Assessing the impact of standard of living on the life expectancy at birth using Vector Autoregressive Model

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Abstract. The aim of the paper is to evaluate the impact of living standards (LS) on the life expectancy at birth. The LS of the population can be described using different variables. Therefore the first part deals with the questions how to alternatively express the LS and whether a significant correlation exists between the imaginary LS variable and other chosen variables used to express it. As there is a problem with quantifying the LS with specific variables or a specific coefficient, the development of monitored life expectancy is modelled by trend function. The LS is one of the key variables that significantly affect the trend of particular demographic indicators such as life expectancy. Using certain assumptions, we can express the quality of life and its level, which should affect the development of life expectancy. However, as it is shown using Granger causality and VAR model, these general assumptions has limited usage. The life expectancy in the last quarter of 2011 was influenced by its values from previous quarter, last year capacity in elderly homes and the percentage of population living in houses connected to water supply system and drains five quarters ago. The impact of other variables was negligible. In summary, in case of CR, it is difficult to express the indicators, which can at the statistical significance level express and influence the quality of life and the life expectancy.

Keywords: alternative prediction, life expectancy at birth, standard of living, VAR
JEL Classification: C10, C13, C53

AMS Classification: 62M10

1 Introduction

Ranking of the countries, regions, firms, etc. according to their performance has become frequented topic of various researches, surveys or analysis. The main concern is usually to create a ranking according to the development level of states. Scholars use various variables, criteria and indicators in order to assess which country does economically better. The reason is, as Dowrick et al. [11] states in their article that “International comparisons of living standards (LS) and development are inescapable. Public opinion, inasmuch as it is represented by the media, has an insatiable appetite for world or regional rankings. Politicians and policy analysts regularly use changes in these rankings as a basis for assessing the efficacy of national policies.” Nonetheless, what is the reliability of these rankings? Are the used ranking criteria meaningful? We argue that usage of measures to rank the countries’ performance is justified only in those cases when appropriate measures are used. The outcome of the performance of the country should not be an end in itself. For example *GDP per capita* is a good of the outcome of the economy recalculated on one person, but does not have direct impact on the life of people (Meisel and Vega [20]). On the other hand, *income per person* indicator does better as these are real money (despite being averaged) which could be used for consumer expenditures of the person. We believe that indicators from the demographic area are the best (with reference to Arltová et al. [2]). We selected as a measure of the outcome an indicator of life expectancy at birth (e_0^0). It enables to capture not only the economic situation of a country (with higher GDP per capita, the countries tend to have longer e_0^0, see e.g. George and Beller [14] or Jia et al. [19]), but also the health of the society and social, hygienic and environmental conditions of a particular country. We consider e_0^0 to be an appropriate measure of the development and performance of a particular country.

1.1 Proxy variables of the standards of living

At the beginning, the proxies for LS must be defined. It is difficult to express the LS objectively. However, subjective assessment is also not without complications. Each individual considers important different features of life. As Binder and Coad [4] noted “Individual’s mental well-being or happiness depends on a complex vector

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of factors, ranging from individual determinants (e.g. self-esteem, optimism) to socio-demographic (such as gender, age, education, or marital status), economic (such as income, status, or unemployment), situational (such as health, social relationships), and even institutional factors". When the comparison of LS is needed, the gross domestic product (GDP) belongs to the often used indicators. "GDP per capita is the most commonly used indicator to compare wealth among countries and is a measure of well-being and development exclusively based on material wealth. However, insufficient income is merely one dimension of under-development, so development cannot be understood by only taking into account economic performance" (Bérenger and Verdier-Chouchane [3]). Dowrick [11] marked, that "the most frequent criticism is based on the observation that standard GDP indexes are more properly regarded as partial measures of aggregate output than as indicators of wellbeing. No allowance is made for environmental differences, domestic activities, or production and consumption externalities." Therefore alternative measures were elaborated by international institutions or scholars. For example "UNDP Human Development Index (HDI) constructed in 1990 was intended to be more comprehensive indicator than per capita income for comparing the well-being of countries" (Bérenger and Verdier-Chouchane [3]). Fleurbaey and Gaulier [13] developed a "measure of LS for international comparisons, based on GDP per capita, in PPP, and incorporate corrections for international flows of income, labour, risk of unemployment, healthy life expectancy, household demography, inequalities and sustainability." From other economic variables can be utilize customer price index (CPI) to measure LS. Nevertheless, the economic indicators are not always good proxies of LS. As Gibson at al. [15] pointed out in their analysis on the situation of Russia during transition period, there was a bias – "the decline in LS has been substantially less than what is inferred by looking at official statistics on real output." Neumayer [21] suggests using as proxy variables for the LS: e_0^0, infant survival rates, literacy rates among the adult population, the combined primary, secondary and tertiary educational enrolment ratio as well as telephone mainlines and television set availability per capita. He considers the telephone availability as a measure of communication facilities and television of entertainment possibilities. However, currently the communication media are advanced. Therefore, instead we use as a proxy the equipment of the households with computers (Šimpach, Langhamrová [22]). "In welfare economics, individual well-being is traditionally conceptualized by the satisfaction of an individual's preferences, and the usual proxy to measure this satisfaction has been income" (Binder and Coad [4]). Day and Dowrick [9] concentrated in their survey on length of life. They had selected indicators which determinate the mortality such as food, medical services, education, environmental conditions, social customs and income distribution. Therefore, we use in our research also some of these indicators in order to assess if they really influence e_0^0 and hence justify their usage in researches. Curi [7] in his study clustered 125 countries according to their LS which were not expressed by any particular indicator. He used a component analysis where 26 indicators from social, economic, demographic, health, cultural and educational area instead. Other possible methodologies which can be used to express LS are Totally Fuzzy Analysis (TFA) and Factorial Analysis of Correspondences (FAC). These two were used by Bérenger and Verdier-Chouchane [3] in order to construct indicators of LS and quality of life which they further utilized as indices of well-being. Similarly various indexes exist in order to express the LS in more complex way. Despite their esteem to capture various aspects of LS, "the problem is that these indicators are based on the aggregation of various sub-indexes of social performance, arbitrarily weighted." Bérenger and Verdier-Chouchane [3] use to express LS by: standard of health - particularly public health expenditure (% of GDP), improved water source (% of population with access), physicians (per 1 000 people); standard of education: age dependency ratio (dependents to working-age population), public spending on education, total (% of GDP), net primary enrolment (%) and *material well-being*: vehicles (per 1 000 people), roads paved (% of total roads), television sets (per 1 000 people). There is a problem of causality relations between variables. Despite the fact, that the proxies for LS were chosen with the assumptions that they influence e_0^0, the dependence could be mutual. It is necessary to consider (as it is recommended by Binder and Coad [4]) the interrelations among explanatory variables. Our indicators from the area of economy, social and facilities used in this study are introduced in the chapter Methodology. We suppose in all cases that the higher is the value of particular characteristics, the higher is e_0^0. The impact is explicitly assessed using Granger causality and VAR model which are discussed in chapter Results. In the chapter Discussion we are arguing that the indicators commonly used as the expression of the LS do not have statistically significant impact on the outcome – i.e. the e_0^0. Final chapter summarizes the conclusion and states limitations of the utilized approach to the analysis as well as the challenges for the future research.

2 Methodology and Material

In order to examine the impact of the different variables representing the LS, a VAR model was constructed (Booth [5]). This method enables to clearly see which characteristics have statistically significant impact. This type of model is frequently used by researchers. However, its utilization in the area of social policy is rare. For example Binder and Coad [4] used a "panel VAR model to examine the coevolution of changes in mental well-being and changes in income, health, marital status and employment status for the British Household Panel Survey (BHPS) data set. As this method uses panel data, it allows "to simultaneously analyse the impact of the aforementioned factors on each other." The selection of the indicators for our analysis was limited to some extend due to the data availability. Not all indicators are gathered since 1996 and in quarterly division. Several proxies from the demographic and economic area were considered as same as various types of facilities (see Table 1). For the consequent analysis it is also important that values of the variables has the same development in time i.e. also increase overtime as same as e_0^0. Therefore, the plot of the values was drawn (see Figure 1).

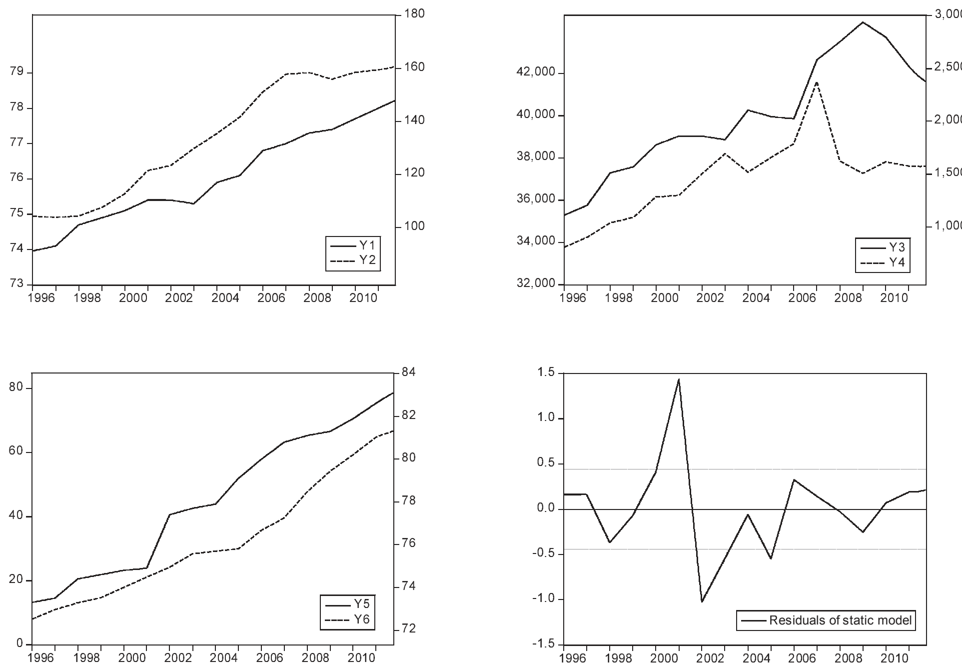

Figure 1 Selected time series and residuals of static regression model. Source: CZSO, authors' construction

Indicators area	Mark	Indicator	Units
Demographic	Y1	Life expectancy at birth (for total population)	years
Economic	Y2	Labour productivity	per 1 hour worked, c.p. in CZK
	Y3	Housing construction in the Czech Republic	three-room flats
Social	Y4	Capacity in elderly homes	number of beds
Facilities	Y5	Population living in houses connected to water supply system and drains	%
	Y6	Computer facilities of Czech households	%

Table 1 Indicators selected for the analysis. Source: authors' construction

To make the analysis as actual as possible we used the time series from 1st q. of 1996 until 4th q. of 2011. Only data for e_0^0 were available throughout all range. Therefore other values (from 1st quarter 2011 until 4th quarter 2011) had to be forecasted using Box-Jenkins methodology (e.g. Arlt, Arltová [1]). It is based on the assumption that the considered time series is stationary. Particularly augmented Dickey-Fuller [10] test (ADF) was used as it enables testing even in case where the error terms ε_t are correlated. The calculation of Y_t is expressed in equation

$$\Delta Y_t = B_1 + B_2 t + B_3 Y_{t-1} + \sum_{i=1}^{m} \alpha_i Y_{t-i} + \varepsilon_t , \tag{1}$$

where ΔY_t is the first difference of the examined variable, t is trend variable, ε_t is a pure white noise error term, m is the maximum length of the lagged dependent variable. The basic assumption of a possible correlation between the time series is that they have a similar trend. At the beginning we must verify whether the examined time series are stationary, because the analysis of the relationship between them makes sense only if they are integrated of the same order. The ADF tests show, that the time series are non-stationary, I (1), see Table 2. The relationship between non-stationary time series is associated with the problem of spurious regression (Granger, Newbold, [17]). Differentiation between co-integration regression and spurious regression is performed by Engle–Granger [12] co-integration test based on the analysis of residues of static regression model. If residues of the model are stationary I (0), then the time series are co-integrated, if the residues are non-stationary I (1), it is a case of spurious regression. From the Figure 1 is evident (t_{ADF} = -3.571947, Prob. 0.0094), that the residues of the static model are stationary I (0), which excludes the possibility of spurious regression. Because the direction of causality of the individual time series and whether the residuals in Table 3 are auto-correlated, is not entirely clear we estimate the short-term relationships between the time series by multi-dimensional VAR model.

Y_t		$\Delta_2 Y_t$	
t_{ADF}	Prob.	t_{ADF}	Prob.
0.225631	0.9720	-8.645782	0.0000
-1.359391	0.5964	-7.672481	0.0000
-1.980265	0.2946	-7.662394	0.0000
-2.333508	0.1650	-6.792391	0.0000
-0.474059	0.8887	-7.681558	0.0000
0.479981	0.9847	-7.681562	0.0000

Table 2 The unit root test of time series Y_t and second differences. Source: authors' calculation

The general model VAR (p) can be written in the form:

$$\mathbf{Y}_t = \mathbf{c} + \sum_{i=1}^{p} \mathbf{\Phi}_i \mathbf{Y}_{t-i} + \boldsymbol{\varepsilon}_t , \tag{2}$$

where $\mathbf{c}$ is l x 1 dimensional vector of constants, $\mathbf{\Phi}_i$, i = 1, 2, …, p are l x l dimensional non-random matrices of AR parameters and $\boldsymbol{\varepsilon}_t$ is l-dimensional process of white noise. On the basis of diagnostic tests displayed in Table 3) (Breusch, Godfrey [6], Jarque, Bera [18], Darnell [8]) it can be concluded that the distribution of residuals is mostly non-normal with exception of population living in houses connected to infrastructure. The autocorrelation was present only at the fourth lag of the explained variable. Usage of heteroscedasticity and autocorrelation correct (HAC) errors did not change the results substantially. As a result of that, we neglect the autocorrelation and use the original model. The variance of residuals is constant and finite. The VAR (5) model

$$\mathbf{Y}_t = \mathbf{c} + \mathbf{\Phi}_1 \mathbf{Y}_{t-1} + \mathbf{\Phi}_2 \mathbf{Y}_{t-2} + \mathbf{\Phi}_3 \mathbf{Y}_{t-3} + \mathbf{\Phi}_4 \mathbf{Y}_{t-4} + \mathbf{\Phi}_5 \mathbf{Y}_{t-5} + \boldsymbol{\varepsilon}_t , \tag{3}$$

or in matrix form:

$$\begin{aligned}\begin{bmatrix} Y_{1,t} \\ Y_{2,t} \\ \vdots \\ Y_{6,t} \end{bmatrix} &= \begin{bmatrix} \phi_{1,11} & \phi_{1,12} & \cdots & \phi_{1,16} \\ \phi_{1,21} & \phi_{1,22} & \cdots & \phi_{1,26} \\ \vdots & \vdots & \cdots & \vdots \\ \phi_{1,61} & \phi_{1,62} & \cdots & \phi_{1,66} \end{bmatrix} \begin{bmatrix} Y_{1,t-1} \\ Y_{2,t-1} \\ \vdots \\ Y_{6,t-1} \end{bmatrix} + \begin{bmatrix} \phi_{2,11} & \phi_{2,12} & \cdots & \phi_{2,16} \\ \phi_{2,21} & \phi_{2,22} & \cdots & \phi_{2,26} \\ \vdots & \vdots & \cdots & \vdots \\ \phi_{2,61} & \phi_{2,62} & \cdots & \phi_{2,66} \end{bmatrix} \begin{bmatrix} Y_{1,t-2} \\ Y_{2,t-2} \\ \vdots \\ Y_{6,t-2} \end{bmatrix} + \cdots \\ \cdots &+ \begin{bmatrix} \phi_{5,11} & \phi_{5,12} & \cdots & \phi_{5,16} \\ \phi_{5,21} & \phi_{5,22} & \cdots & \phi_{5,26} \\ \vdots & \vdots & \cdots & \vdots \\ \phi_{5,61} & \phi_{5,62} & \cdots & \phi_{5,66} \end{bmatrix} \begin{bmatrix} Y_{1,t-5} \\ Y_{2,t-5} \\ \vdots \\ Y_{6,t-5} \end{bmatrix} + \begin{bmatrix} \varepsilon_{1,t} \\ \varepsilon_{2,t} \\ \vdots \\ \varepsilon_{6,t} \end{bmatrix} ,\end{aligned} \tag{4}$$

can be rewritten in the multidimensional form:

$$\begin{aligned} Y_{1,t} &= \phi_{1,11} Y_{1,t-1} + \phi_{2,11} Y_{1,t-2} + \cdots + \phi_{5,11} Y_{1,t-5} + \phi_{1,12} Y_{2,t-1} + \phi_{2,12} Y_{2,t-2} + \cdots + \phi_{5,12} Y_{2,t-5} + \\ &\quad \phi_{1,13} Y_{3,t-1} + \phi_{2,13} Y_{3,t-2} + \cdots + \phi_{5,13} Y_{3,t-5} + \phi_{1,14} Y_{4,t-1} + \phi_{2,14} Y_{4,t-2} + \cdots + \phi_{5,14} Y_{4,t-5} + \\ &\quad \phi_{1,15} Y_{5,t-1} + \phi_{2,15} Y_{5,t-2} + \cdots + \phi_{5,15} Y_{5,t-5} + \phi_{1,16} Y_{6,t-1} + \phi_{2,16} Y_{6,t-2} + \cdots + \phi_{5,16} Y_{6,t-5} + \varepsilon_{1,t} \\ Y_{2,t} &= \phi_{1,21} Y_{1,t-1} + \phi_{2,21} Y_{1,t-2} + \cdots + \phi_{5,21} Y_{1,t-5} + \phi_{1,22} Y_{2,t-1} + \phi_{2,22} Y_{2,t-2} + \cdots + \phi_{5,22} Y_{2,t-5} + \\ &\quad \phi_{1,23} Y_{3,t-1} + \phi_{2,23} Y_{3,t-2} + \cdots + \phi_{5,23} Y_{3,t-5} + \phi_{1,24} Y_{4,t-1} + \phi_{2,24} Y_{4,t-2} + \cdots + \phi_{5,24} Y_{4,t-5} + \\ &\quad \phi_{1,25} Y_{5,t-1} + \phi_{2,25} Y_{5,t-2} + \cdots + \phi_{5,25} Y_{5,t-5} + \phi_{1,26} Y_{6,t-1} + \phi_{2,26} Y_{6,t-2} + \cdots + \phi_{5,26} Y_{6,t-5} + \varepsilon_{2,t} \\ &\vdots \\ Y_{6,t} &= \phi_{1,61} Y_{1,t-1} + \phi_{2,61} Y_{1,t-2} + \cdots + \phi_{5,61} Y_{1,t-5} + \phi_{1,62} Y_{2,t-1} + \phi_{2,62} Y_{2,t-2} + \cdots + \phi_{5,62} Y_{2,t-5} + \\ &\quad \phi_{1,63} Y_{3,t-1} + \phi_{2,63} Y_{3,t-2} + \cdots + \phi_{5,63} Y_{3,t-5} + \phi_{1,64} Y_{4,t-1} + \phi_{2,64} Y_{4,t-2} + \cdots + \phi_{5,64} Y_{4,t-5} + \\ &\quad \phi_{1,65} Y_{5,t-1} + \phi_{2,65} Y_{5,t-2} + \cdots + \phi_{5,65} Y_{5,t-5} + \phi_{1,66} Y_{6,t-1} + \phi_{2,66} Y_{6,t-2} + \cdots + \phi_{5,66} Y_{6,t-5} + \varepsilon_{6,t} \end{aligned} \tag{5}$$

where $\phi_{1,11}$ = 1.304608 (0.19097) [6.83147], $\phi_{5,14}$ = -7.34E-05 (3.2E-05) [-2.28539], $\phi_{5,15}$ = 0.210248 (0.06088) [3.45350], $\phi_{1,21}$ = -6.942611 (2.71596) [-2.55623], $\phi_{1,22}$ = 2.203656 (0.26276) [8.38656], $\phi_{1,23}$ = 0.011441 (0.00383) [2.98806], $\phi_{1,24}$ = -0.002720 (0.00079) [-3.45388], $\phi_{5,24}$ = -0.001226 (0.00046) [-2.68586], $\phi_{1,25}$ = 3.117852 (1.13408) [2.74924], $\phi_{1,33}$ = 1.258935 (0.19049) [6.60886], $\phi_{5,35}$ = 100.5042 (43.0764) [2.33316], $\phi_{4,36}$ = 67.97408 (27.4159) [2.47937], $\phi_{5,36}$ = -70.49117 (14.7622) [-4.77510], $\phi_{1,41}$ = -2600.202 (1057.27) [-2.45935], $\phi_{4,41}$ = 4160.659 (1671.61) [2.48901], $\phi_{5,41}$ = -2956.861 (887.590) [-3.33134], $\phi_{1,42}$ = 317.4339 (102.288) [3.10334], $\phi_{1,43}$ = 3.284038 (1.49050) [2.20331], $\phi_{4,43}$ = -6.465611 (2.16904) [-2.98087], $\phi_{5,43}$ = 4.242376 (1.69592) [2.50152], $\phi_{1,45}$ = 1250.880 (441.476) [2.83341], $\phi_{1,55}$ = 1.248863 (0.32356) [3.85979], $\phi_{1,62}$ = -0.300833 (0.14559) [-2.06631], $\phi_{1,64}$ = 0.000921 (0.00044) [2.11096], $\phi_{1,65}$ = -1.649565 (0.62837) [-2.62516], $\phi_{5,65}$ = -1.305652 (0.47973) [-2.72161], $\phi_{1,66}$ = 1.300585 (0.16400) [7.93039] and $\phi_{5,66}$ = 0.382087 (0.16440) [2.32407]. Standard errors are in ( ) ant *t*-statistics are in [ ].

Normality tests			Autocorrelation tests			Heteroskedasticity test	
Y_t	**Jarque-Bera**	**Prob.**	**Lags**	**LM-Stat**	**Prob.**	**Chi-sq (df)**	**Prob.**
Y_1	11.77285	0.0028	1	36.18057	0.4602	1225.971 (1176)	0.1515
Y_2	11.06396	0.0040	2	49.06088	0.0720		
Y_3	11.53477	0.0031	3	36.37753	0.4511		
Y_4	11.32136	0.0035	4	178.3569	0.0000		
Y_5	0.278317	0.8701	5	23.73942	0.9419		
Y_6	11.04043	0.0040					

Table 3 The diagnostic tests of VAR (5) model. Source: authors' calculation

3 Discussion

The e_0^0 in current quarter is influenced by its values from last quarter, last year capacity in elderly homes and the percentage of population living in houses connected to water supply system and drains five quarters ago. The impact of other variables is negligible. On the other hand e_0^0 significantly influences the labour productivity (LP) in previous period, capacity in elderly homes one, four and five quarters ago. The results imply that commonly used indicators are not always good proxies of the LS as they do not have significant impact on the result expressed by e_0^0. However, the analysis revealed other relations among the indicators. LP is influenced by capacity in elderly homes one and five quarters ago and by population living in houses connected to water supply system and drains in a previous quarter. The number of newly build three-room flats depends not only on the number in previous quarter, but also on population living in houses connected to water supply system and drains and computer facilities (CF) five quarters ago. The later influenced the flats also with one year lag. The social indicator – capacity in elderly homes was dependent not only on the e_0^0 (which is in line with logical assumptions), but also on LP, housing constructions in three-room flats (both one period ago), housing constructions one year and five quarters ago and finally by percentage of population living in houses connected to infrastructure in previous quarter. Surprisingly despite the fact that it had the significant impact on other variables the population living in houses connected to infrastructure facilities was influenced only by itself with one lag.

I/1996-IV/2011	χ^2	Prob.	*I/1996-IV/2011*	χ^2	Prob.	*I/1996-IV/2011*	χ^2	Prob.
$Y_2 \rightarrow Y_1$	7.404649	0.1922	$Y_1 \rightarrow Y_2$	14.14956	0.0147	$Y_1 \rightarrow Y_3$	7.902832	0.1617
$Y_3 \rightarrow Y_1$	8.492336	0.1311	$Y_3 \rightarrow Y_2$	18.05111	0.0029	$Y_2 \rightarrow Y_3$	1.774210	0.8794
$Y_4 \rightarrow Y_1$	17.75160	0.0033	$Y_4 \rightarrow Y_2$	16.65255	0.0052	$Y_4 \rightarrow Y_3$	4.554422	0.4726
$Y_5 \rightarrow Y_1$	27.58778	0.0000	$Y_5 \rightarrow Y_2$	13.94631	0.0160	$Y_5 \rightarrow Y_3$	18.06461	0.0029
$Y_6 \rightarrow Y_1$	17.24373	0.0041	$Y_6 \rightarrow Y_2$	5.989158	0.3073	$Y_6 \rightarrow Y_3$	50.75533	0.0000
$Y_1 \rightarrow Y_4$	26.32671	0.0001	$Y_1 \rightarrow Y_5$	4.890978	0.4293	$Y_1 \rightarrow Y_6$	18.88592	0.0020
$Y_2 \rightarrow Y_4$	17.30898	0.0039	$Y_2 \rightarrow Y_5$	6.705082	0.2435	$Y_2 \rightarrow Y_6$	19.16702	0.0018
$Y_3 \rightarrow Y_4$	25.60349	0.0001	$Y_3 \rightarrow Y_5$	2.210761	0.8193	$Y_3 \rightarrow Y_6$	7.691130	0.1741
$Y_5 \rightarrow Y_4$	10.15793	0.0709	$Y_4 \rightarrow Y_5$	0.962332	0.9655	$Y_4 \rightarrow Y_6$	11.59659	0.0408
$Y_6 \rightarrow Y_4$	20.54387	0.0010	$Y_6 \rightarrow Y_5$	1.107516	0.9534	$Y_5 \rightarrow Y_6$	20.33432	0.0011

Table 4 The results of Granger causality test. Source: authors' calculation

Finally, CF, in spite they influenced only one indicator (housing construction), were affected (except by itself one and five quarters ago) by LP, capacity in elderly homes and percentage of population living in houses connected to water supply system and drains – all one quarter ago. The last one had also influence five quarters ago. Despite that the proxies for LS were chosen with the assumptions that they influence the e_0^0, the opposite direction of dependence was found. The results of Granger test (displayed in Table 4), through which we proved the causal effect of selected time series in Granger sense (Granger [16]), more or less correspond with the results of the models above. Only difference is that VAR hadn't shown that the CF significantly influence the e_0^0. LP and housing construction shouldn't be used as the indicators of LS as they don't directly influence the e_0^0. However, they can have indirect impact. LP influence capacity in elderly homes and CF which jointly cause the e_0^0. Similarly housing constructions are caused by population living in houses connected to water supply system and drains and by CF. The mutual causality was found between e_0^0 and capacity in elderly homes, and between e_0^0 and CF. This causality enabled Fleurbaey and Gaulier [13] to use as measure of LS the e_0^0.

4 Conclusion

Used methods enabled to assess the lag of the influence and the causality among particular variables. VAR showed that the e_0^0 in current period was influenced by its values from last quarter, last year capacity in elderly homes and the percentage of population living in houses connected to water supply system and drains five quarters ago. The effect of other used variables was not significant. Hence, usage of these indicators as an expression of LS is limited. Granger test proved also mutual dependence of e_0^0 and capacity in elderly homes and CF. As a result of that, these indicators can be utilize in the analysis of LS in the CR. The selection of indicators which could have expressed the LS was limited by the type of the progress of the time series. As the e_0^0 shows a raising trend, only those indicators which have the same development were included into the system. We included only those time series that met requirements. Therefore, the challenge for future research is to find methodology enabling wider usage of proxies of LS.

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