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## Construction of Regional Input-Output Tables in Finland 2002

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*CONSTRUCTION OF REGIONAL  
INPUT-OUTPUT TABLES IN FINLAND 2002*

Preliminary version of the paper to be presented  
at the 46th Congress of the European Regional  
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August 30th to September 3rd 2006.

Tuomas Louhela & Mikko Koutaniemi



# *Construction of Regional Input-output Tables in Finland 2002*

Tuomas Louhela<sup>1</sup> & Mikko Koutaniemi<sup>2</sup>

## *Abstract*

Paper describes how supply and use tables and symmetrical input-output tables are made for Finnish regions on year 2002. Analysis was done first time for the year 1995, but previous study is not totally comparable to this one, due to methodological revisions at National Accounts and trade flow estimations. Surveys are not made to the industrial establishments in the current research. Trade flows are estimated instead by freight flow approach, which combines industrial products' sales and transportation data's.

The bottom-up methods are preferred in the regionalisation of supply and use tables, but they are rarely used in their pure form due to data constraints, for example. The mixed approach was found out to be the most efficient way to work in the current research as it relies only on the National and Regional Accounts. In the balancing process of the national input-output table almost 900 commodities were distinguished, but reclassification produced 208 commodities that actually covered all above-mentioned products. The number of industries was 90. Tables will be probably published on the level of 40 industries and product groups.

Keywords: regional input-output, regional supply and use, interregional trade flows.

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## 1 INTRODUCTION

Regional input-output (I-O) tables make possible to analyse interdependencies of the regions and industries and improve the quality of the regular Regional Accounts. I-O tables have, however, been made quite rarely on the regional level in Finland and they have not usually covered the entire nation. Susiluoto (1996) and Saurio (1990), for example, made I-O study for a couple of regions, whereas, Statistics Finland (2000) compiled the first and only I-O analysis for all regions<sup>3</sup> of the country.

As experienced in the Dutch regional I-O project (Nijmeijer, de Vet & Eding 1999) the advantages for users to have at their disposal a set of regional I-O tables constructed by the national statistical office are numerous. Apart from financial reasons, the most important advantage is consistency. A set of tables, all for the same statistical year are compiled according to the same method and with the same data and consistent with the National and Regional Accounts. Even more important is that the regional tables are in all aspects comparable with each other.

The above-mentioned strengths, as well as couple of years usage experience from the last I-O study where in mind, when ministries of the Interior, Agriculture and Forestry, Transport and Communications, Trade and Industry and Labour decided to fund the current project. The ongoing study is based mainly on the bottom-up and mixed approaches as well as earlier analysis (Piispala 2000;1999;1998) and components of supply and use (S&U) tables are constructed first to the regional level and then adjusted to the boundaries of the National Accounts.

Corner stone of National as well as Regional Accounts is European System of National Accounts (ESA 1995), which defines S&U tables as matrices, that record how supplies of different kinds of goods and services originate from domestic industries and imports and how those supplies are allocated between various intermediate or final uses.

The aim of this paper is to present, how S&U table and symmetrical I-O tables are made for Finnish regions on year 2002. The compilation methods and the data of the S&U tables are reviewed at the sections two and three and the conclusion is at the section four. Since the project is still under construction, research results are not included to this paper.

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<sup>3</sup> Statistics Finland (2000) made I-O tables for all twenty NUTS 3-level regions of the country. The ongoing research covers also Extra Territorial Region of Finland.

## 2 OVERVIEW OF THE REGIONAL SUPPLY AND USE TABLES

### 2.1 Input-output and supply and use tables

The I-O framework consists of S&U tables, tables linking the S&U tables to the sector accounts and symmetric I-O tables. S&U tables are matrices by industry and product describing the domestic production processes and the transactions in products of the national economy in great detail. These tables show the structure of the costs of production and the income generated in the production process, the flows of goods and services produced within the national economy and the flows of goods and services with the rest of the world. A simplified example of a supply table is given in Table 1. (Eurostat 1995.)

TABLE 1 A simplified supply table.

<b>Supplies</b>	<b>Industries</b>	<b>Rest of the World</b>	<b>Total</b>
Products	Output by product and by industry	Imports by product	Total supply by product
Total	Total output by industry	Total imports	Total supply

A use table shows the use of goods and services by product and by type of use, i.e. as intermediate consumption (by industry), final consumption expenditure, gross capital formation or exports. Furthermore, the table shows the components of gross value added, i.e. compensation of employees, other taxes less subsidies on production, net mixed income, net operating surplus and consumption of fixed capital. A simplified example of a use table is given in Table 2. (Eurostat 1995.)

TABLE 2 A simplified use table

<b>Uses</b>	<b>Industries</b>	<b>Rest of the World</b>	<b>Final consumption expenditure</b>	<b>Gross capital formation</b>	<b>Total</b>
Products	Intermediate consumption by product and by industry	Exports	Final consumption expenditure	Gross capital formation	Total use by product
Components of value added	Value added by component and industry				
Total	Total inputs by industry				

Between the S&U tables, the identities by industry and product hold.

(2.1) Output by industry = Input by industry.

(2.2) Total supply by product = Total use by product.

The most statistical information that can be obtained from producer units indicates what type of products they have produced/sold and, usually less detailed, what type of products they have bought/used. The format of the S&U tables is designed to fit in with this type of statistical information (i.e. industry by product). By contrast, information of a product by product or industry by industry nature as required by the symmetric I-O table is not often available. For example, surveys of industries usually provide information about the type of products used and about the products produced. (Eurostat 1995.)

However, information on the inputs in terms of products and value added components for each product produced is usually not collectable. Ideally, the administration of an enterprise should show all costs allocated to the various types of output and, simultaneously, show the composition of intermediate consumption by type of product. In practice, information arranged in the form of S&U tables is therefore a practical starting point for constructing the more analytic information in the symmetric I-O tables. The industry by product information in the S&U tables can be converted into product by product or industry by industry, statistics by adding extra statistical information on the input structures, or by assuming constant input structures by product or by industry. (Eurostat 1995.)

## *2.2 Top-down and bottom-up methods*

In general the regionalisation of national economic statistics such as National Accounts can be done by either using bottom-up, top-down or mixed methods. These same methods can be applied to the regionalisation of S&U tables as well. The Bottom-up method involves the use of information on units that are resident in the region, and the regional values must add up to the corresponding national value. (Piispala 1999; Eurostat 1995.)

Whereas, top-down methods involve the distribution of a national figure among regions. The bottom-up methods are preferred, but they are rarely used in their pure form due to data constraints, for example. Therefore mixed methods may also be considered. For example, it can occur that a variable or an aggregate of variables can only be regionalised with the help of the bottom-up method at level NUTS-1. For a further regionalisation at level NUTS-2 or NUTS-3 a top-down method has to be used. (Piispala 1999; Eurostat 1995.)

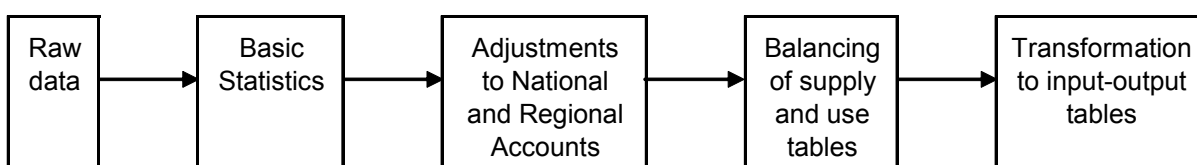
In principle, the advantage of bottom-up methods is that they directly employ relevant sources at the regional level. An advantage of top-down methods is the guaranteed numerical consistency between National and Regional Accounts. A disadvantage is that the estimates are not produced with direct data but with a key that is supposedly correlated with the phenomenon to be measured. (Eurostat 1995.)

### 2.3 Data environment

S&U tables and I-O tables are often treated as one system as they utilise the same data. Nevertheless the supply table and use table are the heart of this system since the basic data are brought together and balanced in the S&U table. This table is afterwards transformed to I-O table. S&U tables are most easily compiled by using National Accounts data as control totals, to which the estimated regional figures are adjusted. Annual National Accounts are completed by I-O tables, which describe economical structures and interdependencies at the more detailed level.

Basic data stems from many different data sources (e.g. production and investment statistics, inquiries of households, foreign trade statistics, government accounts), which are more or less inconsistent. They meet the budget identity, so the totals of the columns of an industry in the use table and in the supply table will be equal. However, transaction identity is not met, so total S&U of a commodity is not equal. This kind of inconsistencies will be removed at the balancing process. Flow of the information from raw data to the I-O tables is described in Figure 1. (Al & de Boer.)

Figure 1. Data flow



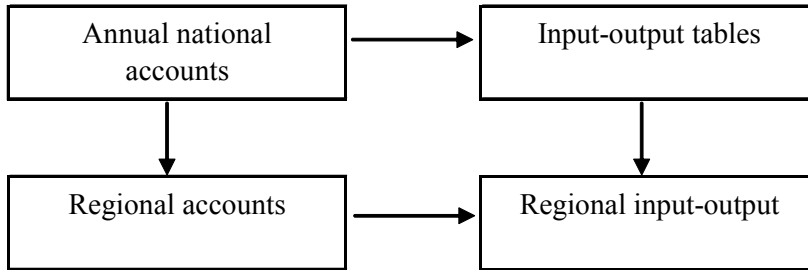
Basic data about regional production by industries is from the Regional Accounts (Statistics Finland 2005). Production is then divided to the goods by using Structural Business Statistics by Statistics Finland, industrial statistics, commodity statistics, Statistics of the Finances and Activities of Municipalities and Joint Municipal Boards, Agricultural Enterprise and Income Statistics, Business Register and Finnish Forest Research Institute's forest growth and harvesting data.

Regional Accounts aim is to describe economic processes in regions and they use the concepts of the National Accounts. Regional I-O tables can be seen as a more detailed system than Regional Accounts in the



same way as national I-O tables are for National accounts. On the other hand regional I-O tables regionalises national I-O table as regional dimension is added to it. As described on the Figure 2, National Account gives borders for the national I-O table. (Piispala 1997;1998.)

Figure 2. Regional I-O as part of the National Accounts.



Regardless of source data, the regional S&U tables are based on the same statistical and administrative information as used in the national tables. Interregional trade flows are the only exception as they are not included in the National Accounts. Regional Accounts describes economic processes in regions and they use the concepts of the National Accounts. The quality and quantity of regional economic data is quite good in Finland, which gives great possibilities to construct I-O tables and models.

### 3 COMPILATION OF REGIONAL INPUT-OUTPUT ANALYSIS ON 2002

#### 3.1 Where to start?

There needs to be some concrete starting point in the research after the research problem and the theoretical framework. In the case of this work there were available some elements of regional supply and use. The first element was Regional Accounts which is done yearly in Finland in regular bases<sup>4</sup> and the second one was the regional trade flow model (Louhela 2005). These elements were ground to regional balance of resources. The balance of resources includes aggregates of narrow supply and use (see Table 3) including discrepancy.

Table 3. The main aggregates of balance of resources

+Value added, gross at basic prices
+Taxes on products minus subsidies on products
=Gross domestic product, at market prices
+Imports
<b>=NARROW SUPPLY TOTAL</b>
+Exports
+Final consumption expenditure
+Gross fixed capital formation
+Changes in Inventories
<b>=NARROW USE TOTAL</b>

There was a need to compile transactions that are not available from Regional Accounts for the regional balance of resources i.e. imports, exports, final consumption expenditure, changes in inventories and the most difficult part imports and exports between regions. In this phase product dimension is not needed. The very early regional balance of resources is presented in Table 4. There is a big discrepancy in regional supply and use in this table due to missing information about regional flows of the most services and the lack of balancing. The product dimension was added after the rough levels of the transactions were in hand.

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<sup>4</sup> Regional Accounts in Finland covers production, employment and gross fixed capital formation for years 1975-2004(e) in detailed level.

Table 4.  
Regional balance of resources in Finland 2002, million €

Transactions		Country total Regions																				EXT	UNREGIONALISED
		01	02	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21		
		261 895																			1 500	160	
P2K	Intermediate consumption at purchasers' prices	139 301																			1 500	66	
B1GPH	Value added, gross at basic prices	68 422																				83	
D21N	Taxes on products minus subsidies on products	18 259																				4	
D21K	Taxes on products	19 329																				4	
D31R	Subsidies on products	1 070																				10	
B1GMH	Gross domestic product, at market prices	18 259																				4	
P7R	Imports of goods and services	42 762																				437	
P71R	Imports of goods	33 951																				7	
P72R	Imports of services	8 811																				429	
P721R	Imports of FISIM																						
P722R	Other imports of services	8 811																				429	
<b>SUPP</b>	<b>SUPPLY TOTAL</b>	<b>183 615</b>																				<b>95</b>	<b>437</b>
P6K	Exports of goods and services	54 001																				431	
P61K	Exports of goods	47 447																				40	
P62K	Exports of services	6 554																				391	
P621K	Exports of FISIM																						
P622K	Other exports of services	6 554																				391	
P3K	Final consumption expenditure	102 486																				173	
P3Y	Private consumption expenditure	72 024																				26	
P3I	Government consumption expenditure	30 462																				148	
P51	Gross fixed capital formation	26 580																				56	
P52	Changes in inventories	548																				-15	
<b>USE</b>	<b>USE TOTAL</b>	<b>183 615</b>																				<b>939</b>	<b>431</b>
SUPP	SUPPLY TOTAL	183 615																				95	437
USE	USE TOTAL	183 615																				939	431
ERD	DISCREPANCY	0																				6	
P7Ra	Regional imports of goods and services	3 343																				2	
P71Ra	Regional imports of goods	3 343																				2	
P72Ra	Regional imports of services	0																				0	
P721Ra	Regional imports of FISIM	0																				0	
P722Ra	Regional other imports of services	0																				0	
P6Ka	Regional exports of goods and services	2 668																				60	
P61Ka	Regional exports of goods	2 401																				54	
P62Ka	Regional exports of services	266																				7	
P621Ka	Regional exports of FISIM	0																				0	
P622Ka	Regional other exports of services	266																				7	
<b>SUPPa</b>	<b>REGIONAL SUPPLY TOTAL</b>	<b>73 437</b>																				<b>1 262</b>	<b>437</b>
<b>USEa</b>	<b>REGIONAL USE TOTAL</b>	<b>55 340</b>																				<b>1 000</b>	<b>431</b>
	REGIONAL DISCREPANCY	-18 097																				-262	134

### 3.2 Regionalisation of supply and use table

Regionalisation of supply table was based to two groups of data sources: roughly one third of the values of products were regionalised by dividing industries total national value of production to the regions by using aforementioned industries regional output information as a weight coefficient (mixed approach). Other data sources were used with the FISIM<sup>5</sup>, industrial production, some services and imports. The FISIM was regionalised by using the data from the local supply and demand. Industrial production was regionalised by industrial output statistics. In most of the real estate, renting, research and business services the products were derived from 5-digit industry classification level. In the local government sector the Statistics on Finances and Activities of Municipalities and Joint Municipal Boards were in use. Imports of the goods and services were regionalised by customs data and Structural Business Statistics/Business Register.

The mixed approach is the most efficient way to work as it relies only on the National and Regional Accounts. The correctness of the estimation results depends on the weight coefficient: does it describe reliably how the national total spreads in the regional level? In the worst case division is done by number of population and in the best scenario we know exact regional values from the source data and there is no need for division.

Despite the above-mentioned weakness, regional values are estimated in the most cases by following way: let us assume that Regional Accounts value of output for the region 1 is EUR 10,000, for the region 2 EUR 3,500 and for the region 3 EUR 1,500. Let us also assume that National accounts total for import duties is EUR 1,000. The total value of output in this case (10,000+3,500+1,500) is EUR 15,000. Respectively, regions' 1, 2 and 3 shares of import duties are 0.67; 0.23 and 0.10. The value of region 1's import duties were in this case ( $1,000 \cdot 0.67 = 667$ ) about EUR 667. Respectively, import duties for the regions 3 and 4 would be EUR 233 and 100.

Although the most of intermediate usage were derived by mixed approach the intermediate usage of the local government sector were analysed more carefully by integrating Statistics on Finances and Activities of Municipalities and Joint Municipal Boards to the Regional Accounts. Final consumption expenditures of the Household were estimated with help of Statistics Finland's Household Budget Survey from the years 2001-2002. Results were then regionalised to NUTS-3 level by small area estimation. General government expenditures were taken directly from supply (other non-market output). Whereas changes in inventories were derived by mixed approach and wholesale and retail trade surplus by volume of value added production and transportation surplus by change in wholesale and retail purchases and inventories.

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<sup>5</sup> Financial intermediation services indirectly measured.

As taxes on products cover all kind of taxes from value added tax to the sugar fee they were derived mostly by mixed approach, but data on household consumption and number of inhabitants were also utilised. Whereas, subsidies on products were regionalised by using mixed approach and agricultural subsidies.

Information about gross fixed capital formation by industry, type of good and region was also from the Regional Accounts. This data was derived then to the products. In the final S&U tables industry information of the gross fixed capital formation will be left out and balancing will be done by using product data.

Price formation concludes S&U on the product level. In the output account (supply) was valued at basic price and intermediate use (use) at purchasers' price. Difference between basic and purchasers' price was counted to make S&U fit together. Purchasers' price was formatted, when taxes on products minus subsidies on products, import taxes, trade and transportation margins and value added taxes were added to the basic price. Value added taxes are divided to the regions by national average by product, but components of the price formation was estimated regionally with the help of the Structural Business Statistics by Statistics Finland and Central government book keeping data.

In foreign trade, exports and imports were estimated first independently by combining customs data, enterprise register and trade statistics to the first hand balance checking. In the final balancing phase, foreign imports were flexible part of the regional usage. In other words, single product had always a certain part of imported good.

Since S&U were compiled independently, there existed difference in their regional values. This problem was handled in three steps: first it was made sure at the mixed approach, that regionalised figures fitted to the national control totals. Then S&U tables were compared on the regional level by good, industry, sector and type of output. As goods were divided to the local and movable products, demands of local products were supposed to equal supply of them. Whereas, gap between supply and demand of movable products was adjusted by interregional trade flows. Since the trade flows can not cover all the difference, the final adjustment was done by RAS-method.

In the balancing process of the national I-O table almost 900 commodities were distinguished, which was far too much for regional I-O project. Reclassification produced 208 commodities that actually covered all above-mentioned products. The number of industries was 90. According to the confidentiality rules of the Statistics Finland, tables will be probably published on the level of 40 industries and product groups.

### 3.3 Trade flows

The biggest difference between studies of 1995 and 2002 was the way, how trade flows were estimated. There was no survey made to the industrial establishments in the current research. Trade flows were estimated instead by freight flow approach, which combined industrial products' sales and transportation data (Louhela 2005;2006).

In the Louhela's research aforementioned trade flow model was used to estimate flows of the year 1996 and the results were compared with the same year's survey (Kauppila 1999). Second themes of the study were flows of the year 2002, which were estimated for the I-O analysis. Trade flow analysis was expanded for this purpose by flows of primary production and services, which were not included in the original research. In addition to this production data from the Regional Accounts was used as a boundary for establishments' value of production.

According to the research results of the survey approach, the freight flow and the gravity model estimated the order of the flows in the same way for 1996, but the freight flow model underestimated trade between smaller regions. The gravity model fitted, however, better to the explanation than to the estimation of trade, as the model assumed, that factors explaining trade have remained unchanged between the estimation and the research year.

## 4 CONCLUSIONS

The aim of this paper was to present, how S&U tables and symmetrical I-O tables are made for Finnish regions on year 2002. The bottom-up methods were preferred on compilation, but due to data constraints regionalisation was done in many cases by dividing industries total national value of production to the regions by using industries regional output information as a weight coefficient (mixed approach).

Since S&U were compiled independently, there existed difference in their regional values. This problem was fixed in three steps: first it was made sure at the mixed approach, that regionalised figures fitted to the national control totals. Then S&U tables were compared on the regional level by good, industry, sector and type of output. As goods were divided to the local and movable products, demand of local products were supposed to equal supply of them. Whereas, gap between supply and demand of movable products was adjusted by interregional trade flows. Since the trade flows can not cover all the difference, the final adjustment was done by RAS-method.

Since regional I-O analysis requires a lot of resources, it will be now made sure that the gap between this and next Finnish I-O does not grow for seven years, which was a case between this and Piispala's (2000) study.

Otherwise there is a great danger that the future research should be started from the very beginning. Analysis is, however, difficult to change for routine work and normal statistical production as the compilation of the data requires continuous development of the accounting methods and data usage in co-operation with National and Regional Accounts. If it is not possible to construct regional I-O for every year, it should be done at least every second or third year to secure continuing development of the tables. This could be a sensible time period also because of slowly changing economical structures.

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