors who would have to know the real data. However, there are many missing data should not be existed but should contain “0” figures instead. Since the data set consisted of a huge amount of qualitative information, then using score method, missing data can be accommodated by giving them “0” score, such the case of “rumah susun or stack-houses” mentioned above.

Most cases in this data set, the missing data represents the non-existence of the variables in the pertinent cases/desas; therefore, it should be “a non existence score”. However, the way of the original data set is coded is problematic, because of the scores assigned for subsequent variables are not uniquely independent. These problems would be elaborated in more detail ways in the following section of data recoding.

Data cleaning process seems to be the most time consuming stage in the data management. However, this is a crucial point in order to acquire a set of reliable data before stepping into the following phases of data set construction.

b. Data Recoding

Data recoding is meant to improve the performance of the data set and to provide a consistent way of doing data interpretation. This is important in order to organize the data based on the logic direction or structure as well as to adjust the data to the reality based on the real distributions among the categories. For instance, regarding the existing of Village Consultative Council or LMD (Variable 8), the original codes are “1” (for exist) and “2” (for not exist), then, the recoding are “1” (for exist) and “0” (for not exist). Another example is instead of having 11 categories of “main transportation” (Variable 219), we could regroup them into three classes due to the existence of “zero” and “very small frequencies” in several categories. Using the above example of Variable 31, the “exist” answers are given score “1” and the “not exist” are given score “0” instead of “2”.

Similarly, for Variable 32, “0” instead of “4” for the “not exist” answers ; and for Variable 33, “0” instead “6” for the “not exist” answers.

Missing data cases, as previously mention needs case-by-case treatment. If it represents zero value, the “0” are assigned to those cases instead of “blank”. The way we fixed this kind of problems are by checking the previous or related variables then tried to get the notion of what really the substance of the variables, the assigned “0” or just leave it blank (not available data).

The missing data existed in Variable 371 to 375 for several cases/desas in all provinces. Using information from Variable 370, which explains if there is a survey of household prosperity has been conducted. The matter of facts is this surveys conducted by another agency—the Family Planning Agency—do not include desas. As the results, in the desas where the surveys are not done, scored “0” in Variable 370, the data entry in Variable 371 to 375 would have to be “blank” or “data is not available”. If there are entry data in these spots, they have to be wiped out.

In line with the treatment applied for the missing data, since the missing data are same for all four provinces, it seems that there are a pattern of missing data has occurred. As mentioned above, missing data mostly are a result of the coding process of the original data. Therefore, we need to solve it through recoding process. Among 70 variables with missing data, five of them, Variable 371 to 375, are have to remain consist of missing data, in this case there are some cases with missing data, then the solution we take is excluding those missing cases from the case list (list wise).

The data verification or data cleaning and data recoding processes have to be worked out simultaneously in order to get the best possible judgments of the available data.

c. Constructed Data Set

The data obtained until this stage are consisted of 25 variables as mentioned before. However, for the sake of the analysis it seems that we need to define several other variables such as proportion or percentage of households having car, parabola set, television set, telephone as well as proportion of household members attending high education, some categories of household prosperity in proportion, etc.

By utilizing various combinations of the verified available data, it has been defined additional 17 variables, so called composed variables as shown in Appendix 1. Thus, total variables that would have to serve in the analysis are 42 variables against 6,649 cases/desas in Sulawesi Region. For illustration, the final data set of Sulawesi Region in the form of descriptive statistics is shown in Appendix 2.

6. Community Living Condition based on Household Data

The 42 variables of the living condition of the household (LHH) firstly are checked by correlation matrix, then we found that HHPROS3X is highly correlated ($r = -0.953$) with the HHNEED, therefore the HHNEED is excluded. Then, the remaining 41 variables are extracted into several factors using *Principal Component Analysis*. However, by checking the communality aspect, we identify as many as seven variables with coefficient of association less than 0.50, which means common factor cannot explain more than 50% of the variance of those variables. These variables are *Variable 200 (diarrhea and vomiting)*, *Variable 201 (dengue fever)*, *Variable 238 (newspaper subscriber)*, *variable 364 (Electric owned by PLN)*, *Variable 372 (Prosperity Households I)*, *Variable 373 (Prosperity Households II)*, *Variable 374 (Prosperous Households III)* and *HIEDUHH (Proportion of Household with High Education Enrollment)*. Therefore, we remove these variables from the analysis. Until this stage, we have 35 remaining variables.

The second run of the *Principal Component Analysis* found another two variables with less than 0.50 of coefficient of association, it is *variable 371 (Pre-Prosperous Households)*. Then, only after the second of the communality test we confirmed that these 32 variables have *communality coefficient (h^2)* greater than 0.50, thus they are now reliable for the next analysis. The Communality tests and the extracted LHH variables are shown in Table 1.

Factor Analysis extracts 10 factors out of the 32 LHH Variables. Regarding the 10 factors, so called LHH Factor 1 to LHH Factor 10, the analysis will observe several aspects such as Total Variance Explained, Rotated Component Matrix as well as Component Transformation Matrix. After this examination, then we decide to take only *five first factor*, Factor 1 to Factor 5, since this factors provide more than 50% in eigenvalues distribution and it is coincide with total eigenvalues is greater than 1.5. Of course we can take all 10 factors with the total eigenvalues is greater than 1.0. However, since we are trying to identify the most important indicators, then the first five factors are considerably sufficient.

The five important components or factors extracted are able to explain more than 51% variances of the 32 variables of the household living standard indicators. Therefore, these factors sufficiently represents the over all 32 LHH variables. From Appendix 3, it is obvious that Factor 1 contributes the most with 19.38%, followed by Factor 2 of 10.10%. The following two factors contribute about 9.25% and 7.50% respectively, the last one contributes only 4.93%. Thus, these five factors could explain more than 50% of the

Table 1. Result Commuality Test for the LHH Variables, Sulawesi Region

Org. No.	Variable	Extraction			Final No.
		1	2	3	
1	VAR041	0.661	0.646	0.644	1
2	VAR042	0.693	0.693	0.694	2
3	VAR044	0.634	0.663	0.662	3
4	VAR045	0.610	0.674	0.672	4
5	VAR068	0.851	0.848	0.846	5
6	VAR069	0.640	0.640	0.642	6
7	VAR070	0.622	0.559	0.554	7
8	VAR071	0.852	0.905	0.907	8
9	VAR200	0.420			
10	VAR201	0.404			
11	VAR202	0.623	0.779	0.781	9
12	VAR203	0.883	0.894	0.893	10
13	VAR204	0.897	0.905	0.905	11
14	VAR229	0.701	0.681	0.674	12
15	VAR235	0.834	0.836	0.837	13
16	VAR236	0.640	0.591	0.651	14
17	VAR237	0.740	0.752	0.761	15
18	VAR238	0.366			16
19	VAR363	0.873	0.872	0.872	
20	VAR364	0.483			17
21	VAR367	0.689	0.665	0.655	
22	VAR371	0.506	0.328		
23	VAR372	0.421			
24	VAR373	0.353			
25	VAR374	0.497			
26	VAR375	0.729	0.639	0.626	18
27	HIEDUHH	0.453			19
28	HOUSQTY	0.540	0.553	0.543	
29	DECEASE	0.721	0.771	0.771	20
30	HHWTELPH	0.643	0.661	0.661	21
31	HHWTV	0.717	0.729	0.733	22
32	HHWPARA	0.566	0.526	0.594	23
33	HHWRADIO	0.524	0.544	0.608	24
34	HHCAR	0.638	0.652	0.655	25
35	HHPROS0X	0.899	0.896	0.926	26
36	HHPROS1X	0.814	0.895	0.984	27
37	HHPROS2X	0.792	0.746	0.735	28
38	HHPROS3X	0.776	0.618	0.598	29
39	HHPROS4X	0.717	0.728	0.746	30
40	PROS	0.950	0.957	0.954	31
41	HHWELECT	0.590	0.532	0.540	32
Extraction Method: Principal Component Analysis.					

Extraction Method: Principal Component Analysis.

Table 2. Variable Association with the Extracted Factors in a form of Rotated Component Matrix for Community Living Condition in Sulawesi Region.

Rotated Component Matrix(a)					
Variable	Component				
	1	2	3	4	5
VAR041	0.786	0.019	0.128	0.017	-0.005
VAR042	0.064	0.286	0.024	-0.638	-0.067
VAR044	0.144	0.13	0.069	-0.02	-0.038
VAR045	0.088	0.111	0.035	-0.024	0.02
VAR068	0.807	0.233	0.013	-0.146	-0.059
VAR069	0.781	0.025	0.063	0.043	-0.013
VAR070	0.522	0.417	-0.064	-0.237	-0.058
VAR071	0.178	-0.04	0.031	-0.07	-0.039
VAR202	-0.047	-0.003	-0.022	0.057	0.879
VAR203	0.028	0.019	-0.054	0.937	0.066
VAR204	-0.038	0.019	-0.067	0.940	0.080
VAR229	0.728	-0.011	0.334	0.023	0.004
VAR235	0.864	0.122	0.200	0.02	-0.024
VAR236	0.549	0.167	0.323	-0.031	-0.020
VAR237	0.799	0.117	0.050	-0.065	-0.030
VAR363	0.849	0.293	0.139	-0.002	-0.030
VAR367	0.749	0.022	0.266	0.013	-0.002
VAR375	0.156	-0.004	-0.017	-0.026	0.027
HOUSQTY	0.139	0.193	0.450	-0.068	-0.029
DECEASE	-0.034	-0.056	-0.049	0.104	0.865
HHWTELP	0.290	-0.012	0.753	-0.014	0.001
HHWTV	0.250	0.135	0.761	-0.044	-0.063
HHWPARA	0.046	0.182	0.644	-0.033	-0.016
HHWRADIO	0.162	0.068	0.325	-0.209	-0.074
HHCAR	0.215	0.085	0.758	-0.05	-0.022
HHPROS0X	-0.134	-0.861	-0.103	0.138	0.024
HHPROS1X	-0.040	-0.04	-0.025	-0.159	-0.035
HHPROS2X	0.095	0.622	0.003	-0.062	0.073
HHPROS3X	0.101	0.581	0.149	0.040	-0.084
HHPROS4X	0.147	0.295	0.147	0.075	-0.004
PROS	0.172	0.897	0.154	-0.034	-0.028
HHWELECT	0.353	0.534	0.216	0.124	-0.024

Notes : —These five main factors are those in eigenvalues distribution >50% (see Appendix 3).—

—Those highlighted coefficients (>0.7) are going to be used for the factors' index construction

variances of the all-32 community living condition variables. The complete result of this calculation can be seen in Table 2.

By confronting the 5 factors and the 32 variables, then we could form the component matrix with matrix elements are the *coefficient of correlation between components/factors and variables*. In order to make it easier in doing interpretation, then we perform orthogonal rotation, which result in the Rotated Component Matrix using *Varimax with Kaiser Normalization* as the Table 2 presents the result. Based on this matrix, we can proceed to the calculation of factor indices representing different variables using the average standardized values (*z-scores*) as the result is shown in Table 3. Those variables having coefficient of correlation (*r*) greater than 0.70 include in the factor index formation. Therefore, the constructed factor indices explain at least 50% of the variable variability (R^2) of those variables included in the factor representations.

Each factor, to the some extends, represents a certain meaning that associate with the variables being represents in addition to the observation of their coefficient of correlation. Since the factors represents various number of variables—ranged from one variable to several variables—sometimes it is difficult to provide a clear-cut meaning of each factor. For instance, LHH Factor 1 represents eight different variables; Var00041 (Number of HH with high education enrollment), Var00068 (Number of non stack houses), Var00069 (Number of permanent houses), Var00229 (Number of HH with telephone), Var00235 (Number of HH with television), Var00237 (Number of HH with radio), Var00363 (Number of HH with electricity), and Var00367 (Number of HH with 4 wheel vehicles). Then, the LHH Factor 1 represents kind of consumption rate of goods and services that only viable for middle-upper income class of the community. Therefore, how should we name this factor is rather dubious. One can name it as *Consumption Rate of Durable Goods and Services*.

In case of Factor 2, it represents three variables, HHWTELP (Percentage of HH with telephone), HHWTV (Percentage of HH with television) and HHCAR (Percentage of HH with 4 wheel vehicles). This is rather different from Factor 1; it represents the proportion of households possessing telephone, television and car, which are luxury goods, so we named it *Rate of Lux-Goods Possession*. On the other hand, Factor 3 represents single variable only, therefore it is no problem in naming it. LHH Factor 3 is unique for variable PROS (Village Prosperity); therefore, it represents the *Village Prosperity Index*.

Factor 4 represents two variables, however they are representing similar issue, so that, naming is not a problem. Factor 4 represents Variable 203 and 204, which are water source for drinking/cooking and water source for bathing and washing. Both variables are

in line with the source of water used in the households or for domestic purposes, so called, *Domestic Water Source*. Factor 5 represents the decease occurrences in the communities and we name it *Decease Occurrence*. As a result, we assign a unique name for each of the four factors, as well as its member variables—variables that are being included in the factor index construction—as shown in Table 3.

Table 3. Representative Factors and Variable Represents for Community Living Condition in Sulawesi Region.

Factors	Factor Name	Represents Variables	Factor Coef.	Description
LHH Factor 1	Consumption of Durable Goods and Services	Var00041	0.786	Number of HH with high education enrollment
		Var00068	0.807	Number of non stack houses
		Var00069	0.781	Number of permanent houses
		Var00229	0.728	Number of HH with telephone
		Var00235	0.864	Number of HH with television
		Var00237	0.799	Number of HH with radio
		Var00363	0.849	Number of HH with electricity
		Var00367	0.749	Number of HH with car
LHH Factor 2	Village Prosperity	HHPROSOX	−0.861	Percentage Pre-prosperous HH
		PROS	0.897	Village Prosperity Level
LHH Factor 3	Rate of Luxurious Possession	HHWTELPH	0.753	Percentage of HH with telephone
		HHWTV	0.761	Percentage of HH with television
		HHCAR	0.758	Percentage of HH with car
LHH Factor 4	Domestic Water Sources	Var00203	0.937	Water source for drink and cook
		Var00204	0.940	Water source for bathing and washing
LHH Factor 5	Decease Occurrence	Var00202	0.879	Number of other deceases occurrence
		Decease	0.865	Decease occurrence ratio

Notes : Extracted from the component matrix presented in Table 2.

The component matrix provided other observation regarding how well each of which variables are being represents into a factor or several factors. This observation could be done by carefully reviewing the horizontal dimension of the rotated component matrix. First, we are expecting to find the coefficient of association that greater than 0.70—having very strong association—, but if it is not available we should go for smaller figures. For instance, Factor 1 well represents Var00041 with the coefficient of 0.789. Var00042 however, is represented by two factors, Factor 3 and Factor 4, each of which by smaller coefficients than 0.70. By going down for each variable, there are several variables are associated by several factors with small coefficients, then it is decided to identify the ones with coefficient larger than 0.30 -explain about 10% variability of the variable.

Naturally, when the coefficient of correlation that greater than 0.70 existed for a variable, it only have one representative factor (indicated by factors with coefficient greater

than 0.70). However, when no coefficient greater than 0.70 existed, then they would be scatter across several factors. For example, Variable 41 went for Factor 3 and Factor 4 with coefficients of 0.420 and -0.635 respectively. The complete result of this procedure is shown in Appendix 4, while the summary is presented in Table 3.

The existence of small association coefficients—or moderate to low association ($0.7 > \text{factor coefficient} > 0.3$)—between variables and factors more or less creates problems in the analysis. First, this would complicate the definition of each factor. Second, since these variables indicated association with more than one factor, so it presented some rather inter factor association. For example, Var00070 (number of semi permanent houses) went for Factor 1 and Factor 3, with almost equal coefficients of 0.50 respectively. Factor 1 defined as consumption rate for durable goods and services, while Factor 3 called *Village Prosperity*, so both names in fact do not represent Var00070.

For the case of Variable HOUSQTY (House quality), it spread out into three factors, Factor 2 (*lux-goods possession*), Factor 3 (*Village prosperity*) and Factor 9 (*Simple houses*). By scattering into several different factors, it is rather complicated to incorporate these variables in the analysis. For instance, in the calculation of the factor values might need some kinds of justification, including possible omission from the analysis. Regarding this justification, the following section of index construction should provide additional elaboration.

7. Factor Index Construction for the Community Living Condition

The Factor Analysis resulted in factor structure which is explained in the previous section is used to construct representative indices for each factor. Indices are employed to capture the notion of the factors consisted of several variables. Variables employed here are the variables that have high association (factor coefficients. 0.70) on specific factor loadings.

Index construction in this case uses linear summation principle by taking the average value of the standardized involved variables for each factor. Therefore, there are several steps in this procedure as follows :

1. Values of the extracted variables are standardized. Since the values of variables involved in the factor are different in range as well as in unit, then it is necessary to be standardized using z-standardization method.
2. Factor indices are calculated. Formation of the indices by calculating the mean of the variable values included into the factors always use standardized variable values.

Having these two steps, representative indices will be constructed for each of the four extracted factors out of 42 variables of Household Living Condition in the following sections.

The factor structure of LHH result in 4 extracted factors. The factors included several variables, which every variable consisted of different values in terms of both value units and ranges. Therefore, we need to assign single value for each factor. As mentioned above, the representative values of the factors in this case are factor indices.

Calculation of factor indices involves several steps. First by standardizing the included variables on a specific factor, we will have standardized variables. Then, by calculating the mean of the standardized variable values, we can get into the factor index directly. For example, Factor 1 is CONSDGS or Consumption of Durable Goods and Services, representing eight different variables. Those variables are Var00041 (Number of HH with high education enrollment), Var00068 (Number of non-stack houses), Var00069 (Number of permanent houses), Var00229 (Number of HH with telephone), Var00235 (Number of HH with television), Var00237 (Number of HH with radio), Var00363 (Number of HH with electricity), and Var00367 (Number of HH with four-wheel vehicles).

Therefore, index of CONSDGS is equal to the average of standardized values of the all eight variables above. So that, if the factor consisted of three variables such as Factor 2, the index is the average of the standardized values of those three variables, and if only two variables involved in a factor, the standardized values of the two formed the index, and so on. Using this procedure, then the unique index for each of the four factors is

Table 4. Representative Index for Community Living Condition and Factor Index Composition in Sulawesi Region.

Factors	Factor Name		Factor Index Composition
	Long form	Short form	
LHH Factor 1	Consumption Rate of Desire Goods and Services	CONSDGS	$(zVar00041 + zVar00068 + zVar00069 + zVar00229 + zVar00235 + zVar00237 + zVar00363 + zVar00367)/8$
LHH Factor 2	Village Prosperity	VILPROS	$(zHHPROSOX + zPROS)/2$
LHH Factor 3	Rate of Lux-Goods Possession	RTLXGPOS	$(zHHWTELPH + zHHWTV + zHHCAR)/3$
LHH Factor 4	Domestic Water Sources	WTRSRCE	$(zVar00203 + zVar00204)/2$
LHH Factor 5	Decease Occurrence	DECSOCC	$(zVar00202 + zDECEASE)/2$

Notes : z-signs indicate the standardized values (z-scores) of the variable.

assigned as shown in Table 4.

Based on the calculation above, the four factors consisted of entirely new set of data, which all values are the standardized ones. After this step, then now we have follow long and systematic procedure and end up with a precise set of four indicators for the household living condition specifically design for Sulawesi Region. Even though, of course these indices can be use for other region, however we recommend developing specific type indicators using local or regional characteristics.

8. Test of Index Validity

Validity test meant to verify the index construction procedure/method, in this case the average standardized values using additive summation principle by comparing the result with the ideal-type factor values, which are regression factor scores. Validity test employs coefficient of Pearson Correlation at significant level ($\alpha = 0.05$ and 0.01). If the constructed indices have significant and strong correlation ($r > 0.6$), then we approve the

Table 5. Correlation Matrix of Factor Indices for Community Living Condition in Sulawesi Region.

	REGR factor score 1	REGR factor score 2	REGR factor score 3	REGR factor score 4	REGR factor score 5	CONS DGS	PROS PEX	LX GOOD	WTR SRC	DECE ASX
REGR factor score 1	1									
REGR factor score 2	0	1								
REGR factor score 3	0	0	1							
REGR factor score 4	0	0	0	1						
REGR factor score 5	0	0	0	0	1					
CONSDGS	.961(**)	.124(**)	.179(**)	-0.015	-0.024	<i>1</i>				
PROSPEX	.139(**)	.611(**)	.117(**)	.081(**)	0.005	.275(**)	<i>1</i>			
LXGOOD	.295(**)	.081(**)	.885(**)	-.042(**)	-.032(**)	.457(**)	.227(**)	<i>1</i>		
WTRSRC	-0.005	0.019	-.062(**)	.969(**)	.075(**)	-.040(**)	.097(**)	-.104(**)	<i>1</i>	
DECEASX	-.046(**)	-.034(**)	-.040(**)	.092(**)	.989(**)	-.085(**)	0.002	-.095(**)	.173(**)	<i>1</i>
** Correlation is significant at the 0.01 level (2-tailed).										
* Correlation is significant at the 0.05 level (2-tailed).										

Notes : Highlighted figures are coefficient of correlations between factor score and its represented index constructed using the average value of the represented variables' z-scores. Italic figures represent the correlation coefficients among the constructed factor indices.

constructed indices as the approximation of the ideal type index and therefore it is valid as factor indices representing the community living condition variables.

Matrix of coefficient correlation among the factor indices, both the ideal type factor score regression outputs and the average standardized value indices is shown in Table 5. By definition, coefficients of correlations among factor scores have to be equal to zero (those in the upper left hand side of the matrix). However, this is not true for the constructed factor index using z-score transformation and the taking the average values of the member variables, even though their correlations are very weak or small coefficient of correlations (those in the lower right hand corner of the matrix).

Table 5 shows that there are significant (at $\alpha=0.05$) and strong correlation between Regression Factor Score 1 and CONSDGS ($r=0.961$) and therefore index construction using average values of the z-scores is valid. Similarly, the other four pairs also have significant and strong correlations. Thus, we can conclude that the index construction method making use of the average values of the z-scores of the factor coefficients that are equal or higher than 0.7 yields valid factor indices.

9. Conclusion and Implication

Factor analysis is particularly useful in coping with huge data set; awesome number of variables, mean while *z-score transformation* and additive summation principle allow index construction by taking the average z-score values of pertinent variables. As the result, we could formulate valid community living condition indicators. Significant and strong correlation between the ideal-type factor index (regression of the all factor scores) and the factor index constructed using the average z-scores confirm these indicators validity. Five most important indicators could characterize community living condition in Sulawesi Region. They are *Consumption of Durables and Services*, *Rate of Luxurious Possession*, *Village Prosperity*, *Domestic Water Sources and Decease Occurrence*. These five indicators provide explanation more than 51% variances of the all data variability in characterizing the community living condition of this region.

Several critical points found in dealing with this kind of secondary data are missing data and inconsistencies of original data coding. Therefore, before running factor analysis, we ought to verify the data set, if necessary to perform data cleaning, recoding and missing data handling. In addition, by making use factor analysis and z-score transformation simultaneously, we are able to construct factor indices much simpler and easier for meaning interpretation than by using factor score regression, since it involves much lesser

variables' factor coefficients.

The identification of five indicators for the community living condition provides several important policy implications. First is the availability of the local-relevant indicators for Sulawesi Region. These indicators in turn should be very useful in line with the policy and program formulation especially in order to deal with the poverty problems in the region in a more precise and effective manners. We recommend using these indicators for further elaborative studies regarding community poverty as well as its surrounding matters for this region. Another implication is in terms of methodological aspects, we could use this procedure to construct factor indices for other regions or even for sub-regions.

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Appendix 1. List of Original Variables and Composed Variables of the Community Living Condition in Sulawesi Region

No.	Variable	Variable Meaning and Composition	Notes
1	VAR00041	Number of households send their children/relatives to Univ./college	original
2	VAR00042	Use of Fuel by most households	original
3	VAR00044	Place for evacuate the bowels	original
4	VAR00045	The condition of sewage system for waste water / sewage	original
5	VAR00068	Number of non stack houses	original
6	VAR00069	Permanent houses	original
7	VAR00070	Semi Permanent houses	original
8	VAR00071	Simple houses	original
9	VAR00200	Diarrhea and vomiting	original
10	VAR00201	Dengue fever	original
11	VAR00202	Other deceases	original
12	VAR00203	Source of water for drinking or cooking	original
13	VAR00204	Source of water for bathing and washing	original
14	VAR00229	Household with telephone	original
15	VAR00235	Household with TV	original
16	VAR00236	Household with Parabola	original
17	VAR00237	Household with Radio	original
18	VAR00238	Newspaper subscriber	original
19	VAR00363	Electric owned by PLN	original
20	VAR00364	Electric owned by Non-PLN	original
21	VAR00367	Number of household owning four-wheel vehicle	original
22	VAR00371	Pre-prosperous Households	original
23	VAR00372	Prosperous Households I	original
24	VAR00373	Prosperous Households II	original
25	VAR00374	Prosperous Households III	original
26	VAR00375	Prosperous Households III Plus	original
27	HIEDUHH	var00041/var00039 * 100	Composed
28	HOUSQTY	(var00069 * 3 + var00070 * 2 + var00071 * 1)/(var00069 + var00070 + var00071)	Composed
29	DECEASE	(var00200 + var00201 + var00202)/var00037 * 10000	Composed
30	HHWTELP	var00229/var00039 * 1000	Composed
31	HHWTV	var00235/var00039 * 1000	Composed
32	HHWPARA	var00236/var00039 * 1000	Composed
33	HHWRADIO	var00237/var00039 * 1000	Composed
34	HHCAR	var00367/var00039 * 100	Composed
35	HHPROS0x	var00371/(var00371 + var00372 + var00373 + var00374 + var00375) * 100	
36	HHPROS1x	var00372/(var00371 + var00372 + var00373 + var00374 + var00375) * 100	Composed
37	HHPROS2x	var00373/(var00371 + var00372 + var00373 + var00374 + var00375) * 100	Composed
38	HHPROS3x	var00374/(var00371 + var00372 + var00373 + var00374 + var00375) * 100	Composed
39	HHPROS4x	var00375/(var00371 + var00372 + var00373 + var00374 + var00375) * 100	Composed
40	PROS	(var00371 * 1 + var00372 * 2 + var00373 * 3 + var00374 * 4 + var00375 * 5)/SUM (var00371:var00375) * 100	Composed
41	HHNEEDx	(var00371 + var00372 + var00373)/SUM (var00371:var00375) * 100	Composed
42	HHWELECT	(var00363 + var00364)/var00039 * 100	Composed

Notes : Var00037=Total population ; Var00039=Number of Households

Appendix 2. Descriptive Statistics of the Community Living Condition in Sulawesi Region

Descriptive Statistics							
No.	Variable	N	Minimum	Maximum	Mean	Std. Deviation	Variance
1	VAR041	6649	0	2732	23.6839	83.61024	6990.673
2	VAR042	6649	1	4	1.8361	0.94345	0.89
3	VAR044	6649	1	4	2.5247	1.47207	2.167
4	VAR045	6649	1	4	2.7845	1.34834	1.818
5	VAR068	6649	22	6479	401.8419	337.31814	113783.53
6	VAR069	6649	0	5951	61.1475	181.95164	33106.399
7	VAR070	6649	0	2490	165.9138	194.12896	37686.053
8	VAR071	6649	0	1723	174.8965	162.20226	26309.572
9	VAR200	6649	0	7	0.1412	0.44902	0.202
10	VAR201	6649	0	6	0.0263	0.21328	0.045
11	VAR202	6649	0	8	0.1498	0.62523	0.391
12	VAR203	6649	1	8	2.7582	1.50786	2.274
13	VAR204	6649	1	8	2.8314	1.61241	2.6
14	VAR229	6649	0	1426	13.6211	73.50078	5402.365
15	VAR235	6649	0	3683	88.5273	220.54182	48638.696
16	VAR236	6649	0	816	9.6022	27.37668	749.483
17	VAR237	6649	0	4595	116.054	217.9867	47518.202
18	VAR238	6649	0	1	0.4924	0.49998	0.25
19	VAR363	6649	0	5461	190.892	330.02119	108913.99
20	VAR364	6649	0	1229	13.5091	46.72053	2182.808
21	VAR367	6649	0	1308	11.0839	42.02958	1766.486
22	VAR371	6299	0	80001	99.3575	1024.2437	1049075.2
23	VAR372	6299	0	47545	154.0348	614.84986	378040.35
24	VAR373	6299	0	49018	127.5883	708.82394	502431.38
25	VAR374	6299	0	20000	68.1164	280.9367	78925.428
26	VAR375	6299	0	8427	19.7038	168.94943	28543.91
27	HIEDUHH	6649	0	86.85	3.859	6.85803	47.033
28	HOUSQTY	6649	1	3	1.604	0.40463	0.164
29	DECEASE	6649	0	343.14	3.0756	11.43297	130.713
30	HHWTELPH	6649	0	856.68	13.842	59.65065	3558.2
31	HHWTV	6649	0	1000	135.0228	177.99938	31683.778
32	HHWPARA	6649	0	594.65	18.8103	30.32789	919.781
33	HHWRADIO	6649	0	1000	225.0884	217.3625	47246.455
34	HHCAR	6649	0	58.55	1.5697	3.23824	10.486
35	HHPROS0X	6299	0	100	26.5231	25.60614	655.675
36	HHPROS1X	6299	0	100	34.9046	21.1094	445.607
37	HHPROS2X	6299	0	99.38	23.9586	19.82131	392.884
38	HHPROS3X	6299	0	98.55	11.9567	15.20578	231.216
39	HHPROS4X	6299	0	97.53	2.6569	5.8874	34.662
40	PROS	6299	1	4.92	2.2932	0.63859	0.408
41	HHNEEDX	6299	1.45	100	85.3864	18.14963	329.409
42	HHWELECT	6649	0	100	38.0115	32.01864	1025.193
Valid N (listwise)		6299					

Appendix 4. Component Score Coefficient Matrix of the Community Living Condition in Sulawesi Region

Component Score Coefficient Matrix					
Variable	Component				
	1	2	3	4	5
VAR041	0.176	-0.064	-0.047	-0.002	0.006
VAR042	-0.006	0.093	-0.026	-0.22	0.023
VAR044	-0.022	-0.04	-0.008	-0.023	-0.012
VAR045	-0.033	-0.039	-0.011	-0.01	0.03
VAR068	0.139	0.031	-0.093	-0.021	-0.001
VAR069	0.175	-0.072	-0.078	0.027	0
VAR070	0.116	0.103	-0.14	-0.088	-0.012
VAR071	-0.048	0.022	0.062	0.031	0.012
VAR202	-0.002	0.023	0.025	-0.052	0.581
VAR203	0.013	0.066	0.002	0.46	-0.038
VAR204	0.002	0.072	0.003	0.448	-0.033
VAR229	0.138	-0.076	0.059	-0.015	0.015
VAR235	0.154	-0.042	-0.023	0.03	0.004
VAR236	0.092	0.049	0.079	-0.061	0.002
VAR237	0.152	-0.032	-0.079	0.024	0.006
VAR363	0.144	0.028	-0.059	0.021	0.003
VAR367	0.152	-0.066	0.02	-0.015	0.01
VAR375	0	-0.072	-0.053	-0.045	0.027
HOUSQTY	-0.007	-0.005	0.138	0.018	-0.003
DECEASE	0.018	0	0.009	-0.035	0.563
HHWTELPH	-0.03	-0.081	0.302	0.013	0.027
HHWTV	-0.062	-0.036	0.298	0.043	-0.007
HHWPARA	-0.06	0.071	0.279	-0.036	0.007
HHWRADIO	-0.029	-0.034	0.12	0.021	-0.01
HHCAR	-0.061	-0.044	0.307	0.018	0.018
HHPROS0X	0.048	-0.338	0.02	-0.038	-0.029
HHPROS1X	0.009	0.036	0.004	0.049	0.021
HHPROS2X	-0.011	0.241	-0.039	0.001	0.051
HHPROS3X	-0.058	0.19	0.009	-0.008	-0.049
HHPROS4X	-0.053	0.039	0.009	0.005	0.006
PROS	-0.065	0.312	-0.014	0.013	0.006
HHWELECT	0.011	0.158	0.017	0.08	-0.008

