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THE STATE OF THE FUTURE INDEX FOR THE CZECH REPUBLIC

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Abstract

The potential development of the Czech Republic is discussed in this paper by using the State of the Future Index (SOFI). This is the only index currently used worldwide that focuses not only on the present (unlike the Human Development Index and others), but also on the future development of opportunities and threats. The paper presents the computation of partial indices focusing economic, demographic, social and environmental factors, where the selection of indicators that enter the computations, including their weighting, is the outcome of a survey conducted among regional development and sustainability experts and academics.

Shrnutí

Index stavu budoucnosti pro Českou republiku

Článek se věnuje hodnocení potenciálu rozvoje České republiky pomocí indexu stavu budoucnosti (SOFI). Tento index, používaný v současnosti na celém světě, je jediným, který se zaměřuje nejen na současnost (na rozdíl od indexu lidského rozvoje a dalších), ale také na budoucí vývoj příležitostí a hrozeb. Příspěvek prezentuje výpočet dílčích indexů zaměřených na ekonomické, demografické, sociální a environmentální faktory, kde výběr ukazatelů, které vstupují do výpočtů, včetně jejich váhy, je výsledkem dotazníkového průzkumu mezi odborníky, kteří se věnují otázkám regionálního rozvoje a jeho dlouhodobé udržitelnosti.

Key words: *Human Development Index (HDI), State of the Future Index (SOFI), Czech Republic*

1. Introduction

The most commonly used indicator of economic output is gross domestic product (GDP). GDP is a total monetary value of all goods and services produced during the period measured (usually one year) within a country's borders. In short, it indicates the economic performance of a country. International analyses most often work with GDP per capita. GDP consists of consumption (household and government expenditures), investments, and net exports (i.e. the difference between exports and imports). Gross national product (GNP) is a similar indicator measuring the value of goods and services produced by citizens of a country, regardless of whether it was within the country's borders.

Since 1990, the United Nations Development Program (UNDP) has been using an alternative indicator, which should also reflect the life quality of the population and not just its economic performance. It is the Human Development Index (HDI). The philosophy behind the index is based on the belief that life quality depends mainly on:

- a long and healthy life;
- access to knowledge; and
- access to sources ensuring a decent standard of living.

Therefore, HDI is defined based on the following four indicators (Desai, 1991), which reflect to what extent basic human needs are met:

- life expectancy[1];
- gross domestic product at purchasing power parity[2];
- literacy[3]; and
- number of the years of schooling[4].

The fact that two of these indicators include education points out the weight (importance) of the indicator.

A host of authors (Kelley, 1991) focus on contrasting the gross domestic product and the human development index. Comparing the ranking of countries by GDP and the HDI leads to some interesting interpretations. For example, former socialist countries still achieve higher ranking of HDI than GDP thanks to their emphasis on literacy, education, and basic health care for all. Of non-socialist countries, Costa Rica has a significantly higher HDI than GDP (World Bank, 2011). In contrast, countries exporting oil, especially in the Middle East, score much lower HDI values compared to GDP. These unfavourable HDI values are probably caused by the unequal position of women, reflected in their lower literacy, and by major social differences (a highly unequal distribution of wealth). Some studies, however, criticize HDI (Sagar, Najam, 1998; Lind, 1991), possibilities of its calibration (Lind, 2010) and modification (Noorbakhsh, 1998).

Another indicator, which has become an alternative or supplement to GDP, is the ecological footprint (Caballero, 2009; Ruževičius, 2011; Amin, 2009). The ecological footprint describes the consumption of natural

[1] Life expectancy at birth, or average life expectancy, is the age a newborn infant would live to if the prevailing patterns of mortality remained the same throughout its life.

[2] GDP at purchasing power parity reflects different price levels in different countries.

[3] The population's literacy rate is given by the percentage of people over the age of 15 who can, with understanding, both read and write a simple statement related to everyday life.

[4] The number of the years of schooling is a combined conversion of years spent at elementary school, middle school, and college.

resources in the form of "global hectares per person", which is a unit comparing the consumption of natural resources and the actual capacity of the biologically productive land on the Earth[5]. One great advantage of the ecological footprint lies in the fact that it can be evaluated at a global, national, local, and even individual level.

While the total ecological footprint of the world's population is 3.1 global hectares per capita, the total ecological capacity is only 2.1 global hectares (as of 2010). This shows that human activities exceed the global ecological capacity by one global hectare per capita. Each inhabitant of the Czech Republic uses up to 5.3 hectares of the ecological footprint but the ecological capacity of the country is only 2.3 global hectares per capita. This makes the ecological deficit more than double. (World Wide Fund for Nature, 2010).

A dramatically different indicator quantifying the performance of a country and its population is "gross national happiness" (GNH). Gross National Happiness attempts to define the quality of life more holistically than GDP, emphasizing the non-materialistic aspects of life. The term was first introduced in 1972 by the King of Bhutan, Jigme Singye Wangchuck, who opened up Bhutan to the age of modernization (Zurick, 2006). Conventional development models consider economic growth to be the most important objective. The GNH concept is based on the assumption that human society can develop when material and spiritual development go hand in hand and complement one another. The four pillars of GNH are: promotion of sustainable development, preservation and promotion of cultural values, protection of the natural environment, and establishment of good governance. The Centre for Bhutan Studies (a major research centre in Bhutan) bases the GNH computation on surveys that serve to express approximately 70 indicators (divided into thematic areas, "indexes") and dimensions on a relative scale (e.g. "frequency of meditation" falls into three groups: never, sometimes, daily; "incidence of suicidal thoughts" is a dichotomous variable: yes, no).

2. The State of the Future Index (SOFI)

So far, the State of the Future Index has been the only variable that not only looks at the present but also tries to identify the development trends of selected variables (indicators). It was coined by Theodore J. Gordon, researcher in the Millennium Project (currently the largest forecasting project worldwide).

At a global level, the State of the Future Index is a statistical combination of 28 key indicators of the state of society, which shows whether the situation is going to improve or deteriorate. SOFI is based on the assessment (through repeated surveys) carried out by selected experts, who identify issues and trends conditioning future development (within a time horizon of 10 years). As part of the surveys, experts estimate the weight of each indicator, as well as events that have not occurred yet but, if they do, their impact would be strong (positive or negative) on the development of the society (Gordon et al., 2011).

Based on available data, the global SOFI was evaluated for the past 20 years, which allowed for a plausible forecast of future trends over roughly the next 10 years. Although

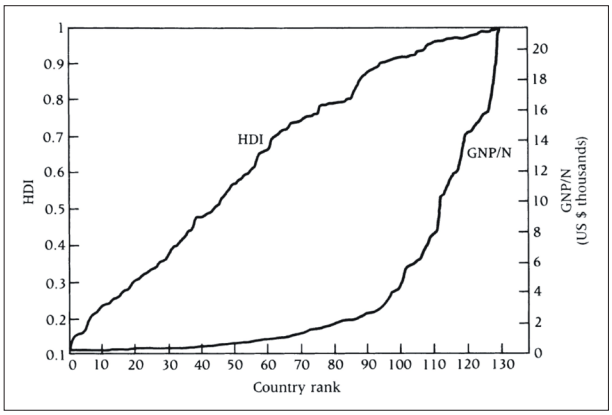

Fig. 1: Ranking of countries by HDI and GNP/N
Source: Kelley, 1991

the total SOFI improved over the past two decades, this positive trend is likely to slow down in the coming decade. By constructing one aggregated index, we lose track of the development of individual sub-indicators. Even with the overall index improving, it may happen that one of the indicators will significantly deteriorate (e.g. an increase due to terrorist attacks). It is therefore advisable to provide, not only the resulting index (designed at global, national and local levels), but also the development of individual indicators. It is also important to pay attention to finding the most accurate and reliable data possible and to identify any possible changes in time.

The 28 indicators assessed at the global level can be divided into four groups, based on how their values developed in the past 20 years and on their likely development in the next decade (Gordon et al., 2011):

1. indicators that improved in the past 20 years and the trend is likely to continue (e.g. adult literacy, the number of internet users, life expectancy at birth, and the number of women in parliaments);
2. indicators that improved in the past 20 years, but the trend may change owing to the economic recession (e.g. access to drinking water, people living in extreme poverty, R&D expenditure, food availability, and the number of refugees);
3. indicators that deteriorated in the past 20 years, but could improve in the coming 10 years (e.g. people voting in elections, forestlands and the prevalence of HIV); and
4. indicators that deteriorated in the past twenty years, and the trend is likely to continue over the coming 10 years (e.g. the level of corruption, CO_2 emissions, unemployment rate and temperature anomalies on the Earth's surface).

This article focuses on the State of the Future Index for the Czech Republic, which has recently experienced social, environmental, and economic development connected with the collapse of the socialist state and subsequent transformations. The aim of the research was to adapt the methodology for computing SOFI for the Czech Republic, with a detailed case study comparing the results with HDI, and computing partial SOFIs for selected variable categories, including the assessment of their relationship and significance against the overall SOFI.

[5] The amount of most resources we consume and the waste we produce can be converted into a physical area. A total of the areas, made up by resource consumption and human waste production, generates an "ecological footprint". If an area corresponding to the ecological footprint of the population exceeds the land area of the country, the population is basically using the productive area of people from other countries or is doing so at the expense of future generations.

3. Research methods

The first stage of the research involved the selection of indicators appropriate for the computation of a SOFI for the Czech Republic. We first proceeded from similar projects, especially from variables considered in the computation of the global SOFI (Glenn at al., 2011), while adapting the criteria to the specific characteristics of development in the Czech Republic. In order to assess the dynamics of development in various areas, we selected variables from four categories (economic, demographic, social, and environmental), which facilitated the computation of partial SOFIs. The computation of the total SOFI included the values of all indicators. A survey was conducted to enable experts and academics dealing with sustainable development, regional geography and regional development, to comment on the quantity and selection of the characteristics. Their recommendations to expand or narrow down the list of variables were respected.

Since not all variables are equally important, we proceeded to weight them. Each variable was given a weight from 1 to 10 (1 – minimum; 10 – maximum) by the respondents and this was reflected in the subsequent computation. Experts also commented on the estimate of two values (best and worst) for each indicator in 2020. The average values of the weights and forecast data for 2020 were computed using the arithmetic mean. The questionnaire survey was conducted online, addressing 72 experts, mainly academics from Czech and Slovak universities. The total return of the questionnaires reached 42%; responses were assessed from thirty respondents.

The study uses nine economic, ten environmental, eleven demographic, and eleven social indicators (Tab. 1). Their legitimacy and balance in each category is demonstrated by the average weight of individual groups (computed as arithmetic mean of the weights of indicators in each category). Differences ranged within two-tenths (5.7 to 5.5), and the

ECONOMIC		ENVIRONMENTAL	
1	Unemployment – gross unemployment rate (%)	10	CO_2 emissions – emissions in tons/year/1,000 inhabitants
2	Gross domestic product – GDP per capita (CZK)	11	Environment protection investments – amounts (CZK) invested in environment protection.
3	R&D expenditure – R&D expenditure relative to GDP (%)	12	NO_x emissions – emissions in tons/year/1,000 inhabitants
4	Gross pay – average gross pay (CZK)	13	SO_2 emissions – emissions in tons/year/1,000 inhabitants
5	Efficiency of electricity use – GDP (USD PPP) per unit of energy used (in kg of oil equivalent)	14	Connection to public sewers – proportion of households connected to public sewers
6	Direct foreign investments – proportion of GDP (%)	15	PM10 emissions – emissions in tons/year/1,000 inhabitants
7	Tourists – accommodated foreign guests per 1,000 inhabitants	16	Proportion of treated wastewater – (%)
8	Highways – length of expressways per 1,000 inhabitants	17	NPK fertilizers – fertilizer consumption in kilograms per hectare of arable land
9	Vehicle ownership rate – number of inhabitants per vehicle	18	Proportion of protected areas – as related to the total area
		19	Logging (salvage) – salvage logging (thousand m^3/1,000 ha)
DEMOGRAPHIC		**SOCIAL**	
20	Natural population change – population growth per 1,000 inhabitants	31	Elections – people voting in the elections to the Chamber of Deputies of the Parliament of the Czech Republic (%)
21	Ageing index – proportion of seniors to children	32	Pension – average pension (CZK)
22	Economic load index – proportion of people aged 14 and younger, along with the volume of people aged 65 and older, per number of people aged 15 to 64	33	Crime – crimes per 1,000 inhabitants
23	Life expectancy – life expectancy at birth (in years)	34	Internet provision – proportion of households with access to the Internet (%)
24	University graduates – proportion of university-educated population	35	Computer provision – proportion of households with a computer (%)
25	Diseases of the circulatory system – proportion of deaths from diseases of the circulatory system of total deaths	36	Physicians – physicians per 1,000 inhabitants
26	Migration – migration balance per 1,000 inhabitants	37	Violent crimes – violent crimes (homicides) per 1,000 inhabitants
27	Divorces – divorces per 1,000 inhabitants	38	Social benefits – expenditure on social benefits (CZK/1,000 inhabitants)
28	Suicides – suicides per 1,000 inhabitants	39	Homes for the elderly – beds for the elderly per 1,000 seniors
29	Abortions – abortions per 1,000 inhabitants	40	Culture – cultural centres per 1,000 inhabitants (theaters, cinemas, monuments, museums, and galleries)
30	Foreigners – foreigners per 1,000 inhabitants (foreign worker visas)	41	Libraries – libraries per 1,000 inhabitants

Tab. 1: List of indicators included in the SOFI computation for the Czech Republic

top fifteen most important indicators (based on the average weight assigned by experts) included four indicators in each of the economic, environmental and demographic areas, and three social indicators. According to the experts, the following indicators have the highest weight: unemployment, GDP per capita, R&D expenditure, natural population change, and CO_2, NO_x, and SO_2 emissions (Tab. 2).

Using mathematical models based on a twenty-year time series, the authors of the global SOFI forecast values for each variable for the following years, usually a 10-year span (until 2020; Gordon et al., 2011). With regard to the availability of statistical data and their consistency, our research had to suffice with a fifteen-year time series of 1995–2010. With the help of regression analysis methods,

Variable	Weight	2020			Regression model
		Best forecast value	Worst forecast value	Model value	
1	7.36	6.52	15.77	7.80	MoF forecasts
2	6.85	517,952.38	370,952.38	434,042.45	MoF forecasts
3	6.85	3.35	1.45	3.00	Linear
4	6.50	36,908.70	29,038.64	31,208.72	MoF forecasts
5	5.04	7.43	7.59	7.00	MoF forecasts
6	4.88	4.95	2.04	5.20	MoF forecasts
7	4.08	822.24	610.71	694.31	Power trend line
8	3.92	0.24	0.14	0.15	MoF forecasts
9	3.65	1.40	1.60	1.40	Exponential trend line
10	6.43	11.02	16.74	12.90	Rational model
11	6.36	35.84	23.05	25.74	Estimate
12	6.17	8.83	12.48	11.40	Rational model
13	6.04	8.82	14.04	14.74	Bleasdale regression model
14	5.91	90.42	83.93	89.52	Exponential
15	5.87	0.48	1.50	0.60	Reciprocal
16	5.86	98.71	96.06	96.94	Logarithmic
17	5.41	91.55	99.77	102.17	Logarithmic
18	4.91	16.55	14.37	15.50	Estimate*
19	4.78	0.67	0.97	1.15	Weibull regression model
20	6.67	1.11	0.30	0.10	CZSO population projections
21	6.42	134.01	149.63	139.00	CZSO population projections
22	6.29	41.25	46.65	64.00	CZSO population projections
23	6.00	77.59	74.85	77.20	CZSO population projections
24	4.71	2.51	3.37	2.93	Linear
24	5.83	16.90	13.42	14.95	Linear
25	5.54	557.50	784.43	511.92	Exponential
26	5.13	1.84	1.15	3.00	CZSO population projections
28	4.63	0.10	0.17	0.14	Logarithmic
29	4.62	2.34	3.61	2.56	Exponential
30	4.21	57.34	43.19	50.00	CZSO population projections
31	6.32	68.84	43.78	56.99	Power
32	6.29	19,084.95	15,192.67	11,643.03	Power
33	6.09	23.95	31.63	26.82	Exponential
34	6.09	80.50	65.36	85.67	Logarithmic
35	6.00	80.90	67.09	90.20	Logarithmic
36	5.86	5.13	4.16	4.93	Linear
37	5.73	0.02	0.03	0.01	Exponential
38	5.62	3,991.75	3,050.00	4,106.96	Power
39	5.59	26.01	21.76	25.64	Linear
40	5.05	4.12	3.67	3.73	Logarithmic
41	4.41	0.80	0.52	0.47	Exponential

Tab. 2: Overview of the weights of individual variables; mathematical model and forecast
**Brdy Protected Landscape Area planned from 2016 (330 km^2, i.e. about 0.4% of CR); CZSO = Czech Statistical Office*

we used them to model data for the period 2011–2020. The SOFI computation, then, includes time series from 1995 to 2020.

3.1 SOFI computation

The State of the Future Index is computed in five steps:

1. value forecasting (2011–2020 in our case);
2. computation of the 1995–2020 mean;
3. definition of the upper good and lower bad limits, maximum and minimum;
4. data standardization and weighting; and
5. final computation of the State of the Future Index.

Item 1:

Estimates of individual characteristics for 2012–2020 were based on the mathematical modeling using the statistics software CurveExpert Professional, Statistica and MS Excel. For each indicator, a mathematical regression model with maximum possible reliability was computed, based on which the future values were modelled. We used the latest demographic forecasts only for demographic indicators – always the medium variant (Burcin, Kučera, 2010), while for economic indicators it was the forecasts of the Ministry of Finance (MoF), also the medium variant.

Item 2:

Label each variable with ai and the value of the variable in a given year with aiyear. First, we work with matrix A (26 rows: the years 1995–2020, and k-columns in general, in our case k = 41: number of variables):

$$\{A\} = \begin{matrix} a_1^{1995} & a_2^{1995} & \dots & a_k^{1995} \\ a_1^{1996} & a_2^{1996} & \dots & a_k^{1996} \\ . & . & \dots & . \\ . & . & \dots & . \\ . & . & \dots & . \\ a_1^{2020} & a_2^{2020} & \dots & a_k^{2020} \end{matrix}$$

Each variable has its weight: w_i

Each variable has an estimate of the best (a_b) and worst (a_w) value for 2020.

Compute the average value for each variable for the period of 1995–2020: $\bar{a}_i = \sum a_i^{year}/26$.

Item 3:

Establish a maximum (a_i^{max}) and minimum (a_i^{min}) for each variable in the period of 1995–2020 and determine the upper good limit (U_{ai}) and lower bad limit (L_{ai}) as a maximum and minimum from a_b; a_w; a_i^{max}; a_i^{min} based on the importance of each variable (depending on whether a higher value of the indicator is positive or negative, e.g. the higher the GDP the better, and the opposite with unemployment).

Item 4:

Standardize data from the original matrix A (the result is a new matrix $B = (b_i^{year})$), using the equation: $b_i^{year} = (a_i^{year} - \bar{a}_i) / (U_{ai} - L_{ai})$:

$$\{B\} = \begin{matrix} b_1^{1995} & b_2^{1995} & \dots & b_k^{1995} \\ b_1^{1996} & b_2^{1996} & \dots & b_k^{1996} \\ . & . & \dots & . \\ . & . & \dots & . \\ . & . & \dots & . \\ b_1^{2020} & b_2^{2020} & \dots & b_k^{2020} \end{matrix}$$

Weight each variable by multiplying each column representing one of the k-variables with a corresponding weight. The result is a matrix $C = (c_i^{year})$,

where $c_i^{year} = b_i^{year}. w_i$

$$\{C\} = \begin{matrix} c_1^{1995} & c_2^{1995} & \dots & c_k^{1995} \\ c_1^{1996} & c_2^{1996} & \dots & c_k^{1996} \\ . & . & \dots & . \\ . & . & \dots & . \\ . & . & \dots & . \\ c_1^{2020} & c_2^{2020} & \dots & c_k^{2020} \end{matrix}$$

Item 5:

Compute the SOFI for each year, $SOFI^{year} = \sum c_i^{year}$, the index per year is a sum of values in one respective row of matrix C. All SOFI values were subsequently qualified in relation to the 2006 value.

4. Results and commentary

4.1 Partial SOFI

Economic

For the period of 1995–2010 the economic SOFI curve shows a predominantly growing trend (Fig. 2). Its course and fluctuation are most affected (based on importance) by the unemployment rate (7.4), gross domestic product (6.8), and R&D expenditure (6.8). The development of these economic indicators varies. Indicators with a high weight tend to grow, or have a relatively favourable development, and thus affect the index trend in a significantly positive way: e.g. gross domestic product rose from CZK 148.5 thousand per capita (1995) to nearly CZK 359 thousand per capita (2010). R&D expenditures did not even reach 1% of GDP in 1995, while in 2010 they neared 1.6% of GDP.

The initial unfavourable development of the unemployment indicator negatively affects the economic SOFI trend. This is due to the transformation of the economy, where the transition of state enterprises into private ownership is beginning to show, and the worse economic situation in the country in the late 1990s. The decline stops in 2000, with the unemployment rate reaching 8.8%. In the following period, the unemployment development curve behaves erratically, but in 2004–2008 it falls sharply (to 4.4%), affecting the index very positively. The economic recession begins to show on the Czech labor market in 2008; unemployment grows again, which is negatively reflected in the overall economic SOFI.

At the beginning of the monitored period, most of the variables included in the computation of the economic SOFI increase, which is reflected in the rapid growth of SOFI. The decrease in 1999–2000 is caused by the rise of unemployment. In 1995, the value of the economic SOFI of the Czech Republic was 0.78 of the 2006 value, while in 2002 it was almost 1.

2003–2004

In 2002 and 2003, the situation deteriorated and the index fell from 0.98 to 0.85 of the 2006 value, thanks to rising unemployment and a significant drop in foreign direct investment, whose share in GDP fell from 11.3 to 2.2%.

2004–2007

In this period, the economic SOFI strengthened significantly, as it reached 1.15 times the value of 2006 in 2007. The period is characterized by a gradual fall in unemployment and a favourable growth in most of the other indicators.

2008–2009

Between 2007 and 2009, the Czech Republic began to feel the growing economic crisis, which resulted in a drop of the economic SOFI. Its value fell from 1.15 to 1.07. Much of the decline in the index was caused by increased unemployment and decreased GDP, as well as by a negative trend of lower weight indicators.

2010–2020

Based on the forecasts of the Czech Ministry of Finance (namely the medium variant), the economic SOFI is expected to grow gradually but slowly until 2020. The forecast is based mainly on a return to at least moderate economic growth, stagnation or a slight fall in unemployment.

Demographic

The development of the SOFI demographic curve (Fig. 3) is most affected by five indicators with the highest weight: natural population change (weight 6.7); age structure variables – ageing index (6.4) and economic load index (6.3); followed by life expectancy (6.0); and the proportion of university-educated population (5.8). From 1995 to 2010, these indicators changed rather dynamically, with varied behaviour. From the beginning of the monitored period, the ageing index deteriorated year-on-year (from 0.72 in 1995 to 1.11 in 2011); this negative trend is projected to continue until it reaches the expected value of approximately 1.39 in 2020. While the economic load index was falling from 0.46 (in 1995) to 0.40 in 2007, its value has been increasing again since 2008 (0.45 in 2011) and the unfavourable trend is expected to continue to reach 0.64 in 2020.

Natural population change develops dynamically. Within the monitored period, it is mainly affected by natality, as mortality (crude death rate) has oscillated only minimally. Natality expressed as crude birth rate, has slumped since the early 1990s, from 12.5 (1990) to 8.8 (1996). Virtually constant until 2001, it began to grow in 2002 thanks to the 1970s baby boomers, who reached their reproductive age, and mothers who had postponed childbirth in the nineties. By 2008, it had peaked at 11.5, when it started to gradually decline; this trend is expected with slight fluctuations until 2020. As the crude mortality rate ranges slightly above 10, the values of natural population change were negative until 2005, where they turned positive, and this trend should continue until 2020.

The other two indicators of the five with the highest weight show a positive development in the entire period of 1995–2010, and the same trend is expected in the near future. The proportion of university-educated population grew (for population aged over 15) from the nineties

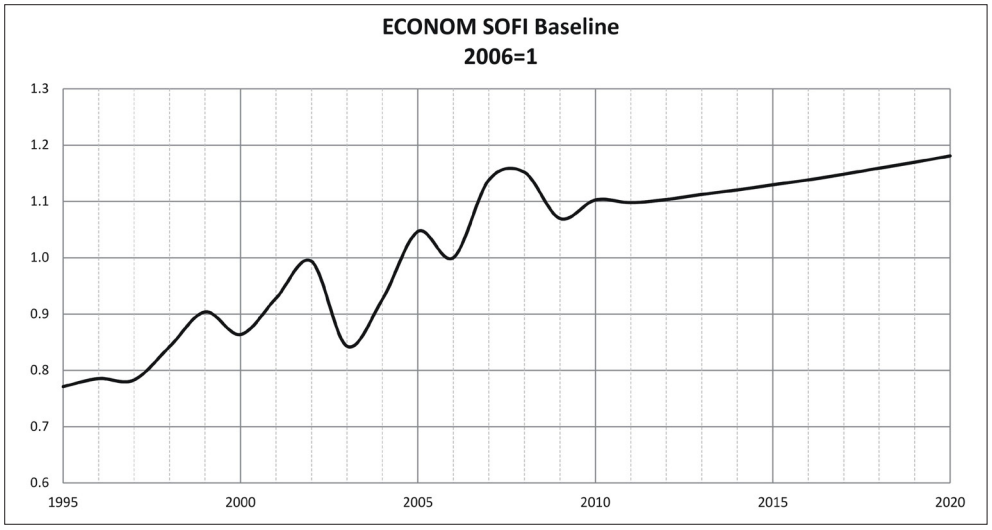

Fig. 2: Development of the economic SOFI 1995–2020

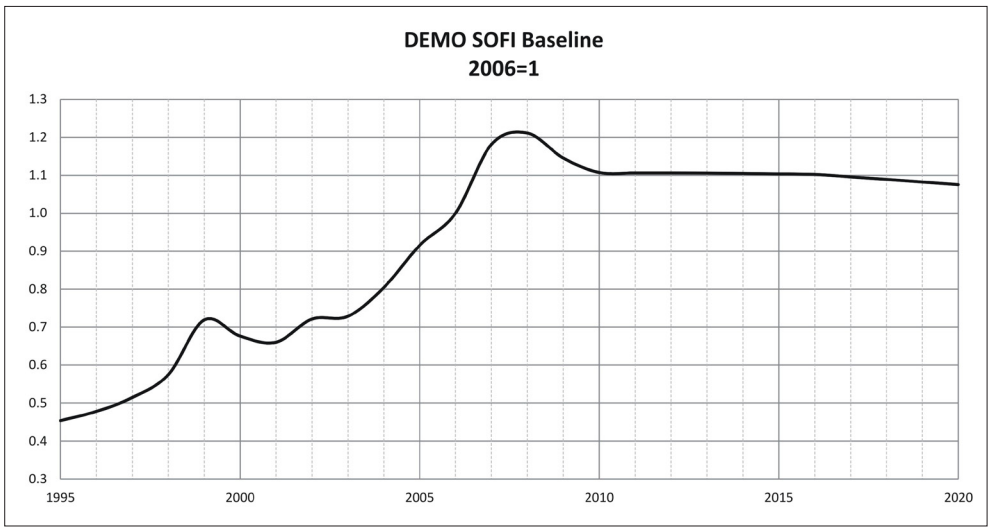

Fig. 3: Development of the demographic SOFI curve

from approximately 6.5% (1991) through 8.9% (2001) to over 14% (2011). While at 69.7 in 1995, life expectancy for men was as high as 74.4 in 2010, and the forecast for 2020 exceeds 77.

The development of the above five indicators heavily influences the SOFI demographic curve, the course of which can be divided into five stages of varying duration.

1995–1998

A period distinguished by index growth, where most demographic characteristics have a favourable trend, with the exception of the ageing index, which, however, grows continuously for the entire time.

1999–2002

The index stagnates, which is caused by the unfavourable development of natural population change; within this period, life expectancy practically does not grow. The stagnation also reflects selected indicators of lower weight, which score nearly the worst values – especially the number of suicides and a negative migration balance.

2003–2007

There is a very positive trend caused by a significant increase in the birth rate and natural population change.

2008–2010

The index values fall due to the stagnation and decline in birth rates, and the trend of the economic load index switches from being positive to negative.

2011–2020

Based on the demographic indicators forecast until 2020, we expect the State of the Future Index to stagnate or drop slightly. This is due to the expected drop in natural population change and the unfavourable development in the age structure of the Czech population, i.e. indicators with high weight.

Social

The computation of the social SOFI (Fig. 4) reflects eleven indicators. Experts attributed the highest weight to the indicators of people voting in elections (6.3), average pension rate (6.3), and crime (6.1). At the beginning of the monitored period, the index curve is stable, oscillating slightly around 0.4 (relative to 2006). From 1998, the index was growing, with one exception – in the period from 2006 to 2008. We expect a similar positive trend for the forecast period until 2020.

From 1995 to 2010, indicators developed with considerable differences in their behaviour. Variables monitoring the number of physicians, pension levels, and households with computer and internet access continued to grow, positively affecting the overall social SOFI. On the other hand, violent crime saw a downward trend, which also had a positive impact on the index. Variables with a deteriorating trend, which affect the overall social SOFI negatively, include public libraries and people voting in elections.

The other indicators fluctuated in the monitored period. Negatively affecting the index, crime continued to grow slightly until it reached over 40 crimes per 1,000 inhabitants in 1999, when it began to fall and affect the social curve positively. The variable monitoring beds in homes for the elderly grew until 2007 (except from 2004 to 2006), which had a positive impact on the social SOFI. However, the number of the beds was reduced significantly after 2007, which had a negative effect on the SOFI. Despite declining at first, cultural centres rose again slightly, but as this indicator is of very little importance, it does not affect the SOFI substantially.

Social benefits are the most problematic indicator included in the calculation of the social SOFI. The problem with this indicator is that it is very difficult to establish an optimum level of welfare. For many people this aid is the only income ensuring a decent standard of living. On the other hand, there are also people who are not interested in securing a job, who abuse the welfare system. Therefore, academics, state organizations, and the public need to open a discussion on this topic, which our research does not include, in order to establish the optimal level of social benefits.

1995–1998

In this period, the total index saw hardly any growth, ranging around 0.40 of the 2006 value.

1999–2007

In these years, the social SOFI index grew quite fast, with nearly all the indicators showing a positive development. In 2007, the social SOFI equalled 1.03.

2008–2010

Following a period of strong upturn, the social SOFI index fell, mainly due to a slowdown in the growth of pensions, a drop in the number of people voting in elections and beds in homes for the elderly, a cut in social benefits, and a reduced

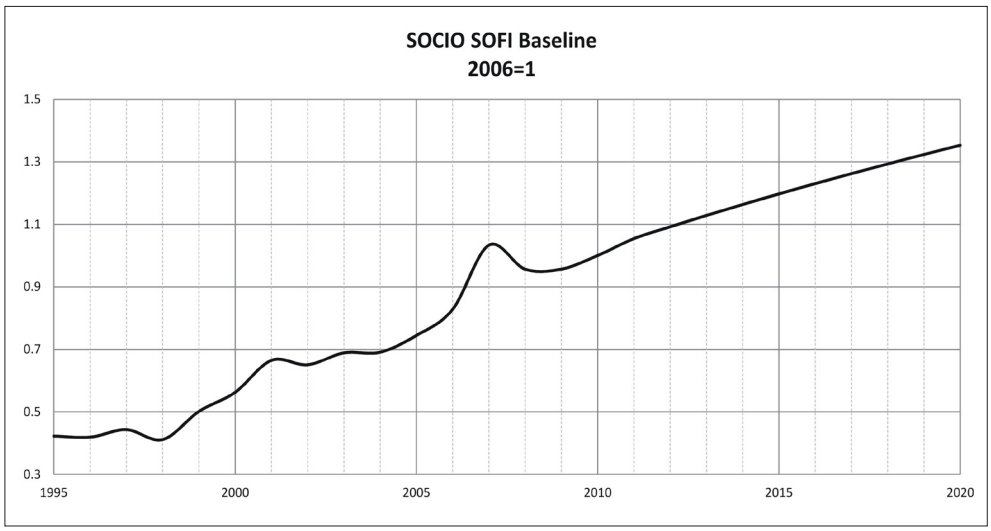

Fig. 4: Development of the social SOFI curve

number of cultural centres and libraries. In this period, the index weakened to 0.96.

2011–2020

In this decade, the social SOFI is projected to grow slightly until it reaches around 1.35 towards the end of the monitored period.

Environmental

Indicators with the highest weight and impact on the development of the environmental SOFI curve (Fig. 5) include CO_2 emissions (6.43), investments into environment protection (6.36), NO_x emissions (6.17), followed by SO_2 emissions (6.04), and finally connection to public sewers (5.91).

From the beginning of the monitored period until 1999, air pollution emissions recorded a sharp downtrend. This was most noticeable with CO_2, of which there were 311,000 tons released in 1995; by 2000, the amount had dropped to less than a half – 146,000 tons. From 2000 to 2005, the production of the monitored emissions remained at the same level. The year 2007 saw an increase, with 180,000 tons of released pollutants. This was followed by yet another decline in the following years, also due to the economic downturn and cuts in industrial production. A trend similar to CO_2 emissions was observed in the other released pollutants, too.

According to experts, the indicator of the second highest weight was investments into environment protection. While in 1995 they amounted to CZK 32 billion, in 1997 investments for environment protection reached CZK 40.5 billion, a maximum for the whole period in question. The large funds spent in the nineties reflected the then poor environmental conditions. The main task was to desulphurize coal power plants and to upgrade the pipeline infrastructure. Since 1998, this trend has seen a downturn, and funds invested into the environment began to drop: in 2002, merely CZK 14 billion were spent to protect the environment, which in the following years stabilized at CZK 20 billion per year. The 2020 outlook expects the current trend of investment to continue.

The economic performance of the Czech Republic remains an important factor influencing the level of investment into environmental protection. The last of the five indicators with the highest weight is the number of inhabitants connected to the public sewage system. Since 1995, the number of inhabitants connected to public sewers has risen exponentially. At the beginning of the monitored period, 73.2% of inhabitants in the Czech Republic were connected to public sewers, while in 2010, the number shot up to 81.2%. In the coming years, this trend will most likely continue. A factor affecting the increasing proportion of inhabitants connected to public sewers is the European funds. Largely because of these investments, which are largely covered by the European Union, municipalities are able to co-finance the construction of sewers, for which they would normally lack sufficient resources. Another reason behind the increase of inhabitants connected to sewers and also in waste water treatment is Act No. 254/2001 Coll. regulating water and amendments to certain other acts (Water Act), which obliges municipalities with over 2,000 equivalent inhabitants to ensure wastewater drainage and treatment by the end of 2010.

1995–1999

This period is characterized by an index upturn, mainly due to the rapid reduction in the monitored CO_2, NO_x, PM10 and SO_2 emissions, as well as due to large investments in environment protection.

2000–2002

The index values fall mainly due to a major drop of investments into environment protection, while characteristics related to released emissions remain at the same level.

2003–2006

In this period, the index follows an improving trend chiefly thanks to increased investments into environment protection and the diminishing amount of emissions.

2007–2010

Following a slump in 2007, with the largest amount of CO_2 pollutants released since 2000, the trend turns positive again and the index rises. Another reason behind the 2007 decline was salvage logging due to a wind calamity; this had a negative impact on the environmental SOFI.

2011–2020

It is extremely difficult to estimate emissions to be released to 2020. The SOFI model anticipates a slight drop in emissions considering the general trend of cuts in these pollutants in the Czech Republic and in Europe in general. Together with

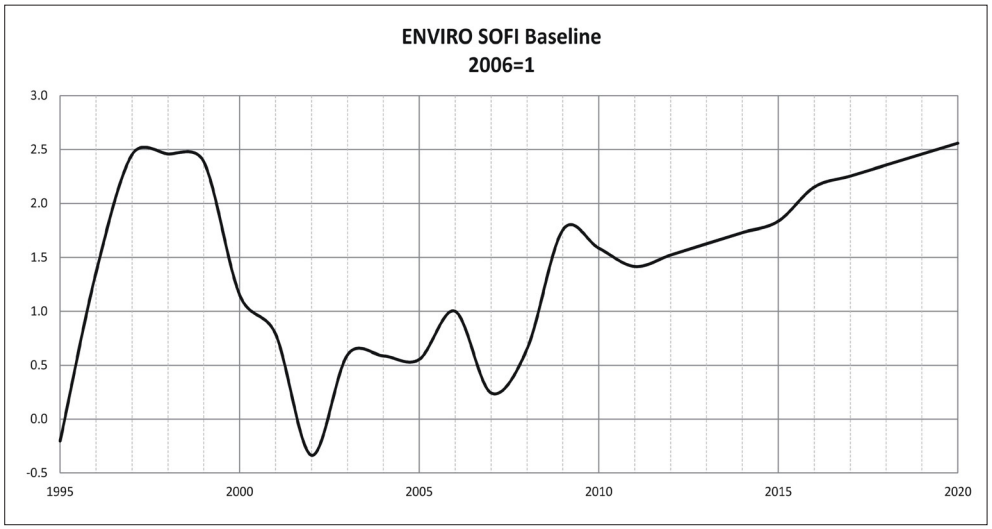

Fig. 5: Development of the environmental SOFI

slowly increasing expenditures on environment protection and stricter limits for the largest emitters, the SOFI model suggests a slowly improving trend.

Conclusion

The overall State of the Future Index for the Czech Republic shows a growing trend virtually for the entire monitored period. It is correlated most with the economic, demographic, and social SOFIs (Fig. 6), as measured by the Pearson correlation coefficient (0.97, 0.96, and 0.93 respectively). In contrast, the overall SOFI trend differs from the environmental index, which behaves quite erratically and is therefore not included in Figure 6.

The total SOFI index is determined by environmental indicators chiefly in the early years (1995–1999), with a positive effect. This is due to high investments into the environment and a sharp drop in emissions in the 1990s. As a result, the overall SOFI grows relatively dynamically despite the fact that the partial social or demographic SOFIs tend to stagnate. The setback in 2000–2004 is related to stagnation or slight decline in virtually all partial SOFIs. Similarly, the index stagnates in the 2007–2011 period, as most of the indicators mirror the consequences of the economic recession and the positive demographic trends slow down.

The comparison of the HDI and SOFI in the Czech Republic (Fig. 7) from 1990 to 2011 reveals that their respective curves

Year	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
HDI	0.788	0.794	0.799	0.805	0.810	0.816	0.824	0.831	0.839	0.846	0.854	0.858	0.861	0.864	0.863	0.865
SOFI	0.468	0.556	0.620	0.696	0.829	0.803	0.838	0.834	0.828	0.870	0.973	1.000	1.101	1.109	1.120	1.133

Tab. 3: Czech Republic HDI and SOFI values. Source: UNDP, authors' calculations
Note: HDI values for years in which the Index was not computed have been interpolated

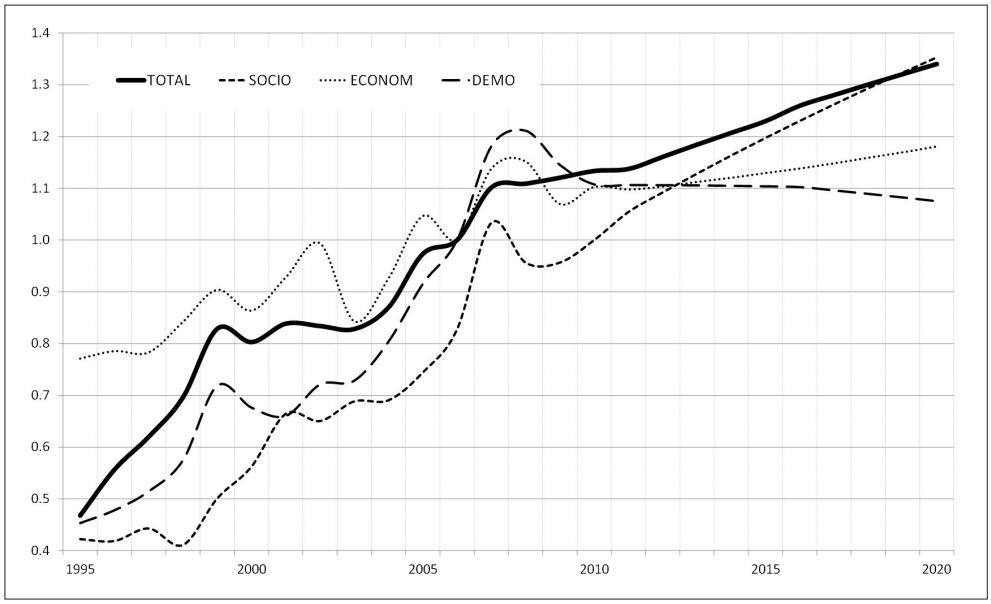

Fig. 6: SOFI compared to partial SOFIs

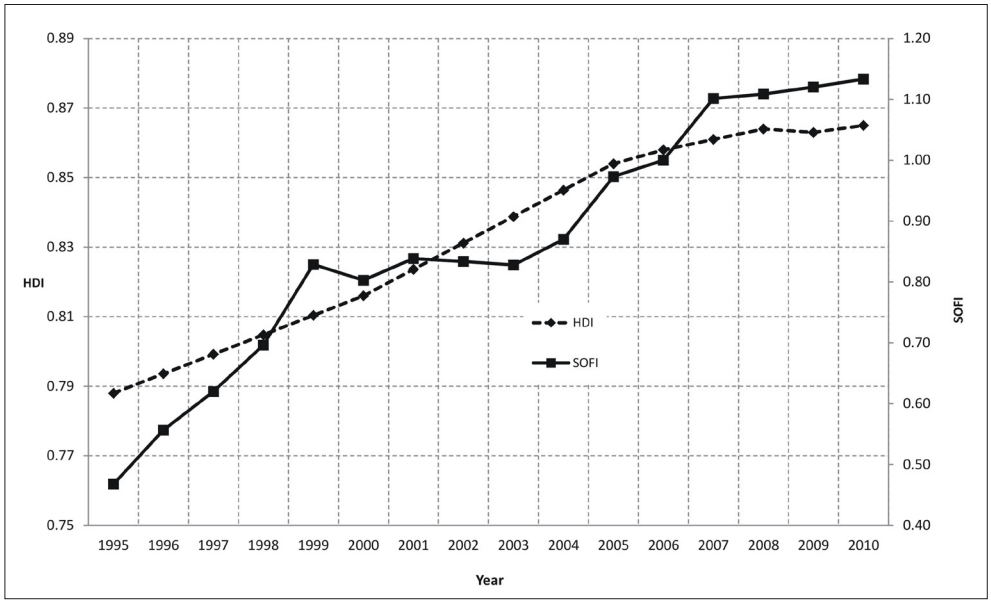

Fig. 7: Comparison of the SOFI and HDI for the Czech Republic

follow a very similar trend; this is expected to continue in the near future as well. Statistically, the HDI and SOFI values significantly correlate (from 1995 to 2010 the correlation coefficient equaled 0.96), which establishes SOFI as a relevant indicator of the country's possible future development.

Combining a wide range of variables, the State of the Future Index is designed to indicate whether we should expect a favourable or unfavourable development in the future. Based on our results it is clear that in the case of the Czech Republic the development will be rather positive, even if much slower than at the turn of the 21st century. As the computation of a national SOFI facilitates the comparison of the potential development of all countries, our following research will focus on juxtaposing a possible development of the V4 countries and on the regions of the Czech Republic.

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