

**REGIONAL GROSS DOMESTIC PRODUCT:**

**INCOME VERSUS PRODUCTION APPROACH**

Jaroslav Kahoun  
Centre for Economic Studies, University of Economics and  
Management, Prague

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## Introduction

Regional gross domestic product per capita is the most commonly used indicator for the comparison of regional disparities in economic performance. Analysis of regional disparities with particular emphasis on the specifics in differences between GDP and disposable income of households and their evaluation of development in time were made in some studies of the Centre for Economic Studies (CES) in the Czech Republic last year. Present paper is aimed more at methodological issues in definition of regional GDP rather than comparing it with other indicators or its limited representativeness. It is aimed mainly at the methods of calculation of regional GDP, existing and conceptual approaches to regional GDP based on regional accounts experience in the Czech Republic and the applicable rules within the EU. The starting point for this study is the assumption that the methods of regional allocation of GDP have more varieties of conceptual approaches (mainly in regionalization of income and production items of gross value added) that can be used in different countries differently but can also in the same country offer a distinct regional view of overall economic performance.

## The general rules for the allocation of regional GDP

For the calculation of macroeconomic indicators at the regional level there are not sufficient data for institutional units (legal entities), which is normally used in the compilation of national accounts. The information is needed for individual local units (respectively for separate units of enterprises). Since the data for local units are often not available, the statistics of regional accounts uses some specific approaches for the regional allocation of GDP. Methods of regionalization of national accounts which standard 1995 ESA (European System of Accounts) allows are:

- **bottom-up method** - is based on the necessary information about local units which are resident in the region (e.g. indicators of output and intermediate consumption for the calculation of GVA), the calculation procedure then follows the procedure used in the national accounts
- **top-down method** - is based on the aggregates of national accounts data that are divided via the keys which are closely related to indicators measured (e.g. value added based on the structure of compensation of employees)
- **pseudo-bottom-up method** - aggregates are formed as an estimate for the local units from the institutional unit level or activity unit level (similar to top-down method but applied from the lowest level)
- **pseudo-top-down method** - the national data is allocated to regions according to the relative but not too closely related indicators
- **mixed method** - it is a combination of several approaches and is common practice in most of EU countries

For estimates of the regional gross domestic product there is theoretically possible to use three basic approaches as well as at the national level: production approach, income approach and expenditure approach.

**Production approach** measures the regional gross domestic product at market prices as the sum of gross value added at basic prices and taxes on products without the subsidies. Gross

value added at basic prices is calculated as the difference between output at basic prices and intermediate consumption at purchasers' prices. Indicators of sales, activation and expenses are in the Czech Republic and very often also in other countries available only for the institutional unit as a whole. On the other hand almost no problem means breakdown of intermediate consumption because the costs of each activity and the local unit are usually well known. Major complication can arise with determination of the value of production of some local units. An important limitation of the multi-regional organizations is the problematic valuation of output per local unit in a typical case when the administrative unit of the company is located in one region and the entire manufacturing business activity is located in another region (problem of regional allocation of sales).

<b>Regional GDP by the production approach</b>	<b>Process of regionalization</b>	<b>Weaknesses</b>
<b>= Regional production</b>	Regional information about sales of products and services, sales of goods for resale minus costs of goods sold, changes in inventory of own production and production for own final use	The problem is the valuation of production for the local unit in a multi-regional organizations (e.g. corporate headquarters, local units performing only administrative activity)
<b>- Regional intermediate consumption</b>	Regional information on material consumption, energy consumption and expenses for services incurred in making production	Usually not
<b>+ Regional net taxes on products (not in the sectoral breakdown)</b>	The usual procedure is the regionalization in the proportion of total regional GVA	Usually not

**Income approach** determines the regional gross domestic product at market prices through aggregation of variables in the generation of income account – compensation of employees, gross operating surplus and taxes on production (without the subsidies) in the regional breakdown. Information regarding employment and compensation of employees by industry is often available at regional level. This information is used for estimation of gross value added by industry either directly or through the production approach. Information on gross operating surplus appears to be the greatest weakness of the regional allocation of GDP by income approach. Gross operating surplus is generally not available broken down by region.

Information on gross operating surplus of market producers can be derived from business surveys but usually it is not done even at national level in national accounts. Breakdown by institutional sectors and regions is usually not available in most of countries in the EU. This indicator complicates the use of the income approach for estimation of the regional gross domestic product.

Taxes connected with production (excluding the subsidies) consist of taxes on products (excluding grants) and other **taxes on production (excluding subsidies)**. An allocation of taxes on products (excluding grants) is subject to a uniform methodology of the ESA which allows allocation of the regional structure in proportion of total regional gross value added. For other taxes on production (excluding the subsidy) data may be theoretically available by industry from business surveys or survey based on a kind of tax or subsidy in a detailed breakdown. These data may be the key for the allocation also by regions.

<b>Regional GDP by the income approach</b>	<b>Process of regionalization</b>	<b>Weaknesses</b>
<b>= Regional compensation of employees paid by resident local units</b>	Information is typically available in a breakdown by the local units and regions	Usually not
<b>+ Regional gross operating surplus and mixed income</b>	Auxiliary keys for regionalization (in the structure of related indicators)	Represents the <b>biggest problem of the income approach</b> - the issue of recording of operating surpluses in the headquarters of the companies / local units
<b>+ Regional consumption of fixed capital</b>	Information can be theoretically treated by local units and regions	In many countries there are no data in the regional breakdown
<b>+ Net taxes on production and imports (taxes less subsidies)</b>	Information can be theoretically treated by local units and regions	In many countries there are no data in the regional breakdown

**The expenditure approach** is not used for measurement of the regional gross domestic product in the EU countries due to lack of information. Example of the lack of direct information is the intra-regional breakdown of exports and imports and final consumption is also problematic in terms of availability of regional data. The costs, complexity and administrative burden to respondents would be disproportionate and therefore Czech Statistical Office and statistical institutions in the EU do not make regional GDP calculation by expenditure approach.

<b>Regional GDP by expenditure approach</b>	<b>Process of regionalization</b>	<b>Weaknesses</b>
<b>= Regional final consumption of households</b>	Information from surveys of households, alternatively information from administrative sources	In many countries there are no data in the regional breakdown (the problem of representativeness of the samples)
<b>+ Regional government expenditure</b>	Information from administrative sources	In many countries there are no data in the relevant regional division
<b>+ Gross capital formation (investment plus change in inventories)</b>	The information is usually available or can be broken down into the local units and regions	Need to estimate regional changes in inventories
<b>+ Regional net exports</b>	Information on intra-regional imports and exports	It constitutes <b>the largest problem of the expenditure approach</b> - the main reason why the EU countries do not use it

## **The method of calculation of regional GDP in the Czech Republic**

Calculation of regional gross value added in the Czech Republic is made on basis of production approach for sectors of non-financial corporations and enterprises in the household sector. Regional indicators of output and intermediate consumption are derived from the same data sources used to calculation at the national level. The calculation is broken down in the details of two-digit NACE level and a special approach of regionalization is applied to some methodological adjustments of national accounts: imputed rent and consumption of fixed capital in government sector (e.g. roads, highways, local roads and rail routes).

The prevailing approach for the production method is the pseudo-bottom-up process of regionalization. This procedure is based on estimates of activity data for the local unit by scheduling data for individual companies. This is similar to top-down method but not on the national totals but on aggregated data for a single institutional unit. The obtained data are then aggregated to get regional aggregated data in the same way as in the classical method of bottom-up.

The method of pseudo-bottom-up is used for gross value added of major institutional sectors: non-financial enterprises (S.11) and households (S.14). The allocation of regional gross value added for other organizations (government, financial institutions and non-profit institutions) is done on basis of wages and salaries broken down by types of survey and required industry-regional breakdown. The structure of the wages is used as the key in top-down method for regional allocation of the remaining recorded gross value added in the national accounts

(more specifically the value before the addition of some methodological and other adjustments made in the final compilation of national accounts). Net top-down method based on wages and salaries in this way is applied on approximately 16% of total national GVA.

After summarization of all the regional observed values there exists still almost one tenth of the gross added value from national accounts that remains not distributed. It is a part of the methodological adjustments of national accounts (excluding imputed rent and consumption of fixed capital for the government sector) and adjustments for exhaustiveness of the economy - includes the deliberate misrepresentation, underground economy, illegal economy, units not subject to identification, etc. These data are regionally allocated according to the structure of total official regional gross value added in each sector. These estimates are mostly done at the national level without the possibility of the currently available and quality regional data. Estimates even at a national level are without a high degree of data accuracy.

### **Regional GDP by income approach**

As it was already mentioned above, the calculation of regional GDP in the Czech Republic is carried out in the prevailing production method. The regional GVA of local units of multi-regional organization (the organization with activity in multiple regions) is based on the structure of the total wages and salaries paid by these organizations in various regions. The production method of calculation is therefore influenced by a key indicator of income method - compensation of employees. This mix of approaches is relatively consistent because compensation of employees constitutes the largest share of gross value added and they are easily detectable by the regions while the best quality identifiable data from statistical surveys of businesses (but not for regions) are indicators characterizing the production method, respectively production and intermediate consumption. In regional accounts it is necessary only to find the key for the allocation of GVA for multi-regional organizations - those are the structures of wages.

An alternative approach would be to calculate the regional gross value added directly by the income approach but excluding compensation of employees it was necessary to work in this case with information about regional consumption of fixed capital and regional operating surplus which are other important pillars of the income measurement of gross value added.

The following experimental calculation of income components of regional gross value added is made on the example of year 2009 for regions of the Czech Republic. Assuming that the balance of production and income approaches must be balanced, **the operating surplus and mixed income is equal to the difference between the total GVA established by production method and the remaining components of the income approach** (compensation of employees, consumption of fixed capital and net taxes on production and imports).

**Regional gross operating surplus and mixed income** = Regional gross value added - Compensation of employees paid by regional resident local units - Regional consumption of fixed capital - Net taxes on production and imports (taxes less subsidies).

While the regional gross added value is known from regional accounts as well as compensation of employees (their regional structures are part of the data that must be

provided for EUROSTAT by EU member states), there is necessary to make also regional estimations of regional consumption of fixed capital and regional net taxes on production and imports.

**Consumption of fixed capital** based on local units is not directly measured in the regional breakdown and its regional values are practically not available with current data sources. For these reasons it is necessary to find the appropriate key for the regional allocation of national values by top-down method. The traditional available statistical indicator of regional accounts is gross fixed capital formation – for its regionalization Czech statistics uses historical data on regional acquisitions of tangible and intangible assets. Regional consumption of fixed capital can be measured based on the assumption that the regional structures of consumption of fixed capital are very close to the regional structures of historical accumulated values of assets acquired (there can be only depreciated these assets that were acquired in the past and if the longer time series are available for accumulation, then we get closer to the regional structure of the estimated indicator). For more accurate results we can also work with the price indices of historical data on property and it would be beneficial also to work with structures of capitals and their depreciation depending on the type and year of acquisition. In this experimental calculations however, we consider for the simplification solely the total cumulative regional values of investments from 1993 to 2008 for which data are available from the Czech statistical surveys. These values are then used as weights for the regional distribution of consumption of fixed capital.

Another item that has to be estimated by top-down method is **net taxes on production and imports** (taxes less subsidies on production and imports). In this case we can choose an equivalent procedure that is recommended by EUROSTAT for the production method in case of net taxes on products. This recommendation allows the regional allocation of net taxes on products in the structure of the total gross value added in the regions (or the shares of regional gross value added on the total national values). This procedure is allowed due to the fact that in most countries there is usually not available regional data on taxes on products and in the case of taxes on production and imports it is usually the same in most countries (as well as in the Czech Republic). However, the regional allocation is done for each sector separately, then the resulting regional structure offer different view in comparison with total GVA (e.g. the largest part of subsidies is concentrated in the agricultural sector which significantly reduce in net taxes on production the share of non-agricultural capital Prague on the whole country).

The remaining value to a total gross value added is gross operating surplus. Table 1 shows the absolute amount of individual income components of gross value added in the regions and in Figure 1 there is a structure of gross value added broken down by individual components – ranking according to shares of operating surplus on gross value added in 2009 (thus in the year of the greatest decline in economic performance since the economic transition 20 years ago). The results confirm the logical expectation that in the regions less affected by economic crises in 2008 and 2009 (Prague, Central Bohemia) there was an operating surplus relatively high whereas in regions more affected by the global recession (Karlovy Vary, Liberec and Plzen Region) the share of operating surplus was relatively low, although this did not apply fully in all cases. It is usually assumed that in a situation of economic downturn operating

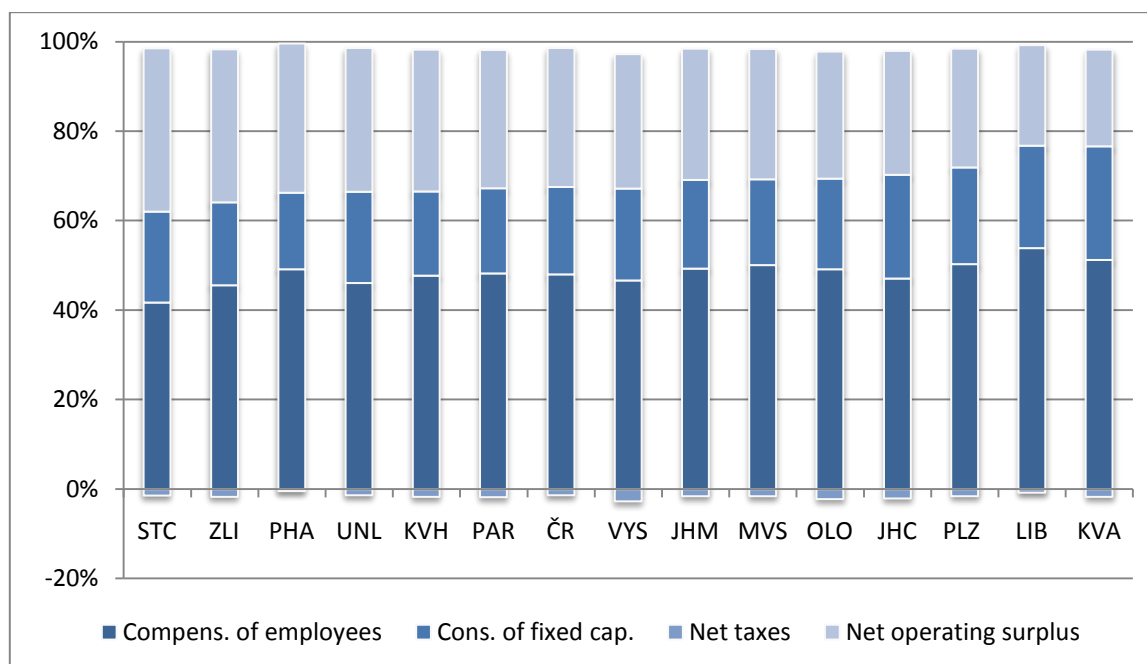
surplus of enterprises decreased first and then enterprises reduced the wages of their workers or lay off the workers.

**Table 1**The values of income components of the regional gross value added in million CZK, year 2009

Regions of Czech Republic, year 2009	Compensation of employees D.1	Consumption of fixed capital K.1	Net taxes D.2-D.3	GVA B.1g	Net operating surplus B.2n
Česká republika	1 607 525	654 553	-45 586	3 257 952	1 041 460
Hlavní město Praha	421 302	147 036	-3 511	850 577	285 751
Středočeský kraj	151 820	74 120	-5 377	353 323	132 762
Jihočeský kraj	83 798	41 296	-3 672	170 602	49 179
Plzeňský kraj	79 867	34 338	-2 496	153 893	42 183
Karlovarský kraj	34 320	17 008	-1 159	64 648	14 480
Ústecký kraj	98 209	43 395	-2 958	207 095	68 450
Liberecký kraj	51 732	21 973	-735	94 528	21 558
Královéhradecký kraj	71 746	28 307	-2 648	145 109	47 704
Pardubický kraj	66 440	26 275	-2 494	132 808	42 586
Vysočina	61 874	27 202	-3 619	125 365	39 908
Jihomoravský kraj	173 629	69 761	-5 479	341 145	103 233
Olomoucký kraj	77 221	31 843	-3 469	150 230	44 635
Zlínský kraj	71 967	29 294	-2 701	152 472	53 912
Moravskoslezský kraj	163 599	62 706	-5 267	316 158	95 120

Source: Czech Statistical Office, experimental calculation.

**Figure 1** Structure of gross value added – items of the income approach by region in %, ranking by the share of the operating surplus in gross value added, year 2009

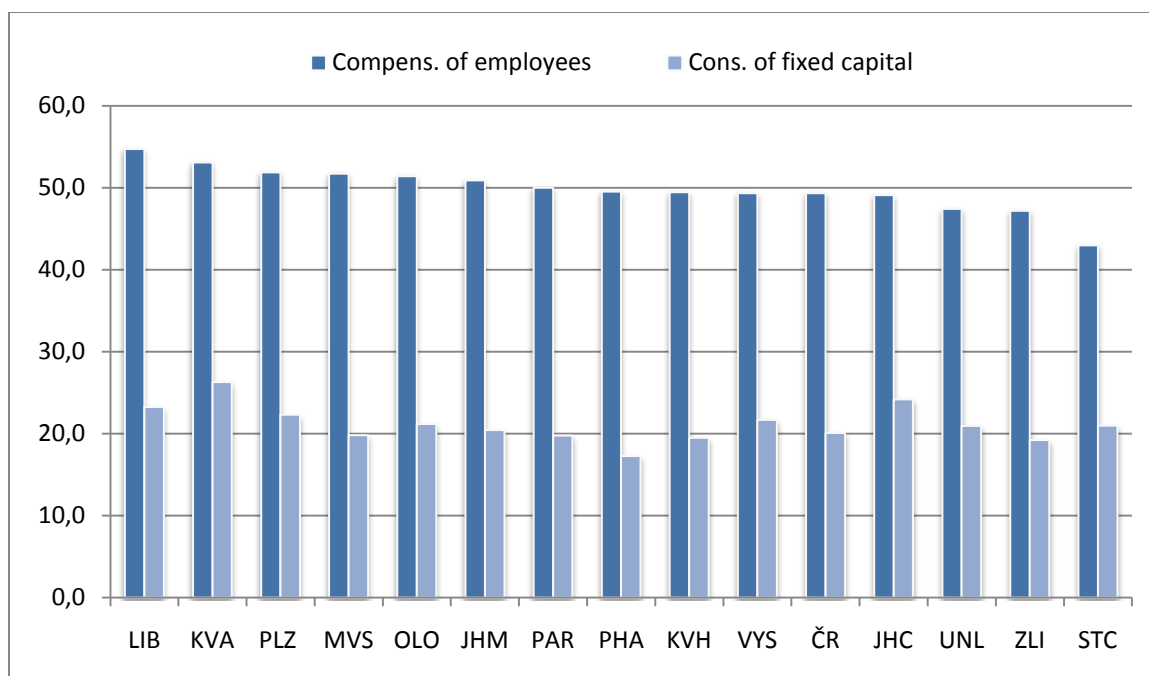


Source: Czech Statistical Office, experimental calculation.

Figure 2 shows the regions in the ranking of compensation of employees shares in the gross value added and to compare the second column showing the proportion of consumption of

fixed capital to gross value added. These two factors can be considered as labour and capital parts of GVA (it reflects the influence and involvement of these two factors in GVA). Ranking of countries in the graph is to a certain extent reverse to the previous Figure 1 since regions with a high share of operating surplus (sort criteria in Figure 1) account for a smaller share of compensation of employees and capital consumption. The importance of capital over wages can be expected in industrial regions and smaller in regions dominated by services (Prague). A high proportion of consumption of fixed capital is in region Karlovy Vary, Plzeň, Liberec and Vysočina. The specific situation is in the South Bohemia region which reflects capital adequacy in energy industry (Temelin nuclear power plant), a similar effect plays an important role in the Vysočina region (Dukovany nuclear power plant).

**Figure 2 Comparison of the shares of compensation of employees and consumption of fixed capital in gross value added (labour and capital part of the gross value added), year 2009**



Source: Czech Statistical Office, experimental calculation.

### **The problem of regional allocation of the operating surplus**

In Table 2 in the last column there is detected the regional structure of the net operating surplus as it is based on the assumption of the balance between income and production method made in the previous experimental calculation. Production method is in this case regarded as decisive for the total amount of gross value added. But in case of production method there is necessary to take into account using the calculation of regional gross value added for multi-regional organization by pseudo-bottom-up method (because of limited data sources based on the regional structure of wages and salaries of individual companies). This means that all items of the income calculation of GDP for this type of organizations are also considered in the structure of wages (including their consumption of fixed capital and operating surplus). This is pretty simplistic and is made purely with regard to the absence of

the necessary regional data. However, the operating surplus is expected with great importance in a number of major multi-regional organizations – energy companies, banks, telecom operators etc.

**Table 2 Regional structures of the income components of GDP, in% of national GVA, year 2009**

Regions of Czech Republic, year 2009	Compensation of employees D.1	Consumption of fixed capital K.1	Net taxes D.2-D.3	GVA B.1g	Net operating surplus B.2n
Česká republika	100,0	100,0	100,0	100,0	100,0
Hlavní město Praha	26,2	22,5	7,7	26,1	27,4
Středočeský kraj	9,4	11,3	11,8	10,8	12,7
Jihočeský kraj	5,2	6,3	8,1	5,2	4,7
Plzeňský kraj	5,0	5,2	5,5	4,7	4,1
Karlovarský kraj	2,1	2,6	2,5	2,0	1,4
Ústecký kraj	6,1	6,6	6,5	6,4	6,6
Liberecký kraj	3,2	3,4	1,6	2,9	2,1
Královéhradecký kraj	4,5	4,3	5,8	4,5	4,6
Pardubický kraj	4,1	4,0	5,5	4,1	4,1
Vysočina	3,8	4,2	7,9	3,8	3,8
Jihomoravský kraj	10,8	10,7	12,0	10,5	9,9
Olomoucký kraj	4,8	4,9	7,6	4,6	4,3
Zlínský kraj	4,5	4,5	5,9	4,7	5,2
Moravskoslezský kraj	10,2	9,6	11,6	9,7	9,1

Source: Czech Statistical Office, experimental calculation.

An alternative procedure of calculating of GDP could therefore be the allocation of income components of gross value added separately even with a rough approximation of the regional structures of capital consumption and other indicators. The fundamental problem remains in finding a key for the regional allocation of operating surplus. It makes the further progress in this direction difficult and therefore the calculation of regional GDP by income approach in most countries is not realized or only in a smaller part of the gross value added.

## Conclusion

The issue of regional allocation of gross value added and GDP has its bottlenecks mainly due to inability to capture all transactions between regions and the existing need to identify all the characteristics required for the calculation of GVA whether by production, income or expenditure approach. In all cases for the calculation of regional GDP there is needed to implement certain approximations, simplification and auxiliary keys and in all countries there is a choice of several different processes which allows accounting standard ESA 1995. The usual procedure in the EU countries (applicable even in the Czech Republic) is the calculation of regional GDP or GVA by production method as the most identifiable data for statistical surveys are indicators characterizing the production method - the sales and intermediate consumption, for which in regional accounts it is necessary only to find the key for the allocation for multi-regional organizations (usually wages or number of employees, if the question on the revenues and expenses is not proceeding directly in the local units). In some

countries the income approach is used as a basic, especially where reliable data on the regional consumption of fixed capital are available. The example of experimental calculation of regional gross value added for the Czech Republic by income approach was illustrated in this study. It showed not only the regional structure of the income components of gross value added but also conceptual problems connected with estimation of the regional operating surplus. These problems lead to the conclusion that the production method (despite the difficulties associated with the allocation of revenues to local businesses and the units carrying out administrative activities of enterprises) is the most feasible procedure for calculation of regional GDP in the Czech Republic. Production method implemented in the Czech Republic calculates the total regional gross value added for uni-regional organizations in equivalent procedure as in the national accounts. This is relatively minor inaccuracy in comparison with the income approach that tackles with the problems of limited data sources for direct calculation of the regional consumption of fixed capital and both conceptual and data limitations for the calculation of the regional operating surplus.

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Jaroslav Kahoun

Centre for Economic Studies, University of Economics and Management, Prague

Narozni 2600/9a

158 00 PRAHA 5

phone: +420 274 054 232

e-mail: [jaroslav.kahoun@vsem.cz](mailto:jaroslav.kahoun@vsem.cz)