Czech GDP between 1970 and 1989 Based on ESA 2010

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Abstract

Long time series of the main macroeconomic indicators are in demand by researches and economic experts. The Department of Economic Statistics from the University of Economics in Prague reconstructed the historical time series of GDP and its components in ESA 1995. Thus, we interpreted economic development of the Czech Rep. Between 1970 and 2013 based on ESA 1995. In 2014 the Czech Statistical Office recalculated national accounts since 1990 using the newly adapted European standard of accounts 2010. Introducing ESA 2010 brought the need to recalculate the historical time series into this new standard. The paper aims at describing the main adjustments in this recalculation and presenting the main results of expenditure and production approaches to GDP. Since the most important changes in the standards concern capitalisation the most significant changes affected gross capital formation.

Keywords		JEL code
Gross domestic Product, Gross value added, Material Product System, ESA 1995, ESA 2010		*E01, C02, N01, O4*

INTRODUCTION

For the purpose of an economy analysis researchers need long time series of the main economic indicators. Until 2014, researchers had at their disposal the time series of the gross domestic product (GDP) and its components according to the European standards of accounts ESA 1995 (Eurostat, 1996). Data for the period between the years 1970 and 1989 were compiled by the researchers from the Department of Economic Statistics at the University of Economics in Prague. The time series since 1990 is published by the Czech Statistical Office (CZSO) as the part of the national accounts official figures. The methodology of the transformation of the indicators published originally according to the Material Product System (MPS) was described in detail in Sixta and Fischer (2014) and Fischer et al. (2013). It corresponds

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to the works presented by Arvay (1992) and United Nations methodological papers (UN 1977 and UN 1981).

In 2014, a new methodological standard, ESA 2010 (Eurostat, 2011), was implemented by national statistical offices. ESA 2010 brings several adjustments in the calculation of GDP and its components. The capitalisation of expenditures on research and development, the capitalisation of expenditures on weapons and the capitalisation of expenditures on small tools represent the main modifications. Moreover, ESA 2010 introduced changes in sector classification, employee stock options, payable tax credits or FISIM between resident and non-resident financial institutions (for detailed information see Eurostat, 2014). Since we focused on the issue of gross domestic product, only selected methodological changes were taken into account. This implementation caused an inconsistency in the time series of the main Czech macroeconomic indicators. While the CZSO publishes macroeconomic indicators from 1990 onwards in ESA 2010 the first part of the time series was published in ESA 1995. The purpose of our project is the recalculation of the historical time series according to ESA 2010.

The aim of this paper is the description of the main methodology changes from ESA 1995 to ESA 2010 and the recalculation of the historical data. Moreover, we present main results gained for the expenditure and production approaches to GDP. Even though we prepared these estimates on the basis published aggregated data, in principle we respected the approach usually used in official statistics. For the cases of research and development and military weapons, we were able to work with real data, see below. The case of small tools was rather more difficult with respect to changing accounting environment and the estimates are based on model approach. Primary data and in many cases aggregated data were inevitably lost during the transformation of Czechoslovak statistics and the rest of them during floods in 2002. Despite these difficulties, we tried to prepare data to be fully consistent with the figures officially published by CZSO for the Czech Republic.

1 DATA AND METHODOLOGY

The methodology of the composition of historical time series of the Czech GDP was described in detail in Sixta and Fischer (2014). This paper focuses on the description of main methodology changes from ESA 1995 to ESA 2010 and its impact on the historical numbers. The most important changes in terms of GDP relate to the capitalisation of expenditures on research and development (R&D), the capitalisation of expenditures on weapons and the capitalisation of small tools. All these changes are connected with the definition of an asset.

The capitalisation of expenditures on R&D reflects changes in society. Such expenditures are expected to bring benefits in the future. Purchases of R&D services and individual expenditures on intermediates, compensation of employees and consumption of fixed capital are regarded as capital formation. In practice, it is recorded similarly to other output for own final use. Data of R&D are not surveyed directly. They are estimated as national accounts adjustment which SNA 2008 regards one of the most important modifications. It represents a significant change that leads to an increase of GDP values. The estimations of the historical data were prepared according to the recommendations described in Eurostat (2014). We use data on current expenditures from statistical Yearbooks 1973–1992 and Selected Indicators of the Balance of Sources and Uses of Global Product and National Income 1980–1985 (CZSO, 1987).

The capitalisation of expenditures on weapons divided noticeably into military and non-military investment. Based on ESA 1995 the purchases of military aircraft and other weapons were treated as intermediate consumption. With ESA 2010 the perception changed. Weapons should provide defence services and the impact of weapons is measured by consumption of fixed capital (CFC) of weapons. For the reconstruction of the historical time series we had to find data for the period between 1970 and 1989 to construct capital formation. Consumption of fixed capital was estimated according to the Perpetual

Inventory Method (PIM).[5] Since data were available for Czechoslovakia only, CFC split between the Czech Republic and Slovakia with the proportion of two thirds to one third, respectively. It corresponded to the procedures used by statisticians in Czechoslovakia in such cases.

The last mentioned adjustment occurred from the updated definition of gross fixed capital formation. This arises from the ESA 1995 act stating that all purchases of small tools with the value lower than 500 ECU in 1995 prices are treated as intermediates (Eurostat, 1996). ESA 2010 dropped this limitation. The only relevant condition for recording capital formation is the usability of small tools for longer time than one year in the production process. This issue is closely connected with accounting procedures in the economy. When CZSO prepared the revision of national accounts, this adjustment presented one of the most important parts among all adjustments. This arises from the relative rigidity in the rules of the income tax law and constantly decreasing prices of electronic devices. Since it was practically impossible to find historical data for small tools, we used the average percentage to decrease intermediate consumption (1.2% of intermediate consumption).[6]

Table 1 shows the impact of all the mentioned adjustments on GDP. Apparently, the capitalisation of research and development represented the most significant impact in the period between the years 1970 and 1990 (it caused the increase of GDP by 2.22% in 1970 and 2.11% in 1980). Since 1990 the impact of the capitalisation of small tools has become the important one (1.66% of GDP in 2010). With respect to the economic development of the Czech Republic in 1970s and 1980s, the changes given by R&D are more important. One of the possible explanations lies in the approach to research institutes with sufficient number of workers and overall amount of paid wages. As expected, the implantation of ESA 2010 affects mainly the "level" of GDP rather than growth rates. Therefore, there are only visible long term tendencies. The changes connected with transformation of the economy are also reflected in increased purchases of small tools (including computers), dissolution of research institutes etc.

Table 1 Impact of inclusion of selected adjustments on GDP, %

	1970	1980	1990	2000	2010
Capitalisation of research and development	2.22	2.11	1.12	1.33	1.20
Capitalisation of weapons	0.17	0.15	0.88	0.25	0.16
Capitalisation of small tools	1.50	1.63	2.76	1.23	1.66
Total	**3.89**	**3.89**	**4.76**	**2.81**	**3.02**

Note: The figures in the table were calculated as a share of each methodical adjustment on GDP in ESA 1995.
Source: Czech Statistical Office, authors' calculation (1970–1989)

There are more methodology adjustments which influenced sources and uses of GDP. They include other adjustments given by the new national accounts standards ESA 2010 and various improvements prepared by statisticians. Due to a lack of data sources we could not manage to estimate adjustments with a limited impact on GDP (e.g. dwelling services, insurance services etc.). Table 2 presents the impact of all adjustments on GDP. The impact of other adjustments represents 0.7% of GDP in the period between 1970 and 1989. Since 1990 their impact increased up to 1.6%.

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[5] We would like to thank Dr. Martina Němečková from the Czech Statistical Office for her support and estimates of consumption of fixed capital on military equipment.

[6] Apparently, it is a very simple method. However, due to the comparability of our and official estimates it is necessary to calculated it this way. With respect to accounting rules in socialism. The investments thresholds were about 3 000 or later 5 000 CSK by 1993.

**Table 2** Impact of all adjustments on GDP, mil. CSK/CZK, %

	1970	1980	1990	2000	2010
GDP ESA 1995	292 954	459 247	632 691	2 269 695	3 775 237
GDP ESA 2010	306 431	480 605	672 776	2 372 630	3 953 651
Adjustments	13 477	21 358	40 085	102 935	178 414
- Selected (R&D, weapons, small tools)	11 381	17 862	30 171	63 815	113 918
- Other	2 096	3 496	9 914	39 120	64 496
Total GDP increase, %	4.6	4.7	6.3	4.5	4.7

Source: Czech Statistical Office, authors' calculation (1970–1989)

2 RESULTS

The first results of our project consist of production and expenditure approaches to GDP, i.e. it covers sources and uses of GDP. Presented values are balanced and compiled according to the ESA 2010 methodology. The process of calculation ensured consistency with the officially published data by CZSO from 1990 onwards. Thus, the time series of GDP and its components from 1970 to the present should be free of methodological inconsistencies and time series breaks.

Figure 1 shows the comparison of GDP using ESA 1995 and ESA 2010 methodology. No significant differences in the development at current prices occurred. This applies mainly to the period between 1970 and 1990. This is caused mainly by the fact that the latest updates of ESA were connected with the knowledge based economy. Effects given by new statistical issues as small tools and R&D expenditures compensate each other. Therefore, methodological adjustments rarely play an important role in the estimates of real growth.

Figure 1 Comparison of GDP between ESA 1995 and ESA 2010 methodology, current prices, 1970–2010, bn. CSK/CZK
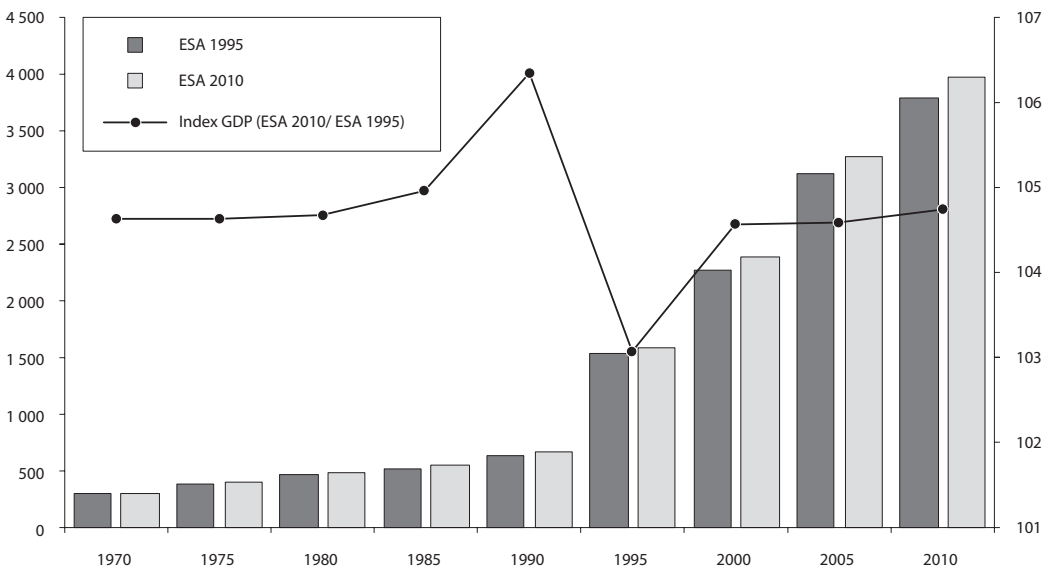
Source: Czech Statistical Office, authors' calculation (1970–1989)

Figure 2 presents volume indices. Apparently, methodological adjustments have no impact on the real development with the most significant drops in 1982 (1.5%) and 1991 (10.0%).

Figure 2 GDP, volume indices, 1970–2010

Source: Czech Statistical Office, authors' calculation (1970–1989)

2.1 Production approach

Gross value added (GVA) brings the most valuable data within the *production approach*. The picture of the economy reflects the currently used industrial classification of NACE rev.2. Figure 3 presents the significant change of the structure of Czech economy between the years 1970 and 2010. The changes were fundamental and the current economy is based on radically different foundations than 40 years ago. The most significant is the decrease of the share of agriculture (A) from 9.5% in 1970 to 1.7% in 2010. Similar development occurred in manufacturing, electricity and water supply and mining; the share of these industries (B to E) decreased by 13.5 p.p. between the years 1970 and 2010. On the other hand, the share of services such as information and communication, financial and insurance activities and real estate activities (J to L) increased by approximately 13 p.p. While in 1970 the GVA of these industries constituted 6.0% of the total GVA, in 2010 it reached 18.9%.

Table 3 shows the changes from ESA 1995 to ESA 2010 concerning GVA broken down by industries. The adjustments mainly changed services such as communication and financial activities. Involving the adjustments decreased the amount of these industries by approximately 5%. On the contrary, in the year 2000 and 2010 the GVA of communication and financial activities (J to L) increased by 18.9% and 14.3% respectively. The impact of research and development is very significant between 1970 and 1990. It is mainly recorded in the industry of Professional, Scientific and Technical Activities (M).

Figure 3 Gross value added in ESA 2010 broken down by industries (CZ-NACE), %
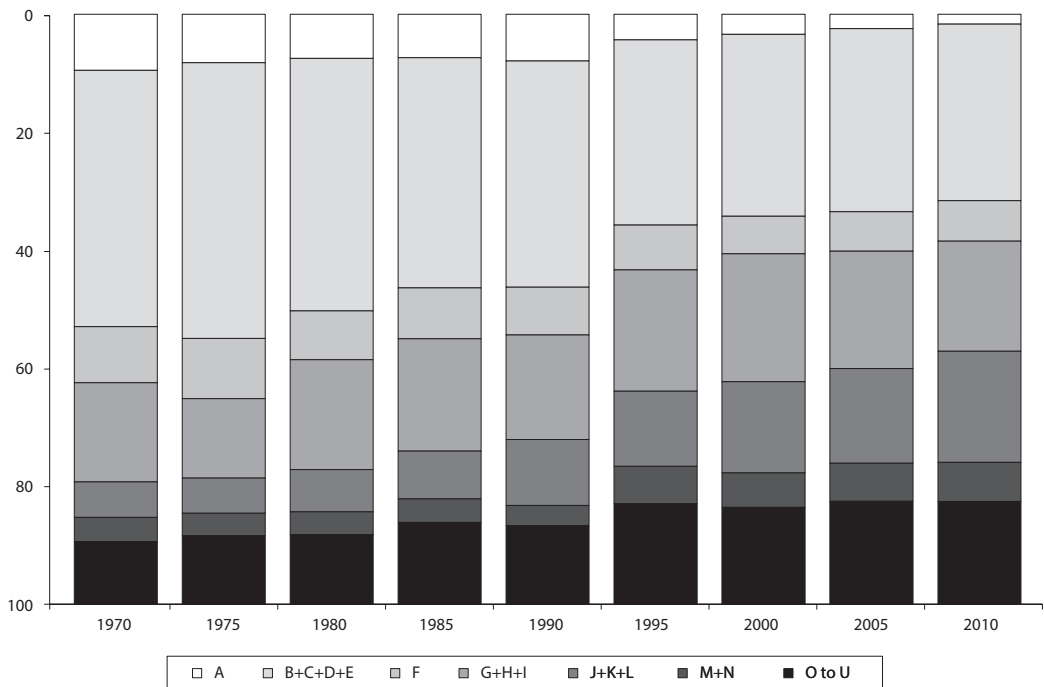
Source: Czech Statistical Office, authors' calculation (1970–1989)
Note: A = Agriculture, Forestry and Fishing; B = Mining and Quarrying; C = Manufacturing; D = Electricity, Gas, Steam and Air Conditioning Supply; E = Water Supply; Sewerage, Waste Management and Remediation Activities; F = Construction; G = Wholesale and Retail Trade; Repair of Motor Vehicles and Motorcycles; H = Transportation and Storage; I = Accommodation and Food Service Activities; J = Information and Communication; K = Financial and Insurance Activities; L = Real Estate Activities; M = Professional, Scientific and Technical Activities; N = Administrative and Support Service Activities; O = Public Administration and Defence; Compulsory Social Security; P = Education; Q = Human Health and Social Work Activities; R = Arts, Entertainment and Recreation; S = Other Service Activities; T = Activities of Households as Employers; Undifferentiated Goods- and Services-Producing Activities of Households for Own Use; U = Activities of Extraterritorial Organisations and Bodies.

2.2 Expenditure approach

Table 4 presents all main components of *the expenditure approach* to GDP. As the most important changes between both standards relate to capitalisation, the most significant changes affected gross capital formation (GFC). The increase of GCF varies from 13% to 19% in the period between the years 1970 and 1990. After 1990 the development is similar. There are several explanations of this development. Prior to 1990 expenditures on R&D were relatively high. There were many research institutes with high number of workers. Contrariwise after 1990 the impact of small tools rose. This can be explained by purchases of small devices, software, laptops, mobile phones and other modern devices with a low purchasing value. The change of final consumption expenditures contains changes in government non-market output given by an increased consumption of fixed capital from selected new types of assets. A small change of household consumption represents an improvement in the measurement of dwelling services. The impact on export and import is given by processing services. As exports and imports are available only for former Czechoslovakia we originally used the available data – i.e. those based on MPS – for the Czech Republic and Slovakia.

Table 3 Changes in gross value added broken down by industries (CZ-NACE), mil. CSK/CZK, current prices

	1970			1980			1990			2000			2010		
	ESA 2010	ESA 1995	diff. (%)	ESA 2010	ESA 1995	diff. (%)	ESA 2010	ESA 1995	diff. (%)	ESA 2010	ESA 1995	diff. (%)	ESA 2010	ESA 1995	diff. (%)
A	25 884	25 619	1.0	32 904	32 440	1.4	48 745	48 336	0.8	74 111	74 301	-0.3	60 217	56 659	6.3
B+C+D+E	118 254	111 359	6.2	187 543	176 731	6.1	236 467	222 618	6.2	668 006	638 892	4.6	1 071 734	1 015 455	5.5
F	25 926	24 755	4.7	36 374	34 394	5.8	52 419	49 690	5.5	138 046	135 607	1.8	246 127	250 786	-1.9
G+H+I	45 680	44 117	3.5	81 625	79 072	3.2	114 987	111 208	3.4	470 150	470 385	0.0	668 181	663 610	0.7
J+K+L	16 433	17 445	-5.8	31 410	33 082	-5.1	49 962	52 334	-4.5	335 233	281 895	18.9	675 589	590 809	14.3
M+N	11 158	9 350	19.3	16 870	13 870	21.6	22 036	17 577	25.4	126 751	117 996	7.4	237 179	233 167	1.7
O to U	28 872	26 085	10.7	51 730	47 509	8.9	87 555	80 853	8.3	355 660	345 925	2.8	623 842	609 812	2.3
Total	272 207	258 730	5.2	438 456	417 098	5.1	612 172	582 616	5.1	2 167 957	2 065 001	5.0	3 582 869	3 420 298	4.8

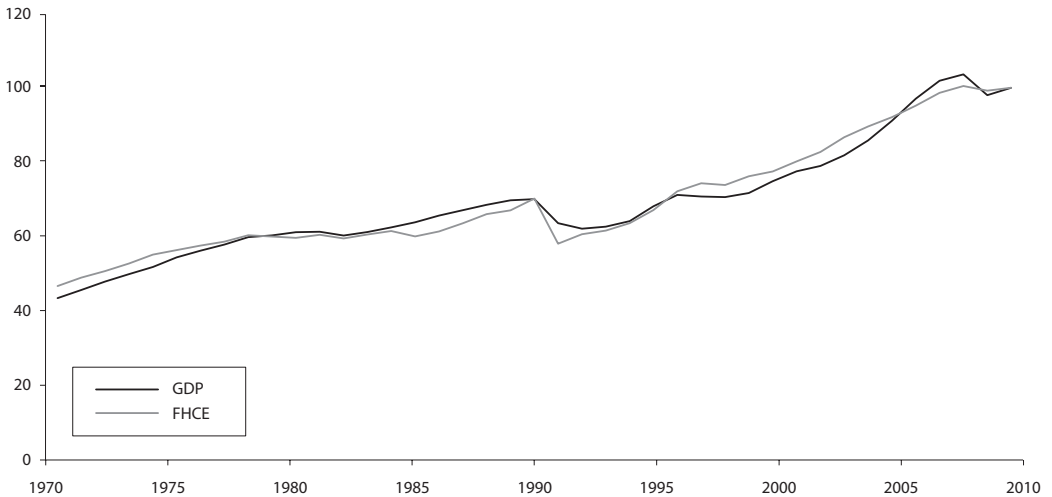Source: Czech Statistical Office, authors' calculation (1970–1989)

Table 4 The components of expenditure approach to GDP, bn. CSK/CZK

		1970	1975	1980	1985	1990	1995	2000	2005	2010
ESA 1995	GDP	293.0	384.1	459.2	520.6	632.7	1 533.7	2 269.7	3 116.1	3 775.2
	FCE	194.7	253.3	305.7	364.4	464.9	1 096.4	1 639.0	2 205.1	2 707.6
	GCF	74.9	108.1	122.1	118.9	152.8	492.8	679.3	825.9	947.1
	NX	23.4	22.7	31.5	37.3	287.8	741.7	1 391.6	2 025.9	2 592.2
ESA 2010	GDP	306.4	401.8	480.6	546.3	672.8	1 580.1	2 372.6	3 258.0	3 953.7
	FCE	197.1	256.4	309.5	369.7	476.7	1 094.1	1 669.2	2 231.0	2 756.8
	GCF	86.0	122.7	139.6	139.4	181.1	535.1	747.4	950.3	1 074.4
	NX	23.4	22.7	31.5	37.3	274.4	644.0	1 152.7	2 046.8	2 645.5

Source: Czech Statistical Office, authors' calculation (1970–1989)
Note1: GDP = Gross domestic product, FCE = Final consumption expenditure, GCF = Gross capital formation, NX = Net exports of goods and services.
Note2: Imports and exports are not available separately. Only net export is known.

Figure 4 GDP and Final household consumption expenditures per capita, constant prices of 2010, 1970–2010

Source: Czech Statistical Office, authors' calculation (1970–1989)

GDP and all other macroeconomic indicators of national accounts were affected both at current and constant prices. All the adjustments had to be deflated separately with their individual price indices. Despite that the resulting impact on real aggregates is very limited because none of these adjustments fluctuate significantly in consecutive years. The impact on GDP varies from –0.2% to 0.2% in the period in question. As figure 4 shows, in 1970 the real GDP per capita was only 45.5% of its value in 2010. GDP per capita increased 2.3 times and final household consumption expenditures 2.1 times. Between the years 1970 and 1980 Czech economy was permanently growing. In early 1980s, former Czechoslovakia suffered from a deferred oil-shock as the Soviet Union increased their oil prices. On the other hand, late 1980s were connected with deep socio-economic changes. After 1996 we observed an increase of the economy which ended by the economic recession in 2009.

CONCLUSION

There is a demand and good use for long time series of macroeconomic indicators. Some important decisions, not only political, largely dependent on the data from national accounts. For example, regional funds extensively rely on the data published by regional accounts or the Treaty of Maastricht emphasized the role of government accounts deficit and debt etc. Moreover, a lot of research mainly from academic sphere require data for a long time analysis. Therefore, we prepared the historical time series of Czech GDP according to ESA 1995. These data were published in 2013. Unfortunately, the implementation of ESA 2010 in 2014 made our work out to date. Thus, we updated our previous research and recalculated the expenditure and production approaches to GDP in ESA 2010.

This paper presents our first results and differences between the results gained in ESA 1995 and ESA 2010. The implementation of ESA 2010 brought about a significant impact mainly on gross capital formation as most of the adjustments concerned capitalisation. Another important alteration emerged in the value of GDP and final household consumption expenditures per capita in constant prices of 2010. GDP per capita increased 2.3 times and final household consumption expenditures 2.1 times.

All figures prepared within this project are fully consistent with the data officially published by CZSO from 1990 onwards and will be published at the website of the Department of Economic Statistics at the end of 2016. Our results will present the figures of total employment divided by the NACE rev. 2 classification as well. This allows us to recalculate labour productivity of Czech industries as it was presented in Vltavská and Sixta (2015). Moreover, we will prepare the income approach which was not prepared in ESA 1995. This brings us a new look at the income side of the economy.

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