

REGIONAL DIFFERENCES IN THE SPOTLIGHT OF INPUT-OUTPUT TABLES

JANA KRAMULOVÁ, PETR MUSIL, JAKUB FISCHER

University of Economics in Prague, Faculty of Informatics and Statistics, Department of Economic Statistics, Nám. W. Churchilla 4, 130 67 Praha 3, Czech Republic
email: jana.kramulova@vse.cz, petr.musil@vse.cz, fischerj@vse.cz

Abstract

Input-output analysis is broadly used for assessment of flows of goods and services and relations between resources and uses in economy. These flows can suitably describe economic performance as well as linkages among products or industries. Usually these flows are examined for big areas as whole states or even macro-regions. We, on the contrary, constructed regional symmetric input-output tables for all 14 Czech NUTS 3 regions based on the year 2011 and ESA95 standard. In case of interrelated regional tables there is one obstacle more, i.e. we have to distinguish interregional from international import and interregional from international export.

This paper analyses differences among Czech regions using input-output tables. The results not only support or falsify general attributes assigned to regions (e.g. structurally affected regions, regions with high unemployment, regions with high share of services, agricultural regions) but also emphasize interesting findings that become evident after comparison of partial results for each NUTS 3.

Key words: regional input-output tables, regional differences, Czech NUTS 3 regions.

1. Introduction

Regional analysis stands in line with recent trends of focus on regional level and smaller territories rather than the whole states when analyzing economic performance and its hidden reserves. There are plenty of methods and opportunities, how to analyze regions. One of them that has been for its complexity so far not much applied is input-output analysis. For its huge data driven and data demanding nature it is far more applied to whole states or even macro-regions as parts of Asia or America (for examples of such papers see Wiedmann, 2009, pp. 213). Big multi-region input-output (MRIO) databases contain data useful for analyses of relations among states included. There are more of them such as AIIOT, EXIOPOL, GTAP, or WIOD (for descriptions see Special Issue of Economic Systems Research Journal, 2013 or Wiedmann et al., 2011). An example of regional input-output tables is an Italian case (Casini et al., 1995). Application of input-output tables to regions brings apart from more complicated data survey one obstacle more, i.e. we have to distinguish interregional from international import and interregional from international export.

This paper analyses differences among 14 Czech NUTS 3 regions using input-output tables that are based on the year 2011 and ESA95 standard. It is divided into several sections. The next one brings a brief overview of input-output tables. The third section presents Czech regions from the point of view of data, methodology and obstacles we met. The fourth section introduces the main results for each region. Final section concludes.

2. Input-output tables

Input-output tables represent on one hand an important research topic that is broadly discussed in the literature in regional science (Isard et al., 1998) as well as in statistics and economics (Wiedmann, 2009, Miller and Blair, 2009 or *Economic Systems Research Journal*). On the other hand it is a part of official statistics because national statistical institutes are obliged to publish national input-output tables. Czech Statistical Office publishes them every five years with some additional years (e.g. 2009). More about Czech input-output tables can be found e.g. in Sixta (2013). We based our computations on national tables for the year 2011 compiled in ESA95 standard that we regionalized into 14 input-output tables, each for one NUTS 3 region.

Official input-output tables are based on transformation of supply and use tables, see below. There are four main methods associated with different assumptions. The Czech Statistical Office applies product technology assumption for product by product tables and assumption of fixed product sales structures for industry by industry tables. However, regional input-output tables are compiled directly, see Fischer, Vltavská and Sixta (2014) or Musil and Kramulová (2014).

Input-output tables provide broad opportunities to analyses. At the national level the main relation is between domestic economy and the rest of the world. When regional input-output tables are compiled, each region can be analyzed in relation to the rest of the world, which comprise in this case not only other states but also other regions in the same state. Here arises a problem of interregional commuting flows (Bracalente and Perugini, 2010), which are not always well perceptible.

Generally input-output tables are split into three quadrants. The first quadrant is also known as an intermediate consumption matrix. The second quadrant contains different forms of final use as final consumption expenditure, gross capital formation and export. In the third quadrant there are components of value added as compensation of employees or net taxes on production. It is usually said that the most important quadrant is the one with intermediate consumption therefore we will in this paper focus mainly on the first and second quadrant. Input-output tables can be compiled as supply and use tables (SUT) or as symmetric input-output tables (SIOT). Both types are introduced e.g. in Miller and Blair (2009) or in Musil and Kramulová (2014). Figure 1 shows an example of Czech SIOT table for the year 2010 with all three quadrants mentioned above.

3. Czech NUTS 3 regions – data, methodology and obstacles

Our research is aimed at 14 Czech NUTS 3 regions. Each of the regions has some characteristics that are for regional scientists known, but we wanted to verify, if such features are apparent in the results of input-output tables as well. These characteristics include sector specialization (primary, secondary or tertiary sector), localization of leading companies or clusters and so on. Some regions are said to be structurally affected or economically weak, e.g. (Ženka and Čadil, 2009), and these conclusions should be at least partially supported by results in regional input-output tables. Regionalizing the national tables is data demanding, but finally we succeeded in compiling all the necessary tables.

CZ-CPA products		INTERMEDIATE CONSUMPTION				Final Consumption Expenditure			Current basic prices CZK million				
		Products of agriculture, hunting and related services	Products of forestry, logging and related services	Other personal services; undifferentiated goods and services produced by private households for own use; services	Total	Households	Governments	NPISH	Gross fixed capital formation incl. valuables	Changes in inventories	Exports (FOB)	Final use total	Used resources total
	Name	01	02	96+97+98+99		P.3		P.51+P.53	P.52	P.6			01
01	Products of agriculture, hunting and related services												02
02	Products of forestry, logging and related services												...
96+97+98+99	Other personal services; undifferentiated goods and services produced by private households for own use; services provided by extraterritorial organisations and bodies												96+97+98+99
P.2	Intermediate consumption (basic p.)												TOTAL
D.21-D.31	Net taxes on products												
P.2	Intermediate consumption (purchasers' p.)												
D.1	Compensations of employees												
D.29-D.39	Other net taxes on production												
K.1	Consumption of fixed capital												
B.2+B.3n	Operating surplus, Mixed income, net												
B.1g	Value added, gross												
P.1	Output (basic p.)												
P.7	Import												
	Resources												

Figure 1. Czech SIOT table (2010).

Source: Czech Statistical Office (2015), authors' adaption.

3.1. Brief introduction of Czech NUTS 3 regions

Let us briefly introduce the main characteristics of 14 Czech NUTS 3 regions that will be verified or falsified in the subsequent sections. The regions are deeply introduced e.g. in (Toušek et al., 2005). Hlavníměsto Praha is specified as capital city itself, without surroundings. Majority of financial and foreign companies have their seats in this region, which means that many economic analyses are influenced by this fact. Hlavníměsto Praha is aimed mainly on service sector and is characterized by high number of people commuting primarily from Středočeský kraj, region surrounding Prague and region of close relationship.

Středočeský kraj is aimed on agriculture and industry (especially automotive – ŠKODA AUTO, a.s. and TPCA, s.r.o.), but service sector has gained greater importance recently. Jihočeský kraj is aimed at primary sector, but apart from agriculture there is a high employment rate in fish farming industry. There is also located South Bohemian wood processing cluster connected with significant wood mining. Plzeňský kraj is connected mainly with secondary sector, especially with food processing industry and electrical engineering. It is famous for production of beer, sparkling wine and spirits. Mechanical engineering is connected primarily with Škoda Company. This region is also very attractive for foreign investors, especially for component production. Karlovarský kraj is the smallest region with the least inhabitants and remote location. This region is now associated mostly with spa industry, catering and accommodation services. Also secondary sector is important here – mining and manufacturing. Ústecký kraj is one of the structurally affected regions, because it was originally aimed at heavy industry. Mining is still important there, manufacturing and chemical industry as well. Liberecký kraj is also region with industrial character, mainly manufacturing and glass industry. Královéhradecký region is characteristic for agriculture, industry (automotive and manufacturing) and services (catering and accommodation in tourism resorts). Pardubický kraj is aimed at agriculture and chemical industry. Moreover, it is quite attractive for foreign companies producing ICT. Kraj Vysočina is traditionally oriented on agriculture and forestry. Nevertheless, its location around highway D1 attracts foreign investments. Jihomoravský kraj comprise second biggest city of Brno, which determines service specialization. However, Jihomoravský kraj includes apart from Brno also its huge surrounding, which means that this region is aimed also on agriculture and industry. Olomoucký kraj is mainly industrial and agricultural. It hosts also plants of foreign investors and several spa resorts are located throughout the region. Zlínský kraj is affected by remote location and decline of footwear production. Its main orientation is on manufacturing industry and agriculture. Moravskoslezský kraj is similarly to Ústecký kraj considered to be structurally affected region and is connected especially with metallurgy, mining, electrical engineering and chemical industry. One of its problems is remote location without direct highway connection. By the way, Moravskoslezský kraj is just as Jihočeský kraj hosting wood processing cluster.

3.2. Regionalization of second quadrant

Regionalization of the second quadrant was done in several steps. Firstly, values of macro-aggregates at purchasers' prices were allocated to regions. This calculation was done in commodity breakdown. Then the regional data were transferred to basic prices (Musil and Kramulová, 2014). Whereas the Czech Republic has a common system of taxation (i.e. no regional taxes or subsidies on products are applied) taxes and subsidies were regionalized

proportionally to purchasers' prices. Some other facts had to be taken into account. Generally, export is exempt from taxes, but purchases of non-residents within domestic economy (part of export of services) are taxed. Similarly changes of inventories are usually supposed to be without taxes. However, inventories of tobacco products include excise tax due to the legislation.

Trade and transport margins were allocated to the regions proportionally as well. It can be argued that assumption of the same rates of margins is not completely correct. Rates of margins on luxury goods, which are mainly sold in Hlavní město Praha, may be higher. In spite of this authors are convinced that it does not influence results significantly.

Regionalisation is based on the research that had been carried out previously. Methodology and results of this research are described in several papers, e.g. in (Kramulová and Musil, 2013). With regard to regionalization of macro-aggregates at purchasers' prices each component was done in a specific way. Although final household consumption expenditure (FHCE) is recorded in product classification in input-output tables (CZ-CPA, Classification of Products by Activity), regionalization was carried out in purpose classification (CZ-COICOP, Classification of Individual Consumption According to Purpose). The reason is that many data sources are available in CZ-COICOP classification and this classification is preferred for the following analysis. The Czech Statistical Office publishes FHCE at the national level in CZ-COICOP 2-digit level (48 groups). The most suitable regionalization key was found for each group. The list of all regionalization keys can be found in (Kramulová and Musil, 2013). As regionalization keys serve e.g. household budget survey, national accounts, transportation statistics, health statistics, number of households or energy statistics.

Final consumption expenditure of government and non-profit institutions consists of two parts: other non-market output and social transfer in kind – purchased market production (for government consumption see also Půlpánová, 2013). Non-market output was regionalised by compensation of employees in industrial division. The main part of social transfer in kind – purchased market production from health services that were regionalised by revenues of hospitals from health insurance companies. Other social transfer in kind – purchased market production was allocated to the regions by mid-year population.

Gross fixed capital formation in regional breakdown is regularly published by official statistics. Changes in inventories were estimated by gross value added of industries in which inventories can occur. Net acquisition of valuables, which is a negligible item, was regionalised by structure of gross fixed capital formation. International trade was regionalized by the assumption that the export capability is the same in all regions and that import demand is the same in all regions, more detailed description can be found in (Kramulová and Musil, 2013). Interregional trade was estimated as a balance between all other supplies and uses. Therefore interregional flows cannot be observed.

4. Results

We decided to emphasize the most interesting results in all particular regions. However, we merged in this section NUTS 3 regions into NUTS 2 regions, so this section is divided just into 8 subsections. As interregional trade is estimated as the difference between supplies and uses we focused primarily on results whether they are plausible. Sometimes we had to go back and check regionalization of indicators.

4.1. Hlavníměsto Praha

Hlavníměsto Praha is the capital city and therefore rather specific region. Balance of international trade is in deficit there, about -53 billion CZK. This seems possible since Hlavníměsto Praha has to import goods that cannot be produced locally and supplies from other regions are not sufficient, e.g. for agriculture and food products or computers. However, this region exports business services as well as catering and accommodation services since Hlavníměsto Praha is the main tourist destination in the Czech Republic. Concerning interregional trade, total balance is in surplus. On the contrary, Hlavníměsto Praha has to import almost all goods and particular services (construction services, transportation services). In addition, Hlavníměsto Praha is a net exporter of services (trade, business services) to other regions, because many companies have headquarters in the capital city. Also electricity is exported from Hlavníměsto Praha. It is partly caused by concept of statistical unit. Czech national accounts are based on institutional units instead of kind of activity units (Sixta, 2013), on which supply and use tables should be based.

4.2. Středočeský kraj (NUTS 2 Central Bohemia)

Středočeský kraj is supposed to be the most export-oriented region in the Czech Republic (Kramulová and Musil, 2013). Its net international export is about 68 billion CZK. Since two of three automotive companies are located there as well as many contractors Středočeský kraj is a leader in exporting vehicles. This region also exports construction services, probably to Prague.

4.3. Jihočeský and Plzeňský kraj (NUTS 2 Southwest)

Net export of agriculture products is observed mainly in regions with good conditions for agriculture such as Jihočeský kraj or Vysočina. Total export of agriculture products is more than 15 billion CZK in these regions. Plzeňský and Karlovarský kraj are well known for production of famous beer (Pilsener Urquell) and spirits (Becherovka, Fernet, Tuzemák). This fact is proved by net export of beverages about 5 billion CZK v Plzeňský kraj.

4.4. Karlovarský and Ústecký kraj (NUTS 2 Northwest)

Town Karlovy Vary is a famous spa resort and this fact can be also supported by results in export of CPA 86 (health services). However, Karlovarský kraj is the least developed region and its balance of net export of many products is in deficit. Ústecký kraj is characterized by very damaged environment as a result of intensive industrial activity in socialist time. Industry was focused mainly on mining, production of chemicals and electricity. Net interregional export is observed for gasoline, coal and electricity.

4.5. Liberecký, Královéhradecký and Pardubický kraj (NUTS 2 Northeast)

These regions are supposed to be medium-developed. Liberecký kraj exports rubbery and plastic products, machinery and vehicles (especially their parts) as many suppliers of car factories are located here. Significant interregional net export of cars is observed in Královéhradecký region, which is probably caused by two production plants of ŠKODA AUTO located in Kvasiny and Vrchlabí. Pardubický kraj exports mainly computers what confirms our assumption of its attractiveness for foreign investors. Net interregional export is also observed for insurance services, because one of the most important insurance companies has its headquarters in Pardubice.

4.6. Kraj Vysočina and Jihomoravský kraj (NUTS 2 Southeast)

Kraj Vysočina is on one hand focused on agriculture and manufacturing of wood. On the other hand this region is a net importer of warehousing services. Our assumption that these services are produced here, because the main highway intersects kraj Vysočina, was not proved. Jihomoravský kraj is the only region in the Czech Republic that produces crude oil and gas that are exported to other regions by about 3 billion CZK. Many start-ups and well-known IT companies are located in Brno which caused net export (international and interregional) of IT services.

4.7. Olomoucký and Zlínský kraj (NUTS 2 Central Moravia)

Economies of these two regions rely on manufacturing of food. Huge export of rubber products (70 billion of which 25 billion is interregional export) is caused by the main factory (Barum Continental) in Zlínský kraj. Big gambling company has seat in Zlínský kraj therefore the region is also a net exporter of this service.

4.8. Moravskoslezský kraj

In the past this region had been successful and well off, but it was affected by transformation of economy in 1990s. Currently Moravskoslezský kraj is still an important producer and exporter of coal and basic metals to other countries and regions. Although there were several attempts to set different type of manufacturing, most of other products have to be imported with one exception: cars. Korean automotive company Hyundai has a factory in Nošovice town.

5. Discussion and conclusion

Regions and regional disparities can be analyzed using many different tools. We tried to use input-output tables to support or falsify general attributes assigned to 14 Czech NUTS 3 regions. We showed that in such a complicated table as input-output table is we can find values that support industrial orientation of particular region. We can also see interregional and international flows. The results shown in previous section mostly proved our theoretical assumptions about particular regions. They also brought some additional information, especially about interregional and international dependence of regions. We can confirm that input-output analysis may help us to learn more about the regions.

We constructed regional symmetric input-output tables for all 14 Czech NUTS 3 regions based on the year 2011 and ESA95 standard. The method of regionalization was briefly introduced. The huge results (14 input-output tables for 14 Czech NUTS 3 regions) are now being subject of final revision, so we tried to emphasize in this paper the main and the most interesting numbers, especially from the 2nd quadrant. We can very well see especially orientation of regions on automotive industry, ICT or rubber products. Regions aimed at agriculture indicated net export of agricultural products.

The partial and semi-definitive results show already that input-output tables can help to identify regions with e.g. high share of services or agricultural regions and can be a useful tool for identifying position of the regions and their strength and weaknesses.

Acknowledgements

This paper was supported by the Czech Science Foundation (GACR), project No. 13-15771S "Regionalization of GDP estimate using expenditure approach".

References

- 1 ----- . 2013. Special Issue of Economic Systems Research Journal, vol. 25, iss. 1, 2013.
- 2 BRACALENTE, B., PERUGINI, C. 2010. The components of regional disparities in Europe. *Annals of Regional Science*, 2010, vol. 44, iss. 3, pp. 621-645.
- 3 CASINI BENVENUTI, S., MARTELLATO, D., RAFFAELLI, C. 1995. INTEREG: A Twenty-Region Input-Output Model for Italy. *Economic Systems Research*, 1995, vol. 7, iss. 2, pp. 101-116.
- 4 CZECH STATISTICAL OFFICE. 2015. Supply and use tables. [cit. 07-06-2015] http://apl.czso.cz/pll/rocenka/rocenkaout.dod_uziti?mylang=EN.
- 5 FISCHER, J., VLTAVSKA, K., SIXTA, J. 2014. Construction of Regional Input-Output Tables in Practice. In: *International Input-Output Conference (IIOA)*. Lisbon: University of Lisboa, 2014, pp. 1-9. [cit. 07-06-2015] https://www.iioa.org/conferences/22nd/papers/files/1444_20140404021_Paper_Sixta_Fischer_Vltavska_final.pdf.
- 6 ISARD, W. et al. 1998. *Methods of interregional and regional analysis*. Aldershot: Ashgate, 1998. Regional science studies series. ISBN 1-85972-410-8.
- 7 KRAMULOVÁ, J., MUSIL, P. 2013. Experimentální odhad složek výdajové metody regionálního HDP v ČR [Experimental Estimate of Components of Expenditure Approach to Regional GDP in the Czech Republic.]. *Politická ekonomie*, vol. 61, iss. 6, pp. 814-833.
- 8 MILLER, R. E., BLAIR, P. D. 2009. *Input-output analysis: foundations and extensions*. 2nd ed. Cambridge: Cambridge University Press. 2009. ISBN 978-0-521-73902-3.
- 9 MUSIL, P., KRAMULOVÁ, J. 2014. Application of MRIO model on a small economy: case study of the Czech Republic. In: *International Input-Output Conference (IIOA)*. Lisbon: University of Lisboa, 2014, pp. 1-9. [cit. 20-04-2015] https://www.iioa.org/conferences/22nd/papers/files/1670_20140509111_Paper_IIOA_2014_PM_JK.pdf.
- 10 PŮLPÁNOVÁ, L. V. 2013. Understanding Government Consumption. *Statistika: Statistics and Economy Journal*, 2013, vol. 93, iss. 2, pp. 15-29.
- 11 SIXTA, J. 2013. Development of Input-Output Tables in the Czech Republic. *Statistika: Statistics and Economy Journal*, 2013, vol. 93, iss. 2, pp. 4-14.
- 12 TOUŠEK, V. et al. 2005. *Czech Republic: portraits of regions*. Prague: Ministry for Regional Development of the Czech Republic, 2005. ISBN 80-239-6346-5.
- 13 WIEDMANN, T. 2009. A Review of Recent Multi-region Input-Output Models Used for Consumption-Based Emission and Resource Accounting. *Ecological Economics*, 2009, vol. 69, iss. 2, pp. 211-222.
- 14 WIEDMANN et al. V. 2011. Quo Vadis MRIO? Methodological, data and institutional requirements for multi-region input-output analysis. *Ecological Economics*, 2011, vol. 70, iss. 11, pp. 1937-1945.
- 15 ŽENKA, J., ČADIL, V. 2009. Regional Distribution of Technology-Intensive Manufacturing Industries in the Czech Republic with an Accent on Risk of Delocalisation. *Prague Economic Papers*, 2009, vol. 18, iss. 1, pp. 61-77.