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Poverty in Moldova

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Capstone

"Poverty in Moldova"

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Executive Summary

Moldova is the poorest nation in Europe and the Moldavian society has one of the highest degrees of economic inequality among the former Soviet states. Official statistics as well as the World Bank poverty reports suggest that the number of people who live below the absolute poverty line is around 30%. However as this research proves, in reality poverty is a **massive phenomenon** in Moldova characteristics to the whole country, and the real poverty rate **exceeds 70%** for both rural and urban areas.

Although poverty is the most stringent problem in Moldova, the research on this issue is *very scarce*, since it had been done primarily due to the initiatives of the international organizations such as the World Bank and the UNDP. However the international experts who analyzed poverty issue in Moldova had not been sufficiently familiar with particular country aspects and moreover they had used a standardized methodological approach to research poverty, based specifically on the **absolute poverty line** methodology. The use of the absolute poverty line currently is significantly scrutinized within academic literature because of many aspects, specifically since absolute poverty line employs the concept of purchasing power equivalence that is not very well defined and not appropriate for poverty assessment[1]. Thus, the use of this estimator had introduced a significant bias in previous poverty research on Moldova and it had substantially underrepresented the real situation of this phenomenon.

Thus, I decided to research poverty phenomenon in Moldova since I felt that I can make a research contribution in this important research area. Moreover the research will eventually help Moldavian decision makers to promote more effective poverty alleviation policies in Moldova.

The research specifically targets the areas that had not been sufficiently studied before such as:

- The location problem and specifically the regional distribution of poverty phenomenon, which part of Moldova is more affected by poverty, and how this could be explained?
- Gender characteristics of the poverty phenomenon in Moldova, are females more or less affected by poverty phenomenon than males?

The research had used primarily parametric statistical methods since the Household Budget Survey contained a sample of 6121 observations, which is more than enough to justify the use of parametric methods, specifically:

- Paired t-tests;
- Chi-square test, Mantel-Haenszel Chi-Square, and Likelihood Ratio Chi-Square;
- Contingency tables.
- Hypothesis testing;
- Power analysis;
- Analysis of variance between groups (one way ANOVA);

However, the non-parametric methods had been used as well, specifically during the analysis of variance between groups (one way ANOVA) procedure since the equal variances of the groups is

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[1] "How not to count the poor", Sanjay G. Reddy, Thomas W. Pogge, www.worldbank.org

one of the basic assumptions of the parametric ANOVA technique. Wilcoxon, Kruskal-Wallis, and Van der Waerden One-Way Analysis tests had been used during non-parametric ANOVA.

The primary audience of this research consists of national and regional decision makers who are involved in the implementation of the Economic Growth and Poverty Reduction Strategy in Moldova.

The actual benefits achieved due to research`s findings are:
- A more efficient allocation and prioritization of the limited governmental resources are expected to take place due to the reseach`s findings;
- Facilitation of the Economic Growth and Poverty Reduction Strategy implementation;
- More studies are expected to be promoted in the field of poverty in Moldova;

The research has the potential to overcome many stereotypes regarding poverty phenomenon in Moldova that persists public mindset, and to become a powerful tool for national and regional decision makers to promote effectively poverty alleviation policies.

The poverty estimator dilemma

There are several estimators used to measure poverty level in Moldova elaborated independently by: the Ministry of Economy (ME), the World Bank, and the National Bureau of Statistics (NBS). All three institutions developed their measures on the basis of Household Budget Survey, which is a national survey conducted monthly by NBS. However, poverty line estimators are different since these institutions use a specific approach and methodology to elaborate them.

The ME and the World Bank apply conceptually similar methods for estimating poverty rates, and both of them are using the definition of *absolute poverty line*. Although assumptions made by the ME and the World Bank are reasonable, they are slightly different. Specifically the World Bank excludes some expenditure from consumption, adjusts consumption by region for differences in price of food, puts consumption on a per capita basis and applies a slightly lower assumption for minimum calories (2100 comparing with ME estimates of 2282 kilocalories per capita per day)[2]. In 2004 The World Bank used poverty rate $2 (US dollars) a day.

The ME however includes all consumer expenditures including housing and utilities. It also computes consumption per adult equivalent, where household size is adjusted for the level and composition of household size. At the same time the Ministry of Economy food poverty line is the cost of purchasing enough food to supply 2,282 kilocalories per person per day. The Ministry of Economy absolute poverty for 2004 constituted 327 lei per month.

The National Bureau of Statistics however does not use the definition of poverty line, but the **minimum existence level, or minimum of subsidence**. We did not find a specific definition of the minimum of existence although we requested it several times through their internet based

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[2] Moldova: Poverty Update, 2006, Document of World Bank.
http://www.worldbank.org.md/WBSITE/EXTERNAL/COUNTRIES/

communication system. However, it could be concluded from the official NBS statistical reports that the minimum subsistence level is the strict level of consumption, which includes food expenditures as well as non-food items. The minimum subsistence level is calculated for rural and urban areas separately, and it is higher within urban areas since the cost of living in urban areas specifically the price for food as well as non-food items is on average higher comparing with rural areas. Moreover, non-food expenditures are a higher percentage of total consumption in urban areas.[3] The minimum of existence level is also reported separately for males, females and children, which makes it a more convenient poverty estimator compared with the Ministry of Economy and the World Bank poverty lines.

Our research will use the **minimum of existence level** to study the phenomenon of poverty in Moldova. Why is the minimum of existence level a better poverty estimator comparing with poverty line calculated independently by the Ministry of Economy and by the World Bank estimates?

1. The World Bank estimate, i.e. absolute poverty line, is currently severely scrutinized in the economic literature for many reasons such as: the Bank uses an arbitrary international poverty line that is not adequately anchored in any specification of the real requirements of human being. Also, the poverty line employs a concept of purchasing power "equivalence" that is neither well defined nor appropriate for poverty assessment[4], according to some reviewers.

2. The minimum of existence level is a better poverty estimator since it captures *the full extent and complexity* of poverty phenomenon in Moldova. This is true, since the minimum of existence takes into account both food and non-food items a person requires to consume in a given time period. Moreover, the minimum of existence

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[3] www.statistica.md

[4] "How not to count the poor", Sanjay G. Reddy, Thoman W. Pogge, www.worldbank.org

takes into account urban and rural, as well as gender and age dimensions of the consumption phenomenon. The World Bank and the Ministry of Economy poverty lines do not have these advantages, and this implies that a significant bias would be committed while researching poverty through them.

Poverty assessment methodology

The poverty level in Moldova will be assessed via a consumption approach, since this approach is more reliable and widely used in poverty research worldwide. *The minimum of existence level will be the primary poverty estimator*, which is the minimum consumption level, expressed in money value lei, per capita and it is reported quarterly by the NBS[5].

The minimum existence level is the total amount of lei a person needs to cover his/her essential food and non-food expenditures. EC_CAPIT is the consumption expenditures per capita, variable that will be primary used to research poverty phenomenon in Moldova. Thus, both measures, the minimum of existence and consumption expenditures per capita, are expressed in money value and refer to individual consumption, and thus it is legitimate to use consumption per capita and minimum of existence level to assess the poverty (both the Ministry of Economy and The World Bank had researched the poverty phenomenon using the expenditures per capita variable).

Geographical characteristics of poverty phenomenon in

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5 National Bureau of Statistics uses minimum existence level and to assess poverty phenomenon in Moldova.

Moldova

Poverty – primary rural or urban phenomenon in Moldova?

To determine whether poverty **is or is not** a primary rural or urban phenomenon is one of central scientific questions in any poverty research. All poverty studies done so far in Moldova, suggested that poverty is mostly a rural phenomenon in Moldova, specifically that:

- "Those who live in urban areas are better off than their rural counterparts, both in term of relative and absolute poverty"[6], i.e. suggesting that poverty is primarily a rural phenomenon in Moldova.

- "The relative number of poor people is much greater in rural Moldova compared to urban areas, and is markedly low in Chisinau compared to the rest of the country."[7] Thus, the last statement clearly localizes the poverty problem suggesting that it is a primarily rural phenomenon in Moldova.

In this part of research we are interested to determine if indeed poverty is a *primarily rural* phenomenon in Moldova. One way to support the view that poverty is a primarily rural phenomenon in Moldova is to recall that after the fall of Soviet Union rural economy in Moldova had deteriorated drastically primarily because of the inability of the Government to facilitate and promote economic development in rural areas. Agriculture had and continues to be the main economic activity of people who live in rural areas and many Moldavian farmers are striving with poverty since prices paid to Moldovan farmer have been far below international prices, and because of the restriction on exports to Russia[8].

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[6] "Moldova Poverty Assessment", World Bank country report, November 1999.
[7] "Moldova Poverty Assessment", World Bank country report, November 1999, p.11
[8] "Moldova: Poverty Update", 2006, Document of World Bank, VIp.

However urban areas should not be significantly better off than rural areas since the economic crisis Moldova had experienced after the fall of Soviet Union *had a cascade effect* drastically deteriorating economical standards of workers, teachers and many other social categories within rural and urban areas as well.

Moreover, poverty had become *a large scale phenomenon* in Moldova, both within rural and urban areas, after Russian financial crisis 1998 that had downsized national economy very much. This crisis had irreversible economic effects on countries that had very close trade ties with Russia, such as Moldova. Moreover, this 1998 crisis had trigged a steep increase in poverty rate as well as generated massive emigration of the skilled workers and young generation, mostly to Russia and Western European countries.

More recently, Russia had provoked the second economical crisis in Moldova (March 2006), when it ceased all imports of alcoholic and agricultural products from Moldova. This had a catastrophic impact on especially on wine making industry, since almost 80% of the wine output had been exported to Russia.

Well-being and economical standards of Moldavian people had been dramatically reduced in the last decade. This would support our view that low living of standards are characteristic not only to the rural areas but also to urban areas, and thus poverty is not a phenomenon characteristics only to rural areas, but to urban localities as well. To identify if there is a difference between poverty rates within rural and urban areas, we decided to take a sub-sample of the HBS, particularly the data for December, 2004.

The data for December is most suitable with out research purpose since it does not require inflation adjustment. The NBS reports quarterly the minimum of existence level, and thus the data for December does not require inflation adjustment. Using the data for December at worst would somewhat under-represent the phenomenon of poverty in Moldova, and not would over-represent

it.

According to National Bureau of Statistics the minimum subsistence level in 2004 (average for both rural and urban territories) constituted - **679.9** lei per month. However, the minimum subsidence level differs between urban and rural regions, and for urban areas it amounted **784.2 lei** per month, while for rural areas it constituted **607.8** lei per month[9].

To determine if there exists a difference between urban and rural poverty level and to study how significant is this difference, we decided to subset HBS December observations into two groups: **rural and urban group**, and identify the percentage of people who live below minimum of existence level within urban and rural areas.

Results:

> ➢ Within the sample of **urban areas**, almost **73%** of the households lived below minimum of existence. Sample consisted of 210 observations;

> ➢ However, within the sample of **rural areas**, almost **77%** of the rural households achieved consumption expenditures per capita below the minimum of existence. Sample consisted of 309 observations;

Conclusion: Both rural and urban localities in Moldova have a very high poverty level. Although in urban areas less households live below the minimum of existence level than in rural areas, this difference is only 4%. Such a small difference between rural and urban poverty level significantly weakens the statement that that poverty is mostly a rural phenomenon in Moldova, and that people who live in urban areas are better off than their rural counterparts, i.e. poverty is not a primary characteristic of the rural areas.

Almost **74%** of the Moldavian households achieved consumption expenditures per capita below the minimum of existence, which for rural and urban areas constituted (679.9 lei per

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[9] www.statistica.md

month). According to the Ministry of Economy, the official poverty level in Moldova for 2004 constituted only **26.5%**[10], which is almost 1/3rd of the real poverty level.

Our next inquiry is to determine if rural and urban groups have statistically different means of consumption expenditures per capita. The means' location is important to identify since this would reveal how significantly different are the distributions of the consumption per capita between rural and urban groups.

Our a priori assumption is that consumption expenditures per capita within urban areas must be statistically significantly greater that consumption expenditures per capita within rural areas. We will perform a **paired t-test** to test this assumption.

Testing the difference between means of paired samples is used when at least one of the following assumptions is not satisfied:

> ➤ Each sample is independent of the other.

> ➤ Both samples are from normally distributed populations.

> ➤ The variances of both samples are equal.[11]

We can not assume the existence of *independence* between urban and rural populations because of multiple reasons such as: a person from rural area could earn his/her income and/or spend for consumer products in urban area, or vice versa. Moreover, the independence assumption is an idealized statistical assumption which is rarely satisfied in the social research, and thus it is even safer and more accurate to use paired t-test comparing with t-test for independent samples.

Null hypothesis: The means of consumption expenditures per capita between rural and urban areas are the same, thus the percentage of people who live below minimum of existence is the same among rural and urban areas.

The alternative hypothesis: The mean of consumption expenditures per capita in urban

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[10] "Moldova: Poverty Update", 2006, Document of World Bank, 1p.
[11] Joseph G. Monks, Byron L Newton, "Statistics for business" Second edition. 317p.

areas is greater than the mean of consumption expenditures per capita within rural areas, thus the percentage of people who live below the minimum of existence is higher among rural areas comparing with urban areas.

Two Sample Paired t-test for the Means of EC_CAPIT_U_1 and EC_CAPIT_U_2

Sample Statistics

Group	N	Mean	Std. Dev.	Std. Error
EC_CAPIT_U_1	210	670.1379	469.57	32.404
EC_CAPIT_U_2	210	476.2179	342.72	23.65

Hypothesis Test

Null hypothesis: Mean of (EC_CAPIT_U_1 - EC_CAPIT_U_2) <= 0
Alternative: Mean of (EC_CAPIT_U_1 - EC_CAPIT_U_2) > 0

t Statistic	Df	Prob > t (P-value)
4.728	209	<.0001

Power Analysis

Alpha	Sample Size	Observed Power
0.050	210	0.999

Where - E_CAPIT_U_1 – population from urban area.

Where - E_CAPIT_U_2 – population from rural area.

Result:
Since the p-value for the test is less than 0.001 we reject the null that the means of consumption expenditures per capita in urban areas are equal with expenditures per capita in rural areas. However, we do not reject the alternative that the two means are indeed different and mean of consumption expenditures per capita for urban areas is higher than the mean of consumption expenditures per capita for rural areas.

Conclusion: There is statistical sufficient evidence to conclude that the mean of consumption per capita in urban areas is higher than the mean of consumption expenditures per in rural areas. However since there a different minimum of existence level for urban and rural areas

the means location determination does not reveals sufficient information regarding the percentage difference of poor people in urban and rural areas.

Until now, we had shown that there is indeed a statistical significant difference between urban and rural areas regarding expenditures for consumption per capita, and our next inquiry is to determine how big is this amount?

For this purpose we will use again the paired t-test procedure. Our hypothesis are formulated as follows:

The null hypothesis: The difference between expenditures for consumption per capita between urban and rural areas is 125 Lei.

The alternative hypothesis: The difference between expenditures for consumption per capita between urban and rural areas is greater than 125 Lei.

Two Sample Paired t-test for the Means of EC_CAPIT_U_1 and EC_CAPIT_U_2

Sample Statistics

Group	N	Mean	Std. Dev.	Std. Error
EC_CAPIT_U_1	210	670.1379	469.57	32.404
EC_CAPIT_U_2	210	476.2179	342.72	23.65

Hypothesis Test

Null hypothesis: Mean of (EC_CAPIT_U_1 - EC_CAPIT_U_2) <= 125
Alternative: Mean of (EC_CAPIT_U_1 - EC_CAPIT_U_2) > 125

t Statistic	Df	Prob > t
1.680	209	0.0472

Power Analysis

Alpha	Sample Size	Observed Power
0.050	210	0.512

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Result:

The p-value less than 5% significance level suggests that we need to reject the null hypothesis that the difference between urban and rural expenditures for consumption per capita equals with 125 Lei. However the test does not reject the alternative hypothesis that the difference between urban and rural expenditures for consumption per capita is greater than 125 Lei. (The actual difference is 126 at alpha-level 0.0496).

Conclusion: Although the minimum of existence in urban areas is **784.2** lei per month, and in rural areas is **607.8** lei per month thus the difference is **176.4** lei per month, however the actual difference between mean expenditures for consumption per capita in urban and rural areas is lower and amounts **126** lei per month.

Why is it legitimate to compare these numbers? Both numbers are averages. Thus, we would expect that the difference between expenditures for consumption within urban and rural areas *would tend to be approximately the same* as the difference between minimum of existence in urban and rural areas (since the minimum of existence is *per se* also a measure of mean). But **176.4** lei per month, which is the difference between the minimum of existence levels in urban and rural areas, is indeed significantly higher than **126**, the difference between mean expenditures for consumption per capita, thus it is more that **50** lei per month. Moreover, the urban sample mean for expenditures per capita is **194 more** than the sample mean for expenditures in rural areas, which is almost 70 units more than t-test value 126. *How could this be explained?*

The minimum of existence level is a **weighed mean**, which implies that it takes into account the percentage of people who live in different areas. In 2004, almost **50%** of the total urban population lived in Chisinau, while the over half of urban population lived in other cities (according to the NBS the total population in Moldova on January 1, 2005 constituted **3386** thousand people from which, **1308.8** or **38.7%** lived in urban areas, and **2077.2** or **61.3%** lived in

rural areas. The total urban population constituted 1308,8 and 647,7 live in the capital[12], 49.5% of the total). Thus, because of the fact that almost **50%** of the urban population live in Chisinau, the minimum of existence estimator for the urban areas *will largely reflect the situation in the Moldavian capital* and the minimum of existence level for urban areas will tend to under-represent the real situation within the remaining 35 urban localities. However the paired t test procedure, used to determine the difference between means of consumption expenditures per capita in urban and rural areas, does not take into account the percentage of people who live in different areas, and this explains why the difference between the means expenditures per capita in urban an rural areas is less than the minimum of existence of urban and rural areas.

The use of the minimum of existence level introduces significant bias in statistical analysis when poverty phenomenon is researched within all urban localities except the Moldavian capital. However a better measure does not exist at the moment and we will continue to use this estimate.[13]

Thus, our next question could be formulated in the following way – *Is there a statistical significant difference between mean of consumption expenditures within urban areas, except Chisinau, and rural areas*? There is a need to perform a new paired t-test that will test the difference between consumption expenditures per capita between urban and rural areas, except the Moldavian capital.

Our a priory assumption is that there **should not be** a statistically significant difference between the mean of consumption expenditures per capita in rural and urban areas, except Chisinau, since population which live in the capital occupies a significant percent within urban population and their consumption expenditure level per capita, and overall living standards are substantially higher than in urban area such as: Balti, Cahul, Edinet or other cities.

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[12] **www.statistica.md**
[13] In fact, to respect the scientific rigor, we would need to have a unique minimum of existence for each primary sampling unit, but since practically is very expensive, we will use the tools that already exist.

Null hypothesis: The means for consumption expenditures per capita in urban (except Moldavian capital) and rural areas are the same.

Alternative hypothesis: The means of consumption expenditures per capita in urban (except the Moldavian capital) and rural areas are not the same, specifically the mean of consumption expenditures within urban areas, except Chisinau, is higher than the mean of consumption expenditures within rural areas.

Two Sample Paired t-test for the Means of EC_CAPIT_exept_chisinau_U_1 and EC_CAPIT_exept_chisinau

Sample Statistics

Group	N	Mean	Std. Dev.	Std. Error
EC_CAPIT_exept_chisinau_U_1	115	495.6057	264.04	24.621
EC_CAPIT_exept_chisinau__U_2	115	487.8765	382.36	35.655

Hypothesis Test

Null hypothesis:
Mean of (EC_CAPIT_exept_chisinau_U_1 - EC_CAPIT_exept_chisinau__U_2) <= 0

Alternative:
Mean of (EC_CAPIT_exept_chisinau_U_1 - EC_CAPIT_exept_chisinau__U_2) > 0

t Statistic	Df	Prob > t
0.169	114	**0.4329**

Result:

Since the p-value 0.43 much higher than alpha-level 5%, the test does not reject the null hypothesis that the means for consumption expenditures per capita in urban (except the Moldavian capital) and rural areas are the same, and do reject **with strong confidence** the alternative hypothesis that the means of consumption expenditures per capita in urban (except the Moldavian capital) and rural areas are not the same. Specifically this means that the mean of consumption expenditures within urban areas is higher than the mean of consumption expenditures within rural areas.

Conclusion: There is sufficient statistical evidence to state that means of consumption

expenditures per capita within urban areas except Chisinau and rural areas are equal.

What does it mean in terms of poverty level within rural and urban areas, except Chisinau? Consumption expenditures per capita variable has almost the same distribution within rural and urban localities, except Chisinau. Moreover, since urban minimum of existence level is higher than the rural poverty estimator, and since people from rural areas have more possibilities to supplement their consumption due to *domestic economy (primarily due to land and animals)*, it follows that people from urban areas, except Chisinau are even more affected by poverty phenomenon comparing with their rural counterparts.
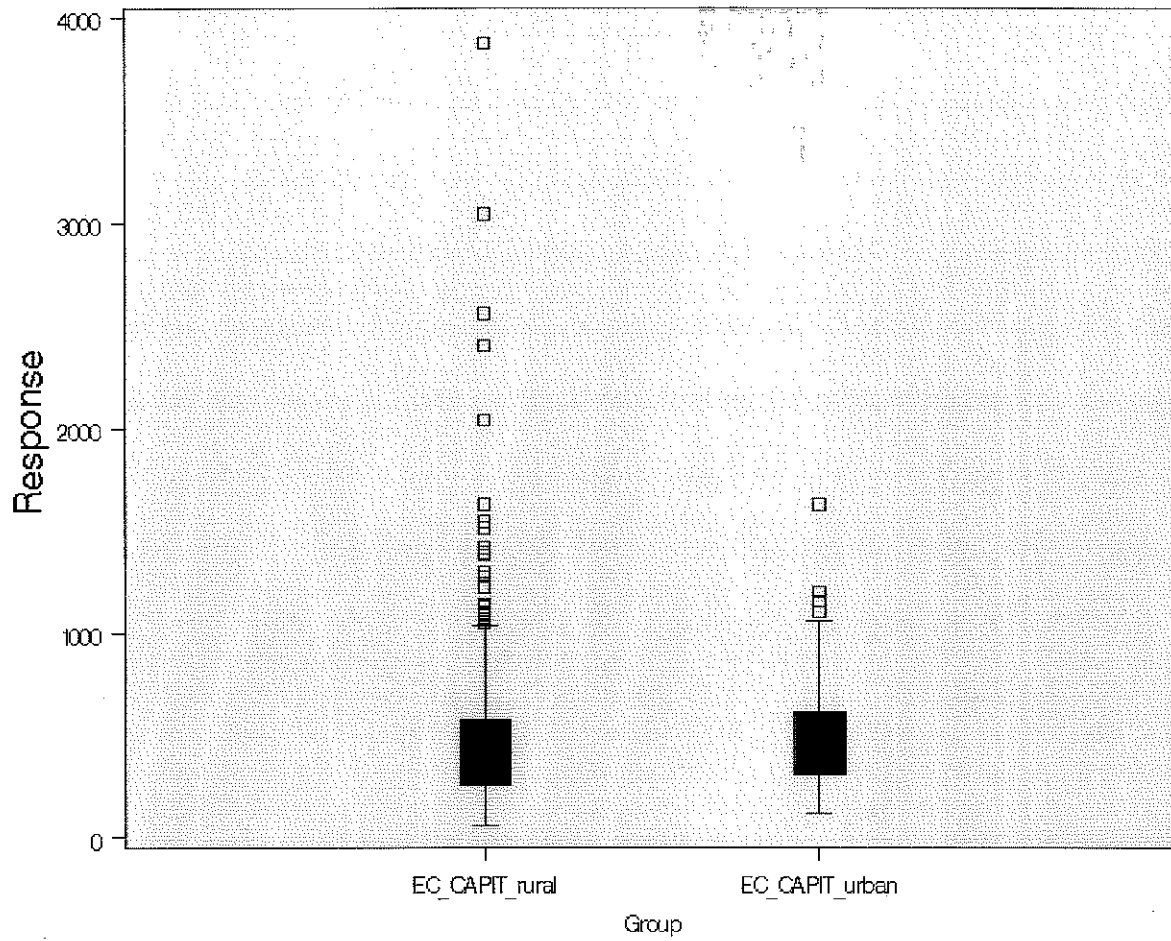
The distribution of consumption expenditures per capita by within urban and rural areas

Where:

- EC_CAPIT_rural – consumption expenditures per capita within rural areas.

- EC_CAPIT_urban - consumption expenditures per capita within urban areas.

Moreover, this result makes significantly weaker the statement that poverty is a rural phenomenon in Moldova, as we had seen it is not the case. However this finding strengthens the statement that **poverty is indeed a phenomenon characteristic for the whole country except the capital – Chisinau.**

Poverty within Moldavian regions

As we had seen, poverty is a major characteristic for **both** urban and rural areas in Moldova, except Chisinau. However an effective national strategy aimed to fight poverty would need to correctly allocate limited public resources according to some well established priorities. That is why an important purpose of a poverty research is to identify the most needful geographical areas and social stratus that will eventually be targeted by poverty alleviation initiatives.

Thus, to determine whether there exists a difference in poverty level between different regions of Moldova, i.e. where **the primary focus** of poverty alleviation policies should be, is the primary goal of our next section.

Traditionally Moldavian territory had been divided into three regions, specifically North,

South, and Central region. HBS includes 46 primary sampling units which are representative for the whole country. Although HBS territorial variable has 46 units, the 36th unit in not defined at all the in the survey and does not appear in the dataset, thus the 36th territorial unit will be omitted in the analysis.

We decided to group the territorial variable according to Northern, Central and Southern region of Moldova as follows, listing by towns, raions (counties):

> **Northern region**, includes the following primary sampling units: Briceni, Grimancauți; Donduşeni; Drochia, Chetrosu; Drochia, Sofia; Edineț, Bratuseni; F ăleşti, Calugar; Glodeni, Hîjdieni; Ocnița; Ocnița, Grinăuț; Bălți; Edineț; Edineț, Gloria; Ocnița, Ocnița; Bălți.

> **Central region**, includes the following primary sampling units: Anenii Noi; Călăra ş, Hîrjauca; Călăraşi, Volocineț; Hîncesti, Bujor; Nisporeni, Ciuciuleşti; Orhei; Orhei, Cucuruzeni; Straşeni, Vorniceni; Teleneşti, Negureni; Ungheni; Ungheni, Pîirlița; Chişinău unit 1, Chişinău unit 2 Chişinău unit 3, Chişinău unit 4, Chişinău unit 5, Chişinău unit 6, Chişinău unit 7, Chişinău unit 8, Chişinău unit 9; Hînceşti, Boghiceni; Ialoveni, Bardar; Straşeni.

> **Southern region**, includes the following primary sampling units: Cahul, Rosu; Cantemir, Carpeşti; Căinari, Carbuna; Căinari, Caşcalia; Comrat; Comrat, Beshlama; Ştefan Vodă, Feştelița; Cahul.

The map of Moldova

Although there are a total of 45 primary sampling units, representative for the whole country, the central region is overrepresented comparing with northern and southern regions. Thus, **24 primary sampling units** within the sample are drawn from central region (53% of the total), **14 primary sampling units** come from Northern region (30%), Southern region is represented by the remaining **8 primary sampling units** (17%).

However, the overrepresentation of central region could be explained due to the fact that more population is concentrated around Chisinau, which is located within central part of Moldova, and Northern region is more densely populated than with Southern region. Thus, the overrepresentation of central region could change the picture for the whole country and thus biased research` results.

To determine whether there is a difference between poverty level in Northern, Central and Southern regions of Moldova, the analysis of variance (ANOVA) will be performed. Since the dataset has a large sample size, the central limit theorem justifies to use normality assumption, and thus to perform ANOVA.

The basic assumptions of the analysis of variances are the following[14]:

> The random errors in the jth observation under the ith treatment are normally distributed. The F test, like the t test, remains approximately valid for moderate to large samples from moderately nonnormal distributions.

> The error variance is constant. Fortunately, if there are an equal number of observations in each group, the F test is not strongly affected.

> The random errors in the jth observation under the ith treatment are independent.

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[14] "Mathematical Statistics and Data Analysis", Third Edition, John Rice, 485p.

The null hypothesis: There is not a statistical significant difference between the means of consumption expenditures per capita within Northern, Central and Southern region of Moldova (symbolically Northern region – 1, Central region – 2 and Southern region - 3), i.e. poverty rate must be the same within these regions.

The alternative hypothesis: At least two means of consumption expenditures per capita are different between Moldavian regions, i.e. poverty rate differs between Northern, Central and Southern region of Moldova.

The ANOVA Procedure

Welch's ANOVA for EC_CAPIT

Source	DF	F Value	Pr > F
TERRIT_recoded	2.0000	17.18	<.0001
Error		322.5	

The ANOVA Procedure

Level of TERRIT_recoded	N	----------EC_CAPIT---------- Mean	Std Dev
1	165	531.714110	393.724656
2	258	643.813079	517.671404
3	96	415.395656	225.669105

Power Analysis

Variable	Dependent Source	Alpha	Power
EC_CAPIT	TERRIT_recoded	0.05	0.987

Where:
      TERRIT_recoded 1 – Northern regions.
      TERRIT_recoded 2 – Central region.
      TERRIT_recoded 3 – Southern region.
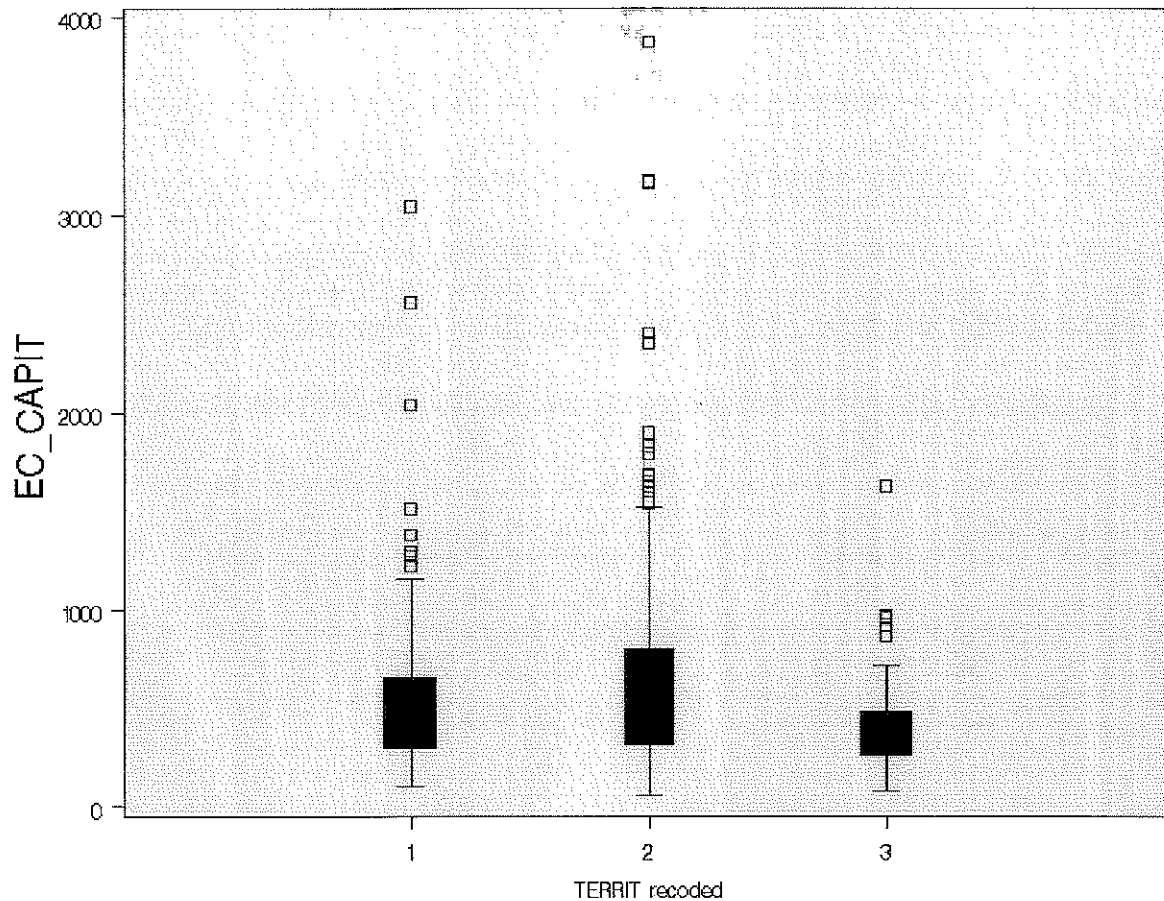
Box plot of the consumption expenditures per capita by region

Where:

> ➢ TERRIT_recoded 1 – Northern region
>
> ➢ TERRIT_recoded 2 – Central region
>
> ➢ TERRIT_recoded 3 – Southern region

Result:

The insignificantly small p-value of the F test, less than 0.0001 strongly suggests that the test rejects the null hypothesis that there is not a statistical significant difference between means of consumption expenditures per capita within Northern, Central and Southern region of Moldova. However, the test does not reject the alternative hypothesis that at least two means of consumption

expenditures per capita are different within Moldavian regions, i.e. **poverty rate indeed differs between Northern, Central and Southern region of Moldova**.. *The power of the test suggests that there is only less than 1.7% chance to commit type II error, i.e. that we would not reject the null hypothesis when it is false, or not to reject the alternative when it is true.*

Conclusion: There is sufficient statistical evidence to state that at least two means of expenditures per capita within Moldavian regions are different, i.e. poverty rate is different between at least two regions. Central region obtains the highest consumption per capita level 643 lei per month, the mean of consumption expenditures per capita within Northern region is 532 lei per month, and the smallest level of consumption expenditures per capita is achieved within Southern region 415 lei per month.

We decided to run a non-parametric version of analysis of variance, specifically one-way layout. This is so, since the normality assumption is not a assumption for non-parametric techniques.

The basic assumptions of the non-parametric analysis of variance are as follows[15]:

> The N random variables ($X_{1j}, X_{2j}, ..., X_{n_j j}$), j = 1, ..., k are mutually independent.

> For each fixed j $\in$ (1, ..., k) the n_j random variables ($X_{1j}, X_{2j}, ..., X_{n_j j}$) are random sample from a continuous distribution function F_j.

> The distribution functions $F_1, ..., F_k$ are connected through the relationship $F_j(t) = F(t - \tau_j)$, $-\infty < t < \infty$, for j=1, ..., k where F is a distribution function for a continuous distribution with unknown median θ and τ_j is the unknown treatment effect for the jth population.

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[15] "Nonparametric Statistical Methods", Myles Hollander, Douglas A. Wolfe, Second Edition, 1999.

However the hypothesis retains their previous formulations as in the parametric version.

The NPAR1WAY Procedure

Analysis of Variance for Variable EC_CAPIT
Classified by Variable TERRIT_recoded

TERRIT_recoded	N	Mean
1	165	531.714110
2	258	643.813079
3	96	415.395656

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Among	2	3933556.16295	1966778.081	10.2373	<.0001
Within	516	99132961.30407	192118.142		

Average scores were used for ties.

The NPAR1WAY Procedure

Wilcoxon Scores (Rank Sums) for Variable EC_CAPIT
Classified by Variable TERRIT_recoded

TERRIT_recoded	N	Sum of Scores	Expected Under H0	Std Dev Under H0	Mean Score
1	165	41537.50	42900.0	1590.94305	251.742424
2	258	73264.00	67080.0	1708.20952	283.968992
3	96	20138.50	24960.0	1326.52925	209.776042

Average scores were used for ties.

Kruskal-Wallis Test

Chi-Square	17.8582
DF	2
Pr > Chi-Square	0.0001

The NPAR1WAY Procedure

Van der Waerden Scores (Normal) for Variable EC_CAPIT
Classified by Variable TERRIT_recoded

TERRIT_recoded	N	Sum of Scores	Expected Under H0	Std Dev Under H0	Mean Score
1	165	-7.342620	0.0	10.508403	-0.044501
2	258	38.931756	0.0	11.282964	0.150898
3	96	-31.589136	0.0	8.761912	-0.329054

Average scores were used for ties.

Van der Waerden One-Way Analysis

Chi-Square	16.9141
DF	2
Pr > Chi-Square	0.0002

Result:

The P-value less than 0.0001 suggest that we need to reject the null hypothesis and not to reject the alternative hypothesis, i.e. poverty rate indeed differs between Northern, Central and Southern region of Moldova.

Conclusion: The non-parametric analysis of variance confirms our previous findings regarding the difference in poverty level between Moldavian regions, i.e. poverty rate is different among Moldavian regions.

As we had seen, all three regional means are less than the minimum of subsidence level, which for 2004 constituted 679.9 lei per month. However, to find out if regional means are statistically significant different than minimum of subsistence level, a t-test procedure is necessary to perform.

Thus, our next inquiry is to determine which geographical regions are more affected by poverty. The a priori assumption is that due to comparatively higher living standards in Moldavian capital comparing with the rest of the country, the *Central region* must be less affected by poverty comparing with *Northern and Southern* parts of the country, this would mean that the mean of consumption per capita in Central regions is significantly higher than the means of the rest of the country. Paired t-test had revealed (p-value less than 0.003) that the apriori assumption is valid and that Central does indeed has a higher expenditures per capita level comparing with the rest of the country.

Two Sample Paired t-test for the Means of EC_CAPIT_CENTRAL and EC_CAPIT_NOT_CENTRAL

Sample Statistics

Group	N	Mean	Std. Dev.	Std. Error
EC_CAPIT_CENTRAL	258	643.8131	517.67	32.229
EC_CAPIT_NOT_CENTRAL	258	489.2017	347.73	21.648

Hypothesis Test

Null hypothesis: Mean of (EC_CAPIT_CENTRAL - EC_CAPIT_NOT_CENTRAL) <= 0
Alternative: Mean of (EC_CAPIT_CENTRAL - EC_CAPIT_NOT_CENTRAL) > 0

```
                    t Statistic   Df   Prob > t
                    ------------------------------
        4.088       257   <.0001
```

However, we would also expect that Northern region would have a higher mean of consumption expenditures per capita comparing with Southern region, which could be explained because of the agricultural economy and general economic underdevelopment of Southern part of Moldova.

To verify this statement we will conduct paired **t-test between** Southern and Northern regions of Moldova and their corresponding per - capita expenditures variables.

The null hypothesis: There is no difference between means of consumption expenditures per capita within Northern and Southern regions in Moldova.

The alternative hypothesis: The Northern part of Moldova the mean of consumption expenditures is higher comparing with the mean of consumption expenditures within Southern part of Moldova.

Two Sample Paired t-test for the Means of EC_CAPIT_NORD and EC_CAPIT_SOUTH

Sample Statistics

```
        Group          N    Mean    Std. Dev.  Std. Error
        --------------------------------------------------
        EC_CAPIT_NORD  96  500.4142   351.07    35.831
        EC_CAPIT_SOUTH 96  415.3957   225.67    23.032
```

Hypothesis Test

```
Null hypothesis:   Mean of (EC_CAPIT_NORD - EC_CAPIT_SOUTH) <= 0
Alternative:       Mean of (EC_CAPIT_NORD - EC_CAPIT_SOUTH) > 0

                t Statistic   Df   Prob > t
                ------------------------------
                  2.029       95   0.0226
```

Where:
> EC_CAPIT_NORD is the consumption expenditures per capita within Northern part of Moldova;
> EC_CAPIT_SOUTH is the consumption expenditures per capita within Southern part of Moldova;

Result:

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Thus since the p-value is 0.0226 less than significance level 5%, the test rejects the null hypothesis that there is no statistical significant difference between means of consumption expenditures per capita within Northern and Southern regions in Moldova. At the same time the test does not reject the alternative hypothesis that within the Northern part of Moldova the mean of consumption expenditures is higher comparing with the mean of consumption expenditures within Southern part of Moldova.

Conclusion: Indeed Southern part of Moldova is more affected by poverty phenomenon in Moldova and thus this region must be a priority for poverty alleviation policies.

What does it mean in terms of poverty?

The poverty level in the Southern region is larger than in the Northern region. However consumption expenditures per capita difference between two regions is not very big. Thus at 5% level of significant this difference is almost **eighteen lei per month,** which is indeed a small difference between means. This would suggest that there should not be a very high difference in terms of the living standards between Northern and Southern regions, thus, both regions should not have a significance difference between poverty rates.

However, using the minimum of existence for the whole country of **679.9**, we find that in Southern part of the country **90%** of the population achieve consumption expenditures per capita less than the minimum of existence, while **76%** of the population from Northern region achieve consumption less than the minimum of existence. This suggests that there are indeed more poor people who live in Southern part of Moldova, comparing with Northern part, which agrees with our a priori assumption.
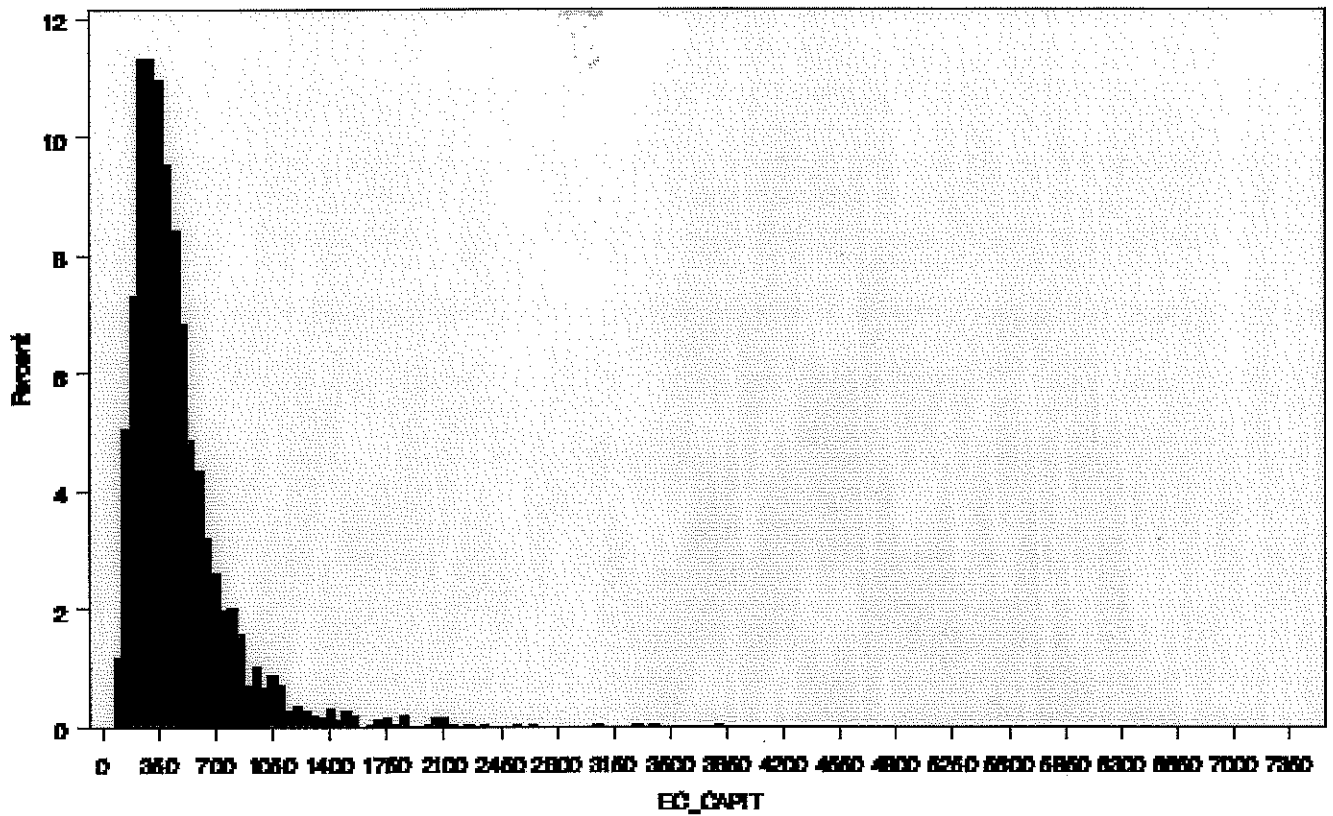
Distribution of consumption per capita in Northern part of Moldova

Where TERRIT IN(3 , 4 , 5 , 6 , 9 , 10 , 21 , 46)
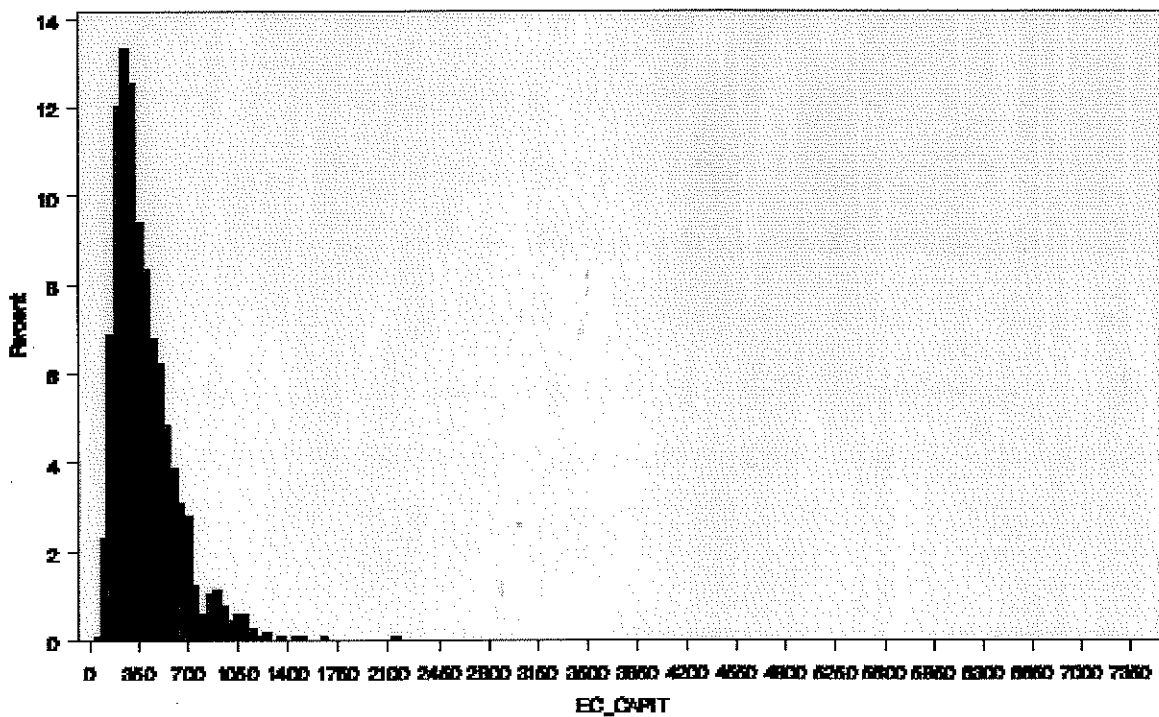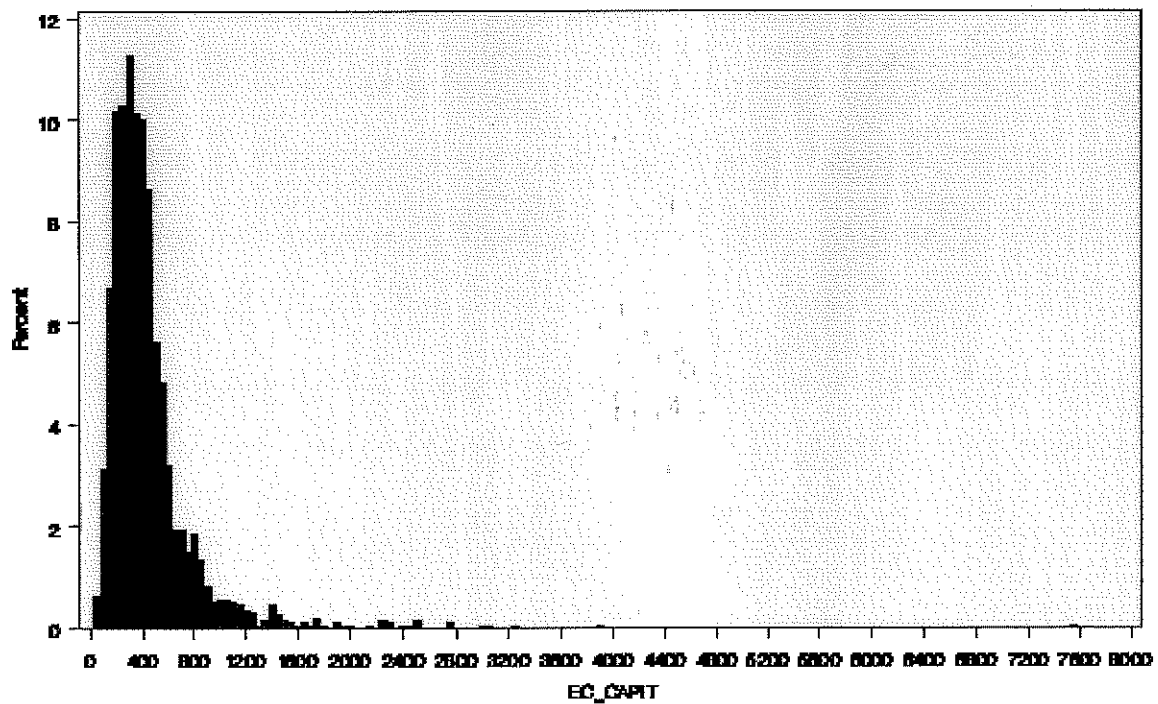
Distribution of consumption per capita in Southern part of Moldova

Distribution of consumption per capita in Central part of Moldova

31
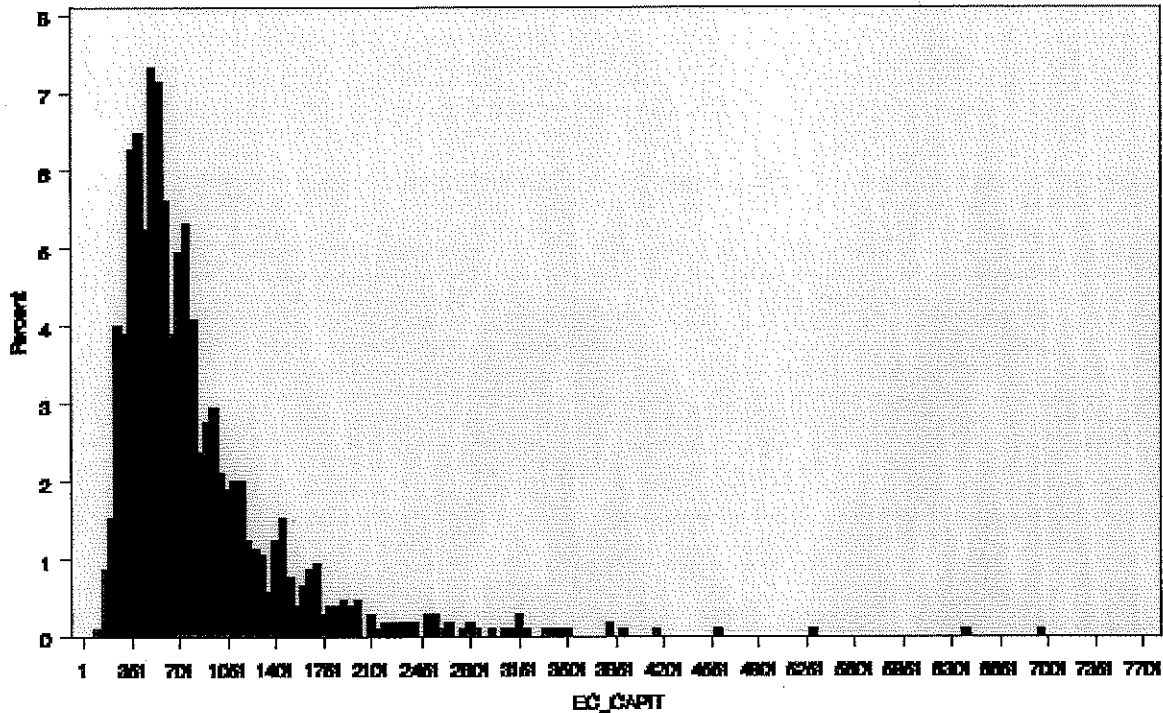
Distribution of consumption expenditures per capita in Chisinau

Consumption expenditures per capita and the minimum of existence level

However, one question still remains open: are means of consumption expenditures per capita within Northern, Central (except the capital), and Southern part of Moldova statistically significantly different from the minimum existence level, i.e. are people from these regions achieve on average lower expenditures per capita than the minimum of existence level?

To answer this question, one sample t test will be performed separately within the samples of three regions. Here we will use minimum subsistence level of 679.9 lei per month, for both rural and urban households, since the samples contain observations from both urban and rural areas.

The null hypothesis: The mean of consumption expenditures per capita within Moldavian region (Northern, Southern and Central, except the capital) is 679.9 lei per month.

The alternative hypothesis: The mean of consumption expenditures per capita within Moldavian region (Northern, Southern and Central, except the capital) is less than 679.9 u.m. per month.

Northern part of Moldova

One Sample t-test for a Mean

Sample Statistics for EC_CAPIT

N	Mean	Std. Dev.	Std. Error
165	**531.71**	393.72	30.65

Hypothesis Test

Null hypothesis: Mean of EC_CAPIT => 679.9
Alternative: Mean of EC_CAPIT < 679.9

t Statistic	Df	Prob > t
-4.835	164	**<.0001**

95 % Confidence Interval for the Mean

Lower Limit: 471.19
Upper Limit: 592.24

Power Analysis

Sample Alpha	Observed Size	Power
0.050	165	**0.999**

Central part, no Chisinau

One Sample t-test for a Mean

Sample Statistics for EC_CAPIT

N	Mean	Std. Dev.	Std. Error
163	**505.33**	430.26	33.70

Null hypothesis: Mean of EC_CAPIT => 679.9
Alternative: Mean of EC_CAPIT < 679.9

t Statistic	Df	Prob > t
-5.180	162	<.0001

95 % Confidence Interval for the Mean

Lower Limit: 438.79
Upper Limit: 571.88

Power Analysis

Alpha	Sample Size	Observed Power
0.050	163	0.999

Southern part of Moldova

One Sample t-test for a Mean

Sample Statistics for EC_CAPIT

N	Mean	Std. Dev.	Std. Error
96	415.40	225.67	23.03

Hypothesis Test

Null hypothesis: Mean of EC_CAPIT => 679.9
Alternative: Mean of EC_CAPIT < 679.9

t Statistic	Df	Prob > t
-11.484	95	<.0001

95 % Confidence Interval for the Mean

Lower Limit: 369.67
Upper Limit: 461.12

Power Analysis

Alpha	Sample Size	Observed Power
0.050	96	0.999

Result:
All three t tests would reject the null hypothesis that the mean of consumption expenditures

per capita within Moldavian region (Northern, Southern and Central, except the capital) is 679.9 lei per month. However the tests would not reject the alternative that the mean of consumption expenditures per capita within Moldavian region (Northern, Southern and Central, except the capital) is less than 679.9 lei per month. Moreover, all three t-tests have a very high power, i.e. there is an insignificant chance to reject the alternative hypothesis when it is true.

Conclusion: There is sufficient statistical evidence to state that Northern, Southern and Central regions of Moldova are greatly affected by the poverty phenomenon. Poverty is indeed a massive phenomenon in Moldova.

The situation is opposite in the Moldavian capital – Chisinau. We decided to test whether the mean of consumption expenditures in the capital is equal to 784.2 lei. per month (the null hypothesis), or it is greater than this level (the alternative hypothesis).

The result of the test strongly suggest that the mean of consumption expenditures is greater than 784.2, since the p-value of the test is less than the critical level of 5%.

One Sample t-test for a Mean

Sample Statistics for EC_CAPIT

N	Mean	Std. Dev.	Std. Error
95	881.41	568.62	58.34

Hypothesis Test

Null hypothesis: Mean of EC_CAPIT <= 784.2
Alternative: Mean of EC_CAPIT > 784.2

t Statistic	Df	Prob > t
1.666	94	0.0495

95 % Confidence Interval for the Mean

Lower Limit: 765.58
Upper Limit: 997.25

Power Analysis

Alpha	Sample Size	Observed Power
----	----	----
0.050	95	**0.504**

Observations: The minimum of existence level for urban areas 784.2 lei per month is an average estimate it follows that the real minimum of existence in Chisinau must be higher than that number. However this would probably mean that the test's null hypothesis would not be rejected, i.e. the mean of consumption expenditures per capita in Chisinau is less than 784.2 lei per month.

Gender characteristics of poverty phenomenon in Moldova

Introduction

The following part of research identifies gender features of poverty in Moldova. As we had shown in the first part of research, poverty is a massive phenomenon in Moldova characteristic to the whole country, except Chisinau. However, *to determine gender features of the poverty phenomenon is another important issue that must be addressed by current research.*

Thus, are females less or more affected by poverty phenomenon in Moldova comparing with males, i.e. are they less or more poor than males? Gender is an important dimension explaining poverty; moreover the determination of the relationship between poverty and gender provides a significant insight regarding the level of gender inequality in a given society. The determination of the gender characteristics of deprivation phenomenon could also help poverty alleviation policies to better fight the problem in Moldova. Thus, the next section will be devoted to research the relationship between gender and poverty in Moldova.

Observation: Since HHBS data set contains only a head of household variable, our research` results will refer only to these categories, i.e. **head of sex of the household**. Thus, we will not discuss the relationship between gender and poverty rate *per se*, but the relation between gender of the household head and poverty rate of the household head. However, these results would reveal significant understanding regarding the relationship between gender and poverty level in Moldova.

In this part of research we will use the whole data set of HBS for 2004, which has **6121 observations**. As in the first part, poverty phenomenon will be assessed through consumption

approach, and thus *consumption expenditures per capita* will be the variable of primary interest.

Consumption per capita and gender of the household head

The HBS sample contains the following data regarding male and female headed households.

Head Sex	Frequency	Percent
Males -1	3517	57.46
Females -2	2604	42.54
Total	6121	100

EC_CAPIT
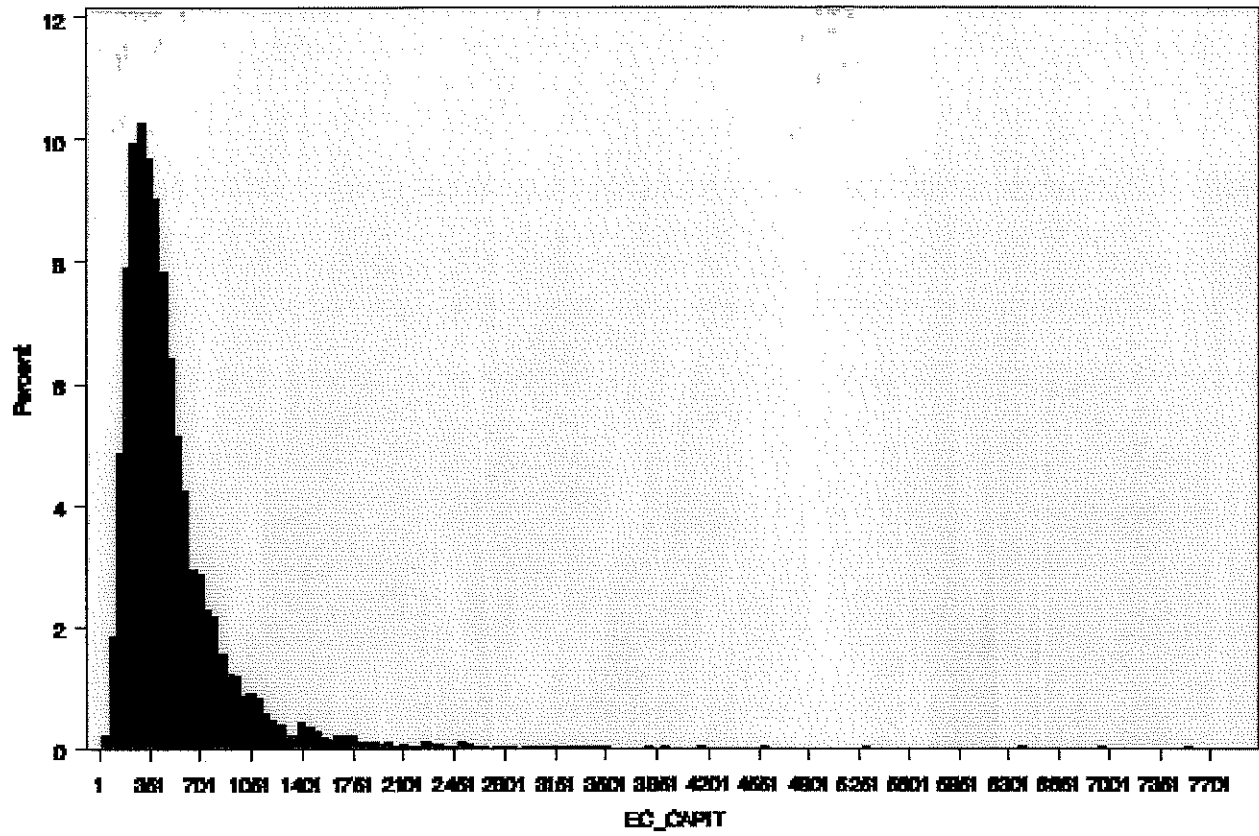
The distribution of consumption expenditures for the whole 2004 sample, both male and

female headed households

Several observations from the graph:

- The bulk of Moldavian population achieves consumption expenditures below or near the minimum of existence level – **679.9** lei per month[16];

- The range of consumption expenditures per capita is very wide. Lower interval bound is 45.8 ($3.5 per month) while the upper bound is 7568.9;

- High polarization of consumption expenditures per capita. There are households with a very high consumption per capita, more than 1200 monetary units per month, a significant amount of households do not even achieve the minimum of existence level;

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[16] www.statistica.md
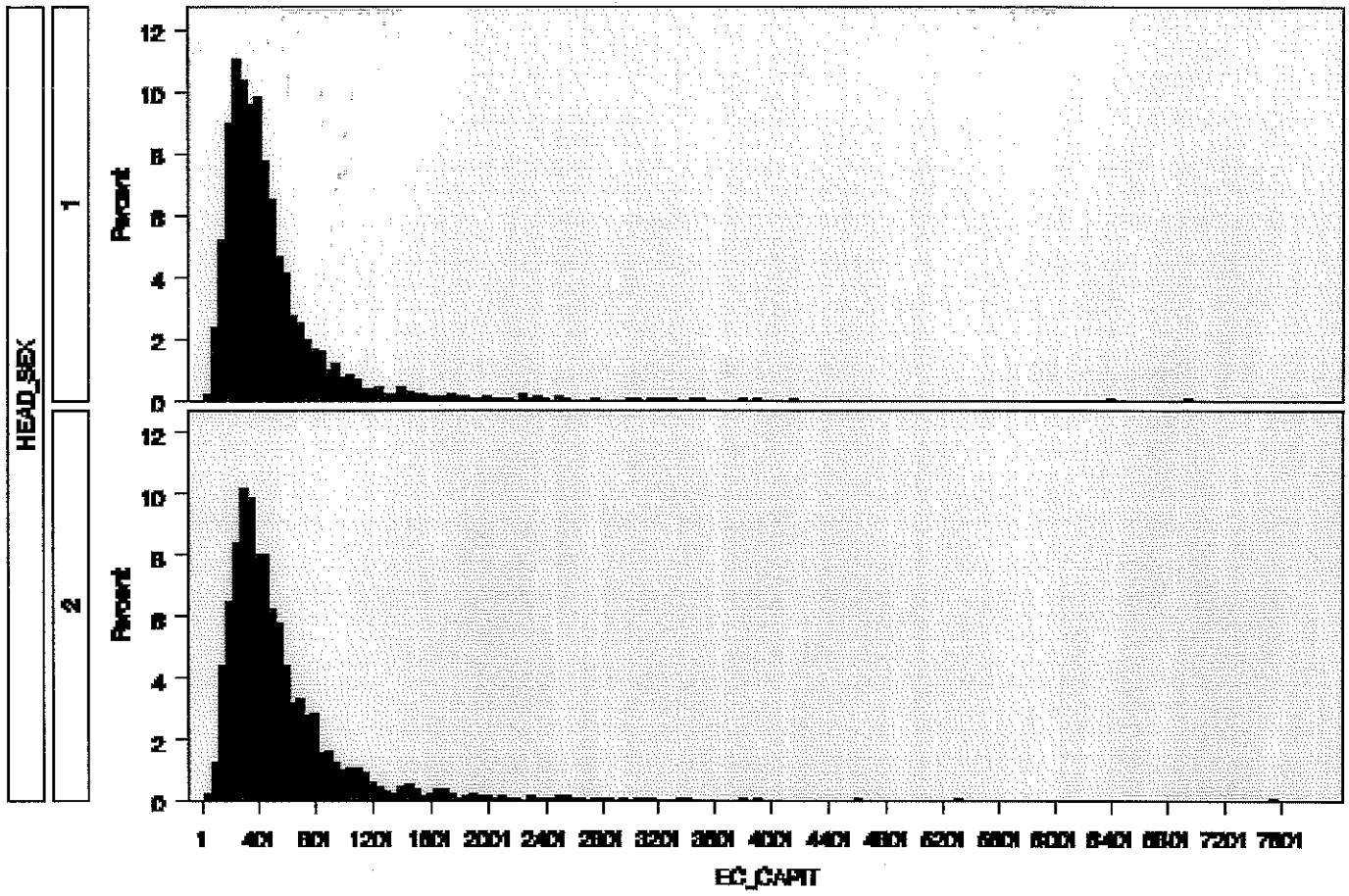
This graph presents the distribution of consumption per capita by male and female headed households.

Where:

 ➢ Head_sex 1 is male headed household;

 ➢ Head_sex 2 is female headed household.

The representation of the expenditures per capita distribution by gender of the household head (1 for males, and 2 for females) presents a first insight regarding sex characteristics of poverty in Moldova. Thus, if you look closely it could be observed that female headed households achieve on average higher consumption per capita levels comparing with male headed households.

A better picture of this is shown below.

Consumption per capita within male headed sample	Consumption per capita within female headed sample
N 3517 Mean 478.253048 Median 390.0500 Mode 249.4000 Std Deviation 390.976019 Variance 152862.247	N 2604 Mean 554.1537 Median 433.0500 Mode 357.0000 Std Deviation 459.21707 Variance 210880
Quantile Estimate 100% Max 6943.750 99% 2016.675 95% 1082.775 90% 839.230 75% Q3 556.050 50% Median 390.050 25% Q1 262.250 10% 188.467 5% 154.013 1% 98.325 0% Min 46.900	Quantile Estimate 100% Max 7568.900 99% 2493.350 95% 1364.250 90% 999.700 75% Q3 656.008 50% Median 433.050 25% Q1 296.825 10% 209.980 5% 169.434 1% 114.410 0% Min 45.800

Results:

- The mean, median and mode of consumption expenditures per capita within female headed households are higher than mean, median, and mode of consumption expenditures per capita within male headed households;

- Beginning with the 1st percentile, female headed households achieve higher consumption per capita comparing with male headed households;

Conclusion: Female headed households achieve on average higher consumption per capita comparing with male headed households, i.e. poverty incidence rate should be lower within female headed households than within male headed households.

How could this be explained, i.e. why female headed households achieve on average higher consumption per capita comparing with male headed households? Are females better off from financial point of view comparing with males in Moldova, are they better heads managers or there is another explanation?

We believe that there is another explanation regarding the inquiry why female headed households obtain higher consumption expenditures per capita comparing with male headed households. Our apriori assumption is that, female headed households appear to achieve higher consumption expenditures per capita *since female headed households contain less people comparing with males headed households.*

To test this assumption we will use **contingency table procedure** as well as **chi-square test** statistic. Thus, **the sex of the household head** will be the *independent variable* (column variable), and the *dependent variable* will be **household size** (row variable).

The null hypothesis: There is no statistical significant difference regarding household size between male and female headed households, i.e. *household sex variable and household size variable are independent, no association between them.*

The alternative hypothesis: There is a statistical significant difference regarding household size

between male headed and female headed households, *i.e. household sex and household size are dependent variables, there is association between them.*

Contingency table of HH_SIZE by HEAD_SEX

Frequency – HH Size	Male- head-hh	Female-headed-hh	TOTAL
1	427 **12.14**	1283 **49.27**	**1710**
2	1223 **34.77**	604 **23.20**	**1827**
3	810 **23.03**	402 **15.44**	**1212**
4	664 **18.88**	208 **7.99**	**872**
5	250 **7.11**	78 **3.00**	**328**
6	107 **3.04**	21 **0.81**	**128**
7	23 **0.65**	6 **0.23**	**29**
8	9 **0.26**	1 **0.04**	**10**
9	4 **0.11**	1 **0.04**	**5**
TOTAL	**3517**	**2304**	**6121**

NOTE:
The second entry in a cell represents the percentage of the total column. Thus, 49.27 represent 49.27 percents of the total female headed households are households composed of a person.

Statistics for Table of HH_SIZE by HEAD_SEX

```
Statistic              DF    Value     Prob
ƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒ
Chi-Square              8   1067.7428  <.0001
Likelihood Ratio Chi-Square   8  1094.4756  <.0001
Mantel-Haenszel Chi-Square    1   682.7526  <.0001

         Sample Size = 6121
```

Results:

- Within the sample of female headed households, **49%** of the households contain only **one**

person, *i.e. a female*. Within the sample of male headed households, only **12%** of the households contain only **one person**, *i.e. a male*;

- Within the sample of female headed households, **23%** of households contains **two persons**, while within the sample of male headed households, **35%** of households contains **two persons**;

- Within the sample of female headed households **15%** of households contains **three persons**, while within the sample of male headed households **23%** of households contains **three persons**;

The trend is clear; if a *household contains two or more people it is more likely to be headed by a male, than by female. If a household is composed of a single person it is much less likely to be headed by a man, but by a female. On average male headed households are composed of more people than female headed households.*

The percent differences between female and male headed households are statistically significant since the p-value for all three tests statistics (Chi-square, Likelihood Ratio Chi-Square and Mantel-Haenszel Chi-Square) are less than 0.0001 which is less than 5% alpha level. This means that the null hypothesis must be rejected – that there is no difference regarding household size between male and female headed households, association is not present. However the test does not reject the alternative hypothesis - there is a difference regarding household size between male and female headed households, association is indeed present.

Conclusion: Since almost 50% of households headed by females are composed of a person, i.e. a female, it follows that female headed households will achieve higher consumption expenditures per capita levels than male headed households. It will be shown that household size is one of the most important predicators of consumption expenditures per capita in a household, i.e. poverty level of a household and thus a member within a household.
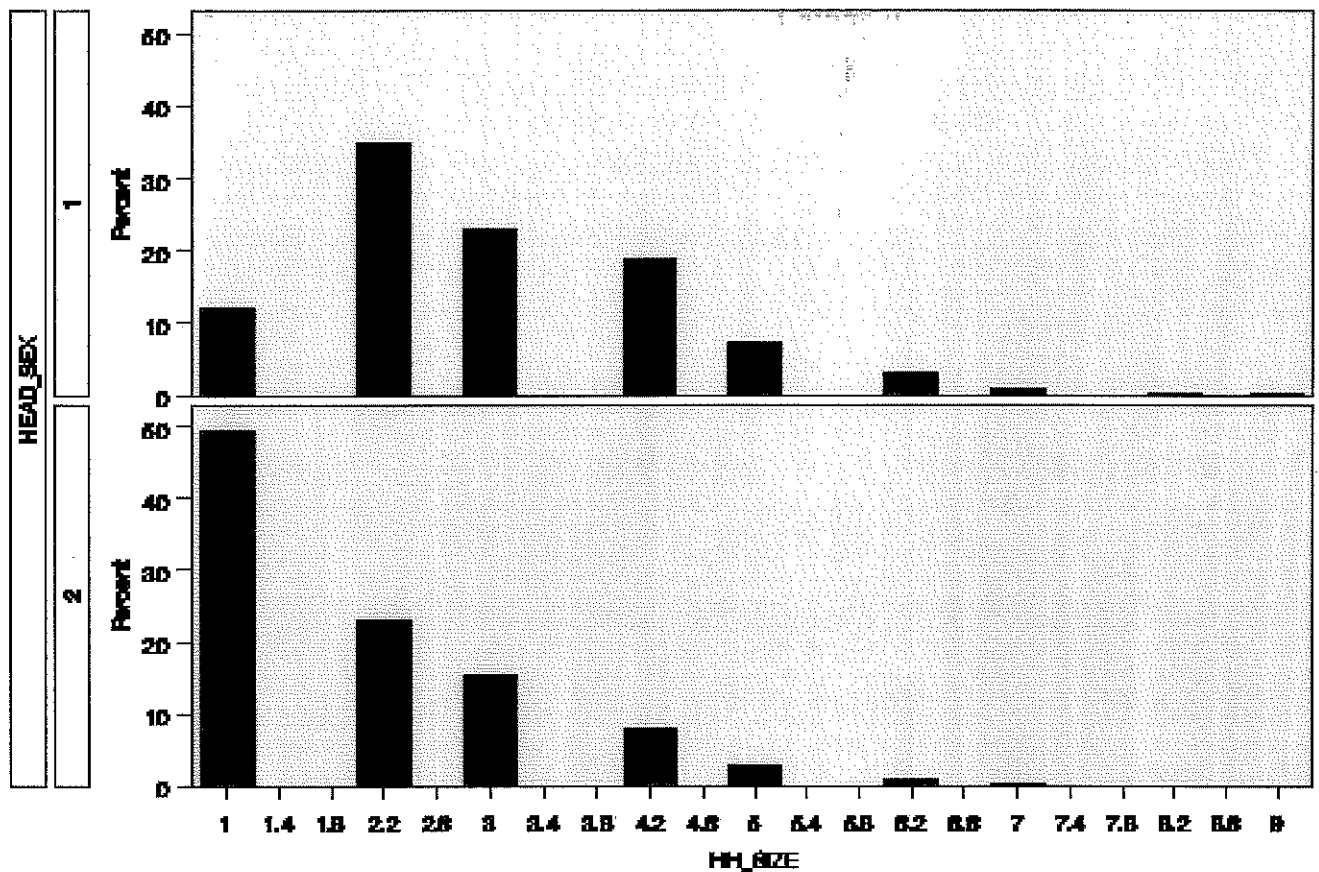
The distribution of household size by the head of sex

This graph strongly supports the conclusion of the chi-square test for independence, since shows that male headed households are much more likely to be composed of two or more members comparing with female headed households.

Gender and household size, determinants of poverty the incidence

However we do not have complete evidence and thus a definitive answer regarding the relationship between **gender and consumption expenditures per capita** yet. So far we had shown that there exists indeed a difference regarding consumption expenditures per capita within male headed households and female headed households, and that consumption expenditures per

capita are on average higher within female headed households. However this does not prove the statement that - females are less likely to be poor than males, since our inferences so far referred only **to the gender of the households heads**.

Observation: As we had seen before, within the sample of female headed households, at least 49%, i.e. almost half of the female headed households, are composed of a female. This result seems to be strange since it suggests that almost half of the female headed households are composed of females who live alone.

One way to explain this issue is to study the distribution of the marital status, within the female headed households.

Marital stratus of female headed households composed of one person.

```
                H_MARIT

                      Cumulative   Cumulative
        H_MARIT  Frequency  Percent  Frequency   Percent
        ffffffffffffffffffffffffffffffffffffffffffffffffffffffffffffffff
           1       207    16.13    207     16.13
           2        43     3.35    250     19.49
           3       856    66.72   1106     86.20
           4       177    13.80   1283    100.00
```

Where, H_MARIT 1 means – never married, 2 – married, 3, a spouse lives separately, 4 - widow.

Observation: To choose a correct value: 2 or 3, would be a confusing task for a respondent who completed HBS, since the variants 2 and 3 are not mutually exclusive. Thus, it might happen that a person who is married and lives separately would check 2, not 3 (moreover he/she would not read other alternatives when he/she picked already the value of 2). This fact introduces significant biases in the analysis. To eliminate this confusion the value of 2 should be assigned to – a spouse lives together.

Results:

- Almost 67% (2/3) of the female headed households are composed of a person represents spouses who live separately;

- Only 16% of the female headed households composed of a person are females who live alone and 17% are of widows;

The large emigration of male population, primarily because of the economical reasons represents one way to explain the significant proportion of female headed households which contain one person. Thus, within the sample of female headed households composed of one person, 2/3 of the total represents *female – a spouse that live separately*, which suggest indeed the impact of the male population immigration. However this means that one third *(2/3*1/2) of the total number of female headed households in Moldova are composed of female – spouse that live separately.*

Moldova is a country of migrants. According to official governmental estimates, more than **600,000** Moldavians are living and working abroad, although the actual figure differs according to different sources and likely tops **one million.**[17] Moreover, the number of females who had never married as well as widows is also substantial within the sample of female headed households composed of one person. However, as we had seen the number of males who live alone is much lower (12%) comparing with the number of females who live alone (49%).

Observation: the sample does not include even one divorced female or male headed household, which is puzzling. One way to explain this fact is the persistence of the *social stigmatization* within Moldavian society regarding divorce, i.e. divorced females or males do not prefer to report their real marital status since it is still negatively perceived, especially in rural areas.

As we said earlier, *household size* is a very important factor which determines the

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[17] www.iom.md, International Organization for Migration, Moldova.

consumption expenditures per capita, and thus the poverty level of a household. Below we provide strong statistical evidence that consumption expenditures per capita indeed depends on the households` size. Analysis of variance procedure is a useful way to show that there is an *inverse relation* between the consumption expenditures per capita and the size of a household.

The null hypothesis: All means of consumption expenditures per capita by household size are equal.

The alternative hypothesis: At least two means of consumption expenditures per capita by household size are not equal.

The ANOVA Procedure

Welch's ANOVA for EC_CAPIT

Source	DF	F Value	Pr > F
HH_SIZE	8.0000	77.43	<.0001
Error	71.0709		

<p align="right">*The ANOVA Procedure*</p>

Level of HH_SIZE	N	---------EC_CAPIT--------- Mean	Std Dev
1	1710	592.065246	452.992587
2	1827	541.691054	457.897850
3	1212	504.656447	418.707996
4	872	392.704699	279.538260
5	328	353.332159	300.416335
6	128	328.471380	281.919130
7	29	254.954631	146.161990
8	10	275.784875	128.818570
9	5	152.014000	43.583805

Power Analysis

Dependent Variable	Source	Alpha	Least Significant Power	Number
EC_CAPIT	HH_SIZE	0.05	0.999	407

Result:

A very big F test statistic, associated with a very small p-value of the test, which is less than 0.0001, leave us with no choice but *to reject the null hypothesis* and *not to reject the alternative hypothesis*, i.e. at least two means of consumption expenditures per capita by household size are not equal (or alternatively that the mean per capita expenditures indeed differs by household size in at least one case). The power of the test is almost 1, which means that the probability of rejecting the null hypothesis when it is actually false, and thus of not rejecting the alternative when it is indeed true is almost 1.

Moreover, the individual paired t-tests confirm that all means are statistically significantly different from each others by household size. Below we provide the non-parametric illustration of the analysis of variance that confirms our previous findings, since the p-value of the test is less than 0.0001.

Conclusion: Consumption expenditures per capita do differ by household size, as household size goes up on average consumption expenditures per capita decreases.

The NPAR1WAY Procedure

Wilcoxon Scores (Rank Sums) for Variable EC_CAPIT
Classified by Variable HH_SIZE

HH_SIZE	N	Sum of Scores	Expected Under H0	Std Dev Under H0	Mean Score
2	1827	5941531.00	5592447.0	63263.9538	3252.06951
5	328	659943.50	1004008.0	31134.7027	2012.02287
4	872	2092821.50	2669192.0	48322.8528	2400.02466
3	1212	3629013.50	3709932.0	55093.9439	2994.23556
1	1710	6139537.50	5234310.0	62032.9766	3590.37281
6	128	217817.50	391808.0	19782.5905	1701.69922
7	29	38185.00	88769.0	9493.6886	1316.72414
8	10	15904.50	30610.0	5583.5727	1590.45000
9	5	1627.00	15305.0	3949.7970	325.40000

Average scores were used for ties.

Kruskal-Wallis Test

Chi-Square   537.0197
DF   8
Pr > Chi-Square   <.0001

The NPAR1WAY Procedure

50

Median Scores (Number of Points Above Median) for Variable EC_CAPIT
Classified by Variable HH_SIZE

HH_SIZE	N	Sum of Scores	Expected Under H0	Std Dev Under H0	Mean Score
2	1827	991.0	913.350760	17.901713	0.542419
5	328	90.0	163.973207	8.810143	0.274390
4	872	307.0	435.928770	13.673850	0.352064
3	1212	576.0	605.900997	15.589856	0.475248
1	1710	1068.0	854.860317	17.553385	0.624561
6	128	22.0	63.989544	5.597852	0.171875
7	29	4.0	14.497631	2.686416	0.137931
8	10	2.0	4.999183	1.579976	0.200000
9	5	0.0	2.499592	1.117669	0.000000

Average scores were used for ties.

Median One-Way Analysis

Chi-Square   344.2374
DF   8
Pr > Chi-Square   <.0001

Female versus male poverty rates

We had found so far **sufficient statistical evidence** that female headed households achieve on average higher consumption expenditures per capita comparing with males headed households. However, as we stated earlier, this does not mean that females in general achieve higher consumption expenditures per capita, comparing with males, i.e. on average are less poor than males.

One way to find out how poverty incidence is related with gender in Moldova is to subset HBS, into two mutually exclusive categories, specifically: *males who live alone* (i.e. household size is composed of one person), and *females who live alone*. The following table represents the statistical characteristics of these two groups.

Consumption per capita within males headed sample, where household size is one	Consumption per capita within females headed sample, where household size is one

N	427
Mean	542.021452
Median	448.1000
Mode	317.0000
Std Deviation	322.816751
Variance	104210.655
Range	2165

Quantile	Estimate
100% Max	2228.75
99%	1766.00
95%	1181.86
90%	969.35
75% Q3	657.00
50% Median	448.10
25% Q1	333.75
10%	235.25
5%	202.00
1%	136.50
0% Min	63.65

N	1283
Mean	608.7205
Median	479.3000
Mode	357.0000
Std Deviation	487.65708
Variance	237809
Range	7523

Quantile	Estimate
100% Max	7568.90
99%	2523.45
95%	1420.60
90%	1071.40
75% Q3	719.16
50% Median	479.30
25% Q1	342.15
10%	255.73
5%	206.00
1%	131.83
0% Min	45.80

Results:
- The mean, median and mode of consumption expenditures per capita for females who live alone **are higher** than mean, median, and mode of consumption expenditures per capita for males who live alone;

- Beginning with the 5th percentile, females who live alone achieve on average **higher** consumption expenditures per capita comparing with males who live alone;

Conclusions: Females who live alone achieve on average higher consumption expenditures per capita comparing with males who live alone, i.e. poverty rate is indeed likely higher for males who live alone comparing with females who live alone.

Observations:
- The structural aspects of the groups could be *very different* in nature according to such criteria as: age, education, marital status, which might have a significant impact on consumption per capita variable;

- It could be the case that males who live alone **save more**, and thus have a lower marginal propensity to consume than females who live alone. Because of this fact male' expenditures per capita are on average less than females' consumption per capita. But as we stated earlier, poverty phenomenon is researched using consumption approach and not the income approach.

However we will use paired t-test to determine if there is statistical significant difference between males and females who live alone regarding samples expenditure per capita means.

The null hypothesis: Females who live alone and males who live alone on average achieve the same level of expenditures per capita, i.e. there is no statistical significant difference between means expenditures per capita within males and females who live alone.

The alternative hypothesis: Females who live alone on average achieve on average higher level of expenditures per capita comparing with males who live alone, i.e. there is a statistical significant difference between means of expenditures per capita within the samples composed of males and females who live alone.

Two Sample Paired t-test for the Means of EC_CAPIT1 and EC_CAPIT

Sample Statistics

Group	N	Mean	Std. Dev.	Std. Error
EC_CAPIT1	427	**607.0878**	479.07	23.184
EC_CAPIT	427	**542.0215**	322.82	15.622

Hypothesis Test

Null hypothesis: Mean of (EC_CAPIT1 - EC_CAPIT) = 0
Alternative: Mean of (EC_CAPIT1 - EC_CAPIT) ^= 0

t Statistic	Df	Prob > t
2.281	426	**0.0230**

Where:

EC_CAPIT1 is consumption expenditures per capita for female headed households composed of one person.

EC_CAPIT is consumption expenditures per capita for male headed households composed of one person.

Result: Since the p-value is less than 0.023, which is less than the critical alpha-level of 5%, we reject the null hypothesis that females who live alone and males who live alone on average achieve the same level of expenditures per capita, i.e. there is no statistical significant difference between means expenditures per capita within males and females who live alone. However we do not reject the alternative hypothesis that females who live alone on average achieve on average higher level of expenditures per capita comparing with males who live alone, i.e. there is a statistical significant difference between means expenditures per capita within males and females who live alone.

Conclusion: There is sufficient statistical evidence to state that females who live alone achieve on average higher expenditures per capita comparing with males who live alone, i.e. are less affected by poverty phenomenon.

This conclusion is consistent with our earlier assumption regarding massive emigration of male population. Moreover in a couple, males are much more likely to emigrate due to economical reasons comparing with female. *Thus, a female who lives alone is much more likely to be financially supported by her partner who works abroad, than a male who lives alone.*

Males who live alone

Marital Status	1	2	3	4

Mean exp per cap	684.78	666.13	482.9	504.64

Females who live alone

Marital Status	1	2	3	4
Mean exp per cap	940.77	969.89	503.17	643.11

Means of expenditures per capita are statistically significantly different from one another (t-test). These means strengthen our previous conclusion that females who live alone achieve higher consumption expenditures per capita comparing with males who live alone, and that a female who lives alone is much more likely to be financially supported by her partner who works abroad, than a male who lives alone.

The following graphs are helpful to visualize the distribution of consumption expenditures per capita.

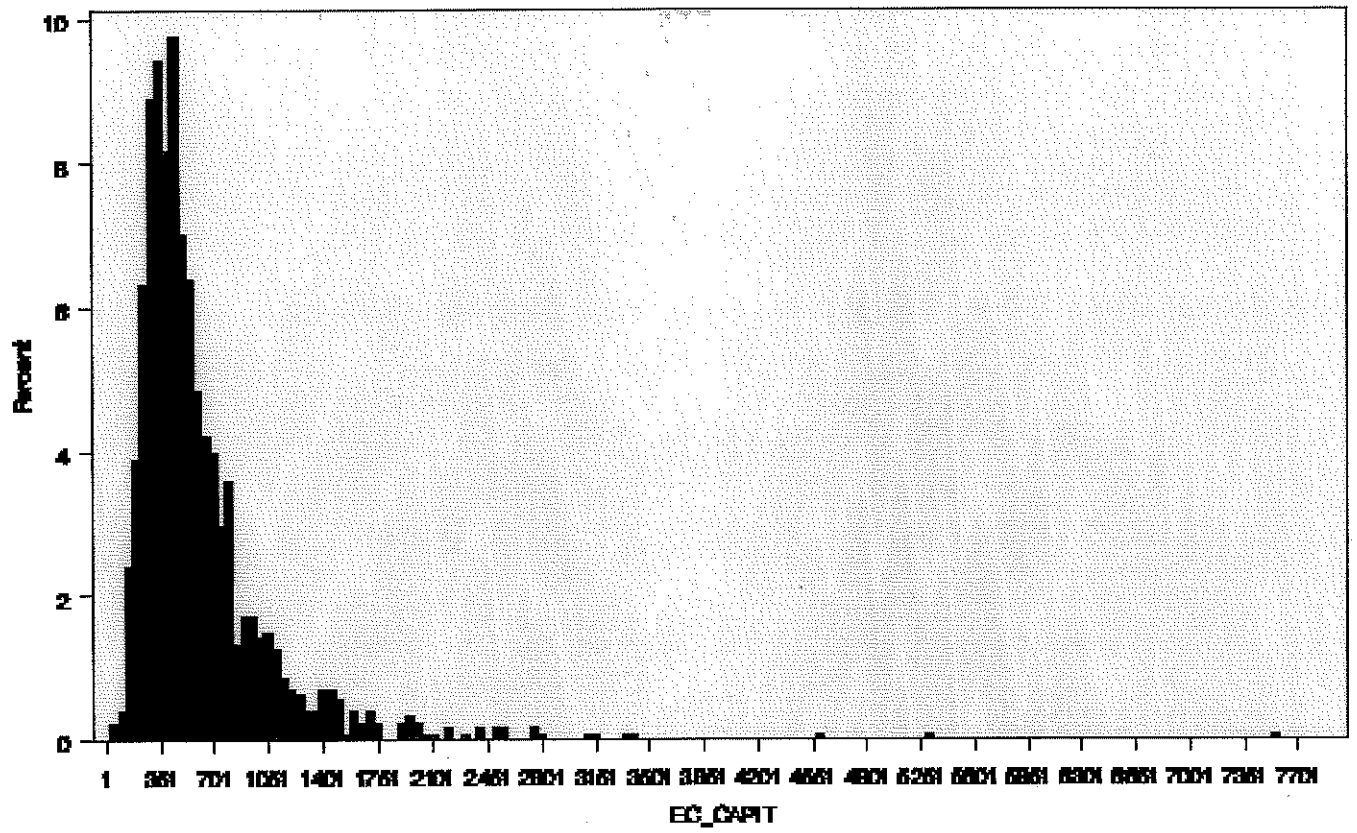Where HEAD_SEX EQ 1 AND HH_SIZE EQ 1
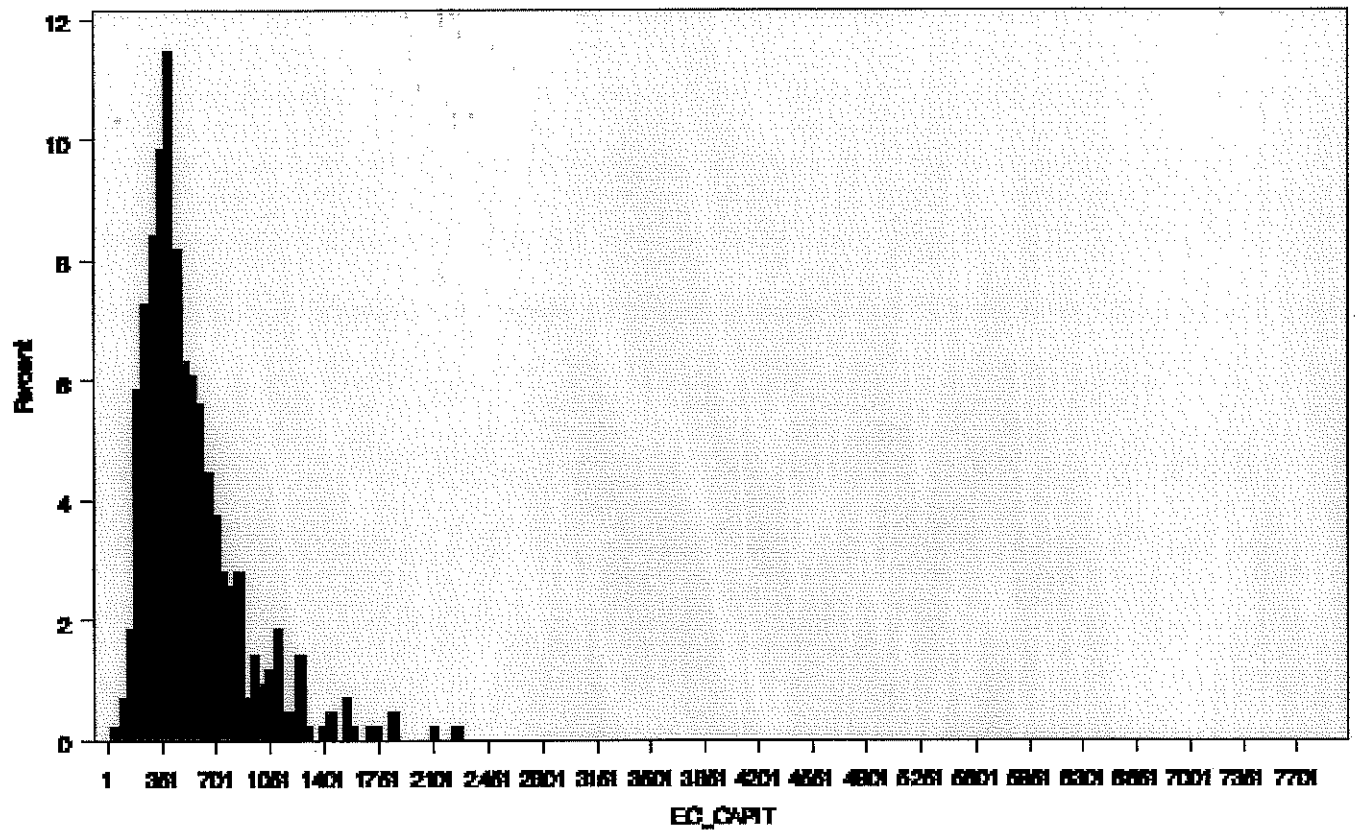
The distribution of expenditures per capita within male headed household composed of one person.

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Where HEAD_SEX EQ 2 AND HH_SIZE EQ 1

The distribution of expenditures per capita within female headed household composed of one person.

Further analysis reveals that female headed households on average achieve higher consumption expenditures per capita within **all age groups** comparing with male headed households. However, the World Bank report as well as the Governmental poverty report stated a different conclusion specifically that "generally, women have a lower incidence of poverty than men, **but the pattern reverses among elderly**".[18]

Where HEAD_SEX EQ 1, Male headed households

The MEANS Procedure

Analysis Variable : EC_CAPIT

H_AGE_GR	Obs	N	Mean	Std Dev	Minimum	Maximum	Median
Under 25	66	66	**915.7641540**	1024.89	92.2800000	6943.75	629.8500000
25-34	382	382	**547.1640384**	496.4534601	63.5000000	3778.45	410.6733333
35-44	753	753	**428.8066351**	333.2441136	60.8266667	3292.00	349.6600000
45-54	936	936	**497.4325371**	422.9391073	46.9000000	6408.49	391.1883333
55-64	599	599	**480.7432418**	315.1965497	84.4460000	2748.56	404.7250000
65 and above	781	781	**430.3526490**	244.6434327	80.8750000	3026.68	385.9600000

Where HEAD_SEX EQ 2, Female headed households

The MEANS Procedure

Analysis Variable : EC_CAPIT

H_AGE_GR	Obs	N	Mean	Std Dev	Minimum	Maximum	Median

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[18] The World Bank Poverty Assessment, 1999, 10p.

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Under 25	152	152	**1073.87**	820.7725135	67.8500000	5318.02	858.5750000
25-34	270	270	**622.4904753**	517.1078369	107.2825000	3908.48	448.3950000
35-44	396	396	**542.1945567**	430.7850166	78.8000000	3071.88	410.1000000
45-54	484	484	**542.6059861**	509.8321508	54.4300000	7568.90	420.1150000
55-64	420	420	**550.5567575**	393.5591696	78.4200000	2942.52	453.5750000
65 and above	882	882	**457.0871733**	262.6298072	45.8000000	3376.14	409.9250000

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Means consumption expenditures per capita versus the minimum of existence

As we had showed so far female headed households on average obtain higher consumption expenditures per capita than male headed households. But one more question still remains open. *What is the **actual difference** of poverty rate between males and females headed households?*

To find out this difference it is necessarily to determine what percentage of male and female headed households live below the minimum of existence level. National Bureau of Statistics reports the minimum of existence level by gender, but only for males and females who are within **working age**. In 2004 the minimum of existence by gender had been 762.6 monetary units per month for males and 674.9 for females[19]. Thus, to determine poverty level within male and female headed households we will subset our dataset for December 2004 into male headed and female headed households. At the same time we will analyze only those observations where the head of the household is younger than 65 years old, and thus household heads not within working age will be excluded from analysis. Household heads are grouped into 6 age groups as follows:

Group	*Age*

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[19] www.statistica.md

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1	Under 25
2	25-34
3	35-44
4	45-54
5	55-64
6	65 & above

Results:

- Within the sample of female headed households, **63%** live below 685.9 monetary units per month;

- However, within the sample of males headed households, **80%** live below 765.7 monetary units per month;

Conclusion: Poverty level is higher within males headed households than within female headed households.

However to determine if there is statistical difference between mean of consumption expenditures per capita within male and female headed households, a paired t-test in necessary.

The null hypothesis: There is no statistical significant difference between the mean of consumption expenditures per capita within male and female headed households.

The alternative hypothesis: There is statistical significant difference between the mean of consumption expenditures per capita within male and female headed households.

Two Sample Paired t-test for the Means of EC_CAPIT_2 and EC_CAPIT_1

Sample Statistics

Group	N	Mean	Std. Dev.	Std. Error
EC_CAPIT_2	136	643.9178	457.29	39.212

EC_CAPIT_1 136 476.9891   365.45   31.337

Hypothesis Test

Null hypothesis: Mean of (EC_CAPIT_2 - EC_CAPIT_1) <= 0
Alternative: Mean of (EC_CAPIT_2 - EC_CAPIT_1) > 0

t Statistic   Df   Prob > t

3.436   135   0.0004

95% Confidence Interval for the Difference between Two Paired Means

Lower Limit   Upper Limit
----------   ----------
70.84   263.02

Power Analysis

Sample   Observed
Alpha   Size   Power
----   ----   ----
0.050   136   0.962

Where:

> ➢ EC_CAPIT_1 is consumption expenditures within male headed households;

> ➢ EC_CAPIT_2 is consumption expenditures within female headed households.

Result:

Since p – value of the test is less than 0.0004 we would reject the null hypothesis that there is no statistical significant difference between the mean of consumption expenditures per capita within male and female headed households and, however the test does not reject the alternative hypothesis that there is statistical significant difference between the mean of consumption expenditures per capita within male and female headed households. The 95% confidence interval for the difference between two paired means is significantly wide, from 70.84 to 263.02 lei per month per month.

Conclusion: There is statistical significant evidence to state that mean of consumption expenditures per capita within the female sample headed households is greater comparing with mean expenditures per capita within the sample male sample headed households (although

minimum of existence level is higher for males comparing with female), i.e. poverty rate should be

lower within female headed households comparing with male headed households.

Are the means of consumption expenditures per capita within male and female headed

household less than the corresponding minimum of consumption expenditures? To find out this,

we will run a paired t-test with the following hypothesis:

The null hypothesis: The mean of consumption expenditures per capita within male/female headed

household is equal or is greater than the corresponding minimum of existence level.

The alternative hypothesis: The mean of consumption expenditures per capita within male/female

headed household is less than the corresponding minimum of existence level.

<u>Where HEAD_SEX EQ 1 AND MONTH EQ 12</u>
Sample Statistics for EC_CAPIT

N	Mean	Std. Dev.	Std. Error
305	542.11	469.46	26.88

Hypothesis Test

Null hypothesis: Mean of EC_CAPIT => 762.6
Alternative: Mean of EC_CAPIT < 762.6

t Statistic	Df	Prob > t
-8.202	304	<.0001

95 % Confidence Interval for the Mean

Lower Limit: 489.21
Upper Limit: 595.01

Power Analysis

Alpha	Sample Size	Observed Power
0.050	305	0.999

<u>Where HEAD_SEX EQ 2 AND MONTH EQ 12</u>
One Sample t-test for a Mean

Sample Statistics for EC_CAPIT

N	Mean	Std. Dev.	Std. Error
214	599.86	409.10	27.97

Hypothesis Test

Null hypothesis: Mean of EC_CAPIT => 674.9
Alternative: Mean of EC_CAPIT < 674.9

t Statistic	Df	Prob > t
-2.683	213	0.0039

95 % Confidence Interval for the Mean

Lower Limit:	544.74
Upper Limit:	654.99

Power Analysis

Alpha	Sample Size	Observed Power
0.050	214	0.848

Result:

Both test reject the null and do not reject the alternative hypothesis, i.e. the mean of consumption expenditures per capita within male/female headed household is less than the corresponding minimum of existence level

Conclusion:

Although female headed households obtain on average higher levels of expenditures per capita than male headed households, both means of female and male headed households' expenditures per capita are statistically **significantly less than their respective minimum existence levels**. This means that within both groups (male and female headed households) the means of consumption expenditures per capita is statistically significantly less than the minimum of existence. Moreover, both means have the 95% confidence interval below the corresponding minimum of existence, while male headed households have this interval far below comparing with female headed households.

Conclusions and Implications

The research's conclusions contradicts the previous study results by the World Bank and the Ministry of Economy of Moldova, particularly:

- The real poverty rate **is much higher than** the official poverty rate reported by the Ministry of Economy and the World Bank. Thus, when poverty phenomenon is assessed using the minimum of existence level, the living standards estimator that is elaborated by the National Bureau of Statistics of Moldova the poverty rate in urban areas constituted 73%, and 77% in rural areas;

- The difference between the percentages of people who live below the minimum of existence level within urban areas **is not significantly higher** than the percentage of people who live below the minimum of existence level within rural areas. The Ministry of Economy and the World Bank report had pictured the poverty as a rural phenomenon in Moldova. However our findings suggest that poverty is not a mostly rural problem in Moldova, it is a **massive phenomenon** in Moldova, characteristic to both rural and urban areas;

- Female headed households on average achieve higher consumption expenditures per capita within **all age groups** comparing with males headed households. This result contradicts the Moldavian government report as well as the World Bank report that stated "generally, women have a lower incidence of poverty than men, but the pattern reverses among elderly".[20]

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[20] The World Bank Poverty Assessment, 1999, 10p.

However we believe that further surveys and studies must be made to research location and gender characteristics of the phenomenon of poverty within the Moldavian regions.

The research provides other important conclusions regarding poverty phenomenon in Moldova that had never been known before:

- The Southern part of Moldova is more affected by the poverty comparing with the Northern and Central regions. However the difference between means of consumption expenditures per capita within the Southern and Northern regions is small. Thus, people from the Northern part of **do not achieve substantially higher** expenditures per capita levels compared with the Southern part. Moreover when the Central part of Moldova is analyzed without including the observations from Chisinau – the capital of Moldova, the statistical tests proved that there is no statistical significant difference between the means of consumption expenditures per capita by regions, i.e. **poverty is indeed a characteristic phenomenon for the whole country**, but it is less severe in Chisinau, since the mean of consumption expenditures per capita in the capital is higher than the minimum of existence within urban areas;

- Female headed households achieve on average **higher consumption expenditures per capita** compared with male headed households, i.e. poverty incidence rate must be lower within female headed households than within male headed households. However, this fact could be explained by the large amount of households headed by females which are composed of a person (almost 50%), i.e. a female who lives alone. Females who live alone achieve on average higher consumption expenditures per capita comparing with males who live alone. This conclusion is consistent with

the major emigration trends of the male population in Moldova. Thus, **a female who lives alone is much more likely to be financially supported by her partner who works abroad**, than a male who lives alone;

- Although female headed households obtain on average higher levels of expenditures per capita than male headed households, the mean of both female and male headed households' consumption expenditures per capita distributions are statistically **significantly less than their respective minimum of existence levels**. This suggests that a significant percentage of people live below the minimum of existence level within both female and male headed households.