INFRASTRUCTURAL POVERTY CONCEPTION AND WELFARE ESTIMATION IN UKRAINE

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Abstract

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The intent of this paper is to estimate poverty in Ukraine by using conception of "infrastructural poverty" and alternative asset index method. Traditionally poverty and inequality analysis is based on income or consumption as preferred indicators of living standards. Such approach defines utility a little bit narrowly – as a function of money and has various data - related disadvantages. Researchers give relatively insufficient attention to the households' ownership of durables (assets) or to the inequality in possessing those assets among households or individuals. This paper defines the socio economic status of households in terms of assets, thus moving the process of poverty measurement from monetary – based measure to asset – based. Asset index method based on Principal Component Analysis is used to estimate poverty. This method allows to estimate headcount poverty indices and degree of inequality in the form of Lorentz Curve and it's numerical equivalent - Gini coefficient. Obtained results are consistent both with economic intuition and findings of previous studies. The main findings of the paper is that wealth is redistributed unequally: poor rural regions and relatively rich urban. Inequality will be reduced by addressing unequal distribution of income generating assets, there is a great necessity in the addressing assistance to the infrastructural development of rural regions.

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Chapter 1

INTRODUCTION

Adequate program to combat poverty requires precise identification of the poor people and appropriate measurement of the intensity of their poverty. The aim of this work is to provide welfare estimation for Ukraine. For this purpose we introduce the notation of infrastructural poverty, determine poverty line and than calculate absolute and relative poverty measures. Traditionally , Ukrainian poverty surveys use data rather on consumption then on income, taken from household budget surveys or other similar surveys. However, the choice of consumption expenditures is dictated by seasonal fluctuations in income, large fraction of unofficial earnings, and by the evidence of self –employment to a greater or lesser extent in agriculture.

In contrast, we provide alternative way of looking on the problem of poverty measurement based on asset index method, which is free of mentioned disadvantages. Our research is motivated by a number of measurement problems that prevent the use of monetary metrics (consumption and income) of welfare in developing countries. Proper and tailored use of consumption expenditures for construction of unified money metric requires precise and reliable information on the prices of consumed goods and services, data on nominal interest rates and depreciation rates of durable goods. Collection and consolidation of data on regional price indices and rental prices on housing requires considerable efforts and organization expenses due to regional diversity and disparity in economic development. There is also a purely data collection problem - recall bias, due to consumption expenditures surveys conducting on the basis of recall – several days (Sahn and Stifel 2002). The longer is the period of recall – the greater is the bias. All these problems involved in constructing monetary metric motivated us to use alternative approach for welfare assessment and designation.

In contrast we define economic status of households in terms of assets of wealth (durables) rather than in terms of monetary units (income and consumption). We use data on the ownership of assets and dwelling characteristics to create asset index. We perform the asset index method using data from the 2004 Household Budget Survey (HBS) collected by the National Statistical Committee of Ukraine which includes data regarding the ownership of different assets (consumer durables, household size and composition). The technique of the asset index method is based on the Principal Components Analysis (PCA) statistical procedure (Chatfield And Collins, 1980). Every asset is assigned a weight obtained through the dimension reduction technique (PCA). The score reflecting the socio-economic status of household is constructed using obtained weights for durables. We set the relative poverty line as an upper bound of the lowest 40 per cent quintile of the distribution of constructed household's scores (asset indices). Regarding taken poverty line various poverty measures are obtained.

In doing research we are not trying to answer exactly the question whether the asset index or consumption expenditures is a superior indicator of well –being. The main idea was to use Sen's (1986) conception of "entitlements", defined as a set of alternative commodity bundles which person can operate and accumulate in society and thus move from the expenditures based idea of poverty towards assets conception of poverty. We define assets based conception of poverty as "infrastructural" poverty. Few studies have tried to determine the extent to which the asset index is a good proxy for household consumption, because it requires a data set that has both information on household consumption and the components of the asset index. It is important to mention that up today there is no any research on poverty in Ukraine done by using this methodology of asset indices construction. Finally, we make conclusions with policy implications of our findings for poverty elimination policies and further research directions.

Chapter 2

LITERATURE REVIEW

Poverty is a serious problem in Ukraine which still remember it's relative prosperity during the epoch of "evil empire". Undoubtedly, extent of poverty changes every year and it is still very important subject. A PULSE study (2005) estimated proportion of Ukrainian population in poverty to be equal to 19 percent. Successful fight with poverty truly depends on it's precise measurement and revelation. The measurement of poverty involves two distinct problems (Kakwani 1993) . First one regards the specification of the poverty line, moreover after determination of poverty line it is necessary to construct an index to measure the intensity of poverty suffered by those below the line. The construction of poverty line always involves some creativity. At the beginning of 20th century researchers regarded poverty line as some minimum level of income that was necessary for sustaining physical existence. Rowntree's (1901) definition of poverty line is truly a nice example of those early definitions. . Rowntree considered the minimum necessary expenditure for the maintenance of physical health and minimum necessary for clothing, fuel and other sundries (Sanger, 1902). Also, he provided definition of "primary poverty", experienced by those families, which had their total earnings insufficient to obtain the minimum necessaries for the maintenance of merely physical efficiency . Bowley (1915) provided another poverty line as a modification of Rowntree's standard of the minimum cost of living for York in 1899 by drawing closer distinctions between the food consumption needs of the children and adopted the sampling method, only visiting about 5 per cent of houses in each town (Sreightoff, 1915). Nowadays we can observe evidence of evolution in the definition of poverty line. With the development of society and consideration of public goods, poverty line evolved to reflect minimum physical (food, housing, education, health care) and nonphysical (participation, social status, etc.) characteristics.

Sen (1983) developed the conception of "entitlements" , defining entitlements as a set of alternative commodity bundles which person can operate in society by means of rights and opportunities that one faces. So, there is interrelation between the conceptions of poverty and "entitlements". We should mention that there are a lot of difficulties in measuring poverty on the international level. In order to construct appropriate international poverty line, one should take in to account different exchange rates, different types of goods and their availability in various areas of our planet, inflation rates and of course, different human needs based on cultural, religious and geographical peculiarities. Also, national poverty lines tend to have higher purchasing power in rich countries in comparison with poor countries, because of usage of more higher standards than in poor countries (World bank, 1999). There are different international poverty lines used to measure poverty . For example, the World Bank uses $1 a day standard developed in 1990 *World Development Report*, measured in 1985 international prices and adjusted to local currency using purchasing power parities (World Bank, 1999). In the latest revision it has been updated up to $1.08 in constant 1993 PPP dollars (Chen and Ravallion, 2000). It might seems strange that given the inflation rates in the U.S. and in the world, the international poverty line have increased only by 8 percent, from $1 to $1.08. But Deaton (2000) argues that updating was carried by going back to the country poverty lines, and converting back to international dollars, so that increase comes because the PPP international dollar has became stronger relative to the poor country's currencies whose poverty lines are plugged into the international line. As an alternative, US International Development (USAID) uses US $150 in constant 1975 US dollars (AID, 1975). Some countries use different nutrition standards to determine poverty line with reference to what Ravallion (1998) refers to as " the nutritional requirements for good health". Such " nutritional" poverty line is defined as the level of income or expenditures which allows to meet required nutritional norms. For example, Ukrainian Government defines poor people, as those whose consumption is lower than a level sufficient to cover the cost of food basket of about 2500 calories per day, plus a significant allowance for non – food goods and services (PULSE, 2005). " This level of calories reflects the country's minimum caloric requirements according to the consumption patterns and the demographic composition of the population. The cost of this basket is UAH 151 per month in 2003 " (PULSE, 2005). Also, Ukrainian Government provided official methodology with a relative poverty line at the level of well – being that equals 75% of median expenditures (UCSR, 2003). It means, that using headcount index, every person whose expenditures fall below the level of well-being , will be considered poor. We should mention that poverty lines are generally biased, because according to it's conception non poor people are those whose income or expenditures are above the poverty line. However, Blackwood (1994) argues that poverty does not end instantly once additional dollar increases household's income beyond a discretely defined poverty line. Also, he suggests that it would be more appropriate and accurate to think of poverty as a continuous function of varying gradations, but from practical point of view it complicates a lot of things.

Another important problem except of establishing the appropriate poverty line is estimation of poverty and inequality by using adequate measures. According to Blackwood (1994) there are four categories of poverty measures: absolute poverty, relative poverty measures, absolute income measures and relatively inequality measures. Absolute poverty measures deal with the welfare of an individual who considered to be poor and does not depend on the well – being of the whole society. The most used absolutely poverty measures are: headcount index, poverty gap, Sen and Pa indices . Deaton (1997) regards headcount index as the most obvious starting point and defines it as the fraction of population below the poverty line. Headcount index can be defined as:

$$P_0 = \frac{1}{N}\sum_{i=1}^{N} 1_{(x_i < z)} \ ,$$

where $1(.)$ is an indicator function, z is a poverty line, x_i is a level of income or consumption of the i-th individual and N is the total number of individuals in the population. Poverty gap calculates the amount of income by which the poor fall short of the poverty line (Blackwood, 1994), and can be measured:

$$P_1 = \frac{1}{N}\sum_{i=1}^{N} (1 - \frac{x_i}{z}) 1_{(x_i \le z)}$$

Deaton (1997) makes conclusion that poverty gap may be increased by transfers from poor to nonpoor, or from poor to less poor who thereby become non poor, but transfers among the poor have no effect on the measure of poverty. Sen (1976) developed his own index, that can be used as the remedy for this problem by incorporating inequality, that is one of the most used absolutely poverty measures . It reflects the number of poor, the extent of their immiseration, and the distribution of income among the poor . Sen index is a combination of the headcount index, poverty gap and the Gini coefficient:

$$P_s = P_0 (1 - (1 - \gamma^p) \frac{\mu^p}{z}),$$

where μ^p is the mean of x among the poor, γ^p is the Gini coefficient of inequality among the poor, calculated by treating the poor as the whole population (Deaton , 1997). Blackwood defines Gini coefficient as the measure of inequality that is based on the Lorenz curve and it equals to the ratio of the area bounded by the Lorenz curve and the 45 degree line to the total area between the 45 degree reference line and the horizontal axes. Foster (1981) introduced the Pa poverty measure:

$$P_a = \frac{1}{N}\sum_{i=1}^{n}(g_i / z)^a ,$$

where: n= number of households below the poverty line

g_i - poverty gap of the ith household

N - total number of households

z - poverty line.

Headcount and poverty gap are special cases of Pa poverty measure corresponding to values for a of 0 and 1, respectively (Deaton, 1997).

While speaking about relative poverty measures, we should mention that in this case poverty is determined relative to the income of the whole population. One can be relatively poor comparatively to others in society, but both have income (or expenditures) higher than poverty line. Different countries have different relative poverty measures. According to Blackwood (1994) researches often are interested in the average income of the poorest 40% of the population or they can define relatively poor as those who posses 50% or less of the mean income.

Another crucial issue in measuring poverty is the decision to use an appropriate proxy for measuring welfare. It is possible to make a choice between taking income and consumption as a proxy variable. One of the most common approaches is to use data on income or expenditure flows over specific period. Bollen et al. (2001) indicates that Friedman's (1957) emphasis on the distinction between permanent and transitory income has led many researchers to reject proxy measures of permanent income and economic status such as current annual earnings, because income may vary greatly from year to year. Behrman and Deolalikar (1990) propose to use average income over several years to get a better measure. Fomenko (2004) argues that consumption is more preferable for measuring poverty in Ukraine, because of measurement bias – due to high taxation and black economy income is often underreported. Because a lot of workers in Ukraine get both official and unofficial salary, it is very difficult to collect precise data on the true income of the households. Moreover, income of households in agricultural regions is comparatively poorly reflected in official statistics about income. Also, Friedman (1957) suggested that consumption behaviour reflects permanent income because it is primarily driven by permanent income (Bollen et al. 2001). It is a well known fact that households tend to smooth their consumption from year to year. Deaton (1992) considers expenditures to be less variable than income and more reflective of long –term economic status, on his mind annual household expenditures may provide better permanent income proxies (Bollen et al. 2001). While using consumption as a proxy for estimation of the welfare, one should be aware of some disadvantages. When the estimation is to be provided for developing countries, the question about the capability for consumption smoothing of the households may appear (Bollen et al., 2001).

Household Budget Surveys (HBS) are the most often used data sources for providing poverty estimations. HBS provide very detailed information about household's economic status and structure. For example, 2004 Ukrainian HBS, collected by National Committee of Statistics has a sample of approximately 9400 households for 24 oblasts (regions). Simple calculation shows that there are approximately 390 observation for every region (oblast).

In many developing countries data set does not contain any information on income or consumption, or is of poor quality. Than data on household's ownership of assets (consumer durable goods) and dwelling quality is used to capture household economic status (Bollen et al. 2001). Usually it is easier to collect data on ownership of different assets than on either income or consumption. Montgomery et al. (2000) treats ownership of different assets as a proxies for the measure of household consumption. Baschieri et al. (2004) also apply an alternative method of welfare estimation, using data from the 1999

Census of Azerbaijan. This method is called asset index method and it allows to define economic status of households in terms of assets, rather than in terms of income or consumption (Baschieri et al. 2004). Asset index method is based on the principal components analysis. The principal component analysis (PCA) is a method of reducing the dimension and it is used to examine the relations between a set of correlated variables (Chatfield and Collins, 1980). PCA was originated in work by Karl Pearson and was further developed by Harold Hotellings and others. Each household was assigned a score generated through principal components analysis. Then those scores where arranged in decreasing order, and poverty measures were obtained.

Recently made poverty analysis in Ukraine defines poverty profile of our country (PULSE , 2005). This research indicates that around 19 percent of the population lived in poverty by 2003. Poverty incidence has declined recently after several years of rapid economic growth, from more than 30 percent in 2000 (PULSE, 2005). Also, this report underlines that reduction of poverty has been faster in Ukraine than in some neighboring countries, but the overall improvement has been paralleled by an increasing poverty gap between rural and urban households (PULSE, 2005). Another work on poverty measurement in Ukraine done by Hanna Fomenko uses probit model for estimation of the probabilities of being poor (Fomenko, 2004). Calculated marginal effects give the understanding of the specific characteristics of the households that increase probability to be poor. Fomenko defines three different poverty specifications: relative poverty, nutrition poverty and subjective poverty and concludes that correlation between these different kinds of poverty is low, so the poverty in Ukraine is not homogeneous. Also she regressed all these specifications on the explanatory variables (household socio - economic characteristics), using data from the household budget survey (HBS). The main conclusion of her analysis is that large households with low level of education and presence of unemployed members are in most danger of poverty. And also probability of being poor decreases with the economic growth in the region, with improvement in employment status of household's members (Fomenko , 2004).

All the researches done for Ukraine used the data on income or consumption expenditures, and provide estimates that are reliable on the regional (oblast) level, due to objective data constraints. However, taking into account problems connected with constructing monetary metric, there is a great necessity to take a look on the problem of definition of household's socio –economic status from the alternative point of view based on the ownership of various assets in order to avoid all the consumption based problems mentioned above.

Chapter 3

WELFARE ESTIMATION USING ASSET INDEX METHOD

Usually poverty and inequality analysis is based on income or consumption as preferred indicators of living standards (Deaton 1997; Deaton and Muellbauer 1980). It leads to the conclusion that researchers nearly always define utility a little bit narrowly – as a function of money (Sahn and Stifel, 2002). Also there is a common practice when income is used for measuring poverty in developed countries and consumption or expenditures for developing countries (Fomenko 2004). Researchers give relatively insufficient attention to the households' ownership of durables (assets) or to the inequality in possessing those assets among households or individuals. "Since meaningful poverty alleviation is largely predicated on the individual's ability to accumulate productive assets, and since income inequality will be reduced by addressing the unequal distribution of income generating assets, there is considerable merit in moving the process of poverty measurement away from solely expenditure – based measures towards a more assets – based form", Sahn and Stifel (2002). Also there are a lot of different drawbacks in using data on expenditures, such as choice of appropriate deflators, necessity to know precise values of goods consumed, difficulties in determining rental equivalent in housing. All the above difficulties with data on consumption push us to use alternative method of welfare measurement, based on the asset measurement. It is important to know that it is much more easier to measure assets in developing countries rather than consumption. Moreover, use of different durables or housing characteristics allows us not to be worried about problems of currency deflation (Sahn and Stifel, 2002). Thus, we use an asset index method as an alternative to traditional measures of poverty. With this technique the socio economic status of households is defined in terms of assets or wealth, rather than in terms of income or consumption. The 2004 Census and Household Budget Surveys in Ukraine included different questions about the ownership of consumer durables and materials used in the construction of the household and also demographic information concerning household size and composition. So, we deal with "multivariate" information on asset ownership of every household from the sample. The idea is to create uniform single – dimensional equivalent to multivariate vector of assets, called "asset index", which was mentioned by Gwatkin et al.(2000) . Thus it will give us the possibility to provide wealth ranking among the households possessing varieties of assets. A number of different methods is used for this purpose. The most straightforward and easiest way is to assign equal weights to the ownership of each asset and to take a sum of these weights for every household, thus ranking households accordingly to the sum of weights. However such approach has some disadvantages. For example, it assumes that having a radio has the same influence on the welfare of the household as having access to gas line. Hence it is not appropriate to use this additive method. Another possible solution is to put our own set of weights, such as prices of different assets, that could be used for constructing an index of household wealth. But, this method involves various problems that deal with availability of the prices of those different assets. As an alternative, we can use statistical technique of principal components analysis (PCA) in order to determine the weights for an index of the assets. PCA was originated in work by Karl Pearson around the turn of the previous century, and was further developed in the 1930s by Harold Hotelling and others (Chartfield and Collins, 1980). According to this method each household is assigned a weight or factor score generated through principal components analysis (PCA). It is used for examining relationship among a set of p correlated variables and also is useful to transform the original set of variables to a new set of uncorrelated variables (called principal components) and thus to reduce dimension. It is variable – directed technique that is appropriate when the variables arise 'equally', so, that we don't have dependent variable and several independent (explanatory) variables as in multiple regression. Thus the advantage of such approach is that PCA technique allows the reduction of the number of variables (dimensionality) without losing too much information. And it is achieved by creation of smaller number of variables which explain most of the variation in the original variables. This newly created variables (principal components) are uncorrelated and are the linear combinations of old ones.

There is a question whether PCA approach is really an appropriate procedure for wealth ranking. Several studies tried to search the range to which the asset index is a nice proxy for household consumption expenditures. Filmer and Pritchett (2001) proposed a method for estimating the effect of economic status on educational outcomes without direct survey information on income or expenditures. They constructed an index based on indicators of household assets, deriving them by the statistical procedure of principal components in order to solve so important problem of choosing the appropriate weights for the assets. Filmer and Pritchett used data from Indonesia, Nepal, and Pakistan which had both expenditures and asset variables. They showed that there is not only the correspondence between a classification of households based on the asset index and consumption expenditures but also that asset index is a better proxy for predicting enrollments than consumption expenditures. Bollen at al. (2001) examined the performance of proxy for economic status based on the asset index method. They found that there is a difference in outcomes while using proxies to direct estimation of poverty, but the choice of proxy variable using asset index for revealing influence on non –economic variables exhibit greater robustness than monetary proxies.

Taking into account the advantages of asset index method and lack of reliable data in on monetary values for Ukraine we made an attempt to apply PCA procedure to poverty (infrastructural) assessment in Ukraine.

C h a p t e r 4

METHODOLOGY

An illustration of Principal Component Analysis (PCA) is provided upon basis of the Chartfield and Collins (1980) and the main idea shortly is presented below. Suppose $X^T = \left[X_1,...,X_p\right]$ is a p – dimensional random variable (in our case p data on household asset) with mean μ and covariance matrix Σ. Our problem is to find a new set of variables, $Y_1,...,Y_p$ that are uncorrelated and whose variances decrease from first to last . Each Y_j (j-th principal component) is taken to be linear combination of the X's :

$$Y_j = a_{1j}X_1 + a_{2j}X_2 + ... + a_{pj}X_p = a_j^T\mathbf{X}, \quad (1.1)$$

where

$$a_j^T = \left[a_{1j},...,a_{pj}\right]$$

is a vector of constants. Also we impose condition :

$$a_j^T a_j = \sum_{k=1}^{p} a_{kj}^2 = 1.$$

This normalization procedure ensures that the overall transformation is orthogonal (distances in p- space are preserved).

The first principal component Y_1, is obtained by taking such a_1, that Y_1 has the largest possible variance. So, we choose a_1 so as to maximize the variance $a_1^T X$ s.t. $a_1^T a_1 = 1$. This approach is originally suggested by Harold Hotelling. The second principal component is found by choosing a_2 so that Y_2 has the largest possible variance for all combinations of the form of equation (1.1) which are uncorrelated with Y_1. Similarly, we derive $Y_3, ..., Y_p$, so as to be uncorrelated and to have decreasing variance.

Let's find the first principal component. We want to choose a_1 so as to maximize the variance of Y_1 subject to the normalization constraint that $a_1^T a_1 = 1$. So

$$\begin{aligned} &Var(Y_1) = Var(a_1^T \mathrm{X}) \\ &= a_1^T \Sigma a_1 \end{aligned} \tag{1.2}$$

We take $a_1^T \Sigma a_1$ as our objective function. Also, we use Lagrange multipliers method as a standard procedure for maximizing a function of several variables subject to one or more constraints. Applying this method to our problem, we have

$$L(a_1) = a_1^T \Sigma a_1 - \lambda(a_1^T a_1 - 1), \tag{1.3}$$

then, we have

$$\frac{\partial L}{\partial a_1} = 2\Sigma a_1 - 2\lambda a_1$$

Setting this equal to **0**, we have

$$(\Sigma - \lambda \mathrm{I})a_1 = 0 \qquad (1.4)$$

If equation (1.3) has a solution for a_1, other than the null vector, then λ must be chosen so that

$$|\Sigma - \lambda \mathrm{I}| = 0$$

Thus a non – zero solution for equation (1.4) exists if and only if λ is an eigenvalue of Σ. But Σ will generally have *p* eigenvalues, which all must be nonnegative as Σ is positive semidefinite. We denote the eigenvalues by $\lambda_1, \lambda_2, ..., \lambda_p$ and lets have assumption that they are distinct, so that $\lambda_1 > \lambda_2 > ... > \lambda_p \geq 0$. We have to choose one in order to determine the first principal component. Now,

$$\begin{aligned} Var(a_1^T \mathbf{X}) &= a_1^T \Sigma a_1 \\ &= a_1^T \lambda \mathrm{I} a_1 = \lambda \end{aligned} \qquad \text{using equation (1.4)}$$

We want to maximize this variance, we choose λ to be the largest eigenvalue, so we take λ_1. Then, using equation (1.4), a_1 which we are looking for must be the eigenvector of Σ corresponding to the largest eigenvalue.

The second principal component , $Y_2 = a_2^T \mathrm{X}$ is obtained similarly but with one extension. In addition to the scaling constraint that $a_2^T a_2 = 1$ we now have a second constraint that Y_2 should be uncorrelated with Y_1.

Now ,

$$\begin{aligned} &Cov(Y_2, Y_1) = Cov(a_2^T X, a_1^T X) = E\left[a_2^T (X-\mu)(X-\mu)^T a_1\right] \\ &= a_2^T \Sigma a_1 \end{aligned} \qquad (1.5)$$

This must be equal to zero. But since $\Sigma a_1 = \lambda_1 a_1$, an equivalent simple condition is that $a_2^T a_1 = 0$. We introduce two Lagrange multipliers λ and δ , and consider the function

$$L(a_2) = a_2^T \Sigma a_2 - \lambda(a_2^T a_2 - 1) - \delta a_2^T a_1 ,$$

and

$$\frac{\partial L}{\partial a_2} = 2(\Sigma - \lambda \mathrm{I})a_2 - \delta a_1 = 0 \qquad (1.6)$$

If we premultiply this equation by a_1^T, we obtain

$$2a_1^T \Sigma a_2 - \delta = 0$$

since $a_1^T a_2 = 0$. But from equation (1.5), we also require $a_1^T \Sigma a_2$ to be zero, so that δ is zero at the stationary points. Thus equation (1.6) becomes

$$(\Sigma - \lambda \mathrm{I})a_2 = 0$$

We see that this time we choose λ to be the second largest eigenvalue of Σ, and a_2 to be the corresponding eigenvector. Continuing this argument , the jth principal component has to be associated with the jth largest eigenvalue. In case when some of the eigenvalues of Σ are equal there is no unique way of choosing the corresponding eigenvectors, but as long as the eigenvectors associated with multiple roots are chosen to be orthogonal, then the argument carries through.

Lets denote the $(p \times p)$ matrix of eigenvectors by A, where

$$A = \lfloor a_1, ..., a_p \rfloor$$

and the $(p \times 1)$ vector of principal components by Y. Then

$$Y = A^T X$$

The $(p \times p)$ covariance matrix of Y will be denoted by Λ and is given by

$$\Lambda = \begin{pmatrix} \lambda_1 & 0 & ... & 0 \\ 0 & \lambda_2 & ... & 0 \\ ... & & & \\ 0 & ... & ... & \lambda_p \end{pmatrix}$$

We can express $Var(Y)$ in the form $A^T \Sigma A$, so that

$$\Lambda = A^T \Sigma A \tag{1.7}$$

gives the important relation between the covariance matrix of X and the corresponding principal components. Equation (1.7) can be rewritten as

$$\Sigma = A\Lambda A^T$$

since A is orthogonal matrix with $AA^T = \mathrm{I}$.

Eigenvalues can be interpreted as the respective variances of the different components. The sum of these variances is given by

$$\sum_{i=1}^{p} Var(Y_i) = \sum_{i=1}^{p} \lambda_i = trace(\Lambda)$$

But

$$trace(\Lambda) = trace(A^T \Sigma A) = trace(\Sigma A A^T)$$

$$= trace(\Sigma) = \sum_{i=1}^{p} Var(X_i)$$

Thus, we have important result that the sums of the variances of the original variables and of their principal components are the same.

The variables used in the analysis are measured in different scales (some of the variables are binary, some other categorical and some other continuous). This can lead to one variable having an excessive influence on the principal components simply because of the scale of measurement. To avoid this problem we will standardize original variables. So, that covariance of the standardized variables

$$X_1^*, X_2^*, ..., X_p^*$$

is simply the correlation matrix of the original variables. For the correlation matrix, the diagonal terms are all unity. Thus the sum of the diagonal terms (or the sum of the variances of the standardized variables) will be equal to p. Thus the sum of the eigenvalues of correlation matrix P will also be equal to p, so that the proportion of the total variation accounted for by the jth component is simply λ_j / p .

We should mention that the proportion of variance explained by the first principal components will depend on the number of variables included in the analysis. So, we will try to include all the variables related to household economics for constructing an household asset, because it will give us more regular distribution of households across quintiles.

C h a p t e r 5

DERIVATION OF PRINCIPAL COMPONENTS FOR ASSET INDEX METHOD

We perform asset index method using data from Household Budget Survey (HBS) collected in year 2004 by The National Statistical Committee of Ukraine. For our analysis we have chosen 20 variables of "first necessity" such as type of dwelling, total living area, heating system, gas supply, access to piped and hot water, ownership of telephone, number of land plots and so on. Table 1 presents descriptive statistics of the taken variables which are to be potential components of the asset index. Table 1 shows mean, standard deviation, minimum and maximum values of the asset variables. For example, variable "type of house" describes different types of dwelling ownership and has 5 possible values: own apartment, communal flat, individual house, part of house or dormitory. Majority of variables has two values: " 1 " if the household owns the asset and " 0 " if does not. We took this variables because we regard them as assets of first necessity that are very crucial in the conception of infrastructural poverty.

Table 1. Ownership of assets and basic household characteristics, HBS 2004

Variable (a_{ij})	Mean x_i	Std. Dev. s_i	Min	Max
Type of house	2.164901	1.073243	1	5
Total area (square meters)	57.12868	22.21393	0	238
Total living area (sq. meters)	38.46227	16.55547	7	180
Number of rooms	2.52488	.986123	1	9
Age of housing	3.277796	1.422996	1	6
Period of last housing's renovation	5.231354	1.411328	1	6
Heating system	.3926164	.4883588	0	1
Private heating	.3108614	.462871	0	1
Water supply	.5959337	.4907367	0	1
Sewerage system	.5708935	.4949751	0	1
Hot water	.2767255	.4474035	0	1
Water boiler	.1362226	.3430431	0	1
Gas line	.6036383	.4891674	0	1
Gas cylinder	.2664526	.4421273	0	1
Electric oven	.0281434	.1653913	0	1
Bathroom	.518138	.4996976	0	1
Telephone	.4208668	.4937246	0	1
Land plot	.6685928	.4707443	0	1
Number of land plots	1.09267	.9856498	0	3
Rural household	.6406635	.4798317	0	1

Each household asset from the above table is assigned a weight which we generate through principal components analysis. Also a dummy variable (with values 0 and 1) was included for rural and urban area, because it captures some part of the local variation due to differences of asset ownership and housing characteristics due to the place of residence. Because we have 20 asset type variables, it gives us 20 dimensioned space, which is impossible to imagine by simple visualization . As it was already mentioned, PCA allows us to reduce the number of variables and thus dimensionality without losing too much information in the process (Baschieri, 2004). It is achieved by creating a smaller number of variables (in our case one variable) that explain most of the variation in the original variables and upon which we can judge about socio- economic status of the households.

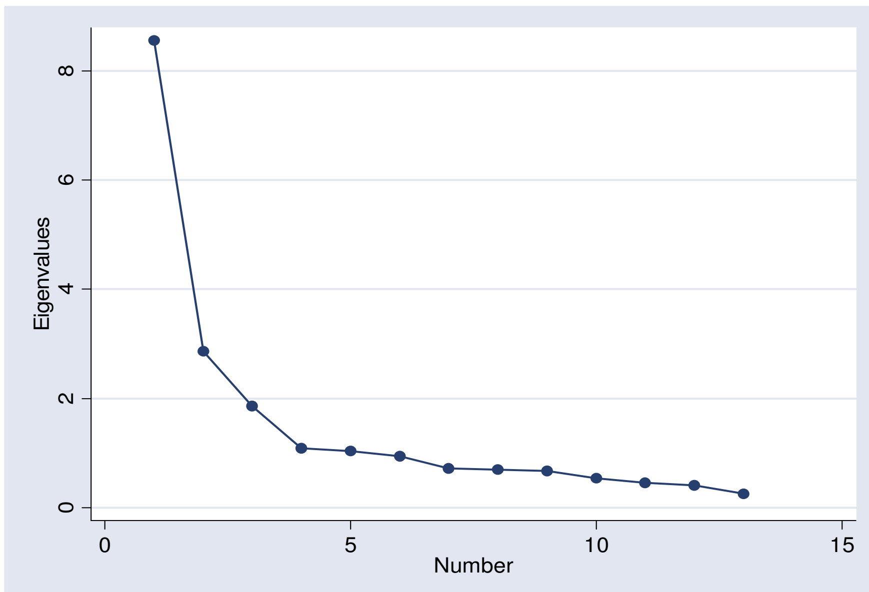
We take those 20 asset variables (presented in Table 1 above) and than calculate principal components (Y_j) by solving maximization problem (1.3). We obtain principal components by taking such a_{ij} from (1.1) for which Y_j has the largest possible variance. Solving maximization problem by Lagrange multipliers method brings us to calculating eigenvalues and corresponding eigenvectors of the covariance matrix of the vector of assets. Table 2 presents the results of our first computations. It shows eigenvalues ranked in decreasing order correspondingly to values of principal components. According to methodology eigenvalues are equal to variances of corresponding principal components. From the Table 2 we can see proportion of variance explained by each principal component. According to Baschieri (2004): "the first principal component is a linear index of variables with the largest amount of information common to all variables". As we can see from the Table 2, first component (Y_1) corresponds to the largest eigenvalue ($\lambda = 8{,}54658$) and explains almost 41 % of the variance of the original variables (assets in 20-dimensional space). Second principal component (Y_2) corresponds to the second largest eigenvalue ($\lambda = 2{,}85644$) and explains only 13 % of the variance. Further we can see more dramatic decrease in the proportion of explained variance – fifth principal component explains only 5 % of variance.

Table2 : Total variance explained by each component

Component	Eigenvalue	Difference	Proportion	Cumulative
Y_j	λ			
1	8.54658	5.69014	0.4070	0.4070
2	2.85644	0.99853	0.1360	0.5430
3	1.85792	0.76578	0.0885	0.6315
4	1.09213	0.05894	0.0520	0.6835
5	1.03319	0.08979	0.0492	0.7327
6	0.94340	0.22401	0.0449	0.7776
7	0.71939	0.02312	0.0343	0.8119
8	0.69627	0.02257	0.0332	0.8450
9	0.67371	0.13706	0.0321	0.8771
......	....	....	....	....
16	0.15577	0.03589	0.0074	0.9826
17	0.11988	0.00418	0.0057	0.9883
18	0.11570	0.02822	0.0055	0.9938
19	0.08748	0.04488	0.0042	0.9980
20	0.04259	0.04259	0.0020	1.0000
21	0.00000	0.000000	0.0000	1.0000

For convenient visualization Table 2 can be graphically represented by Figure 1. The plot in Figure 1 shows the proportion of variance explained by each principal component, on the x –axis are the components and the y – axis depicts the eigenvalue of each component.

Figure 1: Plot for results of principal components



We consider only first principal component due to sharp decrease in proportion of explained variance. The corresponding eigenvector is the vector of weights ($\overline{a}_1 = (a_1,...,a_{21})$). Vector $\overline{a}$ is taken such that Y_1 has the largest possible variance and it defines the weights of explanatory variables in forming the principal component (see (1.1)). Having the corresponding weights for each explanatory variable gives us possibility to calculate asset index for each household from the sample.

Here is the formula that is used for calculating the asset index (A_i) for the i-th household:

$$A_i = a_1(x_{i1} - x_1)/s_1 + ... + a_N(x_{iN} - x_N)/s_N, \quad (1.8)$$

where a_1 is the eigenvector for the first asset as determined by the procedure, x_{i1} is the ith household's value for the first asset and x_1 and s_1 are the mean and standard deviation of the first asset variable over all households. This formula shows the role of the assets characteristics in forming the level of welfare (asset index) computed according to our methodology. Table 3 shows the results on components that form asset index: mean values of explanatory variables, standard deviations, eigenvector (weights) and scores in case of ownership or lack of one or another asset. For asset variables which take only the values of zero or one, the weights have an easy interpretation. A move from 0 to 1 (if household does not own or owns first asset) changes index by a_1/s_1.

For example a household that owns a telephone has an asset index higher by 0,324 than that one that does not. Being a rural household lowers the index by 0,323. Columns (6) and (7) from Table 3 shows the changes in the asset index due to ownership of each asset. Having an access to hot water increase the asset index by 0,409 and gives the score on 0,56 higher than to those household without hot water. Using gas cylinder lowers the index on 0,329 and the difference in the value of index between those households that use gas cylinder and those that don't is almost 0,450. Household that has access to water supply has an asset index higher on 0,229 and less on 0,339 if it does not have access. Those scores shows the sign and value of the influence on index while having different assets. Heating system, sewerage system, hot water supply and gas line are the most significant assets in forming the index because their ownership gains the most to asset score. Ownership of electric oven is significant too (asset score higher on 0,382 in case of ownership) and it is because almost all households which own electric ovens live in urban areas, in comparatively recently built apartments (starting from 1980th).

For variables "type of housing", "age of housing" and "period of last housing renovation" we included dummies separately for each value in order to capture differences between different outcomes. These results are given in Table3.1.

Table3: Scoring factors and summary statistics for variables entering the computation of the first principal component

Variable	(2) Mean x_i	(3) Standard Deviation s_i	(4) Scoring factor (eigenvector) $\bar{a}$	(5) Scoring factor/ Std. Deviation	(6) Score if they have asset	(7) Score if they don't have asset
Type of house*	**2.164901**	**1.073243**	**-0.58616**	**-0.55**	*	*
Total area (square meters)	**57.12868**	**22.21393**	**-0.12521**	**-0.0056**	**	**
Total living area (sq. meters)	**38.46227**	**16.55547**	**-0.14053**	**-0.0084**	**	**
Number of rooms	**2.52488**	**.986123**	**-0.11863**	**-0.12**	**	**
Age of housing *	**3.277796**	**1.422996**	**0.14122**	**0.099**	*	*
Period of last housing's renovation*	**5.231354**	**1.411328**	**0.11738**	**0.0831**	*	*
Heating system	**.3926164**	**.4883588**	**0.30922**	**0.633**	**0,384**	**- 0,249**
Private heating	**.3108614**	**.462871**	**-0.13495**	**-0.2826**	**- 0,195**	**0,088**
Water supply	**.5959337**	**.4907367**	**0.27914**	**0.5685**	**0,229**	**- 0,339**
Sewerage system	**.5708935**	**.4949751**	**0.28811**	**0.5819**	**0,250**	**- 0,332**
Hot water	**.2767255**	**.4474035**	**0.25320**	**0.5654**	**0,409**	**- 0,156**
Water boiler	**.1362226**	**.3430431**	**0.07877**	**0.2296**	**0,199**	**- 0,031**
Gas line	**.6036383**	**.4891674**	**0.19895**	**0.4067**	**0,161**	**- 0,246**
Gas cylinder	**.2664526**	**.4421273**	**-0.19892**	**-0.4499**	**- 0,329**	**0,120**
Electric oven	**.0281434**	**.1653913**	**0.06491**	**0.3926**	**0,382**	**- 0,011**
Bathroom	**.518138**	**.4996976**	**0.29268**	**0.5857**	**0,283**	**- 0,303**
Telephone	**.4208668**	**.4937246**	**0.15998**	**0.3240**	**0,188**	**- 0,136**
Land plot	**.6685928**	**.4707443**	**-0.27288**	**-0.5797**	**- 0,192**	**0,387**
Number of land plots	**1.09267**	**.9856498**	**-0.26841**	**-0.2723**	**	**
Rural household	**.3593365**	**.4798317**	**-0.24245**	**-0.5053**	**- 0,323**	**0,181**

** **:** Household score for type of house are calculated as follow: asset factor score* (type of house – mean)/standard deviation .

The same applies for number of land plots, total and living area, number of rooms, age of housing and period of last renovation.

* : We provide separate Table (3.1) for variables with discrete set of values and include dummy variables for every outcome.

Table 3.1: Scoring factors and summary statistics for dummy variables entering the computation of the first principal components

Variable	(2) Mean x_i	(3) Standard Deviation s_i	(4) Scoring factor (eigenvector) $\overline{a}$	(5) Scoring factor/ Std. Deviation	(6) Score if they have asset	(7) Score if they don't have asset
Type of house:						
Own apartment	**0.4434**	**0.49681**	**0.30961**	**0.6232**	**0.3470**	**-0.2763**
Communal flat	**0.0055**	**0.07408**	**0.01648**	**0,2225**	**0.2213**	**-0.0012**
Individual house	**0.50668**	**0.49998**	**-0.30673**	**-0,6135**	**-0.3027**	**0.31085**
Part of individual house	**0.33963**	**0.18114**	**-0.02973**	**-0.1641**	**-0.1084**	**0.0557**
Dormitory	**0.0104**	**0.10145**	**-0.03627**	**-0.3575**	**-0.3538**	**0.00372**
Age of housing:						
1940– 1949	**0.14582**	**0.35295**	**-0.07811**	**-0.2213**	**-0.1890**	**0.03227**
1950– 1959	**0.16196**	**0.36843**	**-0.08579**	**-0.2329**	**-0.1952**	**0.03772**
1960– 1969	**0.22298**	**0.41627**	**-0.03360**	**-0.0807**	**-0.0627**	**0.01799**
1970– 1979	**0.23572**	**0.42447**	**0.06766**	**0.1594**	**0.1218**	**-0.0376**
1980– 1989	**0.18350**	**0.38710**	**0.09905**	**0.2559**	**0.2089**	**-0.0470**
1990– 1999	**0.04171**	**0.19993**	**0.03060**	**0.1531**	**0.1467**	**-0.0064**
Period of last housing's renovation:						
Before 1970	**0.03178**	**0.17543**	**-0.04222**	**-0.2407**	**-0.2331**	**0.0076**
1970– 1979	**0.04291**	**0.20267**	**-0.05634**	**-0.2780**	**-0.2661**	**0.0119**
1980– 1989	**0.09578**	**0.29430**	**-0.07522**	**-0.2556**	**-0.2311**	**0.0245**
1990– 1999	**0.13452**	**0.44975**	**-0.07624**	**-0.1695**	**-0.1467**	**0.0228**
2000– 2004	**0.14201**	**0.45574**	**-0.07315**	**-0.1605**	**-0.1377**	**0.0228**
Never	**0.81046**	**0.48935**	**0.08189**	**0.16734**	**0.0317**	**-0.1542**

From table 3.1 we can see that asset score of the household that lives in it's own apartment is higher on 0,3470 and it's score is in general lower on 0,2763 if household lives in other types of housing (see columns (6) and (7)). Living in dormitory decreases asset score on 0,3538. Ownership of the individual house influences negatively on the household asset index (less on 0,3027) that can be explained by the fact that majority of individual houses are located in rural regions, while apartment houses are mainly located in urban regions. Column (5) shows the difference in score between having an asset or not. For example, regarding "period of last housing's renovation" we can say that the difference in asset score between the household that live in the dwelling that has never been renovated and the household whose house has ever been repaired is 0,16734 : score is higher on 0,0317 if the renewal has never been done and on 0,1542 less if the renewal has ever been done. In general we should mention that high age of housing influences negatively on asset indices (till year 1970), while living in households built after 1970 positively influences on asset scores. Living in renovated houses brings negative impact on asset score and the degree of negative influence lowers with decreasing of the period of last reconstruction. By analyzing the results from Table 3.1 we came to conclusion that the household that lives in dormitory built in 1950th and renovated in 1970th has the lowest asset score and thus has higher probability to be 'infrastructuraly" poor.

Those scores were summed for every household , indices were calculated by formula (1.8) and households ranked according to their corresponding indices. So, we have sample distribution of household's scores in descending order, that is used to create the breakpoint that defines wealth quintiles as follows. We divided the sample of households into population quintiles. Wealth quintiles are expressed in terms of quintiles of households in the population. Table 4 shows the quintile boundaries of the asset index. It is very important to provide poverty profile that characterizes the poor and distinguishes their attributes from the non – poor.

Table 4: Quintile of asset index, 2004 Household Budget Survey

Variable	Obs	Percentile	Centile	95% Confidence Interval	
				lower bound	upper bound
Asset index	**9345**	**20**	**-2.870701**	**-2.898994**	**-2.83758**
		40	**-1.779024**	**-1.854437**	**-1.684997**
		60	**1.649112**	**1.338771**	**1.869132**
		80	**3.64617**	**3.611118**	**3.671555**

We can't define poverty line in monetary terms. Moreover, there is no common agreement in the literature about the poverty lines for asset index method (poverty lines for infrastructural poverty). Taking into account literature on relative poverty measures, especially Blackwood (1994), we came to conclusion that it would be appropriate to set the poverty line as an upper bound of the lowest 40 per cent quintile of the distribution of household's population indices for the whole sample as it was particularly done by Baschieri (2004) for Azerbaijan . Thus, the index value – 1,78 is taken as a break point (see Table 4, centile value that equals –1.779024) . Household whose index is equal to the break point value -1,78 is from rural region of Zakarpatska oblast. It has it's own house built in 1970s without renovation (4 rooms ,total area equals 110 sq. meters and living area 56 sq. meters) and it uses gas cylinder for heating and boiling the water. Also, this household does not have a telephone and owns two land plots.

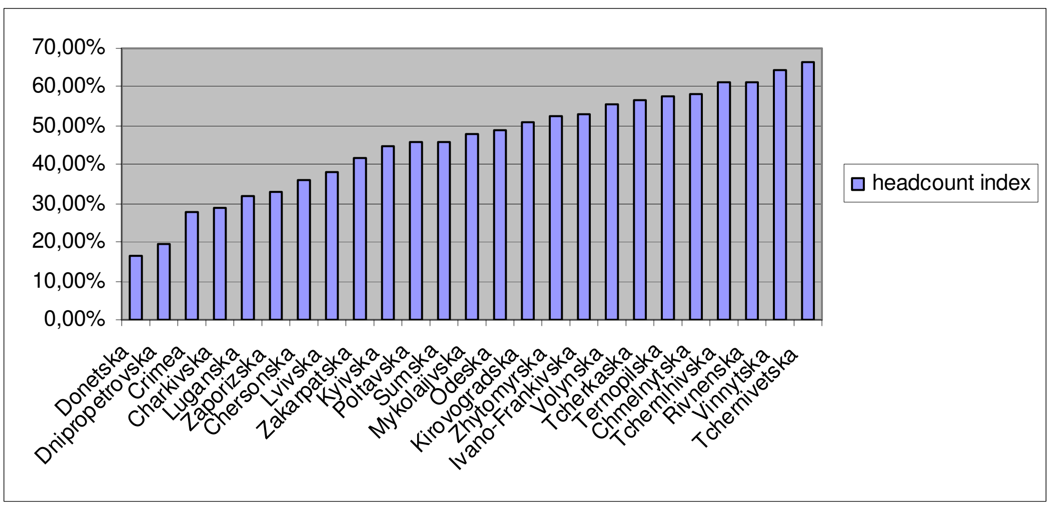
Then on the basis of the taken poverty line, using rural and urban dummies used in the asset index we draw Lorentz curves and calculate headcount indices and Gini coefficients separately for urban and rural regions. I Table 5 below shows a breakdown of headcount index by rural and urban areas. We should mention again that this table reflects levels of "infrastructural" poverty that might be conceptually different than monetary based index.

Table5: Headcount indices for rural and urban areas, 2004 Household Budget Survey

Administrative Units (oblasts)	Rural Regions	Urban Regions	Ukraine (total)
Crimea	53%	10%	28%
Vinnytska	95%	26%	65%
Volynska	90%	25%	56%
Dnipropetrovska	75%	5%	20%
Donetska	72%	9%	17%
Zhytomyrska	88%	23%	53%
Zakarpatska	64%	6%	42%
Zaporizska	85%	12%	33%
Ivano-Frankivska	77%	24%	53%
Kyivska	81%	11%	45%
Kirovogradska	77%	35%	51%
Luganska	87%	24%	32%
Lvivska	95%	5%	38%
Mykolaijvska	92%	18%	48%
Odeska	96%	15%	49%
Poltavska	80%	10%	46%
Rivnenska	89%	32%	61%
Sumska	80%	26%	46%
Ternopilska	86%	20%	58%
Charkivska	75%	17%	29%
Chersonska	68%	17%	36%
Chmelnytska	91%	25%	58%
Tcherkaska	92%	17%	57%
Tchernivetska	96%	19%	66%
Tchernihivska	89%	30%	61%
Kyiv (capital of Ukraine)	n/a	2 %	n/a

On the basis of Table 5 we observe that the poorest oblasts in Ukraine are Tchernihivska (61% of households below poverty line), Tchernivetska (66 %), Chmelnytska (58 %), Ternopilska (58 %), Rivnenska (61 %), Ivano –Frankivska (53 %), Volynska (56 %) and Vinnytska (65 %). The lowest level of poverty is in more urbanized and industrially developed eastern regions: Donetska oblast (17 %), Dnipropetrovska (20 %), Zaporizska (33 %), Luganska (32 %) and Charkivska (29 % of households below poverty line). Kyiv as the capital of Ukraine and it's administrative and financial centre is definitely an outlier from the common statistics: 2 % of households below poverty line among the urban regions. All these indices are shown on Figure 2 for more convenient comparison.

Figure 2: headcount index of "infrastructural" poverty in Ukraine, 2004 HBS

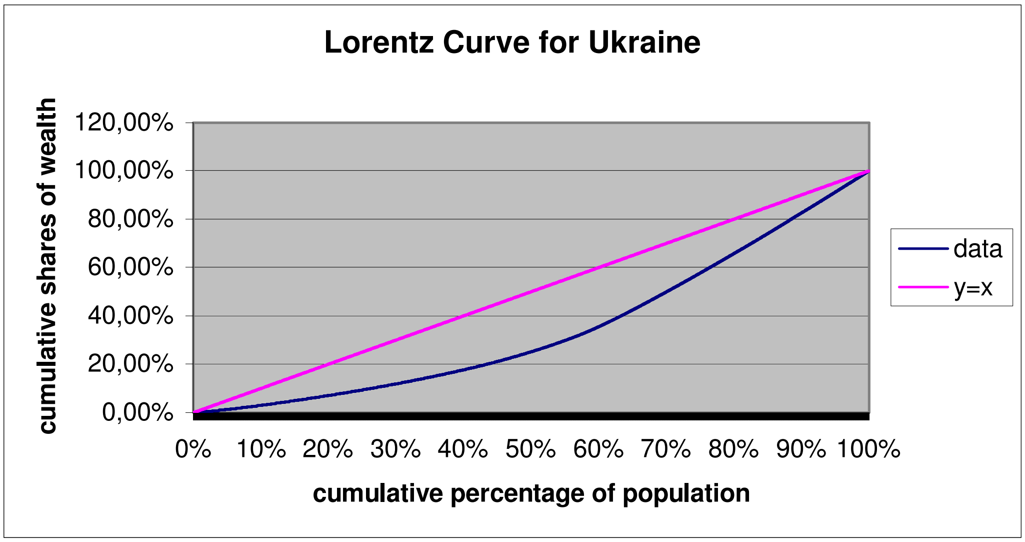


In addition Table 5 shows the levels of "infrastructural" poverty separately for urban and rural regions. Analysis of poverty in rural regions shows large fraction of extremely poor oblasts: Tchernivetska and Odeska (96 %), Tcherkaska (92 %), Lvivska (95 %), Vinnytska (95 %), Volynska (90 %) and Mykolajivska (92 %).

Rankings by the asset index show rural households to be less "wealthy" than do conventional poverty measures (PULSE, 2005). Huge gap between rural and urban households reflects unbalanced industrial growth coupled with increased activities in construction and services. There is an explanation for this divergence. Because many of the asset variables depend on the availability of the access to infrastructure (sewerage system, gas supply, hot water), households from urban areas have the higher possibility (probability) to find themselves among wealthier households. And it is because of the better developed infrastructure in urban regions. We can observe geographic picture of infrastructural poverty: more urban and industrialized Eastern region has lower poverty rates than those in more rural and agricultural Western ones. But also, we can judge on this table that standard poverty measures made using income or consumption approach underestimate the difference between rural and urban households by not adjusting consumption expenditures for the price differentials for services provided by infrastructural assets. It means that though household can have very high level of expenditures it should not necessarily imply that this household should be more wealthier than other with lower level of expenditures, because substantial fraction of expenditures can be spent on the absent assets. For example, household that does not have it's own house should rent it and thus it's expenditures become substantially higher. This phenomena can be another argument to support using asset index method.

Another important issue is to analyze inequality of redistribution of wealth among population. For this purpose we construct Lorentz curves. Figures 3, 4 represent Lorentz curves for Ukraine, in the whole, urban and rural regions respectively. The Lorentz curve is graphical representation of the relationship between the cumulative shares of wealth (on the vertical axis) and the cumulative percentage of population (on the horizontal axis) (Blackwood, 1994). From Figure 3 we can see that 45 % of Ukrainian population control only 20% of the total wealth within Ukraine. In rural regions households from the highest (fifth) population quintile control almost 40 % of the wealth redistributed among rural regions(see Figure 4, (b)), while in urban region 40% of population control only 20% of goods.

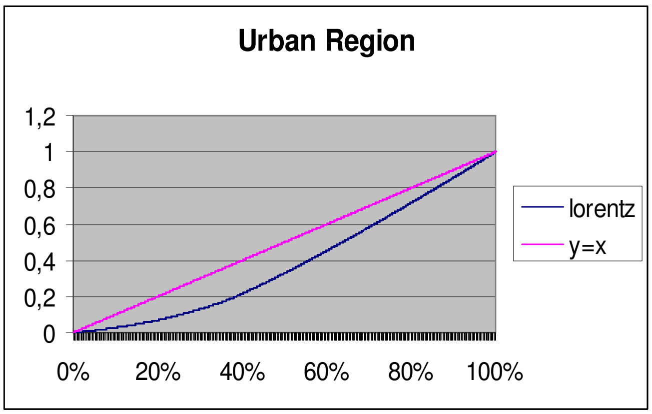
Figure 3: Lorentz curve for Ukraine, 2004 Household Budget Survey

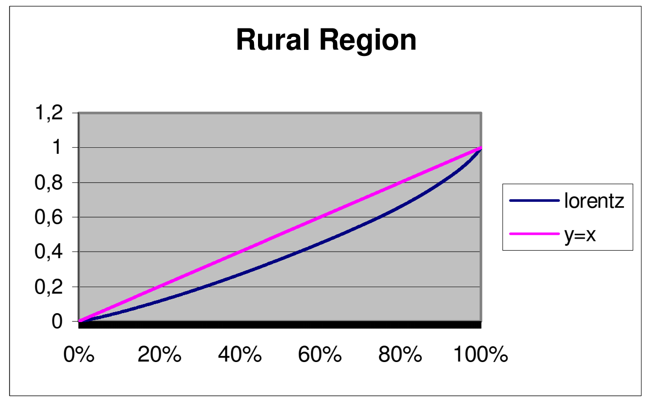


Lorentz curves for urban and rural regions have such distinctive features: degree of curvature is biased to the right in rural regions (Figure 4, (b)) and biased to the left in urban regions (Figure 4, (a)). It shows the different degrees of inequality: higher inequality among households from the lowest quintiles in urban regions and among households from the highest quintiles in rural region.

Figure 4: a) Lorentz curve for Urban Region; b) Lorentz Curve for Rural Region,
2004 Household Budget Survey

a) **b)**





For numerical measurement of inequality in Ukraine, we calculate Gini coefficients. The Gini coefficient is a measure of inequality based on the Lorentz curve being it's numerical reflection. According to Blackwood (1994) it is the ratio of the area bounded by the Lorentz curve and the 45 degree line (denoted on graphs as y=x) to the total area between the 45 degree line reference line and the horizontal axes. It's value varies between zero and one. The larger is the value of the coefficient the higher is the degree of inequality. According to our data for Ukraine, Gini coefficient is equal to 0,31. Coefficients for urban and rural regions were calculated separately: 0,23 for urban and 0,22 for rural. Thus, we can conclude that inequality is lower in rural and urban regions than all over Ukraine: population in rural regions is equally poorer and in urban is equally wealthier.

Chapter 6

CONCLUSIONS AND FURTHER POLICY IMPLICATIONS

As it is shown by recent studies (PULSE , 2005) and verified by our own research, poverty remains a very serious problem for Ukraine. Recent years Ukrainian Government makes consistent steps oriented on the improvement of it's programs of minimal social security by making it more transparent and simpler. Provision of the addressing help to the poorest population became the top priority task for the Ukrainian Government. According to World Bank (2003) materials Ukraine has four main directions of social security programs: (i) privileges that are not addressed on the support of poor; (ii) housing help assigned to support families which are not capable to pay for housing and communal services; (iii) direct family assistances; (iv) social allowance to the poorest of the poor. Nowadays, the question of the social security program efficiency remains opened for discussions. While speaking about efficiency of the current social security system we should mention the necessity to restructure the programs and financing in order to reach the goal – poverty reduction. According to the World Bank analysis of the addressing help to the poorest in year 2000, social assistance was not organized in a proper way (World Bank, 2001). On one hand poor population got only 12,6 % of expenditures on privileges while non- poor obtained almost 87,4 %. More than 50% of poor population did not get housing aid, allowances on kids and assistance in case of unemployment. On the other hand, 43% of non – poor population received at least one kind of addressing help. Moreover poor and non – poor people received approximately the same sums of social security allowances and non – poor population received 50 % more subsidies and three times higher sum of privileges . However in spite of inefficiency, social security programs assisted in poverty reduction in Ukraine (World Bank, 2003). At the same time the influence of social programs on poverty reduction decreased almost on 1% from 1999 to 2001. It happened even despite of increase of the assistance volume from 1,15 % of GDP to 1,47% (World Bank, 2003). There are two most indicative measures of efficiency in the practice of targeting assistance: inclusion and exclusion errors. Inclusion errors characterize fraction of non – poor households that obtain assistance, while error of exclusion determines those fraction of poor households that do not obtain aid. Assistance resources are redistributed with substantial errors of inclusion to the non – poor families in the context of the social security program. At the same time, this program of assistance does not reach poor households due to significant errors of exclusion. Program of housing subsidies is much more wider and theoretically should have smaller errors of exclusion. However, in reality exclusion errors did not become smaller. According to World Bank (2003) survey three quarters of households that obtained housing subsidies were not really poor. Among the poor households 81 % did not get subsidies.

Thus above analysis affirm that in order to increase efficiency of the social security system it is very necessary to provide changes and improvements in the structure of the government assistance program . First of all it is important to reject the use of privileges as an instrument of social security, because professional privileges provision is addressed to relatively well - off skilled workers and according to World Bank (2003) analysis, influences negatively on the wealth redistribution. Privileges are the least oriented instrument on the poverty reduction. Though social privileges are not directly assigned for assistance to poor people, they draw out costs that could be used for aid to poor people. The main negative feature of all the assistances programs lies in their targeting (capability to reach poor households precisely). Provision of targeting assistance is done by the government on the basis of monthly income per person. If total income is revealed incorrectly, social assistance can be unjustified given to too much number of households which constitutes danger from the point of view of financing social security programs. For example, if the social assistance was granted on the basis of total expenditures than the portion of eligible for assistance households would be bounded by 3,5 % of the whole quantity (World Bank, 2003). Assuming that expenditures in monetary form correspond to total real income (total expenditures) than almost 17 % of all households would have the right to get target social assistance. According to World Bank's (2003) estimations, if social aid is given on the basis of money income than the portion of potential assistance recipients would be higher in 4 times than the fraction of those who really need the aid and meet the requirements of the program. Majority of households in Ukraine regularly underdeclare their income and this fact is typical for all kinds of households. Also, non-monetary income increase total consumption up to the level that significantly exceed real monetary expenditures and especially exceed the level of declared monetary income.

Thus we again deal with the problems involved in using the data on income. Before there were considered problems of collecting the precise data on income: seasonal fluctuations, large fraction of unofficial earnings, "recall" bias and self – employment in rural regions. Now, social security authorities face the problem of income underdeclaration and thus the problem of targeting the eligible for assistance households. Alternative poverty designation through conception of "infrastructural" poverty in the framework of asset index method gives us the possibility to look on the social security program from the other side. Principal Components Analysis applied in the asset index method determines the significance of the assets in forming the asset – based poverty profile of the household. The significance of the assets lies in the magnitudes of the weights of the ownership of each asset. These results provide us with the tools of unofficial verification of the means of living by using alternative asset – based measures of welfare in order to avoid problem of underdeclaration.

Based on the given analysis of poverty in Ukraine and government social security programs, we can conclude that poverty alleviation should be more concentrated on the overcoming of inequality of wealth (income) redistribution and rise of individual's ability to accumulate productive assets. According to Sahn and Stifel (2002) income inequality will be reduced by addressing the unequal distribution of income generating assets. It means that due to inefficient costs spending within the social security program, it's basis should be shifted to more asset – oriented form. Government should spent more money on the development of infrastructure, thus alleviating "infrastructural" poverty and providing individuals with income generating assets. On the basis of our research we can conclude that top priority regions that require immediate government investments are rural regions of Vinnytska, Volynska, Zhytomyrska, Lvivska, Tchernigivska, Tcherkaska, Tchernivetska and Odesska oblasts. Resources should be spent on development of gas supply system (gas lines), heating systems, hot water supply, building new housing and improvement of sewerage system. Government's investment oriented on alleviating of unequal redistribution of above assets would significantly decrease "infrastructural" poverty in rural regions and provide population with income generating goods of first-necessity. Only after that, government can pay intent attention on the redistribution of more luxurious goods of "second" necessity, such as cars, TV, computers, access to internet, etc.

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