THE IMPACT OF THE INCREASE IN CONSUMER PRICES ON SOCIAL INCLUSION INDICATORS

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Abstract: *Social inclusion indicators are used to establish social policies, allowing to describe the level of social development as well as existing problems. Excessive increases in consumer prices exert a considerable influence on social inclusion indicators. Consequently, in this article we set out to analyze both the influence of consumer prices (consumer price indices for food, non-food and services) on the indicators of social inclusion (the rate of poverty and material deprivation) as well as the evolution of these indicators. The analysis of the trend and causal links between the indicators analyzed was carried out on the basis of the annual series from the period 2007-2020. Statistical processing and econometric modeling are carried out with Excel and Eviews software packages.*

Keywords: Social inclusion indicators, Consumer price indices, Regression, Statistical tests, Descriptive Statistics.

JEL Classification Codes: E37, F63, O35

1. INTRODUCTION

The Council of the European Union has developed a set of 17 indicators common to all EU Member States, which present issues related to social inclusion (monetary poverty and inequality, employment, health and education). These indicators are complemented by a set of 13 context indicators with which the specific phenomena of the different countries are estimated.

The objective of statistical research on indicators of social inclusion and consumer prices is to establish short-term trends. The annual evolution of these indicators is studied using chronograms and chronological indicators.

The impact of consumer prices on social inclusion indicators is determined with the help of regression analysis that allows studying and measuring the existing relationships between phenomena.

The regression model used to present the relationship between social inclusion indicators and consumer prices is of the form:

$$y = f(x) + \varepsilon \qquad (1)$$

where: y is the dependent variable of the regression model; x is the independent variable of the regression model; ε is the random or disruptive variable.

The estimation of the parameters of the regression model shown in the relationship (1) is carried out using the method of the smallest squares.

One of the fundamental conditions that must be met before estimating the regression equation is to check the stationary character of the time series. The verification of the stationary character of the series is carried out using the Augmented Dickey‑Fuller test.

Time series are stationary if $t\_Statistic \geq t\_Critical$ and the probability p is less than the materiality threshold $\alpha = 0,05$ (Șerbănescu and Necșulescu, 2013).

The intensity of the connection between phenomena is determined by means of the correlation ratio and the accuracy with which the dependent variable is explained by the variation of the independent variable is shown by the coefficient of determination.

The validity of the regression econometric model is given by: the verification of the error independence hypothesis (Durbin – Watson test), the verification of the hypothesis of normality of errors (Jarque Bera test), the estimators of parameters that are significantly different from zero (test t) and the appropriate model of the data (test F).

In this paper we have chosen a small set of social impact indicators, namely the poverty rate and the rate of material deprivation, and within the consumer price indices we have used the price indices for food, non-food goods and services.

2. ANALYSIS OF THE EVOLUTION OF SOCIAL INCLUSION INDICATORS AND CONSUMER PRICE INDICES

In this paper we have chosen from the system of indicators of social inclusion, a limited set of general indicators, namely the poverty rate and the rate of material deprivation, indicators that allow comparability with other EU Member States.

The analysis of consumer price indices covers prices for food, non-food and services goods.

The evolution of consumer prices and the two indicators of social inclusion is made on the basis of annual data taken from the website of the National Institute of Statistics and EUROSTAT for a period of 14 years (2007 – 2020).

By analyzing the descriptive statistics of the variables studied in this paper, we found that all data series are normally distributed (according to the distribution χ^2, the critical value of the statistical test Jarque_Bera for a materiality threshold of 0.05 is 5.99 and the calculated values of the statistical test are between 0.521 and 0.782 with the probabilities higher than the materiality threshold), that the distributions are symmetrical (the Skewness test values are lower than ± 1) and are not accelerated (the Kurtosis test values are lower than ± 3), homogeneous (coefficients of variation: 5.02%, 28.10% and 2.57% respectively are lower than 35%).

Table 1: Descriptive statistics for poverty rate, material deprivation rate and IPC

	Poverty rate	Material deprivation rate	IPC
Mean	23.586	25.879	103.488
Median	23.550	27.700	103.905
Standard Deviation	1.185	7.274	2.664
Kurtosis	-0.783	-0.999	-0.347
Skewness	0.095	-0.240	-0.447
Jarque-Bera	0.521	0.782	0.604
Probability	0.771	0.676	0.739
Count	14	14	14

Source: Data processing taken from the websites:
https://ec.europa.eu/eurostat/databrowser/view/ILC_MDDD11__custom_1889736/default/table?lang=en and http://statistici.insse.ro:8077/tempo-online/#/pages/tables/insse-table

The stationary character of the three data series is checked using the Augmented Dickey-Fuller test. Analyzing the data presented in Table 2, we can state that for the material deprivation rate and IPC, the series are stationary if we accept a signification level of 1% and for the poverty rate, the series is stationary if we accept a signification level of 5%.

Table 2: Augmented Dickey-Fuller test results

	t-Statistic	Prob	t-Statistic	Prob	t-Statistic	Prob
Poverty rate			Material deprivation rate		IPC	
Augmented Dickey-Fuller statistical test	-2.575262	0.0150	-2.946533	0.0070	-3.540856	0.0021
Test critical values:						
1% level	-2.771926					
5% level	-1.974028					
10% level	-1.602922					

Source: Data processing taken from the websites:
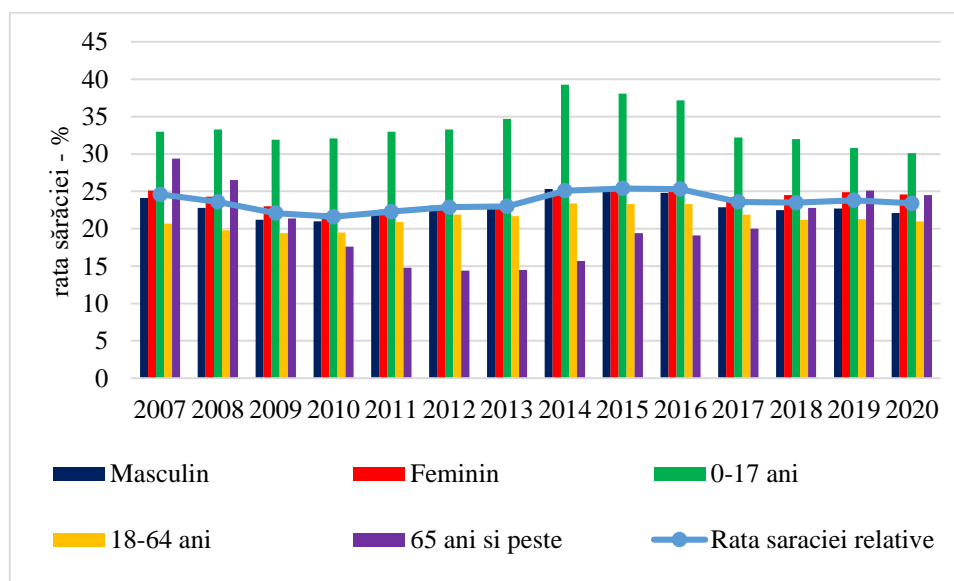https://ec.europa.eu/eurostat/databrowser/view/ILC_MDDD11__custom_1889736/default/table?lang=en and http://statistici.insse.ro:8077/tempo-online/#/pages/tables/insse-table

Figure 1. Evolution of the poverty rate by total, sex and age group

In the period 2007 - 2020, the poverty rate has an oscillating evolution, the maximum value of the period is reached in 2015 (25.4%) and the minimum value in 2010 (21.6%).

Between women and men, the poverty rate statistically registers significant differences ($p = 0.019$). For the entire period, the poverty rate among women is significantly higher than among men, except for the period 2012-2014 when the situation changes.

The poverty rate affects the Romanian population differently depending on the age, so the highest value is found among young people up to 17 years of age, well above the values corresponding to people over 18 years of age ($p = 0$).

In 2020 compared to 2007, we saw a decrease in the poverty rate among both women (0.5 percentage points) and men (2.0 percentage points), among people under the age of 17 (2.9 percentage points) and for people older than 64 years (4.9 percentage points).

Before the start of the pandemic (2019), the poverty rate is 23.8 percentage points. In the pandemic (2020), the poverty rate is reduced to 23.4 percentage points (it is reduced by 0.4 percentage points). One of the main causes of the decrease in the poverty rate is the reduction of the Romanian population. Other causes that can lead to a decrease in the poverty rate are the decisions to increase the incomes and social protections taken by the state in the context of the pandemic. All these positive influences on the poverty rate are mitigated by the price increases for food, non-food goods and services.
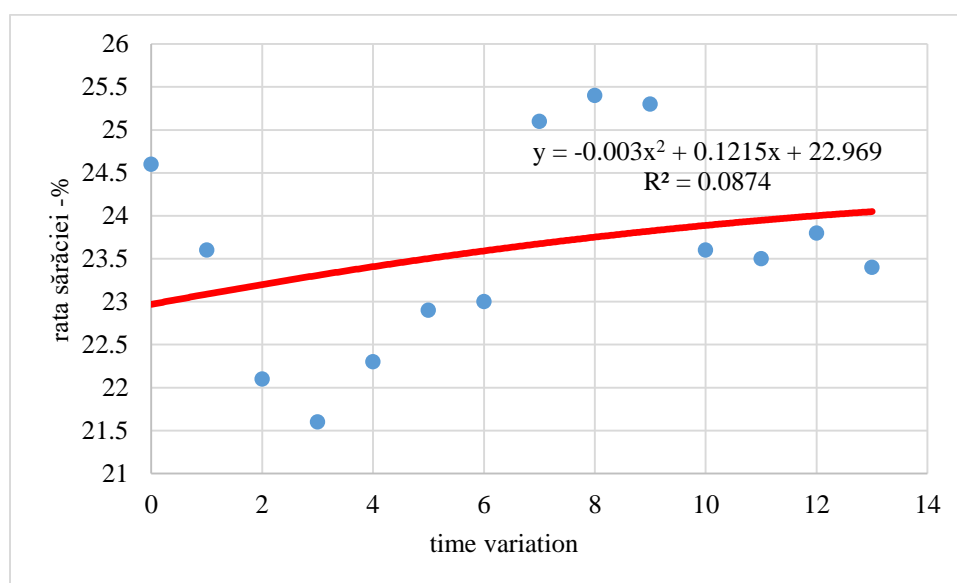

$$y = -0.003x^2 + 0.1215x + 22.969$$
$$R^2 = 0.0874$$

Figure 2. Poverty rate trend in the period 2007 – 2020

During the studied period, 2007-2020, the poverty rate increases on average by 0.12 percentage points/year. For 2021 – 2023, an upward trend is forecasted for the poverty rate (23.76%, 23.79% and 23.82%, respectively).

The poverty of the population can be better highlighted by the material deprivation rate that shows the inability of people to ensure decent living conditions.

If, in the analyzed period, the poverty rate has an oscillating trend, the rate of material deprivation has a decreasing trend.

The rate of material deprivation in the case of women is slightly higher than that of men (the difference is not statistically significant – $p = 0.48$). According to statistical data, people over the age of 65 have the highest values of the material deprivation rate and are followed by those under the age of 17. These high values of the material deprivation rate for the 2 age groups are due to the lack of financial resources and therefore they cannot afford a decent standard of living.
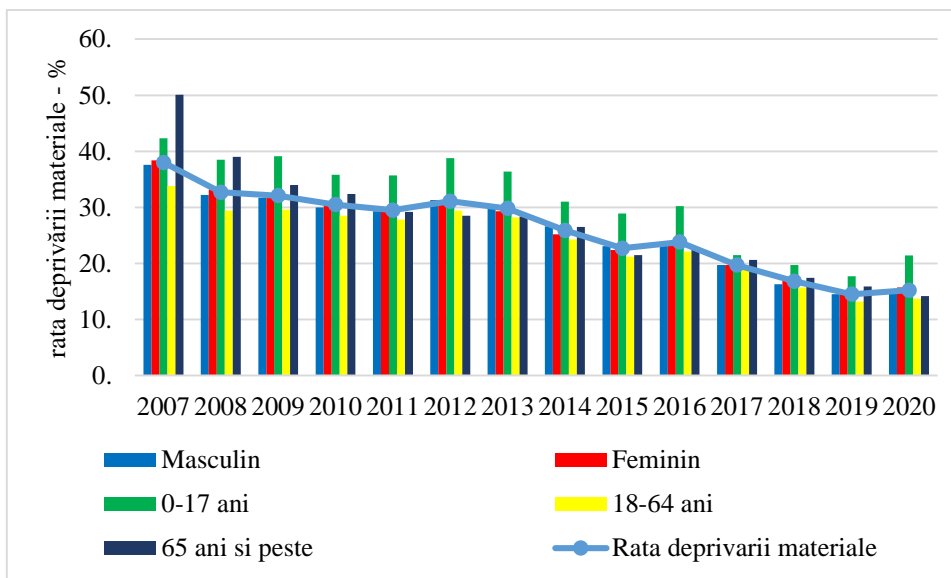
Figure 3. Evolution of the rate of material deprivation by total, sex and age group

In 2020, a year that coincides with the beginning of the pandemic, compared to 2019, the material deprivation rate registers an increase of 0.70 percentage points due to the reduction of financial resources and the increase in consumer prices. This year, the highest increase in the rate of material deprivation is found in the age group under 17 years (increases by 3.7 percentage points).
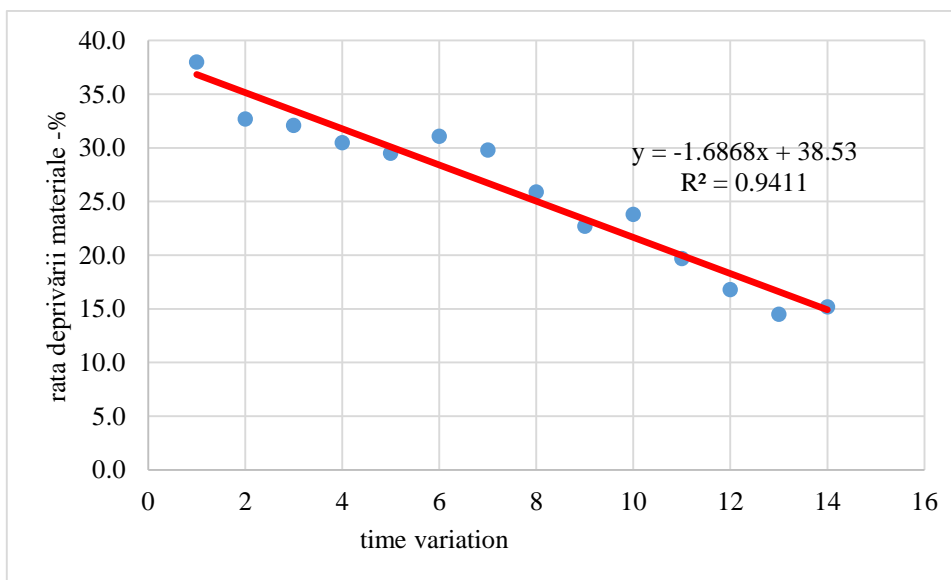

Figure 4. The trend of the material deprivation rate in the period 2007 – 2020

In the studied period, 2007 - 2020, the material deprivation rate decreases annually on average by 1.6868 percentage points / year. For 2021 – 2023, a decreasing trend is forecasted for the material deprivation rate (14.87%, 13.18% and 11.49% respectively).
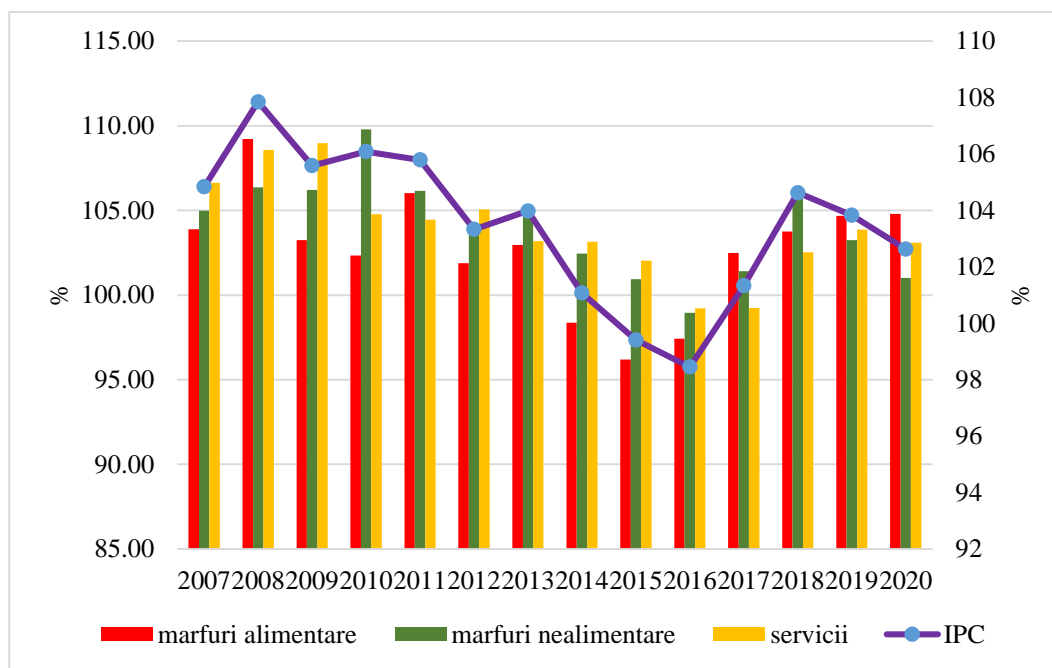
Figure 5. Evolution of IPC in the period 2007 – 2020

In 2020 compared to 2019, both the IPC for the total and the price indices on the categories of food, non-food goods and services increased thus, the IPC in total was 102.63%, the prices of non-food goods evolved the slowest (respectively 101.01%), for food goods the jump was of 104.8% (the fastest increase in prices) and for services was 103.1%.
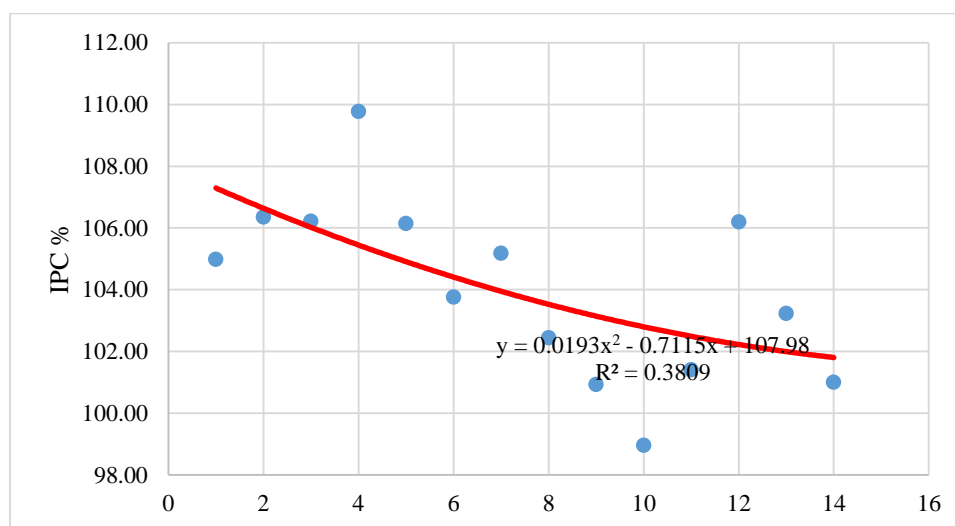

Figure 6. Evolution of IPC in the period 2007 – 2020

For 2021 – 2023, an upward trend is forecasted for the consumer price index (103.34%, 104.07% and 104.95%, respectively). The same situation is encountered in the case of the three price categories. Thus, it is forecasted that the food price indices have the highest increase (107.06%, 109.12%, 111.46% - the trend is given by the function $y = 0.1375t^2 - 2.2758t + 109.76$), followed by the increases in price indices for services (103.14%, 103.83%, 104.68% - the trend is given by the function $y = 0.0753t^2 - 1.6348t + 110.71$) and the increase in non-food

price indices is forecast to be decreasing (101.61%, 101.48%, 101.40% - the trend is given by the function y = 0.0193t^2 - 0.7115t + 107.98).

3. IMPACT OF PRICES ON SOCIAL INCLUSION INDICATORS

The analysis of the correlations between the studied variables is carried out for the period 2007 – 2020. As a result of data processing with the Eviews software we have obtained a series of unifactorial regression functions that we have presented in Table 3.

Table 3: Econometric models of unifactorial regression

Regression function	Multiple R	R Square
IPC –the independent variable *Poverty rate –the dependent variable*		
Poverty rate = -9.59 + 0.32*IPC $\lvert t_c^a \rvert = \lvert -6.16 \rvert$; $\lvert t_c^b \rvert = 3.6$; $p_a = 0$; $p_b = 0.0036$ $F_c = 12.99$; $p = 0.0036$; Durbin-Watson stat = 1.06	0.72102	0.519870
Between the IPC and the poverty rate we have a direct link of medium intensity. About 52% of the change in the poverty rate is justified by the variation in the IPC and 48% by the variation in the factors not specified in the model. The increase in IPC on average by one percentage point/year leads to an annual increase in the poverty rate on average by 0.32 percentage points.		
IPC_food commodities –the independent variable *Poverty rate –the dependent variable*		
Poverty rate = -1.4 + 0.24*IPC_food commodities $\lvert t_c^a \rvert = \lvert -5.189 \rvert$; $\lvert t_c^b \rvert = 2.382$; $p_a = 0.0002$; $p_b = 0.0346$ $F_c = 5.678$; $p = 0.0346$; Durbin-Watson stat = 0.9769	0.566735	0.321188
Between food commodity prices and the poverty rate, we have a direct link of medium intensity. About 32% of the change in the poverty rate is justified by the change in food commodity prices and 68% by the change in factors not specified in the model. The increase in food prices on average by one percentage point/year leads to the annual increase in the poverty rate on average by 0.24 percentage points.		
IPC_non-food goods –the independent variable *Poverty rate – the dependent variable*		
Poverty rate = -8.59 + 0.31*IPC_non-food goods $\lvert t_c^a \rvert = \lvert -6.814 \rvert$; $\lvert t_c^b \rvert = 3.911$; $p_a = 0$; $p_b = 0.0021$ $F_c = 15.29708$; $p = 0.0021$; Durbin-Watson stat = 1.24	0.748594	0.560393
Between the prices of non-food goods and the poverty rate, we have a direct link of medium intensity. About 56% of the change in the poverty rate is justified by the change in the prices of non-food goods and 44% by the change in factors not specified in the model. The increase in the prices of non-food goods on average by one percentage point / year leads to the annual increase in the poverty rate on average by 0.31 percentage points.		
IPC_services –the independent variable *Poverty rate – the dependent variable*		
Poverty rate = 10.4 + 0.13*IPC_services $\lvert t_c^a \rvert = 3.87$; $\lvert t_c^b \rvert = 1.73$; $p_a = 0.0022$; $p_b = 0.01089$ $F_c = 5.9997$; $p = 0.01089$; Durbin-Watson stat = 0.9272	0.4461	0.1999

Between the prices of services and the poverty rate we have a direct link of medium intensity. About 20% of the change in the poverty rate is justified by the change in service prices and 80% by the change in factors not specified in the model. The increase in service prices on average by one percentage point/year leads to the annual increase in the poverty rate on average by 0.13 percentage points.

IPC –the independent variable Material deprivation rate – the dependent variable		
Deprivation rate = -100.05 + 1.22*IPC $\lvert t_c^a \rvert = \lvert -3.40 \rvert$; $\lvert t_c^b \rvert = 2.72$; $p_a = 0.019$; $p_b = 0.011$ $F_c = 4.9735$; $p = 0.011$; Durbin-Watson stat = 1.4254	0.4456	0.1986

Between consumer prices and the rate of material deprivation we have a direct link of medium intensity. About 20% of the change in the material deprivation rate is justified by the change in consumer prices and 80% by the change in factors not specified in the model. The increase in consumer prices on average by one percentage point/year leads to the annual increase in the material deprivation rate by an average of 1.22 percentage points.

IPC_ food commodities –the independent variable Material deprivation rate – the dependent variable		
Deprivation rate = -5.84 + 0.31*IPC_food commodities $\lvert t_c^a \rvert = \lvert -4.09 \rvert$; $\lvert t_c^b \rvert = 3.51$; $p_a = 0.023$; $p_b = 0.042$ $F_c = 5.2628$; $p = 0.042$; Durbin-Watson stat = 1.1934	0.4705	0.2214

Between food commodity prices and the material deprivation rate we have a direct link of medium intensity. About 22% of the change in the rate of material deprivation is justified by the change in food prices and 78% by the change in factors not specified in the model. The increase in food commodity prices on average by one percentage point/year leads to an annual increase in the material deprivation rate by an average of 0.31 percentage points.

IPC_non-food goods – the independent variable Material deprivation rate – the dependent variable		
Deprivation rate = -104.3 + 1.25*IPC_non-food goods $\lvert t_c^a \rvert = \lvert -4.59 \rvert$; $\lvert t_c^b \rvert = 2.99$; $p_a = 0.014$; $p_b = 0.019$ $F_c = 5.9710$; $p = 0.019$; Durbin-Watson stat = 1.5577	0.4990	0.2486

Between the prices of non-food goods and the rate of material deprivation we have a direct link of medium intensity. About 25% of the change in the material deprivation rate is justified by the change in the prices of non-food goods and 75% by the change in factors not specified in the model. The increase in the prices of non-food goods on average by one percentage point/year leads to the annual increase in the material deprivation rate on average by 1.25 percentage points.

IPC_services – the independent variable Material deprivation rate – the dependent variable		
Deprivation rate = -138.95 + 1.59*IPC_services $\lvert t_c^a \rvert = \lvert -2.36 \rvert$; $\lvert t_c^b \rvert = 2.80$; $p_a = 0.036$; $p_b = 0.016$ $F_c = 7.866$; $p = 0.016$; Durbin-Watson stat = 1.6143	0.6293	0.3960

Between the prices of services and the rate of material deprivation we have a direct link of medium intensity. About 40% of the change in the rate of material deprivation is justified by the change in service prices and 60% by the change in factors not specified in the model. The increase in the prices of services on average by one percentage point/year leads to the annual increase in the rate of material deprivation on average by 1.59 percentage points.

For all regression functions, the parameter estimators are significantly different from zero, the calculated values of the F-statistic and t-Statistic statistical statistical tests are superior to the theoretical values and the probabilities are below the materiality threshold and thus the econometric model can be used for forecasts.

Table 4: Forecast of the poverty rate and the rate of material deprivation

	2021	2022	2023
IPC poverty rate	23.48	23.71	23.99
Poverty rate by IPC on food commodities	*24.29*	*24.79*	*25.35*
Poverty rate according to IPC non-food commodities	23.92	23.88	23.86
Poverty rate by IPC services	23.81	23.90	24.01
Rate of material deprivation by IPC	26.02	26.92	27.99
Rate of material deprivation according to IPC food commodities	*27.35*	*27.99*	*28.71*
Rate of material deprivation by IPC of non-food goods	22.71	22.56	22.45
Rate of material deprivation according to IPC services	25.03	26.14	27.48

Analyzing the data presented in table 3, we conclude that the increases in the values of the consumer price indices by total and by category determine the annual increase both of the poverty rate with values between 0.18 and 0.32 percentage points and of the material deprivation rate with values between 0.31 and 1.59 percentage points. The greatest impact on the poverty rate is the increase in prices for non-food goods (the poverty rate increases annually on average by 0.56 percentage points if prices increase by one percentage point) and on the rate of material deprivation, the biggest influence is the increase in prices for services (the rate of material deprivation increases on average by 1.59 percentage points in the case of the increase in prices for services by one percentage point / year).

Using the regression functions presented in Table 3, we determined the probability values (shown in Table 4) for the two indicators (poverty rate and material deprivation rate) according to the consumer price indices for total and by food, non-food and services categories.

4. CONCLUSIONS

As a result of the study carried out, there is a decreasing evolution for the rate of material deprivation and oscillating for the poverty rate. In 2020, a year that coincides with the beginning of the pandemic, the poverty rate is decreasing compared to 2019 as a result of the reduction of the population and the measures taken by the state regarding social protections. As for the rate of material deprivation, it is increasing due to the reduction of financial resources and the increase in consumer prices for food goods and services. Both the poverty rate and the rate of

material deprivation have high values among women. Among young people up to the age of 17, the poverty rate and the rate of material deprivation are well above the values corresponding to people over the age of 18.

Both total consumer price indices and price indices by food, non-food and services categories have increased. The fastest increase in prices is in the case of food commodities and the slowest have evolved the prices of non-food goods.

The increase in consumer prices in total and by category has a negative impact on the two indicators of social inclusion, the poverty rate and the rate of material deprivation, in the sense that they cause increases in these indicators. The biggest impact on the poverty rate is the increase in prices for non-food goods and on the rate of material deprivation, the biggest influence is the increase in prices for services. The link between these indicators is of medium intensity, which means that in addition to consumer prices, there are other indicators that can influence the poverty rate and the rate of material deprivation.

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