

Estimation of Income and Expenditures of the population of the RA using the synthesis of the JMP and Fields methods

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Оценка доходов и расходов населения РА с использованием синтеза методов JMP и Fields

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Аннотация. Для изучения изменений в неравенстве доходов и расходов РА был применен синтез метода JMP и Fields. Этот метод позволяет нам рассчитывать как агрегированные, так и подробные разложения изменений в неравенстве доходов и расходов. Декомпозиция изменения неравенства доходов и расходов за период 2008-2020 гг. показывает, что рост неравенства доходов в Республике Армения был вызван изменениями в образовании и распределением ненаблюдаемых показателей. Образование способствует увеличению неравенства доходов и расходов. Уменьшение надбавки к заработной плате мужчин способствует выравниванию неравенства доходов и расходов.

Ключевые слова: доходы населения, расходы населения, метод JMP, метод Fields, регрессионный анализ

ՀՀ բնակչության եկամուտների և ծախսերի գնահատում JMP և Fields մեթոդների համադրությամբ

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Ամփոփագիր. ՀՀ եկամուտների և ծախսերի անհավասարության փոփոխություններն ուսումնասիրելու նպատակով կիրառվել է JMP և Fields մեթոդի համադրությունը: Մեթոդը մեզ հնարավորություն է տալիս հաշվարկել եկամուտների և ծախսերի անհավասարության փոփոխությունների և՛ համախառն, և՛ ըստ առանձին գործոնների: 2008-2020 թվականների ընթացքում եկամուտների և ծախսերի անհավասարության փոփոխումը ցույց է տալիս, որ Հայաստանի Հանրապետությունում եկամուտների անհավասարության աճը պայմանավորված է կրթության և չնկարագրվող գործոնների բաշխվածության փոփոխություններով: Կրթությունը նպաստում է եկամուտների և ծախսերի անհավասարության ընդլայնմանը, իսկ տղամարդկանց աշխատավարձի հավելավճարի նվազումը փոքրացնում է եկամուտների և ծախսերի անհավասարությանը:

Հանգուցաբառեր՝ բնակչության եկամուտ, բնակչության ծախսեր, JMP մեթոդ, Fields մեթոդ, ռեգրեսիոն վերլուծություն

Introduction: The studies of the income and expenditures of the population give us an opportunity to form a correct picture of the socio-economic situation of the country. There are many factors that have an impact on the distribution of the incomes and expenditures. In order to understand

the sources of the increasing income and expenditure inequality we may need to answer to the following questions “How much do the changes in the education contribute to the changes of the income inequality or “How much do the changes in the education contribute to the changes of the

expenditure inequality. The unified method is used to answer those questions. This method is a synthesis of already existing two methods. Both methods are based on the income and expenditure equation – one by the Fields [1, pp 1-38] and another by Juhn, Murphy and Pierce [2, pp 410-442].

Methodology: Let the incomes and expenditures are generated from the following regression equation

$$\ln y_{it} = \sum_{j=1}^m b_{itj} x_{itj} + e_{it} = \sum_{j=1}^n b_{itj} z_{itj} \quad (1)$$

$i = \overline{1, n}$

where $\ln y_{it}$ is the log value of the income or expenditure for the household i and period t and x_{itj} , e_{it} are the exogenous variables and residuals, respectively, for the j indicator and t period. z_{itj} is a vector which includes exogenous variables and residuals.

The Fields method evaluates the impact of indicator j on the variation of the value of income (expenditure) per capita of household i .

$$\begin{aligned} \text{Var}(\ln y_{it}) &= \text{Cov}(\ln y_{it}, \ln y_{it}) \\ &= \text{Cov}\left(\sum_{j=1}^n b_{itj} z_{itj}, \ln y_{it}\right) \end{aligned} \quad (2)$$

If we divide the two parts of the (2) equations $\text{Var}(\ln y_{it})$ we will get the following equation

$$\begin{aligned} 1 &= \frac{\text{Cov}\left(\sum_{j=1}^n b_{itj} z_{itj}, \ln y_{it}\right)}{\text{Var}(\ln y_{it})} \\ &= \sum_{j=1}^n S_{tj} \end{aligned} \quad (3)$$

where S_{tj} is the participation of the j -th indicator per capita in the variance of the income (expenditure). Shorrocks showed that if income (expenditure) can be represented as a sum of various indicators, then in this case S_{tj} measures the impact of each indicator j on the inequality of income (expenditure) distribution for the inequality indicators (variation, Gini coefficient, Tail index, etc.) [3, pp 194].

JMP method can be constructed as follows. First, replace the coefficients of the earnings equation of time period b_{itj} with those of the second time period while keeping the individual characteristics and residuals unchanged. The auxiliary incomes (expenditures) equation after changing coefficients is: [4, pp 127-132]

$$\ln y_{i,aux} = \sum_{j=1}^m b_{i2j} x_{i1j} + e_{i1} = \sum_{j=1}^n b_{i2j} z_{i1j} \quad (4)$$

$i = \overline{1, n}$

In that case, the difference between the variances of the incomes (expenditures) can be written in this way:

$$\begin{aligned} &\text{Var}(\ln y_2) - \text{Var}(\ln y_1) \\ &= [\text{Var}(\ln y_{aux}) - \text{Var}(\ln y_1)] \\ &+ [\text{Var}(\ln y_2) - \text{Var}(\ln y_{aux})] \\ &= \sum_{j=1}^m \{ [S_{aux,j} * \text{Var}(\ln y_{aux}) - S_{1,j} * \text{Var}(\ln y_1)] \\ &+ [S_{2,j} * \text{Var}(\ln y_2) - S_{aux,j} * \text{Var}(\ln y_{aux})] \} \end{aligned} \quad (5)$$

By combining the JMP and Fields methods, we will get the following equation

$$\begin{aligned} &\text{Var}(\ln y_2) - \text{Var}(\ln y_1) \\ &= \sum_{j=1}^m [b_{2j} * \sigma(Z_{1j}) * \text{Corr}(Z_{1j}, \ln y_{aux}) \\ &* \sigma(\ln y_{aux}) - b_{1j} * \sigma(Z_{1j}) * \text{Corr}(Z_{1j}, \ln y_1) \\ &* \sigma(\ln y_1)] \\ &+ \sum_{j=1}^m [b_{2j} * \sigma(Z_{2j}) * \text{Corr}(Z_{2j}, \ln y_2) * \sigma(\ln y_2) \\ &- b_{2j} * \sigma(Z_{1j}) * \text{Corr}(Z_{1j}, \ln y_{aux}) \\ &* \sigma(\ln y_{aux})] \end{aligned} \quad (6)$$

The first part of the equation (6) refers to a change in the level of general income (expenditure) inequality by changing the coefficients of variables, and the second part refers to a change in variance.

Analysis: Before proceeding to the assessment of inequality, it is necessary to build a regression model, where the dependent variables will be the incomes and expenditures of the population of the Republic of Armenia, and the components characterizing them as independent variables. To build the models, the databases of depersonalized micro-files (by household) of the integrated survey of the level (conditions) of household life, presented by the National Statistical Service in 2008-2020, were used. The variables considered in the model can be divided into the following groups: household structure, income, expenses, education, housing conditions, place of residence.

Table 1: Regression results of the Income Equations

Variable	2008			2020		
	Coefficient	Std. Error	t-Statistic	Coefficient	Std. Error	t-Statistic
C	5.990	0.132	45.39*	6.793	0.233	29.123*

Log (Food Consumption)	0.139	0.006	24.631*	0.128	0.009	13.966*
Log (Food Purchased)	0.371	0.011	34.181*	0.118	0.007	19.243*
Age of the Head	0.006	0.001	10.315*	0.001	0.001	20.317
Education of the Head	0.057	0.005	12.285*	-0.012	0.015	-0.772
Sex of the Head	-0.195	0.017	-11.164	-0.189	0.029	-6.314*
Share of the children in the Household	0.063	0.007	8.905*	0.571	0.085	6.707*
Using central heating as a source of energy	0.225	0.127	1.915	0.142	0.185	0.773
Using electricity as a source of energy	-0.034	0.069	-0.394	0.026	0.043	0.617
Using natural gas as a source of energy	0.174	0.030	4.788	0.203	0.030	6.790*
Settlement type (urban or rural)	-0.097	0.013	-7.313	-0.062	0.334	-1.821*
Education of the members	0.297	0.017	5.726*	0.125	0.019	6.612*
Male share in the household	0.174	0.015	5.530*	0.185	0.069	5.343*

Note: * indicates statistical significance in 5%

Table 1 shows the regression results of the Income equations. Sex of the head, education of the head housing conditions and settlement variables

haven't been included in the 5% significance range and have been removed from the equations.

Table 2: Regression results of the Expenditure Equations

Variable	2008			2020		
	Coefficient	Std. Error	t-Statistic	Coefficient	Std. Error	t-Statistic
C	3.803	0.091	41.930*	4.555	0.154	29.629*
Log (Food Consumption)	0.147	0.004	37.937*	0.117	0.006	19.233*
Log (Food Purchased)	0.610	0.007	81.886*	0.572	0.012	47.293*
Age of the Head	-0.001	0.001	-0.198	-0.002	0.001	-3.461*
Education of the Head	0.032	0.003	10.190*	0.005	0.010	0.474
Sex of the Head	-0.103	0.012	-8.563*	-0.113	0.020	-5.765*
Share of the children in the Household	0.056	0.005	11.519*	0.466	0.056	8.298*
Using central heating as a source of energy	0.313	0.135	1.005	0.220	0.122	1.810
Using electricity as a source of energy	0.057	0.173	0.586	-0.014	0.029	-0.494
Using natural gas as a source of energy	-0.075	0.524	-1.733	0.134	0.020	6.788*
Settlement type (urban or rural)	-0.093	0.009	-10.319	0.022	0.022	0.984
Education of the members	0.177	0.039	6.317*	0.074	0.012	5.920*
Male share in the household	0.214	0.040	6.321*	0.244	0.075	5.632*

Note: * indicates statistical significance in 5%

Table 2 shows the regression results of the Expenditure equations. Sex of the head, education of the head housing conditions and settlement variables haven't been included in the 5% significance range and have been removed from the equations. Using the estimates of the income and expenditure equations, the Fields method has been applied to assess the contribution of individual factors. The results are reported in the Table 3 and

Table 5 shows the results of decomposing the differences in income and expenditure inequality between the two years using the synthesis of JMP and Fields methods.

Table 3: Decomposition of Income inequality

	2008		2020	
VLOG	0.245	(100)	0.318	(100)
Log (Food	0.023	(9.1)	0.019	(6)

