Relevance of the material deprivation indicator, evidence based on Slovak EU-SILC microdata

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Abstract. The indicator of material deprivation is defined as people living in households fulfilling four out of nine conditions defined in the EU SILC methodology. It is also a vital area of interest for the recently created Europe 2020 strategy. In this paper we analyse the construction of the material deprivation strategy validating its informational value as well as test for its validity in case of adding additional dimensions of material deprivation through the use of logistic regression. As a conclusion we propose a change to construction of the indicator.

Keywords: Material deprivation, EU SILC, Europe 2020, Indicator construction

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1 Material deprivation

Material deprivation is considered as one of the dimensions of social exclusion. The discourse about social exclusion originates from France [6] and can the term can be defined in a number of ways. Room [8] characterized social exclusion as a situation where (a) individuals suffer generalized disadvantage in terms of education, training, employment, housing, financial resources, etc; (b) individuals' chances of gaining access to the major social institutions which distribute these life chances are substantially less than those of the rest of the population; (c) these disadvantages persist over time.

Material deprivation, while dependent on the income of an individual is more focused on the non-financial possibilities and resources avaiable to the individual. The notion for the creation of a **common EU-wide measure** of material deprivation first appeared during the design phase of the **Lisbon Strategy** [1]. Several member states had however already constructed and measured material deprivation. Table 1 below illustrates the measures implemented by one or more member states of the EU before the year 2000.

Indicator	Countries using the indicator
Percentage of households lacking specified amenities	Belgium, Spain, France, Ireland, Italy, Portugal, Finland, United Kingdom
Number of homeless	Belgium, Spain, France, Ireland, United Kingdom
Amount of people who have had difficulties in the last 12 months in paying for water, electricity, and gas	France
Percentage of population in rent arrears	France
Percentage of population not going away on holiday	France
Measure of 'consistent' poverty (a combination of financial and non-financial poverty)	Ireland
Percentage with a subjective perception of difficulty of access to some selected services (medical, food stores, schools, police stations, etc.)	Italy
Percentage of population living in housing that does not meet decency standards	United Kingdom
Percentage of households with children living in temporary accommodation	United Kingdom

Table 1 Material deprivation indicators in EU member states, before 2000

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1.1 Material deprivation within the EU context

The EU concept of measurement [1] of material deprivation is supposed to supplement the imperfections accompanying measures of financial poverty. **Indicators of deprivation are generally based on asking survey respondents whether they have a specific item or participate in a certain activity**. The commission responsible for the development of the indicator in regards to material deprivation recommended developing the following measurements: non-monetary indicators of deprivation, Housing of poor environmental quality, housing costs, homelessness and precarious housing

The first EU-wide indicator of material deprivation was developed as a part of the EU Statistics about income and living conditions (EU SILC), which was first conducted in 2003. The first round of EU SILC conducted in Slovakia occurred in 2005 one year after the entry into the EU. The material deprivation indicator however wasn't introduced as a part of the Lisbon Strategy (which was terminated due to its failure in 2009). It appeared in 2009 as a part of the **Sustainable Development Strategy** of the EU [4] within the context of social inclusion [2]. The official definition [5] of the indicator describes it as covering issues relating to economic strain and durables. **Severely materially deprived persons have living conditions greatly constrained by a lack of resources and cannot afford at least four of the following**: to pay rent or utility bills; to keep their home adequately warm; to pay unexpected expenses; to eat meat, fish or a protein equivalent every second day; a week holiday away from home; a car; a washing machine; a colour TV; or a telephone. Table 2 illustrates the development of the material deprivation levels for Slovakia.

Year	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**
Value	22.1	18.2	13.7	11.8	11.1	11.4

Table 2 Levels of material deprivation in Slovakia, 2005-2010

As we can observe, levels of material deprivation in Slovakia have been experiencing a decelerating decrease until 2009, followed by a slight increase due to the impact of the global economic and budget deficit crisis.

European Commissions has, as the reaction to the failure of the Lisbon strategy and in the light of the ongoing global economic crisis created strategy **Europe 2020**. Europe 2020 is supposed to help EU cope with the current economic environment and increase its competitive potential by 2020. Europe 2020 also includes goals for the area of social inclusion. **One of the main indicators used to monitor the progress in this area is the not by a coincidence the material deprivation indicator we described above**.

2 Assessment of the indicator

For evaluating the relevance of the material deprivation indicator we will be using the EU SILC 2010 data spanning 5376 households comprising of 16304 persons. It should be noted, that while the indicator expresses the percentage of materially deprived individuals on the whole population of an EU member state, the access to different amenities is measured at a household level. There are two ways of conducting the analysis of the indicator.

We can **analyse** changes in its values in regards to the threshold formed by the **number of conditions met in order to classify an individual as materially deprived**, this involves basic computation methods of summation and evaluation of logical conditions.

The second option is analysing the conditions themselves, either by **assessing the significance of the conditions** already implemented as a part of the indicator or by taking a look at conditions that could possibly be implemented (based on data availability). In order to evaluate the statistical significance of the conditions in regards to whether an individual is considered to be materially deprived, we will be **using logistic regression**.

In this paper we will use a combination of both methods in order to take into consideration both the informational value of the indicator as a whole as well as the significance of the conditions it includes.

Logistic regression

Logistic regression [7] statistical method similar to multiple regression. It addresses the issue of having a dichotomous dependent variable. In our case the dependent variable is, whether an individual within the sample is or isn't materially deprived. The difference compared to multiple regression is way of estimating its variates – by applying a logit transformation to the dependent variable. This creates several differences within the estimation process as well as the interpretation of the explanatory variables.

The coefficients for independent variables are estimated using maximum likelihood method and will results in two kinds of values – logit values or an odds value.

The original logistic coefficients (logit) measure the direction of the relationship between the individual explanatory variables and the dependent variable. We estimate them using (1):

$$Logit_i = \ln(\frac{prob_{event}}{1 - prob_{event}}) = b_0 + b_1 x_1 + ..b_0 + b_n x_n \quad (1)$$

A second possibility is estimating the exponentiated logistic coefficients (odds value) as shown in (2). Odds values describe the magnitude of the relationship between the explanatory and the dependent variable. It should be noted [7] that both formulations are equivalent. In our analysis we estimate both the logistic coefficients and their exponentiated form.

$$Odds_i = (\frac{prob_{event}}{1 - prob_{event}}) = e^{b_0 + b_1 x_1 + ...b_0 + b_n x_n} \quad (2)$$

As for the model fit, we will be using two main Pseudo R^2 measures - Cox and Snell R2 and Nagelkerke R^2, both operating similarly to basic R^2 measures, with Naegelkerke R^2 being a more accurate measure [9].

2.1 Changes in the amount of conditional requirements

In this part we will see how the values of the indicator change based on the number of conditions that have to be met; we illustrate these changes in Figure 1. Of course we can expect that decreasing the number of conditions that need to be met in order for a person to be materially deprived will feature the increase of persons classified as materially deprived, while an increase of conditional requirements is prone to trigger a decrease.

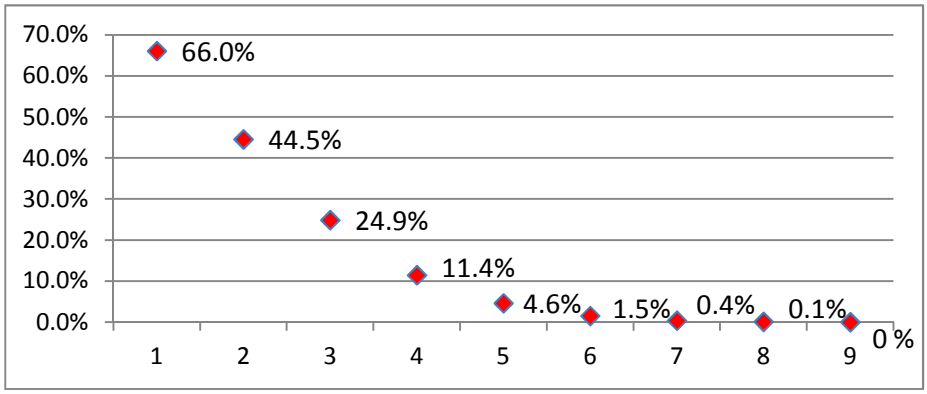

Figure 1 Levels of material deprivation based on the number of conditions which have to be met, Slovakia 2010

Judging from Figure 1, **there are significant changes in the number of conditions that have to be met in order to classify a person as materially deprived**. From a qualitative standpoint, there can be a number of expert opinions on the relevance of the presented numbers. The design intention of the indicator [1] states that the rationale for using deprivation indicators in a cross-sectional context is that current living standards and deprivation levels depend on having a command over resources and experiences over a long period, not just on the flow of income into the household this week, month, or even year. The flow of income into a household per year in regards to poverty is measured by the People at risk of poverty, after social transfers indicator with a value of 12 % for Slovakia in 2010. Taking into account the aforementioned facts, we should expect the level of material deprivation to be on par or below the level of People at risk of poverty, after social transfers. **This means cases with values above 12 % (translated into 1, 2 or 3 conditions met) can be considered as unrealistic**. On the other hand while **values that can be considered quite low** may be able to produce a good image in political terms, indicate a **limited informational value**. We consider this to be the case for 6, 7, 8 and 9 conditions met. The last two options – 11.4 % and 4.1 % (for 4 and 5 respective conditions met) are more realistic. Considering the current employment and poverty levels in Slovakia, we come to the conclusion, that four conditions are, in regards to the informational value of the indicators and the current setting of its conditions the best available options. In this setting there is a 13.3 % overlap between people in poverty and materially deprived individuals.

2.2 Changes in the conditions based on their statistical significance

Using logistic regression we will evaluate the statistical significance of the original conditions of material deprivation, as well as of conditions previously not included in the indicator. Based on the results we will analyse possible changes in the indicator values in a fashion similar to chapter 1.3. First let's take a look at the variables included in the analysis. The codes for variables we will be using are taken from EU SILC methodology [4], we also list the ratio of individuals fulfilling the individual conditions within the sample size:

Original conditions

- Inability to pay to pay rent or utility bills (HS001), 11.3 %
- Inability to keep their home adequately warm (HH050), 4 %
- Inability to pay unexpected expenses (HS060), 37.2 %
- Being unable to afford to eat meat, fish or a protein equivalent every second day (HS050), 22.4 %
- Being unable to afford a week holiday away from home (HS040), 56.4 %
- Being unable to afford a car (HS110), 17.4 %
- Being unable to afford a a washing machine (HS100), 0.6 %
- Being unable to afford a a colour TV (HS080), 0.2 %
- Being unable to afford a telephone (HS070), 0.9 %

It is interesting to observe**, that less people are unable to afford a car, compared to the ratio of people unable to fullfill their dietary requirements or being unable to pay for unexpected expences.** In fact 14,3 percent are people claiming to be unable to fullfill their dietary requirements yet able to afford a car, this applies to 25,2 % people within the sample unable to pay for unexpected expenses as well as to 41,5 % of the sample unable to afford a week holiday away from home. **Only a small amount of individuals in the sample size weren't able to afford a washing machine, a TV or a telephone, yet in all three cases around 90 % of people meeting the individual condition fullfill at least other three condition thus being classified as materially deprived.** As for the conditions not originally a part of the indicator, we picked additional dimensions of material deprivation that are included in EU SILC.

Expanded conditions

- Inability to afford seasonal clothing (SHS055), 41.3 %
- Being unable to afford a computer (HS090), 7.7 %
- Being unable to afford an internet connection (SHS095), 9.4 %
- Being unable to afford a freezer (SHS115), 4 %
- Badly lit/too dark household (HS160), 0.2 %
- Living in a noisy neighbourhood (HS170), 17.7 %
- Pollution, dirt or other environmental factors in the vicinity of the household (HS180), 20 %
- High levels of criminality and/or vandalism in the vicinity of the household (HS190), 9.7 %

In our analysis we inputted both the original and the expanded conditions into a model of logistic regression. Table 3 summarises the model, displaying only statistically significant explanatory variables for material deprivation of individuals. The model contains 9 explanatory variables. **From the original conditions**, **HS040 was removed**, despite being the one most commonly observed. In addition, **the ability to afford a car** was also **removed** due to its statistical insignificance, which perhaps may be a reflection of its anomalous overlaps we described before. **Last original condition removed was the ability to afford a colour TV**.

Taking a look at the expanded conditions, we **added the condition of inability to afford seasonal clothing** which, besides its statistical significance might be a much more important factor of material deprivation compared to owning a colour TV. **Being unable to afford an internet connection is also a statistically significant condition** when it comes to material deprivation, this condition could though be transformed into person being unable to access internet, rather than being able to afford it. **The last condition possessing a statistical significance in our model is the inability to afford a freezer**.

Our model suggests the removal of thee conditions that already were included in the indicator and an addition of other three, that weren't included. All of the logit coefficients suggest that an increase in each of the conditions will trigger an increase in the levels of the indicators overally. As for the magnitudes represented by the odds ratios, the originally included variables possess much higher magnitudes. This occurs due to the model taking into account the original structure of the material deprivation indicator.

Condition	$Logit_i$	S.E.	Wald	Sig.	$Odds_i$
HS001	5.813	.367	250.486	.000	334.552
HS050	6.137	.369	276.784	.000	462.560
HS060	6.339	.406	243.446	.000	566.323
HS070	9.689	1.520	40.639	.000	16136.43
SHS095	1.034	.117	78.079	.000	2.813
HS100	7.759	.770	101.582	.000	2342.319
HH050	5.702	.402	200.904	.000	299.596
SHS055	.608	.136	19.982	.000	1.837
SHS115	2.015	.170	139.892	.000	7.501
Constant	-14.173	.742	365.102	.000	.000

Table 3 Model of logistic regression of the material deprivation indicator

Table 4 illustrates the model fit using the Cox & Snell R Square with the value of 0.403 and the Nagelkerke R Square (generally considered to be the more suitable measure) with the value of 0.,823. **Both of these values indicate a valid model**. In the next step we will adjust the material deprivation indicator to respond to four of the nine adjusted conditions, based on the presented model.

Cox & Snell R Square	Nagelkerke R Square
.403	.823

Table 4 Model fit

The value of the adjusted material deprivation indicator for Slovakia in the year 2010 would reach 9,2 %, which is a slightly lower value compared to the original value (11.4 %). The advantage is a wider gap, when compared to People at risk of poverty, after social transfers indicator (12 %). The overlap between poverty and material deprivation in this case decreases to 11.7 %. Figure 2 illustrates the levels of material deprivation based on the number of revised conditions met. **In general we can say that the adjusted indicator of material deprivation achieves lower values in cases where less than 5 conditions have to be met**. For the rest of the cases the numbers remain almost the same. This supports using four conditions in order to validate the indicator.

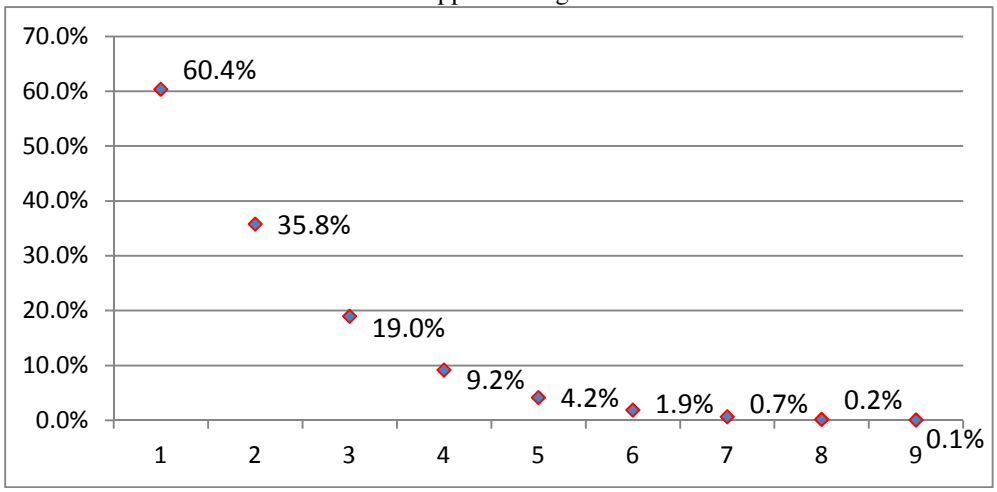

Figure 2 Levels of adjusted material deprivation based on the number of conditions which have to be met, Slovakia 2010

3 Conclusion

In this paper we conducted the analysis of the material deprivation indicator. **Based on results from a logistic regression model we constructed we proposed a removal of three conditions included in this indicator and**

suggested including three conditions that previously weren't taken into account. In Table 5 we summarize these factors.

Original condition	**Conditions after the adjustment**
Inability to pay to pay rent or utility bills	Inability to pay to pay rent or utility bills
Inability to keep their home adequately warm	Inability to keep their home adequately warm
Inability to pay unexpected expenses	Inability to pay unexpected expenses
Being unable to afford to eat meat, fish or a protein equivalent every second day	Being unable to afford to eat meat, fish or a protein equivalent every second day
Being unable to afford a week holiday away from home	Being unable to afford a telephone
Being unable to afford a car	Being unable to afford a a washing machine
Being unable to afford a a washing machine	Inability to afford seasonal clothing
Being unable to afford a a colour TV	Being unable to afford an internet connection
Being unable to afford a telephone	Being unable to afford a freezer

Table 5 Conditions of material deprivation indicator before and after the proposed

Applying the adjustment will result in a decrease of the overall value of the indicator (from 11.4 % to 9.2 %) as well as reduce the overlap between the People at risk of poverty, after social transfers indicator. **The Severely materially deprived persons indicator is also a part of an aggregation forming the values of one of the Europe 2020 headline targets** [3] **- People at risk of poverty or social exclusion**. The proposed adjustment would for People at risk of poverty or social exclusion (for Slovakia, 2010) causes a **decrease from 20.6 % to 19.2 %**. This should not be regarded as an improvement of the situation, rather as a more exact approximation of the current state. **Within our analysis we also gave evidence supporting the usage of four conditions met in order to classify the person as severely materially deprived**. **The same analysis could be conducted** for all of the other countries assuming the availability of EU SILC microdata for **all the 27 member countries** of the EU in order **to compare and generalize the recommendations for the adjustment of the indicator**.

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References

[1] Atkinson T. et al: *SOCIAL INDICATORS: THE EU AND SOCIAL INCLUSION*, Oxford University Press, Oxford, 2002.
[2] Council of the European Union: *Renewed EU Sustainable Development Strategy Annex*, Council of the European Union, Luxembourg, 2006
[3] Council of the European Union: *Europe 2020 targets* [online], Eurostat, Luxembourg:, 2009
[4] EUROSTAT: *Sustainable development in the European Union 2011 monitoring report of the EU sustainable development strategy,* Eurostat, Luxembourg, 2011
[5] EUROSTAT: Severely materially deprived people, 2012*: Quality profile* [online], Eurostat , Brussel, 2012
[6] Haan, A., & Maxwell, **S.**: Poverty and social exclusion. *North and South IDS Bulletin* **29** (1998), 1-9.
[7] HAIR J. F. et al: *Multivariate data analysis a global perspective*, Pearson Education , New Jersey, 2010
[8] Room, G.: *Observatory on national policies to combat social exclusion* (synthesis report)., Unversity of Bath, Bath, 1990
[9] STANKOVIČOVÁ I., VOJTKOVÁ M. 2007: *Viacrozmerné štatistické metódy s aplikáciami,* Iura Edition Bratislava, 2007