Multivariate poverty index based on the Third National Household Budget Survey 2004-2005[1]

Índice de pobreza multivariante a través de la III Encuesta Nacional de Presupuestos Famililares 2004-2005

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Abstract

This study proposes the design of a poverty index using a multivariate approach to create an alternative indicator that combines the bene?ts of the already existing indexes. The construction of such index is based on the data supplied by the Third National Survey of Family Budgets (NFPS) 2004-2005 that contains information on socioeconomic variables of Venezuelan households. We defined eight (8) dimensions with characteristics of households and from there we created an index, which summarizes the information of the different dimensions for measuring poverty.

Keywords: poverty rate, national survey of family budgets, principal component analysis, multiple correspondence analysis.

Resumen

El presente estudio propone diseñar un índice de pobreza usando un enfoque multivariante, para crear un indicador alternativo que conjugue las bondades de los índices existentes. La construcción de dicho índice se basó en los datos suministrados por la III Encuesta Nacional de Presupuestos Familiares(ENPF) 2004-2005, donde hay información concerniente a las variables socioeconómicas de los hogares venezolanos. Se definieron ocho (8) dimensiones con características pertinentes al

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hogar y a partir de lo cual, se creó un índice que resume la información de las distintas dimensiones para la medición de pobreza.

Palabras clave: índice de pobreza, Encuesta Nacional de Presupuestos Familiares, análisis de componentes principales, análisis de correspondencia múltiple..

1   Introduction

In recent years, poverty analysis has become an important topic for most countries; remarkable efforts have been made to fight it, so much so that this scourge occupies part of the objectives of the economic and social policy of various nations. In addition, significant resources for the generation of statistical data on the extent and characteristics of poverty, oriented to the formulation of public policy, are reserved (PNUD 2013, Vakis et al. 2015, BID 2014).

The United Nations Economic Commission for Latin America and the Caribbean (CEPAL 2014) developed a methodology to measure poverty on the base of the cost of satisfying the basic needs, through the scribing of lines of poverty defined in terms of consumption or income. Through this indirect method measurements are focused on material lacks, whose advantage lies in the possibility of making international comparisons and developing a good approximation to the consumption capacity of households (Barrón & Cabezas 2006, Ibarrarán et al. 2015).

In Venezuela there are two indices recognized by the State to measure poverty; the index of unsatisfied basic needs (NBI) and the index of the Poverty Line (LP). The index of NBI measures the poverty of a household through the unsatisfied basic needs like housing, water, education and relation occupied/unoccupied, while the LP index compares the income with the price of the basic basket (dress, education, health, among others) and the cost of the food basket (Ramírez et al. 2001, Alvarado 2004, UNFPA 2006, Alvarado 2006); however, poverty used to be measured based on deficiencies, using indicators as the food consumption, income level, access to health, education and housing (PNUD 2011, BID 2014, Robles & Sáenz 2015).

García et al. (2000) García et al. (2000) determined in their proposal the components that integrate the poverty indexes using data of Swedish surveys about the standard of living, with their corresponding indicators to propose and develop the model and thus integrate the index; in this way they found the point of incidence that existed between them.

In this line the work made by Ramírez et al. (2001), based in the survey of households by sampling in Venezuela, proposed as methodology the optimal quantitative assessment of certain variables associated to life conditions of households, using a multivariate technique related to the analysis of homogeneity where each variable were associated with the method of the poverty line. From the principal component analysis (PCA) they built an index of poverty associated to the first component of a series of partial indices, which were expressed in a scale of 0 to 100,

representing the most intense poverty and the most favorable no poverty. With this study they concluded that the construction of the synthetic index of poverty (SIP), allowed to order households in terms of poverty and provided the global poverty measurement considered for each household from unsatisfied basic needs and poverty line.

It results then that both the LPI and the NBI have some weaknesses around the geographic projection when considering almost exclusively the degree of satisfaction of human needs, without taking into account that these needs can not be common to members of different cultures or even individuals within a society. It is, the LP index takes only one dimension of the problem of poverty: income and the NBI assign the same importance to all basic needs without measuring the poverty level between the same category. The idea that has to prevail is a consensus towards integration where all the areas of development concern (Camardiel et al. 2000, UNFPA 2006, Huerta 2010, BID 2014).

With all what we already mentioned this research seeks to build an index of poverty with a multivariate approach that manages to integrate into a single measure most dimensions covered by the concept of poverty. On the other hand, it allows creating an order in homes belonging to the same category of poverty; where it'll meet in a single index the variables considered representatively in the above mentioned approaches: NBI and LP. From this perspective, the design of the multivariate index of poverty using the III National Survey of Household Budgets of Venezuela 2004-2005 took the categories non-poor, relatively poor and extremely poor in order that in subsequent studies the index created can be compared with the already existing ones.

2   Materials and methods

According to the Central Bank of Venezuela (BCV), the National Survey of Household Budgets (NFPS) is a statistical sample research, conducted among Venezuelan households with the aim of obtaining information on incomes, expenses, housing characteristics, household composition and other economic and social variables. The objective of this survey is to determine the socioeconomic conditions of Venezuelan households to support the decision making in public policy questions. (available in `http://www.bcv.org.ve/epf0405/epf.html`).

The data collection of the survey was done in 56 weeks, ranging from November 2004 to the same month in 2005. The Central Bank of Venezuela (BCV), the National Statistics Institute (INE), the Venezuelan Corporation of Guayana and the University of Los Andes (ULA) (BCV 2007) conducted the fieldwork.

2.1 Sample and variables

The sample on which the ENPF was based was probabilistic, stratified, poly-staged by conglomerates and consisted of 9262 households. Of the total sample, the BCV was in charge of gathering information in 4368 households, the INE in 3172, CVG and ULA in 884 and 840, respectively.

The most significant variables that were considered for this study were those related to the concepts of poverty, which are represented in the dimensions: housing, services, conditions for acquisition of home, education of the head of household, occupation of the head of household, health services of the head of household, household equipment and household income.

2.2 Methodology

This is a study with quantitative approach, of descriptive type and non-experimental design. For the creation of the index in question techniques of multivariate statistics such as the analysis of multiple correspondences (MCA) and the analysis of principal components (PCA) were used. Information was processed from the statistical software SPAD version 5.6, which is a tool employed for the exploratory analysis of multidimensional data. It's also oriented to the statistical descriptive analysis of big tables of data obtained from surveys.

According to what was argued by Polo (2005), the analysis of correspondences "provides a simple geometrical representation, but accurate, in a space of reduced dimension, of the categories of analyzed sets, which makes it manifest the associations within each set and between them, identifying homogeneous subgroups and influences."(p. 43)

The analysis of correspondences can be simple (SCA) or multiple (MCA) depending on the number of variables that are being analyzed. In this sense, the MCA is used to analyze the possible relations between the categories of more than two qualitative variables simultaneously, while in the SCA only the categories of exactly two variables are involved. The purpose for any of two cases is representing in a graphic way the structure of relations of two or more than two qualitative variables through maps of positioning, according to the case (Vivanco 1999).

The interpretation of the results in an MCA depends largely on the subjectivity of the researcher. What these analyzes offer is only the location of a series of categories that, in the case of being more or less grouped, may indicate a similar and different behavior from the behavior of another set of variables or categories that, also grouped, are however far from the previous subgroup (Lozares & López 1991). The analysis of principal components (PCA) comprises a mathematical procedure that transforms a set of correlated variables of response into a smaller set of uncorrelated variables called principal components. Its objectives are to reduce the dimensionality of the set of data and identify new significant underlying variables (Tapia 2007).

For the construction of the proposed index, once the information of the variables strictly involved with the characteristics for the study of the measurement of poverty was prepared, a descriptive analysis that allowed organizing and representing data for a better analysis and development of the research was made. Then we applied the techniques of multiple correspondences to those dimensions whose variables are categorical and of principal components for the quantitative variables related to the dimensions equipment and incomes in household. Once this is made a definitive index with the more relevant indicators of each one of the eight dimensions considered is built. To end, as the index obtained is of continuous nature, to categorize it, taking into account the criteria of poverty, the classification of each household about these indices from quartiles was performed. The first quartile represents the condition of extremely poor, between the first and the third quartile it is considered relatively poor and above the quartile three we'll find the no poor.

3   Analysis of results

Results obtained are presented in four fundamental stages: the first one includes the descriptive analysis of the categorical variables, then the MCA is made for the dimensions housing, services, home, education, occupation and health, then the ACP for the dimensions equipment and incomes; and by last the index through a principal component analysis is made, using the variable of entry to the dimensions calculated before; in this way a single dimension that collects information of the previously dimensions is obtained.

3.1   Descriptive analysis

In the table 1 the descriptive analysis of the categorical variables is specified, from it we can do the following characterization:

As for the type of housing you can say that the families living at home are the 47.7% and 31.7% in an apartment with concierge, highlighting as housing materials a 95% with friezed walls, flat ceilings in a 69.4%, and by last, the floors are presented in marble, mosaic or granite in a 72.5%.

For the household services water is provided with aqueducts of pipeline in a 93,7%; of excreta disposal with pools or sewers in a 91,1%, the 99,6% have electricity, the fuel for the kitchen is of gas with a 89.1%.

Regarding the head of household we have that its educative level is in a 29,4% basic, media diversified in a 20,4%, senior technicians and graduates in a 40%; while at the level of jobs the 89,2% of people has at least one and an employment situation in which he, she or both work as a paid relative or no relative with a 45,6%.

Table 1: *Descriptive analysis of categorical variables. Source: own elaboration.*

Variable	Category	%	Variable	Category	%
Type of housing	Country house	9,2	**Roof materials**	Flat	69,4
	House	47,7		Tile	6,3
	Ap with concierge	31,7		Asphaltic sheet	6,0
	Ap without concierge	8,5		Metallic sheet	16,7
	Rustic house	2,0		Asbestos and similar	1,5
	Peasant ranch	0,9		Others	0,1
Employment	Zero	0,3	**Water supply**	Aqueduct with pipeline	93,7
	One	89,2		Water well	2,0
	Two	8,8		Community well	0,3
	Three	1,5		Tanker truck	1,7
	More than three	0,2		Stream, spring or river	0,2
				Other	2,2
Electricity	Yes	99,6	**Container**	Yes	15,1
	No	0,4		No	84,9
Gas	Yes	37,6	**Floor materials**	Marble/granite	72,5
	No	62,4		Cement	26,3
				Soil	1,1
Excretes	Hollow or sewer	91,1	**Fuel**	Gas	89,1
	Hollow or cesspool	6,0		Electricity	10,3
	Toilet or Latrine	1,4		Kerosene	0,1
	Don't have hollow	1,5		Others	0,5
Education level	Basic	29,4	**Employment situation**	Trabaja de manera remunerada	23,6
	Diversified media, technical and professional	20,4		Work as relative or unpaid	45,6
	Advanced technician	11,6		Don't work but has a job	2,0
	Graduate	28,4		Is looking for job	5,5
	Postgraduate	8,1		Is going to a teaching center	21,9
	Without level	1,7		Household chores	0,2
	Missions	0,5		Retired/pensioned	0,4
				Rentier	0,8
				Other situation	0,1

4 Multiple correspondence analysis

4.1 Dimension of Housing

When performing the MCA for the dimension housing it's obtained that the first four factors accumulate more then the 50% of the total variability; however, based on the subjectivity allowed by this method, it was decided to take only the first factor that is, among all, the one that obtains the greatest percentage of variability (20,22%), and use it as indicator of the dimension housing.

Figure 1 shows that the first axis or factor describes an order regarding the housing's characteristics. Categories that characterize a house in good conditions are

grouped in the first quadrant of the factorial plane different from the categories describing a house in bad conditions, which are grouped in the second quadrant. It is that the first factorial axis can be used as an indicator of the dimension housing. Grouping the households with its house in better conditions on the right side (high magnitudes of the first factor) and on the left side (low magnitudes of the first factor) households with its houses in precarious conditions.
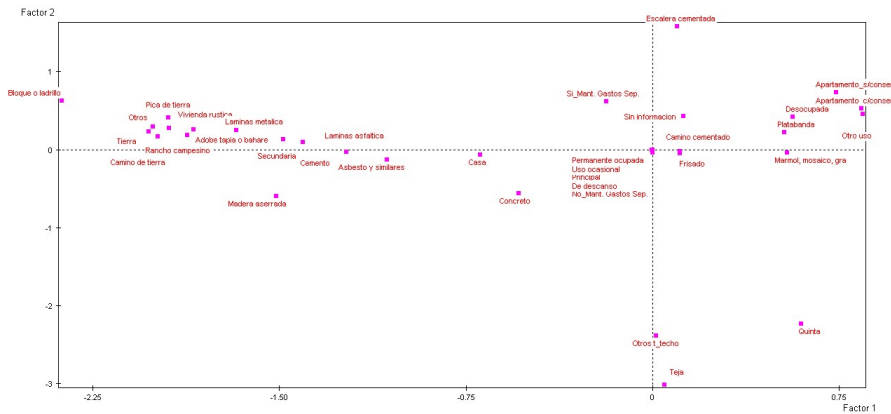

Figure 1: *Dimension of housing. Source: own elaboration.*

The groups previously mentioned have the following characteristics: The households that have a rustic house are related with a road of ground rod, a roof of metallic sheet and walls of adobe, tapia or bahareque, like a peasant ranch is related to roads and floors of soil. Another group, the households with apartments with concierge and without concierge that have flat roofs with marble floors, mosaic or granite.

4.2   Dimension of services

Figure 2 shows a natural order regarding the first axis, where there are households with all the services that indicate better housing conditions, which have an installation for water with pipeline, with hollow to sewer and aqueduct with pipeline, it also relates electricity with measurer, fuel of electricity to cook and direct gas. In the same way, it is formed another group of homes with conditions of low level services because they don't have electricity with measurer, they stock with water through tanker trucks or water wells, they don't have garbage collection and they use latrines because they don't have pipelines for water installation.
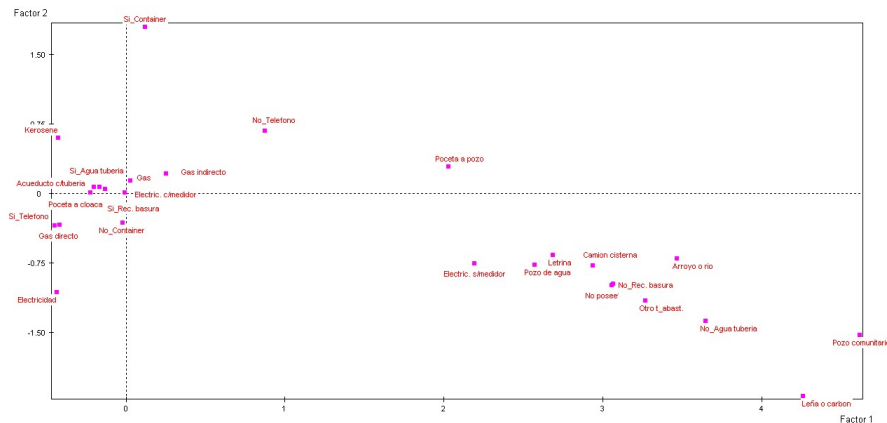
Figure 2: *Dimension of household's services. Source: own elaboration.*

4.3   Dimension of household

Figure 3 makes evident a natural behavior regarding the conditions of acquisition of the household. For this purpose, in the first axis two groups are created: one where the houses are own or own paying, and the other group corresponds to rented houses or houses representing another kind of leasing.

4.4   Dimension of education

As observed in figure 4, there is not a natural behavior that allows giving a clear interpretation according to the tendencies of the characteristics related to the education of the head of household; therefore, this dimension will not be taken into account for the construction and analysis of the multivariate index of poverty.

4.5   Dimension of occupation

Regarding figure 5, it can be appreciated that there is not a natural behavior that relates the employment conditions of the head of household and the presence of groups associated to different categories that facilitate the interpretation of the poverty conditions regarding this indicator, in proportion to their usefulness for the construction of the index proposed in this project.

4.6   Dimension of health

With respect to the dimension of health services reflected in figure 6, it is proved that it exists in the first axis a natural behavior in relation with the heads of
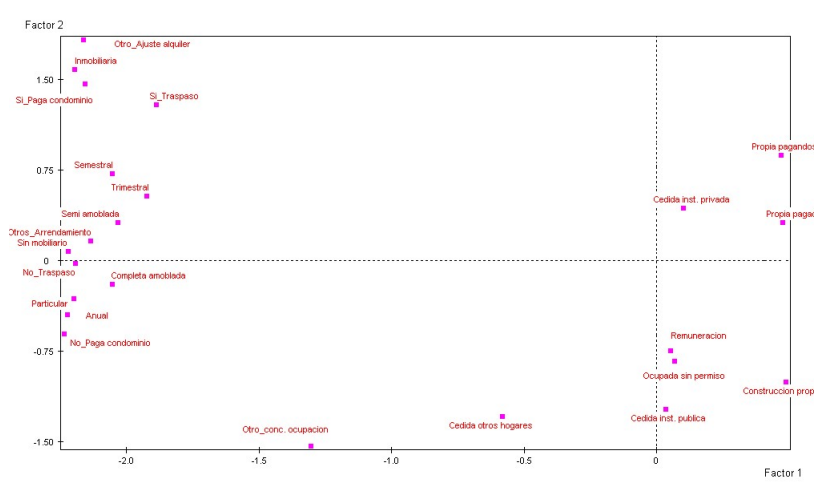
Figure 3: *Dimension of acquisition's conditions of the household. Source: own elaboration.*
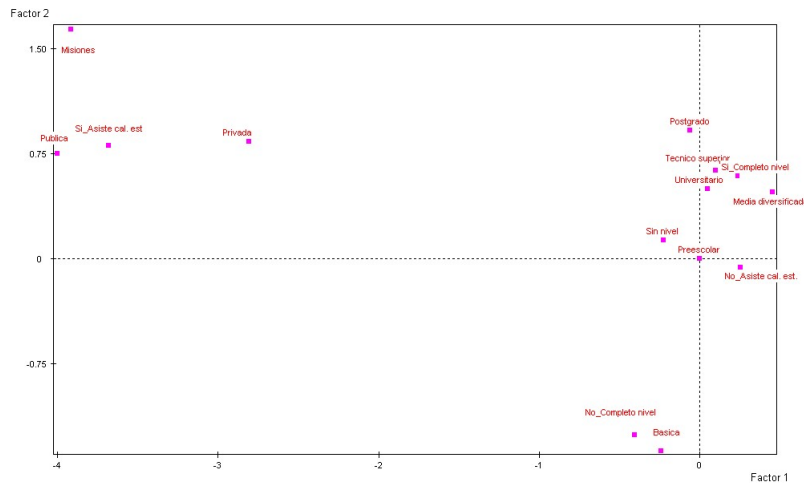

Figure 4: *Dimension of the education of the head of household. Source: own elaboration.*

household, seeing a group that doesn't have any health service nor odontology, and if they have some, it is publicly; instead the other group are heads of household that have better health services, such as private services and dental.
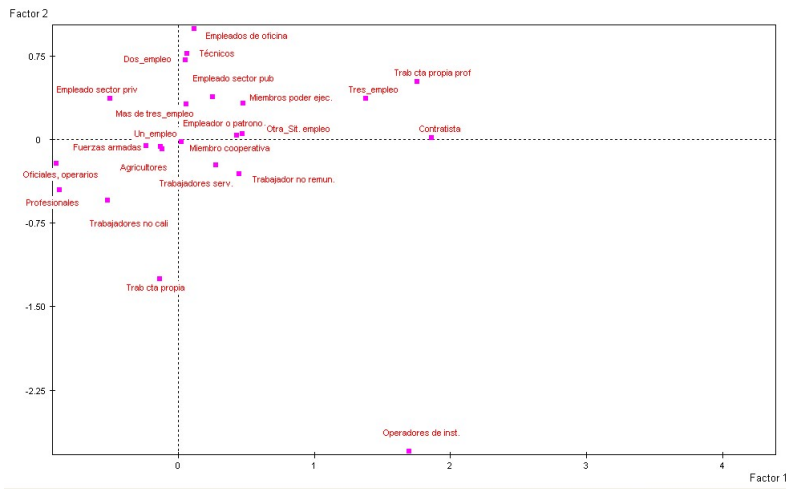
Figure 5: *Dimension of the education of the head of household. Source: own elaboration.*
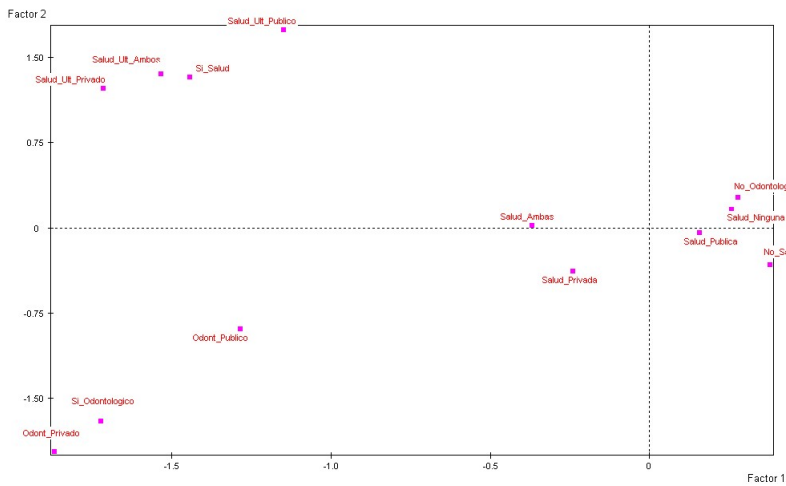

Figure 6: *Dimension of health services. Source: own elaboration.*

5 Principal component Analysis

5.1 Dimension of equipment

Figure 7 shows that most variables are related because all represent a tendency of vectors towards the same direction. Therefore, households represented on the
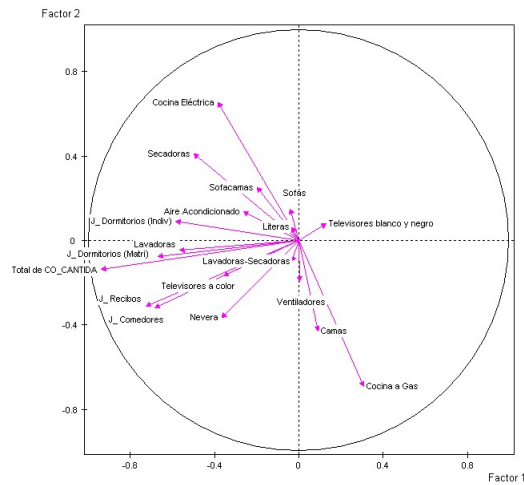
Figure 7: *Dimension of equipment of household. Source: own elaboration.*

left of the first factor will be the homes with high magnitudes, regarding the equipment, and households represented with high values on the component will be homes with lack of equipment.

5.2   Dimension of income

Figure 8 shows that, according to the household's income it exists a correlation between them, since vectors tend to the same direction, except the mixed income; few households have this kind of income. There it is represented that households on the right of the first factor will be the households with high magnitudes regarding their incomes, while households represented with low values in the component will be households with lack of income.

6   Index of multivariate poverty

As we said before the first factors of the MCA and PCA will be seen as indicators for each one of the dimensions considered; therefore it's important to formalize the structure generated by them

Housing: The inherent variables for this dimension were: kind of housing, roads, and materials of floor, roof and exterior wall.

Recapping in the MCA of this dimension the first factor served as an indicator of quality of the housing type. Therefore its coordinates can be used to condense the obtained information about the involved variables (table 3).
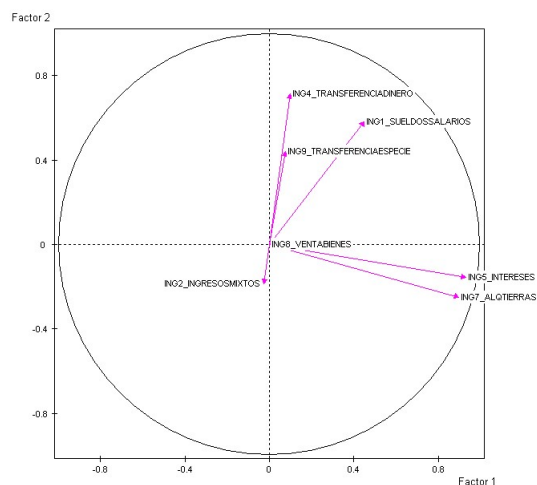
Figure 8: *Dimension of incomes of the household. Source: own elaboration.*

With the data shown in table 4 the magnitude of the indicator housing can be defined. For example, let's suppose two households A and B with the following characteristics:

> Household A: rustic housing, roads of ground rod, floor of soil, walls of adobe and roof of asphaltic sheet.

> Household B: country house, road or stairway of cement, floor of cement, walls of concrete and flat roof.

$$I_{V_{HouseholdA}} = -1,84 - 1,95 - 2,02 - 1,87 - 1,23 = -8,91$$

According to the indicator of housing, the household A has more precarious conditions than the household B, which is consistent with the described in the MCA of the dimension housing, where it was indicated that households with low magnitudes in the first factor will be households with poor conditions regarding the housing. Therefore the first factor was used to calculate the indicator housing for the sample and use it as input for the generation of the definitive index.

Service: For the dimension service we make the same analysis of the dimension housing; however, it can be observed that categories that imply better access to services are those that have coordinates of low magnitude. Therefore, a household with good access to services would have low magnitudes in the indicator service. Therefore the indicator must be multiplied by -1 to change its sense and be in harmony with the indicator housing.

Following the already introduced reasoning for the dimension housing, if a household A has the following characteristics: water installation, it stocks with water

Table 2: *Coordinates of the first factor in the MCA dimension housing. Source: own elaboration.*

Variable	Category	Coord. First Factor
Type of Housing	Ap with concierge	0,84
	Ap without concierge	0,74
	Country house	0,6
	House	-0,69
	Rustic house	-1,84
	Peasant ranch	-1,94
Material of exterior walls	Friezed	0,11
	Concrete	-0,54
	Wood	-1,51
	Adobe, tapia or bahareque	-1,87
	Others	-2,01
	Block or brick	-2,37
Roads	Cemented road	0,11
	Cemented stairway	0,1
	Ground rod	-1,98
Material of the roof	Cemented road	0,11
	Flat	0,53
	Tile	0,05
	Other roofs	0,01
	Asbestos and similar	-1,07
	Asphaltic sheet	-1,23
	Metallic sheet	-1,67
Material of the floor	Marble, mosaic, granite	0,54
	Cement	-1,4
	Soil	-2,02

through the aqueduct, has service of garbage collector, does not use container, has direct gas, telephone, has hollow to sewer and kitchen with electricity, then the indicator of service would be:

$$I_S = -0,17 - 0,2 - 0,13 - 0,02 - 0,42 - 0,45 - 0,23 - 0,44 = -2,06$$

To maintain the criteria (of sense) taken in the previous dimension it's necessary to multiply by -1 the magnitude of the calculated indicator:

$$I_S^* = -1 \cdot I_S = 2,06$$

In this way it's guaranteed that the indicator has the same sense of the dimension housing, which consists in the fact that the greater the magnitude of the indicator, the better the condition of the dimension that it's measuring.

Household and health: In the following two tables the coordinates of the first

Table 3: *Coordinates of the first factor in the MCA dimension service. Source: own elaboration.*

Variable	Category	Coord. First Factor
Water installation	No	3,65
	Yes	-0,17
Gas	Indirect	0,25
	Direct	-0,42
Telephone	No	0,87
	Yes	-0,45
Water supply	Community well	4,62
	Stream or river	3,47
	Another kind of supply	3,27
	Tanker truck	2,94
	Water well	2,57
	Aqueduct	-0,2
Excrete service	Don't have	3,06
	Latrine	2,69
	Hollow to well	3,27
	Hollow to sewer	2,03
Garbage collector	No	3,07
	Yes	-0,13
Garbage container	Yes	0,12
	No	-0,02
Fuel for cooking	Firewood or coal	4,26
	Gas	0,03
	Kerosene	-0,43
	Electricity	-0,44

factor for the MCA used for the dimensions household and health are presented.

Equipment and income: To create the indicators of the dimensions equipment and income an analysis of principal components was used and it was determined the first component as indicator of the mentioned dimensions. Therefore, the indicator of each dimension is the linear combination of the original variables in the study. Therefore, the indicator of each dimension is the linear combination of the original variables in the study. The coefficients of these linear combinations are presented in tables 5 and 6. It should be noted that the coefficients in the indicator equipment were multiplied by -1 to get the same sense as indicators of the other dimensions.

For the construction of the multivariate poverty index the analysis of principal components was used, using as variables of entry the first components of the factorial analysis made for each dimension, it is, that these are considered indicators for each one of the dimensions of the study (housing, services, household, equipment and income).

Table 4: *Coordinates of the first factor in the MCA; dimension household. Source: own elaboration.*

Variable	Category	Coord First Factor
Acquisition condition	Own construction	0,49
	Own paid	0,48
	Own getting paid	0,47
Type of leasing	Particular	-2,2
	Property company	-2,19
	Other	-2,13
Transfer	Yes-transfer	-1,89
	No-transfer	-2,19
Rent adjustment time	Annual	-2,22
	Biannual	-2,05
	Quarterly	-1,92
	Other	-2,16
Rental condition	Furnished	-2,05
	Semi-furnished	-2,03
	Without furnish	2,22
	Other	-2,16
Condominium	Yes, he/she pays	-2,15
	Does not pay condominium	-2,23

Table 5: *Coordinates of the first factor in the MCA dimension health. Source: own elaboration.*

Variable	Category	Coord. First Factor
Type of health service	Public	0,49
	Private	0,48
	None	0,47
	Both	-1,89
Type of last health service	Public	-1,15
	Private	-1,71
	Both	-1,53
Type of dental service	Public	-1,28
	Private	-1,87

The idea of making the PCA is to build a new variable that summarizes the information of the six indicators included in the analysis.

Figure 9 shows a considerable correlation between the dimensions of indicators. Considering the sense of vectors, it's possible to establish also the first component as an index that summarizes the information of the different dimensions. Therefore, households with high magnitude of the first component are families with favorable conditions regarding housing, services, household, health, equipment and income and vice versa; it is, households with precarious situation would

Table 6: *Coefficients of the linear combination of indicator equipment. Source: own elaboration.*

Variable	Coefficient	Variable	Coefficient
Air conditioning	0,26	Washing machines-Dryers	0,03
Beds	-0,09	Litters	0,03
Gas stove	-0,31	Fridge	0,36
Electric Kitchen	0,38	Dryer machines	0,5
J-dinning tables	0,68	Sofa bed	0,2
J-individual dorms	0,58	Sofas	0,04
J-matrimonial dorms	0,67	Color TVs	0,36
J-drawing room	0,72	Black and White TVs	-0,13
Washing machines	0,57	Fans	0

Table 7: *Coefficients of the linear combination of the indicator equipment. Source:own elaboration.*

Variable	Factor 1
Inc1-salary	0,45
Inc2-mixed income	-0,03
Inc 3-rentals	0,01
Inc 4-money transfer	0,1
nc 5-interest	0,93
Inc 6-dividends	0,0
Inc 7-rent land	0,9
Inc 8- sale of goods	0,0
Inc 8- sale of goods	0,08

have small magnitudes in the first factorial axis.

In this vein, from the weights given in each dimension of the resulting factorial matrix of the PCA, the multivariate poverty index shown below is designed:

$$Index = 0,85 Housing + 0,82 Serv + 0,19 Household + 0,31 Health + 0,75 Equip + 0,31 Inc \tag{1}$$

It can be concluded from the resulting index that the dimensions that most affect the index's construction are: housing, services and equipment, since they have a greater coefficient. In this vein, from the previous index the value of the **index for each household** of the sample. With the purpose of carrying it to a scale from 0 to 100, the obtained index was divided in the equation (1) by its maximum value, multiplying it by 100.

$$Index-def = \frac{0,85 Hous + 0,82 Serv + 0,19 Household + 0,31 Health + 0,75 Equip + 0,31 Inc}{Index(max)} *100$$
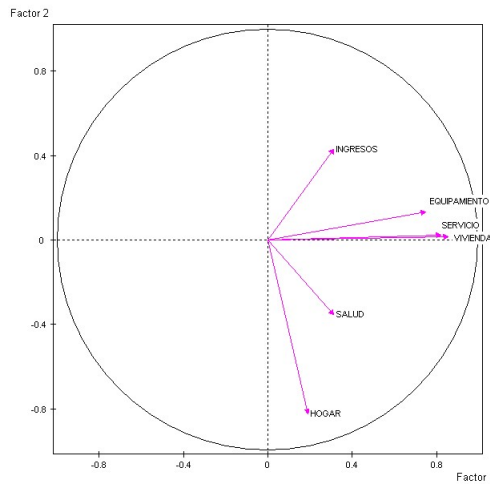
Figure 9: *Multivariate poverty index. Source: own elaboration.*

Table 8: *Factorial matrix of PCA. Source: own elaboration.*

Variable	Component 1
Housing	0.85
Service	0.82
Household	0.19
Health	0.31
Equipment	0.75
Income	0.31

This proposed index is a continuous variable and to be able to compare it with the indexes of unsatisfied needs and of poverty line it was categorized from the quartiles, using the following criteria:

Inside the first quartile is *extremely poor.*
Between the first and the third quartile is *relatively poor.*
Above the third quartile is *no poor.*

In this vein we have that for the calculation of the index of basic unsatisfied needs we have to take into account the number of needs that are satisfied or not in each household. In this sense according to this reasoning we have that:

No poor if they have zero unsatisfied needs
Relatively poor if they have one unsatisfied need
Extremely poor if they have two or more unsatisfied needs

Regarding the index of poverty line, a household was classified in the category

poor, if the income per capita of the household was not enough to cover the cost per capita of the basic basket, and in extreme poverty if the income per capita of the household was not enough to cover the cost per capita of the food basket.

Besides it was classified as no poor if the income per capita of the household was enough to cover the cost per capita of the food basket; and as relatively poor if the income per capita of the household was not enough to cover the cost per capita of the basic basket.

It was classified as extremely poor if the income per capita of the household was not enough to cover the cost per capita of the food basket.

Already at this time and in subsequent studies it is presented the comparison of these three indices and the degree of agreement and disagreement between them.

7   Discussion

Traditionally economic analyses of poverty have been focused on the study of the income as variable. The focus of basic needs, which sought to provide a multidimensional framework to poverty studies that allowed identifying poor populations and sort geographical data from censuses to guide the implementation of public policies, arises in the decades of the seventies. (Program of the United Nations for the Development (PNUD 2010, Ibarrarán et al. 2015)).

So, it is evident that the disadvantage of the index of unsatisfied basic needs is that a household is considered poor or extremely poor if it does not cover one or more than two basic needs respectively, which means that this index assign the same level of importance to all needs. According to this methodology, a household with the needs of housing and basic services unsatisfied is classified like a household that does not cover the need of educations and relation occupied/unoccupied, which not always is true, since basic needs shouldn't have the same importance at the moment of classifying a household, it is, there are needs that are more critical than others. In addition, it classifies a household in the same category of poverty if it does not cover the basic needs (PNUD 2011, CEPAL 2014, López-Calva & Ortiz-Juárez 2014, Vakis et al. 2015).

In this vein, this research reached the established goal; the findings also allow the following conclusions: (a) with handling data of the III National Survey of Household Budgets corresponding to the years 2004-2005 was possible to make an analysis of the data that provided the required information regarding all the involved variables for the measurement of poverty; (b) dimensions that have the greatest contribution for the construction of the index are housing, services, household, health, equipment and income; besides occupation and education of the head of household do not provide a discrimination strong enough to consider them as variable of entry for the construction of the index of multivariate poverty; (c) an advantage of the multivariate index of poverty is that one can compare households that are classified inside the same category, because each household has a scaled

measure between 0 and 100, which means that the greatest the magnitude the smallest the poverty condition; (d) the indices line of poverty (LP) and unsatisfied basic needs (NBI) were built from the variables in study already defined, where the established criteria for each index were taken into account for its construction and in the same way each household was classified regarding its poverty level as in the case of the index of multivariate poverty.

About the limitations of this study, future researches should consider, in first place, to conduct studies that are similar to this one, taking into account the data of surveys of consecutive years, in order to obtain a knowledge of the variety of the level of poverty that may exists in the country. Secondly, use other multivariate statistical techniques in order to make comparisons between each analysis and have different approaches in the field of poverty. By last, the index of multivariate poverty can be very useful in those organisms that analyze the poverty index in the country; therefore, it is suggested to consider it in future studies. Therefore it is suggested that the results obtained through the design of the index of multivariate poverty in this research be considered by institutions that handle statistics of the national poverty, and the upgrade of the information must be taken into account according to new indicators that can get involve to keep data updated and consistent with the national reality.

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A   Description of the variables

Table 9: *Variables selected from the table of Housing. Source: own elaboration.*

Variable	Description
CO-COND-OCUPACIÓN	Occupation condition
CO-TIPO-USO	Type of use of the house
CO-VIALIDAD	Roads to access the house
CO-CUANTAS-PERSO	Number of people living in the house
CO-MANTIENEN	People maintaining separate expenses to buy food
CO-CUANTOS-GRUP	Number of groups maintaining separate expenses to buy food
CO-TIPO-VIVIENDA	Type of house
CO-PARED-EXTERIOR	Exterior walls
CO-MATERIAL-TECHO	Predominant material on the roof
CO-MATERIAL-PISO	Predominant material in the floor
CO-INST-AGUA	Installation for tap water with pipelines
CO-COMO-ABASTECE	Water supply
CO-ELECTRICIDAD	Electricity with measurer
CO-RECOLECCION	Direct collection of garbage
CO-CONTAINER	Garbage container
CO-GAS	Direct gas
CO-TELEFONÍA	Telephony
CO-NINGUNO	Any
CO-EXCRETA	Service of excreta elimination
CO-COMBUSTIBLE	Fuel to cook
CO-DORMITORIO	Number of bedrooms
CO-RECIBO	Number of living rooms
CO-COMEDOR	Number of dinning rooms
CO-RECIBO-COMEDOR	Number of living-dinner rooms
CO-COCINA	Number of kitchens
CO-BAÑO-COMPLETO	Number of complete bathrooms
CO-BAÑO-INCOMPLETO	Number of incomplete bathrooms
CO-SALA	Number of living rooms of multiple uses
CO-MALETEROS	Number of trunks
CO-PUESTO	Number of parking places
CO-SALA-FIESTA	Number of living rooms for party
CO-AREAS	Number of recreation areas
CO-UN-SOLO	Only one ambient
CO-SALA	Number of living rooms of multiple uses

Table 10: *Variables selected from the la table households1. Source: own elaboration.*

Variable	Description
CO-DE	Number of homes in the house
CO-PRINCIPAL	Number of principal houses
NU-CUANTOS-ANOS	Years of the home living in the house
CO-CUARTOS	Number of rooms used by people of the home to sleep
CO-BANOS	Number of bathrooms with shower of exclusive use that the home owns
CO-CONDICIÓN	Property condition of the house
CO-ADQUISICIÓN	Years of acquisition of the house
MO-TOTAL-ALQUILER	Total amount of rent paid
CO-TRASPASO	Transfer for the house
CO-GASTOS	Condominium expenses
MO-PROMEDIO	Average expense in payments of condominium
CO-ALQUILADA	Rent condition
CO-ARRENDAMIENTO	Leasing condition of the contract
CO-TIEMPO-AJUSTADO	Adjustment time for rent
CO-MONTO	Price of rent
CO-CONCEPTO	Concept of house occupation

Table 11: *Variable selected from the table Household2. Source: own elaboration.*

Variable	Description
CO-NRO-VEHÍCULO	Number of vehicles

Table 12: *Variables selected from the table Household-eq. Source: own elaboration.*

Variable	Description
CO-CÓDIGO	Code of equipment or item
CO-CANTIDAD	Number of equipment or items in home

Table 13: *Variables selected from the table persons-car. Source: own elaboration.*

Variable	Description
NU-MIEMBRO	Member of home
CO-SEXO	Sex
NU-EDAD	Age
CO-NACIONALIDAD	Nationality
CO-CONYUGAL	Marital Status
CO-LEER-ESCRIBIR	Know reading and writing
CO-NIVEL-EDUC	Education level reached
CO-COMPL-NIVEL	Completed level
CO-ENSENANZA	Is attending as student
CO-INSTITUCIÓN	Type of institution
SERV-SALUD	Health service that owned
CO-ULTIMO	Required health service the last month
SALUD-ÚLT-MES	Type of health service in the last month
SALUD-ODONTOLÓGICA	Service of dental health
CO-ÚLTIMO-MES	Required dental service the last month
EDUC-MISION	Missions which is attending
CO-EMPLEOS	Number of jobs
CO-OCUP-PPAL	Code of occupation
CO-SITUAC-PPAL	Situation of employment
CO-COND-PPAL	Condition of employment
CO-COD-ACT-PPAL	Economic activity

Table 14: *Variables selected from the income table. Source: own elaboration.*

Variable	Description
ING1-SUELDOSSALARIOS	Salaries
ING2-INGRESOSMIXTOS	Mixed incomes
ING3-ALQUILERES	Rents received
ING4-TRANSFERENCIADINERO	Money transfers
ING5-INTERESES	Interests
ING6-DIVIDENDOS	Dividends
ING7-ALQTIERRAS	Land rentals
ING8-VENTABIENES	Sales of durable goods
ING9-TRANSFERENCIAESPECIE	Transfers in species