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Estimation of Interregional Trade for Finnish Regions in 1996 and 2002 - Freight Flow and Gravity Approaches

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Estimation of Interregional Trade for Finnish Regions in 1996 and 2002

- Freight Flow and Gravity Approaches¹

Tuomas Louhela²

Abstract: When interregional trade flows were estimated in Finland for the year 1996, the survey was sent to almost 10,000 establishments in the manufacturing, construction and service industries (Statistics Finland 1999). In the regional input-output project for the year 2002 the time consuming survey was replaced by integrating commodity and cargo statistics. This freight flow method was used for the years 1996 and 2002 to calculate trade flows for Finnish regions. The estimation results were then compared with the survey's trade flow information. Estimations were also made for these years by the gravity approach to increase knowledge on, how this traditional method works at the regional level. According to the research results, the survey approach and the freight flow and gravity models estimated the order of the flows in the same way for 1996, but the freight flow model underestimated trade between small regions.

Keywords: interregional trade flows, freight flows, regional input-output tables, gravity model.

1 INTRODUCTION

Statistical compilation of trade flow data is an important part of the regional input-output analysis, as the predictions on regional effects depend on the way, in which trade flows are estimated (Statistics Finland 1999, 42). The regional trade flow modelling is, however, quite often based on little if any primary data on interregional exports and imports, even though for most local economies this trade makes up a large share of their local flows of goods and services (Harris & Liu 1997, 851-852).

The little usage of the trade flow data is mainly due to the weak statistical coverage of regional economies. In fact, interregional trade is not covered by official statistics in most countries, which results in it having to be estimated by whoever is interested in it. (Ramos & Sargento 2003, 1.) Since ad hoc surveys are quite expensive, Finnish trade flows have been usually estimated by the nonsurvey approach (Saurio 1990; Susiluoto 1996).

The first regional supply and use tables were constructed in Finland, nonetheless, using data obtained with a direct survey (Kauppila 1999; Statistics Finland 1999), which was sent to almost 10,000 establishments in manufacturing, construction and service industries. Statistics Finland is currently carrying out the second regional input-output analysis, which includes all 20 regions of the country. The greatest difference to the

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study of the year 1995 is that the on-going project does not gather trade flow information by survey, but integrates data on sales of industrial products' and transportation at the freight flow approach.

The aim of this paper is to provide a new view to the estimation of trade flows. The freight flow method is used for the years 1996 and 2002 to calculate trade flows for Finnish regions. The estimation results are then compared with the trade flow information obtained with the survey. The year 2002 is included in the study, because trade data will be integrated into the same year's regional input-output analysis. Estimations are also made for these two years by the gravity approach to increase knowledge on how this traditional method works at the regional level.

The study includes six sections, which proceed from an introduction of trade flow methods and estimation to research results and conclusion. The survey and nonsurvey approaches are reviewed in section 2, gravity and freight flow models are introduced in sections 3 and 4, and the research results and conclusion are presented in sections 5 and 6.

2 TRADE FLOW ESTIMATION METHODS

2.1 Direct surveys

In the ideal case, a trade flow matrix (Table 1) is constructed for all the economic agents by a direct survey, which makes it possible to estimate the sellers and buyers of every product in all industries (Richardson 1985, 609; West 1990, 104). Direct surveys have been especially used to collect information on a single region's trade flows (e.g. Miernyk et al. 1970), but during the past few years they have also been used in multiregional studies (e.g. Genereux & Langen 2002, Statistics Finland 1999 and Eding & Nijmeijer 1998).

TABLE 1 Interregional and internal trade flows.

		Destination region			
		Region 1	Region 2	...	Region 20
Departure region	Region 1				
	Region 2				
	⋮				
	Region 20				

Although Miernyk et al. collected trade flow data by personal interviews (sic), the forementioned three studies used postal surveys. Unfortunately, the postal approach can be recognised from the response rate, which was only 45% for the Finnish project and 57% for the Dutch one. This is also the reason why Kauppila et al. imputed over half of the data by the nearest neighbour method (Statistics Finland 1999, 5–8).

Kauppila (1999) inquired establishments' sales distribution between the home region, the Uusimaa region, the three most important trading regions³, and the rest of Finland and foreign countries. The study of Eding et al. (1998) was slightly simpler as they sorted out only companies' sales to their own region, the rest of the Netherlands and to foreign countries.

2.2 Methods based on production and transportation statistics

Because it is quite expensive to do an extensive survey covering all economic agents, a survey may also be understood as a method that uses information from earlier flows of goods. This kind of purchasing and sales data can be produced by combining production and transportation statistics.

Production data may be obtained, for example, from industrial output statistics, which contain data on sold and total output from establishments with 10 or more employees. As well as industrial production data for industrial output statistics, data on truck cargo are collected by survey. Flows from all other means of transportation are, however, received from the Finnish Maritime Administration, the airline operator Finnair and the railway company VR.

The freight flow model uses as reliable data on production as a traditional establishment-based survey does since both of these methods take advantage of earlier sales data. Kauppila et al., for example, reviewed establishments' regional sales distribution, but they did not inquire about the total volume of sales (Statistics Finland 1999).

The freight flow and the survey approach define, however, the direction of the flows in different ways. In the freight flow model, goods leave from the sales point indicated in industrial output statistics to the destination spot shown in cargo data. Whereas, in the survey, establishments report where the goods have been transported to.

Flow information from surveys may be biased since surveys do not include all establishments, their regional division is insufficient and some of the replies are given at the company level. Trade flows from surveys' may also be misrepresentative because of the questionnaire, which may give certain destination regions (e.g. Uusimaa, own region, rest of Finland). In consequence, the given regions may receive flows above, and other regions below, the real level. In addition to this, flows ending into the rest of Finland should be divided in some way between the remaining 17 regions.

The problems of the freight flow model are, by contrast, related to logistics centres, such as harbours, railway stations and airports. The model should be able to point out which flows remain in the region and which

³ Establishments named themselves the most important trading regions.

continue on forwards. The reliability of the model can also be questioned, since cargo statistics only divide goods to a few dozen groups. More detailed information would be needed, as the estimated value of the flow is based on the weight of the cargo. Despite these problems, the freight flow model was used, for example, in Vertanen's study (2004).

2.3 Nonsurvey methods

Indirect estimation methods (e.g. gravitation and top-down approaches) utilise parameters that describe trading regions, such as the value of their production, the number of population or the cost of transportation. Gravitation methods state that the amount of interaction between two regions (particles) is directly proportional to the product of their masses (e.g. population) and inversely proportional to the square of the distance between them. The approach is reviewed more closely in section 3.

The idea of top-down approaches, such as location quotients, is to derive national input-output tables for the regional level with the help of local information. National coefficients are in this case the upper limit for the local level. All the methods either approve the national coefficient or decrease it depending on the economic structure of the region. (Nenonen 1981, 54–56.) As a drawback these methods tend to underestimate interregional trade flows and assume the production technology to be the same nationally and regionally (Harris & Liu 1997, 860; Susiluoto 1996, 79).

3 GRAVITY MODEL

3.1 Variables and measurement of their values

According to the neural network theory (e.g. Haikonen 2002), the gravity model presumes that regional trade takes place in one spatial location (in capital of the region) only. This means that regional trade flows move on the transportation network (sea, air, railway tracks and highways) between the capitals. The study also assumes that establishments minimise their costs and transport goods by using the shortest possible routes.

The variables of the gravity model are presented in Table 2. There are different variables for departure and destination regions, since the model would not be able to analyse otherwise why more goods are sold to one region than the other ones, for example.

TABLE 2 Variables of the gravity model.

Factors explaining trade flows	Variable	Symbol of the variable	Factors explaining trade flows	Variable	Symbol of the variable
Distance factors	Distance by car	Dc	Distance factors	Distance by train	Dt
	Distance by airplane	Da		Distance by boat	Db
	Number of non-Finnish speaking inhabitants in the departure region	Si		Number of non-Finnish speaking inhabitants in the destination region	Sj
				Trade partners' common border (dummy)	Bij
Concentration factors	Departure regions' population	Pi	Concentration factors	Destination regions' population	Pj
	Departure regions' area	Ai		Destination regions' area	Aj
	Departure regions' population density	Ti		Destination regions' population density	Tj
Productivity factors	Departure regions' grossvalue of production	Ci	Productivity factors	Destination regions' grossvalue of production	Cj
	Departure regions' value added of production	Fi		Destination regions' value added of production	Fj
	Increase on production value in the departure region	Gi		Increase on production value in the destination region	Gj
	Departure regions' increase on production value divided by gross value of production	Hi		Destination regions' increase on production value divided by gross value of production	Hj
	Departure regions' value of exports	Ei		Destination regions' value of exports	Ej
	Number of patents in the departure region	Ii		Number of patents in the destination region	Ij
	Departure regions' r&d-spending	Ji		Destination regions' r&d-spending	Jj
Labor market factors	Number of entrepreneurs in the departure region	Ki	Labor market factors	Number of entrepreneurs in the destination region	Kj
	Number of employees in the departure region	Li		Number of employees in the destination region	Lj
	Number of establishments in the departure region	Mi		Number of establishments in the destination region	Mj
	Number of university graduates in the departure region	Ni		Number of university graduates in the destination region	Nj
	Number of secondary level degrees in the departure region	Vi		Number of secondary level degrees in the destination region	Vj
	Departure regions' unemployment rate	Ui		Destination regions' unemployment rate	Uj

Equation of the gravity model can be specified as

$$\begin{aligned}
 (3.1) \quad I_{ij} = & a_1 D_C + a_2 D_a + a_3 D_t + a_4 D_b + a_5 S_i + a_6 S_j + a_7 B_{ij} + a_8 P_i + a_9 P_j + a_{10} A_i + a_{11} A_j + \dots \\
 & \dots + a_{12} T_i + a_{13} T_j + a_{14} C_i + a_{15} C_j + a_{16} F_i + a_{17} F_j + a_{18} G_i + a_{19} G_j + a_{20} H_i + a_{21} H_j + \dots \\
 & \dots + a_{22} E_i + a_{23} E_j + a_{24} I_i + a_{25} I_j + a_{26} J_i + a_{27} J_j + a_{28} K_i + a_{29} K_j + a_{30} L_i + a_{31} L_j + \dots \\
 & \dots + a_{32} M_i + a_{33} M_j + a_{34} N_i + a_{35} N_j + a_{36} V_i + a_{37} V_j + a_{38} U_i + a_{39} U_j + a_0,
 \end{aligned}$$

where I_{ij} is the value of trade flow in 1996 as determined in the survey of Statistics Finland (1999) and $[a_0, a_{39}]$ are the parameters to be estimated.

3.2 Estimation of the model

The estimation of the gravity model was done with the SPSS 12.0.1 program. In the unlogarithmic model the adjusted R-square was 0.419, but in the logarithmic model no fewer than 0.850. The logarithmic model is reviewed now more closely. The statistically significant ($P < 0.05$) variables in the model were the departure and destination regions' area, population, common border and sea and air distance. The departure regions' gross value of production, unemployment and number of entrepreneurs, establishments and employees, and the destination regions' value added of production and volume of exports, patents, R&D costs, university and upper secondary level degrees and non-Finnish speaking population were also statistically significant variables.

The logarithmic model is now reduced by dropping out variables that are not statistically significant ($P < 0.01$). In addition to this, the number of correlating variables is decreased. The model is estimated by using the stepwise method so that there is only one distance variable (highway, railway, sea or air distance) in the model. All the other variables excluding highway distance, common border, departure regions' gross value of production and number of entrepreneurs, and the destination regions' value added of production were now left out of the model. Models using railway, sea and air distances obtained the same variables.

Gravity models were now specified as

$$(3.2) \quad \ln(I_{ij}) = a_1(D) + a_2B_{ij} + a_3 \ln(C_i) + a_4 \ln(F_j) + a_5 \ln(K_i) + a_0,$$

where I_{ij} is the value of trade flow in 1996 as determined in the survey of Statistics Finland (1999), D is the rail, sea, air or highway distance depending on the model, B_{ij} is a dummy variable describing trade partners' common border, C_i is the departure regions' value of production, F_j is the destination regions' value added of production and K_i is the number of entrepreneurs in the departure region. $[a_0, a_5]$ are the parameters to be estimated in the model.

It is worth noting that in the model (3.2) logarithms are taken from all variables other than distance and common border of the regions. The estimation would have been impossible for logarithmic distance, as one cannot take a logarithm from zero (region's distance from self). This is an important characteristic of the equation, since the model also estimated how much trading took place inside the region. The dummy variable describing common border was also kept without a logarithm, as its values are only zeros and ones.

A summary of the estimated models is shown in Table 3. The estimation results are exceptional as the model based on road distance does not have the greatest R-square, although all the regions excluding Åland have a connection to the highway network. If goods are taken, for example, by boat from Kuopio to Kemi and from

there by truck to Rovaniemi, the length of the journey is 1,760 km. However, the length of direct truck transportation would have been only 491 km. This may also be the reason why the coefficients of the highway and railway models put more weight on distance and less on common border.

TABLE 3 Reduced models explaining the value of trade in the 1996.

Independent variable	Truck distance model		Train distance model		Boat distance model		Airplane distance model	
	Estimated coefficient	t-value	Estimated coefficient	t-value	Estimated coefficient	t-value	Estimated coefficient	t-value
Constant	1.536	2.093*	1.828	2.465*	1.712	2.427*	2.503	3.358**
Distance by car (1000 km)	-1.911	-7.133**	-	-	-	-	-	-
Distance by train (1000 km)	-	-	-1.695	-7.344**	-	-	-	-
Distance by boat (1000 km)	-	-	-	-	-0.882	-9.104**	-	-
Distance by airplane (1000 km)	-	-	-	-	-	-	-1.355	-8.463**
Trade partners common border (dummy)	0.822	7.150**	0.827	7.327**	0.960	10.085**	1.157	13.010**
Departure regions' grossvalue of production	0.44	6.790**	0.435	6.730**	0.377	5.977**	0.364	5.674**
Number of entrepreneurs in the departure region	0.61	7.008**	0.585	6.724**	0.715	8.470**	0.686	8.052**
Destination regions' value added of production	0.725	15.160**	0.721	15.115**	0.729	15.815**	0.681	14.364**
R ²	0.754		0.756		0.77		0.765	
Adjusted R ²	0.751		0.752		0.767		0.762	
Standard error	0.7659		0.76328		0.73975		0.74864	
Durbin-Watson	1.731		1.744		1.83		1.807	

*Variable is statistically significant <0.05

**Variable is statistically significant <0.01

The sea distance model seems to be the best of the models according to R-square, but since 84% of all cargo were transported by truck in 2002 (Louhela 2005, 57), the highway distance model is now selected. The difference between the R-squares of these models is not so significant that it would give reason to do otherwise.

4 FREIGHT FLOW APPROACH

4.1 Review of the data

The freight flow method uses industrial output statistics, which cover 90% of the mining, quarrying and manufacturing goods produced in Finland. The data comprises the value, selling location and weight of the product. Transportation information is collected from air, road, railway and waterway statistics and it includes the weight of the product and the departure and arrival location of the freight. The freight flow model, therefore, assumes that the product has been exported from the selling point in industrial output or regional production statistics to the destination spot in transportation statistics. (Louhela 2005)

Data for the years 1996 and 2002 differ mostly by the number of observations and goods classification. The number of railway observations is clearly smaller in 1996 than in 2002, since flows were counted earlier by traffic area instead of each railway station. In 1996, industrial output statistics used the HS classification,

which was changed to the present-day Prodcum in 1997. A summary of the freight flow model's data is shown in Table 4.

TABLE 4 Data used in freight flow models.

Research year	Data	Year	Number of observations	Goods classification	Variables used in the study
1996	Industrial output statistics	1996	15898	HS	Establishment, product, value of the sold good and community.
	Statistics on goods transport by road	1995-97	50796	NST/R 42	Departure and destination community, product and weight.
	Statistics on goods transport by train	1996	2412	NST/R 24	Departure and destination community, product and weight.
	Statistics on goods transport by airplane	1997	84	n/a	Departure and destination station and weight.
	Finnavia's cargo data	1997	56	2 products	Departure and destination station and weight.
	Statistics on goods transport by sea	1997	560	18 products	Departure harbor or waterway, destination harbor, product and weight.
	Customs' export data	2001	38937	SITC	Product, transportation method, value and weight.
Research year	Data	Year	Number of observations	Goods classification	Variables used in the study
2002	Industrial output statistics	2002	17192	PRODCOM	Establishment, product, value of the sold good and community.
	Statistics on goods transport by road	2001-03	47032	NST/R 42	Departure and destination community, product and weight.
	Statistics on goods transport by train	2002	6812	NST/R 24	Departure and destination community, product and weight.
	Statistics on goods transport by airplane	2002	50	n/a	Departure and destination station and weight.
	Finnavia's cargo data	2002	56	2 products	Departure and destination station and weight.
	Statistics on goods transport by sea	2002	483	18 products	Departure harbor or waterway, destination harbor, product and weight.
	Customs' export data	2002	38773	SITC	Product, transportation method, value and weight.

4.2 Freight flow model

The trade flow estimation is based on the integration of industrial output and cargo statistics and the model assumes that the value of regional exports (in euros) is divided according to the weight (tonnes) of the freight. If region a, for example, has exported good g 80 tonnes to region b and 20 tonnes to region c, the result of the estimation is that ($\frac{80}{80 + 20} = 0,8$) 80% of the value of region a's exports are directed to region b and 20% to region c.

The correctness of the estimation results depends on the goods classification: if the monetary value of the commodities in the same category does not differ, the model works. Unfortunately, this is not the case with cargo statistics, which in NST/R⁴ class 10, for example, cover paper napkins, books and stamps.

Despite the above-mentioned weakness, flows are estimated (Table 5) in the following way: let us assume that region 1 exports commodity 10 only to regions 2, 3 and 4. Let us also assume that commodity 10 is divided into two KTTL⁵ products. The total weight in this case (120+80+60) is 260 tonnes. Respectively, regions' 2, 3 and 4 shares of exports are 0.46; 0.31 and 0.23. The value of region 1's exports to region 2 were in this case ($1000 \cdot [400 + 20] \cdot 0.46 = 193846$) about EUR 194,000. Respectively, exports to regions 3 and 4 would be EUR 130,000 and 97,000. The value of trade between regions 1, 2, 3 and 4 would be altogether EUR 420,000. The value of KTTL exports is derived by multiplying the value of products with the NST/R weight coefficient.

TABLE 5 Value of trade flows.

NST/R-good	KTTL-good	Name of the KTTL-good	Departure region	Destination region	Weight of the flow (tonnes)	Value of the KTTL-product (1000 €)	Weight of the flow divided by weight of all the flows	Value of the KTTL-flow (1000 €)
10	211250	Refined paper	1	2	120	400	0.46	185
10	211250	Refined paper	1	3	80	400	0.31	123
10	211250	Refined paper	1	4	60	400	0.23	92
10	212110	Corrugated paper	1	2	120	20	0.46	9
10	212110	Corrugated paper	1	3	80	20	0.31	6
10	212110	Corrugated paper	1	4	60	20	0.23	5
Sum								420

The estimation of foreign exports was done slightly differently, since it was based on structural statistics on enterprises and on the Finnish Customs' data. By contrast to industrial output statistics, structural statistics on enterprises do not include information on products made at the establishment level. The data reveal only the standard industrial classification, which means that the volume of foreign exports must be estimated for every KTTL product at each establishment.

Since the proportion of exported products was removed from the total value of the goods, the freight flow model used only the value left to the internal trade in Finland. Foreign exports were thus exogenously given

⁴ This study used the Finnish NST/R classification, which includes 42 different products. Additional information is available at: http://europa.eu.int/comm/dgs/energy_transport/figures/pocketbook/nomenclature_nst_en.htm (7.4.2006).

and the transportation and weight information determined how internally traded goods were divided between Finnish regions.

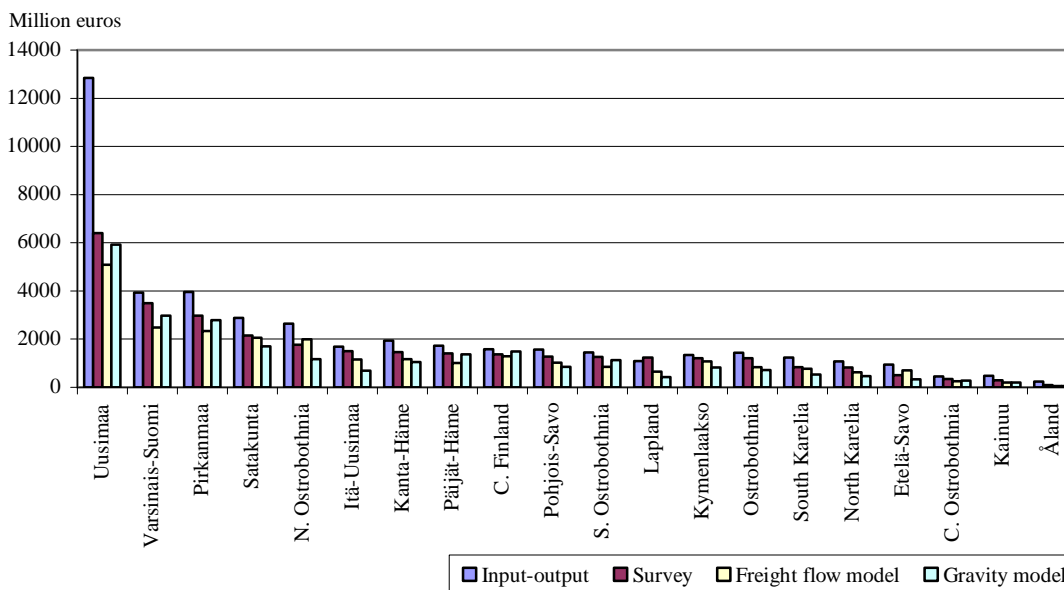
5 RESEARCH RESULTS

Estimated trade flows from the input-output analysis, survey, and the freight flow and gravity models are compared in section 5. The flows from the input-output analysis and from trade flow survey for the years 1995 and 1996 were done by Statistics Finland (2000;1999) while those from the freight flow and gravity models for the years 1996 and 2002 were estimated by Louhela (2005).

5.1 Trade flows in 1996

The estimation methods evaluate regional exports in a similar way, since all of them set the regions of Uusimaa, Varsinais-Suomi, Pirkanmaa and Satakunta as the greatest exporters. Respectively, the exports of Central Ostrobothnia, Kainuu and Åland are estimated to be the smallest (Figure 1).

FIGURE 1 Total value of exports from Finnish regions to Finland in 1996.

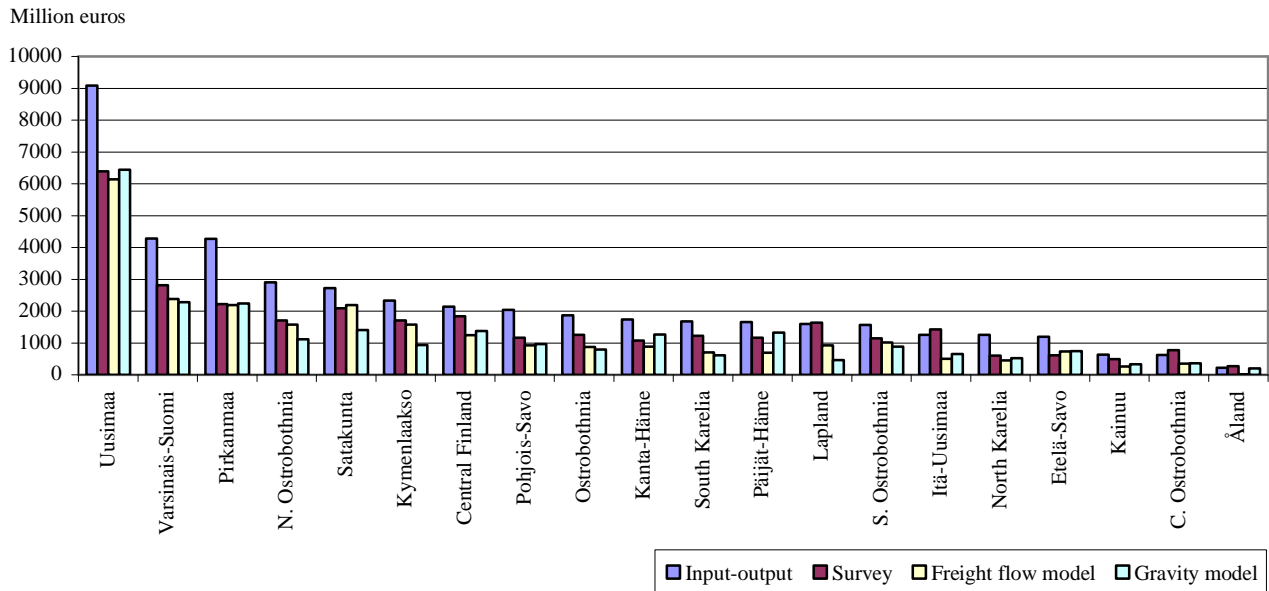


The difference between the results from the survey and the freight flow model is best explained by the fact that the value of trade flows in industrial output statistics was only EUR 54.2 billion, while total sales from the survey exceeded EUR 60.5 billion.

⁵ Finnish national accounts product classification (KTTL) is based on the Statistical Classification of Products by Activity (CPA) of the European Union (http://www.stat.fi/meta/til/vtp_en.html). 7.4.2006.

According to all the estimation methods, the biggest importing regions were Uusimaa, Varsinais-Suomi and Pirkanmaa. The smallest import flows were estimated at the same time for Central Ostrobothnia and Åland. The largest differences in the estimation results concern the imports of Uusimaa and Pirkanmaa, which are clearly estimated greater by the input-output analysis than by the other methods (Figure 2).

FIGURE 2 Total value of imports to Finnish regions from Finland in 1996.

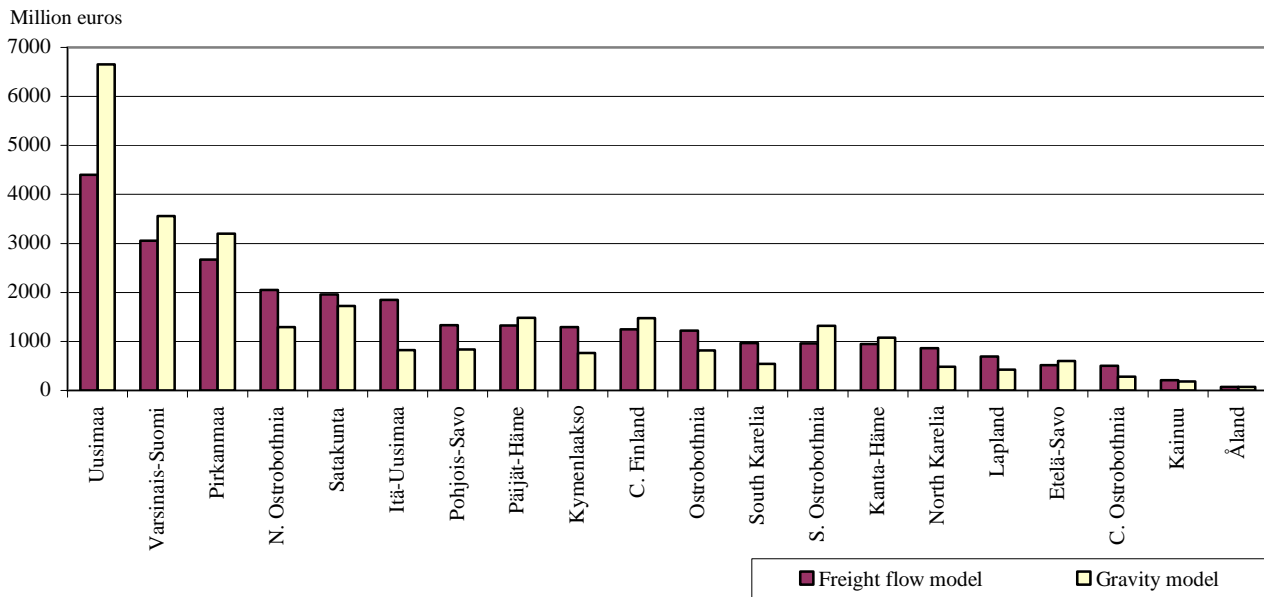


The freight flow model underestimates several flows leaving from and arriving to Åland and Itä-Uusimaa. The model also has problems with the estimation of trade flows between Ostrobothnia and Etelä-Savo and Kainuu and Ostrobothnia, since it indicates that there is no trade between these regions. However, the model overestimates flows between Ostrobothnia and Itä-Uusimaa. The trade between Kymenlaakso and South Ostrobothnia and Åland and Uusimaa is also over five times greater in the model than is reported in the survey.

5.2 Trade flows in 2002

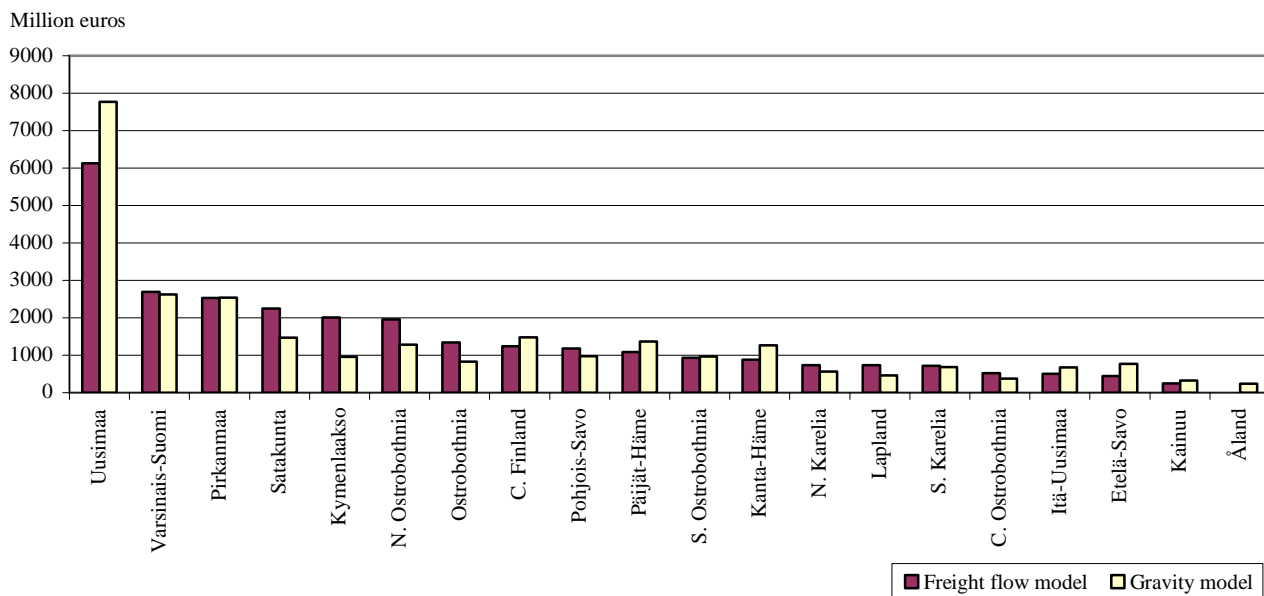
Uusimaa and Pirkanmaa were also the greatest exporters in 2002. Respectively, the exports of Åland and Central Ostrobothnia were the smallest ones. The greatest difference to the year 1996 is that the results from the different approaches differ much more in the Figure 3 than in the Figure 1.

FIGURE 3 Total value of exports from Finnish regions to Finland on 2002.



The freight flow model estimates that imports to Uusimaa have remained unchanged 1996-2002, while the gravity method indicates an increase of EUR two billion. The best aligned are imports to Pirkanmaa (Figure 4).

FIGURE 4 Total value of imports to Finnish regions from Finland in 2002.

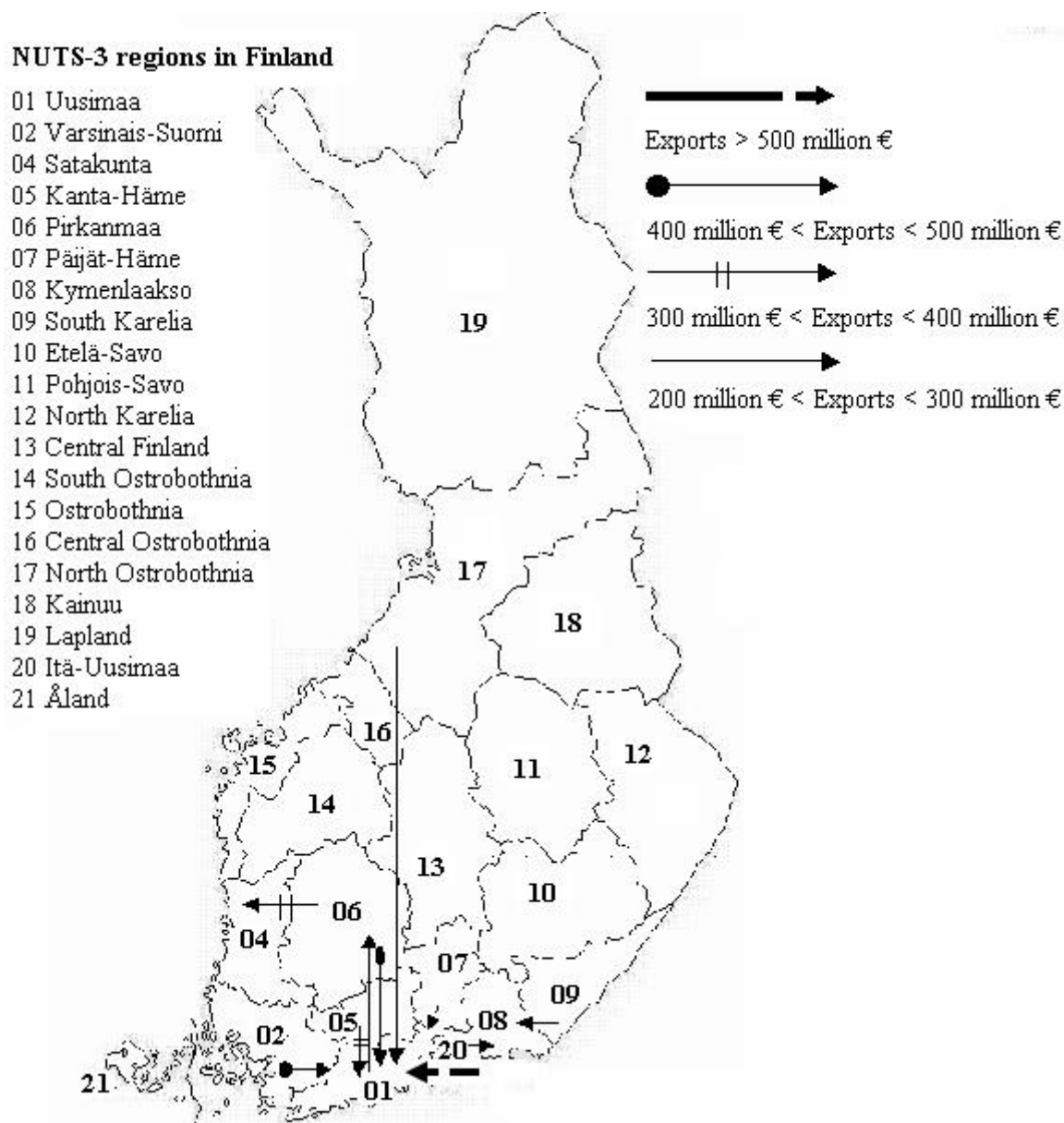


The values of 170 interregional flows decreased between 1996 and 2002 according to the freight flow model. The most surprising finding, however, is the decrease in 12 flows of Uusimaa, which make the region stand in the same category as Kanta-Häme and Kainuu, which both lost value in 11 exports streams.

In 1996 and 2002, the largest trade flows departing from and arriving in Finland took place inside the regions. However, it is not absolutely clear how much the values of these flows changed in the research period. According to the gravity model, trade inside Uusimaa increased by EUR 0.5 billion, while the freight flow model indicated a decrease of EUR 800 million.

Out of the ten largest interregional flows six end in Uusimaa and two in Kymenlaakso in 2002. The largest flows leave Itä-Uusimaa and Pirkanmaa and go to Uusimaa, Kymenlaakso and Satakunta. The longest flow on the top-ten list is the stream from North Ostrobothnia to Uusimaa. Other flows flying over at least one region are those between Pirkanmaa and Uusimaa (Figure 5).

FIGURE 5. The largest interregional flows according to the freight flow model in 2002.



6 CONCLUSION

According to the results of the survey approach, the freight flow and gravity models put the flows in the same order as in 1996, but the freight flow model underestimates trade between small regions. When single flows are compared, the results of the gravity approach differ greatly from the flows obtained with the other two methods.

Nonetheless, the trade flow approaches evaluate the value of entire exports and imports in the same way, since estimation errors balance at the aggregated level. The gravity model fits, however, better to the explanation than to the estimation of trade, as the model assumes, that factors explaining trade have remained unchanged between the estimation and the research year.

The freight flow model worked, but the results would have been probably better if the modelling had been done in two parts: one model for goods that are exported out of Finland and another for local products. The price differences between goods in the same product category could have been reduced in this way.

As the estimation of trade between small and distant regions proved to be impossible with the freight flow model, this gap could be filled either by a local survey or by assuming that oversupply of products on the local market means exports to other regions.

Service streams were unfortunately not included in the freight flow model, since cargo data do not cover immaterial goods. This is also the reason why these flows should be estimated by the above-mentioned supply-demand approach. Goods can be divided for this purpose into Helsinki-based, interregional and local services, which means that business consulting, for example, is exported from Helsinki but barber's shops serve only local customers.

Further research could also be directed at logistics data, which do not tell where products leaving harbours end up and, respectively, which regions export goods to them. The idea is to integrate all the cargo flows from the departure point to the final destination regardless of the used methods of transportation. In this case a commodity flow that, has been carried by truck and boat transportation would be shown as a single stream instead of two unconnected flows.

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