STATISTIKA

STATISTICS
AND ECONOMY
JOURNAL

VOL. **93** (1) 2013

CZECH
STATISTICAL
OFFICE

EDITOR-IN-CHIEF

Stanislava Hronová
Vice-Rector, University of Economics, Prague
Prague, Czech Republic

EDITORIAL BOARD

Iva Ritschelová
President, Czech Statistical Office
Prague, Czech Republic

Marie Bohatá
Vice-President, Eurostat
Luxembourg

Ľudmila Benkovičová
President, Statistical Office of the Slovak Republic
Bratislava, Slovak Republic

Roderich Egeler
President, German Federal Statistical Office
Wiesbaden, Germany

Richard Hindls
Rector, University of Economics, Prague
Prague, Czech Republic

Gejza Dohnal
Vice-President of the Czech Statistical Society
Czech Technical University in Prague
Prague, Czech Republic

Štěpán Jurajda
Director, CERGE-EI: Center for Economic Research and Graduate Education — Economics Institute
Prague, Czech Republic

Vladimír Tomšík
Vice-Governor, Czech National Bank
Prague, Czech Republic

Jana Jurečková
Prof., Department of Probability and Mathematical Statistics, Charles University in Prague
Prague, Czech Republic

Jaromír Antoch
Prof., Department of Probability and Mathematical Statistics, Charles University in Prague
Prague, Czech Republic

Martin Mandel
Prof., Department of Monetary Theory and Policy, University of Economics, Prague
Prague, Czech Republic

František Cvengroš
Head of the Macroeconomic Predictions Unit, Financial Policy Department,
Ministry of Finance of the Czech Republic
Prague, Czech Republic

Josef Plandor
Department of Analysis and Statistics,
Ministry of Industry and Trade of the Czech Republic
Prague, Czech Republic

Petr Zahradník
EU Office, Česká spořitelna, a.s.
Prague, Czech Republic

Kamil Janáček
Board Member, Czech National Bank
Prague, Czech Republic

Petr Vojtíšek
Deputy Director, Monetary and Statistics Department,
Czech National Bank
Prague, Czech Republic

Milan Terek
Prof., Department of Statistics,
University of Economics in Bratislava
Bratislava, Slovak Republic

Cesare Costantino
Research Director,
Italian National Institute of Statistics
Rome, Italy

Walenty Ostasiewicz
Prof., Department of Statistics,
Wroclaw University of Economics
Wroclaw, Poland

ASSOCIATE EDITORS

Jakub Fischer
Vice-Rector, University of Economics, Prague
Prague, Czech Republic

Luboš Marek
Dean of the Faculty of Informatics and Statistics,
University of Economics, Prague
Prague, Czech Republic

Marek Rojíček
Head-Manager of the Macroeconomic Statistics Section,
Czech Statistical Office
Prague, Czech Republic

Hana Řezanková
President of the Czech Statistical Society
Prof., Department of Statistics and Probability,
University of Economics, Prague
Prague, Czech Republic

MANAGING EDITOR

Jiří Novotný
Czech Statistical Office
Prague, Czech Republic

FOREWORD

Dear readers,
It is a great pleasure for me to introduce you the first 2013 issue of Statistika, a quarterly journal published by the Czech Statistical Office.

The second half of 2012 was quite rich in terms of events dealing with environment- and sustainability-related official statistics. I'd like to highlight at least two of them. In June the so-called "Rio +20 Summit" took place in Rio de Janeiro. Its outcome document called "The Future We Want" initiated number of discussions among the representatives of the professional community all over the World. Another important event was European Statistics Director Generals' conference that took place in the Czech Republic in autumn. The result of the conference was the so-called Prague Memorandum aimed at moving forward the green statistics development.

The above mentioned events along with variety of other activities clearly motivated our authors to contribute a significant number of green statistics-related papers. The current issue of Statistika offers a whole block of articles devoted to environmental statistics and broader problems of sustainability. One can also expect that these topics will also be represented in the upcoming journal issues, of course depending on the peer review results. Several other papers included in the current issues of the journal provide very interesting insights on work-related topics and banking sector of the Czech Republic.

This year we will continue working on development of our journal by attracting more authors, extending the geography of peer reviewers and increasing number of our readers by improving the journal distribution channels. Among the major changes that have been already introduced is that the journal is now available on the Google Books portal and from now on Statistika will also be listed in EBSCO Publishing database. This year we plan to continue registrations in other reference databases. I believe that these steps will help us improve popularity and overall impact of our journal among the professional community.

I wish all the journal readers plenty of creative thoughts and professional success!

Iva Ritschelová
President of the Czech Statistical Office

CONTENTS

ANALYSES

INFORMATION

About Statistika

The journal of Statistika has been published by the Czech Statistical Office since 1964. Its aim is to create a platform enabling national statistical and research institutions to present the progress and results of complex analyses in the economic, environmental, and social spheres. Its mission is to promote the official statistics as a tool supporting the decision making at the level of international organizations, central and local authorities, as well as businesses. We contribute to the world debate and efforts in strengthening the bridge between theory and practice of the official statistics. Statistika is a professional journal included in the list of peer-reviewed scientific periodicals published in the Czech Republic and rated by the methodology of the Council for Research, Development and Innovation of the Government of the Czech Republic. Since 2011 Statistika has been published quarterly in English only.

Publisher

The Czech Statistical Office is an official national statistical institution of the Czech Republic. The Office main goal, as the coordinator of the State Statistical Service, consists in the acquisition of data and the subsequent production of statistical information on social, economic, demographic, and environmental development of the state. Based on the data acquired, the Czech Statistical Office produces a reliable and consistent image of the current society and its developments satisfying various needs of potential users.

Contact us

Journal of Statistika | Czech Statistical Office | Na padesátém 81 | 100 82 Prague 10 | Czech Republic
e-mail: statistika.journal@czso.cz | web: www.czso.cz/statistika_journal

Sustainable Development Indicators at the Regional Level in the Czech Republic

Jakub Fischer[1] | *University of Economics, Prague, Czech Republic*
Karel Helman[2] | *University of Economics, Prague, Czech Republic*
Jana Kramulová[3] | *University of Economics, Prague, Czech Republic*
Ludmila Petkovová[4] | *University of Economics, Prague, Czech Republic*
Jan Zeman[5] | *University of Economics, Prague, Czech Republic*

Abstract

Sustainable development has been the topic of expert debates since the 1970s and remains relevant until now. The issue is dealt with intensely by a lot of international institutions (e.g. Eurostat, UN, OECD). A common objective is to identify the domains of sets of sustainable development indicators, establish these sets, compile a smaller set of indicators suitable for international comparison and identify the sources of available data. Both the national and regional level of the issue is of extreme importance.

This paper presents the outcome of an initial stage of our project. Its aim is to verify the set of sustainable development indicators for Czech regions (NUTS 3) that are used by the Czech Statistical Office. The principal task is to determine the availability and usability of the data for further statistical processing and tackle problems that may arise. The adjusted data set will then be used for further statistical analyses.

Keywords

Sustainable development indicators, Czech regions NUTS 3, adjusted data set, statistical analysis

JEL code

Q01, Q56, R11

INTRODUCTION

Sustainable development has been the object of attention for more than 40 years. Numerous studies, analyses and comparisons have been published, covering not only global and national but also regional aspects of the issue. In our view, however, the methodology of these studies has to be subjected to close scrutiny. Firstly, the indicators that are employed in comparisons should be thoroughly analysed from the point of view of their quality, accuracy, relevance, availability and mutual relationships. The indicators have

[1] University of Economics, Nám. W. Churchilla 4, 130 67 Prague, Czech Republic. Corresponding author: e-mail: fischerj@vse.cz, phone: (+420)224095737.
[2] University of Economics, Nám. W. Churchilla 4, 130 67 Prague, Czech Republic.
[3] University of Economics, Nám. W. Churchilla 4, 130 67 Prague, Czech Republic.
[4] University of Economics, Nám. W. Churchilla 4, 130 67 Prague, Czech Republic.
[5] University of Economics, Nám. W. Churchilla 4, 130 67 Prague, Czech Republic.

to be selected according to these criteria. Secondly, the choice of a suitable methodology of aggregation is required for both multiple comparison and a composite indicator construction approach. The justification of the selection of indicators in particular is sometimes missing (or not sufficient) in the projects on the issue of sustainable development. The third important issue is the data coherence in time and space. According to the space coherence requirement at the regional level (especially for smaller countries like the Czech Republic) it is likely for the indicators to be defined consistently, but it is necessary to ensure this coherence for the cases of national comparisons as well. The second dimension is the requirement for the comparability in time. This is a crucial topic particularly in the case of data that are subject to ordinary and extraordinary revisions (e.g. data from national and regional accounts).

The purpose of the present paper is to select appropriate partial indicators of sustainable development for the case of the Czech Republic at the regional level (NUTS 3 level). Recently adopted approaches are taken into account as the basis on which the indicator properties (including their availability at the NUTS 3 level) are analysed. Finally, a set of partial indicators that can be employed for further analyses is presented.

1 MEASUREMENT OF SUSTAINABLE DEVELOPMENT

1.1 Sustainable development and its measurement at the national level

Sustainable development is a broad concept. The most widespread and well-cited definition comes from G. H. Brundtland (WCED, 1987, pp. 8): *"Humanity has the ability to make development sustainable – to ensure that it meets the needs of the present without compromising the ability of future generations to meet their own needs".* There are other similar definitions available (for details see Macháček, 2004, pp. 28–29 or Nováček, 1996, pp. 16–19).

Figure 1 Sustainable Development Model

Source: Own construction

The sense of sustainable development is to balance its economic, social and environmental pillars. The principles of sustainable development have influenced regional strategies at different levels as well as the world of business (particularly in the scheme of corporate social responsibility). Although the purpose of sustainable development is patently obvious, it is not clear how to properly measure such a complex phenomenon.

There are various approaches to statistical assessment of sustainable development, usually dealing with the national level of the issue (e.g. Italian research institution Fondazione Eni Enrico Mattei [FEEM, 2012], Slovak Centre for Economic Development [CPHR, 2012] or German Statistical Office [2012]). In the Czech Republic, sustainable development is also assessed mostly at the national level. In 2001, the European Union adopted the first Sustainable Development Strategy (hereafter SDS) based on the Lisbon strategy. Having embraced the EU SDS three years later, the Czech Republic has updated it several times under the common title of Renewed Sustainable Development Strategy. The document covers the following main areas:

- competitiveness of the economy,
- protection of the environment, natural resources and landscape,

- cohesion and stability,
- research, development and education,
- European and international context,
- governance.

The developments in the above areas are evaluated in the Progress Report on the Czech Republic SDS (Government Council for Sustainable Development et al., 2009) issued by the Ministry of Environment on the basis of indicators that are monitored by the Charles University Environment Center. This Progress Report includes more than 30 indicators divided according to the aforementioned areas and compiled on the basis of the verified data and official methodologies. During the works on our project, new Progress Report was published in the year 2012. (Government Council for Sustainable Development et al., 2012)

1.2 Sustainable development and its measurement at the regional level

A more complicated situation arises when focusing on lower administrative units. Attention has been paid to the monitoring of sustainable development at the local level in recent years, especially in the so called "micro-regions" or at the municipality level (for more details see e.g. Timur, 2012). However, the possibilities of statistical data processing at the local level are rather problematic due to a small number of official – no matter how thoroughly conducted – surveys. In spite of the limited amount of data and different data requirements in comparison with the national level, questionnaire surveys are often launched to find out about public opinion on particular issues. But it is difficult to make spatial and time comparison of the country regions. Only local surveys of a limited scope are carried out.

Even at this level, however, the attempts of sustainable development assessment are rather scarce. Methodology comparison as well as the comparison of results is, therefore, almost beyond feasibility. The year 2005 can be marked as a transition point, when model sustainable development strategies of two regions (Liberecký and Ústecký) were created as an output of a project entitled "Support for the Preparation of Sustainable Development Strategy in Selected Regions of the Czech Republic". The main difference from the previous strategic materials at the NUTS 3 level is that SDS places emphasis on a longer time perspective (from 2006 to 2020). Another important difference is the imbalance of the three basic – economic, social and environmental – pillars. Based on the SWOT analysis, the priorities and strategic objectives for particular pilot regions had been set. For monitoring and regular evaluation of the regional strategy implementation (i.e. finding out whether and how the objectives are achieved), the authors of the strategy proposed a set of indicators. The point is, however, that not all selected indicators for particular model regions are available in other regions. Therefore, the set of indicators used in pilot strategies cannot be considered as unalterable.

Current development indicates that some regions, not being able to create a separate strategy of sustainable development, will integrate the issue of sustainability into existing strategic documents. This will require selecting the indicators that could be employed for the assessment of specific regional goals.

Some regional comparisons are also available, but mostly in the form of quality of life assessments (Mederly et al., 2004) or statistical overviews without a deeper analysis and regional comparison (Czech Statistical Office, 2010). It is usually difficult to use these sources for broader statistical analyses, particularly due to the fact that:

- some data originate from questionnaire surveys carried out irregularly and only in small territories,
- each region compiles its own set of indicators (there is no unified set),
- qualitative and individual assessments are made.

For meaningful statistical analyses, it is necessary to have a high-quality initial data set at one's disposal. In order to ensure a better comparability it is useful to select such indicators that are broadly available in regions not only for single country, but eventually for other countries as well. Concerning just local

specificities makes it impossible to construct subsequent comparative analyses. The arrangement of our panel data matrix will be dealt with later.

1.3 An overview of the selected Czech regional sets of indicators

Let us introduce more closely the two regional examples of sustainable development assessment in the Czech Republic that were mentioned above. One of them can be found in a publication issued by the Czech Statistical Office (hereafter CZSO). Its main drawback is that its updates appeared irregularly (in the years 2007 and 2010), thus not allowing easy prolongation of the indicators' time series. On the other hand, being borrowed from the national indicator set used by the Charles University Environment Center and the Czech Ministry of Environment in the Progress Report on the Czech Republic Sustainable Development Strategy (Government Council for Sustainable Development et al., 2009), the set of indicators in the above publication is adjusted for the needs of regional assessments.

Another example is a joint project of three co-researchers (see Mederly et al., 2004). However, it was just a single attempt to compare regions from a sustainable development view point. Moreover, its outcomes are already behind the times (published in 2004), with no real chance of being revised and republished. The research focused on both international and regional levels of comparison (NUTS 3 and LAU 1), emphasis having been laid on the quality of life in particular. The main drawback of this approach is that the authors employed all the indicators available without selecting just the proper and useful ones. On the other hand, a mix of ex-ante (factual) and ex-post (using only available data) approach was adopted.

2 SELECTION OF INITIAL INDICATOR SET

For the reasons mentioned in Chapter 1.2, the possibility of monitoring sustainable development indicators in territorial administrative units at a lower than NUTS 3 level (14 regions in the Czech Republic) was ruled out. Only in the case of NUTS 3 level can the improved data sources based on the official statistics be found. This does not allow us to study sustainable development in the Czech Republic at a lower regional level in detail, which would be more suitable for the identification of regional disparities in some sustainable development aspects. A greater number of observations would be also more appropriate so that statistical methods could be employed for further analyses. For the reasons already mentioned, in order to facilitate the selection of a good data source, the level of NUTS 3 territorial administration unit was chosen. We decided to draw inspiration for a follow-up analysis from CZSO sources (Czech Statistical Office, 2010), having made – predictably – slight data adjustments (see below).

As already mentioned, a regional sustainable development comparison on the basis of a uniform indicator set was carried out and subsequently revised by the CZSO in 2007 and 2010 respectively. The employed indicators originate from the national SDS 2004 and particular progress reports. Since there are no data available at the regional level, it is not possible to determine all the indicators (examined and evaluated at the national level) for the NUTS 3 level. For this reason, several adjustments of the national indicator set were carried out. Some indicators were replaced by different ones available at the regional level. Not all indicators, however, have a suitable substitute. That is why some areas were not included at all (e.g. corruption perception index, consumption of primary energy sources, common species of wild birds index, alien plant species index, pesticide consumption, etc.). Furthermore, a principle was stressed that the data for further calculation should be obtained from periodic surveys or other sources regularly providing reliable data in the time series.

The Center for Social and Economic Strategies (Mederly et al., CESES 2004), on the other hand, attempted to find the set of indicators at the regional level, having compared *a priori* and *a posteriori* approaches. It was one of the first attempts in this respect in the Czech Republic, even though the research project dealt predominantly with the quality of life and human resources development evaluation. We will update these already outdated results and proceed further in relevant statistical analyses. This will

Table 1 Economic pillar

Indicators
Gross Domestic Product per Capita in thousands of CZK (current prices)
Change in Gross Domestic Product (Development of GDP in constant prices)
Labour Productivity (Development of GDP per 1 employed)
Local Government Deficit / Surplus
Gross Value Added in Services (Share of the Tertiary Sector in Gross Value Added in %)
Investment Rate in %
Net Disposable Income of Households per inhabitant in thousands of CZK
Small and Medium-sized Enterprises (Share of Small and Medium-sized Enterprises in the Total Employment in %)
Transport Infrastructure – Density of the Motorway Network in km per 100 km^2
Transport Infrastructure – Railway Lines Density in km per 100 km^2
Freight Transport (Excluding Transit, including Road, Rail and Water Transport per thousand of CZK GDP, in kg)
Passenger Transport (within the Region by Public Road and Rail Transport per Capita)
Research & Development Expenditures to GDP in %

Source: Czech Statistical Office, 2010

Table 2 Social pillar

Indicators
Households with Net Income below Subsistence Minimum
General Unemployment Rate in % (Aged 15+)
Registered unemployment Rate in % (Aged 15+)
Employment of Elderly Workers (Employment Rate of People Aged 55–64 in %)
Employment of Women in %
Mortality (Standardized Mortality Rate – Number of Deaths per 1000 mid-year Population)
Life Expectancy (of men and women at birth in years)
Highest Level of Education Attained (Share of the Population with Tertiary Education in the Population Aged 15 and Over in %)
Internet Access (Share of Households connected to Internet in %
Local Government Expenditures on Culture per inhabitant in CZK
Coverage of the Czech Republic's Territory by Approved Town and Country Documentation of Municipalities in %
Average Duration of Court Proceedings From the Idea to the Legal Effect Day in Days
Civil Society – Political Participation (Turnout in Elections to Municipal Councils, Regional Councils and to the Chamber of Deputies in %)
Women and Men in Politics (Share of the Total Number of Women Elected Representatives in Elections to Municipal Councils and Regional Councils in %)
Civil Society – Civil Participation (Mid-year Population to Non-profit Organization)

Source: Czech Statistical Office, 2010

Table 3 Environmental pillar

Indicators
Arable Land in %
Consumption of Industrial Fertilizers in Pure Nutrients in kg/ha of Arable Land
Coefficient of Ecological Stability
Organic Farming (Share of organically farmed land in the total area of agricultural land in %
Index of Defoliation in %
Share of Broadleaved Species in %
Quality of Surface Water (Share of profiles in IV. a V. Class of Pollution (group A – General, Physical and Chemical Indicators in %))
Areas with Deteriorated Air Quality in %
Nitrogen Oxide Emissions (REZZO 1–4) in tonne per km^2
Sulphur Dioxide Emissions (REZZO 1–3) in tonne per km^2
Waste Generated by Enterprises in kg per thousand CZK of GDP
Municipal Waste Generated in kg per inhabitant
Acquired Investment Expenditures on Environment Protection according to Location of Investment in CZK per inhabitant
Non-investment Expenditures on Environment Protection according to Region of Residence of the Investor per million CZK of Regional GDP

Source: Czech Statistical Office, 2010

allow us to perform a deeper examination of both the interactions (and developments) of particular regions in the Czech Republic and various aspects of sustainable development.

As already mentioned, our study is based on the indicator set published by the CZSO. The indicators are divided in accordance with the three customary pillars of sustainable development – economic, social and environmental.

The list of all considered indicators (i.e. the initial data set) is shown in Tables 1–3, a brief description being provided in the Annex.

The indicator set presented here was used by the CZSO to assess sustainable development at NUTS 3 level. Some indicators, however, are observed only in *ad-hoc* surveys. Moreover, there are frequent changes in the methodology of data collection and further primary data handling. The indicators whose values cannot be determined for the regions (e.g. the length of court proceedings – see below) represent a special case.

Our aim is to supply these indicators with the data that would allow us to compare regions in space and time. This means not only determining the values for one reference year, but also supplementing the indicators with the longest possible time series. The data have to ensure comparability over time as well, not only from a methodological but also factual point of view.

3 THE CREATION OF THE FINAL DATA SET FOR FURTHER ANALYSIS

In the previous chapter, the construction of the initial data set was described. Here we will dedicate ourselves to creating the final data set that will be used for further analysis in follow-up research. The indicators that will not be dealt with in this chapter remained unchanged in the final data set, thus being the same as those included in the initial data set. In this chapter, all the modifications performed to the initial data set will be considered.

3.1 Discarded indicators

Regrettably, several indicators had to be discarded from the data set. These were as follows:

Registered Unemployment Rate. There were several reasons for discarding this indicator. First, the value of the Registered Unemployment Rate depends, to a certain extent, on decisions and measures taken by the government. Second, all the other [un]employment indicators in the initial data set are constructed on the grounds of the same ILO-based (International Labour Organization) methodology. Although it is true that the Registered Unemployment Rate has become more comparable with similar rates used in the EU and more consistent with ILO-based methodology since 2004, this indicator is still focusing just on registered job-applicants. Conditions for registration of unemployed at Labour Offices may vary in different countries. This also means that indicators such as the General Unemployment Rate – in comparison to the Registered Unemployment Rate – may be better received and understood overseas. Therefore we have decided to discard this indicator.

Average Duration of Court Proceedings. All the five sub-indicators had to be discarded because court districts (i.e. administrative regions till the year 2001) do not coincide with present administrative regions (NUTS 3 level) and it was impossible to convert their values.

Women and Men in Politics. In fact, there were two indicators expressing the proportion of women among all members of the elected bodies – one for a regional and the other for local level. The point is, however, that there were some years when no elections were held; thus an estimation of values for the missing years would be unavoidable for the construction of complete time series. It would be possible to calculate suitable estimations if the researched phenomenon was comparable between two different types of elections. Unfortunately, because of the incomparable numbers of representatives being elected at regional and local levels, the results of the two types of elections (i.e. the proportion of women among all the representatives) cannot be used to estimate the values in the "missing" years. Due to the facts mentioned above, it was impossible to construct complete time series and the solution chosen was to discard the two sub-indicators from the initial data set.

Index of Defoliation. The decision to discard this indicator was also based on serious reasons. The key one is that substantial differences in methodology make it impossible to construct relevant time series. In other words, even the values for a single region are almost incomparable within a year-to-year perspective. Moreover, the data for the Prague region were missing completely, the year 2006 being the last one with the data available for all the other regions.

3.2 Indicators with shortened time series

For certain indicators, gaps in the time series appeared as there were no data available for particular years. For some of those indicators, the nature and development of the time series make it very difficult (or almost impossible) to calculate relevant estimates for the data in the missing years. Since the complete time series are required for further analysis, the following three indicators´ time series had to be shortened:

Households with Net Income below Subsistence Minimum. The data for the years 2001 and 2003 were missing completely, so the time series were shortened by removing the years 2000 and 2002 from the initial data set. Consequently, the first year in the final data set is 2004.

Organic Farming. The regional data on the proportion of organically cultivated soil to the total area of agricultural land are only available for the years 2003 and 2006–2010. For 2004 and 2005, there are only data available for the whole Czech Republic. Since our project deals with regions, both the years 2004 and 2005 together with 2003 were removed from our initial data set, resulting in very short time series for the period 2006–2010 in the final data set. For the earlier years, only the proportion of organizations that practice organic farming was known; the idea of using an indicator defined with this respect was also considered. Nevertheless, the data based on the two respective definitions turned out to be incomparable and so the replacement of an original form of indicator with an alternative was not possible.

Passenger Transport. For this indicator, in the years 2001 and 2002 a completely different methodology was employed – railroad transport not being included in the values gathered. This made these two years' values incomparable to the remaining ones. Because of that, the years 2001 and 2002 had to be removed from the initial data set.

3.3 Indicators with estimated (missing) values

Unlike the indicators mentioned in the previous sub-chapter, the nature and development of the time series of indicators presented in this chapter allowed us to calculate relevant estimates of the data in the missing years. It is to be stressed that the calculation of estimates is not a key task of our project and so the comparison of estimation methods (in order to obtain the best estimates) was not made. The objective was to supplement the missing values with relevant (estimated) data using a method that may be easily employed in the future. Therefore, we have decided to use the simplest methods that would produce satisfactory results. The indicators with some missing (and estimated) values are as follows:

Passenger Transport. There was a problem with the Prague region value for the year 2005 since it did not include the Integrated Traffic System. The development of the time series allowed us to easily estimate the missing value as the average of 2004 and 2006 values.

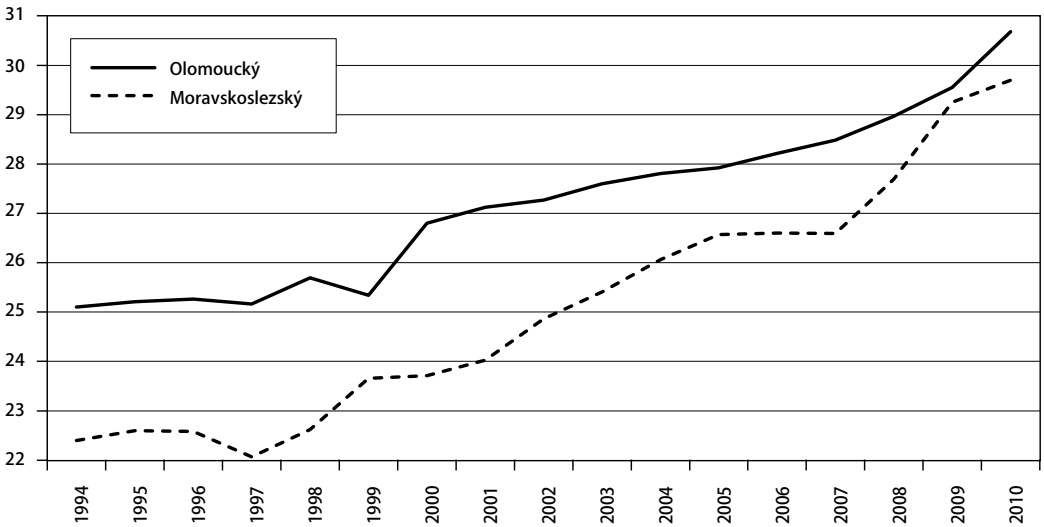
Internet Access. The data for the year 2004 were missing completely. Again, the development of the time series and the nature of this indicator allowed us to employ the simplest method for the estimation of missing values. The 2004 data were calculated as a simple arithmetic average of the two subsequent years, so that the full range from the year 2003 to 2010 is now available for further analysis.

Quality of Surface Water. The two missing values (2005 and 2007 for the Prague region) were estimated on the basis of an expert assessment.

Share of Broadleaved Species. For Olomoucký and Moravskoslezský regions, the data from the period 1994–1996 were missing in the initial data set. The development of the time series allowed us to consider two methods for the calculation of estimates – namely the trend analysis and multiple linear regression

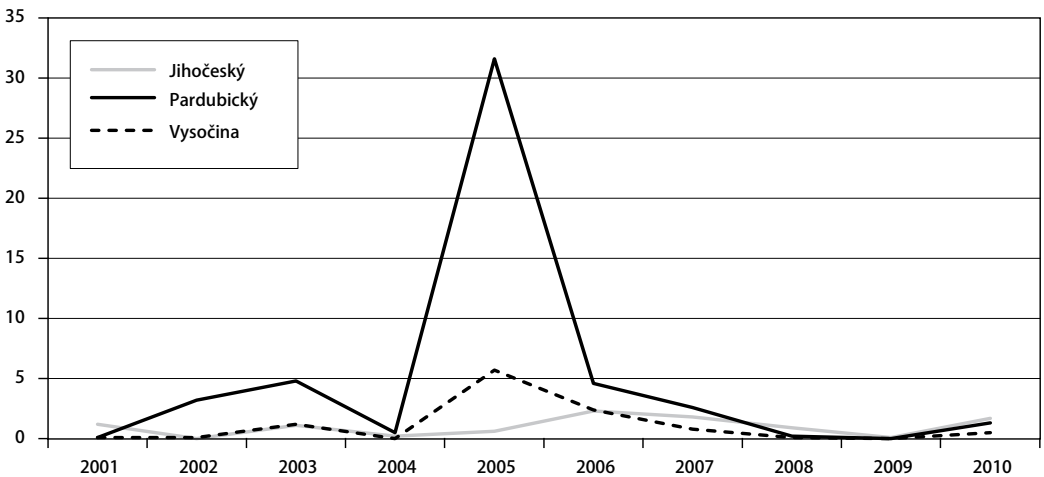
approach. Since the aim was to gain relevant estimates (to obtain the missing numbers) and there was no reason for examining any relationships (e.g. between Olomoucký and other regions) at this stage of our project, all the models were constructed without carrying out deep error-diagnostic tests. In this sense, both above mentioned approaches proved to be relevant – having produced meaningful results. Finally, the regression-based estimates were selected for the final data set because of higher statistical significance; all the parameters involved reached the 5% significance level. The results can be seen in Figure 2.

Figure 2 Share of Broadleaved Species, Olomoucký and Moravskoslezský regions (in %)



Source: Own construction

Figure 3 Areas with Deteriorated Air Quality, Jihočeský, Vysočina and Pardubický regions (in %)

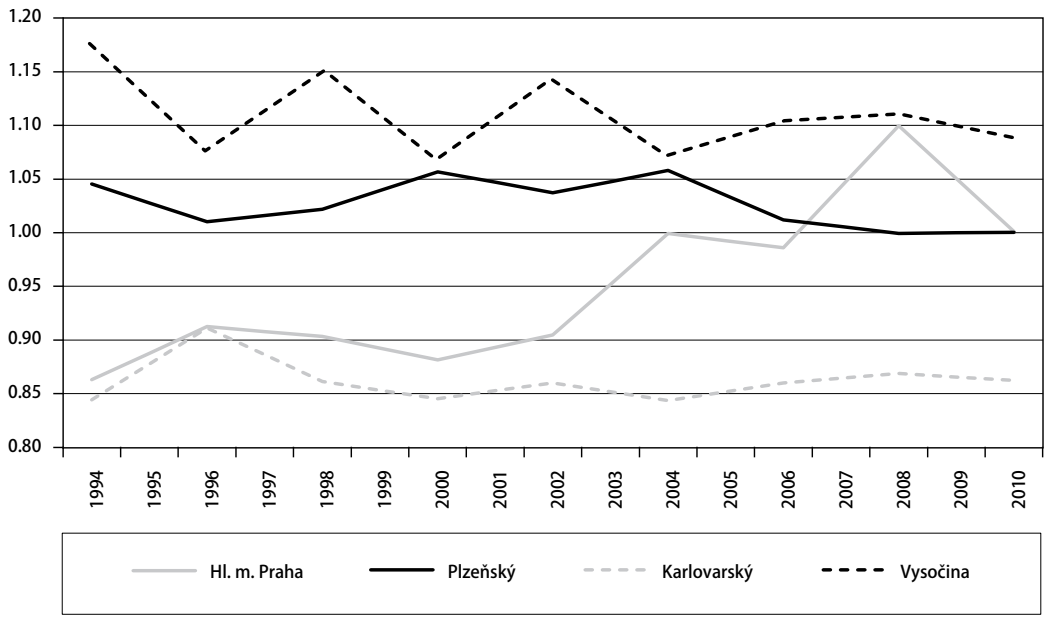


Source: Own construction

Areas with Deteriorated Air Quality. Several values were missing in the initial data sets for Jihočeský (the year 2001), Vysočina (2004) and Pardubický (2002, 2004, 2008 and 2009) regions. Unlike the previous indicator, the trend-analysis approach is not applicable in this case as there is no clear development in the investigated time series (a few high peaks occurred). Consequently, the multiple linear regression models (with 5% significance-level parameters) had to be employed. The resulting estimates had to be further adjusted as they were sometimes slightly below zero. In such a case the final estimate applied for the final data set was adjusted to zero. The final results are shown in Figure 3.

Civil Society – Political Participation. This indicator is expressed in the initial data set as the election turnout rate (in percent). Three types of elections – general, regional and municipal – are involved (i.e. there are three corresponding sub-indicators). Reflecting all three types of elections and beginning with the year 1994, only even years (1996, 1998 and so forth) are covered; in those years at least one type of elections was held. Since this indicator is unique among all the others, we have decided not to discard it. Several steps were taken in the process of time series construction. First, it was necessary to make all the values in the initial data set (coming from different types of elections) comparable. The method chosen was to transform them into the share of regional election turnout within that of the whole Czech Republic. The values transformed in this way then indicate whether the regional election turnout is above or below the total turnout. Fortunately, all the three types of elections proved to be excellently comparable. The second phase was the calculation of averages in the years when more than one type of election was held. In the third stage, the values for odd (missing) years were estimated as the average of the two subsequent years. The results for the selected regions are presented in Figure 4.

Figure 4 Civil Society – Political Participation, share of regional election turnout in the whole Czech Republic election turnout



Source: Own construction

3.4 Problematic indicators

In the previous text, all the adjustments already performed to the initial data set were described. All the other indicators remained unchanged. Nevertheless, we found several of them problematic in some way. It should be also stressed that the list below is not complete in any sense as more difficulties may appear during further analysis. At this stage of our project, the final decision how to deal with already identified "problematic" indicators has not been made. Still it is a good idea to summarize the problematic indicators and describe their weaknesses.

Labour Productivity. This indicator expressed by the usage of working time (hours worked) does not have much relevance in the case of regions. For our project purposes and because of a relevant economic insight, the phrase "per an employee" was chosen, although it brings some difficulties as sudden local peaks and minimums appear in the time series.

General Government Deficit/Surplus. This indicator belongs to the problematic ones due to strong variability of the time series. Its use will be considered even more carefully in the future. (A more suitable indicator would be, for instance, the regional surplus of funding. This entry, however, is not available for the Czech Republic yet.)

Coverage of the Czech Republic's Territory by approved Town and Country Documentation of Municipalities. Unfortunately, this indicator defined as "territory coverage" could not be used for a simple reason – there are no data available. In regular time series only the number (not the location) of municipalities with approved documentation is obtainable. On the grounds of both factual and numerical analysis, we decided to use the rate of municipalities with approved town and country documentation.

Quality of Surface Water. Due to a low number of measuring stations in Prague and Pardubický regions, the time series consist of only a few unique values. For the remaining twelve regions, the values of this indicator are considerably different. This makes all the regions rather difficult to compare.

Areas with Deteriorated Air Quality. As already mentioned in the previous sub-chapter, there is no clear development (trend) in this indicators' time series, several high peaks appearing and high year-to-year differences occurring in some of them in different years and regions. Possibilities of further data transformation will have to be considered in the future.

CONCLUSION

In this paper we contribute to the discussion on indicators of sustainable development in the Czech Republic at the regional level. Several indicator sets have been recently used at the national level. At the first stage of our project we verified the usability of these indicators for the NUTS 3 level. The availability of data at the regional level was checked, a significant amount of work being done on supplementing the regional indicators (and their time series) with concrete data.

Having adapted the national indicator set to the regional level, we made four types of adjustments. At first, we discarded some indicators from the regional sets. Then we had to shorten the time series of several indicators. After that we estimated the missing values. Finally, we identified some problematic indicators that should be deeply analyzed before they can be applied in further research.

The constructed set of indicators will be used for further analysis; e.g. regional comparison of sustainable development and the construction of regional composite sustainable development indicator.

ACKNOWLEDGEMENTS

This paper has been prepared under the support of the University of Economics in Prague, project No. 11 / 2012 "Construction and verification of sustainable development indicators in the Czech Republic and its regions".

References

CENTRE FOR ECONOMIC DEVELOPMENT. *CPHR National Human Development Report – Slovak Republic 2000* [online]. Bratislava: CPHR. [cit. 25.9.2012]. <http://www.cphr.sk/english/undp2000.htm>.

CZECH STATISTICAL OFFICE. *Vybrané oblasti udržitelného rozvoje v krajích České republiky 2010* (Selected Areas of Sustainable Development in the Regions of the Czech Republic 2010). Prague: Czech Statistical Office, 2010, 126 p. ISBN 978-80-250-2009-8.

FEEM SI. FEEM *Sustainable Index* [online]. Venice: FEEM. [cit. 25.9.2012]. <http://www.feemsi.org/index.php>.

GERMAN STATISTICAL OFFICE. *Publikationen im Bereich Umweltindikatoren / Nachhaltigkeit* [online]. Wiesbaden: Statistisches Bundesamt, 2012. [cit. 25.9.2012]. <https://www.destatis.de/DE/Publikationen/Thematisch/UmweltoekonomischeGesamtrechnungen/Umweltindikatoren/Indikatoren.html>.

GOVERNMENT COUNCIL FOR SUSTAINABLE DEVELOPMENT, MINISTRY OF THE ENVIRONMENT. *Progress Report on the Czech Republic Sustainable Development Strategy. Summary.* Prague: Ministry of the Enviroment, 2009, 32 p. ISBN 978-80-7212-492-3.

GOVERNMENT COUNCIL FOR SUSTAINABLE DEVELOPMENT, MINISTRY OF THE ENVIRONMENT. *Progress Report on the Czech Republic's Strategic Framework for Sustainable Development.* Prague: Ministry of the Enviroment, 2012, 170 p. ISBN 978-80-7212-573-9.

MACHÁČEK, J. *Ekonomické souvislosti využívání kulturně historických lokalit* (Economic Context of the Use of Cultural and Historical Sites). Prague: Oeconomica, 2004, 122 p. ISBN 80-245-0765-0.

MEDERLY, P., TOPERCER, J., NOVÁČEK, P. *Indikátory kvality života a udržitelného rozvoje – kvantitativní, vícerozměrný a variantní přístup* (Indicators of Quality of Life and Sustainable Development – Quantitative, Multidimensional and Alternative Approach). Prague: UK FSV CESES, 2004, 117 p. ISBN 80-239-4389-8.

NOVÁČEK, P., MEDERLY, P. *Strategie udržitelného rozvoje* (Sustainable Development Strategy). Prague: G plus G, 1996, 196 p. ISBN 80-901896-2-6.

TIMUR. *Týmová iniciativa pro místní udržitelný rozvoj* (Team Initiative for Local Sustainable Development) [online]. Prague: Timur, 2012. [cit. 30.9.2012]. <http://www.timur.cz/>.

WCED. *Our Common Future.* Oxford: Oxford University Press, 1987, 383 p. ISBN 0-19-282080-X.

ANNEX

Table A1 Economic pillar

Indicators	Description
Gross Domestic Product per Capita in thousands of CZK (current prices)	Essential macroeconomic indicator that is used to determine the level of performance and dynamics of the economy.
Change in Gross Domestic Product (Development of GDP in constant prices)	
Labour Productivity (Development of GDP per 1 employed)	Qualitative indicator of the economic level and competitiveness of the economy. Expresses the efficiency of human labour.
Local Government Deficit / Surplus	Characterizes a balance between the revenue and expenditure side of public budgets, which is an important requirement for the sustainability of public finances. Size of the deficit related to GDP is one of the Maastricht convergence criteria for adopting the single currency Euro.
Gross Value Added in Services (Share of the Tertiary Sector in Gross Value Added in %)	The share of the services sector in the economy is an important indicator of the transition from an industrial to a postindustrial society.
Investment Rate in %	Macroeconomic indicator of future economic development. Characterizes investment activity of the entities in the economy.
Net Disposable Income of Households per inhabitant in thousands of CZK	Characterizes the standard of living and belongs to macroeconomic indicators of population purchasing power.
Small and Medium-sized Enterprises (Share of Small and Medium-sized Enterprises in the Total Employment in %)	Brings the economic significance of groups of small and medium-sized enterprises, which is an important element of stability of economic development and employment due to its flexibility.
Transport Infrastructure – Density of the Motorway Network in km per 100 km^2	Sufficiently dense transport infrastructure is a prerequisite for economic and social growth of the region.
Transport Infrastructure – Railway Lines Density in km per 100 km^2	
Freight Transport (Excluding Transit, including Road, Rail and Water Transport per thousand of CZK GDP, in kg)	Transportation of raw materials and goods is an important prerequisite for economic development, has on the other hand a negative impact on the environment.
Passenger Transport (within the Region by Public Road and Rail Transport per Capita)	Transport of people from an economic point of view is particularly relevant for labour mobility. Public transportation reduces the negative impacts of individual transportation on the environment.
Research & Development Expenditures to GDP in %	The value of expenditures on research and development refers to the ability of the economy to invest in its future development.

Source: Czech Statistical Office, 2010

Table A2 Social pillar

Indicators	Description
Households with Net Income below Subsistence Minimum	It indicates the degree of risk of poverty of households (population).
General Unemployment Rate in % (Aged 15+)	Indicator for the assessment of the situation on the labour market and of the progress of human resources development.
Registered unemployment Rate in % (Aged 15+)	Indicator for the assessment of the unemployment situation in the regions; it indicates problems in the "regional and local" economies.
Employment of Elderly Workers (Employment Rate of People Aged 55–64 in %)	It characterizes the degree of the labour integration of elderly population in the labour market in accordance with the strategy of creating equal opportunities and the fight against all forms of discrimination.
Employment of Women in %	It refers to the status and development in the field of employment of women and the extent of creating equal opportunities.
Mortality (Standardized Mortality Rate – Number of Deaths per 1000 mid-year Population)	It describes the health status of the population and distribution of some types of serious diseases.
Life Expectancy (of men and women at birth in years)	Indicator of the health status of the population and its development.
Highest Level of Education Attained (Share of the Population with Tertiary Education in the Population Aged 15 and Over in %)	It characterizes the educational level of the population, indicates success in the labour market and improvement in the quality of human resources.
Internet Access (Share of Households connected to Internet in %	It indicates the level of approaching of the so-called information society; access to information and communication technologies is a necessary prerequisite for the development of human resources.
Local Government Expenditures on Culture per inhabitant in CZK	It tells about the level of resources dedicated to the culture in the broader sense – culture as a structured area of interest and activities contributes to the development of an individual and the integration of civil society.
Coverage of the Czech Republic's Territory by Approved Town and Country Documentation of Municipalities in %	It refers to an extent of a comprehensive and functional utilization of municipality area, and to the level of conditions' setting according to the long-term harmony among all natural, civilization and cultural values in the territory, especially with the regard to the care of the environment.
Average Duration of Court Proceedings From the Idea to the Legal Effect Day in Days	Indicator for assessing the performance of a long-term development of the judicial system; powerful judiciary is an essential precondition of a functional state administration and the guarantee of the protection of the personal rights.
Civil Society – Political Participation (Turnout in Elections to Municipal Councils, Regional Councils and to the Chamber of Deputies in %)	It quantifies the degree of the political participation of citizens – it measures the interest of the citizens to actively influence public affairs through voting.
Women and Men in Politics (Share of the Total Number of Women Elected Representatives in Elections to Municipal Councils and Regional Councils in %)	It refers to the degree of involvement of women in political and decision-making positions and the extent of promotion of equality among men and women in society.
Civil Society – Civil Participation (Mid-year Population to Non-profit Organization)	It characterizes the degree of citizens´ participation in public affairs in the non-profit sector (the voluntary associating outside the market, state and private life).

Source: Czech Statistical Office, 2010

Table A3 Environmental pillar

Indicators	Description
Arable Land in %	It captures the share of arable land, which belongs to the unstable landscape elements in the total area of agricultural land.
Consumption of Industrial Fertilizers in Pure Nutrients in kg/ha of Arable Land	It measures the consumption of fertilizers per hectare of arable land; excessive supply of nutrients contributes to the contamination of soil, groundwater and surface water.
Coefficient of Ecological Stability	It reflects the character of the landscape, the degree of human influence, the ratio of ecologically stable (forests, water areas, grasslands, orchards, gardens, vineyards, hop-gardens) and unstable areas (arable land, built-up areas, other areas).
Organic Farming (Share of organically farmed land in the total area of agricultural land in %)	It expresses the share of land managed by farmers without industrial fertilizers, chemicals, hormones or genetic modification.
Index of Defoliation in %	It indicates the health of the forests; demonstrates the influence of emissions, drought and species composition of the trees.
Share of Broadleaved Species in %	Forests with a higher share of broadleaved species are more resistant to weather conditions, drought and insect pests. In the original species composition of Central European flora broadleaved species were represented much higher than it is today.
Quality of Surface Water (Share of profiles in IV. a V. Class of Pollution (group A - General, Physical and Chemical Indicators in %))	It reflects the quality of surface water in water courses through a share of profiles, which are found to have highly and very highly polluted water.
Areas with Deteriorated Air Quality in %	It shows the share of area with the poor quality of the air, which exceed the limit values for the protection of human health.
Nitrogen Oxide Emissions (REZZO 1–4) in tonne per km^2	Nitrogen oxides are one of the main pollutants contributing to the formation of acid rain and ground-level ozone; nitric oxide is one of the greenhouse gases.
Sulphur Dioxide Emissions (REZZO 1–3) in tonne per km^2	Carbon dioxide is one of the main pollutants, which is involved mainly in the creation of acid rain.
Waste Generated by Enterprises in kg per thousand CZK of GDP	Waste can be a source of pollution of all environmental components and handling with it creates economic costs.
Municipal Waste Generated in kg per inhabitant	
Acquired Investment Expenditures on Environment Protection according to Location of Investment in CZK per inhabitant	Expenditures on environmental protection reflect the level of environmental protection by the public and private sectors.
Non-investment Expenditures on Environment Protection according to Region of Residence of the Investor per million CZK of Regional GDP	

Source: Czech Statistical Office, 2010

Environmental Accounts in the Czech Statistics

Miloslava Veselá[1] | *Czech Statistical Office, Ústí nad Labem, Czech Republic*

Abstract

European environmental economic accounts are built in the Czech Republic by the Czech Statistical Office (CSO). This article summarizes the work which has been performed by the CSO over the last decade to provide necessary data for environmental economic accounts. The work was commenced in 2003, when the Environmental protection expenditure project was carried out. This was followed by NAMEA air emissions and Material flow accounts projects in 2005, and by Environmental goods and services sector and Environmental taxes projects, finished in 2011. The article describes data sources and methods that were used to provide indicators of above mentioned accounts. Some examples of the use of data are presented in the form of charts or tables.

Keywords

Environmental economic accounts, statistics, indicators

JEL code

Z19

INTRODUCTION

Activities in the field of sustainable development raised the need to measure the environmental impacts of people activities through the environmental accounts. Environmental accounts (EA) track the links between the environment and the economy (at EU, national, sector and industry level), measure what impacts the economy has on the environment (e.g. pollution) and how the environment contributes to the economy (e.g. use of raw materials, resource efficiency, etc.) by using the accounting framework and concepts of the national accounts. EA list of variables, in quantifiable terms, for example, the amount of pollution produced by different industries, may in turn be compared with employment and the value of output produced by these industries (EUROSTAT, 2012).

Efforts to introduce environmental economic accounts into practice resulted in the adoption of Regulation No 691/2011 of the European Parliament and the Council on European Environmental Economic Accounts. The aim of this paper is to describe methods used in the Czech Republic to meet the requirements of this Regulation.

1 EUROPEAN ENVIRONMENTAL ECONOMIC ACCOUNTS

In its Communication of 20 August 2009 entitled 'GDP and beyond: Measuring progress in a changing world', the Commission recognised the need to supplement the existing indicators with data incorporating environmental and social aspects in order to allow for more coherent and comprehensive policy making. To that end, environmental economic accounts offer a tool to monitore the pressures

[1] Czech Statistical Office, Špálova 2684/01, Ústí nad Labem, Czech Republic, e-mail: miloslava.vesela@czso.cz, phone: (+420)472706157.

exerted by the economy on the environment and of exploring how these might be abated. Environmental economic accounts show the interaction between economic, household and environmental factors and, consequently, are more informative than national accounts alone (TOŠOVSKÁ at al., 2010). They provide a significant source of data for environmental decisions and the Commission should consult them when drawing up impact assessments. In line with the tenets of sustainable development and the drive to achieve a resource-efficient and low-pollution economy, embedded in the Europe 2020 Strategy and various major initiatives, developing a data framework that consistently includes environmental issues along with economic ones becomes all the more imperative (EEA, 2006).

The European System of Accounts (ESA), set up by Council Regulation (EC) No 2223/96 of 25 June 1996 on the European system of national and regional accounts in the Community (ESA 95), consistent with the System of National Accounts (SNA), adopted by the United Nations Statistical Commission in February 1993, is the main tool behind the Union's economic statistics as well as many economic indicators (including GDP). The ESA framework can be used to analyse and evaluate various aspects of the economy (e.g. its structure, specific parts, development over time) yet for some specific data needs, such as analysis of the interaction between the environment and the economy, the best solution is to draw up separate satellite accounts. Satellite accounts allow the analytical capacity of national accounting to be expanded for selected areas of social concern, such as pressures on the environment stemming from human activity, in a flexible manner, without overburdening or disrupting the central system. Satellite accounts should be made available to the public regularly and in comprehensible form. The system of integrated environmental economic accounts (SEEA), developed collectively by the United Nations, the European Commission, the International Monetary Fund, the Organisation for Economic Cooperation and Development and the World Bank, is a satellite system of the SNA. It brings together economic and environmental information in a common framework to measure the contribution of the environment to the economy and the impact of the economy on the environment. It provides policy-makers with indicators and descriptive statistics to monitor these interactions as well as a database for strategic planning and policy analysis to identify more sustainable paths of development (REGULATION, 2011).

2 ENVIRONMENTAL ECONOMIC ACCOUNTS IN THE CZECH REPUBLIC

The Czech Statistical Office is responsible body for the compilation of environmental economic accounts tables for the Czech Republic. Three priority areas, NAMEA for air emissions, Economy-Wide Material Flow Accounts and Environmental Protection Expenditure Accounts, were established as basic modules by ESEA Task Force in 2000 (KOLAR, O'CONNOR, 2001). All these topics were carried out by the CSO, environmental statistics department within the PHARE Multi-beneficiary Statistical Co-operation Programme in years 2004–2005. Standard methods have been developed for data acquisition according to SEEA (UN Handbook of Integrated Environmental and Economic Accounting) as the main methodology support. Nowadays the data sets are produced to fill in Eurostat standard tables. The area of environmental accounts is constantly being developed by the CSO. In 2008 the environmental department applied for Eurostat grants to develop methods to compile tables for another environmental accounts – the Environmental Goods and Services Sector and the Environmental Taxes. Projects have been successfully finished and the development of methods for gathering data is constantly working, administrative sources are prevailing data source.

2.1 NAMEA for air emissions

The principle of NAMEA consists of the joining of information on emissions of pollutants with economic information for individual economic activities and households as private consumers. The economic data from national accounts were included in Eurostat tables in 2005 when the project was solved (CSO, 2005), currently only air emissions data are filled in. Within the framework of NAMEA for air emis-

sions compilation, close cooperation with the Czech Hydrometeorological Institute (CHMI) has been initiated. CHMI is the state institution of the Czech Republic which was established by the Ministry of the Environment. It prepares annually air emissions balances for national and international purposes and it is responsible for national air emission pollutant database.

2.1.1 Categories of monitored sources

Data on air pollution sources are recorded by the source operators or are calculated from statistical records. The records are mainly for the purpose of fees for released emissions and for inspection of observation of emissions limits. They are also used for determining the total amount of individual pollutants released into the air, i.e. for building up emissions inventory. Basic statistical data and detailed technical data on incinerating and technological equipment are contained in the so-called Register of Emissions and Air-Pollution Sources (REZZO).[2]

Stationary sources of air pollution are divided into three basic categories with respect to their size, type and environmental risk. The categories and their descriptions are shown in Table 1.

Table 1 Categorization of Stationary Air Pollution Sources

	Extra large and large pollution sources	Medium pollution sources	Small pollution sources
Contains	Stationary facilities for burning fuels with a heat output greater than 5 MW and facilities with especially substantial technological processes.	Stationary facilities for burning fuels with a heat output between 0.2 and 5 MW, facilities with substantial technological processes, coal mines and areas with a risk of burning or the escape of polluting dust or vapors.	Stationary facilities for burning fuels with a heat output less than 0.2 MW, facilities with technological processes not classified as large or medium sources, areas where work is done that could cause air pollution, storage of fuel, raw materials, products and waste and collected air pollutants and other structures, facilities and activities causing significant air pollution.
Character of source	Point source	Point source	Area source
Method of record-keeping	Sources monitored individually	Sources monitored individually	Sources monitored collectively

Source: CHMI, Register of Emissions and Air Polluters

Mobile sources, then, are a separate category, monitored collectively as linear sources, constituting the category REZZO 4. This group of sources includes the separately monitored sources of road, railroad, water and air transport, the operation of agricultural and forestry machinery and the operation of other vehicles and machines (the emissions balances are made by calculations from data on consumed fuel).

From a historical standpoint, the beginning of collection of data on pollutant emissions and complementary technical data on sources goes back to the end of the 1970s. The data was first collected and evaluated for REZZO 1 for 1980, and then after some adjustments for 1982, 1984 and annually thereafter. Updating emissions balances of small and mobile sources was done in a five-year cycle until mid 1990s. Since 1995 it has been done annually. Since 1991, data on emissions and basic technical data from the operation of large and medium sources have been gathered by the Czech Environmental Inspectorate (CEI), and by district and municipal governments. By law, the CHMI expert laboratory receives and processes that data.

[2] From the Czech expression "Registr emisí a zdrojů znečišťování ovzduší".

Data on emissions of small sources are administered by local authorities and are not regularly gathered in electronic form, nor are they forwarded for further processing. The specific methodology was developed by CHMI for modeling the evaluation of data based on the Population and Housing Census. The outcome is data on the structure of home heating and consumption of basic types of fuel burned in households. The data are updated annually in cooperation with regional fuel and energy suppliers. Data on mobile source emissions are calculated from documentation on the transport performance of individual groups of mobile sources, from data on fuel consumption, the breakdown and operation of vehicles and relevant emissions factors.

2.1.2 Emission balances

From the annually updated data on extra large and large pollution sources, medium pollution sources and relevant data on emissions from small and mobile sources, the annual emissions balance of the Czech Republic is being compiled by the Czech Hydrometeorological Institute. Data are available on the CHMI web pages (www.chmi.cz). Major reduction of emissions was recorded in connection with legislative changes brought about by the Air Protection Act (Act No 309/1991 Sb.,) and subsequent implementing regulations, by 31 December 1998, the majority of large and medium air pollution sources had been brought into compliance with air quality limits. This manifested itself in a great improvement of air quality and some relief from the inversions, especially from the 1997/98 heating season until the present (Final Report, 2005).

Table 2 Emissions of main air pollutant (REZZO 1–3) in the Czech Republic (thousand tonnes / year)

Year	Solids	SO_2 Sulphur dioxide	NO_x Nitrogen oxides	CO Carbon Monoxide
1993	441.3	1 418.6	364.1	756.2
1994	346.7	1 270.1	235.4	741.0
1995	194.3	1 083.6	219.0	607.6
1996	169.2	937.8	205.3	594.5
1997	118.3	690.9	187.3	529.1
1998	75.7	432.0	164.2	397.9
1999	57.8	261.7	155.8	353.0
2000	38.6	222.3	153.7	240.6
2001	38.4	224.8	160.5	240.5
2002	37.8	225.8	159.1	246.2
2003	39.2	219.9	158.3	256.7
2004	34.6	216.4	158.2	256.9
2005	33.9	216.8	154.2	241.2
2006	33.2	210.2	153.3	238.8
2007	36.8	215.9	155.4	263.4
2008	35.4	176.4	139.8	222.5
2009	31.4	174.0	130.4	208.0
2010	33.4	169.7	131.3	234.7

Source: CHMI

Since the time when the Phare project was completed, the Eurostat requirements have been extended to new pollutants and to the measurement data by NACE Rev. 2. The new requirements are fulfilled thanks to cooperation with CHMI.

2.2 Material flow accounts

Most environmental problems are directly or indirectly related to the flows of materials in the economy. The goal of compiling economy-wide material flows accounts is the quantification of the overall demands

of an economic system on materials. These demands can be expressed as input of materials into an economic system, their consumption or the overall waste flow arising from the economic system back into the environment.

The need to devise indicator systems, based on economy-wide material flow analysis concerns not only developed countries but especially rapidly industrializing economies (AOKI-SUZUKI, BENGTSSON, HOTTA, 2012).

2.2.1 Building of data collection

The Charles University Environment Centre (CUEC) compiled economy-wide material flow accounts for the first time within the framework of the Environment Ministry project in 2000–2001. The CSO followed up on the experience of the CUEC by the Eurostat project realized in 2004–2005 (CSO, 2005). Methods for detecting data source for compiling the material flow accounts were developed within this project. Eurostat methodology was used as the base for indicators compilation (EUROSTAT, 2001). The Czech Statistical Office focused on compilation of indicators of material input and material consumption. These are the best developed ones from the methodological point of view and are based on available data (Czech Statistical Office, Ministry of Industry and Trade).

2.2.2 Indicators of material flows

Direct material input (DMI) measures the input of used materials in the economy, i.e. all materials that have an economic value and are used for production and consumption. DMI is domestic used extraction (extracted raw materials, grown biomass) plus import. Direct (used) material inputs includes all solid, liquid and gaseous substances that enter the economy for further use in the manufacturing process or consumption. Water and atmosphere are excluded except those parts contained in materials. Indicators of material inputs are derived from the material balance, it is possible, though, to derive them from individual material flow accounts (MFA) without having to set up a total material balance and introduce adjusting items.

Domestic material consumption (DMC) measures the total amount of materials directly used in the economy, without hidden flows. DMC is calculated as DMI minus export.

Physical trade balance (PTB) measures the surplus or deficit of the physical foreign trade of the economy. It is calculated as physical imports minus physical exports.

Indicators of material flow accounts of the Czech Republic mentioned above were divided into following categories:

- Biomass (raw materials, semi-manufactured and final products from biomass);
- Fossil fuels (raw materials, semi-manufactured and final products from fossil fuels);
- Metal ores (raw materials, semi-manufactured and final products from metal ores);
- Non-metallic minerals (raw materials, semi-manufactured and final products from industrial and construction minerals);
- Other unspecified products;
- Waste.

For the calculation of these indicators, two basic material flow accounts were developed:

- Domestic used extraction account – contains extraction of raw materials and biomass harvest from domestic territory;
- Foreign trade account – covers physical import and physical export.

Further, indicators of economic performance can be related to the input and output indicators of material flows. For example GDP per unit DMI or DMC indicates direct material productivity of the economy. On the other hand, if we relate the input indicator to GDP, we get material intensity of the economy (CSO, 2011b).

Table 3 Domestic material consumption by material categories

	2005	2006	2007	2008	2009	2010
Domestic material consumption (in tonnes)						
Total	**187 906 724**	**193 804 728**	**196 650 120**	**193 447 937**	**176 530 403**	**167 718 172**
Biomass	24 619 198	23 551 364	24 221 822	22 134 879	22 771 405	20 779 000
Fossil fuels	72 917 174	73 251 084	72 708 056	71 112 629	67 163 906	66 485 771
Metal ores	4 123 777	5 846 020	4 410 982	6 057 817	3 123 657	4 773 993
Non metallic minerals	86 071 740	90 841 245	94 780 188	94 124 360	83 236 203	75 478 056
Other unspecified products	174 834	315 799	532 593	23 200	237 365	203 102
Waste	–	–783.34	–3 521	–4 948	–2 133	–1 751
Material intensity – DMC per GDP (in Kg / CZK 1 000)						
Total	**71.44**	**68.99**	**65.96**	**63.33**	**60.28**	**55.96**
Biomass	9.36	8.38	8.12	7.25	7.78	6.93
Fossil fuels	27.72	26.07	24.39	23.28	22.94	22.18
Metal ores	1.57	2.08	1.48	1.98	1.07	1.59
Non metallic minerals	32.72	32.34	31.79	30.81	28.42	25.18
Other unspecified products	0.07	0.11	0.18	0.01	0.08	0.07

Source: CSO Material Flow Accounts

Table 4 Physical trade balance account by material categories (in tonnes)

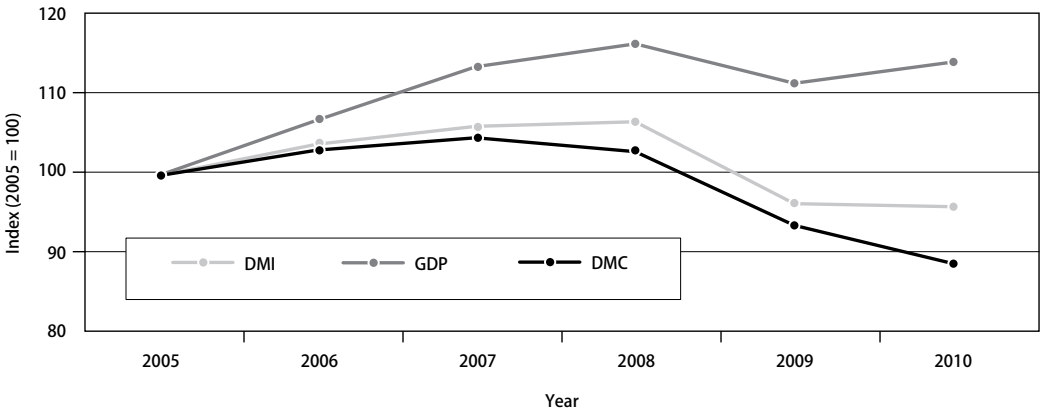
	2005	2006	2007	2008	2009	2010
Total	**6 513 063**	**8 846 073**	**6 779 697**	**5 189 816**	**3 572 534**	**4 685 934**
Biomass	–8 609 630	–8 380 587	–8 834 085	–11 531 008	–10 078 643	–11 104 343
Fossil fuels	10 420 374	10 478 264	10 311 836	10 669 829	10 561 766	11 023 431
Metal ores	4 041 777	5 725 020	4 292 982	5 940 817	2 990 657	4 632 993
Non metallic minerals	485 707	708 362	479 892	91 926	–136 477	–67 499
Other unspecified products	174 834	315 799	532 593	23 200	237 365	203 102
Waste	-	–783	–3 521	–4 948	–2 133	–1 751

Source: CSO Material Flow Accounts

2.2.3 Use of material flow indicators

Material flow analysis is considered a useful method for assessing the environmental performance of socio-economic systems. It is assumed that the volume of material inputs into the economy and material output emitted back to the nature is related to pressures exerted by humans on the environment (KOVANDA, WEINZETTEL, 2008). The human society recorded an unprecedented growth in annual material and energy inputs and outputs over the 20th century, which was also accompanied with the growth of environmental pressure. Developed countries within their strategies of sustainable development therefore adopted a goal to break the relation between pressure exerted on the environment and economic growth, i.e. to meet human needs and improve the standard of living. This phenomenon is shortly called decoupling (from longer "decoupling of environmental pressure from economic growth") (OECD, 2002). DMI and DMC indicators together with GDP were used in the next chart to express the environmental pressure. An index value of 100 is attributed to all indicators for the starting year and their percentage change is shown for the following years. By 2008, it is a relative decoupling, when GDP grows faster than DMI and DMC. Since 2009, we can talk about absolute decoupling, when there is a growth in GDP and an absolute decrease in DMI and DMC.

Figure 1 Trend of the DMI and the DMC indicators (in %)



Source: CSO, Material Flow Accounts

2.3 Environmental protection expenditure statistics

Data on environmental protection investment have been collected since 1986 by the CSO Investments reports, but new demand on non-investment expenditure data led to establish new independent statistical survey.

The statistical survey on the investment and non-investment environmental protection expenditures established in 2003 was the first step to build up the environmental protection expenditure account in the Czech Republic.

According to the definition, Environmental protection expenditures are expenditures on the acquisition of fixed assets for environmental protection (technologies, processes, equipment or parts thereof) and environmental protection non-investment expenditures related to environmental protection activities, where the main purpose is to collect, treat, monitor, control, reduce, prevent, or eliminate pollutants and pollution or any other degradation of the environment, resulting from the operating activity of enterprises (CSO, 2011a).

2.3.1 Structure of the survey

Statistical survey on the environmental protection expenditures includes environmental protection investments, environmental non-investment expenditure and economic benefit from the environmental protection activities (which include revenues from the sale of services for the environmental protection, revenues from the sale of by-products and savings from the use of by-products).

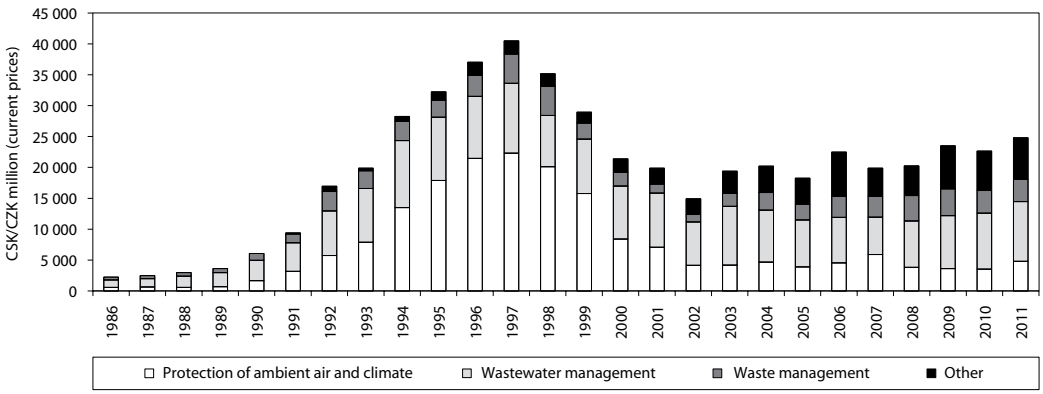
Environmental protection investments and environmental non-investment expenditures are collected by the environment pollution control domains – Air pollution control and climate protection, Wastewater management, Waste management, Landscape and biodiversity protection, Soil, groundwater and surface water protection and remediation, Vibration and noise abatement, Radiological protection, Research and development and Other activities. In addition, we distinguish for environmental protection investments breakdown by type of technology (end of pipe or integrated), by source of finance and by sector (business or public). Environmental protection non-investment expenditures are divided into internal and external one, viewed from the angle of the enterprise.

Generally, data could be further divided by NACE activities, by type of ownership, by regions NUTS2, NUTS3 etc.

2.3.2 Data usage

Due to the fact that the exact methodology of expenditure account is not yet determined, the data from the survey are used to fill the OCD – Eurostat joint questionnaire (JQ on Environmental Protection and revenues) and to analyze the development of investment and non-investment expenditures in the country. It is expected that after completion of the methodology of the expenditure account it will be necessary to make changes in the survey to completely cover the expenditure account by data.

Figure 2 Environmental protection investment in the Czech Republic



Source: CSO, Environmental Protection Expenditure

2.4 Environmental goods and services sector

Another one of upcoming environmental accounts is an account of environmental goods and services sector (EGSS). The Eurostat project was carried out in collaboration with the University J. E. Purkyně, in the years 2010–2011 to discover possibilities for getting data to fulfill Eurostat standard tables (RITSCHELOVÁ et al., 2011).

2.4.1 Description of methodology

The environmental goods and services sector consists of a heterogeneous set of producers of technologies, goods and services that:

- measure, control, restore, prevent, treat, minimise, research and sensitise environmental damages to air, water and soil as well as problems related to waste, noise, biodiversity and landscapes. This includes „cleaner technologies, goods and services that prevent or minimise pollution.
- measure, control, restore, prevent, minimise, research and sensitise resource depletion. This results mainly in resource-efficient technologies, goods and services that minimise the use of natural resources.

As one can see in addition to industry itself, EGSS includes administrative activities, education, training, information and communication activities as well as research and development activities.

Only goods, services and technologies that have environmental end-purpose (i.e. environmental protection or resource management) are considered. Environmental purpose may be defined according either to technical nature of the activity (e.g. through the fact that waste management services producers may or may not have intention to protect environment, waste management is a part of EGSS since it removes waste from the environment) or the producer's intention, i.e. regardless of the intention of the users (e.g. low emission vehicles). Eurostat in the Standard Tables demands quantification of the following variables:

- Turnover;
- Value added;
- Employment;
- Exports.

All these variables are demanded broken down by NACE (2-digit level), by the Classification of Environmental Protection Activities (CEPA), by the Classification of Resource Management Activities (CReMA), by the type of producer (General government, Corporations), by the price setting (Market activities, Non-market activities), by the economic significance of environmental purpose activities (Principal activities, Secondary activities and Ancillary activities).

2.4.2 Project design

The first step of methodology preparation subsisted in the EGSS list definition. The list of EG and ES chosen within a project is a result of compilation of German and French EG and ES lists based on PRODCOM as well as on the list of WTO adjusted by Eurostat based on Combined Nomenclature. The list containing 242 EGSS items has been drawn up. The research team decided to use existing statistical survey for data compilation which is based on PRODCOM classification. The survey Prum 2-01 was suitable, because it provides the detailed information on manufacture of industrial products as well as structural information on production of industrial enterprises (RITSCHELOVÁ et al., 2011, p. 55). The questionnaire Prum 2-01 covers following indicators:

- Total production, which is defined as production produced during the reference period and sold, put in stock or used for production of other product.
- Production sold, which represents production carried at certain time and sold (invoiced) by producing enterprise during the reference period.
- Stocks of finished goods.

Production sold is further surveyed in more detailed breakdowns:

- Production of own products and contract processing.
- Production for direct and indirect export.

The added value indicator demanded by Eurostat is not a part of Prum 2-01 survey. This indicator is surveyed based on yearly survey of economic agents from the chosen production branches P 5-01. For the project purposes the support databases were developed that enable dynamic access to Prum 2-01 and P 5-01 surveys data. Databases were designed in a way that after importing actual data the output indicators required for EGSS statistics preparation are generated. One of the outcomes of the project is a MS Access based environmental products database. The results were used to fulfill Eurostat tables, but only broken down by NACE, more detailed breakdown was not achieved.

2.4.3 Project results

During project preparation number of problems was identified, that need to be solved in order to support the EGSS statistics development in future. They include also the following:

- Number of experts mentions the fact that EGSS tables are too extensive while possibilities of their compilation are very limited.
- Number of experts mentions the fact that EGSS tables are too extensive while possibilities of their compilation are very limited.
- Too detailed data breakdown and small amount of units in number of cases cause problems of individual data with no option of publishing.
- Through the fact that a significant interest in EGSS statistics exists (at least in theory), experts find it difficult to precisely define users and ways of specific EGSS data use.

- With a view to an excessively general definition, as well as national priorities and different stakeholder interest national statistical offices may approach to EGSS statistics differently which gives birth to issues of comparability of data.
- Growth or decline of economic variables as a matter of fact says nothing about quality of technologies, goods and services neither of their impact on the environmental quality.
- Issues of time series comparability: How can one compare statistics from different time periods when some activities that are presently considered to be a part of EGSS either disappear or would be substituted by other activities? How can one interpret technological change or change in the level of costs? How often should producers and EGSS list items be revised?
- Eurostat classification does not allow the definite classification of goods and services within the certain environmental domains.
- EGSS framework contains number of non-systemic exclusions. What is primary environmental purpose and based on what criteria should it be defined (RITSCHELOVÁ et al., 2011).

2.5 Environmental tax account

The Regulation on European economic accounts of 6 July 2011 includes the annex of Module for environmentally related taxes by economic activity, and according to this annex Member States shall send data to Eurostat in 2013. The environmental statistics section of the CSO in preparing to that situation carried out in 2009–2011 the Eurostat project to find data sources for the sectoral breakdown of environmentally related taxes and fees which were proposed by the Eurostat Standard Tables.

2.5.1 Environmental taxes in the Czech Republic

Tax is defined as a mandatory uncompensated payment to the state (either monetary or in natura). Environmentally related tax means a tax whose tax base is a physical unit (or a proxy of it) of something that has a proven, specific negative impact on the environment, whereby only transactions identified by the national accounts as a tax are to be included. Environmental taxes include both taxes that were introduced with the specific environmental purpose, as well as taxes influencing the environmental quality whose introduction was motivated by fiscal rather than environmental purposes (e.g. road tax).

In some cases it is hard to make a distinction between taxes and fees introduced within the national tax system. This is also the case for the environmental taxes. For statistical purposes it is necessary to hold on to principles described in the SNA. The SNA 2008 describes the cases when an agent receives a value (e.g. a license or other certificate) against fee payment and issue of such licences involves little or no work on the part of government. In this case it is likely that the aim of the fee is to simply raise revenue into budget, and therefore this payment is rather a tax than a fee. However, if the government uses the issue of licences to exercise some proper regulatory function (e.g. checking the competence, checking the equipment etc.) the payments made should be treated as fees, i.e. as purchases of services from government.

For the practical reasons in order to provide SNA compatibility, consistency and international data comparability Regulation of the European Parliament and of the Council on European Environmental Economic Accounts includes only taxes identified in ESA 95 within the following categories (REGULATION EU No 691/2011):

- Taxes on production and imports (D.2),
- Current taxes on income, wealth, etc. (D5), and
- Capital taxes (D91).

The majority of environmental taxes make taxes on production and imports. One should also mention that category D.29 Other taxes on production explicitly include pollution taxes among others. These

include taxes levied on emission or exhalation of polluting gases, liquids or other polluting substances into the environment (Final Technical Report, 2011).

2.5.2 Data collection

The first project work brings the establishment of the list of environmentally related taxes and fees. It was the result of close cooperation with the environmental law experts from the Charles University Environment Centre. Based on the definition of environmentally related taxes[3] these experts have identified all taxes and fees valid in 2006 that were related to the environment. After that they created the methodical lists for every tax and fee showing the following attributes: legal base of the tax or fee, taxpayer, tax collector, payment recipient, etc. Consequently the cooperation with national accounts department of the CSO was established. It was focused on designating environmentally related taxes and fees from the list within the public budget structure. The respective ESA 95 code was also verified since with a view to the system of national accounts' compatibility, consistency and international comparability it was decided to include into further processing only those taxes and fees that were designated under D.2, D.5 and D.91 codes within the public budget structure. As a result of these activities the set of 12 taxes and fees corresponding to environmentally related tax definition were identified. These taxes and fees broken down into categories are as follows:

Energy taxes

- Excise duty on mineral oils,
- Tax on natural gas and some other gases – since 1.1.2008,
- Tax on solid fuels – since 1.1.2008,
- Tax on electricity – since 1.1.2008.

Pollution taxes

- Air pollution fees,
- Fee for the discharge of waste water into surface water,
- Fee for the discharge of waste water into ground water,
- Fees for production and import of ozone depleting substances.

Resource taxes

- Charge for removal of land from the agricultural land fund,
- Fee for the withdrawal of forest land.

Transport taxes

- Road tax,
- Fee for entry to chosen places on motor vehicle.

Ad hoc data for filling in the pilot tables were obtained from the Ministry of Finance and the Customs Administration. The negotiations are still ongoing and the contract for regular transmission of data is in preparation.

[3] Environmentally related tax means a tax whose tax base is a physical unit (or a proxy of it) of something that has a proven, specific negative impact on the environment, whereby only transactions identified by the national accounts as a tax are to be included (see Proposal for Regulation of the European Parliament and of the Council on European Environmental Economic Accounts).

Table 5 Taxes and social contributions according to national classification (mil. CZK)

TRANS	Tax name according to national classification	1995	2000	2005	2006	2007	2008
D2122CA	Excise duty on hydrocarbon fuels and lubricants	15 173	21 032	20 489	22 151	21 875	22 143
D2122CF	Energy tax on electricity	M	M	M	M	M	307
D2122CG	Energy tax on natural gas	M	M	M	M	M	310
D2122CH	Energy tax on solid fuels	M	M	M	M	M	129
D214AA	Excise duty on hydrocarbon fuels and lubricants	18 710	25 966	53 825	54 731	59 730	59 027
D214AG	Energy tax on electricity	M	M	M	M	M	819
D214AH	Energy tax on natural gas	M	M	M	M	M	826
D214AI	Energy tax on solid fuels	M	M	M	M	M	344
D214CA	Levy on withdrawal of land from agriculture	366	532	351	360	360	352
D214CB	Levy on withdrawal of land from forestry	0	41	59	79	57	49
D29AB	Levy on temp. withdrawal of land from agriculture	22	76	62	64	46	40
D29AC	Levy on temp. withdrawal of land from forestry	0	8	10	14	6	5
D29AD	Motor vehicle entry fees	0	15	11	13	11	12
D29BA	Road tax	4 834	5 456	5 154	5 597	5 882	5 777
D29FA	Water pollution fee	2 494	529	383	304	403	242
D29FB	Air pollution fee	0	718	513	483	525	553
D29FC	Radioactive waste fee	0	642	1	0	0	0
D29FD	Underground water pollution fee	525	0	0	0	0	2
D29FE	Other environmental fees and levies	0	0	0	0	0	4
D29HA	Highway fee	668	1 227	M	M	M	M
D59DA	Highway fee	286	526	M	M	M	M
D59FB	Motor vehicle entry fees	21	13	11	13	13	12

Codes for specific entries: M – "not applicable / do not exist, transmitted", 0 – "exist but value is zero or considered as zero".
Source: Final Technical Report, Environmental Tax, CSO, March 2011

CONCLUSION

From this article one can conclude that the CSO has a responsible approach to the issue of environmental economic accounts. The CSO carries out methodological transformation of individual accounts into the conditions of the Czech Republic and explores possible data sources for the fulfillment of particular accounts tables. The CSO is able to compile modules of environmental accounts which are covered by the Regulation No 691/2011, these are NAMEA air emissions account, material flow account and environmental taxes.

The expansion of the Regulation on European environmental economic accounts by other modules is expected in the close future, and it will bring further innovation of the work of the CSO, Environmental statistics section.

References

AOKI-SUZUKI, C., BENGTSSON, M, HOTTA, Y. Policy Application of Economy-Wide Material Flow Accounting International Comparison and Suggestions for Capacity Development in Industrializing Countries [online]. *Journal of Industrial Ecology*, 2012. <http://onlinelibrary.wiley.com/doi/10.1111/j.1530-9290.2012.00480.x/abstract>.

CSO. *Environmental Protection Expenditure*. Prague: Czech Statistical Office, 2011a.

CSO. *Final Report, 5.1 Project on Environmental Accounting – A. NAMEA Air Emissions Account, PHARE Multi-Beneficiary Statistical Co-operation Programme 2003*, Eurostat Grant Contract No. 2004.19100.019. Prague: Czech Statistical Office, November 2005.

CSO. *Final Technical Report, Eurostat Grant Agreement No. 50304.2008.001-2008.327, Module 5.03.04: Environmental Accounts and Environmental Expenditure Statistics – Data Centres: "National Resources" and "Products" – Environmental Tax.* Prague: Czech Statistical Office, March 2011.

CSO. *Material Flows Accounts (Selected Indicators)*. Prague: Czech Statistical Office, 2011b.
CSO. *Selected Environmental Accounts on Macroeconomic Level in the Czech Republic*. Prague: Czech Statistical Office, 2005.
EEA. *Sustainable Use and Management of Natural Resources*. Copenhagen: European Environment Agency, 2006.
EU. Regulation No. 691/2011 of the European Parliament and of the Council from 6 July 2011 on European Environmental Economic Accounts. *Official Journal L192 of the European Union*, Volume 54, 2011.
EUROSTAT. *Economy-wide Material Flow Accounts and Derived Indicators. A methodological Guide*. 2001.
EUROSTAT. *What do Environmental Accounts Measure?* [online]. 2012. <http://epp.eurostat.ec.europa.eu/portal/page/portal/environmental_accounts/introduction>.
KOLAR, J., O'CONNOR, M. Natural Resources and Environmental Accounting in the Czech Republic: an Overview of Methodology and Results. *International Journal of Environment and Pollution (IJEP)*, Vol. 15, No. 6, 2001.
KOVANDA, J., WEINTZETEL, J. *Material Efficiency of Economic Sectors: a Case of the Czech Republic*. [online]. 2008. <http://www.kadinst.hku.hk/sdconf10/Papers_PDF/p324.pdf>.
OECD. *Indicators to Measure Decoupling of Environmental Pressures from Economic Growth*. Paris: OECD, 2002.
RITSCHELOVÁ, I., SIDOROV, E., VESELÁ, M. *EGSS Population in the Czech Republic*, *Eurostat Grant No. 50304.2009.001-2009270, Final report,* 2011.
TOŠOVSKÁ, E., SIDOROV, E., RITSCHELOVÁ, I., FARSKÝ, M. *Macroeconomic Context of Environmental Protection*. C. H. Beck, 2010.

Material Consumption in the Czech Republic: Focus on Foreign Trade and Raw Material Equivalents of Imports and Exports

Jan Kovanda[1] | *Charles University Environment Center, Prague, Czech Republic*

Abstract

This article presents a comparison of indicators based on an economy-wide material flow analysis, namely imports, exports, domestic material consumption, raw material equivalents of imports, raw material equivalents of exports and raw material consumption. These indicators were calculated for the Czech Republic for 1995–2010 using, besides economy-wide material flow analysis, the hybrid input-output life cycle assessment method, which allows for a calculation of raw material equivalents of imports and exports. The results showed that calculation of indicators including raw material equivalents is useful, as they provided some important information which was not obvious from imports, exports and domestic material consumption. This includes the facts that the latter indicators tended to underestimate environmental pressure related to consumption of materials, high dependency of the Czech production system on metal ores from abroad and quite unequal and unfair distribution of environmental pressures between the Czech Republic and its trading partners.

Keywords

Economy-wide material flow analysis (EW-MFA), hybrid input-output life cycle assessment method (hybrid IO-LCA), raw material equivalents (RME), environmental pressure, foreign trade, Czech Republic

JEL code

Q56

INTRODUCTION

Our living is based on use of natural resources: raw materials, energy carriers, water and space. The society and economy could not function without these resources. The economy thus behaves like a living organism: it absorbs materials from its surroundings, which are used to satisfy human needs, but at the end all materials are transformed into wastes and emissions and released back to the environment. This

[1] Charles University Environment Center, J. Martiho 2/407, 160 00 Prague 6, Czech Republic. E-mail: jan.kovanda@czp.cuni.cz, phone: (+420)220199476.

flow of materials is called industrial or more widely socio-economic metabolism (Ayres and Simonis, 1994; Baccini and Brunner, 1991; Fischer-Kowalski and Haberl, 1993).

The theory of socio-economic metabolism conceives socio-economic system as a sub-system of the environment, which is connected with its surroundings through material and energy flows. These flows presents a pressure, which is exerted on the environment by humans, and can therefore be, together with changes in land-use and other biological and social factors, understood as a key cause of many environmental problems we face today. These problems include structure landscape changes related to extraction of raw materials, biodiversity loss due to biomass production in large-scale agro-ecosystems, global climate change and acidification because of burning fossil fuels, eutrophication due to excessive use of mineral fertilizers, production of waste, which is direct consequence of material use, etc. (Giljum et al., 2005). If the anthropogenic material flows decrease on the global level, it can be assumed that also environmental pressure related to use of materials goes down (Weizsäcker et al., 2009; Bringezu et al., 2003).

The human society experienced unprecedented growth of yearly material requirements and waste flows over 20th century (Sustainable Europe Research Institute and Wuppertal Institute for Climate Environment and Energy, various years; Adriaanse et al., 1997). This was connected with the growth of environmental pressure. Taking into account the changes in global climate system, biodiversity loss and quick depletion of non-renewable resources, it is obvious that environmental pressure related to consumption of materials is approaching or has even exceeding the Earth's carrying capacity (Rockström et al., 2009). It should be noted that resource consumption is not evenly distributed. While average daily resource use is about 43 kg per capita in Europe and even 88 kg per capita in North America, it is only 14 kg per capita in Asia and 10 kg per capita in Africa (Giljum et al., 2009).[2]

The Czech Republic belongs to the economically developed countries, which is reflected by its high material consumption and high related environmental pressures. The aim of this article is to presents a methodology for calculation of material consumption based on economy-wide material flow analysis and hybrid input-output life cycle assessment method, provide a comparison and discuss development of various material flow indicators in the Czech Republic and set this development into an international context. The focus is put on the comparison of indicators based on simple weight of imports and exports and indicators that include so called indirect flows – materials, which are not parts of traded goods, but were consumed during its production.

1 DATA AND METHODS

Material consumption in the Czech Republic is expressed by means of domestic material consumption (DMC) and raw material consumption (RMC) indicators. DMC is a central indicator of economy-wide material flow analysis (EW-MFA) (Eurostat, 2001). It is calculated as sum of domestically extracted raw materials, domestically harvested biomass and total imports (imports of raw materials, semi-manufactured products and final products) minus total exports. DMC is often criticized for being composed of two incoherent parts: domestic extraction of raw materials/biomass and imports/exports, where the latter presents a mixture of raw materials and manufactured products. It means that a decrease in material consumption can be simply achieved by the substitution of domestic production of manufactured products by their imports. This is because the total weight of raw materials needed to produce manufactured products is usually a few times greater than the weight of the products themselves (Wuppertal Institute for Climate Environment and Energy, various years). To overcome this shortcoming, the concept of raw material equivalents (RME) has been developed (Eurostat, 2001; OECD, 2008; Weisz, 2007). When imports and exports are expressed in RME, they comprise all the raw materials/biomass which were needed worldwide to produce imported/exported commodities. The indicator analogous

[2] Resource use is measured by means of raw material consumption indicator which definition is provided further in the text.

to DMC, including imports and exports in the form of RME, is called raw material consumption (RMC). RME are composed of two parts: materials that have become a part of the mass of traded commodities during their production and were physically imported/exported (further denoted as IM and EX) and materials that entered the production process, but were transformed into emissions and waste flows over its course. The latter are called indirect or hidden flows and are calculated as traded commodities in form of RME minus IM or EX.

In EW-MFA, imported and exported goods can be interpreted as shifts of pressure between countries and world regions (Bates and Dale, 2009; Giljum et al., 2009). For instance, when goods are imported to a country, the pressure related to the production of these goods is shifted to other countries. Inversely, an exporting country imports the pressure from abroad. It has been shown that in the course of globalization, developed countries have increasingly shifted the environmental pressure related to the extraction of resources and production of most resources and emission-intensive commodities to newly industrialized and developing countries (Schütz et al., 2004). It is generally acknowledged that to express above mentioned shifts in pressure correctly, it is advisable to include indirect flows into foreign trade data and express the foreign trade flows in terms of RME (Weisz, 2007; Munoz et al., 2009; Bringezu et al., 2003). This is because this method of presentation takes into account the fact that more-processed commodities require more resources to be produced and exert larger pressures on the environment than less-processed commodities, even though the actual weights of these commodities may be similar when they are imported or exported.

In order to quantify whether a country is a net importer or a net exporter of environmental pressure, one can calculate physical trade balance (PTB) as difference between imports / raw material equivalents of imports and exports/raw material equivalents of exports. If this measure is positive, country rather shifts environmental pressure abroad than other countries shifts its pressure onto its territory (it is therefore net exporter of environmental pressure) and vice versa. From broader sustainability perspective and its claim for equity in sharing area and resources (Bringezu and Bleischwitz, 2009; United Nations, 1992; Commission of the European Communities, 2006), PTB should be close to zero. With the use of PTB, DMC can be calculated as DE plus PTB based on imports and exports and RMC can be calculated as DE plus PTB based on raw material equivalents of imports and exports.

Figures on DMC and their components (extracted raw materials and harvested biomass – DE; total imports – IM and total exports – EX) were taken from the reports of the Czech Statistical Office (Czech Statistical Office, 2010; Czech Statistical Office, 2006), which compiled these indicators in line with the latest methodological standards (Eurostat, 2009a). RMC indicator, raw material equivalents of import (RME_{IM}) and raw material equivalents of exports (RME_{EX}) were calculated using a hybrid input-output life cycle assessment method (hybrid IO-LCA), as described and discussed by Weinzettel and Kovanda (2009). Hybrid IO-LCA is based on the interconnection of input-output analysis (IOA) and LCA. The basis of IOA is represented by supply, use and input-output tables. These tables were provided by the Czech Statistical Office (various years).

Hybrid IO-LCA method allows for a calculation of raw material equivalents of a group of products comprised in the vector yp ($RMEy_p$) by the following equation:

$$RMEy_p = F \times (I - A)^{-1} S^T \times (\mathrm{diag}(x))^{-1} \times y_p \,, \qquad (1)$$

where F is an environmental extension matrix, represented by direct material extraction of individual economic sectors (F_r matrix) divided by economic output of these sectors, I is an identity matrix, A is a technology coefficients matrix (we used a sector by sector input-output table derived under an assumption of fixed product sales structure), S is a supply matrix, ^{T} stands for matrix transposition,

diag stands for diagonalization of a vector, and x is a vector of total domestic supply. The expression $S^T \times (\text{diag}(x))^{-1}$ is used to convert final demand expressed in product groups into output of sectors.

The above calculation assumes that imported commodities are produced abroad using the same production technology as corresponding commodities in the domestic economy. Since this assumption need not hold for a range of products (especially when taking into account imports from developing to developed countries), the results can be significantly distorted. To overcome this shortcoming, there are in general two possibilities: build a multi-regional input output model which uses country specific input output tables for the exporting countries, or integrate life cycle inventory (LCI) data into the model for commodities for which the domestic technology assumption does not hold. In this study, we applied the second approach and used LCI data for natural gas, crude oil, metal ores and basic metals (iron, steel and non-ferrous metals) which are not produced in the Czech Republic at all or only in minor quantities. These data were retrieved from the Ecoinvent database (Ecoinvent, various years) and integrated into the F_r matrix. The technology coefficients matrix, supply table and the vector of domestic output were adjusted accordingly, i.e. imports in these matrices were treated as a domestic production.

RME_{IM}, RME_{EX} and RMC are calculated by replacing the vector y_p (see equation 1) with the vectors of imports (the original vector of imports), exports and domestic final demand, respectively.

$$RME_{IM} = F \times (I - A)^{-1} \times S^T \times (\text{diag}(x))^{-1} \times IM\,, \tag{2}$$

$$RME_{EX} = F \times (I - A)^{-1} \times S^T \times (\text{diag}(x))^{-1} \times EX\,, \tag{3}$$

$$RMC = F \times (I - A)^{-1} \times S^T \times (\text{diag}(x))^{-1} \times y\_FD_d = DE + RME_{IM} - RME_{EX}\,, \tag{4}$$

where y_FD_d is a vector of domestic final demand according to the product groups.

The indicators have been calculated for 1995–2010. For ease of presentation of results and comparison of all the indicators, the materials composing the indicators were aggregated into four broader material categories: fossil fuels and products thereof, metal ores and products thereof, non-metallic minerals and products thereof, and biomass and products thereof. For DMC, IM and EX, the manufactured products composed of the mixture of various materials were attributed to one of these material categories according to the prevailing material. For RMC, RME_{IM} and RME_{EX}, these material categories comprise raw materials only because manufactured products are expressed in terms of raw materials needed for their production. A detailed composition of the four material categories is shown in Table 1.

Table 1 Detailed composition of the main material categories

Material category	Particular material flows
Fossil fuels and products thereof	Brown coal, hard coal, crude oil, natural gas, coke, chemical products, plastics
Metal ores and products thereof	Iron ore, non-ferrous ores, pig iron, basic metals (copper, nickel, lead, zinc, tin, etc.), steel, machinery, transport vehicles, weapons, optical instrument
Non-metallic minerals and products thereof	Salt, graphite, kaolin, feldspar, fluorspar, marble, granite, dolomite, magnesite, limestone, sand and gravel, phosphate rock, lime, cement, artificial fertilizers, glass, pottery, ammunition
Biomass and products thereof	Cereals, roots and tubers, fodder plants, by-products from harvesting, grazing from meadows and pastures, wood, pulp and paper, food

Source: Charles University Environment Center

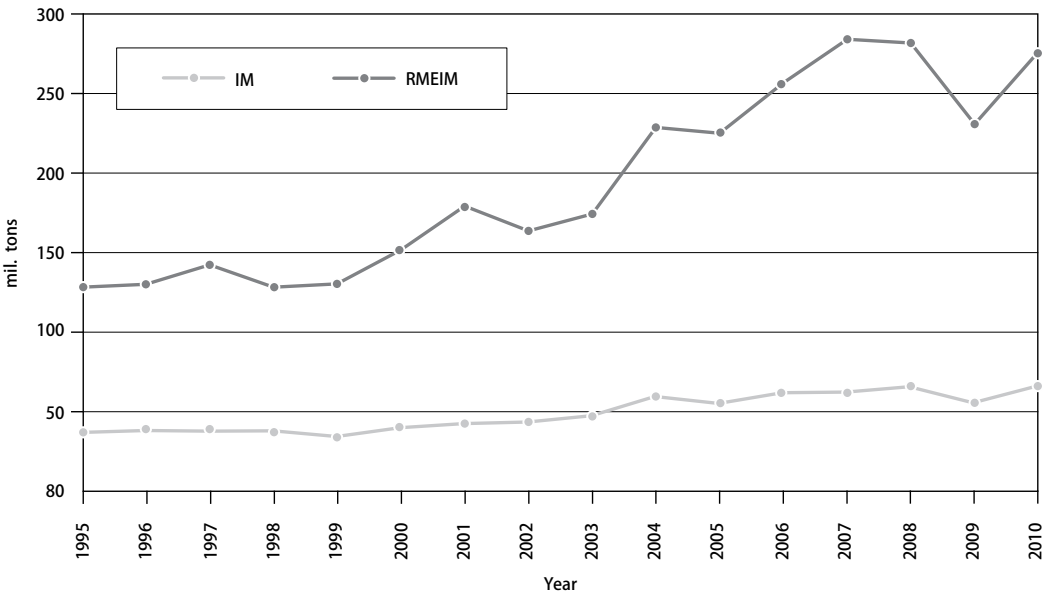
2 RESULTS AND DISCUSSION

2.1 Czech Republic

2.1.1 Foreign trade

According to the definition of DMC and RMC indicators, differences in their volumes and time development are given by differences in IM and RME_{IM} and EX and RME_{EX}, respectively. Figure 1 shows development of IM and RME_{IM} in the Czech Republic in 1995–2010.

Figure 1 IM and RME_{IM}, Czech Republic, 1995–2010



Source: Czech Statistical Office, Charles University Environment Center

Imports recorded gradual growth from 42 mil. tons to 67 mil. tons in 1995–2010. The total growth of imports thus amounted to 59%. The highest growth was recorded in 2004 – it can be attributed to accession of the Czech Republic to the European Union, which was related to abolishment of administrative barriers in foreign trade (economic barriers were gradually eliminated already in the years prior to the Czech Republic accession) (Kovanda et al., 2010). The decrease in imports in 2009 can be attributed to global economic crisis. The trend of raw material equivalents of imports was similar – it grew from 179 mil. tons to 276 mil. tons, i.e. by about 54%. In absolute volumes, however, RME_{IM} grew much more – by 97 mil. tons while IM went up by 25 mil. tons only.

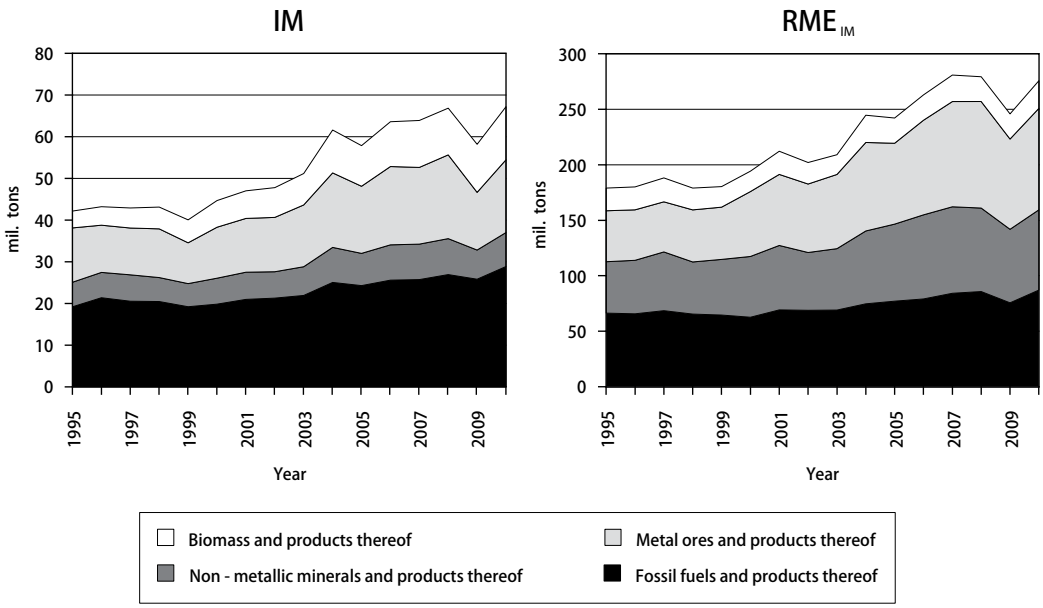
The total weight of RME_{IM} is on average 4.2 times larger than the weight of IM, which means that 4.2 times more raw materials had to be extracted to produce imported commodities. Imports are considered an environmental pressure shifted abroad in EW-MFA. If it is expressed by IM instead of RME_{IM}, this pressure is highly underestimated. The above ratio further suggests that about ¾ of RME_{IM} is composed of indirect flows, which are calculated as RME_{IM} minus IM. These materials we do not consumed, as they are lost during the production process in the form of emissions and waste flows. This is quite a significant share.

Interesting results are yielded by the comparison of RME_{IM} and DE, which varied from 187 mil. tons in 1995 to 163 mil. tons in 2010 with maximum of 198 mil. tons in 1996. This implies that since

1999 the share of DE in RME_{IM} was larger than 1 and thus the environmental pressure abroad related to the production of imported commodities was larger than environmental pressure in the Czech Republic related to domestic raw materials extraction and their processing. While domestic pressure decreased by 13 percent in 1995–2010, environmental pressure caused abroad by Czech production grew by over 54%.

Figure 2 shows development of IM and RME_{IM} in the Czech Republic in 1995–2010 broken down by main material categories. For RME_{IM}, the Figure shows all biomass, metal ores, non-metallic minerals and fossil fuels needed worldwide to produce imported commodities.

Figure 2 IM and RME_{IM} by main material categories, Czech Republic, 1995–2010



Source: Czech Statistical Office, Charles University Environment Center

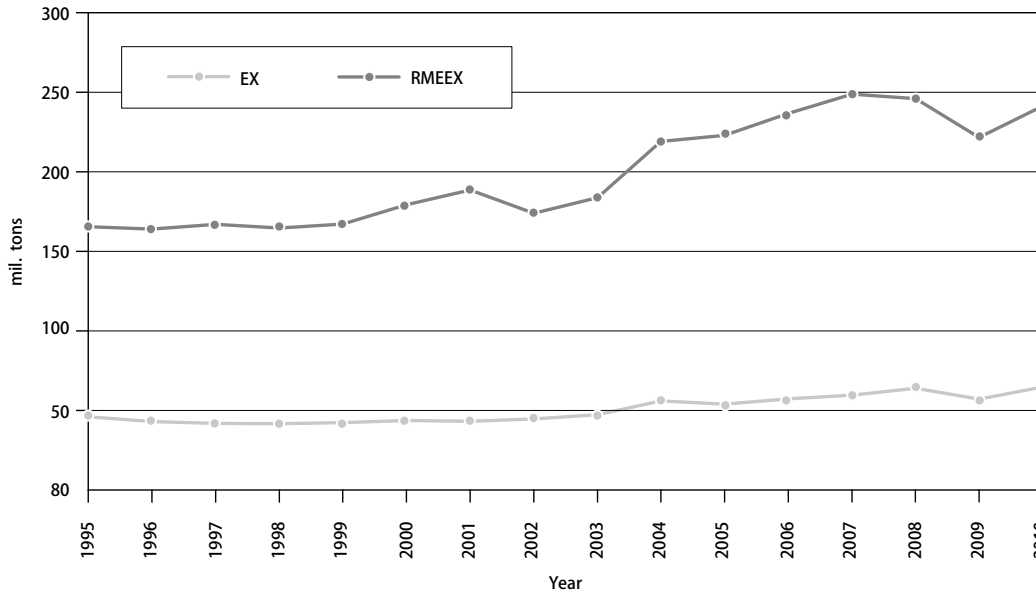
RME_{IM} has a different composition than IM. Fossil fuels and biomass have on average lower shares in RME_{IM}, but the shares of non-metallic minerals and metal ores are higher. The higher share (and larger absolute volume) of metal ores is given by the high share of sectors in the Czech economy requiring metals (e.g. manufacturing of machinery and manufacturing of motor vehicles) (Eurostat, various years) and the fact the DE of metal ores is close to zero. This is because domestic metal deposits suitable for mining are very scarce in the Czech Republic (Czech Geological Survey – Geofond, 2009).

Political and strategic documents in the Czech Republic such as the State Energy Policy (Ministry of Industry and Trade, 2004), Raw Material Policy (Ministry of Industry and Trade, 2009) and the Strategic Framework for Sustainable Development (Government Council for Sustainable Development, 2010) fully acknowledge and address the fact that the Czech Republic has been very much dependent on fossil fuel energy and that a large share of its energy requirements have to be imported. The RME_{IM} further emphasizes the high foreign trade dependency of the Czech Republic on non-metallic minerals and metal ores. While this is not a serious issue for non-metallic minerals because they are quite abundant in the Czech Republic (Czech Geological Survey – Geofond, 2009) and demand for them could be covered from domestic sources, for metal ores this can pose a serious problem, as their vast majority has

to be imported. If the share of metal ores in RME_{IM} grows further, the vulnerability of the Czech economy to an incidental shortage of metal commodities abroad, an increase in their price or an upheaval in terms of other barriers to foreign trade may rise to unacceptable levels.

Figure 3 shows development of EX and RME_{EX} in the Czech Republic in 1995–2010.

Figure 3 EX and RME_{EX}, Czech Republic, 1995–2010

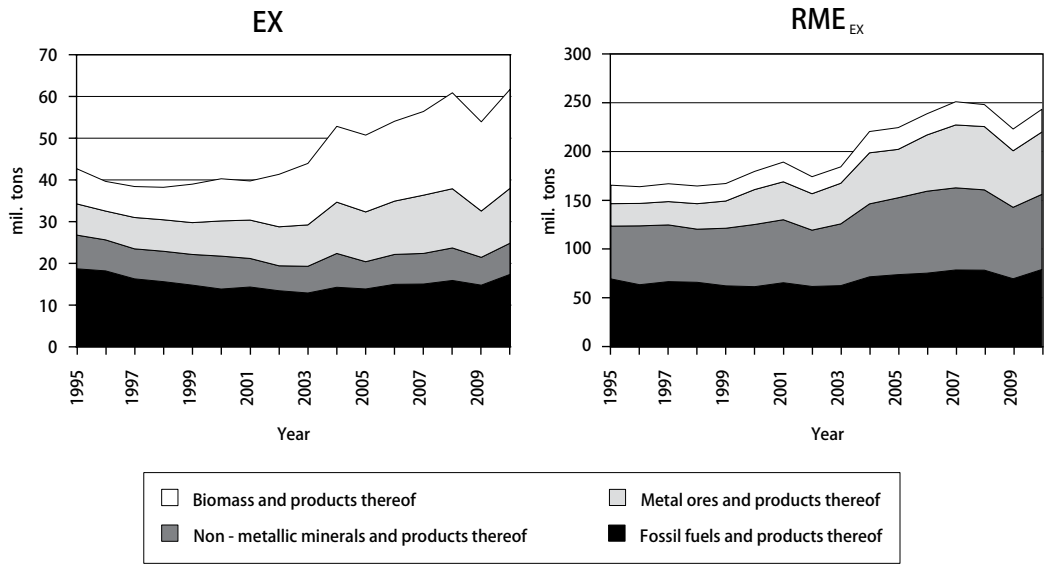


Source: Czech Statistical Office, Charles University Environment Center

Exports and raw material equivalents of exports increased a bit less compared to imports and raw material equivalents of imports. They grew by 45% and 47%, respectively. This means that environmental pressure shifted abroad by the Czech Republic grew faster than pressure shifted to the Czech Republic by other countries. In absolute volumes EX and RME_{EX} went up by 19 mil. tons and 78 mil. tons.

Also the share of EX in RME_{EX} was 4.2 on average over 1995–2010. This implies, similarly to imports, that large share of raw materials consumed for production of exports is lost in terms of emissions and waste flows and that pressure shifts related to exported commodities are highly underestimated when expressed by means of EX instead of RME_{EX}. Regarding changes in structure of EX and RME_{EX}, RME_{EX} shows lower shares of fossil fuels, biomass and metal ores, but significantly higher share of non-metallic minerals (Figure 4). The latter suggests that production system in the Czech Republic is very demanding on infrastructures, which requires large amounts of non-metallic minerals (mostly construction minerals) to be built and maintained.

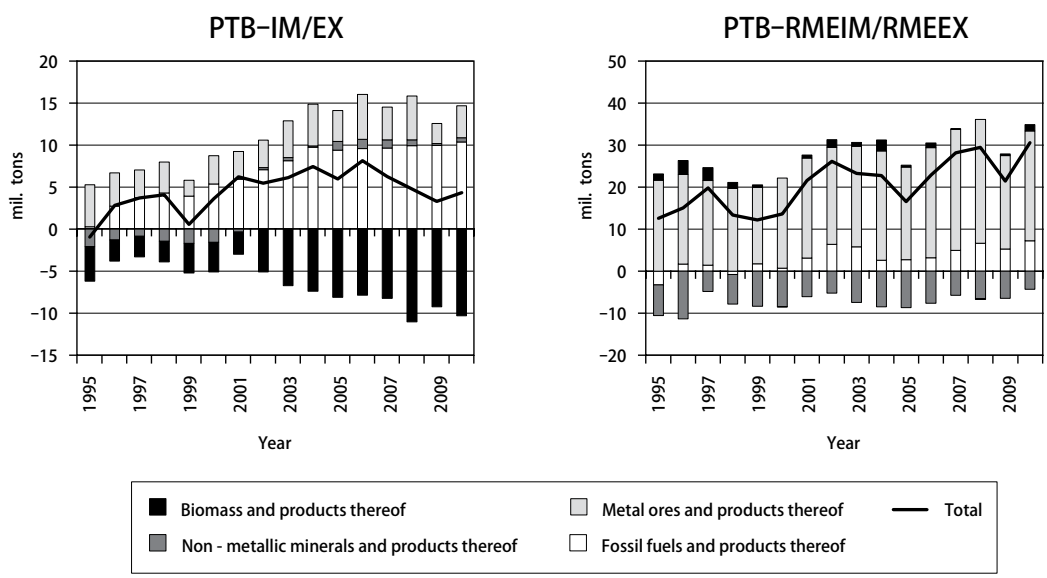
Figure 4 EX and RME_{EX} by main material categories, Czech Republic, 1995–2010



Source: Czech Statistical Office, Charles University Environment Center

In order to assess whether the Czech Republic is a net importer or a net exporter of environmental pressure, we calculated the PTB indicator. Figure 5 shows both PTB based on IM and EX and PTB based on RME_{IM} and RME_{EX}, i.e. after inclusion of indirect flows.

Figure 5 PTB by main material categories, Czech Republic, 1995–2010



Source: Czech Statistical Office, Charles University Environment Center

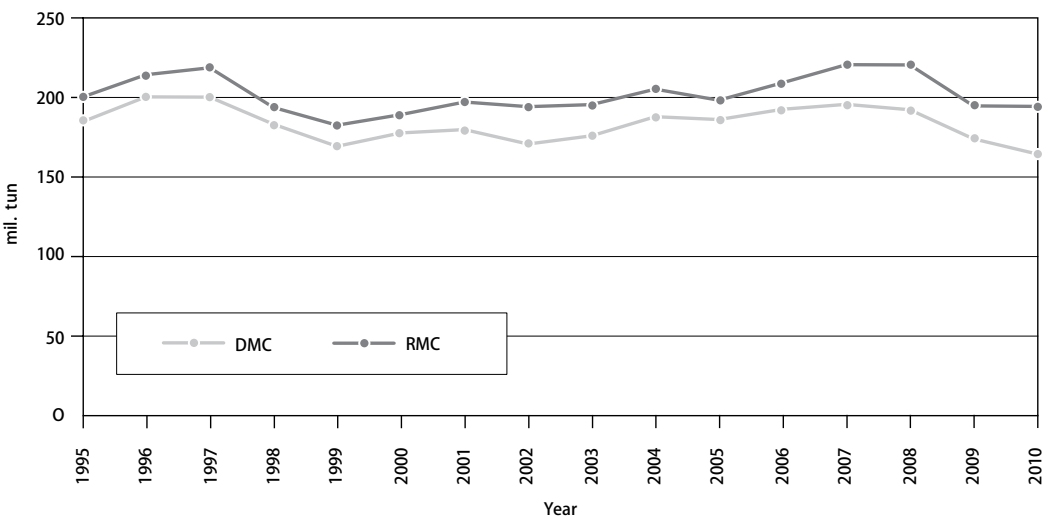
Figure 5 shows that the Czech Republic is a net exporter of environmental pressure, i.e. it rather shifts environmental pressure abroad than other countries shifts its pressure onto its territory. Although both PTB based on IM and EX and PTB based on RME_{IM} and RME_{EX} are positive, the latter indicates quite a steeper growth and also overall higher absolute levels. It can be therefore concluded that also for the PTB indicator, it is better to stick to RME_{IM} and RME_{EX}, as IM and EX can deliver underestimated results. The advantage of PTB based on RME_{IM} and RME_{EX} became even more obvious when studying PTB of particular material groups. While PTB of biomass in terms of its simple imports and exports is negative, when taking into account all biomass needed to produce imported commodities, PTB turns into slightly positive figures. This can be explained by the fact that we import biomass which needs a lot of biotic resources to be produced such as dairy products, meet and soy oil, but exports less biotic resource-intensive biomass such as cereals. Another material category strongly influenced by the selection of the indicator is metal ores, which shows more than four times higher positive results with the use of PTB based on RME_{IM} and RME_{EX}. This is because the Czech Republic imports metal ore concentrates and basic metals, which – when recalculated into the form of metal ores – significantly increase their weight due to often very low metal ore grades. On the other hand the differences in metal ore grades between imported metal ore concentrates and exported metal commodities are not so large. For fossil fuels, the overall lower levels of PTB with the use of PTB based on RME_{IM} and RME_{EX} can be explained by the fact that the Czech Republic rather imports crude oil and nature gas, which are related to lower indirect flows than exported coal.

As noted above the positive and significantly growing PTB of the Czech Republic can be perceived controversial from the sustainability point of view, as it allows for an increased consumption and effective environmental protection at home hand in hand with increasing environmental pressure and pollution levels in other countries.

2.1.2 Material consumption

Figure 6 shows development of DMC and RMC in the Czech Republic in 1995–2010.

Figure 6 DMC and RMC, Czech Republic, 1995–2010

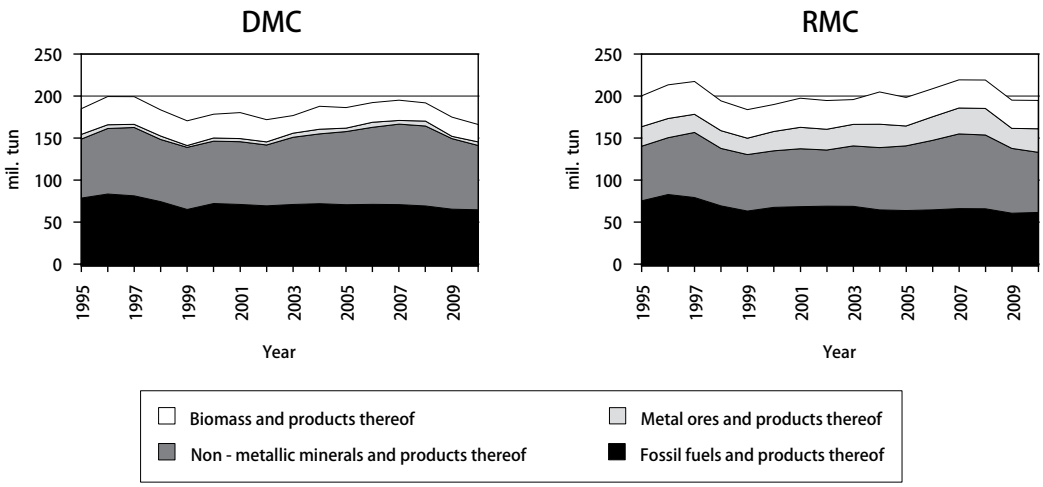


Source: Czech Statistical Office, Charles University Environment Center

DMC and RMC are interpreted as environmental pressure related to material use for domestic final demand. The difference between DMC and RMC was on average 7% till 2000, it started growing in the later years, however, and reached as much as 17% in 2010. DMC therefore consistently underestimated the environmental pressure related to domestic final demand compared to RMC, but the difference was not by far so large as in the case of IM and RME_{IM} and EX and RME_{EX}, respectively. This is because RME_{IM} and RME_{EX} netted out in RMC in a similar way as IM and EX in DMC. While DMC decreased by 10% in 1995–2010 (an absolute decrease by about 19 mil. tons), RMC went down by 3% only (a decrease by 5 mil. tons). DMC thus gives wrong signals about the time development of related environmental pressure.

Figure 7 shows development of DMC and RMC in the Czech Republic in 1995–2010 broken down by main material categories.

Figure 7 DMC and RMC by main material categories, Czech Republic, 1995–2010

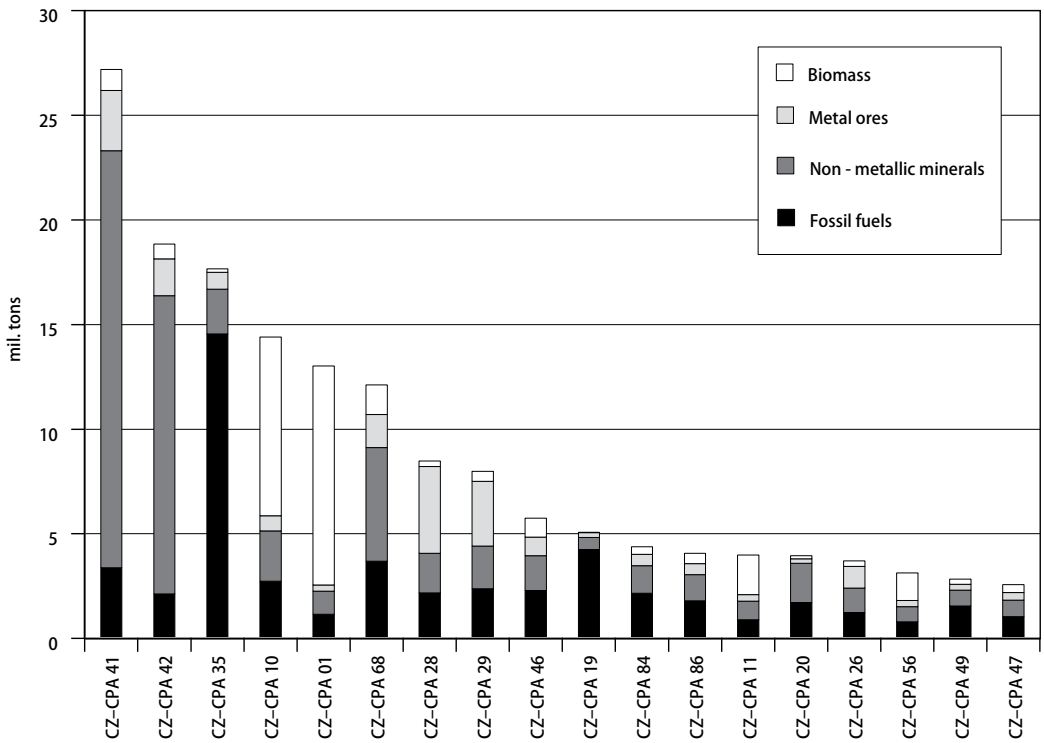


Source: Czech Statistical Office, Charles University Environment Center

RMC shows somewhat lower shares of fossil fuels and non-metallic minerals, a bit higher share of biomass, but a significantly higher share of metal ores compared to DMC. This share is on average 2 percent in DMC, but 12 percent in RMC, which represents an increase in absolute volume by more than 500 percent. It is obvious that environmental pressure related to metal ores is substantially underestimated when using DMC. Apart from this, RMC also indicates the high importance of metal ores for Czech system of production and consumption, which is not very well visible from DMC. This can have serious consequences for securing the sufficient amount of metal resources from abroad through foreign trade (see discussion on structure of RME_{IM}).

The fact that RMC is calculated with the use of hybrid IO-LCA method allows for a breakdown of RMC by product groups going to domestic final demand. This breakdown is shown for 18 product groups with highest RMC in Figure 8.

Figure 8 RMC by product groups going to domestic final demand, Czech Republic, 2010



Source: CZ-CPA – Czech classification of products by activities; CZ-CPA 41 – Buildings and building construction works; CZ-CPA 42 – Civil engineering construction works; CZ-CPA 35 – Electricity, gas, steam and air conditioning; CZ-CPA 10 – Food products; CZ-CPA 01 – Products of agriculture, hunting and related services; CZ-CPA 68 – Real estate services; CZ-CPA 28 – Machinery and equipment n.e.c.; CZ-CPA 29 – Motor vehicles, trailers and semi-trailers; CZ-CPA 46 – Wholesale trade services, except of motor vehicles and motorcycles; CZ-CPA 19 – Coke and refined petroleum products; CZ-CPA 84 – Public administration and defense services; compulsory social security services; CZ-CPA 86 – Human health services; CZ-CPA 11 – Beverages; CZ-CPA 20 – Chemicals and chemical products; CZ-CPA 26 – Computer, electronic and optical products; CZ-CPA 56 – Food and beverage serving services; CZ-CPA 49 – Land transport services and transport services via pipelines; CZ-CPA 47 – Retail trade services, except of motor vehicles and motorcycles.
Source: Charles University Environment Center

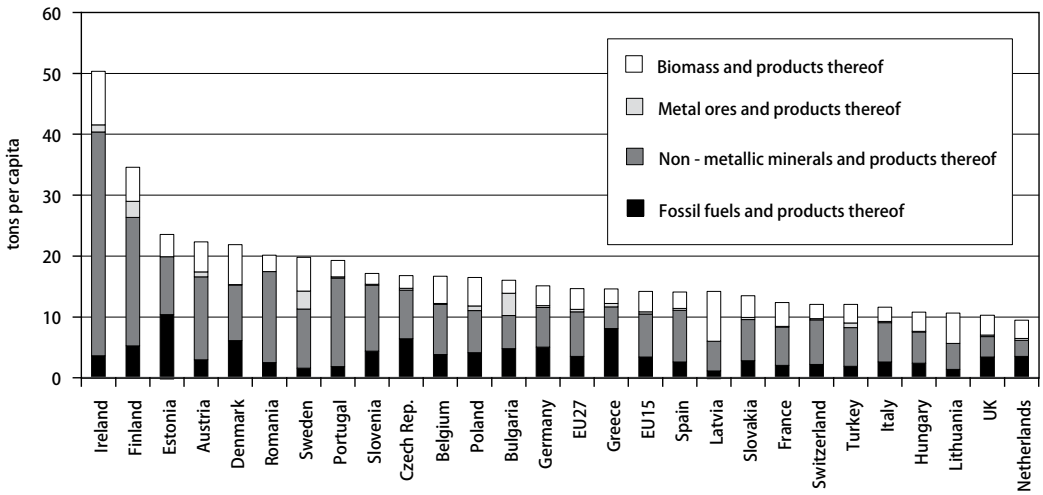
The highest RMC is connected with construction (CZ-CPA 41 and 42), it is however mostly composed of non-metallic minerals, which consumption has lower environmental impacts than consumption of biomass, metal ores and fossil fuels. Construction is followed by electricity and gas (CZ-CPA 35), food products (CZ-CPA 10) and products of agriculture (CZ-CPA 01). Quite high RMC is also related to some services such as real estate services (CZ-CPA 68), wholesale trade services (CZ-CPA 46), public administration and defence services (CZ-CPA 84) and human health services (CZ-CPA 86). This result violates the common assumption that services are completely immaterial.

2.2 International Comparison

Methods for the calculation and analysis of DMC are quite standardized and this is the reason why this indicator is calculated by a range of statistical offices and incorporated into many national and international sets of sustainable development indicators and environmental reports (Federal Statistical Office Germany, 2010; Federal Ministry of Agriculture Forestry Environment and Water Management, 2009;

Department for Environment Food and Rural Affairs, 2009; Kovanda and Hak, 2009; Eurostat, 2009b; United Nations, 2007). This fact makes its international comparison quite easy and straightforward. Figure 9 shows international comparison of DMC for selected European countries.

Figure 9 DMC, international comparison, 2009

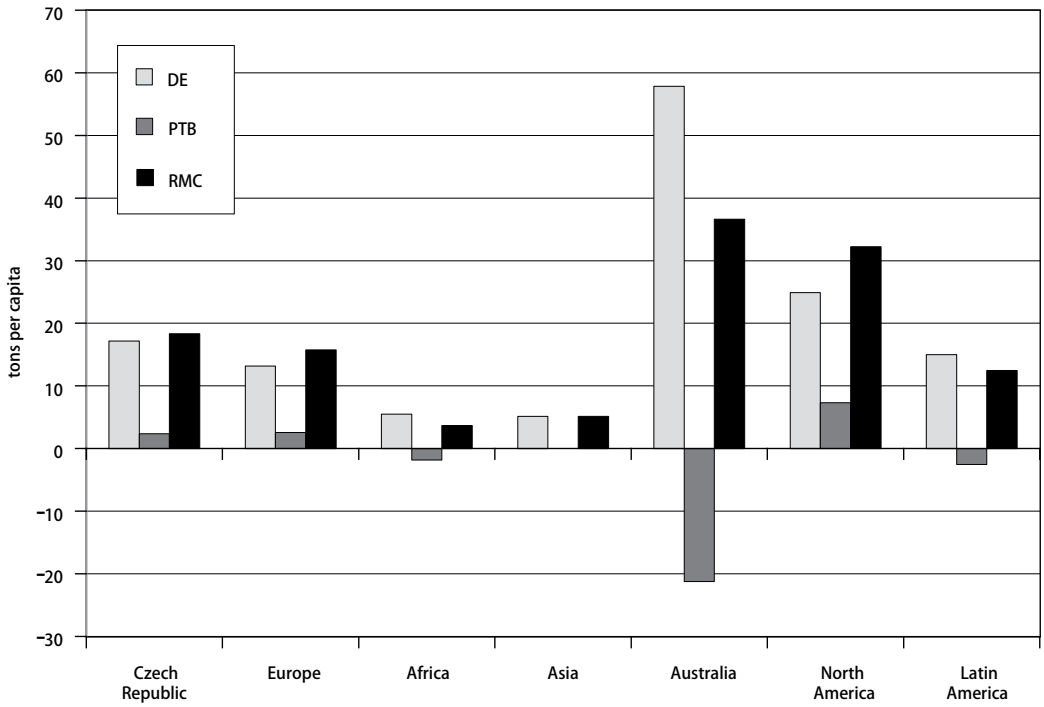


Source: Eurostat

DMC per capita in the Czech Republic is by about 15% higher than the average of EU27 and by 18% higher than the average of EU15. DMC per capita in some countries, however, is significantly higher than in the Czech Republic. Very high level of DMC is determined by high consumption (and extraction) of non-metallic minerals in Ireland, Finland, Romania, Austria and Portugal and by high consumption of fossil fuels in Estonia. Relatively high levels of DMC per capita in the Czech Republic are given by high consumption of fossil fuels and non-metallic minerals. On the other hand the consumption of biomass is the third lowest after Slovenia and Bulgaria. The high consumption of fossil fuels can be explained by high share of solid fossil fuels in primary energy supply and by high energy intensity of the Czech production and consumption system. The latter is among others determined by significant share of industry in the Czech economy.

The calculation of RMC is currently much less developed than the calculation of DMC and is still at the research phase (Giljum et al., 2008; Weisz, 2007; Munoz et al., 2009; Weinzettel and Kovanda, 2009; Wiedmann et al., 2007). Its international comparison must therefore be understood as tentative. Figure 10 shows the comparison of RMC per capita and its two components – DE and PTB based on RME_{IM} and RME_{EX} – for the Czech Republic and particular world regions.

Figure 10 DE, PTB based on RME_{IM} and RME_{EX} and RMC, international comparison, 2000



Source: Charles University Environment Center, Giljum et al. (2009)

The highest RMC is recorded by Australia and North America followed by Europe, Latin America, Asia and Africa. The RMC of the Czech Republic is by about 16% higher that the European average. It is obvious that high raw material consumption is typical for regions with prevalence of economically developed countries (Australia, North America, Europe) while low raw material consumption is typical for poor regions (Asia, Africa). RMC is thus 37 tons per capita per year in Australia which is an equivalent of 100 kg per capita per day. Similarly, RMC is 88 kg per capita per day in North America, 43 kg per capita per day in Europe, but only 14 kg per day in Asia and 10 kg per day in Africa. If poor regions aim at achieving similar standard of living as developed countries and follow the path of increasing material consumption at their level, it will, e.g. in Asia, lead to 3–7 time higher raw material consumption. Taking into account the Asia large population, this would mean up to three times higher global resource extraction. This amount of raw materials could be obtained with large obstacles only and would lead to additional pressure exerted on the environment including the global climate system.

The highest positive PTB based on RME_{IM} and RME_{EX} is recorded for North America, followed by Europe (and the Czech Republic). These blocks of countries thus exports environmental pressure abroad. On the other hand Africa, Latin America and in particular Australia are recipients of environmental pressure, as their economies are based on exports of raw materials to a large extent. It should be noted that Australia is an exceptional case with respect to all three indicators: it shows extremely high resource extraction, PTB and raw material consumption at the same time. RMC is almost equal to extraction of raw materials in Asia. It means that its PTB is close to zero and Asia is neither net importer nor net exporter of environmental pressure.

CONCLUSION

The calculation of indicators including RME improves the most widely used EW-MFA indicators such as DMC. It addresses some criticisms made against this indicator, namely the facts that it is composed of two incoherent parts (DE and IM/EX) and does not properly account for environmental pressure related to foreign trade. The article presented a new innovative method for calculation of RME with the use of hybrid IO-LCA method.

RME_{IM}, RME_{EX} and RMC calculated for the Czech Republic brought about some important information which was not obvious from IM, EX and DMC indicators. Above all, they showed that indicators, which did not include indirect flows, tended to underestimate environmental pressure related to imports, exports and domestic use of materials. Second, they pointed out at high dependency of the Czech production system on metal ores from abroad, which is determined by high share of metal-demanding industrial branches in the Czech economy and the limited deposits of metal ores in the territory of the Czech Republic. Third, they suggested quite unequal and unfair distribution of environmental pressures between the Czech Republic and its trading partners. These points have not been more thoroughly addressed by Czech economic, environmental and sustainability policies so far and present open issues which will have to be dealt with in future. Can, for instance, the Czech Republic base its material welfare on pollution and damage to the environment abroad while preserving its own environment?

ACKNOWLEDGMENTS

The research on the subject presented in this article was undertaken as a part of the research and development project No. P402/12/2116 Various aspects of anthropogenic material flows in the Czech Republic, funded by the Grant Agency of the Czech Republic. This support is greatly appreciated.

References

ADRIAANSE, A., BRINGEZU, S., HAMMOND, A., MORIGUCHI, Y., RODENBURG, E., ROGICH, D., SCHÜTZ, H. *Resource Flows: The Material Basis of Industrial Economies*. Washington, D.C.: World Resources Institute, 1997.

AYRES, R. U., SIMONIS, U. E. *Industrial Metabolism: Restructuring for Sustainable Development*. Tokyo, New York: United Nations University Press, 1994.

BACCINI, P., BRUNNER, P. H. *Metabolism of the Anthroposphere*. Berlin, New York, Tokyo: Springer-Verlag, 1991.

BRINGEZU, S., BLEISCHWITZ, R., eds. *Sustainable Resource Management: Global Trends, Visions and Policies.* Sheffield: Greenleaf Publishing Limited, 2009.

BRINGEZU, S., SCHÜTZ, H., MOLL, S. Rationale for and Interpretation of Economy-Wide Material Flow Analysis and Derived Indicators. *Journal of Industrial Ecology*, 2003, 7(2), pp. 43–64.

COMMISSION OF THE EUROPEAN COMMUNITIES. *Review of the EU Sustainable Development Strategy (EU SDS): Renewed strategy.* Brussels: Commission of the European Communities, 2006.

CZECH GEOLOGICAL SURVEY – GEOFOND. *Mineral Commodity Summaries of the Czech Republic*. Prague: Ministry of the Environment of the Czech Republic, Czech Geological Survey – Geofond, 2009.

CZECH STATISTICAL OFFICE. *Annual National Accounts Database* [online]. Prague: Czech Statistical Office, various years. [cit. July 2012]. <http://apl.czso.cz/pll/rocenka/rocenka.indexnu>.

CZECH STATISTICAL OFFICE. *Material Flows Accounts in the CR 2003–2008 (Selected Indicators)*. Prague: Czech Statistical Office, 2010.

CZECH STATISTICAL OFFICE. *Selected Environmental Accounts on Macroeconomic Level in the Czech Republic (NAMEA for Air Emissions in 1998, 1999, 2003 and MFA in 1993–2004)*. Prague: Czech Statistical Office, 2006.

DEPARTMENT FOR ENVIRONMENT FOOD AND RURAL AFFAIRS. *Sustainable Development Indicators in your Pocket 2009*. London: Department for Environment, Food and Rural Affairs, 2009.

ECOINVENT. *National Life Cycle Inventory Database Ecoinvent, data v 2.05* [online]. Dübendorf: Swiss Centre for Life Cycle Inventories, various years. [cit. July 2012]. <http://www.ecoinvent.ch/>.

EUROSTAT. *Economy-Wide Material Flow Accounts and Derived Indicators: A Methodological Guide.* Luxembourg: Eurostat, 2001.

EUROSTAT. *Economy-Wide Material Flow Accounts: Compilation Guidelines for Reporting to the 2009 Eurostat Questionnaire*. Luxembourg: Eurostat, 2009a.

EUROSTAT. *Eurostat Statistics Database* [online]. Luxembourg: Eurostat, various years. [cit. March 2011]. <http://epp.eurostat.ec.europa.eu/portal/page/portal/statistics/search_database>.

EUROSTAT. *Sustainable Development in the European Union: 2009 Monitoring Report of the EU Sustainable Development Strategy.* Luxembourg: Eurostat, 2009b.

FEDERAL MINISTRY OF AGRICULTURE, FORESTRY, ENVIRONMENT AND WATER MANAGEMENT. *Headline Indicator – Report 2009.* Vienna: Federal Ministry of Agriculture, Forestry, Environment and Water Management, 2009.

FEDERAL STATISTICAL OFFICE OF GERMANY. *Sustainable Development in Germany: Indicator Report 2010*. Wiesbaden: Federal Statistical Office of Germany, 2010.

FISCHER-KOWALSKI, M., HABERL, H. Metabolism and Colonisation: Modes of Production and the Physical Exchange between Societies and Nature. *Innovation in Social Science Research*, 1993, 6(4), pp. 415–442.

GILJUM, S., HAK, T., HINTERBERGER, F., KOVANDA, J. Environmental Governance in the European Union: Strategies and Instruments for Absolute Decoupling. *International Journal of Sustainable Development*, 2005, 8(1/2), pp. 31–46.

GILJUM, S., HINTERBERGER, F., BRUCKNER, M., BURGER, E., FRÜHMAN, J., LUTTER, S., PIRGMAIER, E., POLZIN, C., WAXWENDER, H., KERNEGGER, L., WARHURST, M. *Overconsumption? Our Use of the World's Natural Resources.* Wienna: Sustainable Europe Research Institute, GLOBAL 2000, Friends of the Earth Europe, 2009.

GILJUM, S., LUTZ, C., JUNGNITZ, A., BRUCKNER, M., HINTERBERGER, F. *Global Dimensions of European Natural Resource Use: First Results from the Global Resource Accounting Model (GRAM).* Vienna: Sustainable Europe Research Institute, 2008.

GOVERNMENT COUNCIL FOR SUSTAINABLE DEVELOPMENT. *Strategic Framework for Sustainable Development in the CR.* Prague: Ministry of the Environment, 2010.

KOVANDA, J., HAK, T., eds. *Progress Report on the Czech Republic Sustainable Development Strategy.* Prague: Government Council for Sustainable Development, Ministry of the Environment, 2009.

KOVANDA, J., WEINZETTEL, J., HAK, T. Material Flow Indicators in the Czech Republic in Light of the Accession to the European Union. *Journal of Industrial Ecology,* 2010, 14(4), pp. 650–665.

MINISTRY OF INDUSTRY AND TRADE. *Raw Material Policy.* Prague: Government of the Czech Republic, 2009.

MINISTRY OF INDUSTRY AND TRADE. *State Energy Policy.* Prague: Government of the Czech Republic, 2004.

MUNOZ, P., GILJUM, S., ROCA, J. The Raw Material Equivalents of International Trade. *Journal of Industrial Ecology,* 2009, 13(6), pp. 881–897.

OECD. *Measuring Material Flows and Resource Productivity*. Paris: OECD, 2008.

ROCKSTRÖM, J., STEFFEN, W., NOONE, K., PERSSON, A., et al. Planetary Boundaries: Exploring the Safe Operating Space for Humanity. *Ecology and Society,* 2009, 14(2), pp. 2.

SUSTAINABLE EUROPE RESEARCH INSTITUTE, WUPPERTAL INSTITUTE FOR CLIMATE ENVIRONMENT AND ENERGY. *The Online Portal for Material Flow Data* [online]. Vienna, Wuppertal: Sustainable Europe Research Institute, Wuppertal Institute for Climate Environment and Energy, various years. [cit. July 2012]. <http://www.materialflows.net/>.

UNITED NATIONS. *Agenda 21*. New York: United Nations, 1992.

UNITED NATIONS. *Indicators of Sustainable Development: Guidelines and Methodologies.* 3rd ed. New York: United Nations, 2007.

WEINZETTEL, J., KOVANDA, J. Assessing Socioeconomic Metabolism through Hybrid Life Cycle Assessment: The Case of the Czech Republic. *Journal of Industrial Ecology,* 2009, 13(4), pp. 607–621.

WEISZ, H. Combining Social Metabolism and Input-Output Analysis to Account for Ecologically Unequal Trade. In HORNBORG, A., MCNEILL, J. R., MARTINEZ-ALIER, J., eds. *Rethinking Environmental History: World-System History and Global Environmental Change.* Plymouth: Altamira Press, 2007.

WEIZSÄCKER, E. U., HARGROVES, K., SMITH, M. H., DESHA, C., STASINOPOULOS, P. *Factor Five. Transforming the Global Economy through 80% Improvements in Resource Productivity: A Report to the Club of Rome.* London; Sterling, VA: Earthscan / The Natural Edge Project, 2009.

WIEDMANN, T., LENZEN, M., TURNER, K., BARRETT, J. Examining the Global Environmental Impact of Regional Consumption Activities – Part 2: Review of Input-Output Models for the Assessment of Environmental Impacts Embodied in Trade. *Ecological Economics,* 2007, 61(1), pp. 15–26.

WUPPERTAL INSTITUTE FOR CLIMATE ENVIRONMENT AND ENERGY. *Material Intensity Factors* [online]. Wuppertal: Wuppertal Institute for Climate Environment and Energy, various years. [cit. July 2012]. <http://www.wupperinst.org/en/info/entwd/index.html?beitrag_id=437&bid=169>.

Determinants of the Unpaid Work in Slovakia

Alena Kaščáková[1] | *Matej Bel University in Banská Bystrica, Slovakia*
Gabriela Nedelová[2] | *Matej Bel University in Banská Bystrica, Slovakia*
Mariana Považanová[3] | *Matej Bel University in Banská Bystrica, Slovakia*

Abstract

The article focuses on the exploring the unpaid work of people in the Slovak Republic. Eurostat methodology provides a precise list of certain activities in the household for which a person does not receive any remuneration. These activities are considered as unpaid work. The data are drawn from the results of the primary research conducted in the year 2012. The determinants of unpaid work are being studied separately for the groups of unpaid work activities and separately for the groups of people formed in compliance with their status activity. According to the model results the gender is a significant determinant of unpaid work. Among other determinants significant only for selected categories belong the following: age, educational level and status activity.

Keywords

Unpaid work, time use survey, activity list, determinants of unpaid work, economic and demographic variables

JEL code

C20, D13 J13, J16

INTRODUCTION

Analytically speaking, people allocate their time to activities that can be classified as paid work, unpaid work, and no work. No work activities include time to sleeping, free time spent on personal care and leisure activities. Paid work refers to time contracted out and remunerated. This type of human activities receives much attention by academics as well as by politicians. Unpaid work includes all non- remunerated work activities (Antonopoulos, 2009). In comparison with paid work the unpaid work receives less attention which does not mean that it is less important.

For better understanding the concept of unpaid work, its determinants and role in the economy it is necessary to look closer whether the unpaid work is economic work or non-economic work. The United Nations System of National Accounts of 2008 (SNA), provides the conceptual framework that sets the international statistical standard for the measurement and classification of economic activities. Productive activities are defined as all activities falling within the general production boundary, that

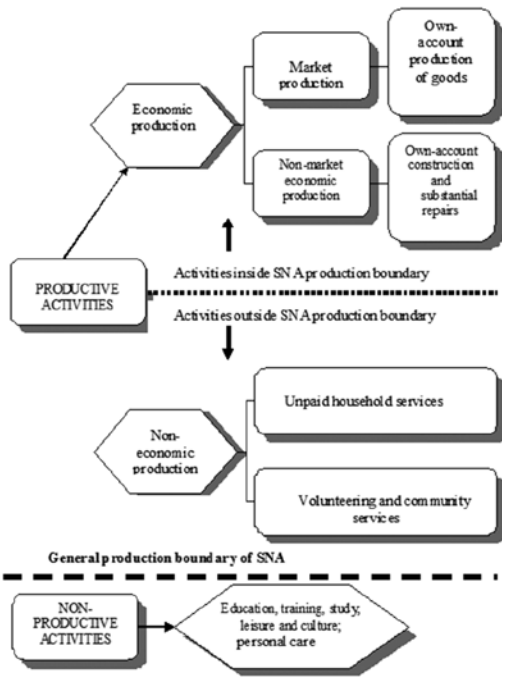
[1] Matej Bel University in Banská Bystrica, Faculty of Economics, Tajovského 10, 975 90 Banská Bystrica, Slovakia. Corresponding author: e-mail: alena.kascakova@umb.sk, phone: (+421)484466615.

[2] Matej Bel University in Banská Bystrica, Faculty of Economics, Tajovského 10, 975 90 Banská Bystrica, Slovakia. Corresponding author: e-mail: gabriela.nedelova@umb.sk, phone: (+421)484466615.

[3] Matej Bel University in Banská Bystrica, Faculty of Economics, Tajovského 10, 975 90 Banská Bystrica, Slovakia. Corresponding author: e-mail: maria.povazanova@umb.sk, phone: (+421)484462419.

is, any human controlled activity resulting in an output capable of being exchanged. Non-productive activities are those for which this condition does not apply like leisure, education etc.

Figure 1 Classification of activities in Relation to the System of National Accounts (SNA)



Source: International Labour Organisation, 2008

"The production boundary in the SNA is more restricted than the general production boundary ... activities undertaken by households that produce services for their own use are excluded from the concept of production in the SNA" (European Communities, 2009). The production of services by members of the household for their own final consumption has traditionally been excluded from measured production in national accounts.[4] Such production activities (as depicted in Figure 1) outside the SNA production boundary are defined as non-economic production. Production falling within the SNA production boundary is defined as economic production. Economic production includes all market production and certain types of non-market production.

From this point of view some types of unpaid work activities are deemed "economic work", other unpaid work activities are classified as "non-economic" and are relegated outside the production boundary of SNA. Non-SNA unpaid work include activities such as cooking, washing up, care of textiles, care of children, the permanently ill, or temporarily sick, older relatives, as well as all volunteer work for community services.

In this paper we focus on the unpaid work performed in the households, especially on those activities that fall outside the production boundary of SNA. That is why a narrow definition of unpaid work is used: it is those unpaid activities in the households for which a person does not receive any remuneration. The special categories of unpaid work activities we use in the paper corresponding with activities on Eurostat´s activity list.

1 ROLE OF UNPAID WORK IN THE ECONOMY

Despite the fact that most of unpaid work activities in households are outside the SNA production boundary, and for this reason their results are not included in the Gross Domestic Product of a certain economy they are important for the economy and they also influence it. The fact that most of household activities are outside the SNA production boundaries does not mean that households are only the suppliers of labor in the market and not the production units. Households also produce output through their unpaid work activities. Becker introduced in neoclassical microeconomics the idea that households are also engaged in production of goods and services (Antonopoulos, Hirway, 2010). This production should expand GDP of a country. For example for Canada it is estimated that production created by unpaid work

[4] For more detailed explanation look at European Communities (2009).

to be worth up to $319 billion in the money economy or 41% of GDP (Government of Canada, 2010). Household production could also replace goods and services normally available in the market. For example meal prepared at home could replace meal in the restaurant. Therefore in some cases unpaid work could influence the demand for certain goods and services available in the market. According to the concept of neoclassical economy it will lead to changes in prices of these goods or services, which in turn could also influence the employment in certain sector of the economy. Antonopoulos (2009) claims that unpaid work could be a subsidy to the marketized part of the economy. She cites a study on selected Latin American countries which showed that over half of women aged 20 to 24 stated their responsibilities at home as the main reason for not seeking a job in the labor market.

Unpaid work is important in the economy. For better description of functioning of the economy it us useful to calculate also the monetary value of unpaid work. It is worth to investigate also the factors that influence its scope and volume in any particular country. In other words it is useful to study the determinants of unpaid work.

2 DETERMINANTS OF THE UNPAID WORK

If we look at the allocation of one`s time into paid work activities, unpaid work activities and no-work activities, the overall allocation of time between them depends upon many factors including age, gender, type of household structure, social class, geographic location, presence of children, or immobile or old persons in households, whether person is employed etc. Equally important is the level of development of the economy, which affects also the duration and allocation of unpaid time among different types of unpaid activities (Antonopoulos, 2009). In developing countries people tend to spend relatively more time on unpaid subsistence work, for example, production for self-consumption etc.; in developed countries large fraction of population has access to paid jobs. Public sector infrastructure plays a role in the specific allocation of time on specific types of unpaid work. Availability and prices of market substitutes to unpaid work activities also influence allocation of time between paid and unpaid work. The volume of unpaid work of child care for example is influenced by the universal free access to child care services the same is true for care of elderly people.

Besides above mentioned factors the non-market factors also play important role. Some people perform unpaid work activities despite the fact that there are existing cheap market substitutes of results of such activities, just because they like to perform such activities.

In this paper we focus on determinants of unpaid work in Slovakia. Since there was not previous research focused primarily on unpaid work in our country we have aimed at specification whether some special demographic variables, like gender, age, education attainment, employment and income determine the amount of unpaid work in Slovakia.

Treas and Drobnic (2010) set out the main factors that are likely to affect the number of hours of unpaid work for a household by type of unpaid work, alongside with the main factors affecting the gendered share of unpaid hours by the type of unpaid work. Among the main factors affecting the amount of unpaid work belong the following: for child care unpaid work: number of children in the households, age of younger child, whether child is a teenager, class; for cleaning: the size of living space, the number of children, location (rural or urban), preferences of about standards of cleanliness and income level. For Maintenance (care of house, clean car, etc.) ownership of house / flat compared with renting, size of house, age of property, number of cars and similarly. Time devoted to gardening depend on whether person live in a house versus an apartment, the size of the garden and preferences about gardening; shopping to the number of adults and children in the households. Hours allocated to washing and ironing, cooking and preparing meals will depend on the number of adults and children in the households, preferences about fast food versus home-cooked meals, or ironed clothes.

Ross (1999) empirically estimated the determinants of unpaid work in nuclear households by each adult in Australia using the 1992 Australian Time-Use Survey. In his paper eight types of unpaid work

are examined. He found that wage rates and demographic variables exert most influence on household time spent on unpaid work. The strongest result was the negative effect of the female wage rate on unpaid work performed by females.

Econometric analysis of determinants of unpaid work can be also found in McCloughan et al. (2011) for three types of unpaid work performed in European countries: caring for and educating children, cooking and housework and caring for elderly or disabled relatives. They found that in each type of unpaid work activities there is strong gender effect. Women spend almost twice as many hours per week on unpaid work than men. Among other important factors which influence the unpaid work were for caring and education of children: employment status and educational attainment.

3 DATA

The data are the first issue connected with the examination of unpaid work. There are multiple sources of unpaid work. Time Use Survey (TUS) is often the primary source of data on unpaid work in many countries (for example: in New Zealand, Australia, Canada, Japan, South Africa, Indonesia, India, Philippines, Palestine, Cuba, Ecuador, and many European countries have designed or undertaken surveys). But there are also other sources of the information about the unpaid work, like New Zealand's five-yearly Census of Population and Dwellings; in Canada it is unpaid work module in Census, etc.

In Slovakia there was not previous extent research aimed at the unpaid work. The TUS has not been conducted here. Some research about volume of unpaid work in Slovakia we can find in Bútorová et al. (2008). The other data about unpaid work in Slovakia can be also found in Second European Quality of Life Survey done in 2007, for more details look McCloughan et al. (2011). But it is important to say, that the primary aim of both of these above mentioned research was not the examination of unpaid work. There was the other valuable research done in Slovakia in related fields (Filadelfiová et. al., 2007). All the previous mentioned facts caused the new research which should bring the unpaid word data had to be done.

Data analyzed in the contribution are taken from primary research done by the research team from the Faculty of Economics in March 2012. It was the first research of its kind in Slovakia. The sample was representative according to the regions, gender and number of household´s members, the sample size was 1 564 households and 4 435 individuals. All of them were surveyed using the questionnaire which was divided into 12 modules. 7 modules were devoted to the household members and 5 modules to the whole household.

Household specified the childcare, belonging to the type of housing, community and region.

Respondents specified their socio-demographic characteristics, informed about the paid employment and specified the person which mostly helps the respondent in the household. They also gave their opinion to the motivation for the unpaid work´s activities and to the amount of the unpaid work in the household in the future. Mainly, they were asked to identify how many hours a week do they spend on average on specified activities.

Thirteen types of activities (categories of unpaid work) are distinguished in the questionnaire. 10 categories of activities which are in Eurostat`s Harmonized European Time Use Survey activity list[5] for which a person does not receive any remuneration and which are considered by SNA within general production boundary (but are outside SNA production boundary) include:

1. Food preparation;
2. Household upkeep;
3. Making and care of textiles;
4. Gardening – tending ornamental plants;

[5] Hirway (1999) distinguished activities in activity list in Eurostat`s time use survey on to 4 categories: activities within the SNA production boundary, activities in practice excluded from the ESA production boundary, activities within the general production boundary, not the ESA and non-productive activities.

5. Pet care;
6. Construction and repairs – repairs to dwelling, repairing equipment, furniture vehicle maintenance;
7. Shopping and services;
8. Child care;
9. Adult care;
10. Volunteering.

Three categories of activities (categories of unpaid work) which belong to activities inside the SNA production boundary (and are not excluded from the ESA production boundary) are: tending edible plants, tending domestic animals and house construction and repair.

Some of them are considered as year-round activities, some of them are activities of seasonal nature. In latter type of activities respondents were also asked to express the number of months in a year when the activity is performed. The respondents who hold paid jobs were also asked to express how many hours a week they spend on average in paid job.

Data processing and analysis was realized using the SPSS program packet. In the hypothesis testing the 0.05 significance level was used. The analyzed data indicate that households devote 74.5 hours to unpaid work a week. From this volume 7.24 hours are spent for activities which are inside the SNA production boundary and 66.3 hours weekly for activities outside the SNA production boundary. The most of the time is devoted by the households to the "standard categories" of unpaid work which are necessary for running of household together with the child care. The most time-spending activity in household is food preparation (15.5 hours per week on average), household upkeep (11.9 hours), shopping and services (8 hours) and making and care of textiles (4.5 hours). The child care is the second most important activity – households devote 13.4 hours weekly to it.

The individual respondent analysis shows that each respondent spends on average 25.8 hours weekly by the unpaid work outside the SNA production boundary. The gender comparison shows that men run the unpaid work 17.7 hours on average, women 32.9 hours weekly which is by 13.1 hours more. According to the categories of unpaid work the women spend more time in each of them except construction and repairs. According to the gender the greatest differences are in the categories: food preparation (5.7 hours), household upkeep (3.4 hours) and making and care of textiles (2.8 hours) which are considered to be the traditional women´s work in our culture.

The studies focused on unpaid work show that women spend more time on unpaid work than men (Miranda, 2011). On the other hand men are more likely to spend more hours at paid work (OECD, 2011). These assumptions were verified by non-parametric Mann-Whitney test. It was validated that men spend more time in paid work (p value = 0) while the women spend more time by unpaid work in household (p value = 0).

Table 1 Descriptive statistics of households´ unpaid work activities

Type of unpaid work	Food preparation	Household upkeep	Making and care of textiles	Gardening – tending ornamental plants	Pet care	Construction and repairs	Shopping and services
Mean	15.504	11.918	4.477	2.867	4.556	2.779	7.950
Median	13.000	9.000	3.000	1.000	1.000	1.000	6.000
Std. Deviation	11.163	10.369	4.535	5.549	13.046	4.305	6.498
Type of unpaid work	**Tending domestic animals**	**House construction and repair**	**Child care**	**Adult care**	**Volunteering**	**Tending edible plants**	**Total unpaid work**
Mean	1.895	1.541	13.381	2.865	0.994	3.805	74.533
Median	0.000	0.000	0.000	0.000	0.000	1.000	56.958
Std. Deviation	5.466	5.313	30.956	12.333	5.373	6.666	61.997

Note: Activities of seasonal nature were recalculated.
Source: Own construction (IBM SPSS Statistics 19)

Some authors (Stiftung, 2002) talk about women`s double burden. They claim, that despite the fact that a lot of women are in paid employment, women are performing most of the unpaid work in the household. The comparison of the total time devoted to the paid work in the job and unpaid work in the household together was done using Mann-Whitney test and it was confirmed that the women work more (p-value = 0). Surely a lot of factors take effect to the volume of paid and unpaid work but it the research focused on this problem is missing in Slovakia.

4 UNPAID WORK MODELS FOR SLOVAK HOUSEHOLDS

The main determinants for various categories of unpaid work are described in the works Treas, Drobnic (2010) and Ross (1999) which were concentrated on the examination of the wage effects to the volume of unpaid work according to the categories in the nuclear family in Australia. Second European Quality of Life Survey (International Labour Organization, 2008) was not primarily concentrated on the unpaid work analysis but the determinants of unpaid work can be found there. In both works the linear regression was used for the identification of significant determinants affecting the volume of unpaid work.

In our research the linear models were used. Following the Slovak legislation only the volume of unpaid work of persons of 15 years and over in household were taken into account. The time devoted to unpaid work in the household as a whole and separately individual activities (10 groups) were analyzed. In the case of activities with the seasonal nature they were recalculated into the form of the whole year practicing. In the analysis of the time volume of the unpaid work per week, the more detailed study was made in the groups of respondents according the activity status: full-time employed, part-time employed, unemployed, students and pensioners. In the process of parameters estimation the backward method was used and statistically non-significant variables were excluded. The final results are in the Table 2.

Table 2 Models results according to the activity status

Activity Status	Independent Variables	Coefficients		Sig.
		B	Std. Error	
Employed full-time	(Constant)	28.023	4.464	0.000
	Age	0.220	0.069	0.002
	Time at work	–0.146	0.070	0.038
	Gender	–11.549	1.545	0.000
	Income from 1 to 400	7.170	2.191	0.001
Employed part-time	(Constant)	26.153	7.531	0.001
	Gender	–17.800	7.485	0.022
	Income from 1 to 400	14.985	8.073	0.070
Unemployed	(Constant)	30.607	7.952	0.000
	Age	0.425	0.180	0.020
	Gender	–29.602	4.869	0.000
Student	(Constant)	11.367	1.004	0.000
	Gender	–5.021	0.865	0.000
	Secondary education	3.383	1.131	0.003
	Higher education	4.537	1.126	0.000
	Income from 401 to 800	5.626	2.199	0.011
Pensioner	(Constant)	77.734	7.461	0.000
	Age	–0.629	0.104	0.000
	Gender	–14.983	1.977	0.000

Note: Dependent variable – volume of time for unpaid work per week.
Source: Own construction (IBM SPSS Statistics 19)

According to the model results the gender is a significant variable in models for all activity status groups used for parameter estimation. The greatest difference between men and women unpaid work

time is shown in the group of unemployed people. Unemployed women devote to unpaid work 29.6 hours more than unemployed men. The age is determinant of unpaid work in the following groups – full-time employed, unemployed and pensioners. In the first two groups according to the sign of estimated parameters it can be stated that the olderer person is the more time spends for unpaid work. In the group of pensioners it is vice versa – with the higher age the physical abilities are getting lost and fewer activities could be done. The intensity of correlation between the age and the unpaid work for people in working age was tested and computed by Spearman´s correlation coefficient. The strongest correlation is in the group of unemployed people (r = 0.287, p-value = 0) than in the group of full-employed (r = 0.140, p-value = 0). The income was the significant determinant of unpaid work in both groups of employed people – full-time and part-time.

Unpaid work determinants were found also for he groups of activities separately. The attention was focused on the activities on which the respondents spend the most time: food preparation, household upkeep, shopping and services and child care. There were gender and activity status the significant determinants in all models.

Table 3 Models results in the groups of activities

Dependent variable	Independent Variables	Unstandardized		Sig.
		B	Std. Error	
Food preparation	(Constant)	8.289	0.518	0.000
	Age	0.045	0.008	0.000
	Gender	–5.068	0.174	0.000
	Secondary education	0.351	0.183	0.056
	Income from 1 to 400	0.879	0.219	0.000
	Income over 800	–0.546	0.267	0.041
	Employed full-time	–1.758	0.366	0.000
	Employed part-time	–1.044	0.579	0.072
	On maternity leave	2.661	0.627	0.000
	Student	–4.182	0.429	0.000
	Pensioner	–1.854	0.477	0.000
Household up keep	(Constant)	5.437	0.369	0.000
	Age	0.028	0.007	0.000
	Gender	–2.919	0.149	0.000
	Secondary education	0.383	0.156	0.014
	Income from 401 to 800	–0.569	0.201	0.005
	Income over 800	–1.270	0.270	0.000
	On maternity leave	2.113	0.465	0.000
	Unemployed	0.968	0.383	0.012
	Student	–2.002	0.279	0.000
	Pensioner	–0.756	0.317	0.017
Shopping and services	(Constant)	3.179	0.180	0.000
	Gender	–1.248	0.088	0.000
	Secondary education	0.880	0.171	0.000
	Higher education	1.143	0.179	0.000
	Unemployed	–0.585	0.221	0.008
	Student	–1.340	0.116	0.000
	Pensioner	–0.501	0.138	0.000
Child care	(Constant)	10.187	0.755	0.000
	Age	–0.109	0.015	0.000
	Gender	–1.660	0.417	0.000
	Income from 1 to 400	0.965	0.488	0.048
	On maternity leave	53.616	1.317	0.000
	Student	–6.709	0.616	0.000

Source: Own construction (IBM SPSS Statistics 19)

In the child care activity the significant determinant is the fact that woman is on maternity leave. The education level is significant in the case of activities food preparation, household upkeep and shopping and services, the most time spend people with secondary education (in all cases used Mann-Whitney test, p-value = 0). The age is the significant determinant in the activities: food preparation, household upkeep and child care. As the estimated regression coefficients have the positive sign in the first two groups it can be expected that with the increasing of the age the time spent for his activity is longer. He opposite situation is in the child care activity.

Taking into account all the activities (both outside and inside the national accounts boundary) it can be stated that the gender segregation of household work continues. So called traditional women activities (food preparation, child care, household upkeep, making and care of textiles) are practiced mainly by women. Men spend more time on traditional men´s activities (construction and repairs, tending domestic animals, house construction and repair). Voluntary work is not influenced by gender. In Slovakia men devote more time to paid work, women to unpaid work.

CONCLUSION

If we take into account all examined categories of unpaid work (those in general production boundary of SNA) we can conclude that in Slovakia gender segregation in the performing unpaid work in household persists. These findings correspond with results of Bútorová et al. (2008) and McCloughan et al. (2011). So-called traditional women`s tasks (food preparation, household upkeep, child care, making and care of textiles, and shopping and services) are performed mostly by women. Men in Slovakia devote more time to traditional masculine types of work than women: construction and repairs, repairs to dwelling, repairing equipment, furniture, vehicle maintenance, tending domestic animals and house construction and repair. Gender does not seem to be an important factor affecting the time spent on volunteering and pet care. The results confirmed that men in Slovakia spend more hours in paid jobs than women.

Other observed determinants are significant only in some categories of unpaid work. The volume of unpaid work activities (to whom households devote the most time) is affected by other than economic and demographic factors. These non-economics aspects were examined closer by other members of our research team: Kika, Martinkovičová (2012). Their main finding was that unpaid work is considered as strongly conservative part of family life in Slovakia. That is why in future research our research team will focus on studying influence of such factors as: tradition, attitude to perform special type of unpaid work and relations in the households on volume of unpaid work in Slovakia.

The research was supported by the Grant Agency VEGA, project 1/1141/11.

References

ANTONOPOULOS, R. *The Unpaid Care Work – Paid Work Connection*. Working Paper No. 86 [online]. Geneva: International Labor Organization, 2009. [cit. 1.8.2012]. <http://www.ilo.org/wcmsp5/groups/public/---dgreports/---integration/documents/publication/wcms_119142.pdf>.

ANTONOPOULOS, C. R., HIRWAY, I. *Unpaid Work and the Economy.* New York: Palgrave Macmillan, 2010.

BÚTOROVÁ, Z. et al. *Ona a on na Slovensku* (She and He in Slovakia) [online]. Bratislava: Inštitút pre verejné otázky (Institute for Public Affairs), 2008. [cit. 1.8.2012]. <http://www.ivo.sk/buxus/docs//Plus_pre_zeny_45/Ona_a_on.pdf>.

EUROPEAN COMMUNITIES. *System of National Accounts 2008* [online]. New York: European Communities, International Monetary Fund, Organisation for Economic Co-operation and Development, United Nations and World Bank, 2009. [cit. 1.8.2012]. <gym-eleous.ioa.sch.gr/textid/SNA2008.html>.

EUROSTAT. *Harmonised European Time Use Surveys. 2008 Guidelines* [online]. Luxembourg: European Communities, 2009. [cit. 1.8.2012]. <epp.eurostat.ec.europa.eu/cache/ITY.../KS-RA.../KS-RA-08-014-EN.PDF>.

FILADELFIOVÁ et. al. *Aspekty rodovej nerovnosti v odmeňovaní* (Aspects of Gender Inequality in Pay). Bratislava: Záujmové združenie žien Aspekt, 2007. ISBN 978-80-85549-76-8.

GOVERNMENT OF CANADA. *Facts on Canada. Women in Canada* [online]. Government of Canada. [cit. 1.12.2010]. <http://www.infocan.gc.ca>.

HIRWAY, I. *Time Use Studies: Conceptual and Methodological Issues with Reference to the Indian Time Use Survey.* Paper presented at the International Seminar on Time Use Studies, 7–10 December 1999, Ahmedabad, India (source courtesy of UNESCAP) [online]. Ahmedabad: Technical Advisory Committee on Time Use Survey, Department of Statistics, Government of India, 1999. [cit. 1.8.2012]. <http://www.undp.org/content/dam/india/docs/time_studies_conceptual_methodological_issues_reference_indian_time_survey.pdf>.

INTERNATIONAL LABOUR ORGANIZATION. *Child Labour Statistics. 18th International Conference of Labour Statisticians* [online]. Geneva: International Labour Office, 2008. [cit. 1.8.2012]. <http://www.ilo.org/wcmsp5/groups/public/@dgreports/@stat/documents/meetingdocument/wcms_099577.pdf>.

KIKA, M., MARTINKOVIČOVÁ, M. Neekonomické súvislosti neplatenej práce (Non-economic Context of Unpaid Work). In: *Zborník vedeckých štúdií Trh práce v kontexte špecifík neplatenej práce, meranie jej rozsahu a dopadu na domácnosti, podnikateľskú sféru a ekonomiku* (Collection of Scientific Studies The Labor Market in the Context of the Specifics of Unpaid Work, Measuring its Extent and Impact on Households, Businesses and the Economy). Banská Bystrica: Faculty of Economics, Matej Bel University, 2012. ISBN 978-80-557-0437-1. CD.

McCLOUGHAN, P., BATT, W. H., COSTINE, M., SCULLY, D. *Second European Quality of Life Survey. Participation in Volunteering and Unpaid Work* [online]. Luxembourg: Publication Office of the European Union, 2011. [cit. 1.8.2012]. <http://www.eurofound.europa.eu/pubdocs/2011/02/en/1/EF1102EN.pdf>.

MIRANDA, V. Cooking, Caring and Volunteering: Unpaid Work Around the World. *OECD Social, Employment and Migration Working Papers No 116.* Paris: OECD Publishing, 2011.

OECD. *How is Life ? Measuring Well-being.* Paris: OECD Publishing, 2011.

ROSS, A. W. Wage Effects on the Volume of Unpaid Work in Nuclear Australian Households. *Australian Economic Papers*, 1999/2, Vol. 38, pp. 91–105, Melbourne: Australian Institute of Family Studies.

STIFTUNG, H. B. *Na ceste do Európskej únie. Sprievodkyňa nielen pre ženy* (On the Way to the European Union. Tour Guide Not Just for Women) [online]. Bratislava: Záujmové združenie žien Aspekt, 2002. [cit. 1.8.2012]. <http://archiv.aspekt.sk/download/EUcelok.doc>.

TREAS, J., DROBNIC, S. *Dividing the Domestic: Men, Women, and Household Work in Cross-National Perspective.* Stanford: Stanford University Press, 2010.

At Work..., and Poor? A Look at the Czech Working Poor Population in the Living Conditions Survey (EU-SILC)

Šárka Šustová[1] | *Czech Statistical Office, Charles University in Prague, Czech Republic*
Martin Zelený[2] | *Czech Statistical Office, University of Economics, Prague, Czech Republic*

Abstract

The main aim of the article is to analyse the working poor employees and their household's social situation in the national income and living conditions survey (EU-SILC).

The analysis starts with the definition of the two main groups of employees according to the number of months spent in the full-time employment – those working whole year and those employed for 6 to 11 months.

Poverty in earned income concept is used to evaluate poverty at individual level, confronting employee's income with single person household poverty line benchmark.

The study then moves to the household level poverty measure based on household's disposable equivalised income. When shifting from the individual income to the household's one the economies of scale represented by an implicit or explicit equivalence scale used in the construction of the household poverty measure play a crucial role. Therefore, attention is paid to the comparison of poverty level based on equivalised disposable income using equivalence scales and per-capita income.

At the end, material deprivation of different subgroups of employees according to their poverty status is examined.

Keywords

Working poor, poverty in earned income, at-risk-of-poverty rate, material deprivation

JEL code

I32

INTRODUCTION[3]

Problems of poverty are often associated with joblessness. Having a job should be a guarantee that one is not poor. However, that is not always true. There are people who are poor despite the fact that they work. This article explores the working poor population in the Czech Republic.

[1] Czech Statistical Office, Social Surveys Unit, Household Surveys Department, Na padesátém 81, 100 82 Prague 10, Czech Republic. E-mail: sarka.sustova@czso.cz, phone: (+420)274052547. Charles University in Prague, Faculty of Science, Albertov 6, 128 43 Prague 2, Czech Republic.

[2] Czech Statistical Office, Social Surveys Unit, Household Surveys Department, Na padesátém 81, 100 82 Prague 10, Czech Republic. University of Economics, Prague, Faculty of Informatics and Statistics, Nám. W. Churchilla 4, 130 67 Prague 3, Czech Republic. E-mail: zelenym@vse.cz, phone: (+420)224095435.

[3] This article is a part of a wider research project on minimum wage and its influence on the economic and social situation and development in the Czech Republic, supported by the Technology Agency of the CR, Project No. TD010171.

The definition of the working poor population consists of two terms that need to be explained – worker and poverty. Because the wider scope of our research is to analyse the influence of wages and of the institute of minimum wage on the social and economic situation in the Czech Republic, the focus of this article is only on employees, deliberately excluding self-employed people. Two groups of employees were defined according to the number of months spent in the main employment – those working full year and those employed for 6 to 11 months. However, in this article the attention is paid mainly to the first group. The whole group is then further broken down into 4 subgroups, depending on whether they are poor on individual and/or household level.

Social situation of individuals as well as whole households could be evaluated not only by using poverty indicators. The article deals also with the indicator of material deprivation, which is one of standard European indicators used to evaluate social exclusion.

1 METHODOLOGY

1.1 Source of data

The European Union – Statistics on Income and Living Conditions (EU-SILC) household survey was used for the analysis of in-work poverty in the Czech Republic. This survey is a reference source for statistics on income and poverty at the EU-level. Both cross-sectional and longitudinal data are collected in all European Union member states and in Croatia, Iceland, Norway, Switzerland and Turkey.[4] The survey has been conducted in the Czech Republic since 2005. The data used for this article come from the EU-SILC 2011.

1.2 Definitions

Working poor population is the population, which is classified as working and at risk of poverty. The term "working poor" could be divided into two parts that are necessary to be defined. First, the definition of a worker for the sake of identifying of the working poor population must be defined. There are three common definitions of a worker in the working poor population analyses. The first type of the definition, used by the U. S. Bureau of Labor Statistics, defines a worker as a person who spent at least 27 weeks on the labour market which means either working or seeking a job (Gardner, Herz, 1992; Mosisa, 2003; Bruder et al., 2011; Ponthieux, 2007). The French national statistical office (INSEE) defines a worker in a similar way as a person who participated at the labour market at least for 6 months and at least one month worked. The third one is used in the European Union and is the strictest of the three definitions, because it defines a worker as an individual who worked at least 6 months and currently is working (Bruder et al., 2011; Ponthieux, 2007). Critiques of this approach say that – because of the strictness of the definition – the sample of the workers is too homogenous and, from the labour market analysis perspective, it therefore does not reflect the overall situation on the labour market. The level of poverty then tends to be influenced mainly by other factors, predominantly by the household composition and the economic activity of the other members of the household (EU, 2010; Ponthieux, 2007).

Our analysis uses the economic activity calendar question of EU-SILC, where economic activity status of respondents is collected on a monthly basis for the 12 months of the preceding calendar year. Two groups of employees were defined according to the number of months spent in the full-time employment. The first group is composed of people who are 16 years old and over and worked 12 months in a full-time employment. People who are 16 years old and over and worked in full-time employment for at least 6 months, but less than 12 months in the reference period, compose the second group. This 6 month criterion is consistent with the definitions of Eurostat, French national statistical office

[4] <http://epp.eurostat.ec.europa.eu/portal/page/portal/employment_social_policy_equality/omc_social_inclusion_and_social_protection/methodology>.

or American Bureau of Labor Statistics. However, the difference between the above mentioned definitions and the definition used in this paper is that only employees were taken into account in the case of our analysis. Self-employed people were excluded because they are irrelevant when evaluating the minimum wage influence on economic and social situation of the Czech households. In other analyses, their inclusion was also often found problematic because of their recorded incomes, which could sometimes be zero or negative, with the corresponding methodological questions how to treat these incomes (Gracía-Espejo and Ibáñez, 2005).

The second part of the term "working poor" refers to the definition of poverty. Household is a natural economic unit and thus also a typical unit when collecting income data. The at-risk-of-poverty rate based on household disposable equivalised income is usually used to measure income poverty in the European context (EU, 2010).

At-risk-of-poverty threshold, At-risk-of-poverty rate

The at-risk-of-poverty rate, which is the standard European measurement of relative poverty, was used to measure poverty at household level. The at-risk-of-poverty rate is the share of people with an equivalised disposable income (after social transfers)[5] below the at-risk-of-poverty threshold, which is set at 60% of the national median equivalised disposable income after social transfers.[6] In 2011 the annual at-risk-of-poverty threshold was 113 040 CZK, corresponding to the monthly amount of 9 420 CZK.

Equivalised disposable income

The equivalised disposable income is the total income of a household after tax and other deductions divided by the number of household members converted into equivalent adults. The equivalised disposable income is calculated in three subsequent steps:

1. all monetary incomes received from any source by each member of a household as well as by the household as a whole are added up and then taxes and social contributions are deducted from this sum;
2. to reflect differences in a household's size and composition, the total (net) household income is divided by the number of equivalent adults, using a standard (equivalence) scale – the modified OECD scale, which gives a weight to all members of the household as follows: 1.0 to the first adult, 0.5 to the second and each subsequent person aged 14 years and over and 0.3 to each child aged under 14 years;
3. the resulting equivalised disposable income is attributed to each member of the household.[7]

Critiques of this approach say that it assumes (equal) sharing of income and living standards among all household members. Further problem is seen in the fact, that it combines individual and household level and that poverty is then influenced mainly by the household structure, which is not the same in all countries and therefore the level of in-work poverty is incomparable across countries (Bruder et al., 2011; Ponthieux, 2007).

Because a worker is defined on an individual level and poverty on the household one, the problems of comparability arise. Therefore, alternative definitions of poverty – based on individual level – were invented (Ponthieux, 2007). To measure poverty at individual level the poverty in earned income concept and poverty in the overall personal income were used.

---

[5] Social transfers cover the social help given by central, state or local institutional units. They include e.g. old-age (retirement) and survivors' (widows' and widowers') pensions, unemployment benefits, family-related benefits, sickness and invalidity benefits, education-related benefits, housing allowances or social assistance (<http://epp.eurostat.ec.europa.eu/statistics_explained/index.php/Glossary:Social_transfers>).

[6] <http://epp.eurostat.ec.europa.eu/statistics_explained/index.php/Glossary:At-risk-of-poverty_rate>.

[7] <http://epp.eurostat.ec.europa.eu/statistics_explained/index.php/Glossary:Equivalised_disposable_income>.

Poverty in earned income

Poverty in earned income is defined at individual level as having annual earned income below the poverty threshold. It can be taken as a measure of the population who would be poor if they could rely only on their own earnings. An individual's earned income is defined as the sum of all the earnings from work, including unemployment benefits:

Earned income = wages + income from self-employment + unemployment benefits.

Poverty in earned income (PEI) is then identified by: earned income < poverty threshold (Ponthieux, 2007).

In this paper, the modification of the earned income concept was used for the first group of employees – those who worked full-time for the whole 12 months. The earned income was defined as the income from the main employment including sickness benefits as a direct substitution of wage. The income from other jobs (employment or/and self-employment) and different social benefits were subsequently added to the income from the main employment until overall personal income was reached. By this procedure, it was possible to study the effect of different kinds of supplementary income sources on reducing poverty of employees.

The population of employees is then broken down into 4 subgroups, depending on whether they are poor in their overall personal income and/or at risk of poverty in their respective households.

2 RESULTS

Altogether, more than 3.71 million people are classified as employee. More than 3.37 million (90.8%) of them are employees who worked full-time for 12 months, while 341 thousands (9.2%) are employees who worked full-time less than 12 months, but at least 6 months.

2.1 Individual level

To evaluate poverty at individual level, poverty in earned income was used for employees who worked full-time for 12 months. There are 5.2% of workers whose income from main employment is not high enough to be above poverty threshold for a household of a single person (113 040 CZK). There are 4.5% of workers whose overall personal income is not sufficient to keep them above the poverty threshold. That means that 0.7% of workers have additional income that helps them to be above the poverty threshold. Another employment income lowers poverty by 0.1 pp, old-age benefits by another 0.2 pp, survivors' benefits by further 0.1 pp and disability benefits by additional 0.3 pp (Table 1). The most helpful in lowering poverty are thus disability and old-age benefits. On the other hand, income from self-employment,

Table 1 Poverty level after consecutive inclusion of different additional incomes into overall personal income, Czech Republic, 2011

	% poor workers	The difference in percentage points
Poverty in earned income	**5.2**	
Poverty after inclusion of:		
Another employee's income	5.1	0.1
Income from self-employment	5.1	0.0
Unemployment benefits	5.1	0.0
Old-age benefits	4.9	0.2
Survivors' benefits	4.8	0.1
Disability benefits	4.5	0.3
Education related allowances	4.5	0.0
Private pensions	4.5	0.0

Source: Own calculations based on the EU-SILC 2011 data

unemployment benefits, education related allowances or private pensions do not have any sizeable impact on reducing poverty in earned income of employees with insufficient employee incomes below the national poverty line of a single person household.

The whole group of workers could be then divided into 4 subgroups as shown in the Figure 1. Subgroup A consists of people who are poor in their earned income as well as in their overall personal income, which means that they do have neither sufficient income from main employment nor additional income high enough to lift them above the national poverty threshold for a household of a single person (113 040 CZK annually). There are 4.5% of employees in this subgroup (an estimated population count of 151 thousand people). Subgroup C comprises employees who do not have sufficient income from main employment, however they have some additional income (income from other employment, self-employment, social benefits etc.) that lifts them above the poverty line for a single person household (an estimated 0.7% of employees). The rest of the employees (3 917 thousand people, 94.8%) are those who are poor neither in their earned income nor in their overall personal income. By definition, there are no people who would not be poor in their income from main employment but were poor in their overall personal income (Figure 1).

Figure 1 Division of employees into 4 subgroups by their poverty status according to their income from main employment and overall personal income, Czech Republic, 2011

		Poverty in earned income (from main employment) Estimated counts in 1000s / share of employees (%)	
		Poor	**Not poor**
Poverty in overall personal income	**Poor**	A – poor both in overall personal income and in earned income **151** **4.5%**	B – poor in overall personal income and not poor in earned income **Not applicable**
	Not poor	C – not poor in overall personal income and poor in earned income **23** **0.7%**	D – neither poor in overall personal income nor in earned income **3 917** **94.8%**

Source: Own calculations based on the EU-SILC 2011 data

Concerning additional income, all persons from Subgroup C have naturally some additional income. In Subgroup A, on the other hand, there are only slightly less than 2 thousand people who have some additional income, while there are estimated about three hundred thousand of those whose overall personal income is higher than earned income from the main employment in Subgroup D.

Subgroup A: poor both in earned income and in overall personal income

There is almost two times higher share of women in this subgroup of employees (86.9%) in comparison to the whole group of employees (44.1%) (Table 2).

People in this subgroup have lower highest education level attained – there are three times more employees with lower secondary education and no people with post-secondary non-tertiary education, first stage of tertiary education or second stage of tertiary education, while these make up a bit below 20% among all employees (Table 2).

Different is also the age structure of the subgroup. There is a higher proportion of younger people – 1.7 times higher share of employees at the age of 20–24 years and 6.5 times higher of those 25–29 years. On the other hand, people at the age of 30–49 years have lower proportion. However, there is also higher percentage of employees at the age of 50–64 years. Mean age is only slightly lower in the Subgroup A (41.3 years) in comparison to all employees (42.4 years).

Employees that are poor both in their income from main employment and their overall personal income have, quite naturally, rather low incomes. Their net income from the main employment is concentrated in the three lowest income intervals (up to 8 000 CZK, 8 001 to 9 000 CZK and 9 001 to 10 000 CZK), while these intervals account only for some 7.8% of all employees (Figure 2).

Structure of the households of employees from the Subgroup A and of the whole group of employees differs as well. Employees in Subgroup A are more than two times less likely to live in the single person households. The probability that they live in single person household is by 74% and 18% lower when considering men and women, respectively. They are more likely to live in households with five or more members. They live more frequently in extended families – the share of people living in two-parent families with other relatives is 1.5 times higher, in lone-parent families with other relatives 1.8 times higher (Table 2).

In sum, this subgroup of low wage employees with personal income below one person household poverty line is dominated by women, with lower education, aged below 30 or above 50 and living in larger households.

Subgroup C: not poor in earned income and poor in overall personal income

Similarly to people in the Subgroup A, persons in this subgroup differ from the whole population of all employees. Women are prevailing also in this group (57.2%), while men prevail among all employees (55.9%), the gender difference is however not that profound as in the Subgroup A (Table 2).

There is much lower share of never married persons (5.4%) in the subgroup in comparison to all employees (26.4%). On the other hand, the share of widowed people is 9.8 times higher (Table 2).

The age structure corresponds to the marital status structure – much lower share of people up to 49 years and higher afterwards. Mean age follows the age structure – it is much higher than for all employees (55.7 years compared to 42.4 for all employees).

Both marital status and age-structure differences are reflected also in the household composition. Employees from the Subgroup C live more often in single person households (2.4 times) or in households with two members (1.7 times), and less often in households with more members. Single female households are 3.7 times more frequent and single male households 1.6 times more frequent than in the all employees group (Table 2). Living in households consisted of two adults where at least one is 65 years or older is 3.3 times more frequent in the Subgroup C, which means that there is also higher representation of couples of retirees.

The old-age benefits are the main reason why these people living in single person households are not poor in their overall personal income, while their income from the main employment is not sufficient to keep them above the poverty line for single person household.

Share of people in this subgroup having lower secondary education (12.7%) is 3 times higher than the proportion of persons with the same highest attained education level in the whole group of employees (4.2%). Similarly as in the Subgroup A, there are no people with post-secondary non-tertiary education, first stage of tertiary education or second stage of tertiary education, while these make up a bit below 20% among all employees (Table 2).

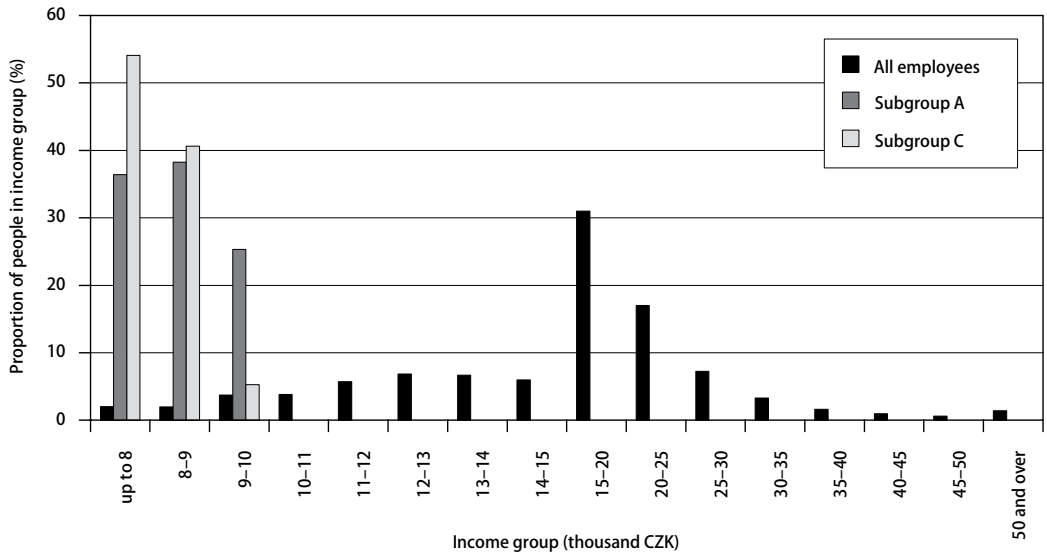
Net income from the main employment belongs again to the three lowest income intervals (up to 8 000 CZK, 8 001 to 9 000 CZK and 9 001 to 10 000 CZK). However, incomes in this subgroup are even more concentrated in the first two intervals – 94.7% of people have their income from the main employment up to 9 000 CZK. The comparison of the income structure of the subgroups A and C and the whole group of employees is shown on Figure 2.

Table 2 Comparison of characteristics of the whole group of employees who worked full-time for 12 months and the subgroups A and C of these employees, Czech Republic, 2011

Category		1	2	3	4	5
		% in employees	% among the working poor in Subgroup A	Ratio (2) / (1)	% among the working poor in Subgroup C	Ratio (4) / (1)
Gender	Male	55.9	13.1	0.2	42.8	0.8
	Female	44.1	86.9	2.0	57.2	1.3
Marital Status	Never married	26.4	27.9	1.1	5.4	0.2
	Married	60.6	60.0	1.0	63.7	1.1
	Widowed	1.5	1.4	0.9	15.0	9.8
	Divorced	11.4	10.7	0.9	15.8	1.4
Highest education level attained	Lower secondary education	4.2	12.6	3.0	12.7	3.0
	Upper secondary education	76.0	87.0	1.1	84.4	1.1
	Post-secondary non-tertiary education	1.4	0.0	0.0	0.0	0.0
	First stage of tertiary education	17.8	0.4	0.0	2.9	0.2
	Second stage of tertiary education	0.6	0.0	0.0	0.0	0.0
Number of members of the household	1	7.6	3.6	0.5	18.7	2.4
	2	23.8	23.8	1.0	40.2	1.7
	3	30.4	28.5	0.9	17.3	0.6
	4	30.2	28.3	0.9	14.0	0.5
	5+	7.9	15.8	2.0	9.8	1.2
Number of dependent children in the household	0	51.5	57.6	1.1	67.9	1.3
	1	24.5	21.2	0.9	20.6	0.8
	2	20.9	18.5	0.9	11.6	0.6
	3+	3.1	2.6	0.8	0.0	0.0
Type of the household	Two-parent nuclear families	51.4	37.4	0.7	43.3	0.8
	Two-parent families with other relatives	29.4	43.8	1.5	25.5	0.9
	Lone-parent families without other relatives	3.0	1.0	0.4	4.5	1.5
	Lone-parent families with other relatives	7.7	13.5	1.8	8.0	1.0
	Not family-related household	1.0	0.5	0.6	0.0	0.0
	Single male	4.7	1.2	0.3	7.7	1.6
	Single female	3.0	2.4	0.8	11.0	3.7

Source: Own calculations based on the EU-SILC 2011 data

Figure 2 Comparison of income structure of the group of all employees, subgroups A and C, Czech Republic, 2011



Source: Own calculations based on the EU-SILC 2011 data

2.2 From individual to household level

Employees working full-time for 12 months represented 32.3% of the population of the Czech Republic. 2.7% of these employees are poor in their household's income, which is a considerably lower rate than it is for the whole population of the Czech Republic (9.8%). However, despite this lower relative risk compared to the total population, these employees represent 9.0% of the population at risk of poverty, which is still a significant portion of income poverty population.

As shown in the previous part of the article, there were 4.5% of employees whose overall personal income was not sufficient to keep them above single household poverty threshold, which means that there is a 1.8 pp decrease when shifting from individual to household level poverty.

The whole group of employees could be divided into four subgroups according to their poverty status by different poverty measures. There are 3 146 thousand (93.3%) persons who are above poverty thresholds both in their overall personal and household's income. There are 4.0% of employees who worked full-time for 12 months who have a sufficient personal income, but the household composition is such that they are poor at household level. On the other hand, there are 2.2% of people who do not have overall personal income high enough, but are not poor at household level. It is only 0.5% of employees who are below both individual and household poverty thresholds (Figure 3). In other words, only 19.3% of the employees who are poor in their household's income are poor also in their overall personal income.

People in each subgroup have different characteristics, which are summarized below and selected results could be find in the Table 3. The results are based on authors' own calculations based on the EU-SILC 2011 data.

Figure 3 Division of the group of employees who worked full-time 12 months into subgroups by their poverty status according to their overall personal income and their household's income, Czech Republic, 2011

		Poverty in overall personal income Estimated counts in 1000s / share of employees (%)	
		Poor	**Not poor**
Poverty in household's income	**Poor**	1 – poor both in household's and overall personal income **18** **0.5%**	2 – poor in household's income and not poor in overall personal income **74** **2.2%**
	Not poor	3 – not poor in household's income and poor in overall personal income **134** **4.0%**	4 – neither poor in household's nor overall personal income **3 146** **93.3%**

Source: Own calculations based on the EU-SILC 2011 data

Subgroup 1: poor both in household's and overall personal income (thereafter the term core of the working poor population is used for this subgroup)

This first subgroup consists predominantly of women. The proportion of women in this group (80.3%) is 1.8 times higher than in the base group of all employees who worked full-time for 12 months. There are 2.8 times more divorced people than in the group of all employees (Table 3). A significant part of employees in this subgroup lives in single person households, with their share 4.0 times higher than among all employees. This is reflected also in the structure by the types of households, where the share of single female households (20.6%) is 6.9 times higher in comparison to all employees. Lone-parent families have also higher proportion, while two-parent families are less represented (Table 3). Usually there is only one economically active person in the household, which is reflected in the income distribution – these people are concentrated in the first income interval (up to 8 000 CZK) (45.3%), followed by the second one (8 001–9 000 CZK) (33.0%) and the third one (9 001–10 000 CZK) (21.8%) (Table 4).

In sum, a typical household in this subgroup could be described as a single female household or a lone-parent household, where a divorced woman is the head of the household.

Subgroup 2: poor in household's income and not poor in overall personal income

This subgroup consists mainly of men (65.5%; their share is 1.2 times higher than in the whole group of employees; Table 3) – breadwinners with overall personal income higher than poverty threshold for the household of a single person (113 040 CZK), but their household's equivalised income is not sufficient to keep them above the threshold for the household. The net income from the main employment does not belong into the lowest intervals – the first two intervals (up to 8 000 CZK and 8 001–9 000 CZK) are underrepresented as well as incomes over 15 000 CZK. However, the most people earn in their main employment between 15 to 20 thousand CZK (24.5%) (Table 4). They are usually the only earners in the household (77.2%).

Most of the persons in the subgroup are married (61.3%), followed by divorced people whose proportion is 2.0 times bigger than that in the whole group of employees (Table 3). The age structure is the youngest of all four subgroups with the mean age of 40.9 years.

The structure of the household corresponds with the fact that the persons themselves earn enough money to be above poverty level, but the household composition causes that they are at risk of income poverty. The households with four and more members are overrepresented in the subgroup as well as households with two and more children. The most frequent type of household is two-parent nuclear family (59.1%), followed by two-parent family with other relatives (16.7%) with only one economically active member (usually a man). On the other hand, single person households are underrepresented.

Table 3 Comparison of characteristics of the whole group of employees who worked full-time for 12 months and the subgroups 1, 2 and 3 of these employees, Czech Republic, 2011

Category		1	2	3	4	5	6	7
		% in employees	% among the working poor in Subgroup 1	Ratio (2) / (1)	% among the working poor in Subgroup 2	Ratio (4) / (1)	% among the working poor in Subgroup 3	Ratio (6) / (1)
Gender	Male	55.9	19.7	0.4	65.5	1.2	12.3	0.2
	Female	44.1	80.3	1.8	34.5	0.8	87.7	2.0
Marital Status	Never married	26.4	25.4	1.0	16.2	0.6	28.3	1.1
	Married	60.6	39.7	0.7	61.3	1.0	62.7	1.0
	Widowed	1.5	2.3	1.5	0.0	0.0	1.3	0.8
	Divorced	11.4	32.6	2.8	22.5	2.0	7.7	0.7
Highest education level attained	Lower secondary education	4.2	13.2	3.2	6.9	1.7	12.5	3.0
	Upper secondary education	76.0	86.8	1.1	87.8	1.2	87.0	1.1
	Post-secondary non-tertiary education	1.4	0.0	0.0	1.0	0.7	0.0	0.0
	First stage of tertiary education	17.8	0.0	0.0	4.3	0.2	0.4	0.0
	Second stage of tertiary education	0.6	0.0	0.0	0.0	0.0	0.0	0.0
Number of members of the household	1	7.6	30.9	4.0	3.4	0.4	0.0	0.0
	2	23.8	14.3	0.6	16.0	0.7	25.0	1.1
	3	30.4	19.4	0.6	20.3	0.7	29.7	1.0
	4	30.2	25.4	0.8	35.1	1.2	28.7	0.9
	5+	7.9	10.0	1.3	25.3	3.2	16.6	2.1
Number of dependent children in the household	0	51.5	41.8	0.8	22.0	0.4	59.8	1.2
	1	24.5	33.8	1.4	18.2	0.7	19.5	0.8
	2	20.9	21.9	1.0	43.0	2.1	18.0	0.9
	3+	3.1	2.6	0.8	16.7	5.3	2.7	0.8
Type of the household	Two-parent nuclear families	51.4	28.2	0.5	59.1	1.1	38.7	0.8
	Two-parent families with other relatives	29.4	12.2	0.4	16.7	0.6	48.1	1.6
	Lone-parent families without other relatives	3.0	4.8	1.6	12.2	4.1	0.6	0.2
	Lone-parent families with other relatives	7.7	24.0	3.1	7.5	1.0	12.1	1.6
	Not family-related household	1.0	0.0	0.0	1.0	1.1	0.6	0.6
	Single male	4.7	10.3	2.2	2.7	0.6	0.0	0.0
	Single female	3.0	20.6	6.9	0.7	0.2	0.0	0.0

Source: Own calculations based on the EU-SILC 2011 data

Subgroup 3: not poor in household's income and poor in overall personal income
Personal income of people in this subgroup is below poverty threshold for the household of a single person, but the composition of their household lifts them above poverty threshold for the household. Usually they are women of better paid men. Women's share is 2.0 times higher than in the whole group of employees working full-time for 12 months (Table 3). Most of them are married (62.7%; Table 3). Because their personal income is not high enough to keep them above single person household poverty line, their net income from the main employment is up to 10 000 CZK (Table 4).

There are two typical types of households in this subgroup. The first type is represented by extended families with more household members including children and other dependants. The second typical household are couples, where both members are with their personal incomes below poverty threshold for a household of a single person, but together above poverty level for their household. This is caused by using equivalence scale to calculate household poverty.

Subgroup 4: neither poor in earned income nor in overall personal income
The last subgroup is composed of people who are not poor both in their personal income and in household's one. There are slightly more men (57.7%) in this subgroup than women (42.3%). They are people with higher education level (21.1% has post-secondary non-tertiary education or higher), mostly living without children (51.9% of households has no children).

Table 4 Comparison of income structure of the group of all employees, subgroups 1, 2, 3 and 4, Czech Republic, 2011

Income (in thousand CZK)	All employees	Subgroup 1	Subgroup 2	Subgroup 3	Subgroup 4
up to 8	2.0	45.3	0.8	35.2	0.4
8–9	2.0	33.0	0.0	39.0	0.3
9–10	3.7	21.8	4.2	25.8	2.7
10–11	3.8	0.0	11.4	0.0	3.8
11–12	5.7	0.0	10.3	0.0	5.9
12–13	6.8	0.0	17.9	0.0	6.9
13–14	6.7	0.0	13.7	0.0	6.9
14–15	6.0	0.0	11.6	0.0	6.1
15–20	31.0	0.0	24.5	0.0	32.6
20–25	17.0	0.0	3.0	0.0	18.2
25–30	7.3	0.0	2.2	0.0	7.7
30–35	3.3	0.0	0.4	0.0	3.5
35–40	1.6	0.0	0.0	0.0	1.7
40–45	1.0	0.0	0.0	0.0	1.1
45–50	0.6	0.0	0.0	0.0	0.7
50 and over	1.4	0.0	0.0	0.0	1.5

Source: Own calculations based on the EU-SILC 2011 data

2.2.1 Economies of scale

When moving from the individual income to the household's one, the economies of scale represented by an implicit or explicit equivalence scale used in the construction of the household poverty measure play a crucial role. Equivalence scale is used to reflect differences in a household's size and its composition. The needs of a household grow with each additional member but not in a proportional way. Needs for housing space, electricity, etc. are usually not three times higher for a household with three members than for a single person. With the help of equivalence scales each household type in the population is assigned a value in proportion to its assumed needs.

Concerning income, it means replacing per capita income by the equivalised one. As a result, household's poverty rate for a given fixed poverty line should decrease. Total household income in numerator is still the same; the denominator is lower when using equivalence scale than when using number of members of the household. Therefore equivalised income is higher than per-capita one for all except of one-person households and thus the at-risk-of-poverty rate should be lower.

When using per-capita income and poverty threshold of 60% median of national equivalised income, the poverty level increases to 24.7% (831 thousand of employees at risk of income poverty), which means that there are 22.0 pp more people who are at risk of income poverty in their household's income (Figure 5) (there are 2.7% of employees poor in their household's income when using the OECD modified equivalence scale).

When using per-capita concept instead of equivalence scales, the core of working poor employees, poor both in their personal income and in their household's income, growths from 0.5% to 2.4%. The share of those whose income is high enough to keep them above poverty threshold for single person household but are at risk of income poverty when looking at their household's income per-capita increased ten times from 2.2% to 22.2%.

As it could be seen in Figure 5, there are 21.9% of employees who are not at risk of income poverty due to the economies of scale. Naturally, there is no one not poor in per-capita income and poor household's income using equivalence scales.

Figure 4 Division of the group of employees who worked full-time 12 months into subgroups by their poverty status according to their overall personal income and their household's income (per-capita), Czech Republic, 2011

		Poverty in overall personal income Shares of employees (%)	
		Poor	**Not poor**
Poverty in household's income (per-capita)	**Poor**	1 – poor both in household's (per-capita) and overall personal income **2.4%**	2 – poor in household's income (per-capita) and not poor in overall personal income **22.2%**
	Not poor	3 – not poor in household's income (per-capita) and poor in overall personal income **2.0%**	4 – neither poor in household's (per-capita) nor overall personal income **73.3%**

Source: Own calculations based on the EU-SILC 2011 data

Figure 5 Division of the group of employees who worked full-time 12 months into subgroups by their poverty status according to their household's income per-capita and using equivalence scales, Czech Republic, 2011

		Poverty in household's income (equivalence scales)	
		Poor	**Not poor**
Poverty in household's income (per-capita)	**Poor**	1 – poor both in household's (equivalence scales) and household's income (per-capita) **2.7%**	2 – not poor in household's income (equivalence scales) and poor in household's income (per-capita) **21.9%**
	Not poor	3 – poor in household's income (equivalence scales) and not poor in household's income (per-capita) **Not applicable**	4 – neither poor in household's (equivalence scales) nor household's income (per-capita) **75.3%**

Source: Own calculations based on the EU-SILC 2011 data

2.3 Material deprivation

Material deprivation, at-risk-of-poverty rate and the share of people living in low work intensity households are three standard European indicators that are used to measure social situation – poverty and social exclusion of people and their households.

The severe material deprivation rate expresses the inability to afford some items considered by most people to be desirable or even necessary to lead an adequate life. The indicator distinguishes between individuals who cannot afford a certain good or service, and those who do not have this good or service for another reason, e.g. because they do not want or do not need it. The indicator measures the percentage of the population that cannot afford at least four of the following nine items:

1. to pay their rent, mortgage or utility bills;
2. to keep home adequately warm;
3. to face unexpected expenses (9 100 CZK for 2011 in the Czech Republic);
4. a meal with meat, chicken, fish or vegetarian equivalent every second day;
5. to go on one week annual holiday away from home (each member of the household);
6. a colour TV;
7. a washing machine;
8. a car;
9. a telephone.[8]

The indicator is based on the enforced lack concept, that means that the person would like to have an item, but cannot afford it, i.e. lack due to insufficient resources and thus problems of affordability, rather than lacks resulting from choices or lifestyle preferences (EU, 2012).

As shown in Table 5, altogether more than 640 thousand persons are considered as severely materially deprived in the Czech Republic. Employees who worked full-time for the whole year have 2.5 pp lower material deprivation rate in comparison with all persons in the Czech Republic.

Table 5 Material deprivation, Czech Republic, 2011

	Absolutely (in thousand persons)	Material deprivation rate (%)
Czech Republic	640.8	6.1
All employees (working full time for the whole 12 months)	122.4	3.6

Source: Czech Statistical Office, own calculations based on the EU-SILC 2011 data

The highest material deprivation rate could be seen in the Subgroup 1 – employees who are poor both in their overall personal income and in their household's income (the core of working poor population). Their material deprivation rate is 7.0 times higher than the one for the whole group of employees working full-time for 12 months. On the other hand, employees who are not poor either in overall personal income or in their household's income have the lowest material deprivation rate (Subgroup 4) (Table 6).

The most frequent item that the household cannot afford is the unexpected expense (35.3%), followed by week holidays for all members of the household (33.8%) and eating meat at least every second day (7.5%) in the whole group of employees. Two items that households could not afford are mostly unexpected expenses and holidays in all subgroups (Table 6).

[8] <http://epp.eurostat.ec.europa.eu/statistics_explained/index.php/Glossary:Material_deprivation_rate>.

Table 6 Material deprivation in the groups and subgroups of employees according to their poverty status, Czech Republic, 2011

	Absolutely (in thousand persons)	Material deprivation rate (%)	Ratio (Subgroup / All employees)[9]	Three most frequently missing items
All employees	122.4	3.6	1.0	unexpected expenses (35.3%), holidays (33.8%), meat (7.5%)
Poverty in earned income vs. overall personal income				
Subgroup A	14.6	9.7	2.7	holidays (55.7%), unexpected expenses (54.6%), car (17.4%)
Subgroup B	na	na	na	na
Subgroup C	2.3	10.2	2.8	unexpected expenses (55.1%), holidays (51.0%), car (18.4%)
Subgroup D	105.4	3.3	0.9	unexpected expenses (34.2%), holidays (32.6%), meat (7.1%)
Poverty in overall personal income vs. household's income				
Subgroup 1	4.5	25.3	7.0	holidays (86.8%), unexpected expenses (73.9%), car (38.8%)
Subgroup 2	9.4	12.7	3.5	holidays (75.9%), unexpected expenses (68.7%), meat (23.3%)
Subgroup 3	10.1	7.6	2.1	unexpected expenses (52.0%), holidays (51.6%), car (14.5%)
Subgroup 4	98.3	3.1	0.9	unexpected expenses (33.6%), holidays (31.7%), meat (6.7%)

Note: na = not applicable.
Source: Own calculations based on the EU-SILC 2011 data

CONCLUSION

According to the poverty in earned income there are 5.2% of workers whose income from main employment is not sufficient to keep them above poverty threshold for a single person household. However, there are 0.7% of workers who have some additional income that helps them to be above the poverty threshold, which results in 4.5% of workers whose overall personal income is lower than the poverty threshold. The most helpful in lowering the poverty are disability and old-age benefits.

There are 2.7% of employees who are poor in their household's income, which means that there is a 1.8 pp decrease when shifting from individual to household level poverty. These employees represent 9.0% of the whole population at risk of poverty. The whole group of employees was divided into four subgroups according to their poverty status by different poverty measures. The core of working poor population – those who are below both individual and household poverty thresholds – consists of 0.5% of employees. In other words, only 19.3% of the employees who are poor in their household's income are poor also in their overall personal income. A typical household of this core working poor

[9] The ratio was computed as it is shown on the following example: material deprivation rate in the group of all employees is 3.6%; material deprivation rate in the Subgroup A is 9.7%; the ratio for the Subgroup A is computed as 9.7 / 3.6, which is 2.7. The ratios for other subgroups are calculated similarly.

population is either a single female household or a lone-parent household, where a divorced woman is the head of the household.

When moving from the individual income to the household's one the economies of scale play a crucial role. When using per-capita income the poverty level increases by 22.0 pp to 24.7%. When using per-capita concept instead of equivalence scales, the core of working poor employees poor both in their personal income and in their household's income growths from 0.5% to 2.4%.

The employees as a whole have 2.5 pp lower severe material deprivation rate than is the rate for the Czech Republic. However, the rate of the core of the working poor employees is seven times higher than that of the population of employees working full-time for the whole year and thus they are the most severely materially deprived group.

References

BRUDER, E. et al. Methodological and Conceptual Difficulties of Analysing the Working Poor Population in Europe. *Regional and Business Studies*, 2011/3 (Supplement 1), pp. 25–33.

EUROPEAN UNION. *In-Work Poverty in the EU. Methodologies and working papers*. Luxembourg: Publications Office of the European Union, 2010. ISBN 978-92-79-16751-5.

EUROPEAN UNION. *Measuring Material Deprivation in the EU. Indicators for the Whole Population and Child-Specific Indicators. Methodologies and working papers.* Luxembourg: Publications Office of the European Union, 2012. ISBN 978-92-79-25571-7.

GARCÍA-ESPEJO, I., IBÁÑEZ, M. *Working Poor and Low Salaries in Spain: An Analysis of Occupational and Household Factors Related to Different Situations of Poverty.* Draft, University of Oviedo, Spain, 2005.

GARDNER, J. M., HERZ, D. E. Working and Poor in 1990. *Monthly Labor Review,* 1992/12 (December), pp. 20–28.

MOSISA, A. T. The Working Poor in 2001. *Monthly Labor Review,* 2003/11–12 (November/December), pp. 13–19.

PONTHIEUX, S. *The Working Poor: Limits of the EU Indicator "In-Work Poverty Risk", Limits of the Statistical Category "Working Poor", and Exploration of a Notion of "Poverty in Earned Income".* Paris: INSEE, ECINEQ.

The Czech Banking Sector: Two Decades with the Shuttle Changes[1]

Drahomíra Dubská[2] | *University of Economics, Prague, Czech Republic*

Abstract[3]

According to stress-test of the Czech National Bank at the end of 2011, the banking sector in the Czech Republic is able to absorb the scenario of the Czech Republic's GDP hypothetically dropping by 5–6%. This analysis elucidate the question of how is possible that the banking sector remained sound and strongly capitalized, even when the parent companies of the largest banks in the Czech market, which comprise nearly the entire banking sector of the Czech Republic in terms of assets, loans and deposits, struggled with existential problems. It describes the history of the practical disappearance of the small and medium-sized banks during 90th and also the development of large banks using a model of sustainable growth. The analysis also includes circumstances of privatization and post-privatization development, as well. Final part of this article enlightens main reasons why the banking sector of the Czech Republic in the decade 2001–2011 was able to expand with high profitability with a relatively low level of risk.

Keywords

Banking, bad loans, sustainable growth, retail banking

JEL code

G, G01, G21, M2, O52

INTRODUCTION

The banking sector in the Czech Republic in the early 1990´s was characterised by significant increase in the number of entities with followed crashes of a lot of small and medium sized banks and with high concentration in the banking sector. This article analyzes the period 1993-2011 and seeks to answer the question why recent global financial crisis has not harmed significantly the banks in the Czech Republic. Financial management theory was used in the analysis comparing real and internally generated

[1] The article is based on the paper Dubska (2012) called "Banks in the Czech Republic: Why have they not been hit by the global financial crisis?" presented at the International conference on Global Business Research (Special Reference to Human Resources, Banking, Accounting), University College of Commerce and Management Studies, Mohan Lal Sukhadia University, Udaipur, India (September 2012).

[2] University of Economics, Nám. W. Churchilla 4, 130 67 Prague, Czech Republic; Czech Statistical Office, Na padesátém 81, 100 82 Prague, Czech Republic. E-mail: drahomira.dubska@czso.cz.

[3] This paper is designed as one of the outputs of the research project "The development of the transaction costs of Czech businesses in bankruptcy proceedings, the possibility of their reducing on the level common in the EU by improving legislation, the possibility of improving statistics insolvency proceedings and creating a model of financial fragility of households" which is registered with the Technology Agency of the Czech Republic under the registration number TD 010093. The international scientific team is coordinated by the University of Economics in Prague.

sustainable growths of banks in a period of the second half of the 90th which was critical for the destiny of the largest Czech banks.

1 THE BANKS IN THE CZECH REPUBLIC IN THE EARLY 90'S

After the split of Czechoslovakia and the emergence of the independent Czech Republic in 1993 the economic transformation from plan economy to a market-driven model continued. In the sphere of financial intermediation, this development reflected an extreme increase in the number of entities in the banking sector. Its high concentration was evident even then.

The four largest banks occupied prevailing market shares. Czech Savings Bank (CS, Ceska sporitelna) which has historically focused primarily on retail clients was profiled as a distinct entity in the market and interbank deposits. Due to its high volume of primary deposits from retail customers the Czech Savings Bank provided loans on the interbank deposit market, particularly to small and medium-sized banks, which arose during the first half of 1990 by the dozens in the Czech Republic. The country only had 10 million inhabitants and its GDP in 1995 amounted to only 1% of the EU GDP so it was over the top in financial intermediation. The high credit exposure of the Czech Savings Bank in the small and medium-sized banks segment threatened its stability due to the fall of these smaller entities, which started to occur around the first half of the 1990s.

The second largest bank in terms of assets was the Commercial Bank (KB, Komercni banka). Its business was concentrated mainly on corporate clients. This was formed substantially in the lending business, where its share in total loans to corporate clients was 50%. Afterwards, only this bank suffered significant losses in the quality of its loan portfolio due to the fact that the loans provided to companies were secured by real estate whose prices fell. KB provided loans to a large number of companies that had moved into private hands, but also to predominately nationalized based companies. After a decline in the prices of these properties which were collateral for loans - but mainly due to a change in regulatory rules of the Czech National Bank – the loan portfolio of Commercial Bank (and partly also of other large banks) deteriorated. This ultimately led to the need to set aside a large amount of bad loans and convert them into a special institution called the Consolidation Agency (Konsolidacni agentura) established by the state. Without this "bail-out" three of the four largest banks would have collapsed. Over 50% of the entire deposits of the banking sector were deposited in these banks.

The Czechoslovak Trade Bank (CSOB, Ceskoslovenska obchodni banka), which was number three in the bank market in the Czech Republic, focused mostly on servicing foreign trade operations. In comparison with other banks CSOB suffered significantly less loss in its quality loan portfolio due to falling prices of pledged property, as used in far more than any other bank liability claims. However, in the case of CSOB some loss occurred with the transfer of bad loans on the shoulders of the state. These bad loans were often associated with CSOB' loans provided to exporting businesses. Its business did not suffer as much as the other banks. The loan portfolio quality of those banks deteriorated due to a decrease in prices of mortgaged property. But CSOB preferred rather pledged receivable.

The last of the four major banks in the Republic, Investment Bank (IPB, Investicni a postovni banka), with the smallest share of the state, was characterized by a strong expansion strategy (see below). This strategy was in some cases on the border of the rules of prudent bank behavior. Ultimately, however, this strategy inflicted the fall of IPB bank.

1.1 The high number of small and medium-sized banks at the beginning of economic transformation

A large number of small and medium-sized banks which emerged in the Czech Republic in early 1990s proved to be unsustainable both in terms of size of the Czech economy, and especially the quality of management of these banks.[4] Between 1990–1998, 15 small and medium-sized banks failed and had their banking licenses withdrawn and another three ended up merging with another bank. In total, 18 banks out of a total of 54 banking institutions in the Czech Republic market ceased to exist this way.

[4] Czech National Bank (CNB) used this operative measure if the bank's capital falls below a certain threshold, i.e. 1/3 of assets.

All of their clients were fully compensated and often beyond the statutory deposit insurance. Five other banking entities expired at the time without liquidation. They continued with the status of joint stock companies without a banking license. Also the German Hypo-Bank and WestDeutsche Landesbank CZ as well as Austrian Bank Creditanstalt CZ, disappeared from the Czech market.

After 2000, seven other banks disappeared through liquidation or withdrawal of banking license.[5] In total, by 2002 thirty banking institutions had disappeared from the Czech market through liquidation or dissolution without liquidation, which was more than a half of their number from the early 1990s.

1.1.1 Crashes of small and medium-sized banks in the Czech Republic

Banka Bohemia (BB) was the first bank in the Czech Republic, which had to close down in 1994. It was also the first financial institution in the post-communist countries, which ended up in forced administration. The Czech government compensated all clients of this bank. The State paid CZK 17 bn that represented at that time about 18% of GDP. The government had to save clients of BB because it was the first failed financial institution and Deposit Insurance Fund had not existed at the time. The Vice President BB escaped shortly before planned police arrests.

The collapse of Banka Bohemia, however, differed significantly from the crashes of the almost two dozen other banks. It was not due to mismanagement by banks but scandal. The public was informed that the management of banks had issued unsecured bank guarantees. The bank at the time of collapse was actually healthy. Its end was precipitated by the "run", but most likely it would have collapsed later by bad loans like other banks. The liquidators detected dozens of small credit fraud when entrepreneurs lured money from the bank and used it for completely different purposes.

Managers of small and medium-sized failing banks were often accused of credit and other fraud, violation of duties of trust and misuse of information in business relations (insider trading). They put banks into bankruptcy mainly by providing loans which were disadvantageous for those banks. They approved of such high loans to companies that did not show any activity, nor employees, and with registered capital only on the minimum amount required for the establishment of limited companies. Subsequent investigations were very complicated – such as the investigation of the collapse of another medium-sized bank, i.e. Industrial Credit Bank (Kreditni a prumyslova banka), which collapsed in 1995. The Czech judiciary took 15 years for came to the verdict.[6]

Overall, the failures of small and medium-sized banks were the result of a wild transition of the Czech economy. Lack of regulation related to the privatization process caused excessive tolerance of risks and also criminal conduct on the part of management and owners of large numbers of small and medium-sized banks in the country. Finally, the term "tunneling" arose in the Czech Republic which has become synonymous to fraudulent money outflows.

2 SUSTAINABLE GROWTH OF LARGE BANKS IN THE CZECH REPUBLIC IN THE PERIOD BEFORE THE PROBLEMS WITH CREDIT PORTFOLIOS

In the first half of the 1990s, very strong growth was typical for the Czech banking sector. Banks' assets went up by more than a fifth in 1994 and almost by a quarter in 1995. In the following years, the volume of assets has increased by about one tenth.

---

[5] This list, however, include foreign bank branches, which later bought the state-owned shares in the large Czech banks. So for the same owner it lost on the merits of maintaining the two entities in the Czech market. This was the case of Erste Bank Sparkassen (CR) when the Austrian Erste Bank privatized state share in the Czech Savings Bank and also the case of Societe Generale Bank, as after the privatization of state share by French parent company in the Commercial Bank.

[6] The accused manager complained about the length of the investigation of the case at the European Court of Justice in Strasbourg. The court confirmed his complaint as for the duration of the legislative process. It ruled in his favour and confirmed unacceptably long duration of the legislative process.

In the 1990s, the largest Czech banks have become the main source of funding for transformation of the Czech economy. By 1995 TOP 4 accounted for approximately two-thirds of total assets of the banking sector and in later years of one half. Nevertheless, even these large banks subsequently found themselves in trouble. In view of subsequent developments, it is interesting to see how these banks were governed by their own dynamics, how banks were able to look at their sustainable growth with regard to capitalization and risk environment, i.e. how banks operated their level of financial management. An analysis of sustainable growth shows to what extent the real dynamics match their capabilities as their financial conditions and capital strength has allowed. Financial management theory allows to analyze and to express by model the growth possibilities of banks. It is used for these purpose:

- The bank's basic performance parameters derived from the profit – return on assets (ROA) and return on equity (ROE); in the logic of the matter is that the lower net profit implies weaker growth capacity for the future.
- Average assets and equity (such as variable values, which measure the dynamics).
- Return on assets (indicates which operating revenue generating unit of total assets).
- Dividend policy (notably, the percentage of net income paid out as a dividend in cash).
- Retained earnings, profit margin, etc.

The relations between these parameters are fixed. They allow you to detect and measure the mutual dependence and sensitivity of each to the other factors change. Application of model also allows the comparison of the growth of banks with what could be reached. In other words, to what extent each of the banks respected possibilities offered measurable capacity to increase their assets. This internally generated sustainable growth[8] of the bank is as follows:[9]

$$SG = \frac{ROA \times (1 - D)}{EC/TA - (ROA \times (1 - D))}, \quad (1)$$

where:
SG .... sustainable growth rate or the annual rate of increase in average total assets that can be supported by internally generated equity capital,
ROA .... return on average total assets, or net income after taxes divided by average total assets,
D .... percentage of after-tax net income paid in cash dividends,
EC .... average equity capital,
TA .... average total assets.

As for analysing of four largest Czech banks, it was possible to determine on the one hand those who in that period expanded with less caution (i.e. their real dynamics measured by growth of total assets were higher than possibilities which were offered according to their internally generated sustainable growth which was detected by model). Conversely, it also determines which banks that evolved more cautiously (in term of risk environment they amounted to real growth rates of their assets that were below their potential for sustainable growth).

[8] This formula had been used with regard to data options and accounting standards of bank statements at that time and shows sustainable growth of the bank's assets based solely on internal capital formation. Therefore it does not record other growth opportunities, such as the external capital formation, subordinated debt, asset securitization, asset sale and leaseback. However, most of these options have not been used by banks in the Czech Republic..

[9] Other three equations for internally generated sustainable growth (SG) can be used with the parameters ROE, profit margins, asset yield and leverage multiplier.

Analysed banks diverged on, as evident from Table 1, the average dynamics of the Czech banking sector but from their internally generated growth capacity, as well. It seems to be logical that their objectives and strategies were generally affected by much better or worse predictable variables: the development environment with regard to the balance sheet structure, the strategy of competing banks, the increase in deposits and loans, profit and loss projections, presupposed movement in interest rates, good identification (or rather optimization) of the balance sheet and profit and loss sensitivity to changing market conditions, etc.

CS was a traditional bank with risk aversion, which is a typical feature of saving societies. This fact was also confirmed by the lower speed with which CS increased its total assets. However, CS was forced to abandon its position as the largest bank due to gradual changes in the distribution market (more and more banks gained its clients that the bank provided as a source). The trend toward reduction or lower dynamics of growth was logical. In spite of CS´ total assets and the large dimension in other parameters (branch network, staff, etc.) CS generated relatively lower profits. This fact had impact to the worse performance indicators derived from profit. Generally, the CS volume of assets increased more slowly than it would have been possible according to its capacity for sustainable growth.

In the case of IPB assets additions in 1994 and 1995 were almost four times higher than the potential for sustainable growth and almost three times higher in 1996. It was not until the subsequent correction in 1997 on asset growth of 3.5% which showed that the bank began to perceive an imbalance in its expansion due to the risky environment and its own financial position. The model effectively highlighted the need for negative growth, i.e., having effectively and markedly reduced the total assets of the previous year.

CSOB showed a long-term balance sheet growth well below potential, which offered its performance parameters. According to the model, it would have been possible to increase the annual balance sheet total up to a quarter. A heavily cautious strategy with an emphasis on the real and potential risks held the bank at the maximum performance without market expansion.

Unlike other major Czech banks in this analysis KB banka as the only one revealed prudent asset growth in 1994. Other banks were over their possibilities. Nevertheless, the sharp increase in total assets in 1995 has already been "overshooting" compared with results of the sustainable growth model. But the next year, it changed. In 1997, the bank had only grown by 1.4% according to its capacity. The real magnification was slightly above it.

2.1 Model results of sustainable growth of banks

Results from the model for sustainable development of the largest Czech banks in the 1990s and their second half showed (Table 1) that their subsequent development actually corresponded to what their internally generated sustainable growth had previously indicated: strongly expanding IPB bank went bankrupt in 2000 (despite the fact that the share of the state in IPB was previously purchased by Japanese investment bank Nomura). Heavily cautious CSOB bank, with asset growth well below potential possibilities of its performance parameters, eventually acquired all the assets of the bankrupt IPB and its valuable financial group (subsidiaries with significant market shares). This happened under extremely favourable conditions for CSOB as the Czech government promised to guarantee all of IPB´s failed assets. The price was one Czech crown (CZK 1). It was a significant interference in the reported government sector deficit in relation to GDP.

Equity shares of the Czech state in the CS and the KB were acquired shortly after 2000. The small Austrian bank Erste Bank (based on the sum of assets, only about one third compared with CS) bought a share in the Czech State Savings Bank. The French Société Generale (bank with global reach) acquired a stake in the Commercial Bank (KB) in 2001. The small Belgian KBC bank bought CSOB at the end of the 1990s, i.e. before operation with IPB.

Table 1 Comparison of real and sustainable growth rate of total assets in large Czech banks in the period before privatisation (annual % change)

Bank	KB		CS		IPB		CSOB		Real growth of banking sector
Year	RG	SG	RG	SG	RG	SG	RG	SG	
1994/1993	12.5	**24.2**	10.0	**7.2**	27.0	**7.5**	31.4	**17.2**	20.5
1995/1994	25.3	**16.2**	1.4	**1.4**	27.6	**7.6**	19.1	**29.6**	23.9
1996/1995	15.9	**14.8**	1.2	**8.7**	15.4	**5.5**	7.6	**23.8**	11.6
1997/1996	4.6	**1.4**	2.5	**7.0**	3.5	–	12.8	**23.3**	11.4

Note: RG = real Growth, SG = sustainable growth.
Source: Annual Reports, own calculations

3 THE SALE OF STATE SHARES IN THE LARGEST CZECH BANKS

The balance sheets of the three largest Czech banks, i.e. KB, CS and CSOB were cleaned of bad claims before offering the sale of equity shares. They were on a massive scale transferred into specially established government agencies and then those claims were sold in packages (yield from sale of bad debts was compared with similar agencies rather just average). Until 2002, the Czech government cleansed the Czech banking sector of an overall amount of CZK 450 bn, which corresponded to 18% of GDP generated in that year. However, the Czech government did not help to clean the bank IPB bank from bad loans before selling off in 1998. The Japanese investment bank Nomura acquired a relatively low share of state in this bank and declared that it was not a strategic investor, but only a financial one. This was also confirmed because a lot of the most valuable assets of the IPB bank, such as stakes in the brewing industry (Pilsner Urquell into the hands of the South African investor) were sold during Nomura´s exposure in IPB.

The Austrian Erste Bank, on the other hand, proved to be an important strategic investor also because of its activities aimed at the promotion of the Czech corporate sector and loans to households were part of the contract for the sale of the state share of the privatized entity. The bank then actually provided preferential interest rates on loans to small and medium companies. However, bonus mortgage interest rates for the public from privatized CS were significantly more successful. This bonus actually started mortgage lending in the Czech Republic, because until then the volumes of housing loans had been low and with limited segment of clients with the highest rating. Between 2003–2007, the volume of mortgage loans in the Czech Republic grew by more than 30% by a year. Moreover, the ratio of loan-to-value have been still favourable for the banks when the outstanding of housing loans were – and still are – only about half of the value of the real estate representing the collateral.

Societe Generale, which won the state share in KB, continued its strategy of orientation primarily on corporate clients. KB, as a subsidiary of Societe Generale, did not concern itself with special operations of an investment nature, especially derivative transactions. This strategy proved to be a great advantage in the later development of the global financial crisis, because the bank's balance sheet and its off-balance were without these special papers. Proceeds from the sale of the state stake in KB (CZK 40 bn) have been used mainly for the subsidy of the State Fund of Transport Infrastructure.

Sale of CSOB into the hands of the relatively small Belgian KBC Bank had attracted attention mainly because the German banks were favourites for tender. In 2000, CSOB had became bank the number one in the Czech banking market by volume of assets thereafter it took over the failing IPB. Nevertheless, the combination of both entities and completion of the merger took a relatively long time due

to the very different corporate culture, incompatible IT systems and refining balances. The bail-out continued for several years.

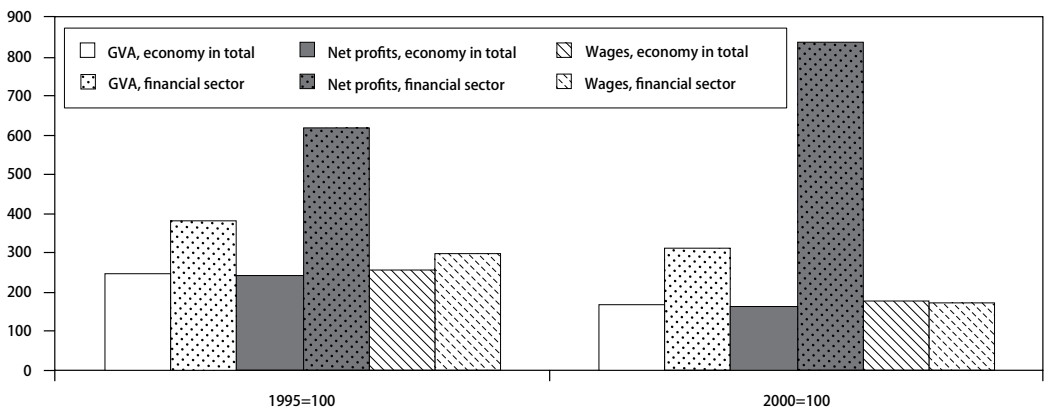
The entry of Japanese Nomura into the IPB has been criticized because of the low selling price of the state share. Operations over time proved controversial and were accompanied by a series of court cases, which also even CSOB led as follow-bank.[10] Nomura proposed to strengthen the bank's retail business. This finally happened and a special division for use of postal branches throughout the country as selling points was created. However, the strongly expansionist strategy of the bank without sufficient quality risk management was the reason for its later failure. This failure had been indicated by the interbank market for a long time to come. IPB gained money sources in the interbank market at much higher costs than other banks.

4 POST-PRIVATIZATION DEVELOPMENT OF THE BANKING SECTOR IN THE CZECH REPUBLIC

The beginning of decade of 2001–2010, when the vast majority of the assets of the Czech banking sector got through the sale of state's shares under foreign control, was associated with the credit-crunch. The largest banks in the country began to prefer strategy of buying securities and substantial reduction in lending. Their behaviour was caused by uncertainties in the economy and by fears of re-deterioration of their balance sheets due to the bad credit. Moreover, the experience of the fall of the fourth largest bank in the country, which was caused by over-expansion, remained a fresh memory. This state of perceived uncertainty lasted until 2004. It was also one of the reasons for the slow growth of the Czech economy because firms lacked financing from banks.

Development of the banking sector after 2000 crucially influenced the growth of gross value added, profits and wages in the financial sector of the Czech Republic. This growth was faster than the development of the indicators for the Czech economy as a whole (Figure 1). An extreme increase was observed especially in the profits of the financial sector which during 2000–2001 increased by 836% whilst in the economy as a whole grew by 165%. The lower profit growth of the financial sector for the period 1995–2011 (by 615%) compared with its growth in a shorter period from 2000 to 2011 (about 836%) is due to the fact that at the end of the second half of the 1990th years banking sector was in the loss.

Figure 1 IM and RME_{IM}, Czech Republic, 1995–2010



Source: Czech Statistical Office

[10] CSOB did not hesitate to sue Czech government although the conditions under which it gained sales network of IPB and its financial group have been particularly beneficial including hundred percent guarantees for total assets. Nomura also as a former majority owner sued the Czech government for about CZK 40 bn whilst CSOB has initiated arbitration against Nomura for about CZK 24 bn regarding of shares of Czech breweries.

4.1 Positions of banks under foreign control in the Czech Republic

Foreign owners after entry into the large Czech banks began to implement a policy of cost savings. They also focused on risk management, which was another reason why the credit-crunch lasted for a relatively long period of time.

The sale of state-owned shares in the largest banks into foreign hands meant that the banking sector of the Czech Republic nearly as a whole found itself foreign-controlled according to the volume of assets and other indicators. Segment banks under foreign control maintained and developed its high proportions during 2001–2010.

In late 2010, foreign owners controlled through the four largest banks 96.9% of the assets of the banking sector in the Czech Republic. They participated in the volume of loans granted to clients of 96.3% and the amount of bonds purchased and held in banks' balance sheets of 96.8%. Foreign-controlled banks also possessed 98.8% of total deposits in the banking sector in the Czech Republic as a whole.

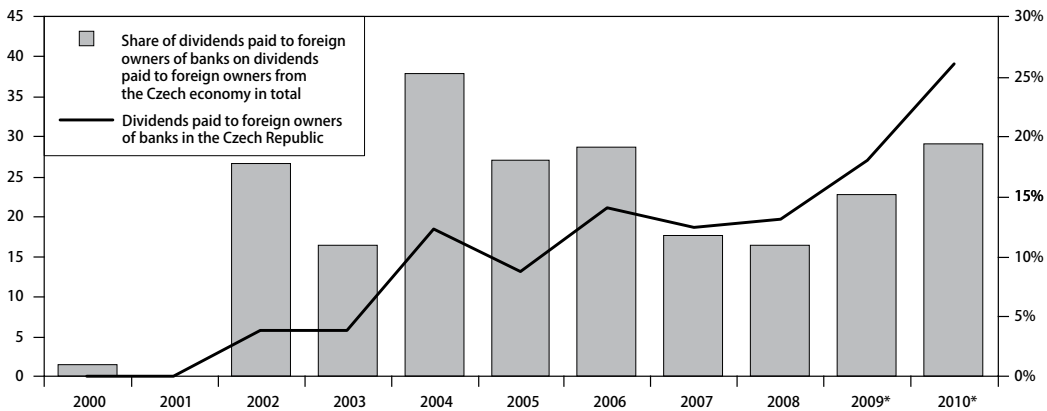
In the Czech economy in general, the position of foreign-controlled companies is relatively strong. The segments of non-financial companies (above all in manufacturing) and financial entities under foreign control together generated 42.5% of total production of these segments against 7.3% in 1995. These companies participated in the amount of paid wages from the one-third, but formed 60% of the total net profits in the Czech economy. This means that segments which are controlled from abroad are far more profitable than the rest of the economy.

The inflow of foreign direct investment in time showed the gain positions in the creation of gross value added in the financial sector itself. In 1995, the segment of financial entities under foreign control generated 10.0% of gross value added of the financial sector, but in 2010, it was already a full 97.1%. According to the data available for 2009 for the Czech economy, financial and non-financial firms under foreign control contributed to gross value added in economy from 30.6%.

Since 2002, high profitability is evident in the banking sector in the Czech Republic and its ROE is higher compared to the European average. Banks with majority of foreign capital accounted for 97.2% of the volume of reserves and the equity capital of the banking sector in the Czech Republic in 2010. They formed 98.2% of the net profit of the sector. The amount of retained earnings at the end of 2010 was roughly 2.5 times higher than the achieved net profit this year.

It is logical that such a strong share of foreign banks in the equity of its acquisitions in the Czech Republic is also reflected in the amount of repatriated profits. The volume of dividends of banks under foreign control which were sent to the countries of parent companies in comparison to the total volume

Figure 2 Dividends paid to foreign owners (in CZK bn on the left axis; in % on the right axis)



Source: Czech National Bank, own calculations

of dividends to foreign investors paid from the Czech Republic (Figure 2) is significantly higher than the comparable share on gross value added created in the Czech economy.

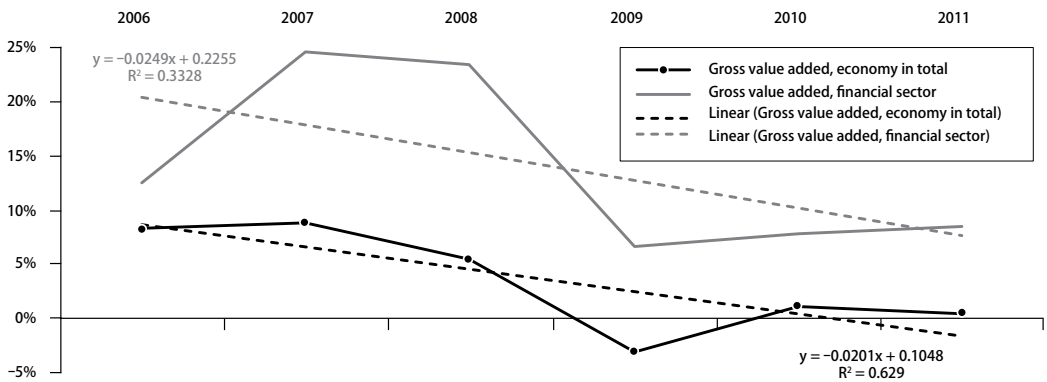
Despite the strong outflow of dividends from banks to abroad, the volume of reinvested profits in the banking sector which was left from foreign owners in the Czech Republic exceeded 53% of total direct investment in the banking sector during 1995–2011. It accounted for CZK 230 bn of the total volume of CZK 432 bn in foreign direct investment in this sector.

5 SITUATION OF THE BANKING SECTOR IN THE CZECH REPUBLIC DURING THE GLOBAL FINANCIAL CRISIS AND IN THE SUBSEQUENT PERIOD

The Czech Republic was not hit by financial crisis in 2008. But immediately afterwards it was affected by the economic crisis, which was caused by a sharp decline in foreign demand. This new situation could not remain unanswered with regard to the strong export orientation of the Czech economy (export value formed 75% of GDP in 2011; for 1995–2004, it was an average of 55% and in the period 2005–2011 66%). GDP in real terms decreased by 4.7% in 2009, i.e. slightly deeper than the GDP of the European Union (–4.5%).

However, the financial sector of the Czech Republic, whose key part is banking, did not show a decline nor during the crisis of Czech economy as shown in Figure 3. The sector only significantly reduced its annual growth rates of gross value added as a measure of its performance. In 2010 and 2011, the gross value added in the financial sector rose slightly, although in 2011, the Czech economy has stagnated and since the 4th quarter 2011 to the 2nd quarter of 2012 already q-o-q was in recession.

Figure 3 Gross value added in the financial sector and the economy of the Czech Republic total (y-o-y in %)



Source: Czech Statistical Office

How is it possible that with such a huge participation of foreign capital in the banking sector the banks in the Czech Republic were able to resist the financial crisis? How is it that the problems were not introduced into the domestic financial market? After all, the crisis hit their parent companies with full strength, and struck in particular on the Societe Generale and Belgium's KBC, which had to be rescued by the Belgian Government. Erste Bank also had problems with its involvement in bonds, purchased from Iceland. These inconveniences with risk affected its profitability and weakened the confidence of the capital markets.

The resilience of banks in the Czech Republic during and after the global financial crisis is apparent in large part from the fact that they "relived“ their crisis previously in the 1990s. Their problems were at the time, due to bad loan portfolios, truly existential problems. The Czech government had to bail

them through converting bad loans. Foreign investors then acquired the large Czech banks "cleaned" under relatively favourable conditions. This was followed by a period of high capitalization of banks in the Czech Republic, which resulted from higher net interest margins, and then also of significant revenues from increased bank fees. They were generated primarily by the bank's retail business. This segment of the retail clients had previously stood for many years considerably outside interest of banks´ lending. Banks also held in their balance sheets only very marginal amounts of asset-backed securities and the volume of their derivatives trades were also relatively small.

The high growth of loans to households for housing and consumption, evident since the beginning of the past decade and significantly amplifying in the boom years of the Czech economy in the period from 2005 to mid-2008, meant that bank profits grew strongly at relatively low risk for the banking sector. On the other hand, the persistent conservatism of Czech retail clients has simplified maintaining the volume of deposits in banks. Also the ratio of deposits to the usually monitored parameters remained at a favourable level for banks. The total volume of clients´ deposits in the banking sector is by about 49% higher than the volume of loans granted. Accordingly, the relatively large quantities of the primary deposits from retail customers that banks can use in their transactions on the asset side of the balance is very cheap in terms of interest rates paid. Conversely, rates on loans to retail clients are very high, particularly for loans for consumption, which accounts for roughly a quarter of all loans granted to households.

In total, it can be said that the profits of the largest banks in the Czech Republic, which completely dominated the whole sector, can significantly improve the economic performance of foreign parent companies. Their acquisitions in the Czech Republic have become extremely successful over time. It was so even in years when the non-consolidated results of foreign parent companies were not or are not successful. With certain dose of exaggeration it can be said that Czech savers help to improve the "health condition" of the parent companies of the largest banks in the country.

CONCLUSION

After the birth the independent Czech Republic in 1993, the segment of small and medium-sized banks in the turbulent development and in liquidity crises almost disappeared from the banking sector. The four largest banks whose total assets exceeded the total assets of the banking sector in the Czech Republic were in trouble due to the conditions of the wild transformation of the Czech economy. The model used in this article shows the variations of actual and sustainable growth of banks at the time. The fourth largest bank failed and the Czech government, in fear of the problem occurring for the other three big banks, cleaned their balance sheets through costly operations, i.e. transferring the bad assets into a government institution. Thus prepared banks were sold to the foreign hands.

The previous purification of bank portfolios from bad loans already at the end of the 90th and also subsequent years of intensive capitalisation supported the favourable financial position of the Czech banks. After failures of small and medium-sized banks in the 1994–1998, when less than half the previous number of subjects remained on the market, the Czech government decided to sell the state shares in four largest banks and to purify very costly their portfolios. A model and analysis of real and sustainable growth of banks from the period before privatisation demonstrates one of the causes of the fall of the fourth largest bank in the country (but not enough prudent banking supervision played negative role in this case, as well). Through sales into the hands of foreign owners the Czech banking sector became almost completely under foreign control. The jump of the capital forces of the largest banks and thus of whole banking sector began after 2002. Under foreign control were over 95% of the assets, loans and deposits of the entire banking sector. The subsequent credit crunch was replaced by a boom mainly in the retail business of the banks with high margins and a hard fee policy.

Expansion in high-yield business with retail clients also meant a substantial risk diversification and generally lower level of this risk compared to corporate loans. Significantly, it also increased the

volume of fees and their share in the structure of bank income (fees for the various banking services in the Czech Republic are higher than in the countries of the parent banks in Western Europe). Banks benefited from a "hunger" of the Czech households for their own housing and mortgage boom. Another reason for the good financial health of Czech banks was that their portfolios had contained only negligible amounts of risk and asset backed securities. Later, this was to protect the banks in the Czech Republic from the impact of the global financial crisis.

Since 2002, the return on equity of the acquisitions of foreign investors is higher than returns on average in the European Union. All this resulted in the strong capitalization of banks in the Czech Republic. Capital adequacy is almost twice as higher than the Basel convention determines. Also, other indicators of the "health of banks" are at a high level. The Czech banking sector practically has not felt the global financial crisis. The banks also endured the economic crisis better than the Czech economy as a whole.

Czech households, however, have felt that bank services are expensive. The crisis hit Czech households later. In 2011 and 2012, it expressed itself by stagnation in real wages, by a non- decreasing level of unemployment, increasing tax burdens and through tough budgetary restrictions. However, these restrictions are greatly exaggerated, because the comprehensive debt, i.e. debt of the government sector and the households and also debt of businesses together as a percentage of GDP is the second lowest in the European Union.

References

BABECKY, J., HAVRANEK, T., MATEJU, J., RUSNAK, M., SMIDKOVA, K., VASICEK, B. *Early Warning Indicators of Economic Crises.* Prague: Czech National Bank, May 2012.

BERNON, D. G. *Capacity for Asset Growth Model: A Tool for Internal Bank Management and External Bank Analysis.* 1978.

CNB. *Czech Banking Sector Stress Tests.* Prague: Czech National Bank, Financial Stability Department, November 2011.

CNB. *Financial Stability Report 2011/2012.* Prague: Czech National Bank, May 2012.

DUBSKA, D. *Banks in the Czech Republic: Why Have They Not Been Hit by the Global Financial Crisis?* Contribution at the International conference on Global Business Research (Special Reference to Human Resources, Banking, Accounting) organized by University College of Commerce and Management Studies, Mohan Lal Sukhadia University, Udaipur (Radjastan), India, September 2012.

DUBSKA, D. *Changes in the Czech Household Sector during 1995–2005: Savings and Indebtedness* (Czech only) [online]. Prague: Czech Statistical Office, November, 2005. ISBN 978-80-25-1134-8. <http://www.czso.cz/csu/2005edicniplan.nsf/publ/1533-05_v_obdobi_1995_az_2005>.

DUBSKA, D. Foreign Controlled Companies in the Czech Economy [online]. *Statistika, Statistics and Economy Journal,* 2012/2, pp. 4–28. ISSN 0322-788X (Print). <http://www.czso.cz/csu/2012edicniplan.nsf/engpubl/1802-12-eng_q2_2012>.

DUBSKA, D. Impact of the Economic Crisis on the Institutional Sectors of the Czech Economy [online]. *Statistika, Economy and Statistics Journal,* 2011/4, pp. 4–21. <http://www.czso.cz/csu/2011edicniplan.nsf/engpubl/1802-11-eng_q4_2011>.

DUBSKA, D. Real and Sustainable Growth (Czech only). *Ekonom* Weekly, November, 44/1998, pp. 28–31.

DUBSKA, D. *Savings and Indebtedness: Are the Czech Households in a Debt Trap?* (Czech only). Prague: Czech Statistical Office, November 2008. ISBN 978-80-250-1743-2.

DUBSKA, D. The Hovering Fog in the Balance Sheets of Banks (Czech only). *Ekonom* Weekly, January, 4/2000, pp. 28–31.

GERSL, A., SEIDLER, J. *Excessive Credit Growth as an Indicator of Financial (In)Stability and Its Use in Macroprudental Policy* [online]. Prague: Czech National Bank, May 2011. <http://www.cnb.cz/miranda2/export/sites/www.cnb.cz/en/financial_stability/fs_reports/fsr_2010-2011/fsr_2010-2011_article_2.pdf>.

HEMPEL, G., SIMONSON, D., COLEMAN, A. *Bank Management: Text and Cases.* 4th ed. John Wiley & Sons, Inc., 1994. ISBN 0-471-55256-9.

KOCH, T. W., MACDONALD, S. S. *Bank Management.* 7th ed. Mason, Ohio, USA: South-Western CENGAGE Learning, 2010.

ROSE, P. S. *Commercial Bank Management.* 5th ed. New York: McGraw-Hill, 1993. ISBN 0-07-112122-6.

ANNEX

Table A1 Indicators of the banking sector and in the Czech Republic and related indicators

	2006	2007	2008	2009	2010	2011
Macroeconomic environment						
Real GDP growth (y-o-y, %)	7.2	5.7	2.9	–4.5	2.6	1.7
Public finance deficit/nominal GDP (%)	–2.4	–0.7	–2.2	–5.8	–4.8	–3.1
Financial sector						
Financial sector assets / GDP (%)		133.3	135.6	141.3	142.9	150.2
Share of banks in financial sector assets (%)		76.8	77.5	77.5	77.6	78.2
Banking sector						
Bank assets / GDP (%)	94.0	102.4	105.1	109.5	111.0	117.5
Share of client loans in total assets (%)	45.2	48.4	50.8	50.3	50.6	50.5
Share of bond holding in total assets (%)	23.1	22.6	20.0	21.2	21.1	21.9
Share of client deposits in total liabilities (%)	66.7	65.6	64.2	66.6	67.3	65.9
Share of bond issued in total liabilities (%)	8.5	9.4	9.0	8.8	8.4	8.4
Client loans / client deposits	67.7	73.8	79.1	75.5	75.2	76.6
Share of non-financ. corp. in total liabilities (%)	44.9	41.7	40.9	37.2	35.9	35.9
Share of households in total liabilities (%)	35.0	37.5	38.9	42.7	44.2	43.8
Growth in loans (y-o-y, %, end of period)						
Total	19.9	26.4	16.4	1.3	3.5	6.0
Non financial corporations	20.8	17.2	14.1	–7.8	–0.3	6.1
Households	30.4	35.1	20.9	11.1	7.0	5.0
- loans for house purchase	32.5	37.6	20.1	11.5	6.4	6.1
- consumer credit	26.5	26.1	22.8	9.8	7.	–1.6
Non-performing loans / total loans (%)						
Total	3.6	2.7	3.2	5.2	6.2	5.9
Non financial corporations	4.4	3.1	4.2	7.9	8.9	8.2
Households	2.9	2.7	2.7	3.8	5.0	4.9
Coverage of non-perform. loan by provisions (%)	53.6	60.0	58.1	50.1	46.8	48.9
Aggregate LTV for housing mortgages	42.6	44.7	43.3	*56.4	56.3	57.0
Capital adequacy (%)	11.4	11.5	12.3	14.1	15.5	15.3
Return of assets	1.2	1.3	1.2	1.5	1.3	1.2
Return of Tier 1	22.5	24.4	21.7	25.3	26.1	26.9
Quick assets / total assets (%)	30.4	24.0	23.1	25.3	26.1	26.9
Quick assets / client deposits	45.5	35.6	35.9	38.0	38.8	40.8
Net external position (% of GDP)	9.4	9.2	6.6	6.2	5.7	5.0

* The definition of mortgages was changed in 2009.
Source: Czech National Bank, Financial Stability Report 2011/2012

Strengthening the Role of Information and Indicators at the Rio +20 Summit

Bedřich Moldan[1] | *Charles University Environment Center, Prague, Czech Republic*

INTRODUCTION

The outcome document of the UN Conference on Sustainable Development held in Rio de Janeiro in June 20–22 (Rio +20 Summit) is called "The Future We Want" (FWW). Several months before the Summit, the Report of the UN Secretary–General´s High-Level Panel on Global Sustainability entitled "Resilient People Resilient Planet: A Future Worth Choosing" (RP) was launched. In both of these two important documents and within the preparatory process and several follow-up activities the role of science-based quantitative information, analysis and indicators was stressed. We would like to focus on four areas. Our analysis will be based primarily on the appropriate paragraphs from the aforementioned documents.

1 STRENGTHENING THE ROLE OF SCIENCE-BASED ANALYSIS

It is emphasized in many places that decision making should be supported by data, information and assessment. *Governments, international institutions and international development banks should step up their efforts to promote sustainable development and to assess and monitor adequately the consequences of their policies in the social and environmental spheres* (RP, recommendation 33).

Reliable data and information are particularly important for promoting one of the major goals of the Summit, namely the green economy: *We acknowledge that it will be important to take into account the opportunities and challenges, as well as the costs and benefits, of green economy in the context of sustainable development and poverty eradication, using the best available scientific data and analysis…* (FWW, § 63).

One of the important features of the Rio+20 Summit was its focus on an adequate balance between and among the three pillars of sustainable development. At the outset of the Conference it was stressed in particular that less attention is given to the environmental pillar than the other two. This was reflected in the efforts to strengthen the United Nations Environmental Programme (UNEP). The whole IC section of the outcome document is entitled "Environmental pillar in the context of sustainable development". A special feature of the UNEP is its strong association with science. This is also stressed by the Rio+20 recommendation: *Promote a strong science-policy interface, building on existing international instruments, assessments, panels and information networks, including the Global Environmental Outlook, as one of the processes aimed at bringing together information and assessment to support informed decision making* (FWW, §88d). *Disseminate and share evidence-based environmental information and raise public awareness of critical as well as emerging environmental issues* (FWW, §88e).

The document Resilient People Resilient Planet recognizes that many critical natural systems are under severe stress. It recommends that *Governments and the scientific community should take practical steps, including through the launching of a major global scientific initiative, to strengthen the interface between pol-*

[1] Charles University Environment Center, José Martího 2/407, 162 00 Prague, Czech Republic. E-mail: bedrich.moldan@czp.cuni.cz, phone: (+420)220199471.

icy and science. This should include the preparation of regular assessments and digests of the science around such concepts as "planetary boundaries", "tipping points" and "environmental thresholds" in the context of sustainable development… (RP, Box 2, recommendation 51). A key element here is developing a reliable set of indicators quantifying the individual boundaries, thresholds and tipping points.

The development and promotion of geospatial information is another important area of work emphasized by the outcome document, as geographic considerations are uniquely important for environmental decision making. The Conference therefore recognized *the importance of space-technology-based data, in situ monitoring, and geospatial information for sustainable development policymaking…* (FWW §276).

A large part of the outcome document was devoted to action and follow-up under the various thematic areas and/or cross-sectoral issues. Mention was made in many places of the value and importance of observation, monitoring, data collection, use and analysis of indicators, and the setting of goals and targets: *We recognize that goals, targets and indicators, including where appropriate gender-sensitive indicators, are valuable in measuring and accelerating progress* (FWW §104). The importance of such information is specifically stressed within the sections on sustainable cities and human settlements (FWW §136), health and population (FWW §138), oceans and seas (Global Reporting and Assessment of the State of Marine Environment, FWW §161), disaster risk reduction (the importance of early warning systems and geospatial information, FWW 187), biodiversity, desertification, land degradation and drought (§204), and chemicals and waste (science-based assessment of the risks posed by chemicals to human beings and the environment, FWW §220).

2 SUSTAINABLE DEVELOPMENT CRITERIA

The document Resilient People Resilient Planet promotes an important instrument for assessment relevant to various activities focused on sustainable development. Governments should establish price signals that value sustainability to guide the consumption and investment decisions of households, businesses and the public sector by:

- *Establishment of natural resource and externality pricing instruments,*
- *Schemes for payments of ecosystem services* (RP recommend 27),
- *Sustainable development criteria for public institution procurement* (RP recommend 28),
- *Long-term sustainable development criteria in investment* (RP recommend 30).

Sustainable development criteria should be also applied by financial institutions, stock market regulators, and credit ranking agencies (RP recommend 32). An indispensable prerequisite for developing such criteria within various contexts is solid data and an indicator framework. However, sustainable development criteria should be understood with appropriate caution as they may be seen as an instrument of green conditionality by some sectors or countries.

3 "BEYOND GDP" INDICATORS

It is generally accepted that the fundamental economic indicator of Gross Domestic Product was not designed to measure prosperity and human wellbeing. However, in many cases it is taken as an appropriate proxy even if several alternatives already exist, such as the Human Development Index of the United Nations Development Programme (UNDP 2012). There is a growing need to develop an indicator or set of indicators that are more inclusive of social and environmental aspects to cover the concept of sustainable development in its totality. The document Resilient People Resilient Planet devotes a lot of attention to this issue in section D "Establishing a common framework for measuring progress". Several international initiatives are mentioned here, including the Report of the Commission on the Measurement of Economic Performance and Social Progress established by Nicolas Sarkozy (Stiglitz et al., 2009). Hák and Janoušková (2012) provide a detailed analysis of efforts of OECD and European Commission (Eurostat) in this respect. These organizations have proposed indicators/indices presuming

to give politicians the lacking information on worthy elements of development (wellbeing and possibility of its lasting in the future). All the findings might be summarized in the following recommendation: *To measure progress on sustainable development, a Sustainable Development Index or set of indicators should be developed by 2014. To this end, the Secretary-General should appoint a technical task force, including relevant stakeholders* (RP, recommend 39).

The same question is addressed in The Future We Want in § 38: *We recognize the need for broader measures of progress to complement gross domestic product in order to better inform policy decisions, and in this regard we request the United Nations Statistical Commission , in consultation with relevant United Nations system entities and other relevant organizations, to launch a programme of work in this area building on existing initiatives.* Here we see a concrete request promoting a specific UN body to work on this issue. Many national statistical offices around the world are working in this direction. Eurostat and the European Commission, who started a broad process called GDP and Beyond (EC 2009), are very active in this respect.

4 SUSTAINABLE DEVELOPMENT GOALS

Following the proposals made by Colombia and Guatemala, the participants at Rio+20 agreed to establish a set of sustainable development goals (SDGs). These should guide the post-2015 development agenda, as that is the date the Millennium Development Goals expire. The SDGs should address and incorporate the social, economic and environmental dimensions of sustainable development in a balanced, holistic, coherent and synergistic way while capturing inter-linkages and cross-cutting issues. The SDGs should be focused on priority areas for the achievement of sustainable development. According to The Future We Want SDGs *should be action-oriented, concise and easy to communicate, limited in number, aspirational, global in nature and universally applicable to all countries while taking into account different national realities…* (FWW §247). It is clear enough that without appropriate measurement, data, and statistics such goals cannot be meaningful. This is fully acknowledged: *We recognize that progress towards the achievement of the goals needs to be assessed and accompanied by targets and indicators…* (FWW §250). *We recognize that there is a need for global, integrated and scientifically based information on sustainable development…* (FWW §251).

5 RIO+20 FOLLOW-UP

The most important result of the Rio+20 Summit is the decision to establish the Sustainable Development Goals. To this end, a process of preparation was started: *We resolve to establish an inclusive and transparent intergovernmental process on sustainable development goals that is open to all stakeholders, with a view to developing global sustainable development goals to be agreed by the General Assembly. An open working group shall be constituted…* (FWW §248). Responding to this request, the Secretary-General prepared an Initial Input into the open working group. This document stresses that the development of SDGs should be linked to assessing progress. To this end, it was suggested that a system for monitoring and accountability and a well-functioning set of indicators would need to be created (UNS-G 2012).

The European Union fully accepted the outcomes of the Rio+20 Summit. At its European Council (Environment) session on 31 October 2012 it adopted the Conclusions reaffirming all the main results of Rio+20. In particular, *it stressed the need to further develop science-based and rigorous methods of measuring growth, natural wealth and social well-being and calls on the UN Statistical Commission to launch the programme of work on broader measures of progress towards sustainability to complement GDP* (Council 2012, §15). It also states that the *SDGs should be global in nature and universally applicable to all countries, limited in number, action-oriented, easy to communicate and linked to concrete targets and indicators* (Council 2012, §30).

CONCLUSION

The outcome document of the Rio+20 Summit was criticized for not being ambitious enough, and not setting any concrete commitments or new bold initiatives. However, within the realm of measurement, scientific assessment and policy-relevant information it represents an important stimulus and challenge for the scientific community in general, and for statisticians and other data and information providers in particular. The need for developing and using scientifically based information and analysis for decision making is stressed in many places. In particular, probably the most important decision of the Summit, namely to launch the Sustainable Development Goals, is closely linked to concrete goals and targets. Without rigorous methods of monitoring and assessing progress towards these goals – including new measures to assess human well-being – the SDGs are not conceivable.

References

EUROPEAN COMMISSION. *GDP and Beyond: Measuring Progress in Changing World.* COM fiscal 433 / 2009.

HÁK, T., JANOUŠKOVÁ, S. *Review Report on Beyond GDP Indicators: Categorisation, Intentions and Impacts.* 7 FP Project BRAINPOoL (Bringing Alternative Indicators into Policy) [online]. October 2012. [cit. March 2013]. <http://www.brainpoolproject.eu/wp-content/uploads/2012/12/D1.1_BRAINPOoL_Review_report_Beyond-GDP_indicators.pdf>.

STIGLITZ, J. et al. *Report of the Commission on the Measurement of Economic Performance and Social Progress.* Paris, 2009.

UN. *Conference on Sustainable Development: The Future We Want.* Rio de Janeiro, 22nd June, 2012.

UNDP. *Human Development Report 2012.* New York, 2012.

UN. *Secretary-General´s High-level Panel on Global Sustainability: Resilient People Resilient Planet: The Future Worth Choosing.* New York, January 2012.

UNS-G. *Secretary-General´s Input to the Open Working Group on Sustainable Development Goals.* New York, December 2012.

Recent Publications and Events

New Publications of the Czech Statistical Office

Cizinci v České republice 2012 (Foreigners in the Czech Republic 2012). Prague: CZSO, 2012.
Historická ročenka českého zemědělství 1918–2010 (Historical Yearbook of Czech Agriculture in 1918–2010). Prague: CZSO, 2011.

Other Selected Publications

AZZALINI, A., SCARPA, B. *Data Analysis and Data Mining*. New York: Oxford University Press, 2012.
CIMPLER, P, ŠÍPEK, L. *Obchod a služby cestovního ruchu v ČR 2011–2012* (Trade and Services of Tourism in the Czech Republic 2011–2012). Prague: Grada Publishing, 2013.
HANČLOVÁ, J. *Ekonometrické modelování* (Econometric Modelling). Prague: Professional Publishing, 2012.
HRADECKÝ, P., TURČAN, M., MADRYOVÁ, A. *Pravděpodobnost* (Probability). Ostrava: VŠB – Technical University of Ostrava, 2012.
HUGHES, I. G., HASE, T. P. A. *Measurements and their Uncertainties – A Practical Guide to Modern Error Analysis*. New York: Oxford University Press, 2012.
MAREK, L. *Pravděpodobnost* (Probability). Prague: Professional Publishing, 2012.
SCHNEIDER, F., ed. *Handbook on the Shadow Economy*. Cheltenham, UK: Edward Elgar, 2011.
ŠTĚDROŇ, B., POTŮČEK, M., KNÁPEK, J., MAZOUCH, P. *Prognostické metody a jejich aplikace* (Forecasting Methods and their Applications). Prague: C. H. Beck, 2012.
VONDRA, R. *Peníze v moderních českých dějinách* (Money in Modern Czech History). Prague: Academia, 2012.
WALKER, I. *Výzkumné metody a statistika* (Research Methods and Statistics). Prague: Grada Publishing, 2013.
WAWROSZ, P., HEISSLER, H., MACH, P. *Reálie k makroekonomii – odborné texty, mediální reflexe, praktické analýzy* (Facts on Macroeconomics – Professional Texts, Media Reflections, Practical Analyses). Prague: Wolters Kluwer CR, 2012.

Conferences

The ***59th World Statistics Congress*** (WSC) will be held during ***25–30 August 2013 in Hong Kong, China***. The Scientific Programme of the 59th WSC is developed with an aim to reach out to practitioners in the statistical community and to share and exchange the latest insights in their work. The ISI World Statistics Congress, formerly known as ISI Sessions, takes place once every two years in a different country and is organised with the host country's central bureau of statistics. More information available at: *http://www.isi2013.hk/en/index.php.*

The ***16th International Scientific Conference AMSE 2013*** (Applications of Mathematics and Statistics in Economy) will take place ***from 28 August to 1 September 2013 in Gerlachov, Slovakia***. The aim of the conference is to acquaint the participants of the conference with the latest mathematical

and statistical methods that can be used in solving theoretical and practical economic problems. AMSE 2013 is organized by the University of Economics, Prague, Czech Republic (Faculty of Informatics and Statistics, Department of Statistics and Probability), Matej Bel University, Banská Bystrica, Slovakia (Faculty of Economics, Department of Quantitative Methods and Information Technology) and the Wroclaw University of Economics, Wroclaw, Poland (Department of Statistics). More information available at: *www.amse.umb.sk*.

The ***31st International Conference on Mathematical Methods in Economics*** (MME 2013) will be held during ***11–13 September 2013 in Jihlava, Czech Republic***. The Conference is held under the auspices of the Czech Society for Operations Research, Slovak Society for Operations Research and the Czech Econometric Society. The MME conference is a traditional meeting of professionals from universities and businesses interested in the theory and applications of operations research and econometrics. More information available at: *https://mme2013.vspj.cz*.

The ***7th International Days of Statistics and Economics*** will take place during ***19–21 September 2013 at the University of Economics, Prague, Czech Republic***. The aim of the conference is to present and discuss current problems of statistics, demography, economics, and management and their mutual interconnection. The Conference is organized by the University of Economics, Prague (Department of Statistics and Probability and the Department of Microeconomics), the University of Economics with seat in Košice (Faculty of Business Economics) and the ESC Rennes International School of Business. It is organized at the occasion of the 60th anniversary of the University of Economics, Prague. More information available at: *http://msed.vse.cz*.

New President of the Czech Statistical Society

The General Assembly of the ***Czech Statistical Society*** took place at the University of Economics, Prague on Thursday 31 January 2013. A new committee for the 2013–2015 functional period was selected. ***Hana Řezanková*** from the Faculty of Informatics and Statistics, University of Economics, Prague was elected the new president.

Papers
We publish articles focused at theoretical and applied statistics, mathematics and statistical methods, econometrics, applied economics, economic, social and environmental analyses, economic indicators, social and environmental issues in terms of statistics or economics, and regional development issues.

The journal of *Statistika* has the following sections:
The *Analyses* section publishes high quality, complex, and advanced analyses based on the official statistics data focused on economic, environmental, and social spheres. Papers shall have up to 12,000 words or up to twenty (20) 1.5-spaced pages.

The *Methodology* section gives space for the discussion on potential approaches to the statistical description of social, economic, and environmental phenomena, development of indicators, estimation issues, etc. Papers shall have up to 12,000 words or up to twenty (20) 1.5-spaced pages.

The *Book Review* section brings reviews of recent books in the field of the official statistics. Reviews shall have up to 600 words or one (1) 1.5-spaced page.

Language
The submission language is English only. Authors are expected to refer to a native language speaker in case they are not sure of language quality of their papers.

Recommended Paper Structure
Title (e.g. On Laconic and Informative Titles) — Authors and Contacts — Abstract (max. 160 words) — Keywords (max. 6 words / phrases) — JEL classification code — Introduction — … — Conclusion — Annex — Acknowledgments — References — Tables and Figures

Authors and Contacts
Rudolf Novak*, Institution Name, Street, City, Country
Jonathan Davis, Institution Name, Street, City, Country
* Corresponding author: e-mail: rudolf.novak@domainname.cz, phone: (+420) 111 222 333

Main Text Format
Times 12 (main text), 1.5 spacing between lines. Page numbers in the lower right-hand corner. *Italics* can be used in the text if necessary. *Do not* use **bold** or underline in the text. Paper parts numbering: 1, 1.1, 1.2, etc.

Headings
1 FIRST-LEVEL HEADING (Times New Roman 12, bold)
1.1 Second-level heading (Times New Roman 12, bold)
1.1.1 Third-level heading (Times New Roman 12, bold italic)

Footnotes
Footnotes should be used sparingly. Do not use endnotes. Do not use footnotes for citing references (except headings).

References in the Text
Place reference in the text enclosing authors' names and the year of the reference, e.g. "White (2009) points out that…", "… recent literature (Atkinson et Black, 2010a, 2010b, 2011, Chase et al., 2011, pp. 12–14) conclude…". Note the use of alphabetical order. Include page numbers if appropriate.

List of References
Arrange list of references alphabetically. Use the following reference styles: [for a book] HICKS, J. *Value and Capital: An inquiry into some fundamental principles of economic theory.* Oxford: Clarendon Press, 1939. [for chapter in an edited book] DASGUPTA, P. et al. Intergenerational Equity, Social Discount Rates and Global Warming. In PORTNEY, P., WEYANT, J., eds. *Discounting and Intergenerational Equity.* Washington, D.C.: Resources for the Future, 1999. [for a journal] HRONOVÁ, S., HINDLS, R., ČABLA, A. Conjunctural Evolution of the Czech Economy. *Statistika, Economy and Statistics Journal,* 2011, 3 (September), pp. 4–17. [for an online source] CZECH COAL. *Annual Report and Financial Statement 2007* [online]. Prague: Czech Coal, 2008. [cit. 20.9.2008]. <http://www.czechcoal.cz/cs/ur/zprava/ur2007cz.pdf>.

Tables
Provide each table on a separate page. Indicate position of the table by placing in the text "insert Table 1 about here". Number tables in the order of appearance Table 1, Table 2, etc. Each table should be titled (e.g. Table 1 Self-explanatory title). Refer to tables using their numbers (e.g. see Table 1, Table A1 in the Annex). Try to break one large table into several smaller tables, whenever possible. Separate thousands with a *space* (e.g. 1 528 000) and decimal points with a *dot* (e.g. 1.0). Specify the data source below the tables.

Figures
Figure is any graphical object other than table. Attach each figure as a separate file. Indicate position of the figure by placing in the text "insert Figure 1 about here". Number figures in the order of appearance Figure 1, Figure 2, etc. Each figure should be titled (e.g. Figure 1 Self-explanatory title). Refer to figures using their numbers (e.g. see Figure 1, Figure A1 in the Annex).

Figures should be accompanied by the *.xls, *.xlsx table with the source data. Please provide cartograms in the vector format. Other graphic objects should be provided in *.tif, *.jpg, *.eps formats. Do not supply low-resolution files optimized for the screen use. Specify the source below the figures.

Formulas
Formulas should be prepared in formula editor in the same text format (Times 12) as the main text.

Paper Submission
Please email your papers in *.doc, *.docx or *.pdf formats to statistika.journal@czso.cz. All papers are subject to double-blind peer review procedure. You will be informed by our managing editor about all necessary details and terms.

Contacts
Journal of Statistika | Czech Statistical Office
Na padesátém 81 | 100 82 Prague 10 | Czech Republic
e-mail: statistika.journal@czso.cz
web: www.czso.cz/statistika_journal

Managing Editor: Jiří Novotný
phone: (+420) 274 054 299
fax: (+420) 274 052 133
e-mail: statistika.journal@czso.cz
web: www.czso.cz/statistika_journal
address: Czech Statistical Office | Na padesátém 81 | 100 82 Prague 10 | Czech Republic

Subscription price (4 issues yearly)
CZK 372 (incl. postage) for the Czech Republic,
EUR 110 or USD 165 (incl. postage) for other countries.
Printed copies can be bought at the Publications Shop of the Czech Statistical Office (CZK 66 per copy).
address: Na padesátém 81 | 100 82 Prague 10 | Czech Republic

Subscriptions and orders
MYRIS TRADE, s. r. o.
P. O. BOX 2 | 142 01 Prague 4 | Czech Republic
phone: (+420) 234 035 200,
fax: (+420) 234 035 207
e-mail: myris@myris.cz

Design: Toman Design
Layout: Ondřej Pazdera
Typesetting: Chráněná grafická dílna Slunečnice, David Hošek
Print: Czech Statistical Office

All views expressed in the journal of Statistika are those of the authors only and do not necessarily represent the views of the Czech Statistical Office, the Editorial Board, the staff, or any associates of the journal of Statistika.

© 2013 by the Czech Statistical Office. All rights reserved.

93rd year of the series of professional statistics and economy journals of the State Statistical Service in the Czech Republic: ***Statistika*** (since 1964), ***Statistika a kontrola*** (1962–1963), ***Statistický obzor*** (1931–1961) and ***Československý statistický věstník*** (1920–1930).

Published by the Czech Statistical Office
ISSN 1804-8765 (Online)
ISSN 0322-788X (Print)
Reg. MK CR E 4684