

Retrospective Measures of GDP Using Input-output Tables for Former Czechoslovakia¹.

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1. Foreword

The development of economy can be measured by many indicators but mainly gross domestic product (GDP) is used. Better indicators like gross national income and gross national disposable income are not very popular among economic analysts. Although we prefer national income to domestic product, domestic product is easier to measure. The description of the development of economy in a long perspective is common only for some developed countries, e.g. series of GDP for USA starts in 1929 [16]. If we focus on the new EU members, like the Czech Republic, Poland, Slovakia etc., it is difficult to obtain time series starting before 1995. Data for the Czech Republic are available since 1995 onwards in SNA 1993 (ESA 1995) methodology. The Czech Republic is a successor of Czechoslovakia and it was founded 1.1.1993; for the period 1993 – 1995 only volume indices of GDP can be found.

We focus on the estimates of GDP for the Czech Republic (former Czech Socialistic Republic) both at current and constant prices. There are two important problems that we currently face. The first problem is the lack of data. When socialist regime in former Czechoslovakia fell down, many experts left the statistical office. Subsequently, the statistical office decided to switch from material product system (MPS) to system of national accounts (SNA) 1968 [12]. The links between socialist statistics and newly established statistics were broken down. Lots of data that survived the change of the system were destroyed during catastrophic floods in August 2002. The second problem is caused by different methodology. The system of national accounts (SNA) represents consistent and systematic approach to the description of the economy but socialist countries used their own approach, material product system (MPS) [2], [5] and [7]. These systems have the same basic notion but they differ mainly in the scope. MPS was aimed at material products and productive services while SNA tries to cover both market and non-market production. There are also other differences in the distribution of income and financial accounts but this paper deals with gross domestic product only.

2. Methodology

During the socialism, many projects regarding to the comparison of SNA and MPS were done (e.g. [1]). Experts from the West met experts from the East and they provided methodological papers under the UN. Nowadays, these papers are considered to be very old. Moreover, SNA was changed in 1993 [14] and existing comparisons refer to SNA 1968. When entering the EU, new member states faced to the problems of keeping European System of Accounts 1995 (ESA 95) [4] and all the effort was devoted to this task. The main issue for the Czech Republic was to compile national accounts in line with ESA 95 since 1995 onwards. It caused that the previous system of work and data sets were mainly forgotten or lost.

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When comparing SNA and MPS, the main difference is in the range of activities covered by both systems. We focus on the production account. Production is represented in MPS as global product (GP). Global product covers goods and material services produced in material sphere. In SNA, production is represented by output covering market and non-market output. Therefore the difference is not only in market and non-market output but also in market output. MPS uses goods and material services only. According to [12], the transition from global product to gross domestic product was following:

1. **Global product**
2. Costs of the provision of non-material services
3. Profit and loss of non-material sphere
4. State insurance services
5. Non-material production of households
6. **Output** = 1 + 2 + 3 + 4 + 5 + 6
7. Material part of intermediate consumption
8. Non-material part of intermediate consumption
9. **Intermediate consumption** = 7 + 8
10. **Gross domestic product at market prices** (basic prices) = 6 – 9
11. Taxes on products
12. Interventions in purchases
13. Imputed bank services
14. **Gross domestic product at producers' prices** = 10 + 12 + 13

Currently, the difference between MPS and SNA is more significant because of the change of SNA in 1993. Recently issued SNA 2008 is not taken into account because EU countries will use it in 2014. The process of transition from global product to GDP described above is based on the approach of experts in 1990s. Nowadays, some issues may be considered differently, e.g. point 14. is described as GDP at producers' value; actually it is valued at purchasers' prices in current methodology.

Generally, the MPS in socialist bloc was not as much harmonised as SNA in the West. Therefore there were differences among countries in socialist block. Especially Hungarian approach was a bit different and Hungary was able to provide data in SNA methodology, as well. Political reasons in the Czechoslovakia after 1968² caused that a lot of work on harmonisation and publication of different statistical data on Czechoslovak economy was stopped. MPS was being developed during socialist era but practically it was also influenced by different economic level of socialist countries. According to [1], there was planned an updating programme of MPS in 1986. The programme was aimed at producing one single methodological document and removing several differences between MPS and SNA. The part

² There was an invasion of Warsaw Pact armies in August 1968.

concerning the difference between MPS and SNA was postponed to 1989 and finally terminated because of the political changes in socialist countries.

MPS after the revision in 1986 included following chapters:

1. The balance of production, consumption and accumulation of the global products (the material balance);
2. The balance of production, distribution, redistribution and final disposition of the global product and the national income (the financial balance);
3. The input-output table;
4. The manpower balance;
5. The indicators of the national wealth and the balance of fixed assets;
6. The indicators of the incomes and consumption of the population;
7. The balance of non-material services.

In the case of former Czechoslovakia, the Federal Statistical Office was able to fulfil MPS criteria fully and there were also experts who cooperated on international comparison programme. Lot of their work was not published or even considered as secret. Anyway, it was possible to provide some picture of the Czechoslovak economy in nowadays methodology. The case of Czech and Slovak statistical offices was different. Although Czechoslovakia was organised as a federative state, there were disproportions between these three offices. Federal office was responsible for federal indicators and for the methodology, as well. Slovak statistical office closely cooperated with research institution in Slovakia. The main purpose of the Czech and Slovak office was data collection. Similar organisation of work can be found in many other countries that had to built up their statistics from the base (post Yugoslavian countries, Ukraine, etc.). The misbalance was therefore also between Czech and Slovak statistical office. It explains the lack of data for the Czech Republic.

Specific approach is required because of the development of methodology. Particularly, it means following issues:

- a. Non-market services provided for free or nearly for free by government and non-profit institutions. The valuation of such output is based on the cost method covering intermediate consumption, compensation of employees and consumption of fixed capital. The approach to non-market services will be simplified because some government services are hardly to split between Czech a Slovak republic (defence, justice, etc.). A problematic issue is the valuation of consumption of fixed capital at replacement costs [11].
- b. Own-account output covering mainly own-account investments (in companies and individual housing construction), dwelling services (imputed rent) and self-supply of households.

3. Basic Facts About Czechoslovak Economy by MPS

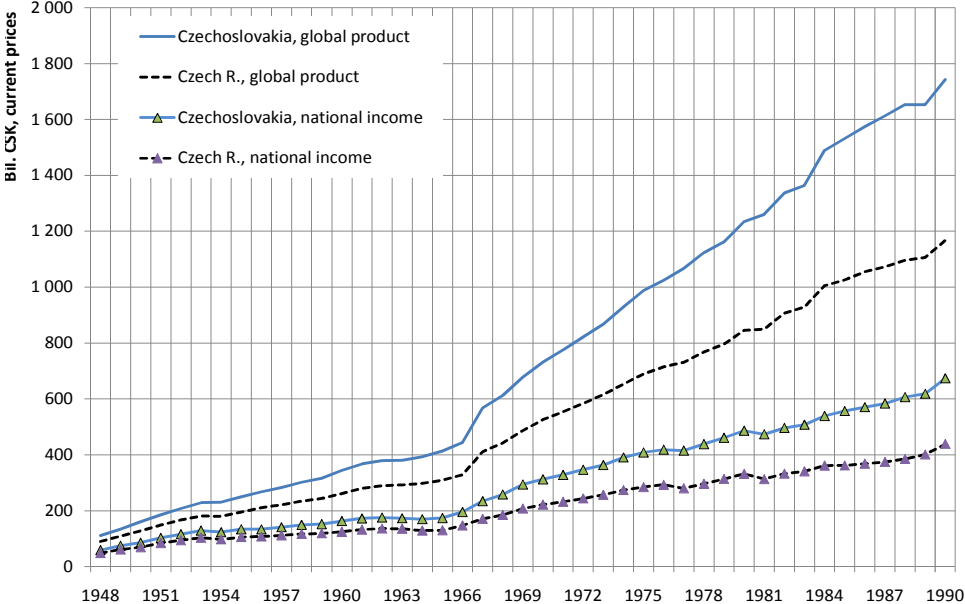
As stated above, mainly former Czechoslovakia was internationally compared with other countries. According to law, Czechoslovakia was federative state consisting of two republics.

It means that there can be found a lot of different aggregates but there is not a consistent system. Special issue is a foreign trade between these two countries, foreign trade was rarely officially published but it can be derived indirectly.

The development of the economy was mainly described by global product and national income. Global product (GP) is like output today and national income (NI) corresponds to gross domestic product (GDP). In a period of socialism there was not income considered in today's practice. Primary incomes with non-residents like dividends, interest and wages were not common.

Our goal is a description of the Czech economy within the system of national accounts but before our own estimates we would like to follow up the work already done (and sometimes officially published). The following chart shows the development of global product in former Czechoslovakia, Czech Republic and Slovak Republic in current prices (Czechoslovak Koruna, CSK).

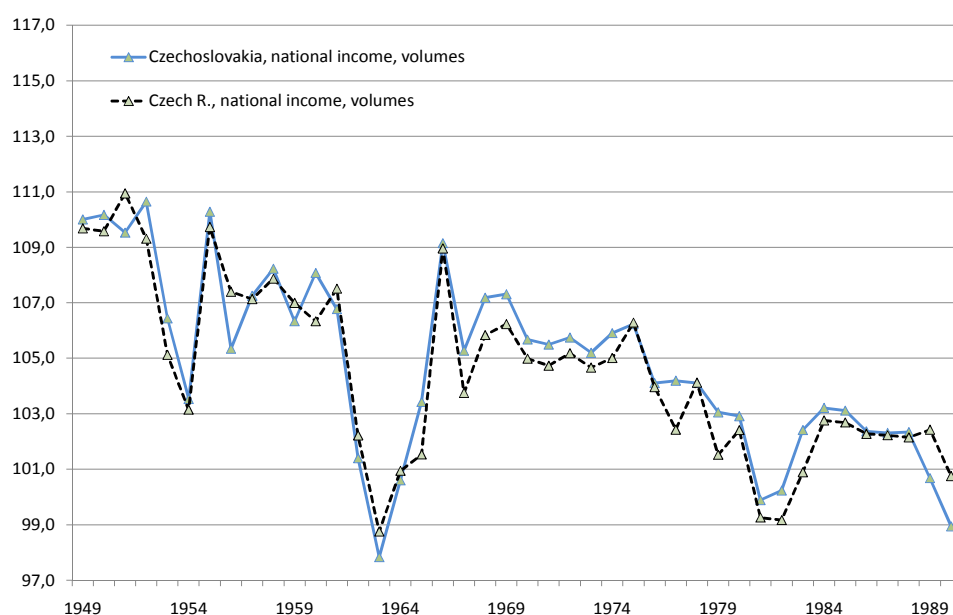
Chart 1 Global product and national income in Czechoslovakia and in the Czech Republic



Source: Czech Statistical Office, computations of authors

The Chart 1 describes Czechoslovak economy at current prices and it is clear the Czech share on Czechoslovak economy was slowly decreasing during the whole period. Global product of the Slovak Republic represented 19% in 1948 and 33% in 1990. The share of Slovak national income had similar development, from 19% to 35% between 1948 and 1990.

Chart 2 National income in Czechoslovakia and in the Czech Republic, y-o-y volume indices



Source: Czech Statistical Office, computations of authors

Due to the methodological differences, the nominal values of national income are not comparable with GDP in terms of national accounts. On the other side, differences between growth rate of GDP and NI (from MPS) may not be serious. Generally, the level of GDP should be higher mainly because of non-productive services, non-market services and self-supply. Socialist countries were closed countries with very low level of international links and they focused on heavy industry and agriculture. The level of services and production of consumer goods was incredibly low. Chart 2 describes the development of national income in year-on-year volume indices in Czechoslovakia and in the Czech Republic. There were very high growth rates between 1949 and 1952, above 9%. In 1953, there was a monetary reform, growth rate of the Czech Republic decreases to 5.1% and 3.1% in 1954. The biggest drop was in 1963 when national income in the Czech Republic fell by 1.2%. Contrary to it, 1966 was a great economic success when the growth rate was above 9%. Then the last peak was in 1975 when the growth rate reached 6.3% and since then the growth rate slowly declined. The bottom occurred in 1981 and 1982 when national income in the Czech Republic fell by 0.7% resp. 0.8%. Since 1984 national income rose more than 2% per year. In 1990 the Czechoslovak economy fell by 1.1% but the Czech Republic slowly rose (0.8%).

4. Transformation of MPS data to National Accounts

Transformation of macroeconomic data from MPS to SNA is a demanding process where experts' estimates and additional information are needed. The quality of Czechoslovak statistics allows us to use price indices, material balances and non-material balances. The splitting of data for foreign trade between Czech and Slovak republics is an important task because these data were not officially published. Transition from MPS to SNA was briefly described in section 2. Practical computations are also complicated due to the missing data for 1990 -1994 because Czech national accounts are available since 1995 onwards. The Czech Statistical Office plans methodological revision for the end of 2011 and these data sets should

include 1990 – 1994, as well. Current official values of GDP are necessary for setting of the level of GDP.

Transition from MPS to SNA 1968 was done in Czechoslovakia in different periods. The last estimates are available in Statistical Yearbook 1990 [12]. The following table 1 shows the relations between global product and national income and gross domestic product. These data were originally estimated by experts from the Federal Statistical Office. From nowadays perspective, there are some procedures that have changed since that time (allocation of FISIM, approach to GDP at purchasers' prices, etc.) but the basic picture of economy was presented. When comparing national income (NI) from MPS and GDP from SNA, it is clear that NI is lower. The share of GDP on NI in Czechoslovakia was from 120% in 1980 to 123% in 1989. Unfortunately, there was not officially published estimate for GDP in the Czech Republic. We provisionally estimated GDP in the Czech Republic according to the shares of national income, see chart 4. For comparison of the level of GDP, we added officially published figure for 1995 (in ESA 95 methodology).

Table 1 Gross domestic product in Czechoslovakia, current prices, CSK mil.

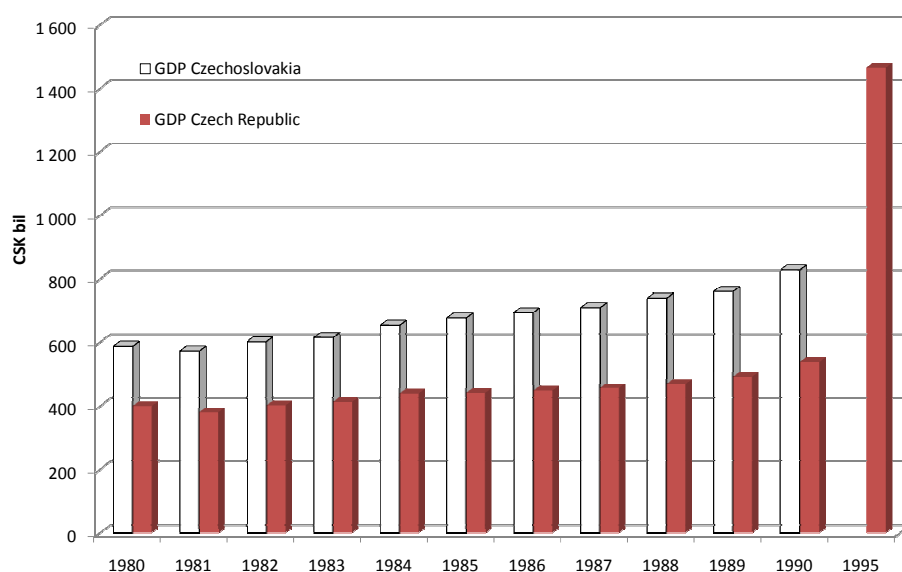
	1980	1985	1987	1988	1989
Global product	1 233 783	1 531 496	1 613 038	1 652 872	1 653 515
Material Consumption	747 502	975 171	1 029 781	1 046 492	1 035 450
National Income	486 281	556 325	583 257	606 380	618 065
Output ¹	1 436 187	1 781 930	1 886 508	1 936 821	1 953 100
Intermediate consumption	849 367	1 104 884	1 175 403	1 196 855	1 193 610
Gross value added	519 427	607 584	644 956	667 621	700 325
FISIM	11 191	16 704	18 787	17 478	21 340
Taxes on products	92 466	90 141	87 881	93 593	83 938
Subsidies on products	13 882	3 975	2 945	3 770	3 433
Gross domestic product	586 820	677 046	711 105	739 966	759 490
% Output/global product	116,4	116,4	117,0	117,2	118,1
% Intermediate c./Material c.	113,6	113,3	114,1	114,4	115,3
% GDP/National income	120,7	121,7	121,9	122,0	122,9

¹the valuation of output does not correspond to SNA 1993, gross value added is therefore not pure difference between output and intermediate consumption

Source: Czech Statistical Office, computations of authors

Distribution of GDP between the Czech and Slovak republics was based on the shares of national income. The development of GDP between 1980 – 1989 was not available for all required years. At first, we estimated GDP for 1981 -1984, 1986 and 1990 and then we split these data.

Chart 4 Nominal value of GDP in Czechoslovakia and in the Czech Republic, CSK/CZK mil



Source: Czech Statistical Office, computations of authors

The estimate of the development of GDP in Czechoslovakia and in the Czech Republic is based on many assumptions but there are not any surveyed statistical data available. In this first phase we focused on the comparison of the level of GDP at current prices. For having a benchmark, we added the year 1995 to chart 4. If we compare 1995 with 1990, the value of GDP tripled. Contrary to socialism, prices during economic transformation grew rapidly, mainly in the first half of 1990s. Inflation rate (measured by consumer price index) started to grow in 1990 (9.7%) and reached the peak in 1991 (56.6%) then slowly decelerated in the period 1992 -1995 (11.1%, 20.8%, 10.0% and 9.1%), total increase was about 157% (1995 to 1990).

5. The Use of Input-output Tables for Czechoslovakia

There are several ways how to estimate the development of GDP in the Czech Republic. As described above, we have some provisional estimates that were based on previous work of statisticians done in the past. Originally, we were not able to obtain input-output tables for the Czech Republic and we had for Czechoslovakia only. Finally, in the beginning of April 2011 we received two copies of input-output tables for 1973 and 1987. It means that that we can use these reduced tables directly and tables for Czechoslovakia will be used mainly for the structures and details. The quality of Czech tables is significantly lower than the quality of tables for Czechoslovakia. Also they are available in a very limited detail.

To provide more accurate estimates including volume indices (deflation) of GDP we build the models on the following basis:

- I. Taking over input-output tables for the Czech Republic. There are available for 1973 (28x28) and 1987 (30x30). There is available supply and use table for 1992 (60x28).

- II. Taking over tables for Czechoslovakia for 1973 (29x29), 1979 (29x29), 1989 (31x31) and for some years we have additional breakdown of second quadrant (500 commodities).
- III. Enlarge input-output tables for non-productive sphere and for non-market output.
- IV. Comparing GDP estimates based on input-output tables with existing ones.
- V. Provide estimates of time-series of GDP 1970 – 1990 based on selected extended input-output tables.
- VI. Obtaining volume indices based on existing deflators with respect to the deflation within national accounts (special focus on non-productive services and non-market output).

When comparing the existing input-output tables for Czechoslovakia and the Czech Republic, there is not a conceptual difference. Although we have only symmetric input-output tables (we do not obtained supply and use tables), we use them as supply and use tables because they are available both in basic prices and purchaser's prices. The tables for Czechoslovakia are available for the years 1973, 1978 and 1989. All the input-output tables are based on industry-industry concept. As we discussed it with the experts who were responsible for the compilation during past times, the tables for the whole Czechoslovakia had higher quality than national tables. The tables for the Czech Republic and Slovakia were derived subsequently from the totals. Therefore, we also sometimes use the structures from input-output tables for Czechoslovakia. Table 2 shows reduced symmetric input-output table for the Czech Socialist Republic for 1973 compiled at current purchaser's prices.

Table 2 SIOT, Czech Socialist Republic 1973, current prices, CSK mil.

Industry	Intermediate consumption (IC)				TOTAL (IC)	Personal consump.	Social consump.	Investment + inventories	Export	Transfers with Slovakia	Losses and differences
	Agric.	Industry	Constr.	Services							
Agricul.	20 837	34 629	129	60	55 655	11 673	1 866	2 742	1 575	-1 249	1 553
Industry	17 602	302 596	28 775	23 864	372 838	121 141	24 006	36 826	73 255	4 130	-1 502
Constr.	503	2 706	1 923	2 306	7 437	697	7 455	54 440	918	-70	-101
Services	2 690	39 115	6 414	9 420	57 638	8 963	1 650	1	18 037	0	-214
Total IC	41 631	379 045	37 242	35 650	493 568	142 473	34 977	94 008	93 785	2 811	-263
Depreciation	2 626	14 687	1 241	7 132	25 686						
Wages	20 058	52 079	14 066	23 427	109 630						
Other net production	4 558	30 481	9 343	14 014	58 396						
Profit	-2 013	48 590	7 097	917	54 591						
Sales tax	99	38 469	1	0	38 568						
Gross value added	25 329	184 306	31 747	45 490	286 872						
Output	66 960	563 351	68 989	81 141	780 440						
Import	6 854	67 342	1 787	4 934	80 918						
Resources	73 814	630 694	70 776	86 075	861 358						

Source: Czech Statistical Office

The following specifics we consider as the most important:

- a. Tables were compiled both at basic and purchaser's prices.
- b. The meaning of social consumption (column social consump.), in nowadays terminology it represents more intermediate consumption of government bodies and benefits in kind.
- c. The column transfers with Slovakia shows the net foreign trade between Slovak and Czech economy.
- d. The use records losses and differences.
- e. Income structure of value added covered a part of output that was not considered as productive and was a part of distribution flows.

We were able to obtain input-output tables for the Czech Socialist Republic for 1973 and 1978 in dimension 28x28 and 30x30, respectively. When transforming original tables into current concept, it is necessary to add specific products or industry (non-market services and output for our final use).

When transforming SIOT into current methodology, we moved social consumption into intermediate consumption and we split it into non-market and non-productive (services). We also estimated sales regarding to non-productive services but the final result on value added of industry of services is negative due to the lower profitability (-7 CZK bil.), this was transformed into the profit of services. The value of non-market services was estimated as following:

Table 3 Estimates of non-market services, CSK mil.

Intermediate consumption (IC)	19 616
Consumption of fixed capital (CFC)	1 691
Compensation of employees (COMP)	11 513
TOTAL	32 820

Source: computations of authors

There are contra effects when moving from MPS to SNA. The "market" industries will reduce some of their efficiency because there are missing non-productive services. It means that these services originally classified as non-productive, we classify as market. Non-market services are devoted only for typical (in the Czech Republic) government agencies like administration, defence, schools, hospitals etc. Taking into account non-market services and non-productive services, total gross value added rose by 5.4% (16 CSK. Bil). In comparison with existing estimates for 1980 (see table 1), it is less because there are still missing dwelling services, self-supply of households and financial services. These estimates are planned to be ready by December 2011.

Table 4 describes the first version of adjusted input-output table where we added a new industry (non-market service). The output of this industry is consumed in the same industry as government consumption (we did not distinguish benefits in kind). There are also remaining issues that will have to be solved (own-account output and other production in input-output table).

Table 4 Adjusted SIOT, Czech Socialist Republic 1973, current prices, CSK mil.

Industry	Intermediate consumption (IC)					TOTAL	Households	Government	Investments+inventories	Export	Transfers with Slov.	Losses and differences	Uses
	Agric.	Indust.	Constr.	Services	NS								
Agric.	20 837	34 629	129	879	1 047	57 521	11 673	0	2 742	1 575	-1 249	1 553	73 814
Indus.	17 602	302 596	28 775	34 407	13 464	396 844	121 141	0	36 826	73 255	4 130	-1 502	630 694
Constr.	503	2 706	1 923	5 580	4 181	14 892	697	0	54 440	918	-70	-101	70 776
Servic.	2 690	39 115	6 414	10 145	925	59 288	26 668	0	1	18 037	0	-214	103 780
NS	0	0	0	0	0	0	0	32 821	0	0	0	0	32 821
IC	41 631	379 045	37 242	51 010	19 617	528 545	160 178	32 821	94 008	93 785	2 811	-263	911 884
CFC	2 626	14 687	1 241	10 934	1 691	31 179							
COMP	20 058	52 079	14 066	29 727	11 513	127 443							
OP	4 558	30 481	9 343	14 014	0	58 396							
Profit	-2 013	48 590	7 097	-6 840	0	46 834							
TAX	99	38 469	1	0	0	38 568							
GVA	25 329	184 306	31 747	47 835	13 204	302 421							
Output	66 960	563 351	68 989	98 846	32 821	830 966							
Import	6 854	67 342	1 787	4 934	0	80 918							
Res.	73 814	630 694	70 776	103 780	32 821	911 884							

Explanatory notes:

- IC intermediate consumption
- CFC consumption of fixed capital
- COMP compensation of employees
- OP other production
- GVA gross value added
- NS non-market industry

Source: Czech Statistical Office, computations of authors

6. Deflation and Volumes

We found two issues that can influence the deflation when transforming original tables. The first is given by the methodology. We will add non-market services and own-account output. We also have to reclassify non-productive services in output and select suitable price index. The second issue is represented by experts' doubts about the price indices used for deflation of investment. The socialist economy was facing unpleasant reality of being less competitive on one side and on the other side; the companies were not allowed to increase prices. Suppose that a company wants to increase prices by 10%. It introduced a "new or significantly improved" products that was in reality improved just by 1 – 2%. The problem was not in the quality of official statistics but in the economic environment that was very far from market conditions.

Taking into account all the remarks relating to the deflation, the final GDP growth rate should be lower than the growth rate of national income. Even if the industry was increasing, the services were not developed and their annual increase incredibly low.

7. Conclusion

The issue of GDP reconstruction for the Czech Republic is complicated by several factors. On a one hand, the methodology of macroeconomic data significantly changed and on the other hand, the Czech Republic was established on 1.1.1993 after the disintegration of Czechoslovakia. Moreover, the data availability is complicated by the floods in 2002 that destroyed the Czech Statistical Office and many documents were lost. When we started our

three-year project aimed at GDP reconstruction in 2010, a lot of time was devoted to data reconstruction and digitalisation from printed publications. The next steps, differences in methodology, were deeply discussed with former or senior expert from the Czech Statistical Office. We are able to present both data at current prices and volumes of global product and national income in Material Product System methodology. Our initial estimates of GDP are provisional because we intend to deeply focus on selected years and use digitised input-output tables. Next issue is a deflation. Even if price statistics was well developed in former Czechoslovakia, we intend to use adjustment prepared by experts because the hidden inflation was not recorded properly. The last complication is the absence of time series of GDP for 1991 – 1994. We closely cooperate with the Czech Statistical Office and it announced to be published in the end of 2011. After it, we will finally adjust the level of GDP.

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