Swedish Base Matrices Report.
Estimates for 2004, estimation methodology, data, and procedures

by

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Executive summary

Background

With the aim of improving the overall forecasting capability for planning and analyses of goods transport issues in Sweden, it was decided in 2004 to prioritise the development of two key components: Base Matrices for Swedish transport planning and analysis based on the P/C [production/consumption] approach, and the development of a logistics model.

The process to develop the base matrices started with a few preliminary studies. More active development work along the lines that were agreed on for the Base Matrix development started within SIKA (Henrik Edwards) in 2005. During the last year contributions to the documentation of the development work carried out by Henrik Edwards, now at Vägverket Konsult, have been made by John Bates and Henrik Swahn. Base matrices, as well as firm to firm flows, from the project have been delivered to the company that is currently involved in the development of the new logistics model.

On the concept of (base) matrices and their use in transport planning

Matrices in transport planning and modelling give a description of demand for movement of goods or people. Such matrices may be interesting in themselves, e.g. for studies in regional economics, since they reflect the pattern of spatial economic interaction.

In transport planning the matrices are mostly used as input to transport/traffic models that show how the demand for movements is handled by the transport system and how this affects the use of various parts of the transport infrastructure.

The matrices produced in this project may also be used as the basis for traffic model assignment in the traditional way used by transport planners, using the STAN model, for example. In this case, however, the particular purpose of the matrix development project is to provide demand input to the newly developed logistics model.

The aim of the logistics model is to deal with demand for goods movements in a way that in reasonable detail reflects the way the real world logistics system would deal with such demand. This means that various aspects of the logistics system are modelled, such as use of different transport modes and a rich variety of types of vehicles within each mode. Further, the logistic model aims to find the lowest cost solution to handling the complex interaction between different goods flows between different relations. To accomplish this the logistic model uses various mechanisms to benefit from scale and scope advantages, such as forming transport chains involving multiple modes and vehicles and thus also using different kinds of freight terminals, consolidation of shipments, using unitised cargo carrier solutions etc..

The input requirement from the logistics model has been the main determinant of the requirements on the demand matrices that have been developed in this project. Thus the product structure has been made considerably more detailed than the earlier STAN-based SAMGODS model (from 12 to 35 products). To allow the logistics model to operate in an adequate way the demand for goods movements in the matrices must in principle reflect movements from the origin of the goods (P=production) to the place where the goods is used for final or intermediate consumption (C= consumption). (Wholesale companies act as both P- and C-type players). The logistics model also deals with different shipment sizes since it is well known that shipment size is a very important parameter in logistics.

To meet this requirement, it was decided that the Swedish Base Matrices project should also deliver data relating to the number and sizes of shipments that constitute the goods flows quantified in each demand matrix element.

The term Base Matrices is used to denote matrices that relate reasonably close to the present situation[1]. Base matrices are normally used in transport planning to establish a “base” situation which is used as reference case for studies of the effects of various policies, investment programmes or to study the effects of changes over time, e.g. changes of the economy, population etc that are exogenous to the transport sector. For the latter case. forecast matrices are produced and used and compared with the base situation.

Some general remarks on the Base Matrices estimation process

No single data source is available that would allow us to directly estimate the matrices. Earlier approaches had to rely on O/D data from standard transport statistics, but obviously such data, though potentially useful for validation purposes, do not adequately support the P/C approach to logistics and modelling transport, which is theoretically superior to the earlier O-D approach. The problem with the P/C approach has generally been the lack of a reasonable empirical basis. However, the decision in Sweden to launch the CFS surveys has made it much more realistic to commit to the P/C approach.

It has become quite clear, however, that the CFS surveys are too small to allow the Base matrix estimation to rely solely on CFS. Additional mechanisms are therefore required, and the approach taken involves using available data in the best way, supplemented (for the domestic parts of the matrices) by various modelling approaches, as will be further explained below and in detail in the report.

What has been accomplished in the project? Beside the base matrices as such, the estimation methodology has been developed, especially for the domestic matrices and for the firm to firm flows. Moreover, many data bases have been organised, checked and put to productive use, e.g. CFS 2001 and 2004/2005, FTS 2004, CFAR, National accounts and Sampers data.

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[1] Clearly, due to lags in data collection etc. in practice the base matrices must always relate to an earlier time period than the present.

Domestic matrices

The domestic matrices are constructed by combining observed upscaled values from CFS and a synthetic matrix. The synthetic matrix for each product is estimated in four major steps:

1) First a set of regression models for each product and for row and column sums are estimated; separate models are estimated for flows from producers (P) and wholesalers (W). The dependent variable for each model is the row and column sums that were observed in CFS 2001 and CFS 2004/2005. Independent variables are production, intermediate consumption and final consumption for each zone, calculated from national account data disaggregated over the zones using employment data for each zone and product. Further, employment data for different industry and trade sectors are used as independent variables.

2) Second, for each product the parameters of a model for the cell values are estimated. These models are of a "gravity" type. The dependent variable is the observed CFS-flow for each cell and the independent variables are the relevant modelled row (supply) and column (demand) values, the network distance calculated from STAN for each matrix cell.

3) Third, the synthetic domestic product matrices are computed

4) Fourth, for each product the synthetic matrix is combined with observed values from CFS according to certain rules designed to avoid generating values for all cells, since this would lead to too many small values. One further aim is to ensure that a target value, compatible with National accounts, is met for each product matrix.

Export and import matrices

Like the domestic matrices, export and import matrices are estimated for each product (35 products including air freight). Data on export and import product values and weights between Sweden and other countries are available at a very detailed product level in the foreign trade statistics (FTS), and these are judged to give reliable estimates of the country to country trade flows per product. However, there is no information at all in the foreign trade statistics on the **regional** distribution of trade, which is required to make it possible to estimate the export and import matrices.

Fortunately, the CFS databases also cover export and import flows that to a considerable extent also are coded with location of origin and destination, though there are flaws in the location coding that have to be addressed. Observations on export and import flows from CFS (2001 and 2004/2005) therefore potentially provide a source for information on the domestic and foreign regional distribution of trade flows.

The approach to the export and import matrices therefore has been to use FTS-data to determine the level of trade, and CFS-data for the regional distribution of the trade in both ends.

One problem is that the number of CFS-observations on foreign trade is rather small, with the effect that many trade relations that are present in the FTS are very sparsely or not at all covered by CFS-observations. To handle this certain supplementary rules have been used, intended to generate reasonable distributions even in cases where there are only very few or no observations for the particular product and country to country flow.

Thus the export and import matrices are entirely estimated from available data. Unlike the domestic matrices, no synthetic (modelled) matrices have been used for the foreign trade matrices.

Transit matrices

The transit matrices are entirely based on the earlier transit matrices for 2001 (?) that were produced for the STAN-product groups in 2004. The STAN oriented transit matrices have been distributed among the 34 new products, and the flow values for each product have been recalculated to 2004 level, using the growth rate for Swedish foreign trade between 2001 and 2004.

Firm to firm flows and shipments (step A)

As was mentioned above, the new logistics model operates not on aggregate zone-zone flows but on shipments between firms. Initially the idea was to let the logistics model handle the generation of firm to firm shipments based on the matrices: this approach has indeed been taken for the Norwegian logistics model. However, since much data that is required to generate firm to firm shipments is also useful for the estimation of the base matrices, it was decided for Sweden to integrate the generation of firm to firm flows/shipments with the base matrix project.

The firms are divided into three different size categories. For each cell of the base matrix there could therefore be 3x3 = 9 types of trade relations. The number of companies for each size class producing or using each product can be calculated from CFAR-data. The total goods quantity that is shipped between these companies is given by the Base matrix cell value. This quantity is distributed among the nine subcells, and within each subcell, some control to observed shipment size (from CFS) is applied, based on the formula for the economic order quantity in standard inventory theory. The data on the number of firm to firm flows as well as the demand allocated among the nine subcells become the input to the logistics model.

The resulting base matrices

The resulting base matrices are produced in the form of a comprehensive text file that includes all products and all different parts of the matrices (domestic, singular, export/import and transit)

What about the quality of the results?

No systematic evaluation of the quality of the matrices has yet been completed. However, a process with the aim of evaluating the Base matrices has recently been initiated by SIKA and VTI. Preliminary results indicate that the outcome is similar to CFS and earlier estimates for many products. For certain products, though, there are considerable deviations, both from earlier base matrix estimates that were partly based on other types of data (transport statistics and foreign trade statistics) and from the directly upscaled CFS values. One further problem seems to be that there might be too many small cell values and also too many small shipments.

From a purely modelling point of view it has been observed in the project that most of the regression models for row and column sums perform rather poorly. Due to the fact that the Base matrix estimates are derived from a combination of synthetic and observed values, the potential negative impact may not be so important for the base matrices. In a forecasting situation, however, this weakness might be more serious.

As was said initially, most of the evaluation work still remains to be carried out.

Procedures, programmes and data bases

In the report there is only a very sketchy description of the procedures, programmes and data bases that have been used. This description is hardly sufficient to run the programmes etc for a normal user. Therefore, more detailed program documentation and operations manual needs to be produced if the procedures are to be more widely used.

1 Aim

In 2003 the Samgodsgroup asked *John Bates* and *Henrik Swahn* to give recommendations on the way ahead for the Swedish national freight model development, and this was the subject of a report (SIKA [2004]). The two items which were identified as priorities were the development of a logistics component, and the construction of a set of base matrices (the latter representing the geographical distribution of demand for goods movements). Both these items have been the subject of separate intensive effort over the last three years. This report documents the work which has been done in respect of the Base Matrices.

In earlier versions of the SAMGODS model the freight matrices have not been on a consistent basis, and this was noted as a significant problem in the work cited above (§2.2.2). To quote directly from that document (p 109):

"The distinction between P/C and O-D formats has become widely accepted within the freight research community, and was central to both the SCGE and Logistics Pre-studies. …. The basic distinction between the two matrix formats is set out on p 8 of the SCGE Pre-Study:

- The pattern of economic trade in commodities from the initial producer to the ultimate consumer is termed the *Production/Consumption (P/C) zone pair matrix of trade*. Changes in this matrix are strongly influenced by changes *outside* the transport and distribution sectors.

- The actual set of physical transport movements generated by the logistics structure that is used to distribute and transport these P/C trades in practice is termed the *Origin/Destination (O-D) zone pair matrix of shipments.* Changes in this matrix are strongly influenced by changes *within* the transport and distribution sectors.

"The reason for having a P/C matrix in addition to an O-D matrix for the same commodity is that the impact of trends in logistics and of the responsiveness of logistics to policy initiatives can best be modelled in a realistic fashion if these impacts are applied to a P/C matrix. The resulting O-D matrix is then what is captured in the standard statistical surveys of vehicle movements."

The aim of the Base Matrices project was, firstly, to commit to the P/C (Production-Consumption) definition, and then to build up an improving sequence of estimates, by gradually refining the methodology and the amount of data used. The Commodity Flow Survey (CFS) was expected to be a major data source.

In this connection an initial problem which had to be faced related to the treatment of "intermediate" locations. According to the pure "P/C" concept, these should be ignored (in other words, they relate to the logistic processes which convert between P/C and O-D). However, the CFS 2001 indicates that a high proportion (more than half) of the recorded flows are sent from wholesalers rather than from producers. In addition, it is not possible to tell from the CFS whether the receiver is a wholesaler or a consumer. For these reasons it was decided to relax the definition and allow for three separate kinds of flows in the matrices:

Producer to Wholesaler (PW)
Producer to Consumer (PC)
Wholesaler to Consumer (WC)

[NB. The category C includes also intermediate consumption by producers; thus flows from producer to producer and from wholesaler to producer are components of the PC-flows]
Collectively these are referred to as "PWC matrices". For a fuller discussion of the rationale behind this decision, see RAND Europe, "The Specification of Logistics in the Norwegian and Swedish National Freight Model Systems: Model scope, structure and implementation plan", November 2004

In the course of the parallel work on the logistics component, the requirements for the base matrices were more clearly specified as follows:

a Produce Base Matrices on a P/C basis Q^k_{rs}, where Q refers to annual weight (tonnes), k is commodity group(as specified in Table 2.1 below), and r and s represent the zones of production and consumption respectively, at the level of the Swedish *kommuner* together with an appropriate representation of external zones (the zoning system is unchanged from the version used in the earlier STAN model). Some indication of value is also required, so that matrices in SEK can be constructed.
b Additionally, it has been decided in the course of developing the logistics model that these individual cells should be segmented by a maximum of 9 categories, representing combinations for trade between firms of different sizes (in three classes). This latter requirement represents and substitutes for the "Step A" of the logistics component. There is a further, 10th, category for "singular flows" (see Section 5.2 for further discussion).

The complete matrix will be divided into four sectors. The domestic matrix (D) gives the flows between zones within Sweden. The export (X) and import (M) matrices give the flows between each internal zone in Sweden and the foreign zones. Finally, the transit matrix (T) gives the flows between foreign areas that could reasonably be expected to pass through Sweden.

The Base Matrices should be prepared for the specified base year of 2004, and the methodology as well as the process and software used should be documented so that new versions of the matrices for the base year 2004 as well as other base years could be produced in the light of further data being available or new base year requirements. It was envisaged that the main data source should be CFS 2004/5, though it was acknowledged that all the preliminary work had been done using CFS 2001.

2 General discussion of method and data

2.1 Introduction

During 2004 an initial project was carried out by Anderstig et al [2004] to determine how to proceed with the Base Matrices. This work was used in the following manner during 2005:

1. SIKA developed a first version of a priori PWC-matrices based on the Commodity Flow Survey [CFS].
2. Software for an entropy model with soft constraints along the lines presented in the report by Anderstig et al was implemented at SIKA during 2005.
3. The results were confined to domestic PWC-flows.

The work initiated at SIKA has been continued at Vägverket Konsult during the latter half of 2006. In the course of this continued development it was decided to develop a synthetic estimate of the domestic matrices at the detailed spatial level, which is then adjusted to reflect the observed data from the CFS. However, rather separate methodologies and data sources have been developed to deal with the other three matrix sectors, and they will be separately described below.

Unfortunately, there is no single source of data which by itself can be considered adequate for the construction of the matrices, though the CFS was planned and designed to provide as much as possible of the data needed for construction of the matrices. However, the CFS is based on a sampling procedure and the samples are by far not large enough to allow by themself reliable estimates of goods flows at the level of spatial detail that is required in the matrices. Hence, to get reasonably well founded estimates of the matrix elements, it is necessary to synthesise the data to a considerable extent, which is in fact the modelling strategy that has been chosen. This involves developing and estimating parameters of a range of models using and combining several sources of data (eg employment, input-output relationships from National Accounts), and this introduces complications in that definitions do not match. A particular problem is that employment and input-output relationships are predominantly defined in terms of **sectors** rather than commodities. In addition, some quantities are available in value rather than weight terms, again requiring conversion.

The models that have been defined and estimated for generation of synthetic matrix element data as well as the data sources for each of the four matrix sectors will be discussed in more detail at appropriate places in this Report. However, in respect of data for actual freight movements referring to the PWC concept, it is quite clear that the most useful key data sets :

The Commodity Flow Survey CFS, available for two years – 2001, and 2004/5
The Foreign Trade Statistics FTS, available annually

The CFS, with some exceptions that will be further discussed below, gives reasonably reliable estimates of bothe domestic and export/import flows at an aggregate spatial level. For export and import commodity flows, the FTS provides additional and rather precise information on a country to country basis that could be used as a control for the basic level, albeit at an aggregate level, so that the main additional requirement on CFS is to provide spatial disaggregation. For domestic flows, by contrast, the only available "control" to CFS estimates is at the national level but only in value terms, primarily from the Input-Output tables

As may be expected, there are unresolved discrepancies between all the sources used. The way by which these are dealt with are described where appropriate below.

2.2 Notation

As far as possible, the notation established for the **logistics** program is followed. This relates particularly to spatial definition, commodities, and the matrices themselves. However, where some concepts do not overlap in any way between the Base Matrix methodology and the logistics methodology, it is legitimate to use the same or similar notation for different purposes, with the aim of improving the understanding of the procedures.

General

k	commodity group for logistics model
h	sector (SNI – see below)
i,j	SNI product category
r,s	kommuner (and foreign zones)
sz	size class for firms in terms of employees
m,n	firms in sender and receiver zones respectively

Items common with Logistics model

Q^k_{rs}	annual demand (tonnes)
v^k	product value per ton
ω	inventory holding rate (assumed = 0.2) including interest, company profit expectations above bank interest rate, costs for handling and storage etc
o^k	order setup cost
EOQ	economic order quantity

CFS discussion

u	local unit in the CFS sample
$\{x\}_u$	set of sampled consignments for local unit u
$f^{obs}_{x[krs]:u}$	individual sampled consignment in CFS
U^1_u, U^2_u, U^3_u	CFS expansion factors
$F^{obs}_{k,rs}$	observation of aggregated flow x[krs] used for model estimations based on sampled work places
w_{2001}, w_{2004}	Weights for combining CFS survey data

$Upscale_k$ Factor to ensure representativity over whole of Sweden
n the number of observations of *rs*-flows of each product matrix separately for flows of type W and type P
s_x the standard deviation of the n *rs*-flow observations

National Accounts items

Sup_{jh} Supply table (product × sector – matrix) from National Accounts: **value** of output of product j which is produced by the sector h. The output is mainly on the diagonal, but some "by-products" also result from the sector activities.
$IO_{i,j}$ Input-output table (*product × product*– matrix) from National accounts: **value** of the input of product i used in the production of output product j.
$IO_{\cdot 65}$ final consumption from NA (column 65 of the *siot* table) + investments
A matrix of Leontiev coefficients, derived as IO/IO_{58} (where the values in each column is divided by the sum of the column values in row 58
$IO^{norm}_{.j}$ $IO_{.j} / IO_{58j}$ for all j = *normalised* input-output matrix [= **A**]

CFAR data relating to companies and employment

Emp_{hr} proportion of total employed persons in SNI sector h that are in zone r
Buz(r, h, sz) = number of companies in zone *r*, 2 digit SNI92-category *h*, and size class *sz*.

Estimated quantities for Row and Column Models (Section 4.3)

EmployeeOutput zonal vector with average output per employee in sector h (in MSEK/employee)
P_r zonal production vector of SNI products [j]
$Prod_{rk}$ corresponding estimate of zonal production of commodity group k
W_{rj} estimated warehouse supply in sector j for the zone r
$Ware_{rk}$ corresponding estimate of zonal warehouse supply of commodity group k
C^I_r intermediate consumption vector (57 products j) for zone *r*
$InterM_{rk}$ corresponding estimate of intermediate consumption of commodity group k
C^F_r final consumption vector (57 products) for zone *r*
$Final_{rk}$ corresponding estimate of final consumption of commodity group k
$SAMSDAG_{zj}$ number of employees in the SAMSDAG-database for zone r in SNI-sector j
$SNIsum_{rk}$ number of employees in zone r that are potentially producing NSTR/ product group *k* [$=\sum_j (SAMSDAG_{rj} \mid S2N_{jk} > 0)$]
$S2N_{jk}$ fraction of production in SNI-sector j that goes into NSTR product group *k*

Estimated quantities for rs Cell Models (Section 4.4)

α, β and c_{dist} model parameters to be estimated
S_r supply estimate in zone r in SEK (Row total model from Section 4.3)
D_s demand estimate in zone s in SEK (Column total model from Section 4.3)
$dist_{rs}$ distance in kms between zones r and s
const scaling parameter

Estimated quantities for Step A Disaggregation

M,N "aggregate" firms in sender and receiver zones respectively
y cell "MN"
$Q^k_{MN|rs}$ annual demand (tonnes) between firms in aggregate size classes M and N
$N^k_{MN|rs}$ number of movements between firms in aggregate size classes M and N
$\pi^k_{M|r}$ and $\pi^k_{N|s}$ row (sender) and column (receiver) proportions of total zonal demand among aggregate size classes
AverageEmp(r, h, sz) estimated average number of employees in a company in zone r, SNI92-category h, and size class *sz*.

SNIProdset set of production SNI sectors {SNI01, ..., SNI36}
$Buz_{prod}(r,k,sz)$ estimated number of companies in zone *r*, producing product *k*, in size class *sz.*
$Emp_{prod}(r, k, sz)$ estimated number of employees in zone *r*, producing NSTR product *k*, and size class *sz*.
$\varphi_{j(h)}$ the average value of product j per employee in sector h
Prod(r, k, sz) estimated production of k in each zone r by employees in size class sz

SNIWholeset = set of wholesale SNI sectors {SNI50, SNI52}
$Buz_{whole}(r,k,sz)$ estimated number of wholesale companies in zone *r*, sending out product *k*, in size class *sz.*
$Emp_{whole}(r, k, sz)$ = estimated number of wholesale employees in zone *r*, sending out NSTR product *k*, and size class *sz*.
Turnover(r, k, sz) estimated turnover of k in each zone r by employees in size class sz

$Buz_{InterM}(r,k,sz)$ estimated number of companies in zone *r*, involved in intermediate consumption of product *k*, in size class *sz.*
$Emp_{InterM}(r, k, sz)$ = estimated number of employees in zone *r*, involved in intermediate consumption of product *k*, and size class *sz.*
InterM(r, k, sz) value of intermediate consumption of k in each zone r by employees in size class sz

$Share_{j(h)k}$ the share of activity in SNI-sector h allocated to product group *k*
$Buz_{Final}(r,k,sz)$ estimated number of companies in zone *r*, involved in final consumption of product *k*, in size class *sz.*

$Emp_{Final}(r, k, sz)$ = estimated number of employees in zone *r*, involved in final consumption of product *k*, and size class *sz*.
Final(r, k, sz) value of final consumption of k in each zone r by employees in size class sz

Q^k_y annual demand in subcell y (for product k, separately for each "rs")
N^k_y annual number of shipments to subcell y
n^C_y number of firm to firm relations (sender-receiver relations) in subcell *y* for product group *k*
$n^C_{y,receive}$ number of *receiving* companies in each subcell *y*.
f_{adj} = adjustment factor for the number of receivers (equal to 1 initially)

<u>*Other data items*</u>

$PopInc_r$ population income in zone *r*(taken from the rAps-data base at NUTEK and SCB).
TotInc national, total income (source:rAps data base at Nutek and SCB)

2.3 Description of commodities and sectors

The basic description of **commodities for the logistics model** is taken from NST/R ((Nomenclature uniforme des marchandises pour les Statistiques de Transport, révisée). This is the standard EU transport statistics reporting level for goods classification, and came into use following a recommendation in 1961 by the Commission of the European Communities, though it should be noted that there are differences between countries at the 3-digit level. The analytical structure of the NST/R divides the headings of the classification into 10 chapters and 52 main groups, according to a system which consists of:

1 digit for the chapters,
2 digits for the groups,
3 digits for the headings

One advantage of using the NST/R nomenclature as the basis for the commodity structure of the logisitics model and hence the Base Matrices is that estimates of transport flows obtained from the logistics model may be compared with av validated by means of transport survey data. A second advantage is that the NST/R to some extent groups products according to their logistics and transport properties. The disadvantage is that some of the data needed or deemed useful to estimate the matrices are given according to other product/commodity nomenclatures, which will make it necessary to convert data between the different nomenclatures. Such conversions in most cases will be a source of errors in data.

For the Swedish logistics model the 34 commodity groups k used, however, are all based on groupings of NST/R, as shown in Table 2.1.They include everything apart from items such as garbage transports and snow removed from cities. The "basic" 30

NSTR/UVAV[2] product groups used in the official statistics of goods transport by road have thus been slightly expanded.

Table 2.1 Description of Swedish product groups k for logistics model in terms of NSTR

k	NSTR	Description	
		English	*Swedish*
1	010	Cereals	Spannmål
2	020	Potatoes, other vegetables, fresh or frozen, fresh fruit	Potatis, andra färska eller frysta köksväxter, färsk frukt
3	031	Live animals	Levande djur
4	032	Sugar beet	Sockerbetor
5	041	Timber for paper industry (pulpwood) (Old: Wood in the rough)	Trä till papper och pappersmassa (Old: Rundvirke)
6	042	Wood roughly squared or sawn lengthwise, sliced or peeled	Sågade och hyvlade trävaror
7	043	Wood chips and wood waste	Flis, sågavfall
8	044	Other wood or cork	Bark, kork, övr. virke, ved (ej brännved)
9	050	Textiles, textile articles and manmade fibres, other raw animal and vegetable materials	Obearbetade material eller halvfabrikat avs. textil, textilartiklar, konstfibrer och andra råmaterial från djur eller växter
10	060	Foodstuff and animal fodder	Livsmedel och djurfoder
11	070	Oil seeds and oleaginous fruits and fats	Oljefrön, oljehaltiga nötter och kärnor samt animaliska och vegetabiliska oljor och fetter
12	080	Solid mineral fuels	Stenkol, brunkol och torv samt koks och briketter därav
13	090	Crude petroleum	Råolja
14	100	Petroleum products	Mineraloljeprodukter
15	110	Iron ore, iron and steel waste and blast-furnace dust	Järnmalm, järn- och stålskrot samt masugnsdamm
16	120	Non-ferrous ores and waste	Icke järnhaltig malm och skrot
17	130	Metal products	Obearbetat material eller halvfabrikat av järn eller metall
18	140	Cement, lime, manufactured building materials	Cement, kalk och byggnadsmaterial
19	151	Earth, sand and gravel	Jord, sten, grus och sand
20	152	Other crude and manufactured minerals	Annan rå och obearbetad mineral
21	160	Natural and chemical fertilizers	Gödselmedel, naturliga och tillverkade
22	170	Coal chemicals, tar	Kolbaserade kemikalier och tjära
23	180	Chemicals other than coal chemicals and tar	Andra kemikalier än kolbaserade och tjära
24	190	Paper pulp and waste paper	Pappersmassa, returpapp och

[2] UVAV = Series of regular Swedish statistical survey of goods transport by lorries (>3,5 ton) and railway, Statistics Sweden series T30 according to EU-regulation (EG) 1172/98. Sometimes the concept “UVAV” is used to denote not only series T30 but also the related series T56 (Swedish international road transport), series T54 (Foreign lorries and trailers in Sweden) as well as surveys of domestic goods transport by light goods vehicles (T57).. The commodity groups are based on NST/R.

			pappersavfall
25	200	Transport equipment, whether or not assembled, and parts thereof	Transportmedel och –utrustning, samt delar därtill
26	210	Manufactures of metal	Arbeten av metal
27	220	Glass, glassware, ceramic products	Glas, glasvaror och keramiska produkter
28	231	Paper, paperboard; not manufactures	Papper, papp och kartong, obearbetat
29	232	Leather textile, clothing, other manufactured articles than paper, paperboard and manufactures thereof	Diverse andra färdiga varor
30[3]	240	Mixed and part loads, miscellaneous articles etc	Styckegods
31	45	Timber for sawmill (old 41)	Timmer till sågverk (old 41)
32	201	Machinery, apparatus, engines, whether or not assembled, and parts thereof (old 200)	Maskiner, apparater, samt delar därtill (old 200)
33	233	Paper, paperboard and manufactures thereof (old 231)	Papper, papp och varor därav, bearbetat (old 231)
34	250	Product wrappings/coverage/protection material. Second hand goods.	Tomemballage, förpackningar, begagnade

In addition, for version 1 of the logistic model, a special category for Air freight has been included as group 35.

As was mentioned above, other product classifications than NST/R are used in some of the data sets that have been used in estimating the Base Matrices. The foreign trade statistics (FTS) thus uses two different classifications in parallel namely the KN8 (CN see below) and the SNI 97, which incidentially and conveniently provides a basis for constructing a key for reclassification between KN and SNI 97.. The national accounts (NA) and CFAR (Central Register of companies and work places) both use SNI. More details on these product classifications are given for each data set below. Suffice it to say here that the use of different classification schemes, however suitable for specific purposes, also means that conversions have to be carried out which will inevitable introduce some lack of precision as well as errors.

The **sectors**, denoted by h, are defined in terms of SNI(92) categories: this is the Swedish Standard Industrial Classification (see Appendix B for detail). Again, this is a hierarchical system, and can generally be used on the basis of the 57 combinations defined by the first two digits, as given in Table 3.3 below. As we discuss later, it is necessary to establish a “key” to move between data based on sectors and data based on commodities.

[3] Note that product group 30 (NSTR 240) is not “genuine” in the sense that it denotes a certain kind of goods. With hindsight it would be useful to consider whether quantities classified as NSTR 240 in principle should be redistributed to other products, probably based on sender´s sector.

2.4 Spatial structure of the Base matrices

The spatial structure of the domestic matrices D (one for each commodity k) is based on the Swedish municipalities ("kommuner"). The domestic matrix therefore gives the goods flow from kommun to kommun (r,s). There are at present 290 Swedish kommuner The domestic matrices therefore have the dimensions (290, 290).

The zones defined for foreign countries are used to set up the matrices for export (X) and import (M). The level of detail of the zones for each foreign country is adapted to the countries' distance from Sweden as well as its importance as a trade partner for Sweden. The most detailed zone structure for foreign countries is used for the other Nordic countries, other countries around the Baltic and North Sea. For more distant countries the foreign zone structure becomes very coarse. There are 174 foreign zones in total and thus the totatal number of zones is 464 (290+174). The dimension (r,s) of the total matrix including all four matrix sectors therefore is (464, 464).

The transit matrix T (174,174) by definition covers only flows from foreign zones to other foreign zones. However, as mentioned above, the T matrix only contains data in cells that contain flows that reasonably could be assumed to pass through Sweden due to logistics considerations by the foreign senders and/or receivers.

A graphical illustration of the overall spatial structure that was described above is given below.

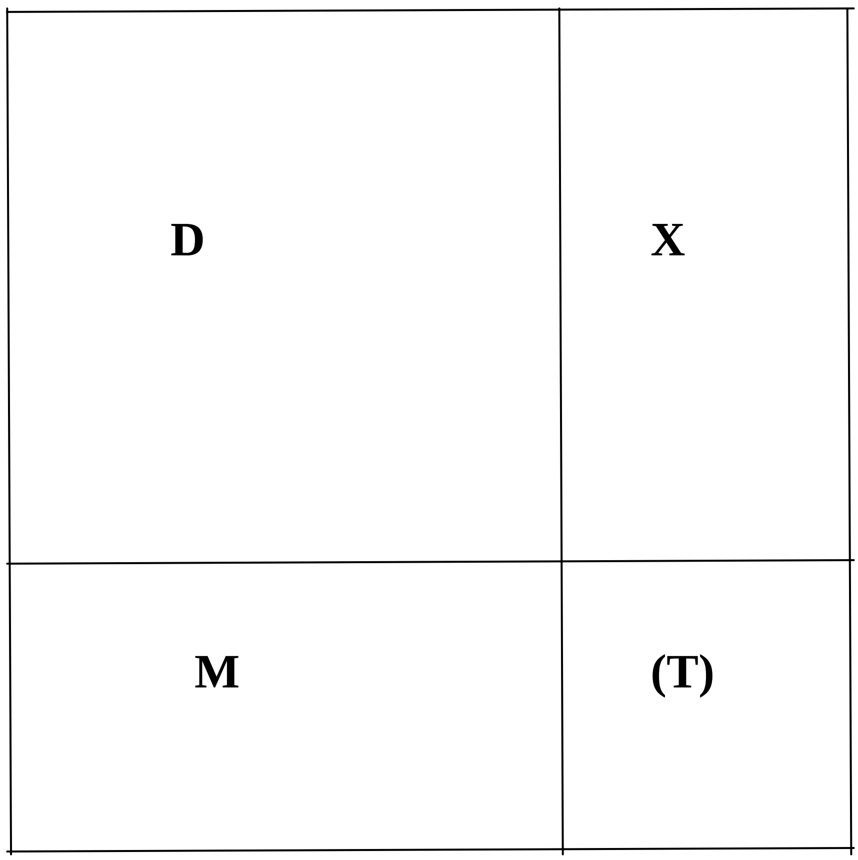

Figure 2.1The four sub-sections of the Swedish Base Matrices

3 Data used for estimation of base matrices

3.1 Overview of data used

The approch to take to estimate the base matrices heavily depends on the availability of data. The ideal situation would be to have access to one comprhensive data set that gives the numerical values of all the four sectors of the goods flow matrix. However, since such data set is not available a number of data sets will have to be combined directly and indirectly by means of a set of suitable models. However, the precise methods and models to use very much depends on the characteristics of available data, which will play a crucial role for the choice of methods. Therfore we have chosen in this chapter to first present the characteristics of the key data sets before in later chapters going into the details of the estimation methodology. The data sets, as it were, form the foundation upon which the base matrices are built.

Thus the estimation procedures for the Base Matrices are based on a range of different data sets. A summary of the data sets that are used is given in Table 3.1 below. As was mentioned above, the key data sets are the commodity flow surveys (CFS) and the foreign trade statistics (FTS). Those two data sets are used both to establish the absolute levels of goods flows (for matrix D the CFS surveys are used and for X/M the FTS-data) as well as for the spatial distribution of flows. The other data sets mentioned in Table 3.1 below are in a sense subordinate and are used to estimate various parameters of the functions that are used in the generation of synthetic matrix data. However, the T matrix is solely based on the study from 2004 that is the last entry of the table.

Table 3.1 Summary of data sets and data sources used at various stages of the Base Matrix estimation

Dataset	Main use for matrix	Abbre-viation	Comments on the use of the data set, sources etc.
Commodity Flow Surveys 2001 and 2004/2005	D, X, M	CFS 2001, CFS 2004/05	Described in detail in chapter 3 below. Contains key data for spatial distribution of D-flows as well as X and M flows
Foreign Trade Statistics 2001 and 2004	X, M	FTS 2001 FTS 2004	Data on trade between Sweden and other countries at a detailed product level with dual classification (KN8 and SNI97). Used for export and import flow volumes and for derivation of a key from SNI to NSTR
CFAR-data 2001		CFAR	Used to disaggregate the national value of production based on. the zonal employment in each zone from the CFAR
Sampers-data 2001			Used for the same purpose as CFAR above but Sampers data have a finer split into SNI categories
Employment per SNI-sector and zone for 2004			This data set has been used to construct explaning variables for row and column sums. It can also be used to rescale the CFAR 2001 data to 2004 for a company mix to be used in the disaggregation step. However, this option is not used for the present set of pwc-matrices.
Key from KN8 to SNI			Necessary for computing the key from SNI to NSTR.
Supply table 2001 from the National Accounts			Output from SNI-sectors of SNI-prodcts. 57 sectors × 57 products.
Input/Output table 2000 from the National Accounts		I/O table 2000 (NA)	Required input from of SNI-products for production of SNI-prodcts. 57 products × 57 products. Also information on final consumption and investments.
An income distribution from the rAps-data 2001 per LA-region.	D?		The income distribution concern the 81 labour market areas.
Transit matrices from Samgods-model 2001 from Silverberg et al [2004]	T		Ref. Transit Freight Matrices for Sweden, March 2004, LT Consultants and Matrex Ltd.

In the following sections of this chapter there is a more detailed presentation and discussion of the main data sets of Table 3.1.

3.2 The Commodity Flow Survey (CFS)

The Commodity Flow Survey includes transportation of goods with Swedish and foreign recipients and foreign shippers. The survey provides information about the type of commodities shipped, their value, weight, and transport mode(s) as well as sending and receiving zones Method reports are available, see SIKA (2005,2006).

The original work on the Base Matrices was confined to the 2001 CFS. Since then, we have had access to the results of the CFS 2004/2005 (encompassing the latter and first part of 2004 and 2005 respectively).

3.2.1 Sample and Data content (including differences between 2001 and 2004/5)

For CFS 2001, the data holds information regarding 81[4] product groups (see Appendix A) split into domestic, import and export flows. Senders are classified according to the full SNI92 5-digit code (see Appendix B for the complete list), which allows us to split between senders in the **production** sector (which excludes SNI sectors 50-52) and the **warehouse** sector (SNI 50 – 52).

Appendix A also indicates how the CFS 2001 product groups were aligned with the 34 commodity group definitions in Table 2.1[5]. It was not possible to split between product groups 10 and 11 on the basis of the CFS commodity codes, and in this case an allocation was made dependent on the value to weight ratio for the individual consignments.

As is described in more detail in the CFS Method report, in total the investigation covered 4 periods of 13 weeks each, from which we can obtain an estimation of the average volume and value per year.

Because respondents in the CFS 2001 had problems with the 81 commodity group classification, it was decided to use the NST 2000 nomenclature in the CFS 2004/2005. (This nomenclature is linked to **sectors** and will become compulsory within the EU.) In CFS 2004/2005, the number of product groups actually recorded is only 49, and there is less direct equivalence to the 34 NSTR-based product grouping used in the logistics model[6].

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[4] though in fact only 79 are found to be present

[5] The chosen “k-structure” for the products reported in VFU 2001 under codes 051-057 is not necessarily the most obvious grouping. This could be tackled later as a possible modification of the k-structure that has been used in this report.

[6] Again, with hindsight, the 34 product groups could be re-considered in subsequent work, as it is clearly a disadvantage that a crucial data set does not clearly lend itself to be transformed to the chosen product structure

This changed product grouping in the new CFS 2004/2005 (see Table A3 of Appendix A) caused some problems. Rather more allocations needed to be made on the basis of the value to weight ratio[7]. The details are included in Table A3.

NSTR commodities 44 (product group 8) and 240 (product group 30) are not available in either of the CFS surveys. See footnote 2 for some earlier commentary on product group 30.

To estimate the Base matrices as precisely as possible it was considered necessary to combine data from CFS 2001 and CFS 2004/2005.

In both surveys there were problems with some of the foreign locations. While text names were available, they could not always be allocated uniquely to country codes. For the 2001 survey, there were approximately 18,200 text name locations of which 8,000 are unknown countries. In 2004/2005 the corresponding values, after hard identification work, were 26,700 with 12,000 unknowns.

A disturbing fact is that the regional codings AM, AF and AO are used according to:

- AM for North- and South America,
- AF for Africa
- AO for Asia

instead of the actual countries. In all these cases the country code alone would determine the location for the current SAMGODS network. Furthermore the notations used coincide with the ISO-codes for Armenia, Afghanistan and Angola.

The geographically unidentifiable observations were dropped, though the unallocated volumes were included in calculating the upscale factors. Furthermore the used totals are provided from the foreign trade statistics. The problem is mainly that the geographic alloation is distorted, both in the foreign countries but also in Sweden. This might have some impact on the quality of the data.

The following Table 3.2 summarises the proportion of observations where the full location of both origin and destination zones could not be determined: Generally they suggest little problem, with the exception of Domestic for which the weight loss for 2001 is remarkable. For revised versions of the Base Matrices this weight loss should be further investigated.

[7] for future work, alternatives could be considered, such as using sending or receiving sectors

Table 3.2 Summary overview of availability of information on sender and receiver location in the two commodity flow surveys 2001 and 2004/2005

CFS 2001				
Domestic	records	value [1000SEK]	weight [tonnes]	product groups affected
Complete observations	729326	647347000	103694000	
receiver unknown	837	6105860	22124300	5, 7, 31
sender unknown	1677	734937	2216250	5, 7, 31
neither known	0	0	0	
total	731840	654187797	128034550	
incomplete %	0.3435	1.0456932	19.0109232	
Exports				
Complete observations	113864	479281000	50557800	
receiver unknown	2	10113.6	2483.81	
sender unknown	0	0	0	
neither known	0	0	0	
total	113866	479291113.6	50560283.81	
incomplete %	1.76E-03	2.11012E-03	4.91257E-03	
Imports				
Complete observations	60122	306774000	46428300	
receiver unknown	0	0	0	
sender unknown	0	0	0	
neither known	0	0	0	
total	60122	306774000	46428300	
incomplete %	0	0	0	
CFS 2005/6				
Domestic	records	value [1000SEK]	weight [tonnes]	product groups affected
Complete observations	2619715	516400000	109373000	
receiver unknown	56028	2582880	2400370	esp 2, 5, 31
sender unknown	13787	2638520	543856	esp 19, 20
neither known	5199	56424.1	164373	
total	2694729	521677824.1	112481599	
incomplete %	2.7837	1.0117018	2.7636511	
Exports				
Complete observations	188679	562097000	56631200	
receiver unknown	634	3471540	47487.4	esp 12
sender unknown	0	0	0	
neither known	0	0	0	
total	189313	565568540	56678687.4	
incomplete %	0.3349	0.6138142	0.0837835	
Imports				
Complete observations	66295	281126000	48910300	
receiver	0	0	0	

unknown				
sender unknown	555	8273480	166100	esp 17, 20
neither known	0	0	0	
total	66850	289399480	49076400	
incomplete %	0.8302	2.8588441	0.3384519	

3.2.2 Expansion procedures [taken from CFS 2001 Report]

"The survey was carried out partly as a sample survey and partly as a register-based survey. The sample survey covered the mining, manufacturing and wholesale sectors. The sample survey was supplemented with register data for the sectors production of forest and logging products, sugar beet cultivation and dairy farming.

"The survey population in the sample survey consisted of outgoing and incoming shipments at particular local units within the companies. From a sample of 12,419 local units, commodity flows were estimated for a universe of approximately 38,000 local units.

"The sample was selected using a stratified three-stage design in which the first sampling stage was local units within the companies. The second sampling stage was reporting different periods of measurement for the respective unit and the third sampling stage individual shipments at the respective unit in the selected reporting period.

"The sampling frame of local units was constructed by selecting a subset of local units from the Business Register (CFAR). The CFAR is a database maintained by Statistics Sweden (SCB) containing information about local units. A new sampling frame for the CFS was constructed for each respective quarter.

"Local units in the sampling frame were stratified by size of local unit, geographic location and the main type of commodity production. The latter stratification variable had to be derived from the sector to which the local unit belonged. The size of the local unit was measured by the number of employees at each local unit.

"Small local units falling below a specified cut-off limit varying by different strata were excluded from the sampling frame. The exclusion or cut-off limit varied according to the date of the survey. The stratification according to the size group produced four different size-groups. Local units in the largest-size group were selected with certainty on a quarterly basis. Local units in the second largest-size group were selected with certainty on an annual basis. Local units in the two smallest-size groups were randomly selected within each stratum where the probability of selection varied according to group size and other stratification variables.

"Consequently, the design of the sample meant that the largest firms in size group 1 were sampled four times during the year. The reporting period each quarter for the largest local units was set to one week randomly selected and separated by a 13-week period to assure equal representation during the year.

"The local units in the smaller-size groups were included in the survey with randomly distributed reporting periods over the year. To assure sufficient representation, the length of the reporting periods was adjusted for these local units according to the size of the local unit so that local units in size-group 2 were included with reporting periods of two weeks and local units in size group 3 with reporting periods of three weeks.

"In the third sampling stage, each selected local unit was requested to report a systematic sample of individual shipments, i.e. a sample of shipments at fixed intervals depending on the total number of shipments made during the reporting period, as estimated by the respondent. Bearing in mind the potential burden on the respondent, the total number of shipments for which details were to be reported for different categories, i.e. outgoing shipments with recipients within and outside the county and incoming shipments, was limited to 150."

3.2.3 Production of (partial) "observed" matrices

Based on the preceding section, any local unit u included in the sample will have a set of sampled consignments $\{x\}_u$, and these will vary in terms of k, r and s. If we can consider them representative, then we can multiply each x by the probability of them being sampled, which is the product of the three-stage sampling process described in the previous section.

Consequently, each sample observation $f^{obs}_{x[krs]:u}$ is associated with three expansion factors:

U^1_u = expansion to the total number of work places in Sweden (not dependent on the numbers of employees at the work places). It varies between sectors and products.

U^2_u = expansion factor to the period length (= 13 weeks). The factors vary from 1 to 13 depending on the data collection period.

U^3_u = expansion to the total number of shipments from the work places included in the investigation (in general only a subset of shipments are included from each work place)

By applying the last two expansion factors to individual observations x, and summing over values where k, r and s coincide, the observations used for the basic model estimations are obtained as:

$$F^{obs}_{k,rs} = \sum_u \left(U^2{}_u \cdot U^3{}_u \cdot \sum_{x[krs]} f^{obs}_{x:u} \right) \tag{3.1}$$

where

$f^{obs}_{x[krs]:u}$ = observation data (SEK)

$F^{obs}_{k,rs}$ = observation of aggregated flow x[krs] that will be used for model estimations based on sampled work places

The first expansion factor is used later to create an "upscale" factor so that the results are representative of the whole of Sweden. This upscale factor is calculated separately for each commodity k (and can also be calculated separately according to whether the observations x are treated in weight or value terms). The upscale factor is calculated as follows:

$$Upscale_k = \frac{\sum_{rs}\sum_{u}\left(U^1{}_u \cdot U^2{}_u \cdot U^3{}_u \cdot \sum_{x[krs]} f^{obs}_{x:u}\right)}{\sum_{rs}\sum_{u}\left(U^2{}_u \cdot U^3{}_u \cdot \sum_{x[krs]} f^{obs}_{x:u}\right)} \qquad (3.2\ )$$

The procedures are carried out independently for the two surveys (2001, and 2004/5). In both surveys observations without product classification have been skipped[8]. Although observations without sender or receiver location cannot be directly used for estimating the PWC-matrices, the values and volumes can be used for upscaling the total values. This may be viewed as a fourth scaling factor serving the same purpose as U^1_u in equation (3.2)[9].

The fourth type of upscale factors, i.e. due to observations for which sender or receiver location is not defined, have been calculatede separately for Domestic, Export and Import for both CFS 2001 and CFS 2004. These factors are calculated for each product group as the quantity (weight) of all observations with missing location divided by the quantity (weight) of all observations with identified locations. The results are expressed as percentages and the calculation results can be found in the excel file cfs_results.xls, sheets CFS2001 and CFS2004, in columns P, T and X.

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[8] In future work, the major output product of the sector of the workplace u could be used to patch the data

[9] The general upscale factors $Upscale_k$ can be found in the file CFS_results.xls, sheets TotalUpscale2001 and TotalUpscale 2004 for both values and weights.

3.3 Swedish National Accounts [NA]

The National Statistics Bureau, SCB, provide supply-, use- and input/output tables at their homepage[10]. The format for the supply- and use-tables are *product* $\times$ *sector*. Excel Sheets marked *sup* show the output matrix - product output (rows) from different sectors (columns). Correspondingly, sheets marked *use* show the input matrix - products consumed in different sectors. Based on SNI[11] (see Table 3.3 below), there are 57 sectors and 57 product categories.

The Supply table represents the output from different SNI92-sectors (in the columns) of SNI92-products (in the rows), i e it is a product $\times$ sector – matrix. An element $Sup_{\text{row,col}}$ gives the **value** of output of the row product which is produced by the column sector. The output is mainly on the diagonal, but some "by-products" also result from the sector activities.

The input-output table format represents the required input of products on the rows for producing the output in the columns, i e it is a *product* $\times$ *product*– matrix, derived from the supply and use tables. The structure of the table is that the element $IO_{\text{row,col}}$ represents the **value** of the row input used in the column output. To obtain the standard (Leontiev) coefficients these values need to be divided by the total row value.

Table 3.3 gives the standard SNI 2-digit sectors, as well as their re-numbering within the NA, into 57 categories. Note that SNI codes are used both for activities **and** the products of those activities. Since the definitions are very close, we have, for convenience, made use of the product definitions. It should be borne in mind, however, that the sectors relate primarily to activities.

Table 3.3 SNI Sectors. Two digit codes, "57" code and sector description

SNI 2-digit	"57" code	Description
1	1	Products of agriculture, hunting and related services
2	2	Products of forestry, logging and related services
5	3	Fish and other fishing products; services incidental of fishing
10	4	Coal and lignite; peat
11	5	Crude petroleum and natural gas; services incidental to oil and gas extraction excluding surveying
12	6	Uranium and thorium ores
13	7	Metal ores
14	8	Other mining and quarrying products
15	9	Food products and beverages
16	10	Tobacco products

[10] http://www.scb.se/statistik/NR/NR0102/2003A01/SupplyAndUseTables19952001.xls
http://www.scb.se/statistik/NR/NR0102/2003A01/InputOutputTables1995o2000.xls
[11] In the Swedish National Accounts the classification of activities is according to SNI92, Svensk Näringsgrensindelning 1992,???hasn't this been changed to SNI 2002? cf above which is a classification based on NACE Rev.1. SNI92 and NACE Rev. 1 are identical on the published level. The classification of products is according to Prod-SNI and is identical to CPA96 on the published level.

17	11	Textiles
18	12	Wearing apparel; furs
19	13	Leather and leather products
20	14	Wood and products of wood and cork (except furniture); articles of straw and plaiting materials
21	15	Pulp, paper and paper products
22	16	Printed matter and recorded media
23	17	Coke, refined petroleum products and nuclear fuels
24	18	Chemicals, chemical products and man-made fibres
25	19	Rubber and plastic products
26	20	Other non-metallic mineral products
27	21	Basic metals
28	22	Fabricated metal products, except machinery and equipment
29	23	Machinery and equipment n.e.c.
30	24	Office machinery and computers
31	25	Electrical machinery and apparatus n.e.c.
32	26	Radio, television and communication equipment and apparatus
33	27	Medical, precision and optical instruments, watches and clocks
34	28	Motor vehicles, trailers and semi-trailers
35	29	Other transport equipment
36	30	Furniture; other manufactured goods n.e.c.
37	31	Secondary raw materials
40	32	Electrical energy, gas, steam and hot water
41	33	Collected and purified water, distribution services of water
45	34	Construction work
50-52	35	Trade, maintenance and repair services of motor vehicles and motorcycles; retail sale of automotive fuel. Wholesale trade and commission trade services. Retail trade services, repair services of personal and household goods.
55	36	Hotel and restaurant services
60	37	Land transport; transport via pipeline services
61	38	Water transport services
62	39	Air transport services
63	40	Supporting and auxiliary transport services; travel agency services
64	41	Post and telecommunication services
65	42	Financial intermediation services, except insurance and pension funding services
66	43	Insurance and pension funding services, except compulsory social security services
67	44	Services auxiliary to financial intermediation
70	45	Real estate services
71	46	Renting services of machinery and equipment without operator and of personal and household goods
72	47	Computer and related services
73	48	Research and development services
74	49	Other business services
75	50	Public administration and defence services; compulsory social security services
80	51	Education services
85	52	Health and social work services
90	53	Sewage and refuse disposal services, sanitation and similar services
91	54	Membership organisation services n.e.c.

92	55	Recreational, cultural and sporting services
93	56	Other services
95	57	Private households with employed persons

Each year's i/o table is represented by three Excel worksheets, *imp, dom and siot*. These abbreviations represent imported, domestic and total production. Only the total table (*siot*) has been used. The input-output tables (thus all three "sheets") are described as "symmetric", meaning that for each product the (total) supply is equal to the (total) use.

Appendix D illustrates the structure of the Supply-Use tables, and Appendix E illustrates the structure of the Input-Output tables as well as their symmetric nature. Both these sets of tables are in **value** terms.

The supply and use tables hold values at purchase prices, i e they include product taxes, mainly VAT, and product subsidies. Furthermore trade margins are included for each product.. In the input-output tables the products are valued at basic prices, i e excluding product taxes and subsidies. Trade margins are embedded in the "warehouse" row, *50-52 Trade, maintenance and repair*, i e they are not allocated to different products as in the supply- and use-tables.

For each product of the supply and use tables the supply and use balance should hold according to the follwing equality:

Domestic Supply + Import = Intermediate consumtion + Final consumtion + +Investment + Export

3.4 CFAR (SNI sectors)

As input to the base matrix construction as well as for the logistics model we needed company level employment data at a suitable geographic level. The natural choice was to use the CFAR (the Central company and work place register) with basic information about registered companies in terms of SNI-code SNI 92, (sector), number of employees and turnover (in size class groups).

The other information on the CFAR database is the zone (kommun) and in some cases a second and third SNI-category indicating that the company may carry out multiple activities and thus produce more than one kind of output product. Therefore, different SNI-sectors will be given for such companies, and the turnover will be split between the relevant SNI sectors[12].

Beside detailed information about companies, the CFAR also holds an aggregate file which simply provides the number of employees per zone and SNI-category. For the year 2004 we have only made use of this file, but for 2001 we have also used the

[12] The turnover is also only provided in terms of size classes, and furthermore for multi-workplace companies the turnover is only available at the company (headquarters) level, so that it would need to be allocated among individual workplaces according to some principle. As we see no acceptable way to achieve this, we have not made use of the turnover information.

company information in order to effect the Step A disaggregation process. SAMPERS data on employment have also been used. This is discussed further in Section 7 below.

Because both the CFAR data on employees and the National Accounts information is based on SNI sectors, while the commodity classification used in the model is the NSTR, we need to find a way to link the two. Foreign trade statistics (FTS) and an additional key between KN and NSTR can be used to generate a key between SNI92 and NSTR , as is further elaborated inSection 3.5 below..

3.5 Foreign Trade Statistics

For Domestic flows ("D"), the CFS is the basic source. However, for Export ("X") and Import ("M"), the Foreign Trade Statistics (FTS) also provide valuable information, though of course these are country-to-country movements, so the detailed locations are not recorded.

We have foreign trade data statistics from 1998 until 2004. The data bases hold information about all export and import flows at the country level, i e the countries that we are trading with. In addition to the export/import countries, the data holds information on value, weight, KN8[13] and SNI**97**[14]. For 2004 the database contains approximately 250 000 export records and 170 000 import records (at a very detailed level based on commodity classification KN and country; note however that the statistics still gives figures for aggregates of shipments albeit at a detailed level).

We consider the available data in CFS for the foreign trade to be too limited in comparison with the detailed foreign trade statistics that are available. This is illustrated in Table 3.4, where the commodity estimates for total tonnage are given, separately for import and export, from the two sources. In terms of total tonnage for all product groups, the figures for both imports and exports are very close (though it should be noted that not all product groups are included in the CFS). However, it can be seen that the ratio of the volumes among product groups is very different from unity in many cases. For example, the CFS appears substantially to underrepresent product groups 2 and 19, both for imports and exports. These considerable relative differences may, however, be partly explained by errors in the conversion key between the varying product classifications in the different databases.

Since the FTS contains information on product classification both by KN and SNI, it is possible to use this to construct a "key" between SNI92 and NSTR. With a key

[13] = CN (combined nomenclature) –a common standard in the EU for export and import declarations of goods

[14] Product SNI97 is based on the activity based industrial classification system SNI92 but is now formally an independent product classification code. The industrial classification SNI 92 was replaced some time ago by a revised classification SNI2002 which is based on the EU standard NACE rev 1.1, and a new version SNI2007 is now being introduced. The formal autonomy of product SNI97 in relation to SNI92 may cause some classification errors if product output for industry sectors coded by SNI92 is assumed to be the quantity given by the product classification SNI97 code that is identical with the SNI92 code for the industry.

between a) KN and SNI92 and b) KN and NSTR the data in Appendix C can be derived in the following way:
FTS-statistics provides value/volume classified according to both KN and SNI. The above mentioned key KN8 – NSTR makes it possible to allocate each value/volume to an NSTR-code. The result could be represented as a table with SNI92-rows and NSTR-columns which constitutes the key between SNI92 and NSTR given in appendix C.[15]

The table in Appendix C gives the proportions of each SNI product that can be allocated to each NSTR commodity group[16]. The proportions given in appendix C are computed as the sum of export and import according to FTS allocated to each cell (SNI, NST/R) divided by the row sum total per SNI.

Table 3.4 Data comparing foreign trade statistics and the CFS 2001

[15] The key KN8 to NSTR was first defined in the process of developing a Foreign Trade Model for SIKA in the 1990s. It was updated 2005 by Lars Werke at Statistics Sweden. It seems as if this key is based on manual identification of the text labels for the numerical codes given in KN and NSTR. In general therefore this key must be updated with revisions of the code structures for NSTR and KN.
[16] The derived proportions reflect the distribution in Swedish **foreign** trade, and this procedure might introduce a bias when applied to domestic flows. Note that separate numbers could easily be derived for X and M for later use.

Table 3.4 Data comparing the foreign trade statistics and the CFS 2001 (Mton).

k	(NSTR)	Commodity	FTM 2001 Export	FTM 2001 Import	CFS 2001 Export	CFS 2001 Import	Ratios FTM/CFS 2001 Export	Ratios FTM/CFS 2001 Import
1	10	Cereals	1.50	0.31	0.92	0.32	*1.63*	*0.97*
2	20	Potatoes, other vegetables, fresh or frozen, fresh fruit	0.08	0.92	0.01	0.18	*12.55*	*5.20*
3	31	Live animals	0.00	0.00	0.00	0.00		
4	32	Sugar beet	0.13	0.15	0.00	0.00		
5	41	Timber for paper industry (pulpwood)	1.12	8.30	0.23	5.66	*4.95*	*1.47*
6	42	Wood roughly squared or sawn lengthwise, sliced or peeled	5.43	0.19	2.19	0.06	*2.48*	*3.07*
7	43	Wood chips and wood waste	0.36	1.64	0.00	0.26		*6.26*
8	44	Other wood or cork	0.00	0.36	0.00	0.00		
9	50	Textiles, textile articles and manmade fibres, other raw animal and vegetable materials	0.15	0.30	0.15	0.25	*0.99*	*1.21*
10	60	Foodstuff and animal fodder	1.15	2.33	0.65	2.18	*1.78*	*1.07*
11	70	Oil seeds and oleaginous fruits and fats	0.20	0.49	0.00	0.00		
12	80	Solid mineral fuels	0.13	3.41	0.06	2.85	*2.13*	*1.20*
13	90	Crude petroleum	0.00	19.79	0.03	15.24	*0.00*	*1.30*
14	100	Petroleum products	10.70	6.82	11.26	10.35	*0.95*	*0.66*
15	110	Iron ore, iron and steel waste and blast-furnace dust	14.20	0.52	10.75	3.61	*1.32*	*0.14*
16	120	Non-ferrous ores and waste	0.54	0.73	0.19	0.50	*2.89*	*1.47*
17	130	Metal products	5.10	3.72	4.93	2.99	*1.03*	*1.24*
18	140	Cement, lime, manufactured building materials	1.97	0.84	3.76	1.46	*0.52*	*0.58*
19	151	Earth, sand and gravel	2.40	1.09	0.06	0.29	*37.49*	*3.73*
20	152	Other crude and manufactured minerals	2.05	2.78	0.52	1.57	*3.98*	*1.77*
21	160	Natural and chemical fertilizers	0.35	1.00	0.00	0.07		*14.60*
22	170	Coal chemicals, tar	0.67	0.15	0.00	0.00		
23	180	Chemicals other than coal chemicals and tar	4.16	4.96	4.72	6.38	*0.88*	*0.78*
24	190	Paper pulp and waste paper	3.22	1.07	2.32	0.42	*1.39*	*2.57*
25	200	Transport equipment, whether or not assembled, and	2.74	2.23	2.68	2.47	*1.02*	*0.90*

		parts thereof						
26	210	Manufactures of metal	0.44	0.44	0.90	3.01	*0.49*	*0.15*
27	220	Glass, glassware, ceramic products	0.32	0.27	0.30	0.22	*1.06*	*1.22*
28	231	Paper, paperboard; not manufactures	9.40	0.98	10.63	0.85	*0.88*	*1.16*
29	232	Leather textile, clothing, other manufactured articles than paper, paperboard and manufactures thereof	1.73	1.68	4.04	2.18	*0.43*	*0.77*
30	240	Mixed and part loads, miscellaneous articles etc	0.00	0.00	0.00	0.00		
31	45	Timber for sawmill			0.21	1.66		
32	201	Machinery, apparatus, engines, whether or not assembled, and parts thereof			1.59	1.69		
33	233	Paper, paperboard and manufactures thereof			4.24	0.61		
34	250	Product wrappings, coverage protection						
35	247	Air cargo	0.14	0.10				
		Total	70.38	67.61	67.34	67.33	*1.05*	*1.00*

4 Estimation of The Domestic Matrices

4.1 General Methodology

The Domestic matrices rely heavily on the CFS, supplemented with employment data (CFAR) and some information from the national accounts (NA).

We begin by producing a synthetic PWC base matrix for each commodity. These matrices are then combined with the actual CFS observations.

In order to produce the synthetic base matrix we make use of the simple, commonly utilized idea that the demand for goods in a certain P/C relation is dependent on

1. the supply of goods in zone r and all other origin zones (row-sums)
2. the demand of goods in zone s and all other destination zones (column-sums)
3. the distance and/or generalized cost between the origin and destination zones r and s

To implement models based on this principle requires suitable variables describing the entities in items 1-3.

Note that while a simultaneous estimation of row- and column sums together with a distance aversion function might be preferable, the numerical problems associated with that approach make it more difficult to handle. Hence, the current procedure involves two separate estimation steps that might subsequently be combined, provided the numerical problems could be handled.

For the models for row and column sums, the basic idea is to use information from National Accounts, CFS, CFAR and SAMPERS as much as possible to provide numerical values for the independent variables. The observations for domestic PWC-flows from the CFS are put together into (regression) models[17].

For both production and warehouse/consumption totals, the potential explanatory factors we have chosen are employment levels in different SNI-categories, together with derived variables which combine appropriate employment data with National Accounts data using supply and input/output tables at the national leve[18]l.

In order to populate the cells of the matrix, a distance aversion term ("deterrence function") is estimated. The distance values (in kms) have been computed with the aid of the STAN-model. It would be straightforward to replace the distance matrix with generalized costs and re-run the base-matrix estimation system.

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[17] In the future this could also be done for export and import matrices.

18 Although the initial idea had been to utilize more regional information from the rAps-model, our experience with using those results was not encouraging.

4.2 “Singular” flows

Singular flows have been defined using two separate sources. Firstly some singular flows have been identified and quantified based on particular knowledge that has been provided by SAMGODS, originally from the rail and road agencies.Secondly, in the course of analysing the CFS data, a criterion has been instituted that, within the CFS datasets, singular flows have been defined as “very high flows, at least 10 000 tons per year and more than five standard deviations away from the average shipment size”: implicitly these are firm-to-firm flows between large workplaces.

The total quantities defined as singular flows based on the two sources are given in the following Table 4.1.

Table 4.1 Estimates of singular flows from two sources. Details can be found in CFS_results.xls, sheet Singular flows (ascii-file VFU_result\KommunOD_Singular_Flow_CasesYYYY.dat)

SUM TONNES 2001 CFS	**56 042 150**
SUM TONNES 2004 CFS	**27 247 990**
SUM TONNES SAMGODS PC	**10 315 191**
SUM TONNES SAMGODS Total (PC, OC,PD)	**37 059 633**

The total amount of singular flows in the base matrices is approximately 44.9 million tonnes. This is calculated as the weighted sum of the identified singular flows from CFS 2001 and CFS 2004 to which Samgods PC data are added. However, when data from CFS and Samgods overlap in a relation only the maximum value is kept.

How singular flows are dealt with in the process of developing the synthetic matrices as well as in producing the final matrices is explained in the relevant sections below.

4.3 Developing models for row and column totals

4.3.1 Outline of the methodology

Separately for each product group k, the expanded CFS values in SEK for $F_{k,rs}^{obs}$ (see Eq 2.1 in Section 3.2.3) are summed to produce “observed” row and column totals for each zone, with further classification according to whether the senders are producers or wholesalers. These are used as the dependent variables in linear regression models, which include non-negativity constraints on the coefficients.

In addition, the level of intrazonal product flows may be of interest to estimate separately from the total row and column sums (compare with the discussions of RPC in the report by Anderstig et al [2004]). However, in the present version this option is not utilised.

Observations from both CFS 2001 and CFS 2004/2005 are used when estimating the row and column sum functions. Thus observations of the dependent variables of the models used for producing the synthetic matrices are based on a weighted combination of observation values from CFS 2001 and CFS 2004/2005. The weights used to combine CFS2001 and CFS 2004 for each type of flow (PW, PC etc) and product k are proportional to the number of observations divided by the corresponding standard deviation per product group for each CFS .However, in case there are only few observations in one of the CFS data from the other CFS is used.

The initial analysis began by attempting to construct appropriate variables for the Production and Consumption in each zone, using zonal employment data and input-output relationships from National Accounts. The key variables that were constructed are described in section 4.3.1a. However, these were only partly successful in explaining the zonal pattern of the CFS observations. As a result, the search was widened to allow a large number of employment variables to be used directly

The aspects above have been integrated into a software for automatic generation of the best linear functions (highest adjusted R^2) for each product group k, with positive coefficients, separately for the estimation of row and column sums:

$$y_r = \sum_{i \in VarSet} c_i \cdot x_{ir} \qquad (4.1)$$

where
y_r = dependent variable ("observed" row or column sum for a product group in zone r)
x_{ir} = independent variable i (from the variable set Varset described below) for zone r
c_i = coefficients to be estimated

The requirement on positive coefficients is used to avoid models that may result in negative values and as a precaution against multi-collinearity.

The idea of using a number of independent variables has been supported by the consultants involved in the base matrix project (Henrik Swahn, John Bates and Jonas Eliasson).

An issue of considerable importance is that in many the cases the supply/demand for certain product groups is concentrated to only a few zones. This is dealt with in two ways. Firstly, as noted at the outset, exceptional size flows are removed, and treated separately as "singular flows" (see previous section).

Secondly, potential "dummy variables" are introduced, linked to the explanatory variable with the highest correlation to the observed flows. Possible dummy variables are linked to PW-zones with a high concentration, more than 10 %, of the total domestic PWC-flow. In these cases we use as a dummy variable not the number 1, but instead the square root of the variable that displays the best correlation. This is discussed further below.

4.3.2 Construction of zonal estimates of production and consumption

The National Accounts data and the supply/use equality were discussed in section 3.3 above. Since the National Accounts give the total value for each sector for the whole country, a reasonable approach to identifying the row totals in each zone (ie total production) is to attempt to disaggregate the national value. Since we have the zonal employment in each zone from the CFAR, this provides a basis for proceeding. In the first place, we create the zonal vector "Prod".

1. <u>Prod</u>

Based on the CFAR data, for each zone r we can calculate the proportion of national totals of employees in the 57 different supply sectors h in the National Account table as in Table 3.3: we write this as the vector Emp_r. Then applying these proportions to the national supply matrix[19] *Sup* (see section 3.3), we compute the estimated value of supply (= production output) vector P_r with SNI92-products j from each zone, in line with eq (4.2):

$$P_r = Sup \cdot diag(EmployeeOutput) \;.\; Emp_r \qquad (4.2)$$

so that $P_{rj} = \sum_h Sup_{jh} \;.\; Emp_{hr} \;.\; EmployeeOutput_h$

where

P_r = production vector (SNI products) for zone *r* (MSEK)
P_{rj} = production output of SNI product *j* for zone *r* (MSEK)
Sup = supply matrix from the national accounts for 2001 (57 products × 57 sectors)
Emp_r = vector with employee levels as proportions of the national per SNI92-sector for zone *r* (in total 57 elements)

diag(vector) is the diagonalization operator creating a diagonal matrix holding the vector values in the diagonal, it is used to make the matrix multiplication valid

EmployeeOutput = vector with average output per employee[20] in sector h (in kSEK/employee). The vector values are calculated from dividing *Sup* column sums (row 58) by total employment per relevant SNI. The total SNI employment 2001 are obtained from the Sampers data base 2001, the data base used in the person transport model. These data are updated with the aid of zone based totals for 2004 acquired from SCB.

Note that the supply table gives supply from service as well as production sectors for both products and services. In the CFS only shipments of material products are registered. Therefore, only rows with material products and sectors (columns) producing such products are actually used in the P_r vector as well as in the *Sup* matrix.Additionally the wholesale/retail sectors 50-52 (row/column number 35) are used. This means that the actual dimension of the Sup matrix effectively used here is 35 x 35. However, on grounds of general consistency/auditing, we have retained the product and sector numbers from the NA.

By then using the key from SNI92 to NSTR, see Appendix C, the distribution of the SNI92 product output to NSTR-product groups can be determined, giving us an estimate of the total production per NSTR product group in value terms for each commodity group k in each zone r:

$$Prod_{rk} = \Sigma_j \; P_{jr} \times S2N_{jk}$$

---

[19] The values used relate to 2001, which is currently the latest available
[20] NB While the inclusion of this factor is the preferred definition of the production vector, in that includes variations not only by the numbers in local employment but also the output variation by sector, it was in fact excluded in the earlier work developing the row and column models, so that a reduced version of the formula in 3.1 was used: $P_{jr} = \sum_h Sup_{jh} \;.\; Emp_{hr}$

where $S2N_{jk}$ is the key in appendix C.

Note that the key only covers 29 SNI products, while we have 35 SNI-products/sectors (including the wholesale sector) in the Supply table that potentially could generate transportable products. However, a closer look reveals that it is unlikely that the missing ones actually contribute much to the transport flows registered in CFS. The missing ones are summarized in Table 4.2 below:

Table 4.2 SNI numbers for material transportable products for which no key to NST/R is available in appendix C

SNI	Description	Commentary
12	Uranium and thorium ore	No output value registered in NA
37	Secondary raw materials (= recycled materials)	Some of this might contribute under some NSTR; this could be an omission of some importance
40	Electric energy, gas, steam	Some gas is transported as liquid gas; might be an omission of some significance
41	Collected and purified water	Should be transported; a potential omission
45	Construction work;	A major sector though with mostly service output which is not part of CFR

The variable "Prod" deals explicitly with production. However, it is also necessary to develop models for flows from Warehouses. Product supply from the warehouse sector is not directly available in any statistical sources. Thus it is necessary to define a proxy variable for this for products k for every zone r. This is referred to as the vector "Ware"

2. <u>Ware</u>

We assume that the supply of products from the warehouse sector for each product j in any zone r is linked to the estimated production of the product j in the zone r (P_{jr}, as calculated in Eq 3.1*)*, multiplied by the national total value of services from the warehouse sector as a proportion of all output according to the national IO tables (*siot00*)[21]. This is obtained from row 35 (SNI 50-52) which represents the warehouse sector, and row 58 (in both cases summation is over all 57 sectors).

We begin by calculating the variable W_{rj} in terms of the SNI products, as in Eq (4.3).

$$W_{rj} = IO_{35,j}/IO_{58,j} \cdot P_{rj} \qquad (4.3)$$

where

$IO_{58,j}$ is the column sum in the I/O-table.
W_{rj} = estimated warehouse supply determined based on the supply in *IO* and the activity level in different sectors j in the zone defined by P_{jr} (MSEK).

[21] This relates to the year 2000, which is the latest available for this data

IO = input-output matrix from the national accounts (57 products × 57 products) (see section 4.1). Only row 35 comprising the warehouse sector is utilized here (together with the total row 58).{The IO table row 35 defines the distribution of the services produced by the warehouse, maintenance and repair sector over input to other sectors (including service sectors) and final uses;

These levels are then converted into NSTR/-product groups before use:

$$\mathrm{Ware}_{rk} = \Sigma_j \; W_{rj} \times \mathrm{S2N}_{jk}$$

where $\mathrm{S2N}_{jk}$ is the key in appendix C.

In considering the **consumption** side, there are a number of items to be reflected. In the first place, we deal with **intermediate** consumption, and for this we make use of the standard Input-Output relationship:

$$\mathbf{C}^{\mathrm{I}} = \mathbf{A} \times \mathbf{P}$$

where **A** is the matrix of Leontiev coefficients, derived as IO/IO_{58} (where the values in each column is divided by the sum of the column values in row 58) and, as before, *IO* represents the rows of the input-output matrix, and IO_{58} is the summation over the rows. This gives us an estimated variable which we refer to as “InterM”.

3. InterM

The demand for intermediate, input factor products is based on the estimated production levels P_r in each zone described above (NB **before** conversion to NSTR-product groups), and the input-output table (= *IO* , see section 4.1. above). We describe this in eq (4.4).

$$C^I_r = IO^{norm} \times P_r \qquad (4.4)$$

so that $C^I_{rj} = \Sigma_i \, (IO_{ji} / \Sigma_\iota \, IO_{\iota i}) \times P_{ri}$.

where

C^I_r = intermediate consumption vector (57 products) for zone *r*

Then, again, by using the key from SNI92 to NSTR, see Appendix C, the distribution of intermediate consumption in terms of the NSTR-product groups can be determined:

$$\mathrm{InterM}_{rk} = \Sigma_j \; C^{I}_{rj} \times \mathrm{S2N}_{jk}$$

where $\mathrm{S2N}_{jk}$ is the key in appendix C.

As a matter of fact this calculation of the intermediate demand includes the "Ware" variable described in eq (4.3) in the previous subsection: i.e. (4.3) is a special case of (4.4).

In addition to the intermediate consumption, we also require an index of final consumption by households and (government)[22], based on the last column in the input-output table. We refer to this as "Final".

4. Final

Final consumption from the Input-Output table is allocated proportionately to zones according to the total population income in each zone (derived from local labour area statistics for 2001)[23]. We describe this in eq (4.5).

$$C^F_r = IO_{\cdot 65} \cdot PopInc_r / TotInc \qquad (4.5)$$

so that $C^F_{rj} = IO_{j,65} \cdot [PopInc_r / TotInc]$

where

C^F_r = final consumption vector (57 products) for zone r
$IO_{\cdot 65}$ = final consumption from NA (column 65 of the *siot* table) + investments
$PopInc_r$ = population income in zone r, taken from the rAps-data base at NUTEK and SCB. We have used model based wage sums for the 81 LA-areas (= Lokala Arbetsmarknadsområden - Local Labour Market areas), derived from modeled local labour area statistics for 2001. Further disaggregation to zone is proportional to the employment level per zone][24]

$TotInc$ = national, total income (source:rAps data base at Nutek and SCB)

Actually the only SNI product group of the first SNI 01 – 36 consumed by the government in considerable quantities (54 % of the total), is product SNI 24, *Chemicals, chemical products and man-made fibres*. The main part of these products are purchased from companies in the wholesale sector, and therefore we set up these volumes to be transported to companies in the wholesale sector.

Once again, the values are converted to the 34 product groups using the key in Appendix C:

$$Final_{rk} = \Sigma_j\ C^F_{rj} \times S2N_{jk}$$

where $S2N_{jk}$ is the key in appendix C.

Numerical values from the national accounts are given per product for production, intermediate consumtion and final consumption in Table 4.3 below.

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[22] In further development it could be considered whether to include Gross Capital Formation together with final consumption.

[23] {Perhaps the supply/use tables should be used instead since these are for 2001 while the IO-tables are for 2000}
[24] The information for $PopInc_z/TotInc$ in held in sheet "IncomeLevelperEmployee" of the excel-file *CFS_results.xls*

The interpretation of columns is as follows: [
PRODUCTION:
Output in value (MSEK, purchase prices) from all sectors of products that are assumed to be transported i.e for SNI serial numbers 1-30 from the supply table converted by means of key in app C to NSTR. The data source is Sup01table 7 of the Supply and Use tables (Excelsheets). This domestic supply plus import of the same products gives total supply of the same products. This corresponds with the variable “Prod” [Section 4.3.2]

CONSUMPTION (INTERMEDIATE)
The total value (basic prices) of input of products we assume to be transported (29 SNI or 34 NSTR) to the output of all sectors (i.e.including the service sectors and sectors not producing output assumed to be transported). The data source is the IO tables for 2000 from Statistics Sweden, sheet siot00table 4) The SNI values are again converted to NSTR via the key in appendix C. This corresponds with the variable “InterM” [Section 4.3.2]

CONSUMPTION FINAL[25]
Final consumption (value, basic prices MSEK) by households and government of products assumed to be transported (29 SNI, 34 NSTR) . The data source is the IO tables for 2000, siot table 4 no 1-30 (30 but uranium ore has 0 and is excluded from the key in appendix C) The SNI values are again converted to NSTR via the key in appendix C. This corresponds with the variable “Final” [Section 4.3.2]

As noted (footnote 21), an alternative to using the IO column for 2000 for final consumption the Use table for 2001 is available; there is a striking difference of the value of the corresponding final consumption in these two sources: 226 000 in the IO-table for 00 and 494 000 in the use table. The difference is due to the tax/subsidy difference between basic and purchase prices.

[25] Consideration should also be given to including **investments** in the methodology, since the use of products for investment purposes might differ from the pattern of intermediate and final consumption for the same product groups.

Table 4.3 Overview of input data values for production, intermediate and final consumption that are the basis for regional distribution of P, CI and Final according to eqs (4.2), (4.4) and (4.5). Data sources: Statistics Sweden Supply table for 2001 and IO table for 2000. Conversion from SNI to NSTR has been done by means of the key in appendix C.

Product description	k	NSTR	Produc-tion [MSEK]	Consumption (Intermediate) [MSEK]	Consump-tion (Final) [MSEK]
Cereals	1	10	7 690	6 451	2 394
Potatoes, other vegetables, fresh or frozen, fresh fruit	2	20	22 133	18 471	6 978
Live animals	3	31	320	282	87
Sugar beet	4	32	4 597	2 179	3 011
Timber for paper industry (pulpwood). (Old: Wood in the rough)	5	41	24 969	22 081	713
Wood roughly squared or sawn lengthwise, sliced or peeled	6	42	39 648	25 514	529
Wood chips and wood waste	7	43	2 376	1 661	40
Other wood or cork	8	44	288	187	11
Textiles, textile articles and manmade fibres, other raw animal and vegetable materials	9	50	10 249	7 861	3 617
Foodstuff and animal fodder	10	60	104 300	50 570	67 149
Oil seeds and oleaginous fruits and fats	11	70	6 467	3 798	3 385
Solid mineral fuels	12	80	2 959	3 713	622
Crude petroleum	13	90	49	36 656	0
Petroleum products	14	100	32 979	23 634	8 743
Iron ore, iron and steel waste and blast-furnace dust	15	110	5 782	4 033	4
Non-ferrous ores and waste	16	120	7 788	5 992	5
Metal products	17	130	83 447	74 928	1 443
Cement, lime, manufactured building materials	18	140	26 711	20 324	697
Earth, sand and gravel	19	151	955	1 238	10
Other crude and manufactured minerals	20	152	5 109	6 442	124
Natural and chemical fertilizers	21	160	989	709	190
Coal chemicals, tar	22	170	1 165	797	243
Chemicals other than coal chemicals and tar	23	180	104 317	74 511	20 553
Paper pulp and waste paper	24	190	21 562	8 301	360
Transport equipment, whether or not assembled, and parts thereof	25	200	159 345	73 379	31 252
Manufactures of metal	26	210	76 542	62 146	2 325
Glass, glassware, ceramic	27	220	11 498	11 527	674

products					
Paper, paperboard; not manufactures	28	231	69 101	26 604	1 153
Leather textile, clothing, other manufactured articles than paper, paperboard and manufactures thereof	29	232	128 645	98 819	45 197
Mixed and part loads, miscellaneous articles etc	30	240	1 158	1 063	6
Timber for sawmill	31	45	1 451	1 283	41
Machinery, apparatus, engines, whether or not assembled, and parts thereof	32	201	388 301	199 986	22 007
Paper, paperboard and manufactures thereof	33	233	39 611	28 535	4 647
Product wrappings, coverage protection	34	250	5 147	4 930	285
		T otal	1 397 647	908 607	228 493

As was pointed out above at the end of section 3.3 the supply and use balance for the transportable products for the entire economy can be written as follows:

Domestic Supply + Import = Intermediate consumtion + Final consumtion +
+Investment + Export

Using the values from *Table 4.3* and supplementing with values for import, export and investment from the IO-tables for 2000 for the products that are included in *Table 4.3* and hence in the Base matrices we get the following balance:

Table 4.4 Supply and use balance for transportable products in the Base Matrices. Consistency check of data. (Basic prices)

Supply	Billion SEK	Use	Billion SEK	Data sources
Domestic supply	1392	Intermediate consumption	863	*Table 4.3*
Import	670	Final consumption	225	SCB Imp00 table 6 + *Table 4.3*
		Export	761	SCB siot table 4
		Investment (gross capital formation)	190	SCB siot table 4
Total	**2062**		**2039**	

4.3.3 Selection of additional variables

In addition to the key variables described in § 4.3.1a, a large number of other variables were considered

Further possible independent variables are in most cases simply the number of employees in different SNI-sectors. See Appendix B for a definition of the different SNI-categories. While the general intention was to use only SNI 2-digit variables, a few 3 digit variables have been included among the candidates as well, though an important issue with using 3-digit variables is their potential unavailability in a forecasting procedure.

Allowed SNI 2-digit variables to be included for any particular commodity group k have, in principle, been limited to the ones available in the SNI92 to NSTR key derived from the foreign trade statistics (Appendix C). This means that only employment for those SNI sector/products that contribute to an NST/R product are used. The motive is to avoid including variables that merely represents a statistical fit by coincidence.

An additional variable, SNIsum, has been calculated to create an aggregate employment variable encompassing all the different sectors potentially producing each NSTR-product. This is based on the sectors whose main products are identified in the key $S2N_{jk}$ (Appendix C). For each one of the NSTR product groups, the variable SNIsum is computed by taking the sum of the number of employees in the relevant SNI92–sectors in each zone. A more formal description is given in eq (4.6).

$$SNIsum_{rk} = \sum_j \left(SAMSDAG_{rj} \mid S2N_{jk} > 0\right) \qquad (4.6)$$

where

$SNIsum_{rk}$ =number of employees in zone r that are potentially producing NSTR/ product group k
$SAMSDAG_{zj}$ = number of employees in the SAMSDAG-database for zone r in SNI-sector j[26]
$S2N_{jk}$ = fraction of production in SNI-sector j that goes into NSTR product group k according to the key in app C

The complete candidate set of independent variables (VarSet) is listed in Table 4.5. The first five variables have already been described in detail above.

[26] SAMSDAG is used instead of the alternative source CFAR due to the fact that only SAMSDAG data were available when the base matrix work started. A potential reason for keeping SAMSDAG data for future base matrix work is that forecast data might be available for SAMSDAG but not for CFAR. Samsdag data are also available at a finer geographical level (9000 areas in Sweden) which later on could be useful for future development towares more geographically disaggregated models. SAMSDAG data are only available at the two digit SNI level as opposed to 5-digit SNI for CFAR .

Table 4.5 List of potential explanatory variables for row and column sum values ("Varset").

Row- and column sum variables	Description
Prod	Production. Source of PC-flow. Specific for each NSTR-product.
Ware	Warehousing. Source of WC-flow. Specific for each NSTR-product.
InterM	Demand for input products. Flow to C. Specific for each NSTR-product.
Final	Final consumption. Flow to C. Specific for each NSTR-product.
SNIsum	Nbr of employees in the SNI-groups associated with each NSTR-product..
Dag00	Nbr of employees in the zone, regardless of sector.
Dag25	Nbr of employees in the zones with centres inside a 25 km radius, regardless of sector.
Dag50	Nbr of employees in the zones with centres inside a 50 km radius, regardless of sector.
IM+Fin	Sum of variables InterM and Final.
W50	Nbr of employees in warehouse sector SNI 50. See Appendix B.
W51	Nbr of employees in warehouse sector SNI 51. See Appendix B.
W52	Nbr of employees in warehouse sector SNI 52. See Appendix B.
SNIxx	Number of employees in sector SNIxx. xx=SNI92 sectors in the National account data. Employee data per zone from the SAMPERS database
SNI50-52	- " -. Exception: This variable holds an aggregate of number of employees in the warehouse sectors 50 – 52.
SNIzzz	Number of employees in SNIzzz zzz=SNI 92 sectors (3-digit level, 5-digit level descriptions in Appendix B). Employee data per region in from the CFAR database.]

Given the set of appropriate explanatory variables for any particular product group k, the correlations with the dependent variable are independently calculated and the one with the highest correlation value is chosen to provide the basis for a "dummy variable". This assumes a value equal to the square root of the selected variable if the zone has more than 10% of the sum of all zone observations (in value) otherwise zero. Thus the dummy variable allows to the highest correlation variable an additional potential influence on the estimate of the dependent variable for possibly existing "dominant" zones in terms of observed value. The idea for this variable was to capture concentration of flows to some zones.

4.3.4 Calculating total value of the matrices from CFS 2001 and CFS 2004

As noted above all PWC-flow observations both from CFS 2001 and CFS 2004/2005 are used when estimating the row and column sum functions. The total weighted flow in each relevant matrix (per product k and P or W) is, in priority order, based on

1. Data from 2004 if the total value of regular flows and the number of observations both are highest for that year ($w_{2001} = 0$, $w_{2004} = 1$).
2. Data from 2001 if data is missing for 2004 ($w_{2001} = 1$, $w_{2004} = 0$).
3. a weighted sum of CFS 2001 and 2004/2005 upscaled observed values. The weight that is assigned to each of the two years is determined by the total

number of PWC-flow observations in each product matrix divided by the standard deviation of these observations as is formally set out below. At least 11 observations are required for each year (weighting is described below).

4. Data from 2004 provided the number of observations is more than 10 (w_{2001} = 0, w_{2004} = 1).
5. Data from 2001 provided the number of observations is more than 10 (w_{2001} = 1, w_{2004} = 0).
6. Data is noted as MISSING.

Each of the two CFS contains *rs* flow observations for each product *k*. (These observations are in turn summations of underlying firm to firm shipments). For each product matrix *k* and flow type (P or W) we have a number of *rs*-observations and for these we can calculate a mean value and the standard deviation. The observed as well as the upscaled total value of the matrix might be more or less different between the two different CFS and the question is if and how these two possibly different estimates of the total value of the relevant matrix should be combined. The approach taken here is to combine the two by means of a weighting procedure.For each CFS-year (2001 and 2004) and for each matrix k and flow type (W or P) we calculate:

$$z_{2001} = \frac{n_{2001}}{s_x^{2001}} \qquad (4.7)$$

$$z_{2004} = \frac{n_{2004}}{s_x^{2004}} \qquad (4.8)$$

The weights w_{2001} and w_{2004} for CFS 2001 and CFS 2004 are then calculated as:

$$w_{2001} = \frac{z_{2001}}{z_{2001} + z_{2004}} \qquad (4.9)$$

$$w_{2004} = \frac{z_{2004}}{z_{2001} + z_{2004}} \qquad (4.10)$$

where

n is the number of observations of *rs*-flows of each product matrix separately for flows of type W and type P

s_x is the standard deviation of the n *rs*-flow observations

Should data be missing or associated with too few values ($\leq$ 10), then the other survey, if available, is used. This means that if for some products we have observations for 2001 or 2004 only then what is available is selected provided the number of observations in either survey is greater than 10.

The weighting procedure is further illustrated in Table 4.6 below.

Table 4.6 Illustration of weighting and/or selection of values based on CFS 2001 and/or CFS 2004 of Source:.Excerpt from Excel Upscaled_WeightValue_CFS_10++region_matrices(3)_NSTR-level.xls

NSTR	SerP	P/W	YEAR	ObsValue [MSEK]	ObsTon [kton]	Upscale ObsValue [MSEK]	Upscale ObsTon [kton]	Nbr regular obs	Nbr singular obs	% singular of Obs Value	Selection or weighting	Weighted / Selected Upsc Value [MSEK]	Weighted / Selected Upsc Ton [kton]	Price per ton [SEK/ton]	Share 2001	Share 2004
10	1	P	2001	0	0	0	0	0	0	0						
10	1	P	2004	2867	2719	3920	3116	1761	0	0	Sel:2004	3920	3116	1258		
10	1	W	2001	399	169	1415	796	110	0	0						
10	1	W	2004	679	398	1347	795	223	1	31.4	BOTH	1360	795	1710	0.19	0.81
20	2	P	2001	3	0	3	0	1	0	0						
20	2	P	2004	964	2193	1428	2418	128	0	0	Sel:2004	1428	2418	591		
20	2	W	2001	10894	677	18660	1407	265	0	0						
20	2	W	2004	3454	345	11954	1292	749	0	0	BOTH	12047	1294	9312	0.01	0.99
31	3	P	2001	0	0	0	0	0	0	0						
31	3	P	2004	3643	443	3733	454	2127	0	0	Sel:2004	3733	454	8224		
32	4	P	2001	1128	2644	1128	2644	50	0	0						
32	4	P	2004	0	0	0	0	0	0	0	Sel:2001	1128	2644	427		
32	4	W	2001	0	0	0	0	0	0	0						
32	4	W	2004	0	0	0	0	0	0	0	MISSING::					
41	5	P	2001	7492	22569	11399	34343	2840	7	9.1						
41	5	P	2004	7695	34524	8098	36333	3932	0	0	BOTH	9908	35242	281	0.55	0.45
41	5	W	2001	586	1549	977	2456	14	14	80						
41	5	W	2004	7	25	44	158	3	0	0	Sel:2001	977	2456	398		

For illustrative purposes let us take as a numerical example product 2 and the flow type W from Table 4.6 above. To compute z_{year} and w_{year} for product 2 and observation type W we need data on n and the standard deviation s_x for the two years. The data as well as calculated values for this numerical example is summarized in Table 4.7 below.

Table 4.7 Numerical example of calculation of weights to combine CFS2001 and CFS2004 for product 2, type W flows.

Data/variable	**Source**	**Numerical value CFS 2001**	**Numerical value CFS 2004**
Mean of observed rs-flows,	Excel CFS_results, weighting2001 vs 2004[27]	41111	4612
Number of regular observations *n*	Table 4.6	265	749
Standard deviation s_x	Excel CFS_results, weighting2001 vs 2004	399000	15767
Total observed value of matrix (2,W) = $n \cdot \bar{x}$	Table 4.6, Excel Upscaled_Weightvalue	10894	3454
Upscaled observed value	Table 4.6, Excel Upscaled_Weightvalue	18660	11954
z_{year}		$6{,}64 \cdot 10^{-4}$	0,0475
w_{year}		0,014	0,9862

The weighted upscaled value can thus be calculated as the sum of the products of w_{2001} and w_{2004} with the corresponding upscaled value. i.e :

The total weighted value = 0,014*18660+0,9862*11954,

which gives the value 12047 that is also found on the line for product 2 flow type W in Table 4.6 above.

The independent variables in "VarSet" that are used to estimate the RS-models are the same for both 2001 and 2004 but their actual values are calculated separately for the two years.

4.3.5 Selecting the row and column sum models and estimating parameter values for the models

For each commodity group k where there is recorded data in the CFS (product groups 8, 13 and 30 are missing), we generate equations for the row and column totals, in terms of appropriate independent variables. When CFS records contain data for senders from both producers and wholesalers, separate equations are developed.

The chosen equation is then based on the optimum combination of the identified variables, including the dummy variable, provided that all coefficients are positive, up

[27] The Excel file CFS_results does not in itself contain the observations on aggregate rs-flows that are needed to compute the standard deviation s_x;The standard deviations as well as the mean values for the observed rs-flows for two years are given in the sheet Weighting 2001vs2004 in direct numbers.Mean and standard deviation are calculated from the observed rs flows per product. The observed rs-flows are calculated as set out in section 3.2.3 based on the two CFS data sets. Singular flows are not included

to a maximum of four variables (a sub-optimization may occur since it is less likely that both the dummy variable and the variable on which it is based will show up in the function with the best adjusted R2-value. However, as can be seen from Table 4.8 below, a few cases exist where both the highest correlation variable and the dummy based on this variable appear as part of the same RC-model).

The results are summarised in Table 4.8

Table 4.8 headings:

Product (k)	= the product group number (k)
NSTR	= NSTR code
P or W	= production/warehouse model
Row or Column	= model for Row/Column data

[I think the two SNI92 mainly contributing to "k" (=NSTR) would be useful to include since this would show whether the SNIxx, SNIzzz employment variables of the model are for the same SNI or for something else]

# obs =	number of non-zero observations (zones) for the two CFS years (max = 580, one per zone, 290 zones, 2 surveys)
Adjust R2 =	adjusted R2 for the best model using maximum 4 variables. For some of the models for product group k=4 there were too few available observations to determine a function
Correlation =	correlation between observations and the R/C-model values
Variables =	list of variables used in the model. CONST = means that a constant is used. Variable name followed by [D] means that this has been used as a dummy variable for large flow (> 10 %) from/to certain zones

Table 4.8 A summary of the estimation data and results of the models for row and column sum values (RC-models).

Product (k)	NSTR	P or W	Row or Column	#_obs 2001	#_obs 2004	Adjust R2	Correlation	Variables
1	10	P	R	0	228	0.5263	0.6172	SNI01, SNI011
1	10	P	C	0	162	0.4785	0.6006	W50, SNI15, SNI011
1	10	W	R	19	16	0.2326	0.2338	SNI011
1	10	W	C	75	134	0.1847	0.2768	Prod, Dag50, W50[D]
2	20	P	R	1	49	0.6935	0.6784	SNI011
2	20	P	C	1	37	0.1417	0.2994	W50
2	20	W	R	18	34	0.1764	0.3594	Dag50
2	20	W	C	158	270	0.0392	0.1781	Dag25, SNI40
3	31	P	R	0	288	0.706	0.7717	SNIsum
3	31	P	C	0	53	0.4434	0.5591	SNIsum, InterM[D]
4	32	P	R	44	0	0.6294	0.6173	Dag50, SNI01, SNI011
4	32	P	C	2	0	n/a	0	
4	32	W	R	0	0	n/a	0	
4	32	W	C	0	0	n/a	0	
5	41	P	R	285	287	0.6755	0.7036	InterM, SNIsum, SNI211
5	41	P	C	101	254	0.7354	0.8276	InterM, SNIsum, SNI40, SNI211
5	41	W	R	13	1	0.7889	0.7937	SNIsum
5	41	W	C	9	3	0.3718	0.2194	Dag25
6	42	P	R	74	139	0.3996	0.4477	Prod, SNI37
6	42	P	C	218	285	0.5137	0.5752	Prod, W50, SNI36, SNI201
6	42	W	R	18	72	0.4779	0.6254	Dag50, SNI40, SNI201, SNI40[D]

6	42	W	C	45	223	0.6061	0.7346	Prod, Dag50, SNI36, W50[D]
Product (k)	**NSTR**	**P or W**	**Row or Column**	**#_obs 2001**	**#_obs 2004**	**Adjust R2**	**Correlation**	**Variables**
7	43	P	R	238	85	0.0735	0.1506	Prod, SNI02, InterM[D]
7	43	P	C	100	164	0.3154	0.4885	InterM, W51
7	43	W	R	7	27	0.1726	0.1731	Dag50, SNI02[D]
7	43	W	C	21	42	0.2414	0.3393	InterM, SNI201
9	50	P	R	15	52	0.5756	0.7313	SNI01, SNI17, SNI25
9	50	P	C	132	217	0.2956	0.4215	W50, SNI02, SNI18, SNI245
9	50	W	R	38	74	0.5378	0.6808	Dag50, SNI18, SNI011, SNI18[D]
9	50	W	C	248	288	0.5574	0.7043	InterM, W50, SNI18
10	60	P	R	128	127	0.6877	0.7902	Prod, Dag25, SNI05, SNI05[D]
10	60	P	C	289	290	0.8244	0.897	Prod, W50, W51, SNI37
10	60	W	R	95	79	0.5552	0.7223	W51
10	60	W	C	289	289	0.1746	0.3678	Dag25, W50, SNI01, SNI16
11	70	P	R	273	212	0.3475	0.508	SNIsum, W51, SNI01, SNI15
11	70	P	C	211	222	0.4516	0.6293	W50, SNI15, SNI17, SNI15[D]
11	70	W	R	51	22	0.2382	0.3708	SNI01, InterM[D]
11	70	W	C	242	209	0.23	0.3061	Dag25, SNI01
12	80	P	R	34	15	0.4977	0.5974	Dag50, SNI10
12	80	P	C	225	73	0.2533	0.449	InterM, SNI10
12	80	W	R	3	7	0.2323	0.3628	InterM
12	80	W	C	3	12	0.0187	-0.0623	W50
14	100	P	R	18	23	0.2975	0.5613	CONST, SNI23[D]
14	100	P	C	109	141	0.2745	0.4932	SNI45, SNI231, SNI245
14	100	W	R	48	287	0.1988	0.4065	W50, SNI11, SNI231

14	100	W	C	289	288	0.4866	0.6442	W50, SNI23, SNI37, SNI231
Product (k)	**NSTR**	**P or W**	**Row or Column**	**#_obs 2001**	**#_obs 2004**	**Adjust R2**	**Correlation**	**Variables**
15	110	P	R	10	3	0.9026	0.9345	InterM, SNI13[D]
15	110	P	C	14	7	0.7803	0.8615	Prod, SNI37, SNI271
15	110	W	R	13	0	0.4362	0.0709	Dag50
15	110	W	C	67	0	0.2939	0.4368	Prod, SNI27, SNI37
16	120	P	R	5	5	0.8405	0.8912	Prod
16	120	P	C	5	7	0.1948	0.1763	Prod
16	120	W	R	10	4	0.9991	0.9996	W50, Prod[D]
16	120	W	C	5	16	0.0909	0.2867	Prod, SNI37[D]
17	130	P	R	121	101	0.574	0.7373	W50, SNI28, SNI271, SNI27[D]
17	130	P	C	275	259	0.5829	0.7522	W50, SNI271, SNI285, SNI27[D]
17	130	W	R	76	40	0.4888	0.6601	Dag25, SNI40, SNI231, SNI285
17	130	W	C	287	271	0.632	0.7685	W50, SNI23, SNI28, SNI231
18	140	P	R	83	126	0.3113	0.3636	Dag50, SNI20, SNI26, SNI285
18	140	P	C	279	288	0.819	0.8763	Ware, Dag25, W50, SNI37
18	140	W	R	51	81	0.376	0.5794	Dag25, SNI26, SNI40
18	140	W	C	191	287	0.2951	0.4805	W50, SNI201, SNI37[D]
19	151	P	R	27	41	0.3645	0.4519	Dag50, SNI142, W50[D]
19	151	P	C	96	92	0.2944	0.4716	InterM, SNI142
19	151	W	R	10	2	0.3755	0.4824	Dag50, SNIsum[D]
19	151	W	C	16	5	0.5304	0.5636	Dag50, SNI142
20	152	P	R	41	54	0.0523	0.0521	SNI45, SNI14[D]
20	152	P	C	151	230	0.042	0.1812	W50, SNI14[D]
20	152	W	R	21	25	0.4295	0.5167	Dag50, SNI37[D]

20	152	W	C	72	99	0.4724	0.6048	W50, SNI142, SNI11[D]
Product (k)	**NSTR**	**P or W**	**Row or Column**	**#_obs 2001**	**#_obs 2004**	**Adjust R2**	**Correlation**	**Variables**
21	160	P	R	5	2	0.9912	0.9982	SNI37, SNI244, SNI262
21	160	P	C	13	1	0.7715	0.8341	SNI019, SNI262
21	160	W	R	13	9	0.1071	0.2325	Dag50, SNI01[D]
21	160	W	C	79	100	0.0948	0.1773	Dag50, SNI142, SNI01[D]
22	170	P	R	0	21	0.6376	0.7487	Prod, Ware[D]
22	170	P	C	0	121	0.7595	0.8675	Prod, SNI244
22	170	W	R	0	10	1	1	CONST, SNI231, W50[D]
22	170	W	C	0	77	0.2134	0.3553	Dag25, SNI23, SNI231, SNI40[D]
23	180	P	R	88	146	0.4691	0.6653	W51, SNI24, SNI245
23	180	P	C	268	284	0.5766	0.728	Prod, W50, SNI245, SNI271
23	180	W	R	92	83	0.3418	0.5832	W51, SNI15
23	180	W	C	289	289	0.5721	0.723	W50, W51, SNI15, SNI29
24	190	P	R	26	18	0.2343	0.2433	Dag25, SNIsum[D]
24	190	P	C	50	36	0.3618	0.4602	Prod, SNI02
24	190	W	R	6	1	0.9899	0.994	Dag25, SNI45
24	190	W	C	10	1	0.5302	0.5558	SNIsum
25	200	P	R	81	88	0.4812	0.6695	Ware, SNI34[D]
25	200	P	C	252	259	0.9474	0.973	Prod, SNIsum, SNI35, SNI34[D]
25	200	W	R	40	45	0.31	0.4939	Final, Dag50
25	200	W	C	264	279	0.4413	0.6085	Prod, W50, SNI29, SNI37
26	210	P	R	188	191	0.1618	0.308	Ware, SNI26, InterM[D]
26	210	P	C	285	288	0.3363	0.5557	InterM, SNI29, SNI285
26	210	W	R	120	96	0.113	0.3211	W50, SNI26

26	210	W	C	289	289	0.179	0.3967	W52, SNI25, SNI29, SNI29[D]
Product (k)	**NSTR**	**P or W**	**Row or Column**	**#_obs 2001**	**#_obs 2004**	**Adjust R2**	**Correlation**	**Variables**
27	220	P	R	41	38	0.4917	0.6236	Prod, SNI244
27	220	P	C	215	246	0.5029	0.6782	InterM, SNIsum, SNI05, SNI244
27	220	W	R	51	43	0.1445	0.3089	Prod, SNI262
27	220	W	C	222	243	0.4716	0.6558	Dag50, W52, SNI36, Final[D]
28	231	P	R	24	0	0.6313	0.667	SNI45, SNI211
28	231	P	C	137	0	0.4709	0.6182	W50, SNI21
28	231	W	R	12	0	0.4373	0.6131	W50
28	231	W	C	50	0	0.0766	0.0899	W50
29	232	P	R	224	185	0.2809	0.4055	Dag50, SNI20, SNI25, SNI36
29	232	P	C	289	287	0.7703	0.8582	W50, SNI29, SNI37, W51[D]
29	232	W	R	183	169	0.3154	0.5141	W51, SNI29, SNI201
29	232	W	C	289	290	0.8357	0.9032	W50, SNI33, SNI45, SNI22[D]
31	45	P	R	185	250	0.4524	0.4979	Prod, SNI201
31	45	P	C	82	202	0.4541	0.5331	Prod, SNI201
31	45	W	R	45	3	0.2336	0.0829	Dag50, Ware[D]
31	45	W	C	29	11	0.3337	0.4294	InterM, SNI201
32	201	P	R	135	191	0.1535	0.2903	Ware, SNI31, SNI35, SNI29[D]
32	201	P	C	283	290	0.3015	0.514	Dag25, W50, SNI29, SNI31
32	201	W	R	134	141	0.7463	0.8653	Dag25, SNI22, SNI32
32	201	W	C	289	289	0.7889	0.8817	Dag50, W51, SNI32, SNI231
33	233	P	R	103	118	0.165	0.3459	Dag50, SNI21, SNI22
33	233	P	C	289	290	0.3298	0.5499	W50, SNI21, SNI22
33	233	W	R	75	55	0.1175	0.2675	Dag25, SNI37[D]

33	233	W	C	289	290	0.6539	0.8004	W50, W51, SNI22, SNI37
Product (k)	**NSTR**	**P or W**	**Row or Column**	**#_obs 2001**	**#_obs 2004**	**Adjust R2**	**Correlation**	**Variables**
34	250	P	R	77	26	0.0251	-0.1202	Dag50, SNI201
34	250	P	C	169	46	0.239	0.3687	SNIsum, Dag25, W50
34	250	W	R	19	33	0.3654	0.3071	Ware, SNI20, SNI40[D]
34	250	W	C	46	71	0.2541	0.3213	Dag50, SNI37, SNI201

The models in Table 4.8 were generated by means of an automated estimation procedure as mentioned above.Output data from this procedure are textfiles describing which linear model was fitted to the observed data (in subdirectory RCZ_fnc\).

It is noteworthy that the four “key” variables derived from NA sources (Prod, Ware, InterM, Final) only appear in some 45 out of 120 regression models according to Table 4.8 . This suggests that a “naïve” zonal factoring of the production and consumption data is not well supported by the commodity flows recorded in the CFS.

The average R^2-value for all the cases is 0.430. Two of the cases result in a negative correlation: one of these is discussed below. In summary the results could be better. Probably we would need better independent variables to explain the row and column sums, since also cases with several hundred observations result in rather mediocre correlations.

The values generated by the selected (best) model and observed data for two cases are illustrated in the diagrams below. In each diagram a simple linear regression line is given to further highlight the relation between modelled and observed values,[28]

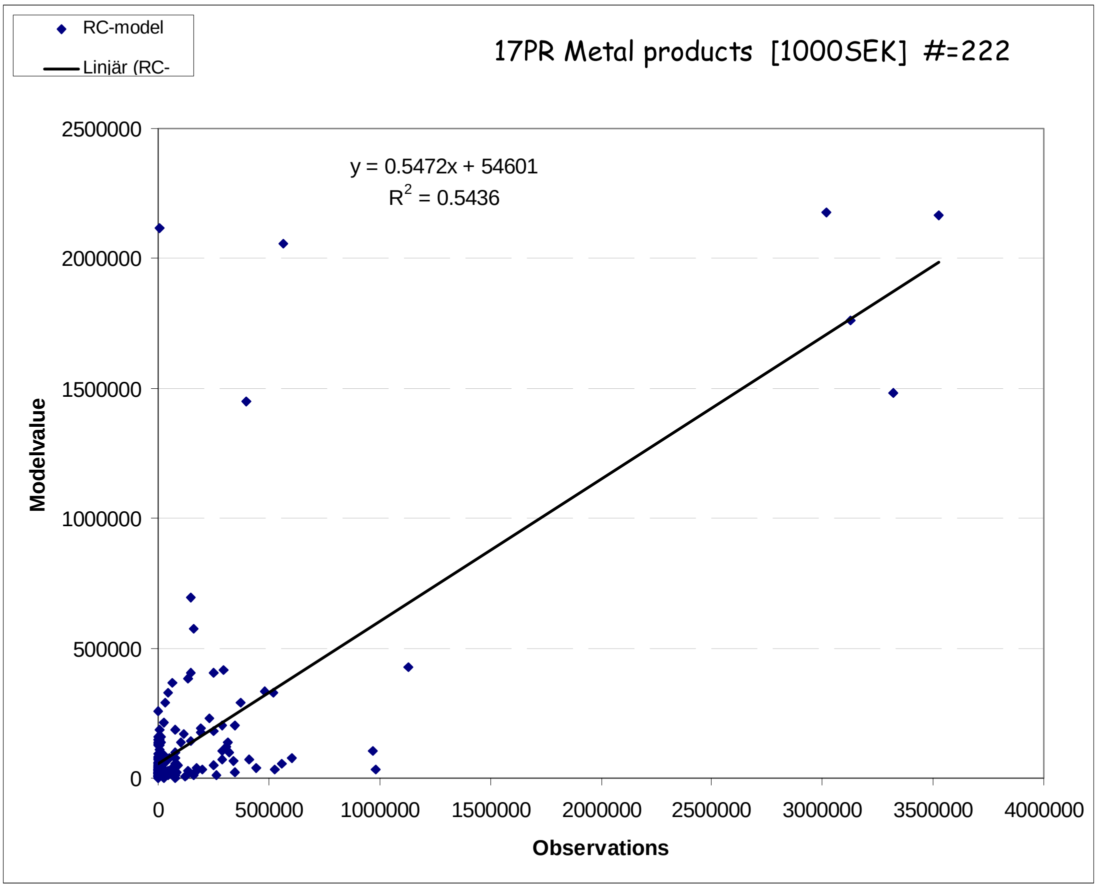

Figure 4.1 Relation between modelled values for the best (selected) model and observed data for type PR flow for product 17, Metal products

[28] Using the Excel-file CFS_results.xls, sheet scatter RC each of the estimated functions may be studied by means of a selection mechanism. With the list box in the upper left corner a combination of product, P/W and Row/Column is selected. The result comes out as below. 120 different combinations can be selected. In the version from 2007-09-10 also the selected independent variables with names, coefficients and data are provided.

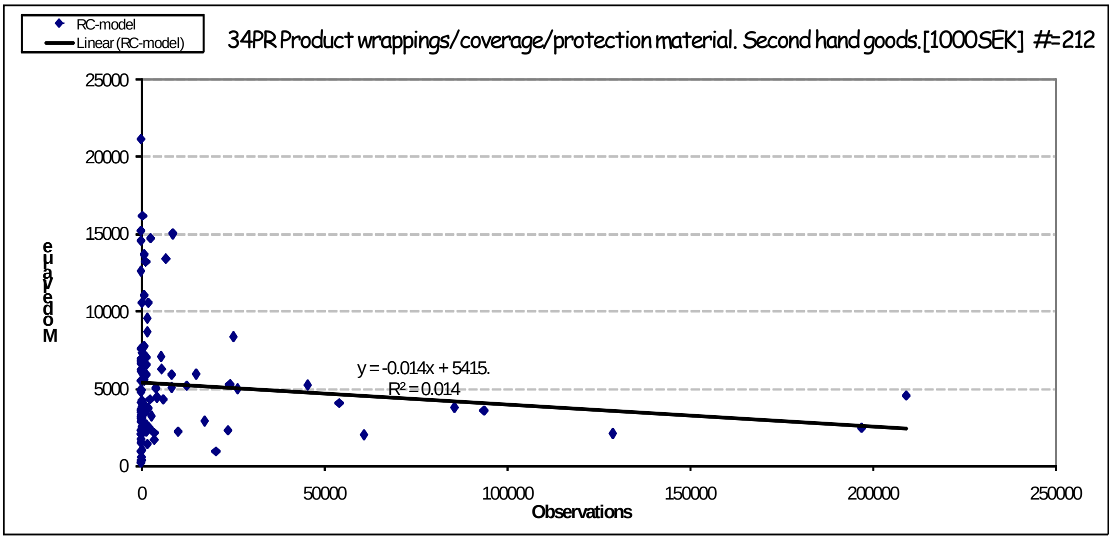

Figure 4.2 Relation between modelled values for the best (selected) model and observed data for type PR flow for product 34, Product wrappings, coverage etc

Attention should be drawn to the warehouse row model for product group 22 which is illustrated in Figure 4.3 below.

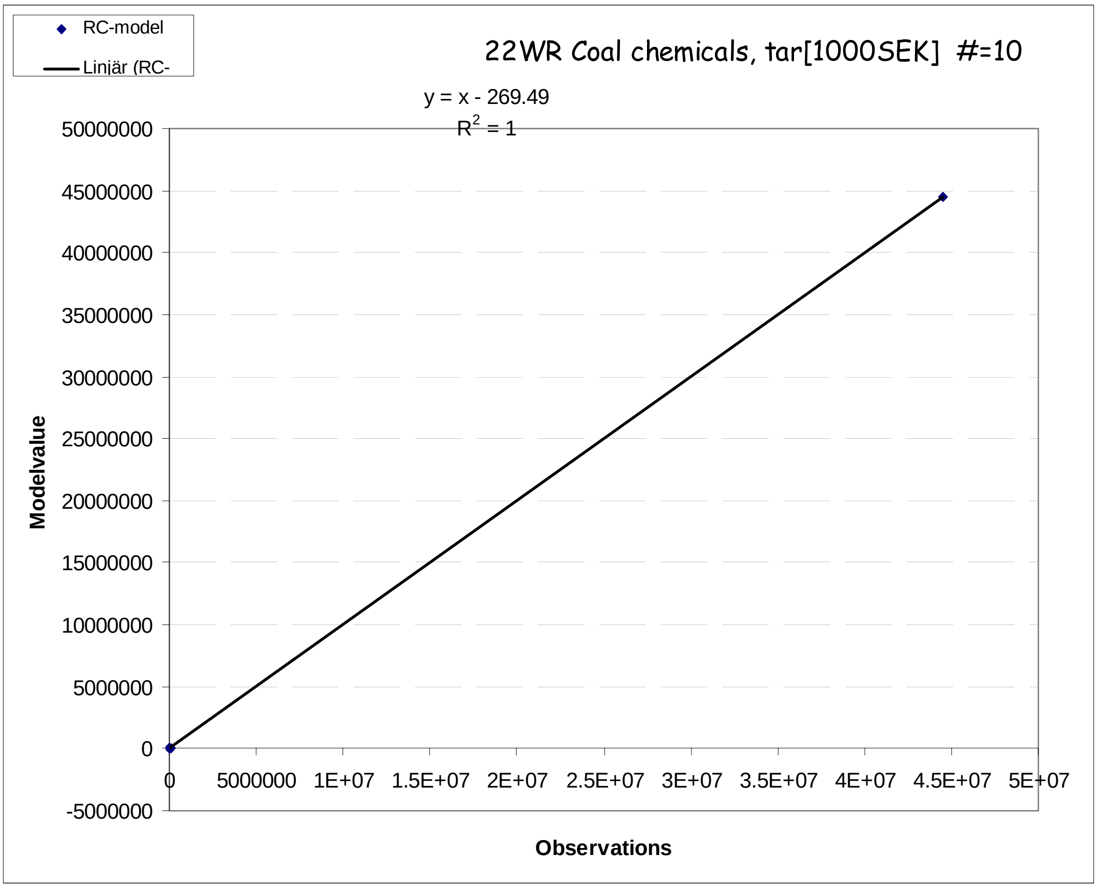

Figure 4.3 Relation between modelled values for the best (selected) model and observed data for type WR flow for product 22, Coal chemicals, tar etc.

The correlation is 1.000 (see Table 4.8) and according to Table 4.10 below the total regression sum is equal to 489 billion SEK [see source summary_res.dat in CFS_Result.xls], whereas the observed total is "only" 58.2 billion SEK. The reason is that 99.77 % of all the observed value is sent from zone 1480 (Göteborg), a fact that dominates the determination of the coefficients, as is shown in the data below.

Table 4.9 Observations of W-type row sum values for product 22, coal chemicals and tar illustrating the total domination of the observed value for Göteborg

Prod	NSTR	P/W	P/R	Year	#obs	zone nbr	hierach nbr	Zone name	Obs	RC-model
22	170	W	R	2004	1	11	138	Tyresö	4314.1	745.9
22	170	W	R	2004	2	16	163	Sollentuna	320	1743.4
22	170	W	R	2004	3	17	180	Stockholm	77985.5	77986
22	170	W	R	2004	4	18	181	Södertälje	989.2	3368.1
22	170	W	R	2004	5	21	184	Solna	775.1	4975.1
22	170	W	R	2004	6	33	382	Östhammar	19.3	514.2
22	170	W	R	2004	7	117	1281	Lund	12900.8	3710.6
22	170	W	R	2004	8	164	1480	Göteborg	44484732	44485000
22	170	W	R	2004	9	176	1493	Mariestad	1015.8	553
22	170	W	R	2004	10	286	2580	Luleå	42.6	2339.6

One way of improving this case would be to reconsider this dominating supply. If we removed the exceptionally high flow from Göteborg the estimation would be completely different. This would have to be done separately, however, since the singular flow mechanism does not apply to the flows from Göteborg since these flows are split on several separate destinations. Moreover the total flow from Göteborg, although high in value terms does not qualify as a singular flow in weight terms which is due to the high goods value.

The model results can be assessed by computing the total of the output values from the model, and comparing it with the upscaled values from the CFS. These results are summarised in Table 4.10. For this purpose, the "singular flows", which have been excluded from the regressions, are re-instated.

Table 4.10 headings:
Product (k) = the product group number (k)
NSTR = NSTR code
P or W = production/warehouse model
Row or Column = model for Row/Column data
Value regression model [MSEK], 2004 = total value of the flows in MSEK according to the fitted regression model. It is obtained by applying the fitted coefficients for all relevant zone data for the year 2004.
Value total [MSEK], upscaled = total, weighted value of the upscaled observed flows in billion SEK (including factors U1-U3). The upscaled value totals are based on data for both 2001 and 2004.

Value obs [MSEK] = value of the weighted observed flows in billion SEK (including factors U1-U2 only) based on CFS data for both years 2001 and 2004.

Singular flows [MSEK] = value of the weighted, observed singular flows identified in CFS (billion SEK)

Table 4.10 A summary of the implied results from the row and column sum estimation.
The estimation results accounted for in this table are based on observations from both CFS 2001 and CFS 2004

Product (k)	NSTR	P or W	Row or Column	Value regr model [Mkr], 2004	Value total [Mkr], upscaled weighted	Value obs [Mkr] weighted	Singular flows [Mkr]
1	10	P	R	3 080	3 920	2 867	0
1	10	P	C	3 702	3 920	2 867	0
1	10	W	R	2 460	1 360	453	173
1	10	W	C	788	1 360	453	173
2	20	P	R	2 379	1 428	964	0
2	20	P	C	2 651	1 428	964	0
2	20	W	R	75 873	12 047	3 557	0
2	20	W	C	8 759	12 047	3 557	0
3	31	P	R	4 102	3 733	3 643	0
3	31	P	C	8 711	3 733	3 643	0
4	32	P	R	5 068	1 128	1 128	0
4	32	P	C	0	1 128	1 128	0
4	32	W	R	0	0	0	0
4	32	W	C	0	0	0	0
5	41	P	R	6 865	9 908	7 208	375
5	41	P	C	8 028	9 908	7 208	375
5	41	W	R	1 760	977	117	469
5	41	W	C	7 470	977	117	469
6	42	P	R	9 319	21 909	8 873	102
6	42	P	C	5 674	21 909	8 873	102
6	42	W	R	674	3 470	364	0

6	42	W	C	373	3 470	364	0
Product (k)	**NSTR**	**P or W**	**Row or Column**	**Value regr model [Mkr], 2004**	**Value total [Mkr], upscaled weighted**	**Value obs [Mkr] weighted**	**Singular flows [Mkr]**
7	43	P	R	450	4 910	389	568
7	43	P	C	527	4 910	389	568
7	43	W	R	76	182	8	0
7	43	W	C	45	182	8	0
9	50	P	R	2 364	10 085	1 244	0
9	50	P	C	990	10 085	1 244	0
9	50	W	R	2 479	10 754	1 819	0
9	50	W	C	1 351	10 754	1 819	0
10	60	P	R	84 355	106 413	66 042	1 114
10	60	P	C	74 303	106 413	66 042	1 114
10	60	W	R	128 349	182 810	63 053	6 678
10	60	W	C	86 755	182 810	63 053	6 678
11	70	P	R	12 841	20 895	12 077	1 809
11	70	P	C	11 524	20 895	12 077	1 809
11	70	W	R	3 258	4 784	1 391	0
11	70	W	C	1 488	4 784	1 391	0
12	80	P	R	3 090	710	346	0
12	80	P	C	299	710	346	0
12	80	W	R	1 180	838	31	0
12	80	W	C	33	838	31	0
14	100	P	R	4 560	2 500	474	398
14	100	P	C	1 100	2 500	474	398
14	100	W	R	23 670	37 671	32 822	2 176

14	100	W	C	21 872	37 671	32 822	2 176
Product (k)	**NSTR**	**P or W**	**Row or Column**	**Value regr model [Mkr], 2004**	**Value total [Mkr], upscaled weighted**	**Value obs [Mkr] weighted**	**Singular flows [Mkr]**
15	110	P	R	3 687	3 206	3 017	0
15	110	P	C	18 226	3 206	3 017	0
15	110	W	R	851	1 090	38	0
15	110	W	C	49	1 090	38	0
16	120	P	R	20 650	2 990	2 306	0
16	120	P	C	6 164	2 990	2 306	0
16	120	W	R	4 873	6 141	914	0
16	120	W	C	4 114	6 141	914	0
17	130	P	R	17 852	57 420	15 443	26 065
17	130	P	C	16 430	57 420	15 443	26 065
17	130	W	R	13 680	16 068	7 352	0
17	130	W	C	6 461	16 068	7 352	0
18	140	P	R	12 327	25 401	8 690	130
18	140	P	C	7 221	25 401	8 690	130
18	140	W	R	3 394	13 523	1 992	0
18	140	W	C	1 210	13 523	1 992	0
19	151	P	R	829	1 120	168	0
19	151	P	C	321	1 120	168	0
19	151	W	R	76	43	3	0
19	151	W	C	50	43	3	0
20	152	P	R	1 649	5 670	1 189	718
20	152	P	C	597	5 670	1 189	718
20	152	W	R	250	1 500	124	0

20	152	W	C	118	1 500	124	0
Product (k)	**NSTR**	**P or W**	**Row or Column**	**Value regr model [Mkr], 2004**	**Value total [Mkr], upscaled weighted**	**Value obs [Mkr] weighted**	**Singular flows [Mkr]**
21	160	P	R	24 900	750	259	0
21	160	P	C	1 190	750	259	0
21	160	W	R	5 260	1 370	286	0
21	160	W	C	788	1 370	286	0
22	170	P	R	5 561	4 916	3 465	0
22	170	P	C	4 031	4 916	3 465	0
22	170	W	R	489 402	58 208	44 583	0
22	170	W	C	103 538	58 208	44 583	0
23	180	P	R	15 363	31 285	10 432	206
23	180	P	C	10 404	31 285	10 432	206
23	180	W	R	35 968	29 296	6 992	0
23	180	W	C	14 695	29 296	6 992	0
24	190	P	R	8 316	7 142	4 452	962
24	190	P	C	23 096	7 142	4 452	962
24	190	W	R	1 170	1 320	70	0
24	190	W	C	252	1 320	70	0
25	200	P	R	34 344	55 825	35 373	1 206
25	200	P	C	33 257	55 825	35 373	1 206
25	200	W	R	18 749	16 016	9 717	0
25	200	W	C	7 176	16 016	9 717	0
26	210	P	R	17 040	60 005	19 430	0
26	210	P	C	24 060	60 005	19 430	0
26	210	W	R	11 465	21 565	7 225	0

26	210	W	C	5 527	21 565	7 225	0
Product (k)	**NSTR**	**P or W**	**Row or Column**	**Value regr model [Mkr], 2004**	**Value total [Mkr], upscaled weighted**	**Value obs [Mkr] weighted**	**Singular flows [Mkr]**
27	220	P	R	9 245	6 439	2 829	0
27	220	P	C	3 337	6 439	2 829	0
27	220	W	R	7 022	4 356	1 302	0
27	220	W	C	1 121	4 356	1 302	0
28	231	P	R	11 360	7 137	5 650	258
28	231	P	C	7 772	7 137	5 650	258
28	231	W	R	219	491	40	0
28	231	W	C	49	491	40	0
29	232	P	R	25 138	73 429	23 169	83
29	232	P	C	22 121	73 429	23 169	83
29	232	W	R	23 625	74 493	21 170	49
29	232	W	C	21 644	74 493	21 170	49
31	45	P	R	3 759	4 967	4 778	0
31	45	P	C	4 827	4 967	4 778	0
31	45	W	R	1 270	720	240	88
31	45	W	C	1 420	720	240	88
32	201	P	R	42 306	62 873	29 441	0
32	201	P	C	41 530	62 873	29 441	0
32	201	W	R	44 593	88 864	21 817	0
32	201	W	C	26 790	88 864	21 817	0
33	233	P	R	30 674	49 699	21 949	4 509
33	233	P	C	33 334	49 699	21 949	4 509
33	233	W	R	17 098	21 989	8 601	0

33	233	W	C	8 550	21 989	8 601	0
Product (k)	**NSTR**	**P or W**	**Row or Column**	**Value regr model [Mkr], 2004**	**Value total [Mkr], upscaled weighted**	**Value obs [Mkr] weighted**	**Singular flows [Mkr]**
34	250	P	R	1 310	1 750	778	0
34	250	P	C	1 150	1 750	778	0
34	250	W	R	831	4 690	253	0
34	250	W	C	431	4 690	253	0

4.4 Developing models for {rs} cells

In this section we describe the estimation of the synthetic PWC-matrices based on the CFS-observations and the row- and column-sum models from Section 4.3 for domestic flows.

Initially different tests with some ordinary regression models were attempted, primarily regression models of the type in eq (4.11). After taking the logarithm of both sides, a linear model is obtained.

$$F_{k,rs}^{obs} = const \cdot S_r^{\alpha} \cdot D_s^{\beta} \cdot \exp(-c_{dist} \cdot dist_{rs}) \tag{4.11}$$

where

$F_{k,rs}^{obs}$ = as before, the expanded CFS values in SEK for flow from zone r to zone s

α, β and c_{dist} = model parameters to be estimated
S_r = supply estimate in zone r in SEK (Row total model from Section 4.3)
D_s = demand estimate in zone s in SEK (Column total model from Section 4.3)
$dist_{rs}$= distance in kms between zones r and s
const = scaling parameter to ensure that sum over all r, s agrees with upscaled value from CFS (the weighted upscaled value according to

The values of the independent variables determining the S_r and D_s variables depend on the weighting of the data. If observations are selected from only one of the two years (2001 or 2004), data from that year is used. If data have been weighted together, then the values are a weighted combination of data from the two years using the same weights that were used for weighting the CFS-observations together. (see section 4.3.3 above)

In some cases this gave inappropriate results in terms of counter-intuitive signs for the independent variable parameters α and β and for the distance aversion parameter c_{dist} as well as low R^2-values. For some products the tests gave acceptable results but too many were unacceptable. In many cases S and D are also highly correlated, which generate problems with multi-collinearity in the models.

In order to enable the formulation of a unified model it was thought preferable to make use of the logit model for distributing the flow to different destinations by including the distance aversion. The exponential component with the distance aversion corresponds to the utility function in the logit model, whereas the column sum parts (D_s) correspond to a proportional allocation. More complex formulations both in the distance aversion function as well as the proportional parts could be developed in the future.

The PWC-matrix flow allocation is thus carried out according to the gravity type model in eq (4.12) (the product index *k* is left out for enhanced readability). The model parameters α and β are also used in approximately the same manner as in (4.11), though D_s has been moved into the nominator of the distance component,

leaving the factor $D_s^{\beta-1}$ outside. The exponents α and β are only allowed to vary

between predefined lower and upper bounds (here 0.1 and 1.2) and we require $c_{dist} \geq 0$. Note however that the use of the power functions for S and D in eq (4.12) means that the modelled row sum target will not be met and hence the overall total will not be in agreement. This therefore requires an additional normalising constant (see below).

$$F_{rs} = const \cdot S_r^{\alpha} \cdot D_s^{\beta-1} \cdot \frac{D_s \cdot \exp(-c_{dist} \cdot dist_{rs})}{\sum_k D_k \cdot \exp(-c_{dist} \cdot dist_{rk})} \qquad (4.12)$$

where, in addition to the previously defined variables (Eq 4.11)

const is now a normalization constant to ensure that the total estimated flow is in agreement with the CFS when summed over all zones for outgoing flow.

The numerical estimation of the coefficients α, β and c_{dist} has been carried out by using a coordinate search in the three dimensions. A one-dimensional search with application of the golden section method has been used iteratively in each of the dimensions[29].

The result of the estimations are summarized in Table 4.11 . The columns of the Table hold:
Product = the product group number (k)
NSTR = NSTR three digit code
P/W = *P* represents flow from a producing company to consumption, *W* represents flow from the warehouse sector to consumption. The consumption may be intermediate or final.
Corr R = correlation between the row function value, S_r =weighted row sum function value, and the observed row outflow (weighted if data exists from both years). [30]
Corr C = correlation between the c*olumn* variable, D_s =weighted column sum function value, and the observed column inflow (=weighted if data exists from both years).
Corr RC = correlation between the two explaining variables (determined over all zones).
α, = estimated exponent for the supply component
β = estimated exponent for the demand component

[29] Most of the computations described here are in a set of procedures that are used, after data have been setup, in four sequential steps. Each of these step are computed with the same program that can be ran by starting 4 batch files in sequence. The first two of these batch files handles one product group and either P or W demand at each run. The estimation procedure above is handled by the second batch file.

[30] Note that the values for this and the next item are not compatible with those in Table 3.1, since these correlations were computed after deriving the synthethic matrix.

c_{dist} = distance coefficient in the distribution model, eq (4.12)
Correlation PWC = correlation between the modeled PWC-flow and the observations
 # PWC-obs = # of PWC-flow observations [over both years]

Table 4.11 Summary of PWC-estimation results using the linear estimates from Table 4.8 . {value of the constant in 3.13 not given}

Product (k)	NSTR	P/W	Corr R	Corr C	Corr RC	α	β	cDist [1E-6]	Corre-lation PWC	# PWC-obs
1	10	P	0.62	0.60	0.92	0.5171	0.8352	-23490	0.5786	1761
1	10	W	0.36	0.37	0.64	1.2	0.527	-1234	0.2679	333
2	20	P	0.67	0.32	0.33	0.7779	0.4275	-10689	0.6831	129
2	20	W	0.06	0.50	0.80	1.2	1.012	-192	0.1368	1014
3	31	P	0.77	0.56	0.76	1.1366	0.6644	-8802	0.6622	2127
4	32	P	0.62	0.00	0.00	0.9644	1.0485	-14843	0.6425	50
5	41	P	0.82	0.85	0.55	1.2	1.2	-19907	0.6648	6772
5	41	W	0.80	0.03	-0.24	0.4285	0.1136	-931	0.6362	17
6	42	P	0.63	0.71	0.78	0.4587	0.4209	-441	0.1942	4200
6	42	W	0.63	0.81	0.65	0.5008	0.6903	-2306	0.4859	744
7	43	P	0.17	0.66	0.53	0.3196	1.1894	-1	0.3551	938
7	43	W	0.17	0.33	0.57	1.2	0.2484	-4940	0.1937	72
9	50	P	0.78	0.55	0.49	1.2	0.8909	-1	0.3629	881
9	50	W	0.68	0.87	0.68	0.6477	0.7367	-1438	0.2648	3659
10	60	P	0.83	0.91	0.90	1.0482	1.1056	-4077	0.529	9792
10	60	W	0.61	0.71	0.90	1.2	0.9766	-2061	0.1478	7993
11	70	P	0.65	0.71	0.89	0.563	0.4424	-7470	0.2537	2670
11	70	W	0.48	0.35	0.72	0.6423	0.4373	-10904	0.2724	916
12	80	P	0.69	0.24	0.35	1.1871	0.8747	-2513	0.8958	527
12	80	W	0.35	-0.06	0.79	1.2	1.2	-8773	0.7241	15
14	100	P	0.61	0.07	0.15	1.2	0.9086	-1	0.2929	412
14	100	W	0.70	0.73	0.93	0.6173	0.5894	-9591	0.2948	3402
15	110	P	0.94	0.74	0.78	1.2	0.3886	-1	0.7933	25
15	110	W	0.07	0.44	0.04	0.3499	0.1	-1	0.3244	106
16	120	P	0.89	0.03	1.00	1.2	0.1	-1	0.0619	15
16	120	W	1.00	0.33	0.77	1.2	0.3596	-1	0.5754	31

Product (k)	NSTR	P/W	Corr R	Corr C	Corr RC	α	β	cDist [1E-6]	Corre-lation PWC	# PWC-obs
17	130	P	0.73	0.77	0.91	0.6246	0.88	-1	0.4924	3398
17	130	W	0.73	0.82	0.93	0.2189	0.9433	-1	0.2051	3260
18	140	P	0.37	0.93	0.57	0.8203	0.7416	-694	0.2949	5436
18	140	W	0.76	0.60	0.78	0.7923	0.6976	-1499	0.2476	1773
19	151	P	0.40	0.61	0.68	1.2	1.2	-22750	0.4584	248
19	151	W	0.47	0.51	0.54	1.2	1.2	-5789	0.7512	23
20	152	P	0.04	0.25	0.67	1.0884	0.4976	-8566	0.463	975
20	152	W	0.62	0.57	0.39	0.1917	0.5325	-2182	0.3857	249
21	160	P	1.00	0.83	0.16	0.8518	0.4863	-1	0.6079	22
21	160	W	0.32	0.05	0.60	1.2	0.75	-2354	0.2122	205
22	170	P	0.75	0.87	0.92	0.8309	0.7468	-8967	0.6885	252
22	170	W	1.00	0.36	0.96	0.6762	0.1	-48	0.8329	104
23	180	P	0.68	0.81	0.96	1.2	1.1832	-93658	0.5751	4789
23	180	W	0.80	0.87	0.94	1.2	1.2	-18602	0.3811	5891
24	190	P	0.26	0.42	0.28	0.4348	0.7292	-6173	0.5719	157
24	190	W	0.99	0.62	0.00	1.0269	0.7146	-4393	0.9699	23
25	200	P	0.66	0.98	0.79	0.6126	1.2	-1	0.4909	2659
25	200	W	0.50	0.76	0.80	0.8455	0.8587	-1	0.2363	2796
26	210	P	0.38	0.75	0.91	0.3079	0.9743	-1	0.0684	9174
26	210	W	0.45	0.67	0.71	1.2	0.8654	-13706	0.2749	7391
27	220	P	0.61	0.73	0.62	1.2	1.2	-7979	0.4762	1482
27	220	W	0.38	0.78	0.04	0.1	0.6548	-1	0.1545	1488
28	231	P	0.67	0.62	0.38	1.0705	0.6838	-1	0.4476	333
28	231	W	0.61	0.09	1.00	1.2	0.1379	-6240	0.1045	60
29	232	P	0.49	0.92	0.42	0.9293	0.9311	-1824	0.1936	12665
29	232	W	0.51	0.95	0.97	1.0677	1.1394	-1546	0.3976	17531
31	45	P	0.55	0.59	0.84	0.5243	0.8079	-14611	0.4445	2534
31	45	W	0.10	0.48	0.55	0.1502	0.5648	-3801	0.3662	78

Product (k)	NSTR	P/W	Corr R	Corr C	Corr RC	α	β	cDist [1E-6]	Corre-lation PWC	# PWC-obs
32	201	P	0.40	0.73	0.72	0.9048	0.8736	-2407	0.0768	7496
32	201	W	0.95	0.98	0.96	1.2	1.2	-13608	0.7827	12552
33	233	P	0.42	0.69	0.90	0.7012	1.116	-3085	0.1213	5927
33	233	W	0.31	0.94	0.58	0.8034	1.003	-1891	0.2544	3157
34	250	P	-0.13	0.41	0.63	0.1	0.4868	-602	0.112	507
34	250	W	0.38	0.29	0.62	0.2833	0.4429	-2168	0.2561	252

Row and column correlations are computed over the set of zones with observations. *Corr RC* is computed using all zones, regardless of any existing observations.

Correlations are only computed for cells with observations. Some of them seem to be remarkably high. This could be caused by too few observations or a few dominating observations that represents most of the flow. On the issue of observed zero flows, we are lacking that type of information. Missing PC-flows are in most cases the result of the sample based survey, and we can only to a limited extent distinguish true zero valued PC-flows.

As with the row and column total models, the model results can be assessed by computing the total of the output values from the model, and comparing it with the upscaled values from the CFS. These results are summarised in Table 4.12. Again, for this purpose, the “singular flows”, which have been excluded from the regressions, are re-instated.

The columns of the Table 4.12 hold:
Product = the product group number (k)
NSTR = NSTR three digit code
P/W = *P* represents flow from a producing company to consumption, *W* represents flow from the warehouse sector to consumption. The consumption may be intermediate or final.
Tot value [MSEK] = total value in MSEK of the PWC-flows
Tot ton [Mton] = total PWC-flow volume in Mtonnes
Value [SEK/ton] = the average value of the PWC-flow in SEK/ton
Matrix density [%] = the percentage of the final result matrix that holds non-zero values.
Final matrix density [%] = the percentage of cells in the final domestic matrix that hold non-zero values. The full matrix holds $290 \times 290 = 84100$.

Exception cases = denotes the exception rules according to Table 4.13 [see following section].

Table 4.12 A summary of the implied results from the matrix cell models.

Product (k)	NSTR	P/W	Total value [MSEK], upscaled	Total tonnes [Mton], upscaled	Value [SEK/ton]	Matrix density during estimation [%]	Final matrix density [%]	Ex-cep-tion case
1	10	P	3910.0	3.109	1257.9	56	20	0
1	10	W	1356.0	0.793	1709.9	27	26	1
2	20	P	1427.0	2.417	590.6	42	23	0
2	20	W	12040.0	1.293	9311.8	57	1	0
3	31	P	3733.0	0.454	8224.5	68	20	0
4	32	P	1128.0	2.644	426.7	63	0	0
5	41	P	9671.0	34.400	281.1	65	5	0
5	41	W	953.9	2.398	397.8	43	43	0
6	42	P	21910.0	3.612	6065.9	77	77	0
6	42	W	3470.0	0.383	9053.0	64	63	0
7	43	P	4913.0	8.214	598.2	57	57	0
7	43	W	182.1	0.399	456.3	12	10	2
9	50	P	10080.0	0.064	158143.4	59	56	0
9	50	W	10750.0	0.068	158119.9	70	70	0
10	60	P	106400.0	7.308	14560.4	83	52	0
10	60	W	182800.0	7.480	24440.0	78	72	0
11	70	P	20890.0	7.970	2621.6	59	3	0
11	70	W	4784.0	2.000	2391.6	54	40	0
12	80	P	521.9	1.332	392.0	20	8	0
12	80	W	616.5	0.266	2321.2	1	1	2
14	100	P	2503.0	0.849	2947.0	28	0	0
14	100	W	37670.0	11.290	3336.1	63	3	0
15	110	P	3206.0	7.434	431.2	5	0	0
15	110	W	1090.0	1.227	888.4	18	18	0
16	120	P	2990.0	0.994	3006.8	1	1	2
16	120	W	6141.0	0.232	26438.3	1	1	2

Product (k)	NSTR	P/W	Total value [MSEK], upscaled	Total tonnes [Mton], upscaled	Value [SEK/ton]	Matrix density during estimation [%]	Final matrix density [%]	Ex-cep-tion case
17	130	P	3910.0	3.109	10076.7	70	70	0
17	130	W	16070.0	1.829	8783.4	72	72	0
18	140	P	25400.0	16.450	1543.8	82	82	0
18	140	W	13520.0	1.495	9047.2	69	68	0
19	151	P	1122.0	15.570	72.1	25	10	0
19	151	W	42.5	0.141	302.5	6	6	2
20	152	P	5670.0	4.547	1247.0	48	35	0
20	152	W	1500.0	1.891	793.4	38	37	0
21	160	P	665.4	0.382	1742.0	1	1	2
21	160	W	1215.0	0.549	2214.3	18	16	1
22	170	P	4916.0	0.035	142285.7	14	7	1
22	170	W	58210.0	0.018	3311416.8	1	1	2
23	180	P	31290.0	2.882	10856.4	78	9	0
23	180	W	29300.0	0.914	32037.6	73	18	0
24	190	P	7142.0	1.737	4111.5	15	12	0
24	190	W	1318.0	2.189	602.1	12	10	0
25	200	P	55820.0	0.821	68032.4	61	3	0
25	200	W	16020.0	0.202	79429.7	62	62	0
26	210	P	60010.0	2.734	21943.9	91	91	0
26	210	W	21560.0	1.142	18878.8	87	48	0
27	220	P	6439.0	0.418	15403.7	50	27	0
27	220	W	4356.0	0.293	14867.9	53	53	0
28	231	P	7137.0	1.185	6020.8	22	18	0
28	231	W	491.3	0.460	1069.0	3	3	2
29	232	P	73430.0	3.492	21027.5	95	93	0
29	232	W	74490.0	2.444	30483.3	94	92	0
31	45	P	4462.0	12.280	363.3	56	2	0
31	45	W	647.0	2.074	311.9	48	36	0

Product (k)	NSTR	P/W	Total value [MSEK], upscaled	Total tonnes [Mton], upscaled	Value [SEK/ton]	Matrix density during estimation [%]	Final matrix density [%]	Ex-cep-tion case
32	201	P	3910.0	3.109	125085.8	90	8	0
32	201	W	88860.0	2.717	32709.8	92	38	0
33	233	P	48050.0	2.751	17468.0	77	5	0
33	233	W	21260.0	1.610	13205.2	67	58	0
34	250	P	1538.0	0.257	5977.2	63	63	0
34	250	W	4119.0	2.257	1825.3	56	56	0

4.5 Producing the final domestic matrices

In this final section on the Domestic matrices, we describe how the synthetic base matrices are computed using the regression models explained above and then how they are combined with actual CFS-observations. The calculations are done separately for each product group k. In addition separate calculations are done for each type of flow (PW, PC etc[31]).

The first step is to use the regression models according to Table 4.8 to calculate the row (S_r) and column sums (D_s). We then input these to the model in eq (4.12), which yields a first estimate of the matrices Q_{rs}^k.

Since the direct application of the model will give a non-zero result in all or almost all cells in the base matrix, these observations suggest that some heuristic rules are required to restrict its application. The aim, in particular, is to avoid spreading the total demand too thinly. It also needs to reflect the general evidence (eg from the IVP-data) that the production of commodities tends to be more spatially concentrated than the consumption.

In order to accomplish this we rank the rs- relations according to the two quantities

- Rank01 = $S_r \cdot D_s$ and
- Rank02 = $Prod_r \cdot Cons_s$ [where Cons = InterM + Final]

separately for each commodity. It will be recalled that the variables Prod, InterM and Final were described in Section 4.3.1a.

In the first place all zone-zone relations are eligible to be included **except** those having the 10 % lowest values for **both** Rank01 and Rank02. Thus this removes from the total set of {r-s} movements those where the likely demand is the smallest. However, two further exception criteria are applied:

Table 4.13 Exception rules for activating base matrix cells.

Exception level	Total flow	Nbr of observations	Criteria to include observations based on the cumulative distribution
1	< 1 Mton	< 400	Rank01 and Rank02 values should both be higher than the 30 % lowest
2	< 1 Mton	< 200	Rank01 and Rank02 values should both be higher than the 50 % lowest

In this Table, "Total flow" means the estimated total "observed" flow for this product, separately for P and W, obtained by weighting the two CFS:s together, and applying all three upscale factors. The "Nbr of observations" is the number of OD-pair [rs] relations from the CFS:s used in the regression estimation, on the basis that if there are few observations, the spatial distribution for the product should be restricted.

[31] though since the distinction between W and C cannot be made at the receiving end as this is not recorded in CFS, in practice the matrices are either P-[W/C] or W-[W/C]

This results in a further set of r-s cells being potentially removed. But regardless of the result of these rules, all relations with **observed** flows (from either CFS2001 or CFS2004) are retained.

In addition, a further relaxation is made. For each eligible cell, all sender zones and receiver zones in the same NUTS2-area[32] are considered eligible for flows according to the model in eq (4.12): the aim of this is to avoid an excessive number of zero cells. Since there are 9 NUTS2-level areas in Sweden, a NUTS2-area comprises on average 290/9 = 32 zones. Hence this exception rule involves allowing approximately 900 non-zero values, though further cut-off mechanisms are later brought into operation, as described below.

Given a modified synthetic matrix as a result of the application of these rules, we now combine these estimates with the actual CFS observations. For this purpose, observations both from CFS 2001 and CFS 2004/2005 are used: for each cell where there are observed flows, these replace the synthetic modelled value. If flows are recorded in both years, the larger observation is used.

We now control over all cells, for both regular and singular flows. The aim for each commodity is to meet the target value, defined as the figures for "**Total value [MSEK], upscaled, weighted**" provided in Table 4.10 and Table 4.12. The logic is as follows:

- If the total of the (upscaled) **observed** flows > the target value, then only the observed values are used, scaled down uniformly to the target

- If the total of (upscaled) **observed** flows **plus** the synthetic values for the remaining flows > target value, then the synthetic values are scaled down to the difference between the target and upscaled observed flows, while the observed values are unchanged

- If the total of (upscaled) **observed** flows **plus** the synthetic values for the remaining flows < target value, then the combined matrix (observed + synthetic) is scaled up uniformly to the target.

Following this re-scaling, small cell values (< 1000 SEK) are removed, to avoid handling very small flows[33]. Then the remaining matrix is again rescaled to the target value.

Up to now all calculations have been in value terms (MSEK). The resulting matrices are now converted to tonnes by means of national average product values. The values that have been used are given in Table 4.14 below. They were based on the weighted total values over the total volumes obtained from the CFS data[34].

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[32] The NUTS2-couplings to the domestic zones in the SAMGODS model is provided in sheet *IncomeLevelPerEmployee* in CFS_results.xls

[33] This is carried out in *PWC_Adjust.f90* after estimation of the synthethic matrix.

[34] Values are computed from both years using the weighting procedure described in Section 4.3.3 (Please note the priority order used). After this the values for the P- and W-parts are weighted together with weights equal to the upscaled tonne values for P and W respectively. Only values for domestic transports are included.

Table 4.14 Average product values for conversion of matrices in value to tonnes. Source; Input_RAND_2006_10_26_new commodity_prices

1	Cereals	1350
2	Potatoes, other vegetables, fresh or frozen, fresh fruit	3631
3	Live animals	8224
4	Sugar beet	427
5	Timber for paper industry (pulpwood)	289
6	Wood roughly squared or sawn lengthwise, sliced or peeled	6352
7	Wood chips and wood waste	592
8	Other wood or cork	452
9	Textiles, textile articles and manmade fibres, other raw animal and vegetable materials	158131
10	Foodstuff and animal fodder	19558
11	Oil seeds and oleaginous fruits and fats	2576
12	Solid mineral fuels	713
13	Crude petroleum	2597
14	Petroleum products	3309
15	Iron ore, iron and steel waste and blast-furnace dust	496
16	Non-ferrous ores and waste	7444
17	Metal products	9762
18	Cement, lime, manufactured building materials	2169
19	Earth, sand and gravel	74
20	Other crude and manufactured minerals	1114
21	Natural and chemical fertilizers	2020
22	Coal chemicals	1210937
23	Chemicals other than coal chemicals and tar	15959
24	Paper pulp and waste paper	2155
25	Transport equipment, whether or not assembled, and parts thereof	70281
26	Manufactures of metal	21041
27	Glass, glassware, ceramic products	15183
28	Paper, paperboard; not manufactures	4637
29	Leather textile, clothing, other manufactured articles than paper, paperboard and manufactures thereof	24920
30	Mixed and part loads, miscellaneous articles	19521
31	Timber for sawmill	356
32	Machinery, apparatus, engines, whether or not assembled, and parts thereof	47132
33	Paper, paperboard and manufactures thereof	15894
34	Wrapping material, used	2250
35	Air freight (2006 model)	561026

The output (and later input) data from the construction of the domestic matrices from the row and column sum models by the combination model in equation (4.11) and the complementary rules discussed in this section are textfiles describing the PWC-matrices per product group in flow of tonnes (in subdirectory *OutputData\ProdSpec*. Files: *pwc_xx_yyy_t.tmp*).

The distinction between P and W is maintained in the output files which thus gives separate values for P and W for each flow relation r,s where such values exist. The resulting base matrices are given as text files in the directory ftp://ftp2.vti.se/Basematrices/BasMatSwed_2007-12-12.zip. The format of the files is described in pwc_info_contents_2007-12-12 in the same directory.

5 Export and Import Matrices

5.1 General Methodology

The levels of import and export are determined from the FT data base for the year 2004 (and can be checked against aggregate NA data at an aggregate product level). The main use of CFS-data is to help determine the spatial distribution for X and M flows within Sweden and other countries or regions. However, approximately 50 % of the domestic zones have no observations in CFS.

The foreign trade statistics represent aggregate P/C – flows from country to country, which have to be allocated to receiving/sending zones at each end. Thus, in contrast to the Domestic section of the matrix, the basic spatial pattern of movements – in this case movements between countries – is available, and the further question is to disaggregate this basic pattern to origins and destinations within Sweden (and in some cases, within other countries).

The major source for the disaggregation is the CFS (although Table 3.4 demonstrated that there are some important differences between the volumes implied in the two sources).

5.2 Determining export and import flows at the country level.

For export and import the volumes of product flows are taken from FTS 2004. The FTS values per product group are summarized in Table 5.1 below.

Table 5.1 Summary of foreign trade statistics converted to NSTR and product (k) used in logistics model. Source: CFS_results.xls sheet FTS 2004. FTS source files for 2004 are two ASCII-files: SIKA_Exp2004.txt and SIKA_Imp2004.txt

Foreign Trade Statistics 2004							
		EXPORT		IMPORT			
k	Product	Value[1000SEK]	Weight[tonnes]	Value[1000SEK]	Weight[tonnes]		
1	10	1 271 260	1 058 050	1 552 480	257 557		Cereals
2	20	1 102 230	121 922	8 261 830	1 077 110		Potatoes, other vegetables, fresh or frozen, fresh fruit
3	31	192 797	3 443	124 373	518		Live animals
4	32	863 366	150 591	1 622 660	157 624		Sugar beet
5	41	681 878	1 249 310	3 663 910	8 226 810		Timber for paper industry (pulpwood) (Old: Wood in the
6	42	20 866 000	5 787 530	1 724 000	236 401		Wood roughly squared or sawn lengthwise, sliced or peel
7	43	231 300	539 742	1 035 920	2 455 820		Wood chips and wood waste
8	44	124 214	30 700	98 526	66 816		Other wood or cork
9	50	1 239 780	113 908	3 901 520	299 771		Textiles, textile articles and manmade fibres, other raw ar
10	60	24 944 200	1 321 370	42 097 200	3 374 740		Foodstuff and animal fodder
11	70	2 020 390	305 986	2 860 990	746 427		Oil seeds and oleaginous fruits and fats
12	80	151 397	203 265	3 340 360	3 998 180		Solid mineral fuels
13	90	739	84	41 252 100	20 505 700		Crude petroleum
14	100	31 847 400	12 140 700	24 167 700	8 447 500		Petroleum products
15	110	6 453 410	18 113 800	1 965 950	428 610		Iron ore, iron and steel waste and blast-furnace dust
16	120	2 888 710	628 754	10 014 900	1 132 730		Non-ferrous ores and waste
17	130	69 212 300	5 897 840	49 740 800	4 402 360		Metal products
18	140	10 902 800	1 866 470	7 114 230	1 669 990		Cement, lime, manufactured building materials
19	151	205 941	2 293 670	265 297	1 385 780		Earth, sand and gravel
20	152	718 442	2 939 840	2 205 100	3 122 060		Other crude and manufactured minerals

21	160	460 385	270 927	934 285	724 129		Natural and chemical fertilizers
22	170	1 760 480	630 621	385 799	173 463		Coal chemicals, tar
23	180	104 546 000	4 995 060	74 660 200	5 532 520		Chemicals other than coal chemicals and tar
24	190	14 849 500	3 776 350	2 289 200	1 279 550		Paper pulp and waste paper
25	200	126 683 000	1 496 720	91 260 000	1 263 160		Transport equipment, whether or not assembled, and part
26	210	25 308 000	457 944	20 724 400	514 648		Manufactures of metal
27	220	3 987 870	334 689	4 743 870	274 559		Glass, glassware, ceramic products
28	231	59 422 300	10 413 300	6 033 910	842 335		Paper, paperboard; not manufactures
29	232	62 076 300	1 063 490	87 087 600	1 475 250		Leather textile, clothing, other manufactured articles than
30	240	1 456 550	27	118 934	3		Mixed and part loads, miscellaneous articles etc
31	45	3 972	1 106	255 362	533 949		Timber for sawmill (old 41)
32	201	299 621 000	1 936 230	212 405 000	1 492 460		Machinery, apparatus, engines, whether or not assemble
33	233	9 512 540	449 904	7 662 270	360 274		Paper, paperboard and manufactures thereof (old 231)
34	250	3 089 280	186 814	2 849 450	157 623		Product wrappings/coverage/protection material. Second

5.3 Distribution of export/import flows over domestic and foreign zones.

For both export and import the product flow patterns [in SEK] are taken from the observed flows in both CFS-studies, i e we use registered PWC-flows between different locations. The total volume of the flow is derived from the foreign trade statistics 2004 which holds information of the trading countries, import/export, and volumes in SEK and tonnes. In many trade relations that are present in the FTS we have none or very few observations in the CFS:s and in those cases a number of complementing rules are applied. The derived pattern according to the observations and these rules are then upscaled to the total values in the FTS 2004[35].

The allocation procedure used is based on FTS-values, and is carried out inside the CFS_STAT program used to prepare the base matrix data from the micro data in the both CFS:s. The results are saved for later steps in the base matrix construction in tonnes (by division of the FTS-values with the averages prices from the FTS).

Export and import to and from different countries are entered in value terms together with prices for export and import respectively. These are then converted into tonnes and distributed among zones in both ends. The reason for using both values and prices is that data are setup in a format suitable for matrix balancing, which is useful for handling forecasts where future trade flows per product and country usually only are available in value terms.

5.3.1 Editing CFS-data on origins and destinations for X and M

There were considerable problems with missing data on receiving and sending locations in the original CFS-data. Considerable effort has therefore been made to amend CFS-data in this respect. This effort has resulted in an important improvement of the data on sending and receiving locations. The result after this effort is summarized in Table 5.2 below. Detailed information on sending and receiving locations for both CFS:s is given in CFS_results.xls.

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[35] An avenue possibly worth to explore is to derive row and column sum models for export and import in the same manner as for domestic flows. These could then be applied for the domestic allocation of the export/import flows. However, in many cases the correlations between the observed row and column sums and the model values are rather low (only 15 % are >= 0.8, only 27 % are >= 0.7).

Table 5.2 Status of data on sender and receiver locations in CFS 2001 and CFS 2004 after amending effort.

CFS 2001

Summa av Nobs2001					
	Both_destinations_known.	BOTH_destinations_unknown.	Receiver_destination_unknown.	Sender_destination_unknown.	Totalt
Domestic	729326	0	837	1677	731840
Export	113864	0	2	0	113866
Import	60122	0	0	0	60122
Totalt	903312	0	839	1677	905828

CFS 2004

Summa av Nobs2004					
	Both_destinations_known.	BOTH_destinations_unknown.	Receiver_destination_unknown.	Sender_destination_unknown.	Totalt
Domestic	2619715	5199	56028	13787	2694729
Export	188679	0	634	0	189313
Import	66295	0	0	555	66850
Totalt	2874689	5199	56662	14342	2950892

5.3.2 Using CFS-data to distribute export/import flows over domestic and foreign zones

During the extraction of data from the CFS-databases, statistics on export and import patterns have been collected. In total the number of observed unique combinations of product and zone-pair relations for international trade is approximately 26 000 in each of the two surveys. Since there are 34 product groups and 174 foreign zones in the model, this gives 5916 combinations, so that on the average there are only somewhat more than 4 observations per combination in each CFS survey which provides a rather thin coverage of zones in Sweden.

Moreover, in reality the observations are concentrated to our main trade partners which results in an uneven spread of the observed flows, and for many cases we will have no data at all. In cases with missing CFS-data for a specific country and product we therefore use observations related to other products, for example averages over all products, and other countries. This sparseness has led us to implement the spatial allocation according to one of the following rules, with priority according to ascending rule number:

1. A first condition for applying rule 1 is that the trading country has at least one observation in the CFS for the current product. (If there are no such observations the procedure moves on to rule 2 and so forth). If the number of zones in a foreign

country having observations relating to one product is more than 50 % of the zones, then that spatial allocation pattern in value terms is used. For other cases we use the observed spatial distribution with a weight 0.5 and an average distribution over all products with a weight 0.5 i.e. 50 % of the observed flows in FTS for this product and country are distributed according to the observed CFS-pattern for this product and country, and 50 percent of the flows according to the CFS distribution in the country. The observed relations with zones in Sweden are kept for each of the zones in the country[36].

2. When there are more than two (2) export/import-zones in Sweden for the export/import of the product to/from all countries, the observed domestic trade proportions among these are applied, separately for export and import for the specific trade flow with the country for which there were no observations. The allocation to multiple zones in the foreign country is based on the average of the observed flows for all products in value terms in CFS upscaled to the total level in FTS 2004. The final allocations to individual domestic/foreign zone relations are computed as the product of the two distributions. Note that Rules 1 and 2 are self contained. They are not handled in combination.
3. When there are one or two export/import-zones in Sweden for the export/import of the product to/from all countries, these are combined with up to twenty (20) of the domestic zones that have the highest proportionate shares of (domestic) flows in monetary terms for this product group. The procedure is then finalized by combining the domestic and foreign zone distributions in the same manner as in Rule 2. This means that if trade flows for the product with all countries is concentrated in Sweden to 1 or 2 zones, these are supplemented by up to 20 additional zones before distribution, while if there are more than 2, e.g. 3 zones in Sweden with observed flows, these 3 zones only (rule 2) are used to form the distribution as described in rule 2.
4. When there are no observed export/import zones in Sweden in the CFS for the export/import of the product to/from all countries, the domestic zone proportions for this product group is applied. The domestic C-type flows are applied to import and the domestic P-type flows are applied to export. The procedure is then finalized by combining the domestic and foreign zone distributions in the same manner as in Rule 2. Thus if CFS has no observed X/M flows for the product at all, the observed FTS-flows are allocated in Sweden according to domestic C and P proportions for the product, which might imply that the flow is distributed over more than 22 zones and thus more thinly than according to rule 3.
5. Should none of the rules above be applicable, the spatial distribution for this product is determined on the basis of a substitute product group. The substitutions applied are given in Table 5.3 below.

[36] The implication of rule 1 is that the distribution pattern in Sweden that was observed in CFS is retained for all flows (FTS-flows) for which there is at least one CFS-observation for the specific product/country flow. Rules 2-5 will thus only become active if there are zero CFS-observations for a certain product/country X/M-flow.

Table 5.3 Substitute product groups for zone distribution of X/M flows from FTS when data required for rules 1-4 are missing.

Product group	Substitute product group
31	60
44	43
70	60
170	180
240	232

The procedure above (i.e. applying rules 1-5 and based on these forming the zone-zone distribution) is carried out separately for each of the both CFS databases and the results are weighted together with equal weights, provided that data were available. Otherwise observations from the CFS with the “best” observations are used. The criterion applied here is that if the tonnes in CFS 2004 is less than 50 % of the tonnes in CFS 2001 then only CFS 2001 is used. Otherwise they are weighted together with shares 50 % for CFS 2001 and value2001/value2004 $\times$ 50 %] for CFS 2004. After this they are upscaled to the total level from the FTS2004.

Observed singular flows are handled in the same manner as for domestic singular flows, i e they are added separately and the other flows are adjusted down to keep the total level constant.

The net results of the split up of X/M flows into regular and singular flows are shown in Table 5.4. The trade matrices are given in tonnes in the intermediate output files, i.e. the tonnes as reported in the FTS 2004. Thus the data in Table 5.4 are the input from the FTS and a summary of the detailed output, except for the singular flows derived from the CFS. Then the matrices in tonnes are used directly in the disaggregation procedure (Step A)

Table 5.4 Summary of export and import result. The last product group, 247, is air cargo, cf Section 2.3

		Regular flow		Singular flow	
Product group (k)	**NSTR**	**Export [kton]**	**Import [kton]**	**Export [kton]**	**Import [kton]**
1	10	949	227	108	30
2	20	122	1077		
3	31	4	1		
4	32	151	158		
5	41	1249	7221		1013
6	42	5394	217	394	19
7	43	539	2155		300
8	44	31	67		
9	50	114	308		
10	60	1274	3332	49	44
11	70	306	648		98
12	80	203	1794		2206
13	90	0	20503		
14	100	1887	3716	10759	5748
15	110	18128			3356
16	120	590	833	39	300
17	130	4497	3482	1402	921
18	140	1284	843	583	827
19	151	2288	1389		
20	152	2891	1896	53	1227
21	160	271	694		31
22	170	631	173		
23	180	4181	2933	819	2605
24	190	3206	1280	571	
25	200	1497	1264		
26	210	414	515	44	
27	220	335	226		49
28	231	8669	842	1745	
29	232	832	1330	232	147
30	240				
31	45	1			817
32	201	1887	1390	49	104
33	233		360	2133	
34	250	187	147		11
35	247	256	90		
	Total	**64267**	**61109**	**18980**	**19851**

Air freight is handled in the same manner as export and import and the format is the same as for foreign trade in general. From the foreign trade statistics, information is set up on export and import where air transport is utilized (these flows also include trucking since neither the CFS nor the FTS has coded trucking as a mode).

Directly after determining export and import according to the description above, the same procedure is applied to air cargo.

The disaggregation of the X/M rs-flows to the company level (step A of the logistics model for export/import flows) will be discussed in chapter 7 below.

Table 5.5 below shows the resulting distribution of Swedish import 2004 for each NSTR product over NUTS2 areas.

Table 5.5 Resulting regional distribution of import 2004 over NUTS2-areas. Source: C:\Work\BaseMatrix2004\Documents\Upscaled_WeightValue_CFS_10++region_matrices(3)_NSTR-level.xls.

		1	2	3	4	5	6	7	8	9
		Stock-holm	Östra mellan sverige	Småland och öarna	Syd-sveri-ge	Väst-sveri-ge	Norra mellan sverige	Mellersta Norrland	Övre Norrland	Örebro/Västmanland
1	Cereals	20	1	20	205	12	0	0	0	0
2	Veg & fruit	57	8	4	901	65	11	0	0	31
3	Live animals	0	0	0	0	0	0	0	0	0
4	Sugar beet	0	0	0	158	0	0	0	0	0
5	Pulpwood	0	2447	1254	0	136	2792	1604	0	0
6	Wood. sawn	16	4	78	78	46	13	0	0	0
7	Wood chips	394	329	0	60	350	609	68	0	644
8	Other wood	8	8	0	1	10	18	2	0	19
9	Textiles, fibres	11	11	9	58	198	5	1	4	11
10	Foodstuff	1503	111	24	683	740	123	3	3	185
11	Oil seeds, fat	257	23	45	220	140	21	0	0	39
12	solid min fuels	10	1711	7	26	1243	29	480	363	131
13	Crude petro	4705	0	0	2	15796	0	0	0	0
14	Petro produc	1602	139	84	389	5720	145	1201	63	120
15	Iron ore &waste	0	89	0	44	89	68	81	57	0
16	Non ferr ore& waste	0	51	0	0	84	199	0	798	0
17	Metal prod	45	619	284	495	476	1187	86	365	846
18	Cement, lime build mtrl	103	200	25	466	571	46	87	147	24
19	Earth, sand, gravel	104	36	405	67	702	22	0	10	44
20	Other material	21	121	3	495	1003	790	178	257	256
21	Fertilizers	5	226	49	99	217	0	0	0	128
22	Coal chemicals	73	7	8	36	27	7	6	3	5
23	Chemical other	1655	321	140	1831	1114	156	125	17	178
24	Paper pulp	0	0	135	55	597	412	18	63	0
25	Trpt equipm	316	102	23	11	756	3	11	7	35
26	Manufact metal	75	70	81	57	131	25	6	5	64
27	Glass, ceramic	45	34	43	61	80	3	5	2	2
28	Paper, paperboard	1	564	94	119	3	54	0	0	7
29	Clothing	162	132	594	131	197	84	52	79	43
30	Mixed part load	0	0	0	0	0	0	0	0	0
31	Timber for saw	0	0	115	9	0	127	30	253	0
32	Machinery &parts	641	149	84	115	300	78	34	10	83
33	Paper & paperboard manuf	66	52	93	48	71	17	0	3	9
34	Prod wrappings	8	28	9	19	27	19	0	41	6
35	Air freight	24	10	10	9	21	5	2	2	7
Sum		11931	7603	3720	6948	30923	7070	4084	2555	2918

The resulting matrices for export and import, which are sections of the total matrices, are integrated in the overall matrix files for each product given in the directory BasMatSwed_2007-12-12.

6 Transit Flows

The CFS databases do not contain information on the transit transport. We therefore utilize the transit flow data from SAMGODS 2001, c f Silfverberg et al (2004) for details. That data is represented at the 12 STAN product group level. These flows are disaggregated into NSTR products by assuming the same distribution as for our foreign trade flow. Then the observed growth of the foreign trade according to our databases 2001 and 2004 are applied to the transit flows as well. This procedure gives the result in Table 6.1.

Table 6.1 Statistics on number of shipments and tons per shipment.

Product group (k)	NSTR	STAN-product	STAN-share X+M 2001 [from CFS]	Growth X+M 2001-2004 [from FTS]
1	10	1	0.47879	0.7251
2	20	1	0.26287	1.2041
3	31	1	0.00048	2.2492
4	32	1	0.07565	1.0755
5	41	2	0.95551	1.0202
6	42	3	0.73864	1.0315
7	43	3	0.25342	1.4941
8	44	3	0.00793	1.5541
9	50	12	0.04960	0.9319
10	60	4	1.00000	1.3498
11	70	1	0.18221	1.5246
12	80	5	0.15162	1.1885
13	90	5	0.84838	1.0360
14	100	6	0.95646	1.2273
15	110	7	0.92073	1.2609
16	120	7	0.07927	1.3903
17	130	8	1.00000	1.1688
18	140	10	0.30785	0.9421
19	151	10	0.28584	1.0550
20	152	10	0.40632	1.2247
21	160	11	0.12862	0.7405
22	170	6	0.04354	0.9803
23	180	11	0.87138	1.1571
24	190	9	0.29486	1.1800
25	200	12	0.21946	1.3766
26	210	12	0.09634	1.1047
27	220	12	0.06433	1.0365
28	231	9	0.64326	1.2041
29	232	12	0.22489	1.2364
30	240	12	0.00000	1.2101
31	45	2	0.04449	1.2371
32	201	12	0.31384	1.1959
33	233	9	0.06188	0.9010
34	250	12	0.03153	1.1957

The regional distribution within countries are provided in the transit matrix from Silverberg et al (2004). The only update of the matrices that have been done is to upscale them from 2001 to 2004/2005. The upscale factors has been the same as for export and import.

Before being able to upscale NSTR product groups based on the 12 STAN product group transit matrices, the latter ones must be split up into our 34 NSTR product groups. This is accomplished by distributing them between the NSTR product groups according to the weight distributions among export and import during 2004/05. After this the transit flows for the NSTR product groups are upscaled.

For the Step A disaggregation of transit flows in foreign countries the average number of companies per size class in Sweden is used for the disaggregation.

7 Disaggregating cells according to size of firm (Step A)

7.1 Introduction

The base matrices described in previous sections give the total volume of demand flow from r to s for each commodity k: this is Q^k_{rs}. Note that in addition the matrices are split between PC and WC according to the classification of the sender (the classification of the receiver is not known from CFS).

The logistics model operates at the level of (simulated) firm-to-firm [f2f] flows, between firm m in sending zone r and firm n in receiving zone s. The original RAND proposal was that this would be disaggregated to a set of firm to firm flows $Q^k_{m\varepsilon r, n\varepsilon s}$ such that $\sum_{mn} Q^k_{m\varepsilon r, n\varepsilon s} = Q^k_{rs}$. Denote the number of such f2f flows by $N(mn)^k_{rs}$.

Because the basis proposed for this disaggregation requires data (CFAR) used elsewhere in the preparation of the Base Matrices, it was decided to transfer the disaggregation from the logistics model to the production of the base matrices.

At the same time, it was agreed that it was not necessary to attempt to simulate each f2f flow, and that it would be sufficient to deal with representative movements, provided the likely variations in **scale** were respected. This led to the concept of movements between firms of different size classes, categorised as small, medium and large. Essentially this can be viewed as aggregating the (hypothetical) firms into 9 categories[37] {MN} based on the size of the sending and receiving firms. This allows us to write:

$$Q^k_{MN|rs} = \sum_{m\varepsilon M, n\varepsilon N} Q^k_{m\varepsilon r, n\varepsilon s}$$

and the corresponding number of firm-to-firm flows in each MN category will be $N^k_{MN|rs}$, with the properties that:

$$\sum_{MN} Q^k_{MN|rs} = Q^k_{rs} \quad \text{and} \qquad \sum_{MN} N^k_{MN|rs} = N(mn)^k_{rs}$$

Thus, if we can provide the quantities $Q^k_{MN|rs}$ and $N^k_{MN|rs}$ for each MN combination, then we achieve the disaggregation in terms of "representative" firms in each MN size category.

It is proposed that, as far as the volumes Q are concerned, we identify the row and column proportions by size class for each zone: write these as $\pi^k_{M|r}$ and $\pi^k_{N|s}$. Multiplying these together gives the estimate of the proportionate allocation of the total Q^k_{rs} among the 9 {MN} categories. In other words:

$$Q^k_{MN|rs} = \pi^k_{M|r} \,.\, \pi^k_{N|s} \,.\, Q^k_{rs}$$

[37] a 10th category is used to denote "singular flows"

Hence, as far as the volume is concerned, the task is to provide appropriate estimates of the row and column proportions $\pi^k_{M|r}$ and $\pi^k_{N|s}$. The upshot is that for a given commodity k, the total flow (tonnes) between each particular pair of zones rs, after removing any "singular" flows, can be split into up to 9 possible categories, as illustrated in Table 7.1 below:

Table 7.1. Illustrative% allocation of flow From r To s among nine categories

			To			
			Small	Medium	Large	
		% \ %	10	80	10	Row sum
From	Small	20	2.0	16.0	2.0	*20*
	Medium	30	3.0	24.0	3.0	*30*
	Large	50	5.0	40.0	5.0	*50*
		Col sum	*10*	*80*	*10*	*100*

While this allocates the total demand between r and s, it does not in itself indicate how many separate firm-to-firm movements are involved. Hence, a further estimate is required ($N^k_{MN|rs}$) as to the likely number of f2f movements in each of the 9 {MN} cells.

7.2 Further Discussion of CFAR data

The CFAR data set was described in Section 4.2, but there the focus was essentially on the total number of employees by SNI category. In addition to this, CFAR has data specifically relating to companies. We provide an overview of the data categorized by the SNI-code for the SNI-sectors 01-52 in Table 7.2.

Note that the "wholesale" categories are within SNI sectors 50-52. In addition, SNI-sectors 37-45 do not generally deal with transportable commodities: products from these sectors are not included in either CFS or FTS.

Table 7.2 Allocations of companies into SNI-categories

SNI	Total number of companies	Descriptions
1	131529	Products of agriculture, hunting and related services
2	26176	Products of forestry, logging and related services
5	1378	Fish and other fishing products; services incidental of fishing
10	142	Coal and lignite; peat
11	24	Crude petroleum and natural gas; services incidental to oil and gas extraction excluding surveying
12	0	Uranium and thorium ores
13	50	Metal ores
14	585	Other mining and quarrying products
15	3221	Food products and beverages
16	8	Tobacco products

17	1866	Textiles
18	1634	Wearing apparel; furs
19	404	Leather and leather products
20	6401	Wood and products of wood and cork (except furniture); articles of straw and plaiting materials
21	486	Pulp, paper and paper products
22	9194	Printed matter and recorded media
23	51	Coke, refined petroleum products and nuclear fuels
24	905	Chemicals, chemical products and man-made fibres
25	1614	Rubber and plastic products
26	1904	Other non-metallic mineral products
27	415	Basic metals
28	10485	Fabricated metal products, except machinery and equipment
29	5375	Machinery and equipment n.e.c.
30	413	Office machinery and computers
31	1354	Electrical machinery and apparatus n.e.c.
32	740	Radio, television and communication equipment and apparatus
33	2153	Medical, precision and optical instruments, watches and clocks
34	783	Motor vehicles, trailers and semi-trailers
35	1478	Other transport equipment
36	5435	Furniture; other manufactured goods n.e.c.
37	226	Secondary raw materials
40	2103	Electrical energy, gas, steam and hot water
41	621	Collected and purified water, distribution services of water
45	57655	Construction work
50	20391	50. Trade, maintenance and repair services of motor vehicles and motorcycles; retail sale of automotive fuel.
51	45757	51. Wholesale trade and commission trade services.
52	63743	52. Retail trade services, repair services of personal and household goods.
Total (1-52)	406699	
Total (1-36)	216203	Products corresponding to manufactured products included in CFS and FTS
Total (37-45)	60605	“Products” NOT included in CFS and FTS
Total (50-52)	129891	“Wholesale”

Companies in SNI categories higher than 50-52 (the wholesale sector) are essentially service sectors that do not “produce” large quantities of goods (though they certainly consume a lot of goods and need to be taken into account on the consumption side). Note that in many cases the CFAR data contains optional 2nd and 3rd SNI categories for firms. In the analysis here, we have only allocated the companies listed in the CFAR-database according to their first SNI-category.

For reasons of confidentiality, the CFAR detailed work place information database for 2001 holds information on the number of employees in terms of **size classes** [sz] relating to the number of employees at the workplace, as follows:

Table 7.3 Employment classes in the CFAR.

Size class sz by employees	Description [# employees]	Assumed midpoint
0	No information	
1	0	0.5
2	1-4	2.5
3	5-9	7
4	10-19	15
5	20-49	35
6	50-99	75
7	100-199	150
8	200-499	350
9	500-999	750
10	1000-1499	1250
11	1500-1999	1750
12	2000-2999	2500
13	3000-3999	3500
14	4000-4999	4500
15	5000-9999	7500
16	10000-	15000

Thus the CFAR-data give the number of businesses per zone r, SNI- category and size class sz. To obtain the correct number of employees, *on the average*, in each size class, the data must be calibrated against total employees by zone and SNI- category levels. Since aggregate zone data on employment levels in different SNI-categories are not subject to confidentiality rules, they can therefore be used for this purpose. We have:

Buz(r, h, sz) = number of companies in zone *r,* 2 digit SNI92-category *h,* and size class *sz.*

sz = size classes 1-16 as described in Table 7.3

Separately for each zone the number of employees per cell, *AverageEmp(r, h, sz),* is initially set to the midpoint values in the last column of Table 7.3.. It is then adjusted, uniformly between the size classes, with the condition that no class boundary according to Table 7.3 is violated, so that it balances the total levels *Emp(h, r)*:

$$\sum_{sz} Buz(r, h, sz) \cdot AverageEmp(r,h, sz) = Emp(h, r) \qquad (7.1)$$

where
AverageEmp(r, h, sz) = estimated average number of employees in a company in zone r, SNI92-category h, and size class *sz*.

For the year 2004 we only have an aggregate CFAR file which simply provides the number of employees per zone and SNI-category. Since the same information is also available from the SAMPERS database for 2001, we could use this to estimate the number of companies in each zone with a specific number of employees within the class limits (as in the last column of Table 7.3) for 2004 as well, ensuring that the total number of employees per SNI-category sums is consistent with the aggregate zonal values per SNI-sector. In fact, however, it has been assumed that the changes during these three years have had an insignificant impact on the final result.

Suppose, for example, we have a zone with 2 companies in a sector having employees in classes C1 and C2 with assumed midpoint values N_{C1} and N_{C2} according to Table 7.3. The aggregate zone data for 2004 tells us that the exact number of employees are N. In principle the exact number of employees in each class can be estimated by multiplying them with a factor, f, so that:

$$f \times (N_{C1} + N_{C2}) = N$$

In estimating this factor f it must be ensured that the constraints from the upper and lower bounds in the size classes are not violated.

7.3 Creating the aggregate companies per NSTR product group

Since the CFAR-data for companies are in terms of SNI92-sectors, we need to convert them appropriately in relation to the NSTR product groups. On the sending side, the production proportions ($\pi^k_{M|r}$ for PC flows) are achieved by using the zonal employment data by SNI, and using the key between SNI (products) and NSTR shown in Appendix C to estimate the likely production of commodity group k among firms of different sizes.

As will be seen below, the treatment differs slightly according to whether we are dealing with Production, Intermediate Consumption, or Final Consumption. The basic methodology is explained in some detail with regard to production, and then the modifications for the other quantities are noted in subsequent sections.

7.3.1 Production

The number of companies producing a certain NSTR product group *k* is derived by multiplying the number of SNI-companies in each size class in the zone *Buz(r, h, sz)* by the average proportion of the SNI-output that goes into product group *k* (the same principle is used when converting all the companies into NSTR -companies, as when converting SNI-output in terms of money into NSTR -money):

$$Buz_{prod}(r, k, sz) = \sum_{h \in SNIProdset} Buz(r, h, sz) \cdot S2N_{j(h)\,k} \qquad (7.2)$$

where
$Buz_{prod}(r, k, sz)$ = estimated number of companies in zone *r*, producing NSTR product *k*, and size class *sz*.
$S2N_{j(h)\,k}$ = share of a SNI92-**product** *j (assumed equivalent to sector h)* that becomes an NSTR product *k*
SNIProdset = set of production SNI sectors {SNI01, ..., SNI36}

Note that because the S2N key does not deal with product group k=35 air cargo, this will not give any companies producing this category, so that special arrangements are required: these are described below.

In an analogous manner the number of employees in each size class are computed according to:

$$Emp_{prod}(r, k, sz) = \sum_{h\in SNIProdset} Buz(r, h, sz) \cdot AverageEmp(r, h, sz) \cdot S2N_{j(h)\,k} \qquad (7.3)$$

where
$Emp_{prod}(r, k, sz)$ = estimated number of employees in zone *r*, producing NSTR product *k*, and size class *sz*.

For air transport the basic equations (7.2) and (7.3) are modified by means of an additional air usage factor for a limited set of NSTR products, according to the Table 7.4 below:

Table 7.4 Domestic air usage factors for NSTR-products

NSTR-product	Usage factor
180	0.16
200	0.04
231	0.09
201	0.71
others	0

The modified equations for calculating *Buz* and *Emp* are:

$$Buz_{prod}(r, 35, sz) = \sum_k \sum_{h\in SNIProdset} Buz(r, h, sz) \cdot usage\_factor_k \cdot S2N_{j(h)\,k} \qquad (7.2factor)$$

$$Emp_{prod}(r, 35, sz) = \sum_k \sum_{h\in SNIProdset} Buz(r, h, sz) \cdot AverageEmp(r, h, sz) \cdot usage\_factor_k \cdot S2N_{j(h)\,k} \qquad (7.3factor)$$

In addition, for each SNI **product** j, we know the total value of production (from National Accounts) and we know the number of employees in each sector h. This allows us to calculate the average value of product j per employee in sector h, which we refer to $\varphi_{j(h)}$.

Hence we can make an estimate of the production of k in each zone r by employees in size class sz as:

$$Prod(r, k, sz) = \sum_{h\in SNIProdset} Buz(r, h, sz) \cdot AverageEmp(r, h, sz) \cdot \varphi_{j(h)} \cdot S2N_{j(h)\,k} \qquad (7.4)$$ [38]

The result is that, within each product k, we know a) the number of companies in each zone and size class [$Buz_{prod}(r, k, sz)$], and b) the corresponding total value of production [$Prod(r, k, sz)$]. The complete set of results over r and sz is now sorted

[38] Note that it would be possible to control this to ensure that $\sum_{sz} Prod(r, k, sz) = Prod_{rk}$, as described in section 5.3.2, but this has not been done in the current version

according to the criterion *Prod/Company*, calculated as *Prod(r, k, sz)/ Buz_{prod}(r, k, sz)*, with the purpose of sorting the companies into size groups with different levels of output. Note that because of the use of the S2N key, the output of a given product can vary between companies of the same size but different SNI classifications.

In Table 7.5 we show an example[39] of the result for NSTR product 60 (Foodstuff and animal fodder) in zones 180 (Stockholm) and 1280 (Malmö).

Table 7.5 Excerpt from production details for Product group 10.

i	Product group (k)	NSTR	Zone r	Size Class sz	#Comp	Prod [kSEK]	Prod/ Comp [kSEK]	Cumu-Perc [%]	Emp/Buz-ratio[*1000]
389	10	60	180	1	226	223078	987	8	556
808	10	60	180	2	70	461188	6 588	13	3736
890	10	60	180	11	1	9288	9 287	14	1328076
1018	10	60	180	3	32	498818	15 588	18	8836
1161	10	60	180	4	22	722020	32 819	25	18817
1280	10	60	180	5	16	1352613	84 538	37	48074
1349	10	60	180	6	4	768576	192 144	50	96548
1376	10	60	180	7	1	298646	298 646	58	198604
1406	10	60	180	8	2	1497456	748 727	78	498209
1422	10	60	180	9	1	1499218	1 499 217	97	997001
271	10	60	1280	1	88	47046	534	4	304
780	10	60	1280	2	24	125358	5 223	12	2941
1022	10	60	1280	3	8	127204	15 900	18	8623
1162	10	60	1280	4	8	263422	32 927	25	18414
1283	10	60	1280	5	5	450691	90138	37	46893
1335	10	60	1280	6	2	307601	153 800	47	95314
1377	10	60	1280	7	3	911896	303 965	59	193960
1405	10	60	1280	8	4	2871829	717 957	77	461627
1421	10	60	1280	9	1	1483089	1 483 089	96	997817

NB the shaded values will be further used as an illustration in relation to Table 7.6 below

The column labels in Table 7.5 mean:
i = serial rank over all entries (r, sz) for product group 10
k = product group number
NSTR = NSTR -product code
Zone = sender community id (r)

[39] The table is derived from the Excel-file *CFAR-Empl-NA-Aggregation.xls*, sheet *Production_Detail*. It can be obtained upon request from the author.

Size(Class) = company size category as in Table 7.3
#Comp = $Buz_{prod}(r, k, sz)$ = estimated number of companies producing product group k (rounded to nearest integer, minimum is 1)
Prod [kSEK] = $Prod(r, k, sz)$= estimated Production [kSEK] from the #Comp companies (at the zone level these would sum to $Prod_r$)
Prod/Comp[kSEK] = estimated Production per company [kSEK] (ratio of two preceding columns)
CumuPerc [%] = cumulative distribution of the total **Production** [%] [see below]
Emp/Buz-ratio[*1000] = estimated number of employees per company in size class sz for the zone.

After ranking all possible (r, sz) observations for a particular product group in ascending values of prod/comp, we calculate the point on the (overall) cumulative distribution, based on the production volumes[40]. We can now allocate the observations within each zone to one of three size categories according to the percentiles 33, 67 and 100 %.

Note that while the order of the companies in terms of prod/comp generally follows the size class, this is not invariably the case. The third row for zone 180 displays a low average output value for a large size company (sz = 11). This is because the SNI category for this company is not the main contributor to product group 10[41].

In zone 1280 there are 88 companies in the smallest size class (sz = 1) and the average value of *Prod/Company* for these companies is estimated at 534 Ksek. It turns out that among all zones and size classes, 4 percent of total production is produced by companies with an average value of *Prod/Company* equal to or smaller than that. Correspondingly, for zone 180 size class 1 has an average production of 987 Ksek/company and at the overall national level 8 percent of production is produced by companies with an average value of *Prod/Company* equal to or smaller than that.

The Table also shows, in the last column, the implied average number of employees per company in each size group, given as the ratio $Emp_{prod}(r, k, sz)/ Buz_{prod}(r, k, sz)$. Allowing for the scaling factor of 1000, this can be compared with the midpoint values in Table 7.3.

The detailed results as illustrated in Table 7.5 are then aggregated into results for different size categories in terms of *Prod/Company*. For this purpose we have aggregated the sorted data into 3 categories as discussed earlier, namely the percentiles 33, 67 and 100 %. An example of results[42] per zone (in this case zone 1280, Malmö) is shown in Table 7.6.

[40] Note that since these depend on **all** the observations (and therefore not just the values presented in this excerpt), the cumulative values cannot be derived from the values in the Table
[41] This is a company in SNI 24 with 1780 employees (rescaled) and its contribution to NSTR 60 is only 0.00314 per output unit. Its total output is therefore quite limited
[42] Detailed results for all the products are placed in the enclosed Excel-file *CFAR-Empl-NA-Aggregation.xls*, sheet *Production_Zone*.

Table 7.6 Excerpt from production in zone 1280 (Malmö).

			Allocation of Production to size categories			Allocation of Companies to size categories		
Product group (k)	NSTR	Zone r	low (0_33%)	medium (33_67%)	high (67_100%)	low 0_33%	medium 33_67%	high 67-100%
1	10	1280	7 316	8 805	81 601	74	9	7
2	20	1280	17 543	21 365	214 652	168	20	10
3	31	1280	422		3 667	6		6
4	32	1280	12 950	88 411	174 204	4	4	2
5	41	1280						
6	42	1280	87 582			38		
7	43	1280	3 458			4		
8	44	1280	555	1 012		5	3	
9	50	1280	9 440	12 995	226 600	63	8	7
10	60	1280	563 030	1 670 188	4 354 918	128	10	5
11	70	1280	3 697	23 517	189 725	17	5	5
12	80	1280	3 666			2		
13	90	1280						
14	100	1280	257 222			9		
15	110	1280	1 485			8		
16	120	1280	3 344			2		
17	130	1280	227 534			25		
18	140	1280	98 051	28 775	85 241	32	1	1
19	151	1280		11 979			2	
20	152	1280	26 344	17 554	35 234	8	1	1
21	160	1280	5 217	34 872		5	3	
22	170	1280	4 888	34 241		5	3	
23	180	1280	1 560 016	1 934 882		45	4	
24	190	1280	99 918			4		
25	200	1280	649 255			23		
26	210	1280	505 173	312 676	582 066	142	9	4
27	220	1280	100 946		137 890	21		1
28	231	1280	352 204			9		
29	232	1280	923 446	1 532 153	1 989 134	507	33	7
30	240	1280	847			2		
31	45	1280				5		
32	201	1280	2 529 049	2 624 491		295	10	
33	233	1280	377 631	640 344	719 033	135	12	3
34	250	1280	17 506	28 045		7	2	

By comparing the cumulative percentages in Table 7.5 next to the shaded figures, it can be seen how the shaded figures for product group 10 in Table 7.6 have been derived. For example, in the smallest size category, the first four size classes in zone 1280 are within the cumulative percentage cut-off of 33%: there are altogether 128 companies in these four classes, and the total production is 563030 KSek.

This shows how the total production in each zone can be allocated to the three size classes M. It also provides a first estimate of the proportion of **firms** in each category.

The methodology as devised is most suitable for dealing with sending firms where the sender is a producer (P). In the case of wholesalers (W), an identical methodology is used, merely replacing, in Eqq (7.2), (7.3) and (7.4), the set of SNI sectors “SNIProdset” by “SNIWholeset” where

SNIWholeset = set of wholesale SNI sectors {SNI50, SNI52}

together with a “usage factor”, representing the likelihood of the commodity being dealt with by the Wholesale sector, in a similar way to the treatment of air cargo. This usage factor is assumed to be the same as “percent of total” column in Table 7.8 below. The Wholesale “production” is represented by “Turnover”.

In Table 7.7 we show an example[43] of the result for NSTR product 60 (Foodstuff and animal fodder) in zones 180 (Stockholm) and 1280 (Malmö).

Table 7.7 Excerpt from wholesale company details

I	Product group (k)	NSTR	Zone	Size (Class) sz	#Comp	TurnOver [kSEK]	TurnOver/ Comp [kSEK]	Cumu-Perc [%]	Emp/Buz-ratio[*1000]
257	10	60	180	1	1267	602 978	475	7	590
553	10	60	180	2	746	1 786 898	2 395	25	2 970
883	10	60	180	3	283	1 895 331	6 697	44	8 310
1200	10	60	180	4	128	1 839 595	14 371	63	17 820
1452	10	60	180	5	81	2 710 222	33 459	86	41 589
1523	10	60	180	6	13	948 754	72 981	94	89 113
1549	10	60	180	8	1	134 173	134 172	98	414 873
1553	10	60	180	7	3	460 002	153 334	99	178 184
132	10	60	1280	1	572	191 521	334	3	600
420	10	60	1280	2	227	381 898	1 682	15	3 010
731	10	60	1280	3	74	348 363	4 707	33	8 430
1050	10	60	1280	4	39	391 311	10 033	52	18 060
1381	10	60	1280	5	15	357 778	23 851	75	42 147
1508	10	60	1280	6	5	262 277	52 455	90	90 303
1540	10	60	1280	8	1	94 159	94 158	96	420 479
1548	10	60	1280	7	1	121 058	121 057	97	180 500

The tables 7.5 – 7.7 and more can be retrieved from CFAR-Empl-NA-Aggregation.xls

7.3.2 Consumption

In the case of consumption, which, it may be recalled, refers to both intermediate plus final but, NB not investment, the approach is slightly less straightforward.

For each sector h and company size class sz, the number of companies *Buz(r, h, sz),* as well as the number of employees per company [which, within each size class, can be obtained as the product of *Buz(r, h, sz)*and the values of *AverageEmp(r, h, sz)*

[43] The table is derived from the Excel-file *CFAR-Empl-NA-Aggregation.xls*, sheet *Production_Detail*. It can be obtained upon request from the author.

estimated from Eq (7.1)] will, of course, be the same regardless of whether we speak in terms of production or **intermediate** consumption.

For **intermediate consumption**, the procedure follows the same essential lines, with some minor modifications. Corresponding to Eqq 7.2, 7.3 we need to calculate $Buz_{interM}(r, k, sz)$ and $Emp_{interM}(r, k, sz)$. In place of using the S2N key directly, we need to modify it to take account of input requirements. Thus the equations become:

$$Buz_{interM}(r, k, sz) = \sum_h Buz(r, h, sz) \times IO^{norm} \times S2N_{j(h)\,k} \quad (7.2M)$$

where

$Buz_{interM}(r, k, sz)$ = estimated number of companies in zone *r*, involved in intermediate consumption of NSTR product *k*, and size class *sz*.

$S2N_{j(h)\,k}$ = share of a SNI92-**product** *j (assumed equivalent to sector h)* that becomes an NSTR product *k*

$IO^{norm}_{.j} = IO_{.j} / IO_{58j}$ for all *j* = *normalised* input-output matrix (see §4.3)

In an analogous manner the number of employees in each size class are computed according to:

$$Emp_{interM}(r, k, sz) = \sum_h Buz(r, h, sz) \cdot AverageEmp(r, h, sz) \times IO^{norm} \times S2N_{j(h)\,k} \quad (7.3M)$$

where

$Emp_{interM}(r, k, sz)$ = estimated number of employees in zone *r*, involved in intermediate consumption of NSTR product *k*, and size class *sz*.

Hence we can make an estimate of the value of intermediate consumption[44] of k in each zone r by employees in size class sz as:

$$InterM(r, k, sz) = \sum_{h \in SNIProdset} Buz(r, h, sz) \cdot AverageEmp(r, h, sz) \times IO^{norm} \times \varphi_{j(h)} \times S2N_{j(h)\,k} \quad (7.4M)$$[45]

Hence, within each product k, we know a) the number of companies in each zone and size class [$Buz_{InterM}(r, k, sz)$], and b) the corresponding total value of intermediate consumption [*InterM(r, k, sz)*]. Analogously with the treatment of Production, the complete set of results over r and sz is now sorted according to the criterion *InterM/Company*, which in turn allows us to allocate the observations within each zone to one of three size categories according to the percentiles 33, 67 and 100 %.

Final consumption is handled differently since the companies involved here mainly are in the retail sectors 50 and 52, and we do not have any NSTR-distribution related to them. We therefore use the allocation of the consumption[46] in terms of NSTR-products in Table 4.3. The relevant information is reproduced in Table 7.8 below:

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[44] Note: there is some question as to whether it is appropriate to use the same value $\varphi_{j(h}$ as was used for the Production value calculation: this is a matter for ongoing discussion.

[45] Note again that it would be possible to control this to ensure that $\sum_{sz} InterM(r, k, sz) = InterM_{rk}$, as described in section 5.3.2, but this has not been done in the current version

[46] strictly speaking, Investment should also be included, but this has not been done in the current version

Table 7.8 Extract from Table 4.3 for Final Consumption only

Product description	k	NSTR	Consump-tion (Final) [MSEK]	percent of total	SNI sector alloca-tion
Cereals	1	10	2 394	1.05%	52
Potatoes, other vegetables, fresh or frozen, fresh fruit	2	20	6 978	3.05%	52
Live animals	3	31	87	0.04%	
Sugar beet	4	32	3 011	1.32%	52
Timber for paper industry (pulpwood). (Old: Wood in the rough)	5	41	713	0.31%	52
Wood roughly squared or sawn lengthwise, sliced or peeled	6	42	529	0.23%	
Wood chips and wood waste	7	43	40	0.02%	
Other wood or cork	8	44	11	0.00%	
Textiles, textile articles and manmade fibres, other raw animal and vegetable materials	9	50	3 617	1.58%	52
Foodstuff and animal fodder	10	60	67 149	29.39%	52
Oil seeds and oleaginous fruits and fats	11	70	3 385	1.48%	52
Solid mineral fuels	12	80	622	0.27%	
Crude petroleum	13	90	0	0.00%	
Petroleum products	14	100	8 743	3.83%	50
Iron ore, iron and steel waste and blast-furnace dust	15	110	4	0.00%	
Non-ferrous ores and waste	16	120	5	0.00%	
Metal products	17	130	1 443	0.63%	52
Cement, lime, manufactured building materials	18	140	697	0.31%	
Earth, sand and gravel	19	151	10	0.00%	
Other crude and manufactured minerals	20	152	124	0.05%	
Natural and chemical fertilizers	21	160	190	0.08%	
Coal chemicals, tar	22	170	243	0.11%	
Chemicals other than coal chemicals and tar	23	180	20 553	9.00%	52
Paper pulp and waste paper	24	190	360	0.16%	
Transport equipment, whether or not assembled, and parts thereof	25	200	31 252	13.68%	50
Manufactures of metal	26	210	2 325	1.02%	52
Glass, glassware, ceramic products	27	220	674	0.29%	
Paper, paperboard; not manufactures	28	231	1 153	0.50%	
Leather textile, clothing, other manufactured articles than paper, paperboard and manufactures thereof	29	232	45 197	19.78%	52
Mixed and part loads, miscellaneous articles etc	30	240	6	0.00%	
Timber for sawmill	31	45	41	0.02%	
Machinery, apparatus, engines, whether or not assembled, and parts thereof	32	201	22 007	9.63%	52
Paper, paperboard and manufactures thereof	33	233	4 647	2.03%	52
Product wrappings, coverage protection	34	250	285	0.12%	
		T otal	228 493		

15 of the product groups correspond to just under 98 % of the total consumption and we assume that those products are delivered from the warehouse in the proportions (in **value** terms) indicated in Table 7.8 .

Because of the differing balance between SNI sectors 50 and 52 between zones, this results in a different number of companies per zone for consumption products.

In line with the previous methodology for Production and Intermediate Consumption, we require a) the number of companies $\{Buz_{final}(r, k, sz)\}$, b) the number of employees, and c) the value of final consumption.

The number of companies can be formulated as:

$$Buz_{final}(r, k, sz) = \sum_{h \in \{SNI50, SNI52\}} Buz(r, h, sz) \times S2N_{j(h)\,k} \times Share_{j(h)\,k} \times C^{F}_{rj(h)} \qquad (7.5)$$

where

$Share_{j(h)k}$ = the share of activity in SNI-sector h allocated to product group *k*

$C^{F}_{r} = IO._{65} \cdot PopInc_{r}/TotInc$ from eq (4.5) in §4.3

The corresponding equation for the number of employees is

$$Emp_{final}(r, k, sz) = \sum_{h \in \{SNI50, SNI52\}} Buz(r, h, sz) \times AverageEmp(r, h, sz) \times Share_{j(h)\,k} \qquad (7.6)$$

By analogy with Production and Intermediate, we can make an estimate of the value of final consumption[47] of k in each zone r by employees in size class sz as:

$$Final(r, k, sz) = \sum_{h \in \{SNI50, SNI52\}} Buz(r, h, sz) \cdot AverageEmp(r, h, sz) \times Share_{j(h)\,k} \times \varphi_{j(h)} \times S2N_{j(h)\,k} \qquad (7.7M)$$[48]

Hence, within each product k, we know a) the number of companies in each zone and size class [$Buz_{Final}(r, k, sz)$], and b) the corresponding total value of intermediate consumption [*Final(r, k, sz)*]. Analogously with the treatment of Production and Intermediate Consumption, the complete set of results over r and sz is now sorted according to the criterion *Final/Company*, which in turn allows us to allocate the observations within each zone to one of three size categories according to the percentiles 33, 67 and 100 %.

7.3.3 Formation of Aggregate Companies

Now we are prepared with the necessary tools to set up the aggregate companies, separately for each NSTR product.

To obtain an overview of the result statistics on the number of companies is provided in Table 7.9. Note that the total of the production companies = total of (intermediate and final) consumption companies, though the size distributions are different, since

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[47] Note: again there is some question as to whether it is appropriate to use the same value $\varphi_{j(h}$ as was used for the Production value calculation: this is a matter for ongoing discussion.

[48] Note again that it would be possible to control this to ensure that $\sum_{sz} Final(r, k, sz) = Final_{rk}$, as described in section 5.3.2, but this has not been done in the current version

these are decided with respect to the specific commodity groups. In addition, the wholesale companies are treated separately from production companies, as discussed in previous sections.

Table 7.9 Summary Statistics on the total number of companies (Buz) of different sizes per NSTR-product (the retail consumption products are denoted in green font).

		Production company distribution			(final + intermediate) Consumption company distribution			Wholesale[49]/[retail??/petrol stations??/ company distribution		
K	**NSTR**	**0 – 33%**	**34 - 66 %**	**67 - 100%**	**0 – 33%**	**34 - 66 %**	**67 – 100%**	**0 - 33%**	**34 - 66 %**	**67 - 100%**
1	10	17858	7899	1057	23371	3218	225	0	0	0
2	20	40600	17024	1832	52591	6546	319	2557	583	146
3	31	1636	838	303	2283	405	89	0	0	0
4	32	968	77	24	918	119	32	0	0	0
5	41	20177	3178	272	21171	2253	203	0	0	0
6	42	3778	193	52	3601	332	90	0	0	0
7	43	1155	224	61	1136	234	70	0	0	0
8	44	1203	182	51	1174	203	59	0	0	0
31	45	1702	446	127	1889	307	79	0	0	0
9	50	17515	5034	396	20251	2567	127	1973	453	122
10	60	21339	217	39	21188	351	56	22411	2620	620
11	70	5864	619	64	5960	536	51	0	0	0
12	80	121	16	4	141			0	0	0
13	90	11			11			0	0	0
14	100	492	2	2	449	42	5	4792	667	134
15	110	667	8	2	638	33	6	0	0	0
16	120	286	12	4	266	31	5	0	0	0
17	130	2147	35	5	1960	193	34	0	0	0
18	140	3018	240	75	2893	334	106	0	0	0
19	151	236	53	12	265	35	1	0	0	0
20	152	1078	110	28	1041	134	41	0	0	0
21	160	605	38	8	551	84	16	0	0	0
22	170	449	31	8	422	58	8	0	0	0
23	180	2439	82	12	2280	205	48	6834	962	290
24	190	289	28	12	282	41	6	0	0	0
25	200	2056	57	10	1996	109	18	13202	1524	273
32	201	9963	414	82	9817	525	117	6834	962	290
26	210	8557	698	174	8432	794	203	0	0	0
27	220	1320	70	21	1219	152	40	0	0	0
28	231	327	28	12	315	46	6	0	0	0
29	232	16959	765	161	16874	853	158	14947	1830	455
33	233	3721	206	52	3598	310	71	1973	453	122
30	240	260	15	4	243	32	4	0	0	0
34	250	1259	139	31	1239	154	36	0	0	0
-	**Total**	190055	38978	4997	210465	21236	2329	75523	10054	2452

[49] defined as the retail companies in the wholesale sectors

7.4 Discussion of Step A disaggregation

As described above, we have constructed "aggregate companies" of different sizes handling the different product groups. The purpose is to construct a way of disaggregating the flow between firms, or aggregates of firms, that are handling shipments of various quantities. These will later on be dealt with in the logistics module. Based on the estimated number of small, medium and large firms in each zone we construct for each base matrix cell with a positive value 9 sub-cells (3×3), representing flows between the firms, as noted earlier.

As discussed in Section 7.1, the method of disaggregation has to achieve two aims: a) the allocation of the total volume of demand flow Q^k_{rs} (separately for PC and WC) between the 9 categories[50] {MN} and b) the number of f2f movements within each MN category, $N^k_{MN|rs}$.

The preceding section allows us to allocate the total value of production and consumption in each zone to the sending and receiving categories M and N respectively (eg, as illustrated in columns 4, 5 and 6 of Table 7.6). Although these production and consumption estimates are not expected to represent the out- and inflow of transported goods to individual firms, they should be adequate to represent the structure and sizes of the firms in terms of transport volumes in proportionate terms. Hence, we can straightforwardly calculate the row and column proportions $\pi^k_{M|r}$ and $\pi^k_{N|s}$, and, as set out in Section 7.1, multiplying these together gives the estimate of the proportionate allocation of the total Q^k_{rs} among the 9 {MN} categories, $Q^k_{MN|rs}$, as was illustrated in Table 7.1.

7.5 Number of f2f-relations per sub-cell

Corresponding row and column proportions are available for the number of **companies** in each zone based on *Buz*$_{...}$*(r, k, sz)* (eg, as illustrated in columns 7, 8 and 9 of Table 7.6). This provides an allocation method among the {MN} categories, but in this case we do not know the **total** of f2f movement for the cell rs. Clearly, while the total number of companies by size group in both r and s are known, the product of the two will greatly exceed the actual number of interactions. Hence, the full number of companies needs to be reduced to reflect the fact that neither all the senders, nor all the receivers interact in each zone-zone relation.

To achieve this, some rules have been developed in order to restrict the number of interactions.

We can use the CFS observations to estimate, at a national level, the number of sender-receivers relations in each of the 9 MN sub-cells[51]. Suitable initial values in the f2f-cells are the number of receiving companies in the cells. For singular flows the number of sender-receivers is of course 1.

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[50] after identifying and removing "singular flows"

[51] The number of senders-receiver relations is such that the number of shipments, summed over all cells in all rs relations, match the estimated national number of shipments.

In cases of production and consumption in foreign countries, corresponding information that would assist us in setting up corresponding data for our trading partners is not available. The simple, straightforward solution applied is to simply assume that they have a similar company structure for these products. On that basis, the national average values from the Swedish profile for production (as was illustrated by means of an excerpt in Table 7.6) is used for Import (ie, production in foreign countries). Corresponding average values from the Swedish profile for intermediate and final consumption are used for Export (ie, consumption in foreign countries).

To avoid dealing with too small quantities in the f2f-cells we apply the following further rules to cut down the number of non-zero valued cell.

1. **Do not distribute smaller total shipments than 1 ton among different company sizes. In such cases the largest relation is the only one used.**
2. **If any of the three smallest cells represents less than 2.5 % of the total volume they are set to zero, and the remaining cells are rescaled to 100 %**

From the CFS surveys we have information on the number of shipments and their distribution in terms of value and tons, see Table 7.10. One objective of the disaggregation procedure is to ensure that these observations can be properly reflected.

Table 7.10 CFS Statistics on number of shipments and tons per shipment. Total values for domestic and foreign trade are used.

		# Shipments		Average shipment size [ton]	
k	**NSTR**	**2001**	**2004**	**2001**	**2004**
1	**10**	41 314	125 170	33.2	30.8
2	**20**	481 610	1 299 900	3.3	3.4
3	**31**	-	128 530		3.5
4	**32**	50	410 780	52870.0	0.3
5	**41**	42 508	1 139 100	838.9	35.9
6	**42**	153 190	1 148 800	28.3	11.3
7	**43**	138 740	-	68.7	
8	**44**	-	-		
9	**50**	1 064 300	2 782 900	0.4	0.2
10	**60**	12 319 000	11 136 000	2.2	1.5
11	**70**	-	792 450		12.0
12	**80**	35 274	34 449	54.0	50.3
13	**90**	679	2 369	15560.5	12833.0
14	**100**	766 560	336 490	30.2	46.3
15	**110**	150 270	6 167	130.0	3653.3
16	**120**	14 419	21 625	163.2	90.3
17	**130**	2 761 900	1 459 100	4.2	6.3
18	**140**	1 111 900	2 998 900	11.8	7.0
19	**151**	196 020	1 356 500	43.8	31.1
20	**152**	243 300	-	27.5	
21	**160**	51 180	67 149	18.4	13.2
22	**170**	-	280 100		0.8
23	**180**	4 552 800	4 553 500	2.4	2.6

24	**190**	132 870	52 200	49.4	80.7
25	**200**	1 852 400	2 459 100	1.6	1.2
26	**210**	5 704 800	6 333 500	1.0	1.6
27	**220**	692 990	1 232 200	1.3	1.1
28	**231**	265 670	-	23.3	
29	**232**	18 896 000	14 284 000	0.7	0.6
30	**240**	-	-		
31	**45**	87 952	405 790	128.5	40.9
32	**201**	11 358 000	15 894 000	0.3	0.4
33	**233**	9 759 900	4 630 000	0.8	3.1
34	**250**	105 410	146 830	3.4	24.1
35	**247**	-	-		
Total		**72 981 006**	**75 517 599**		

In the preparatory work done for the Swedish input data to the Logistics model we have derived estimates of inventory holding costs and order setup costs. We now make use of these to achieve some kind of control at the shipment size level, based on the CFS-data, using the concept of the Economic Order Quantity (EOQ) – see Appendix H.

We start by defining some key national entities to be used in the description:

v^k = product value per ton
ω^k = inventory holding rate (assumed = 0.2) including interest, company profit expectations above bank interest rate, costs for handling and storage etc (see Appendix H for discussion)
o^k = order setup cost

This basic data is provided in Table 7.11.

Table 7.11 Basic data for EOQ-determination [summarized in row_col_pc_flows(06).xls]

Product group [k]	NSTR	Value per tonne v	unit inventory cost v × ω	Cost per order O
1	10	1349	270	1610
2	20	3530	706	203
3	31	8226	1645	402
4	32	5602	1120	200
5	41	231	46	293
6	42	3924	785	875
7	43	692	138	235
8	44	452	90	999
9	50	154450	30890	222
10	60	15673	3135	99
11	70	2601	520	87
12	80	706	141	225
13	90	2597	519	4893
14	100	2528	506	813
15	110	456	91	841
16	120	8067	1613	233
17	130	9232	1846	198

18	140	2244	449	122
19	151	291	58	37
20	152	334	67	264
21	160	2019	404	205
22	170	1204270	240854	604
23	180	14313	2863	229
24	190	2279	456	446
25	200	70235	14047	786
26	210	23675	4735	358
27	220	13751	2750	101
28	231	5005	1001	935
29	232	24598	4920	119
30	240	19521	3904	999
31	45	365	73	712
32	201	46590	9318	224
33	233	15065	3013	88
34	250	2396	479	949
35	247	561026	112205	600

For each rs movement, and product k, we begin with the total annual demand in each subcell y (= MN): Q^k_y

The aim is to predict $N^k_{MN|rs}$, the annual number of firm to firm relations (sender-receiver relations) in each subcell *y* for product group *k*. For notational convenience we re-write this as n^C_y. Initially this is set to the number of receiving companies in zone s $Buz_{final}(s, k, sz) + Buz_{InterM}(s, k, sz)$ as allocated to subcell *y*: we denote this as $n^C_{y,receive}$. The number of relevant receiving firms will be adjusted by a factor f_{adj} (equal to 1 initially): in other words $n^C_y = f_{adj}\, n^C_{y,receive}$

The disaggregation starts with the assumption that **all** n^C_y companies in subcell *y* demand input from the possible senders (we disregard which of them). On this basis the total annual demand per receiving company is $Q_y / (n^C_y)$. This gives an EOQ shipment size according to (cf Appendix H and basic literature on inventory management):

$$EOQ = sqrt(2 \cdot o \cdot (Q_y / n^C_y) / (\omega \cdot v)) \qquad (7.8)$$

From this we can calculate the average annual number (frequency) of shipments to this subcell y as:

$$f_y = Q_y / EOQ \qquad (7.9)$$

If the number of shipments **per receiving company** (= f_y / n^C_y) is sufficiently large (currently the criterion is that is should be $\geq$ 2) then this solution is accepted. The number of receiving companies is iteratively adjusted, subject to a lower limit of 2, by a factor of f_{adj} = 0.5 until the criterion is met.

This procedure is carried out for all relations and all f2f-cells. The resulting number of receivers is stored for each subcell in each base matrix cell. The total number of shipments over all rs and f2f cells is checked against the target levels derived from Table 7.10. Provided that the estimated number of shipments at the national level is consistent with the estimated number from the process above, the calculation is considered complete.

Should the number of shipments deviate too much from the target, an iterative procedure is initiated in which the factor f_{adj} is selected so as to meet the target. Currently f_{adj} is bounded within the range [0.2, 5.0]. The weighting is carried out by a linear extrapolation using modelled number of shipments for two recent values on f_{adj} in an attempt to reach the target level from the observations in Table 7.10. In each iteration n^C_y is initialised with $f_{adj} \cdot n^C_{y,receive}$.

The procedure is finalised by exporting the result to an ascii-file. For each y-cell the following information is saved:

1. the y-cell nbr (0,...,9)
2. the quantity [tonnes]
3. the number of f2f-relations (n^C_y)

8 Resulting matrices and a brief discussion of their consistency with other data and earlier estimates

8.1 Introduction and overview

In this chapter we will briefly discuss the consistency of the resulting matrix estimates with other data. However, these consistency checks are only very preliminary, since there will be a more thorough validation of the matrices in due course.

In the preceding chapters the main sections of the overall PWC-matrices have been defined namely:

- Domestic PWC matrix,
- Export/Import (including air freight),
- Transit flow matrix

The basic dimensions of these matrices are determined by the product and zone structure that has been decided for the development of the new Swedish freight model as explained in chapter 2 (section 2.4) above.

Each of these sections of the base matrices should be validated against other available formal data sources as well as by more informal judgments on whether specific values are generally reasonable or not. The actual use of the Base matrices for different applications will be an important source of such reasonability judgments.

Beside the matrices the BM procedures also provide additional necessary data for the new Logistics model that is being developed. These data are a further break down of the zone to zone cells of the matrices into nine sub-cells. The sub cells give the distribution of each base matrix cell flow over a maximum of nine relation types (ten if singular flows are included) between companies of different size groups. The methodology for estimation of the flow distribution over sub cells, number of companies and shipment was discussed in chapter 7 above. For convenience the sub cell categories are summarized in Table 8.1 below

Table 8.1 Categories of sub cells among which the goods volume of each Base Matrix element is distributed; the definition of the three categories small, medium and large is explained in more detail in chapter 7

Subcell number	Explanation in terms of business volumes
0	singular or transit flow
1	small to small
2	small to medium
3	small to large
4	medium to small
5	medium to medium
6	medium to large
7	large to small
8	large to medium
9	large to large

It is important that also these estimates are scrutinized and validated as far as possible in a similar way as the base matrices. However, there is no such validation available as yet that could be reported here.

8.2 Summary of total volumes and total value in the different components of the estimated PWC- matrices

A summary of the results in the base matrix is provided in Table 8.2. All matrices are given in tonnes. However, the average product group value is available so it is a straightforward task to produce both weight and value matrices. These product group values are given in Table 4.14.

A summary of the regional distribution of Swedish import 2004 for each product was presented in table 5.5 above. The source (excel-sheet) quoted in the head of table 5.5 also gives the regional allocation in Sweden for domestic and import flows The change of the coding of some of the product groups in the CFS on the basis of the values per ton, see section 3.1, has led to a revision of the base matrices.

Table 8.2 Summary of pwc-matrix 2004 in ktonnes.

Product number, description and classification				Domestic		Foreign trade, (regular flows)[52]		Foreign trade,, singular flows			Total
SerP		**NSTR**	**STAN**	**Regular**	**Singular**	**Export**	**Import**	**Export**	**Import**	**Transit**	**sum**
1	Cereals	10	1	3777	123	949	227	108	30		5214
2	Veg & fruit	20	1	3703		122	1077				4902
3	Live animals	31	1	453		4	1				457
4	Sugar beet	32	1	420		151	158				729
5	Pulpwood	41	2	34628	2171	1249	7221		1013		46282
6	Wood. sawn	42	3	3962	30	5394	217	394	19	11	10027
7	Wood chips	43	3	8339	265	539	2155		300	6	11604
8	Other wood	44	3	749		31	67			0	847
9	Textiles, fibres	50	12	132		114	308			99	653
10	Foodstuff	60	4	14143	599	1274	3332	49	44	2159	21601
11	Oil seeds, fat	70	1	9353	616	306	648		98		11021
12	solid min	80	5	1589		203	1794		2206		5792

[52] So called singular flows are of two types, namely large flows identified in the CFS or flows exogenously provided by members of the Samgods group. Such singular flows are kept separate from all other flows called regular flows. The regular flows are estimated using the methodology described in the report .

	fuels										
13	Crude petro	90	5	42		0	20503				20545
14	Petro produc	100	6	11131	1010	1887	3716	10759	5748	1	34252
15	Iron ore &waste	110	7	8660		18128			3356	6	30150
16	Non ferr ore& waste	120	7	1227		590	833	39	300	1	2989
17	Metal prod	130	8	5888	1640	4497	3482	1402	921	1122	18951
18	Cement, lime build mtrl	140	10	17726	223	1284	843	583	827	3	21488
19	Earth, sand, gravel	151	10	15780		2288	1389			3	19460
20	Other material	152	10	5813	268	2891	1896	53	1227	4	12153
21	Fertilizers	160	11	930		271	694		31	0	1926
22	Coal chemicals	170	6	52		631	173			0	856
23	Chemical other	180	11	3599	197	4181	2933	819	2605	2	14336
24	Paper pulp	190	9	3800	125	3206	1280	571		48	9030
25	Trpt equipm	200	12	1009	13	1497	1264			649	4432
26	Manufact metal	210	12	3877		414	515	44		229	5078
27	Glass, ceramic	220	12	711		335	226		49	143	1463
28	Paper, paperboard	231	9	1594	50	8669	842	1745		108	13009

29	Clothing	232	12	5907	29	832	1330	232	147	597	9074
30	Mixed part load	240	12								
31	Timber for saw	45	2	13965	379	1			817		15162
32	Machinery &parts	201	12	3219		1887	1390	49	104	806	7455
33	Paper & paperboard manuf	233	9	4250	111		360	2133		8	6861
34	Prod wrappings	250	12	2514		187	147		11	81	2939
35	Air freight	247	12	66		256	90				412
		SUM		**193006**	**7850**	**64267**	**61109**	**18980**	**19851**	**6086**	**371151**

8.3 Consistency and validity checks based on official statistics

After processing through the logistics model, we will be able compare the goods flows with regular aggregate transport statistics on transport volumes in tonnes and tonkilometers. However, also before this is done it is possible to make rough comparisons with other types of data.

Data on the domestic goods volumes on road, sea, and rail are available from official statistical sources. From SIKA/Statistics Sweden[53] we have statistics on domestic transports with Swedish trucks and rail according to Table 8.3. The average number of lifts can be calculated as lifted tons according to transport statistics in Table 8.3 divided by the pwc matrix volume according to Table 8.2. Only considering domestic flows, it needs to be lifted (411666/(193006+7850) = 2.05 times on the average. Somewhat simplified you can say that every transport is lifted twice.

Table 8.3 Domestic goods flow according to official statistics 2004-2005

		Volume in kton	Volume in Mtonkm	Source
Road		348 907	34 682	SCB: Svenska lastbilars godstransporter under år 2005
Rail	Total	36 553	13 190	SCB: Transporter och kommunikation: Järnvägsstatistik: SIKA databas; Bantrafik 2004.xls, Sheets D2
	Ore on the ore railway (part of total)	12 079	2 050	
Sea		26 206	7 579	SCB: Utrikes och inrikes trafik med fartyg: Sammanfattnings-tabell för 2005- Utrikes och inrikes varutrafik
Total		411 666	55 451	

A check of the domestic tonkms from the base matrix results in 65 712 Mtonkm (Table 8.4) which is 27 % higher than the total in Table 8.3 (this checksum is derived by multiplying all domestic flows with the shortest distance, regardless of mode truck, rail or sea calculated from the STAN network for each element of the domestic Base matrices; intra-zonal distances for domestic zones have been set to the minimum of the zone diameter and 25 kilometres and to 8 km by default for all foreign zones). It should be higher since in the statistics in Table 8.3 we are missing non-domestic trucks as well as light trucks, and values for road and sea are from 2001, but it seems too high. However, other sources of statistics ought to be consulted as well. Also important is the definition of domestic transports in this context. Tonkm in transport statistics on road and rail include transport of export/import goods to/from ports and other border passages as well as transport of transit goods on Swedish lorries. This would influence in the opposite direction thus again widening the margin between the rough estimate and values from statistical sources.

53 (http://www.scb.se/templates/Amnesomrade____10070.asp Transporter och kommunikationer)

Table 8.4 Domestic goods transport volumes [Mtonkm] with the base matrix values and the distance matrix based on closest distance, regardless of mode truck, rail or sea as derived from the STAN-network.

SerP	NSTR	Domestic [Mtonkm]
1	10	385
2	20	488
3	31	56
4	32	66
5	41	4426
6	42	1737
7	43	3854
8	44	85
9	50	56
10	60	3759
11	70	1492
12	80	397
13	90	4
14	100	2381
15	110	7448
16	120	1051
17	130	3266
18	140	6713
19	151	1095
20	152	1371
21	160	205
22	170	14
23	180	913
24	190	930
25	200	346
26	210	1437
27	220	260
28	231	747
29	232	2137
30	240	
31	45	1446
32	201	937
33	233	1276
34	250	883
35	247	22
Total		**65712**

8.4 Consistency with earlier Samgods matrix estimates

The new base matrices have been checked at STAN product group level with the old SAMGODS 2001-2004 levels. The results are given in Table 8.5. For some STAN product groups the new totals are much higher than for the existing, old matrices, in particular STAN product groups 1 (agricultural products), 9 (paper and pulp) and 10 (earth, stone, building materials). Partly this is explained by the fact that some transported quantities are excluded in the old matrices, e g goods transports over short distances ($\leq$ 25 km) and goods transported with trucks having a capacity less than 3.5 tonnes.

After allowing for these, the total volume is now the same as for the old STAN-matrix, so that the differences must lie in the product grouping in the CFS data bases. A few other facts can influence this comparison as well, for example the product **values** used in the two compared cases. The "Adjusted ratios" column, which partly compensates for this, is computed by moving up the STAN rail transports to product group 7 and distributing the other three items at the bottom to the other product groups.

Table 8.5 Summary of PWC-matrix 2004 in ktonnes at STAN product group level for comparison with the existing STAN2001-2004 OD-matrices.

STAN	Total (NEW)	Total(OLD)	Ratio	Adjusted ratios	Product group
1	22324	11643	1.92	1.68	Agricultural products
2	61444	51568	1.19	1.04	Unprocessed lumber
3	22477	24334	0.92	0.81	Processed wood products
4	21601	17957	1.20	1.05	Foodstuffs
5	26337	24722	1.07	0.93	Crude petroleum
6	35108	37674	0.93	0.82	Petroleum products
7	33138	22874	1.45	1.01	Iron ore and metal waste
8	18951	18892	1.00	0.88	Metal products
9	28900	20266	1.43	1.25	Paper and pulp
10	53102	32242	1.65	1.44	Earth, stone and building material
11	16262	16461	0.99	0.86	Chemicals
12	31507	39351	0.80	0.70	Manufactured industrial products
		29087			Truck (single) / Lbu
		4281			Truck, transit
		10076			Rail domestic, iron ore
		8662			Container goods
Total	371151	370090	1.00		

8.5 The validity of the structure and contents of subcells

The number of non-zero base matrix cell is presented in Table 8.6 together with the number of sub-cells with non-zero values. On the average there are 2.85 active sub-cells per base matrix cell. For the moment nothing can be said about the plausibility of these figures. Further validation must be done.

Table 8.6 Density of the base matrix and the number of sub-cells after the disaggregation in step A.

SerP	NSTR	# base matrix cells > 0	# of sub-cells
1	10	41254	179892
2	20	22167	116380
3	31	21373	29989
4	32	21796	36751

5	41	43188	233442	
6	42	124732	408393	
7	43	61917	213808	
8	44	7537	15936	
9	50	113856	232124	
10	60	108043	277456	
11	70	40833	126091	
12	80	9550	18573	
13	90	1026	1026	
14	100	5316	13122	
15	110	15039	24105	
16	120	2953	4965	
17	130	125530	215835	
18	140	130169	446250	
19	151	15288	37640	
20	152	65837	161301	
21	160	16782	34611	
22	170	13337	17988	
23	180	29244	65419	
24	190	21023	44399	
25	200	61934	91227	
26	210	128061	487078	
27	220	75409	149395	
28	231	19850	41110	
29	232	169985	670091	
30	240			
31	45	32488	113884	
32	201	52228	123961	
33	233	56363	144525	
34	250	107896	218766	
35	247	31074	40796	
Total		**1793078**	**5036329**	**2.81**

8.6 Conclusions

The methods that have been applied seem generally reasonable and appear to work, but they have to be scrutinized further with the aim of making key improvements in methodology as well as checking for possible errors and mistakes. CFS has been very useful and gives data about spatial distributions both in Sweden and abroad that is not available from any alternative sources. At first sight the aggregate magnitudes seem reasonable but further checking is necessary both per product and as for the spatial structure. The sub-cell approach remains to be thoroughly tested in the logistics module. A lot more thinking about the validity of the different components is necessary and many additional consistency checks will have to be carried out.

9 Program documentation and data – draft preliminary overview

9.1 Purpose and overview of contents

The purpose of this final chapter is to give a rough overview of the procedures and computer programs that have been used to apply the methodologies for estimation of Base Matrices that have been described in earlier chapters. It should be said already at the outset that the documentation provided here is probably far from sufficient to enable potential users to actually run the programs and use data bases etc and thus to replicate the Base Matrices that have been produced in this project.

It is most likely, however, that there will be a need for revisions and up dates of the Base matrices for a number of reasons, such as new data becoming available, need for a more recent base year, improved methodology, identified errors in data etc. A new forecasting methodology for matrices might also draw heavily on the present BM methodology and programs. For such revisions and developments to become feasible with controlled quality it is necessary that the methodology that has been developed in the BM project could be applied in a consistent and transparent way. For discussions on and actual changes of the current methodology the earlier chapters in this report can form a basis, but it is also necessary that the program implementations of these methodologies can be identified and scrutinized in detail.

Therefore it seems necessary in due course to further develop the fragmentary documentation in this chapter to more comprehensive program documentation for users as well as developers.

The rough overview in this chapter is organised in the following way.
In section 9.2 we show how the final matrices are organized and how the data files containing these matrices are formatted. In section 9.3 the different functions of Base Matrix program are described module by module. The description and tables are supported by three flow diagrams.

9.2 File structure and formats for the output (result) matrices

All the components of the PWC matrices are recorded in a single text file that can be dealt with in the logistics module or used for other purposes. The procedure and software needed to generate this text file is described in later sections in this chapter.

The format of this text file is shown in Table 9.1. The business numbers in the file refers to the aggregation into 9 sub-cells, 1 -9, and one cell for singular flows, 0.

Table 9.1 Format for the pwc-matrix in the text file pwc.txt.

From	To	Serial product group number k	P or W sender	Annual demand in base matrix cell [tonnes]	Nbr of subcells, possibly also singular flows	First non-zero sub-cell	Annual demand in first sub-cell [tonnes]	# of firm-to-firm flows	Second non-zero sub-cell	Annual demand in second sub-cell [tonnes]	# of firm-to-firm flows	Third non-zero sub-cell	Annual demand in third sub-cell [tonnes]	# of firm-to-firm flows	Fourth non-zero sub-cell	Annual demand in fourth sub-cell [tonnes]	# of firm-to-firm flows	...
711400	713600	1	P	8.10E+01	4	5	9.91E+00	1	6	1.40E+01	1	8	2.36E+01	1	9	3.34E+01	1	
711400	713600	1	W	5.05E+00	4	5	6.18E-01	1	6	8.74E-01	1	8	1.47E+00	1	9	2.08E+00	1	
711400	713800	1	P	1.97E+01	2	5	5.83E+00	1	8	1.39E+01	1							
711400	713900	1	P	4.62E+01	4	4	5.78E+00	1	5	7.86E+00	1	7	1.38E+01	1	8	1.87E+01	1	
711400	714000	1	P	1.21E+01	2	4	3.59E+00	1	7	8.55E+00	1							
711400	716000	1	P	4.73E+01	4	4	5.50E+00	1	5	8.48E+00	1	7	1.31E+01	1	8	2.02E+01	1	
711400	716200	1	P	1.06E+01	4	4	8.63E-01	1	6	2.26E+00	1	7	2.06E+00	1	9	5.40E+00	1	

The table gives for each pwc-matrix element the quantity in tons and the distribution of this quantity over a number of relevant (non-zero) sub cells according to the sub cell numbers given in Table 8.1. For each active sub cell the number of firm to firm flows is given. Some further information can be found in
pwc_info_contents_15mar2007.txt

9.3 Program modules and flow charts

The principal data and programs used for construction of the base matrices are shown in the flow charts in Figure 9.1 to Figure 9.3.

9.3.1 Key SNI to NSTR

The key SNI to NSTR is constructed based on three input data files holding information:

1. FTS-statistics provides: KN8
2. Keys: KN8 - NSTR/UVAV
3. Coupling: KN8 - SNI92

By matching KN8 on each input row in FTS with the couplings to SNI92 and NSTR respectively, we create a table with with SNI92-rows and NSTR-columns, which constitutes key SNI92 - NSTR

Program: nyckel.exe

Input data:
kn8_to_uvav30++.txt (Keys: KN8 - NSTR/UVAV)

```
        ecerpt::
        KN8     NSTR/UVAV_34_utvidgat_förslag_20051013_UVAV30++   UVAV30/New02 & New03
& New04
        1011010 31      New02
        1011090 31      New02
        1011100 31      31
        1011910 31      31
        1011990 31      31
        ...
```

sni92-uvav.txt (Coupling: KN8 - SNI92)

```
        excerpt:
        VTYPKOD;BAKOD;KNNR;SITC;SNI69;SNI92;CSTE;BAKODU;LOGFAM02;LOGFAM01;LOGFAM03
        1;3;01011100;00151;11101;01228;0301001;5;Varugrupp C;JORDBRUK;Levande djur
        1;3;01011910;00151;11101;01228;0301001;5;Varugrupp C;JORDBRUK;Levande djur
        1;3;01011990;00151;11101;01228;0301001;5;Varugrupp C;JORDBRUK;Levande djur
        1;3;01012010;00152;11101;01228;0301001;5;Varugrupp C;JORDBRUK;Levande djur
        1;3;01021010;00111;11101;01212;0301001;5;Varugrupp D;JORDBRUK;Levande djur
        1;3;01021030;00111;11101;01212;0301001;5;Varugrupp D;JORDBRUK;Levande djur
        1;3;01021090;00111;11101;01212;0301001;5;Varugrupp D;JORDBRUK;Levande djur
        1;3;01029005;00119;11101;01212;0301001;5;Varugrupp D;JORDBRUK;Levande djur
        1;3;01029021;00119;11101;01212;0301001;5;Varugrupp D;JORDBRUK;Levande djur
        1;3;01029029;00119;11101;01212;0301001;5;Varugrupp D;JORDBRUK;Levande djur
        1;3;01029041;00119;11101;01212;0301001;5;Varugrupp D;JORDBRUK;Levande djur
        1;3;01029049;00119;11101;01212;0301001;5;Varugrupp D;JORDBRUK;Levande djur
        ....
```

..\Input_rapsXM\Handel04.txt

```
        ecerpt::
```

```
% År InfUtf Varukod[KN8] UVAV34      Landskod Transpsatt Värde Vikt AnnanKvant
(2004)
2004;U;1011010;;AE;4;176318;800;2;
2004;U;1011010;;AT;;2902;0;1;
2004;U;1011010;;BE;;12108;0;1;
2004;U;1011010;;BG;3;103149;500;1;
2004;U;1011010;;BR;4;234524;1000;2;
2004;U;1011010;;CA;4;90000;500;1;
....
2004;I;97060000;232;NZ;5;737;1;;
2004;I;97060000;232;PK;4;8997;85;;
2004;I;97060000;232;TH;4;18548;19;;
2004;I;97060000;232;TR;4;53409;1005;;
2004;I;97060000;232;US;1;265137;3731;;
2004;I;97060000;232;US;3;165687;76;;
2004;I;97060000;232;US;4;503292;773;;
2004;I;97060000;232;US;5;410122;117;;
```

Output data:

handel04.out (includes keys SNI to NSTR)

```
excerpt:
...
  -73 -73 -73 (4 digits)
  -73 -73 -73 Export+Import-nyckel(UHM,SIKA,handel01.txt + sni92->UVAV/NSTR)
  -73 -73 -73   SNI NSTR/UVAV  Share_of_SNI->NSTR  Sum(SNI->UVAV)  Sum(SNI)
    1   10      0.15497693  0.238590E+10  0.153952E+11
    1   20      0.51608647  0.794524E+10  0.153952E+11
    1   31      0.02123019  0.326842E+09  0.153952E+11
    1   50      0.16819936  0.258946E+10  0.153952E+11
    1   60      0.10481888  0.161371E+10  0.153952E+11
    1   70      0.03468818  0.534031E+09  0.153952E+11
    2   41      0.90550736  0.434579E+10  0.479928E+10
    2   43      0.01367259  0.656186E+08  0.479928E+10
    2   44      0.00000786  0.377430E+05  0.479928E+10
    2   50      0.02293409  0.110067E+09  0.479928E+10
    2  232      0.00409682  0.196618E+08  0.479928E+10
    2   45      0.05378128  0.258112E+09  0.479928E+10
    5   20      0.00076457  0.564059E+07  0.737750E+10
    5   50      0.00064827  0.478260E+07  0.737750E+10
    5   60      0.99836736  0.736546E+10  0.737750E+10
    5  220      0.00021981  0.162161E+07  0.737750E+10
...
```

Location in flow chart: Figure 9.1.

9.3.2 CFS-data

This program summarizes the microdata from CFS 2001 and 2004/05 residing in the files:
Data YYYY \VFUYYYY_mikrodata_revised.dat   where YYYY $\in$ {2001, 2004}

Complementing data on geographical location is provided in the files:
DataYYYY\Ort_Land_Zone_ YYYY.txt   where YYYY $\in$ {2001, 2004}
This allows a dynamic updating of new identified locations for foreign zones in particular.

During the registration of the transport flows, the singular flows are identified and placed in designated files for later use. The observed spatial patterns for export and import flows are set up here, and it is used directly for generating the PWC-flows. The total is based on the total trade volumes from the foreign trade statistics.

Program: cfs_stat.exe

Location in flow chart: Figure 9.1

9.3.3 Row and column sum models

This part of the base matrix program estimates the linear regression models described in association with eq (4.1).

Program: BaseMatrix.exe (Note. This program is used for all the steps described in 9.3.3 – 9.3.6. Different run control parameters guides its use.)

Execution procedure: Run the batch file *BM-multi01.bat* which in turn calls *rone.bat.* This executes the program for all product groups and combinations of P and W where data exist.

BM-multi01.bat

```
echo bm_multi01 > last.run
call    rone    1       P       4 _
call    rone    1       W       4 _
call    rone    2       P       4 _
call    rone    2       W       4 _
call    rone    3       P       4 _
REM call        rone    3       W       4 _
call    rone    4       P       4 _
call    rone    4       W       4 _
call    rone    5       P       4 _
call    rone    5       W       4 _
call    rone    6       P       4 _
call    rone    6       W       4 _
call    rone    7       P       4 _
call    rone    7       W       4 _
REM call        rone    8       P       4 _
REM call        rone    8       W       4 _
call    rone    9       P       4 _
call    rone    9       W       4 _
call    rone    10      P       4 _
call    rone    10      W       4 _
call    rone    11      P       4 _
call    rone    11      W       4 _
call    rone    12      P       4 _
call    rone    12      W       4 _
REM call        rone    13      P       4 _
REM call        rone    13      W       4 _
call    rone    14      P       4 _
call    rone    14      W       4 _
call    rone    15      P       4 _
call    rone    15      W       4 _
call    rone    16      P       4 _
call    rone    16      W       4 _
call    rone    17      P       4 _
call    rone    17      W       4 _
call    rone    18      P       4 _
call    rone    18      W       4 _
call    rone    19      P       4 _
call    rone    19      W       4 _
call    rone    20      P       4 _
call    rone    20      W       4 _
call    rone    21      P       4 _
call    rone    21      W       4 _
call    rone    22      P       4 _
call    rone    22      W       4 _
call    rone    23      P       4 _
call    rone    23      W       4 _
call    rone    24      P       4 _
call    rone    24      W       4 _
call    rone    25      P       4 _
call    rone    25      W       4 _
```

```
call    rone    26      P       4 _
call    rone    26      W       4 _
call    rone    27      P       4 _
call    rone    27      W       4 _
call    rone    28      P       4 _
call    rone    28      W       4 _
call    rone    29      P       4 _
call    rone    29      W       4 _
REM call        rone    30      P       4 _
REM call        rone    30      W       4 _
call    rone    31      P       4 _
call    rone    31      W       4 _
call    rone    32      P       4 _
call    rone    32      W       4 _
call    rone    33      P       4 _
call    rone    33      W       4 _
call    rone    34      P       4 _
call    rone    34      W       4 _

REM end of all
```

Rone.bat

```
REM Prod    = NSTR product number 1 - 34 (010 - 250), 35 (247) for air (only when
CtlReg == 1)
REM
REM iPW     = sender Producer or Warehouse
REM
REM CtlReg  = 4  Estimate functions for row and column sums
REM           2  Estimate PWC-matrices
REM           1  Disaggregation/Step A
REM           0  Sum all pwc-matrices into pwc.txt

REM                  Prod  iPW   CtlReg
BaseMatrix.exe   base %1     %2   %3
```

Location in flow chart: Figure 9.2

9.3.4 Synthetic domestic matrices

Here the base matrix program estimates the synthetic domestic PWC-matrices, see Section 4.4.

Program: BaseMatrix.exe

Execution procedure: Run the batch file *BM-multi02.bat* which in turn calls *rone.bat.* This executes the program for all product groups and combinations of P and W where data exist.

BM-multi02.bat

```
echo bm_multi02 > last.run
call    rone    1       P       2 _
call    rone    1       W       2 _
call    rone    2       P       2 _
call    rone    2       W       2 _
call    rone    3       P       2 _
REM call        rone    3       W       2 _
call    rone    4       P       2 _
REM call        rone    4       W       2 _
call    rone    5       P       2 _
call    rone    5       W       2 _
call    rone    6       P       2 _
call    rone    6       W       2 _
call    rone    7       P       2 _
call    rone    7       W       2 _
REM call        rone    8       P       2 _
REM call        rone    8       W       2 _
```

```
call    rone    9       P       2 _
call    rone    9       W       2 _
call    rone    10      P       2 _
call    rone    10      W       2 _
call    rone    11      P       2 _
call    rone    11      W       2 _
call    rone    12      P       2 _
call    rone    12      W       2 _
REM call        rone    13      P       2 _
REM call        rone    13      W       2 _
call    rone    14      P       2 _
call    rone    14      W       2 _
call    rone    15      P       2 _
call    rone    15      W       2 _
call    rone    16      P       2 _
call    rone    16      W       2 _
call    rone    17      P       2 _
call    rone    17      W       2 _
call    rone    18      P       2 _
call    rone    18      W       2 _
call    rone    19      P       2 _
call    rone    19      W       2 _
call    rone    20      P       2 _
call    rone    20      W       2 _
call    rone    21      P       2 _
call    rone    21      W       2 _
call    rone    22      P       2 _
call    rone    22      W       2 _
call    rone    23      P       2 _
call    rone    23      W       2 _
call    rone    24      P       2 _
call    rone    24      W       2 _
call    rone    25      P       2 _
call    rone    25      W       2 _
call    rone    26      P       2 _
call    rone    26      W       2 _
call    rone    27      P       2 _
call    rone    27      W       2 _
call    rone    28      P       2 _
call    rone    28      W       2 _
call    rone    29      P       2 _
call    rone    29      W       2 _
REM call        rone    30      P       2 _
REM call        rone    30      W       2 _
call    rone    31      P       2 _
call    rone    31      W       2 _
call    rone    32      P       2 _
call    rone    32      W       2 _
call    rone    33      P       2 _
call    rone    33      W       2 _
call    rone    34      P       2 _
call    rone    34      W       2 _

REM end of all
```

Location in flow chart: Figure 9.2

9.3.5 Disaggregation step A

Now the base matrix program performs the disaggregation process, Step A, see Chapter 7. In this step also the exogenous input of large flows is carried out. The data resides in the file
AdditionalBaseMatrixValues.txt

Program: BaseMatrix.exe

Execution procedure: Run the batch file *BM-multi03.bat* which in turn calls *rone.bat.* This executes the program for all product groups where data exist. No split is required with respect to P and W, since they are dealt with in the same run.

BM-multi03.bat

```
echo bm_multi03 > last.run
call    rone    1       P       1 _
call    rone    2       P       1 _
call    rone    3       P       1 _
call     rone   4       P       1 _
call    rone    5       P       1 _
call    rone    6       P       1 _
call    rone    7       P       1 _
call    rone    8       P       1 _
call    rone    9       P       1 _
call    rone    10      P       1 _
call    rone    11      P       1 _
call    rone    12      P       1 _
call    rone    13      P       1 _
call    rone    14      P       1 _
call    rone    15      P       1 _
call    rone    16      P       1 _
call    rone    17      P       1 _
call    rone    18      P       1 _
call    rone    19      P       1 _
call    rone    20      P       1 _
call    rone    21      P       1 _
call    rone    22      P       1 _
call    rone    23      P       1 _
call    rone    24      P       1 _
call    rone    25      P       1 _
call    rone    26      P       1 _
call    rone    27      P       1 _
call    rone    28      P       1 _
call    rone    29      P       1 _
REM call        rone    30      P       1 _
call    rone    31      P       1 _
call    rone    32      P       1 _
call    rone    33      P       1 _
call    rone    34      P       1 _
call    rone    35      P       1 _

REM end of all
```

Location in flow chart: Figure 9.3

9.3.6 Summary of PWC-matrices

Finally the base matrix program summarizes the result after the Step A procedure.

The transit flows from the Samgods 2001 model in the file
InputData\ transit2001-HED.314
are rescaled to the level 2004/05 utilizing the trend in export and import from FTS.

Program: BaseMatrix.exe

Execution procedure: Run the batch file *BM-multi04.bat* which in turn calls *rone.bat.* This executes the program once for all product groups simultaneously. Only a dummy product number and a P/W character are required.

```
echo bm_multi04 > last.run
call    rone    1       P       0 _
```

```
REM end of all
```

Location in flow chart: Figure 9.3

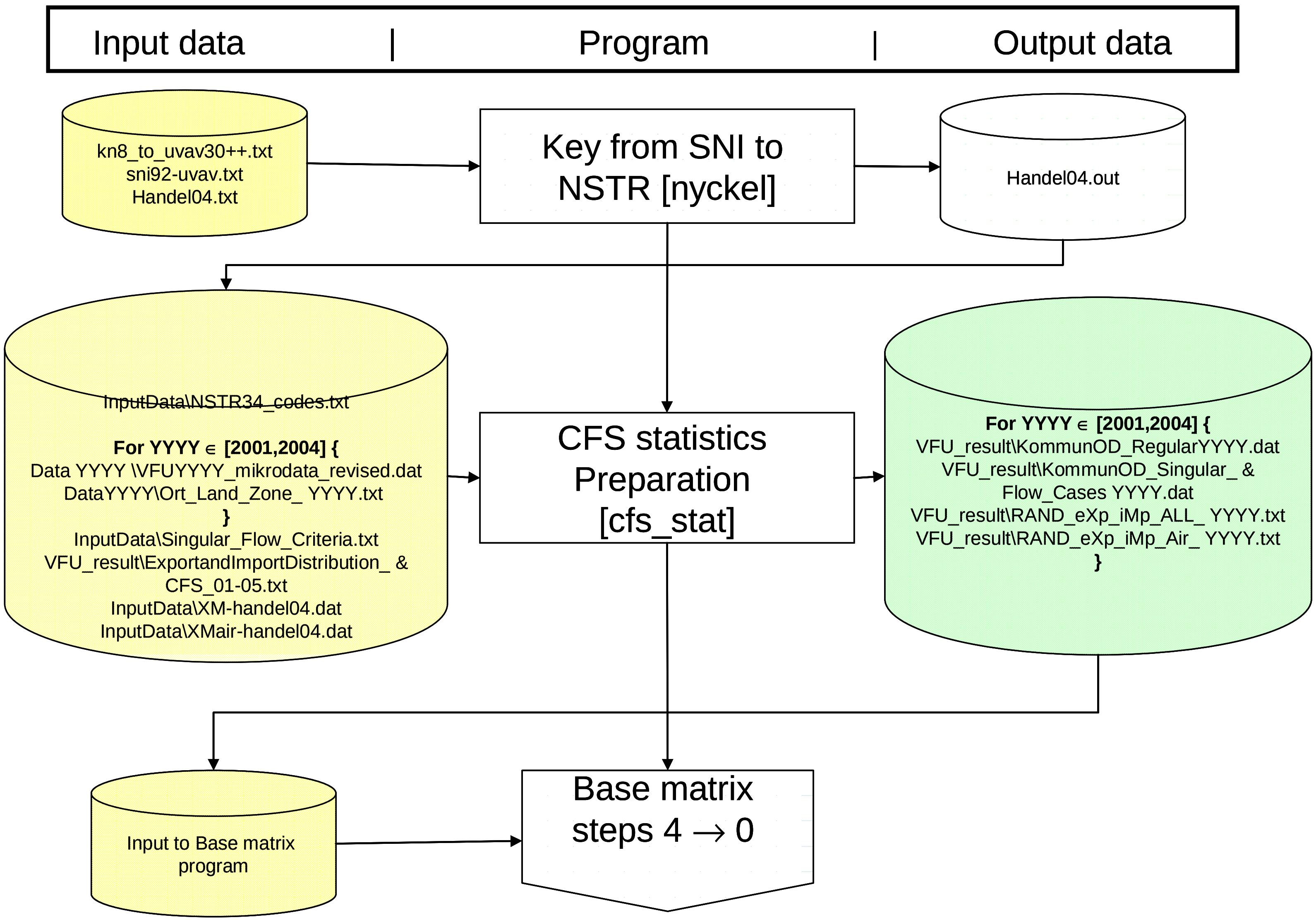

Figure 9.1 **Base matrix program flow chart (Part 1)**

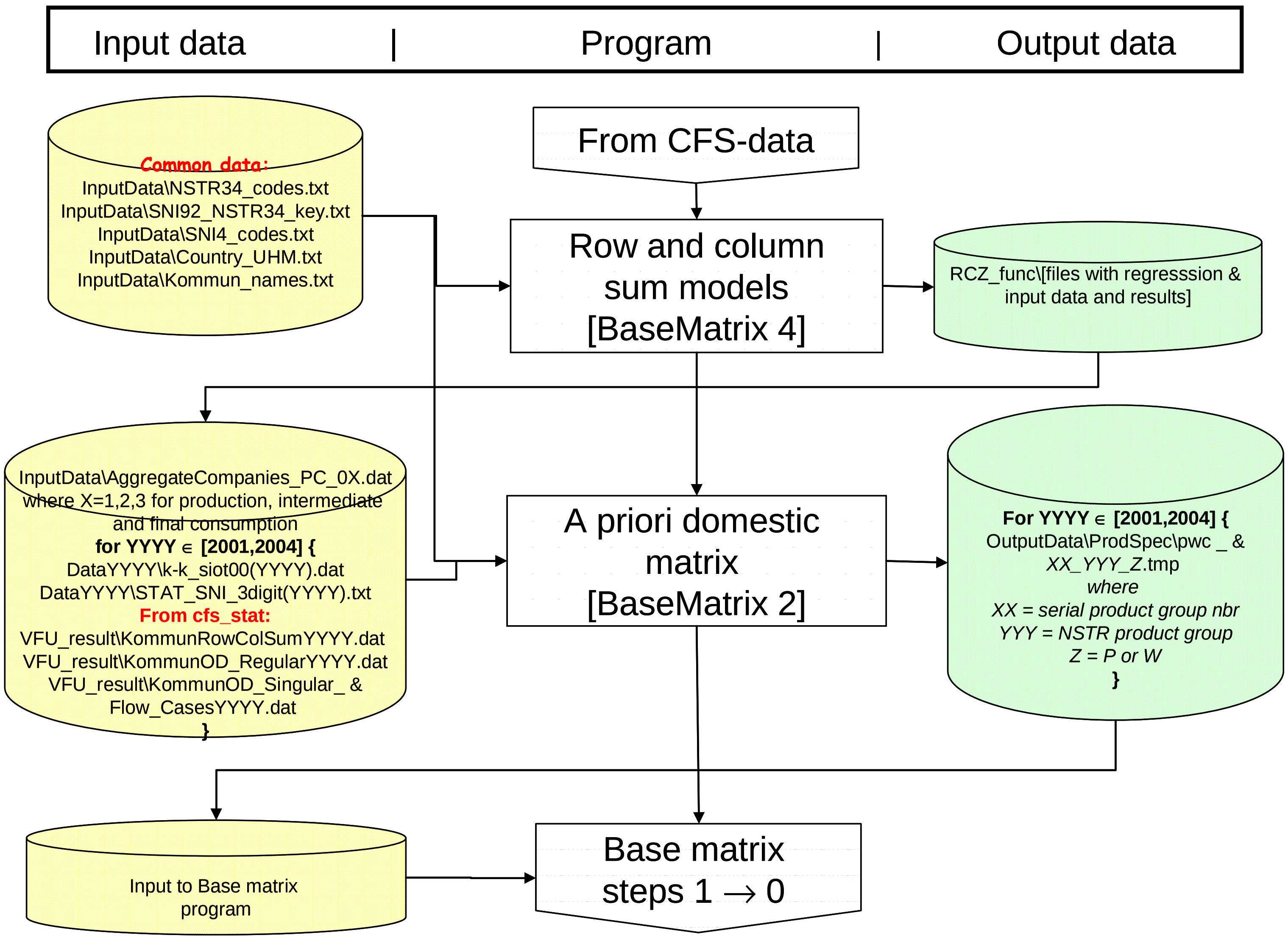

Figure 9.2 **Base matrix program flow chart (Part 2)**

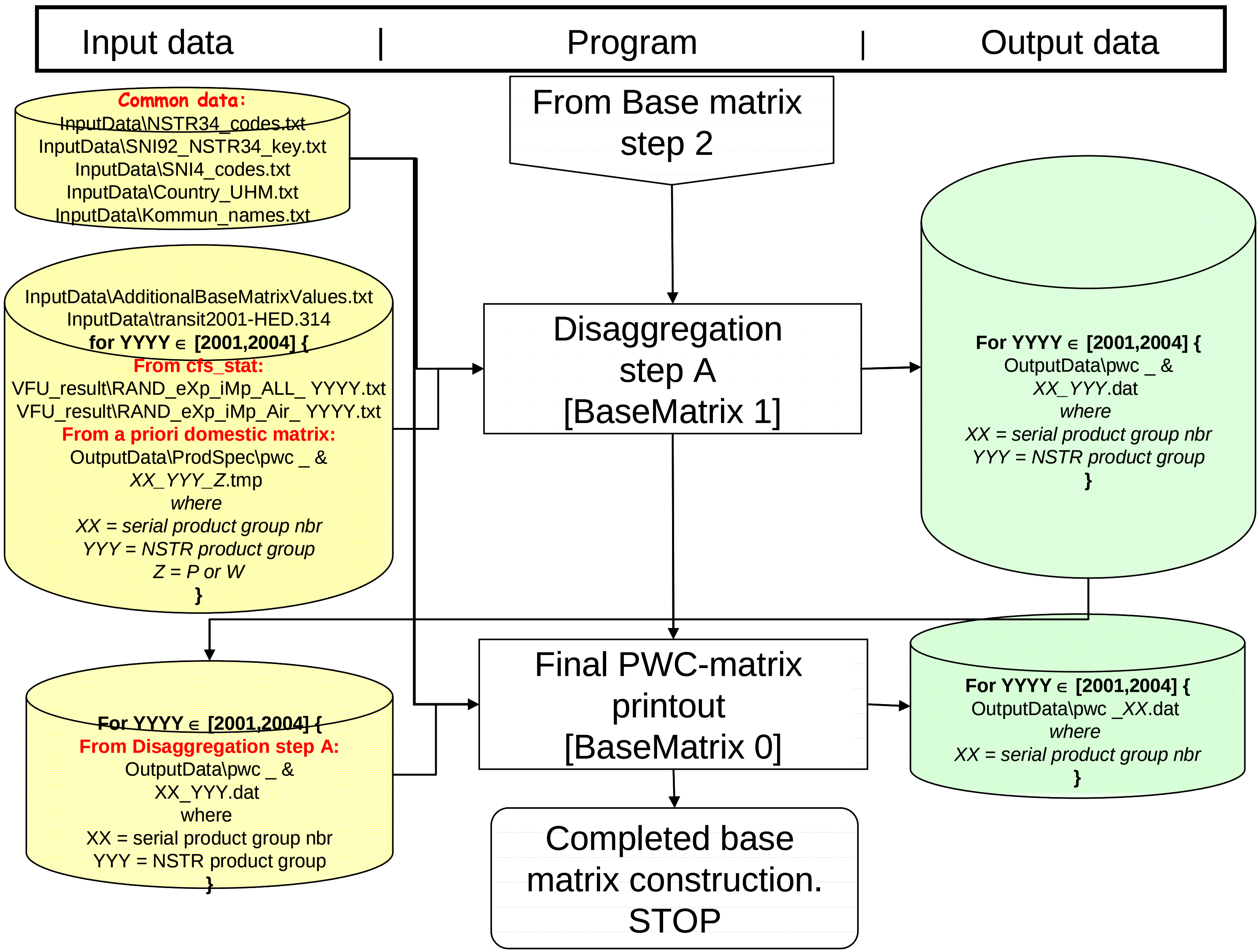

Figure 9.3 **Base matrix program flow chart (Part 3**

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Appendices

Appendix A CFS product group codes (VFU 2001original structure is in app A but not the 2004/2005 reporting structure, which I think it should)

Appendix B SNI92 5-digit codes {I don’t see that we are actually using SNI at such a detailed level; could this be shortened?}

Appendix C Key between SNI92 and NSTR

Appendix D structure of the Supply-Use tables [note: existing version does not contain useful information]

Appendix E Structure of the Input-Output tables (excerpt)

Appendix G Import/Export allocation in CFS 2001

Appendix H EOQ calculation

Appendix I Product group values used for conversion to tonnes

Appendix A
Table A1 VFU 2001 Commodity codes

Commodities in CFS-term

Agriculture products, forest products, textiles and live animals

000 Live animals
010 Grain
020 Potatoes
030 Other vegetables, fresh or frozen or frozen fresh fruit and nuts
040 Textiles, textile goods, textile waste and artificial fibres
051 Pulp wood
052 Pit props
055 Round timber
056 Railways and tramway sleepers of wood and other wood roughly squared, half-sawn or sawn
057 Wood, charcoal, untreated cork and cork and wood waste
060 Sugar beet
090 Other untreated animal and vegetable material e.g.. rubber and untreated hides and skins

Foodstuffs and animal fodder

100 Sugar, beverages, coffee, spices, fruit, vegetables, meat, fish, dairy products and other foodstuffs and animal fodder and food waste

Solid mineral fuels

210 Coal and carbon bricks
220 Brown coal, brown coal bricks and peat
230 Coke, semi-coke of coal or brown coal

Petroleum products

310 Crude oil
321 Petrol
323 Paraffin, jet fuel and mineral turpentine
325 Distilled fuels
327 Residual combustible oils
330 Gaseous hydrocarbons, liquid or compressed
341 Lubricating oils and fats
343 Petroleum bitumen and bituminous mixtures
349 Other derivatives of non-fuels

Ores and metal waste

410 Iron ore and concentrated except iron pyrites
450 Non-iron ore and waste
460 Iron and steel waste and flue dust

Metal products

510 Pig iron and furnace steel, ferro alloys
520 Semi-finished rolled steel products and other semi-finished steel products
530 Rolled steel, beams, sections, wire rods, iron and tramway construction material of iron and steel
540 Steel plates, plates, band and band steel
550 Pipes, pipelines, cast iron and steel and forging
560 Non ferrous metals

Unprocessed minerals and processed minerals, building materials

610 Sand, gravel, clay, pumice stones and slag
620 Salt, iron pyrites, sulphur
630 Other stone, earth, macadam, chalk and minerals
640 Cement, lime
650 Plaster
690 Other manufactured building materials e.g.. concrete, bricks and tiles

Fertilisers

710 Natural fertilisers
720 Chemical fertilisers

Chemicals, Chemical products and paper pulp

811 Sulphuric acid, smoking sulphuric acid
812 Caustic soda and soda lye
813 Sodium carbonate, soda
814 Calcium carbide
819 Other basic chemicals
820 Aluminium oxides and hydroxides
831 Benzol
839 Pitch, mineral tar and other derivatives of unprocessed mineral chemical from carbon and natural gas
841 Paper pulp
842 Paper waste and waste products of paper
891 Plastic material, unprocessed
892 Dyeing, tanning and colouring material
893 Medical and pharmaceutical products, perfume and cleaning substances
894 Manufactured explosives, fireworks and other pyrotechnic products, sport ammunition
895 Starch and gluten
896 Other chemical products and preparations

Transport equipment, transport equipment, machinery

910 Transport equipment, transport equipment, assembled or in parts and parts for
920 Tractors, agricultural machinery and equipment, assembled or in parts and appurtenant parts
931 Electrical machinery, apparatus, equipment and appurtenant parts
939 Non-electric machinery, apparatus, tools and motors and appurtenant parts

Manufactured products and diverse products

941 Finished metal constructions and parts of metal constructions
949 Other manufactured products of metal
951 Glass
952 Glassware, ceramic and other mineral products
961 Leather, leather products, of raw hides and skin
962 Textile yarn, cloth, composite and other similar textile products
963 Bags, clothing, knitted and crochet products, footwear
971 Semi-finished products of rubber and rubber products
972 Paper and cardboard, unprocessed
973 Paper and cardboard products
974 Paper material
975 Furniture, new
976 Wooden and cork products, besides furniture
979 Other manufactured products
991 Empty packaging, packaging, used
992 Construction material, entertainment park vehicles and equipment, used
993 Removal equipment
994 Gold, coins, medals
999 Other manufactured products, not specified

The 81 commodity codes were re-arranged to the 34 groups according to the following table:

*Table A2 Couplings between CFS-2001 codes and 34 Swedish commodity groups **k** coordinated through NSTR*

CFS-code [2001]	**k**	NSTR	Comment
000	3	031	*Live animals. No observations*
010	1	010	
020	2	020	
030	2	020	
040	9	050	
051	5	041	
052	?	0	*Pit props. No observations*
055	31	045	NSTR:041 old number
056	6	042	
057	7	043	
060	4	032	
090	9	050	
100	10/11	060 / 070	This CFS product group is split into product group 060 and 070. Observations with a value less than 4100 SEK/ton are categorized as 070.
210	12	080	
220	12	080	
230	12	080	
310	13	090	
321	14	100	
323	14	100	
325	14	100	
327	14	100	
330	14	100	
341	14	100	
343	14	100	
349	14	100	
410	15	110	
450	16	120	
460	15	110	
510	17	130	
520	17	130	
530	17	130	
540	17	130	
550	17	130	
560	17	130	
610	19	151	
620	20	152	
630	20	152	
640	18	140	
650	18	140	
690	18	140	
710	21	160	
720	21	160	
811	23	180	
812	23	180	
813	23	180	
814	23	180	
819	23	180	
820	23	180	

*Table A2 (ctd) Couplings between CFS-2001 codes and 34 Swedish commodity groups **k** coordinated through NSTR*

CFS-code [2001]	**k**	NSTR	Comment
831	23	180	
839	23	180	
841	24	190	
842	24	190	
891	23	180	
892	23	180	
893	23	180	
894	23	180	
895	23	180	
896	23	180	
910	25	200	
920	32	201	NSTR:200 old number
931	32	201	NSTR:200 old number
939	32	201	NSTR:200 old number
941	26	210	
949	26	210	
951	27	220	
952	27	220	
961	29	232	
962	29	232	
963	29	232	
971	29	232	
972	28	231	
973	33	233	NSTR:231 old number
974	33	233	NSTR:231 old number
975	29	232	
976	29	232	
979	29	232	
991	34	250	NSTR:232 old number 1. NST/R 991 Emballasje fra sin gruppe 232 til 250 50
992	18	140	NSTR:232 old number 2. NST/R 992 Bygningsmateriell fra sin gruppe 232 til 140
993	29	232	
994	29	232	
999	29	232	

*Table A3 Couplings between CFS-2004/2005 codes and 34 Swedish commodity groups **k** coordinated through NSTR*

CFS-code [2004/05]	**k**	NSTR	Definitions from CFS 2004/05
10	1	10	Spannmål
11	5/31	41 / 45	Rundvirke[54]
12	2	20	Andra färska frukter och grönsaker
13	2	20	Levande växter och blommor
14	3	31	Levande djur
15	4	32	Fisk och fiskprodukter
16	11	70	Andra animaliska och vegetabiliska material.
20	12	80	Kol, brunkol och torv
21	13	90	Råolja
22	14	100	Naturgas
30	15	110	Järnmalm
31	16	120	Icke-järmmalm
32	21	160	Kemiska och naturliga gödningsmedel
33	19/20	151 / 152	Sand, grus, lera, sten jord salt samt övriga mineraler[55]
40	10	60	Beredda livsmedel, drycker och tobak
50	9	50	Textilier
51	9	50	Kläder och päls och läderprodukter
60	6/7	42 / 43	Produkter av trä och kork[56]
61	24	190	Pappersmassa
62	33	233	Papper och pappersprodukter
63	33	233	Trycksaker
70	12	80	Koks
71	14	100	Flytande raffinerade petroleumprodukter och spillolja
72	14	100	Gasformiga kolväte, vätska eller komprimerade
73	14	100	Fasta raffinerade petroleumprodukter
80	22	170	Läkemedel
81	23	180	Gummi- och plastprodukter
82	23	180	Övriga kemiska produkter ej gödningsmedel
90	27	220	Glas, glasvaror och keramik
91	18	140	Cement, kalk, gips
92	18	140	Övriga byggnadsmaterial
100	17	130	Tackjärn och råstål, järnlegeringar
101	17	130	Valsat stål, balkar, valstråd,stålplattor,plåtar,bandstål
102	26	210	Rör, rörledningar, järn och stålgjutningar och smide
103	17	130	Icke järnmetaller
104	26	210	Övriga metallprodukter
110	32	201	Jordbruks- och skogsmaskiner
111	32	201	Vitvaror
112	32	201	Kontorsmaskiner och datorer
113	32	201	Övriga elektriska maskiner och apparater
114	32	201	Elektronikkomponenter

[54] CFS product group 11 is split into NSTR product group 41 Timber for pulp and 45 Timber for sawmill respectively on the basis of the product values (> 300 SEK/ton ⇒ 45).
[55] CFS product group 33 is split into NSTR product group 151 Earth, sand and gravel and 152 Other crude and manufactured minerals respectively on the basis of the product values (> 100 SEK/ton ⇒ 152)
[56] CFS product group 60 is split into NSTR product group 42 Wood roughly squared or sawn lengthwise, sliced or peeled and 43 Wood chips and wood waste respectively on the basis of the product values (< 1500 SEK/ton ⇒ 43)

115	32	201	TV, video, radio, dvd och liknande
116	32	201	Medicinska, optiska och övriga precisionsinstrument samt klockor. Ifflöd
117	32	201	Övriga maskiner, maskindelar, vapen och vapendelar.
120	25	200	Produkter från fordonsindustrin
121	25	200	Övrig transportutrustning
130	29	232	Möbler och övriga tillverkade varor
140	34	250	Skrot och övrigt avfall
200	29	232	Andra produkter, inte specificerade efter sort

Appendix B. SNI92. 5-digit codes.

SNI92DetaljGrupp	SNI92 description
00000	Detailed group missing
01111	Growers of cereals etc.
01112	Cultivators of grass lands
01113	Growers of potatoes
01114	Growers of sugar beet
01115	Growers of cereals and other crops, mixed
01117	Growers of crops and market garden produce, mixed, mainly cereals and other crops
01119	Other growers of crops
01121	Growers of vegetables in the open
01122	Growers of nursery products etc. in the open
01123	Growers of vegetables under glass
01124	Growers of flowers and ornamental plants under glass
01125	Growers of vegetables, horticultural specialties and nursery products, mixed
01127	Growers of crops and market garden produce, mixed, mainly vegetables, horticultural specialties and nursery products
01129	Growers of mushrooms etc.
01131	Producers of fruit and berries
01137	Growers of crops and market garden produce, mixed, mainly fruit, berries, nuts etc.
01139	Growers of spice crops etc.; gatherers of berries
01211	Milk producers
01212	Beef producers
01213	Producers of milk and beef, mixed
01217	Farmers of animals, mixed, mainly cattle
01221	Sheep farmers
01222	Goat farmers
01223	Farmers of sheep and goats, mixed
01227	Farmers of animals, mixed, mainly sheep and goats
01228	Breeders of horses etc.
01231	Raisers of piglets
01232	Raisers of swine for slaughter
01233	Raisers of piglets and swine for slaughter, mixed
01237	Farmers of animals, mixed, mainly swine
01241	Egg producers
01242	Raisers of chicken for slaughter
01243	Farmers of poultry, mixed
01247	Farmers of animals, mixed, mainly poultry
01249	Other poultry farmers
01250	Reindeer keepers
01251	Raisers of fur animals
01252	Bee keepers, raisers of worms and other small animals
01253	Breeders of pet animals
01254	Raisers and breeders of other animals
01259	Mixed farming
01300	Mixed farming, mainly crops and market garden produce
01301	Mixed farming, mainly animals
01302	Companies for agricultural services
01410	Companies for animal husbandry services, except veterinary services
01420	Hunters and game propagators including related service companies
01500	Small-scale farmers
01900	Forest owners; producers of standing forest and standing timber
02010	Reafforestation and forest conservation companies
02011	Loggers
02012	Forest tree nurseries
02013	Other forestry companies
02014	Timber evaluation societies
02019	Other service companies related to forestry and logging
02021	Timber evaluation
02029	Other forestry and logging related service activities

05011	Sea water trawlers
05012	Other sea water fishermen
05013	Fresh water fishermen
05021	Fish farms
05022	Producers of fish fry
05023	Producers of crustaceans
05024	Producers of molluscs
05025	Growers of aquatic plants
10100	Coal mines
10200	Lignite mines
10301	Peat industry, for fertilization purposes
10302	Peat industry, for energy purposes
11100	Crude petroleum and natural gas extraction industry
11200	Service companies incidental to oil and gas extraction
12000	Uranium and thorium mines
13100	Iron ore mines
13200	Other metal ore mines
14110	Quarries of stone for construction
14120	Limestone, gypsum and chalk quarries
14130	Slate quarries
14210	Gravel and sand pits
14220	Clay and kaolin mines
14300	Mines of chemical and fertilizer minerals
14400	Salt industry
14500	Other mines and quarries n.e.c.
15111	Slaughterhouses
15112	Meat cutting industry
15120	Poultry meat industry
15130	Meat and poultry meat product industry
15200	Fish and fish product industry
15310	Potatoe processing industry
15320	Fruit and vegetable juice industry
15330	Fruit and vegetable processing industry n.e.c.
15410	Industry for crude oils and fats
15420	Industry for refined oils and fats
15430	Industry for margarine and similar edible fats
15511	Cheese industry
15512	Other dairy product industry
15520	Ice cream industry
15611	Grain mills
15612	Industry for breakfast cereals, blended flour mixes and other prepared grain mill products
15620	Starch industry
15710	Industry for prepared feeds for farm animals
15720	Industry for prepared pet foods
15810	Bakeries
15821	Crispbread industry
15822	Industry for biscuits and preserved pastry goods and cakes
15830	Sugar industry
15841	Industry for sugar confectionery
15842	Industry for cocoa and chocolate confectionery
15850	Industry for macaroni, noodles, couscous and similar farinaceous products
15860	Coffee and tea industry
15870	Industry for condiments and seasonings
15880	Industry for homogenised food preparations and dietetic food
15890	Industry for other food products n.e.c.
15910	Distilleries
15920	Industry for ethyl alcohol from fermented materials
15930	Wine industry
15940	Industry for cider and other fruit wines
15950	Industry for other non-distilled fermented beverages
15960	Breweries
15970	Malt industry
15980	Industry for mineral waters and soft drinks
16000	Tobacco industry

17110	Cotton-type fibre industry
17120	Woollen-type fibre industry
17130	Worsted-type fibre industry
17140	Flax-type fibre industry
17150	Silk-type fibre industry
17160	Industry for sewing threads
17170	Other textile fibre industry
17210	Cotton-type cloth mills
17220	Woollen-type cloth mills
17230	Worsted-type cloth mills
17240	Silk-type cloth mills
17250	Other cloth mills
17300	Textile finishing industry
17401	Curtain industry
17402	Industry for bed linen and other linen goods
17403	Industry for tarpaulins, tents, sails etc.
17510	Industry for carpets and rugs
17520	Industry for cordage, rope, twine and netting
17530	Industry for nonwovens and articles made from nonwovens, except apparel
17541	Industry for ribbon, trimmings and lace
17549	Industry for various other textiles n.e.c.
17600	Industry for knitted and crocheted fabrics
17710	Industry for knitted and crocheted hosiery
17720	Industry for knitted and crocheted pullovers, cardigans and similar articles
18100	Industry for leather clothes
18210	Industry for workwear
18221	Industry for other outerwear for men and boys
18222	Industry for other outerwear for women and girls
18231	Industry for shirts and other underwear for men and boys
18232	Industry for blouses and shirts for women and girls
18233	Industry for girdles, brassières, corsets etc.
18234	Industry for other underwear for women and girls
18240	Industry for other wearing apparel and accessories n.e.c.
18300	Fur industry
19100	Tanneries
19200	Industry for luggage, handbags, saddlery etc.
19300	Industry for footwear
20101	Saw-mills
20102	Planing-mills
20103	Wood impregnation plants
20201	Industry for veneer sheets, plywood and laminboard
20202	Industry for particle board
20203	Industry for fibreboard
20301	Industry for prefabricated wooden buildings
20302	Industry for other builders' carpentry and joinery
20400	Industry for wooden containers
20510	Industry for other products of wood
20520	Industry for articles of cork, straw, cane etc.
21111	Industry for mechanical or semi-chemical pulp
21112	Industry for sulphate pulp
21113	Industry for sulphite pulp
21121	Industry for newsprint
21122	Industry for other printing paper
21123	Industry for kraft paper and paperboard
21129	Industry for other paper and paperboard
21211	Industry for corrugated paper and paperboard and for containers of corrugated paperboard
21219	Industry for other containers of paper and paperboard
21220	Industry for household and sanitary goods and for toilet requisites
21230	Industry for paper stationery
21240	Wallpaper industry
21250	Industry for other articles of paper and paperboard n.e.c.
22110	Book publishers
22121	Publishers of daily newspapers
22122	Publishers of advertising newspapers

22130	Publishers of journals and periodicals
22140	Publishers of sound recordings
22150	Other publishers
22210	Printers of daily newspapers
22221	Printers of periodicals
22222	Book printers and other printers
22230	Bookbinding and finishing industry
22240	Composition and plate-making industry
22250	Other service establishments related to printing
22310	Industry for the reproduction of sound recording
22320	Industry for the reproduction of video recording
22330	Industry for the reproduction of computer media
23100	Industry for coke oven products
23200	Industry for refined petroleum products
23300	Industry for nuclear fuel
24110	Industry for industrial gases
24120	Industry for dyes and pigments
24130	Industry for other inorganic basic chemicals
24140	Industry for other organic basic chemicals
24150	Industry for fertilizers and nitrogen compounds
24160	Industry for plastics in primary forms
24170	Industry for synthetic rubber in primary forms
24200	Industry for pesticides and other agro-chemical products
24300	Paint industry
24410	Industry for basic pharmaceutical products
24420	Industry for pharmaceutical preparations
24510	Industry for soap and detergents, cleaning and polishing preparations
24520	Industry for perfumes and toilet preparations
24610	Industry for explosives
24620	Industry for glues and gelatines
24630	Industry for essential oils
24640	Industry for photographic chemical material
24650	Industry for prepared unrecorded media
24660	Industry for other chemical products n.e.c.
24700	Industry for man-made fibres
25110	Industry for rubber tyres and tubes
25120	Tyre retreading and rebuilding industry
25130	Industry for other rubber products
25210	Industry for plastic plates, sheets, tubes and profiles
25220	Industry for plastic packing goods
25230	Industry for builders' ware of plastic
25240	Industry for other plastic products
26110	Producers of flat glass
26120	Industry for the shaping and processing of flat glass
26131	Industry for bottles and glass containers
26132	Industry for other domestic glass wares
26140	Glass fibre industry
26150	Industry for other glass products
26210	Industry for ceramic household and ornamental articles
26220	Industry for ceramic sanitary fixtures
26230	Industry for ceramic insulators and insulating fittings
26240	Industry for other technical ceramic products
26250	Industry for other ceramic products
26260	Industry for refractory ceramic products
26300	Industry for ceramic tiles and flags
26400	Industry for bricks, tiles and construction products, in baked clay
26510	Cement industry
26520	Lime industry
26530	Plaster industry
26611	Industry for light concrete products
26619	Industry for other concrete products for construction purposes
26620	Industry for plaster products for construction purposes
26630	Industry for ready-mixed concrete
26640	Industry for mortars

26650	Industry for fibre cement
26660	Industry for other articles of concrete, plaster and cement
26701	Industry for stone products for construction purposes
26709	Other stone product industry
26810	Industry for abrasive products
26821	Industry for stone and mineral wool products
26829	Industry for various other non-metallic mineral products n.e.c.
27100	Iron and steel mills
27210	Industry for cast iron tubes
27221	Industry for welded steel tubes
27222	Industry for seamless steel tubes
27310	Cold drawing mills
27320	Cold rolling mills for narrow strips
27330	Cold forming mills
27340	Wire drawing mills
27350	Industry for other first processing of iron and steel n.e.c. and for non-ECSC ferro-alloys
27410	Precious metals mills
27420	Aluminium mills
27430	Lead, zinc and tin mills
27440	Copper mills
27450	Other metal mills
27510	Iron foundries
27520	Steel foundries
27530	Light metal foundries
27540	Other metal foundries
28110	Industry for metal structures and parts of structures
28120	Industry for builders' carpentry and joinery of metal
28210	Industry for tanks, reservoirs and containers of metal
28220	Industry for central heating radiators and boilers
28300	Industry for steam generators, except central heating hot water boilers
28400	Industry for forging, pressing, stamping and roll forming of metal; industry for powder metallurgy
28510	Industry for the treatment and coating of metals
28520	Workshops for general mechanical engineering
28610	Cutlery industry
28621	Industry for shaping tools
28622	Industry for cutting tools
28629	Industry for other tools
28630	Industry for locks and hinges
28710	Industry for steel drums and similar containers
28720	Industry for light metal packaging
28730	Industry for wire products
28740	Industry for fasteners, screw machine products, chain and springs
28751	Industry for sinks, sanitary ware etc. of metal for construction purposes
28759	Industry for various other fabricated metal products n.e.c.
29110	Industry for engines and turbines, except aircraft, vehicle and cycle engines
29120	Industry for pumps and compressors
29130	Industry for taps and valves
29140	Industry for bearings, gears, gearing and driving elements
29210	Industry for furnaces and furnace burners
29220	Industry for lifting and handling equipment
29230	Industry for non-domestic cooling and ventilation equipment
29240	Industry for other general purpose machinery n.e.c.
29310	Industry for agricultural tractors
29320	Industry for other agricultural and forestry machinery
29401	Industry for machine-tools for wood processing
29402	Industry for welding and soldering machines
29409	Industry for other machine-tools
29510	Industry for machinery for metallurgy
29520	Industry for machinery for mining, quarrying and construction
29530	Industry for machinery for food, beverage and tobacco processing
29540	Industry for machinery for textile, apparel and leather production
29550	Industry for machinery for paper and paperboard production
29561	Industry for machinery for plastic and rubber processing
29569	Industry for various other special purpose machinery n.e.c.

29600	Industry for weapons and ammunition
29711	Industry for refrigerators, freezers, washing machines and dishwashers
29719	Industry for other electric domestic appliances
29720	Industry for non-electric domestic appliances
30010	Industry for office machinery
30020	Industry for computers and other information processing equipment
31100	Industry for electric motors, generators and transformers
31200	Industry for electricity distribution and control apparatus
31300	Industry for insulated wire and cable
31400	Industry for accumulators, primary cells and primary batteries
31501	Industry for lamps and lighting fittings
31502	Industry for light bulbs and fluorescent tubes
31610	Industry for electrical equipment for engines and vehicles n.e.c.
31620	Industry for other electrical equipment n.e.c.
32100	Industry for electronic valves and tubes and other electronic components
32200	Industry for television and radio transmitters and apparatus for line telephony and line telegraphy
32300	Industry for television and radio receivers, sound or video recording or reproducing apparatus and associated goods
33101	Industry for medical and surgical equipment
33102	Dental technicians' workshops
33200	Industry for instruments and appliances for measuring, checking, testing, navigating and other purposes, except industrial process control equipment
33300	Industry for industrial process control equipment
33400	Industry for optical instruments and photographic equipment
33500	Industry for watches and clocks
34100	Industry for motor vehicles
34200	Industry for bodies (coachwork) for motor vehicles; industry for trailers and semi-trailers
34300	Industry for parts and accessories for motor vehicles and their engines
35110	Shipyards
35120	Builders of pleasure boats
35200	Industry for locomotives and rolling stock
35300	Aircraft industry
35410	Motorcycle industry
35420	Bicycle industry
35430	Industry for invalid carriages
35500	Industry for other transport equipment n.e.c.
36110	Industry for chairs and seats
36120	Industry for other office and shop furniture
36130	Industry for other kitchen furniture
36140	Other furniture industry
36150	Industry for mattresses
36210	Industry for coins and medals
36220	Industry for jewellery and related articles n.e.c.
36300	Industry for musical instruments
36400	Industry for sports goods
36500	Industry for games and toys
36610	Industry for imitation jewellery
36620	Industry for brooms and brushes
36630	Other manufacturing industry n.e.c.
37100	Industry for recycling metal waste and scrap
37200	Industry for recycling non-metal waste and scrap
40100	Electric power works
40200	Gas works; distribution of gaseous fuels through mains
40300	Steam and hot water works
41000	Water works
45110	Building demolition and earth moving contractors
45120	Test drilling and boring contractors
45211	Contractors for the general construction of buildings
45212	Contractors for the general construction of civil engineering works
45221	Contractors for sheet-metal roof covering
45229	Contractors for other roof covering and frame erection
45230	Contractors for the construction of highways, roads, airfields and sport facilities
45240	Contractors for the construction of water projects
45250	Other building and civil engineering contractors

45310	Electrical installation contractors
45320	Contractors for insulation work
45331	Contractors for heating and sanitary equipment installation
45332	Contractors for ventilation equipment installation
45333	Contractors for refrigeration and freezing equipment installation
45339	Other plumbing contractors
45340	Other building installation contractors
45410	Plastering contractors
45420	Joinery installation contractors
45430	Floor and wall covering contractors
45441	Painting contractors
45442	Glazing contractors
45450	Other building completion contractors
45500	Companies for renting construction or demolition equipment with operator
50101	Sales establishments for lorries, buses and specialized motor vehicles
50102	Sales establishments for passenger motor vehicles
50103	Sales establishments for caravans and motorhomes
50201	Non-specialized maintenance and repair garages for motor vehicles
50202	Garages for bodywork repair and painting of motor vehicles
50203	Garages for the installation and repair of electrical and electronic motor vehicle equipment
50204	Tyre service garages
50301	Wholesale establishments for motor vehicle parts and accessories
50302	Retail sale establishments for motor vehicle parts and accessories
50400	Sales and repair establishments for motorcycles and related parts and accessories
50500	Petrol stations
51110	Agents involved in the sale of agricultural raw materials, live animals, textile raw materials and semi-finished goods
51120	Agents involved in the sale of fuels, ores, metals and industrial chemicals
51130	Agents involved in the sale of timber and building materials
51141	Agents involved in the sale of machinery, industrial equipment, ships and aircraft, except office machinery and computer equipment
51142	Agents involved in the sale of office machinery and computer equipment
51150	Agents involved in the sale of furniture, household goods, hardware and ironmongery
51160	Agents involved in the sale of textiles, clothing, footwear and leather goods
51170	Agents involved in the sale of food, beverages and tobacco
51180	Agents specializing in the sale of particular products or ranges of products n.e.c.
51190	Agents involved in the sale of a variety of goods
51210	Wholesale of grain, seeds and animal feeds
51220	Wholesale of flowers and plants
51230	Wholesale of live animals
51240	Wholesale of hides, skins and leather
51250	Wholesale of unmanufactured tobacco
51310	Wholesale of fruit and vegetables
51320	Wholesale of meat and meat products
51330	Wholesale of dairy produce, eggs and edible oils and fats
51340	Wholesale of alcoholic and other beverages
51350	Wholesale of tobacco products
51360	Wholesale of sugar and chocolate and sugar confectionery
51370	Wholesale of coffee, tea, cocoa and spices
51380	Wholesale of other food including fish, crustaceans and molluscs
51390	Non-specialized wholesale of food, beverages and tobacco
51410	Wholesale of textiles
51420	Wholesale of clothing and footwear
51431	Wholesale of household appliances
51432	Wholesale of radio and television goods
51433	Wholesale of gramophone records, tapes, CDs and video tapes
51434	Wholesale of electrical and lighting equipment
51440	Wholesale of china and glassware, wallpaper and cleaning materials
51450	Wholesale of perfume and cosmetics
51460	Wholesale of pharmaceutical goods
51471	Wholesale of furniture and interior fittings
51472	Wholesale of sports and leisure goods
51473	Wholesale of stationery and other office supplies
51479	Wholesale of household goods n.e.c.

51510	Wholesale of solid, liquid and gaseous fuels and related products
51520	Wholesale of metals and metal ores
51530	Wholesale of wood, construction materials and sanitary equipment
51541	Wholesale of hardware
51542	Wholesale of plumbing and heating equipment
51550	Wholesale of chemical products
51561	Wholesale of industry supplies
51562	Wholesale of packaging materials
51569	Wholesale of intermediate products n.e.c.
51570	Wholesale of waste and scrap
51610	Wholesale of machine-tools
51620	Wholesale of construction machinery
51630	Wholesale of machinery for the textile industry, and of sewing and knitting machines
51640	Wholesale of office machinery and equipment
51651	Wholesale of measuring and precision instruments
51652	Wholesale of computerized materials handling equipment
51653	Wholesale of telecommunication equipment and electronic components
51659	Wholesale of machinery for industry, trade and navigation n.e.c.
51660	Wholesale of agricultural machinery and accessories and implements, including tractors
51700	Other wholesale
52111	Department stores and the like with food, beverages and tobacco predominating
52112	Other non-specialized stores with food, beverages and tobacco predominating
52121	Other department stores and the like
52129	Non-specialized stores n.e.c.
52210	Greengroceries
52220	Butcher's shops
52230	Fish-shops
52241	Bread and cake shops
52242	Sugar confectionery shops
52250	Liquor stores
52260	Tobacconist's shops
52271	Health food shops
52279	Specialized stores for food n.e.c.
52310	Dispensing chemists
52320	Shops for medical and orthopaedic goods
52330	Shops for cosmetic and toilet articles
52410	Textile stores
52421	Stores for men's, women's and children's clothing, mixed
52422	Stores for men's clothing
52423	Stores for women's clothing
52424	Stores for children's clothing
52425	Furrier's shops
52431	Shoe stores
52432	Leather goods stores
52441	Stores for furniture, carpets and rugs
52442	Stores for home furnishing textiles
52443	Stores for glassware, china and kitchenware
52444	Stores for electrical fittings
52451	Stores for electrical household appliances
52452	Radio and television stores
52453	Stores for records and video tapes
52454	Stores for musical instruments and music scores
52461	Stores for hardware, plumbing and building materials
52462	Paint stores
52471	Stores for books and stationery
52472	Stores for newspapers and magazines
52481	Opticians
52482	Stores for photographic equipment and related services
52483	Stores for watches and clocks
52484	Stores for jewellery, gold wares and silverware
52485	Stores for sports and leisure goods
52486	Toy stores
52487	Florist's shops
52488	Pet shops

52491	Art dealers and galleries
52492	Coins and stamps shops
52493	Stores for computers, office machinery and computer programmes
52494	Stores for telecommunication equipment
52495	Stores for wallpaper and floor coverings
52496	Stores for boats and boating accessories
52499	Specialized stores n.e.c.
52501	Antiques shops and second-hand book stores
52509	Stores for other second-hand goods
52611	Non-specialized mail order houses
52612	Mail order houses for textiles and clothing
52613	Mail order houses for sports and leisure goods
52614	Mail order houses for books and other media goods
52615	Mail order houses for household goods
52619	Other mail order houses
52621	Food stalls and market stands
52629	Other stalls and market stands
52631	Retail sale on commission
52632	Ambulatory and occasional retail sale of food
52633	Ambulatory and occasional retail sale of other goods
52639	Non-store retail sale n.e.c.
52710	Repair shops for boots, shoes and other articles of leather
52720	Repair shops for electrical household goods
52730	Repair shops for watches, clocks and jewellery
52740	Repair shops n.e.c.
55111	Hotels with restaurant, except conference centres
55112	Conference centres, with lodging
55120	Hotels and motels, without restaurant
55210	Youth hostels etc.
55220	Camping sites etc.
55230	Other short-stay lodging facilities
55300	Restaurants
55400	Bars
55510	Canteens
55521	Catering establishments for the transport sector
55522	Catering establishments for hospitals
55523	Catering establishments for schools, wellfare and other institutions
55529	Other catering establishments
60100	Railway companies
60211	Urban or suburban transport companies
60212	Interurban coach companies
60220	Taxi companies
60230	Other land passenger transport companies
60240	Road haulage companies
60300	Pipeline transport companies
61101	Ferry companies
61102	Other sea and coastal water shipping companies
61200	Inland water shipping companies
62100	Scheduled air transport companies
62200	Non-scheduled air transport companies
62300	Space transport companies
63110	Cargo handling companies
63120	Storage and warehousing companies
63210	Other service companies supporting land transport
63220	Other service companies supporting water transport
63230	Other service companies supporting air transport
63301	Tour operators
63302	Travel agencies
63303	Tourist assistance agencies
63400	Forwarding agents, haulage terminals, shipping agents etc.
64110	The General Post Office
64120	Other post and courier companies
64201	Network stations
64202	Broadcasting stations

64203	Cable television companies
65110	The Central Bank
65120	Other banks
65210	Financial leasing companies
65220	Other credit companies
65231	Investment trusts
65232	Unit trusts
66011	Unit link insurance companies
66012	Other life insurance companies
66020	Pension funds
66030	Non-life insurance companies
67110	Companies for the administration of financial markets
67120	Security brokers etc.
67130	Service companies auxiliary to financial intermediation n.e.c.
67201	Insurance brokers
67202	Other service companies auxiliary to insurance and pension funding
70110	Companies for the development and selling of real estate
70120	Companies for buying and selling own real estate
70201	Companies for letting dwellings
70202	Companies for letting industrial premises
70203	Companies for letting other premises
70204	Tenant-owners' associations
70209	Companies for letting other property
70310	Real estate agencies
70321	Management departments of national cooperative building societies
70329	Other companies for real estate management on a fee or contract basis
71100	Automobile renting companies
71210	Companies for renting other land transport equipment
71220	Companies for renting water transport equipment
71230	Companies for renting air transport equipment
71310	Companies for renting agricultural machinery and equipment
71320	Companies for renting construction and civil engineering machinery and equipment
71330	Companies for renting office machinery and equipment including computers
71340	Companies for renting other machinery and equipment n.e.c.
71401	Video film renting companies
71402	Companies for renting other personal and household goods n.e.c.
72100	Hardware consultancy companies
72201	Software consultancy companies
72202	Software supply companies
72300	Data processing companies
72400	Data base companies
72500	Repair shops for office, accounting and computing machinery
72600	Other data service companies
73101	Institutes for research and development on natural sciences
73102	Institutes for research and development on engineering and technology
73103	Institutes for research and development on medical sciences
73104	Institutes for research and development on agricultural sciences
73105	Institutes for interdisciplinary research and development, predominantly on natural sciences and engineering
73201	Institutes for research and development on social sciences
73202	Institutes for research and development on humanities
73203	Institutes for interdisciplinary research and development, predominantly on social sciences and humanities
74111	Solicitor's firms etc.
74112	Patent and copyright agencies etc.
74120	Firms of accountants, auditors etc.
74130	Market research and public opinion polling companies
74140	Business and management consultancy companies
74150	Holding companies
74201	Architects offices
74202	Construction and other engineering consultancy companies
74300	Companies for technical testing and analysis
74401	Advertising agencies
74402	Advertisment placement agencies

74403	Companies for advertising material delivery
74409	Other advertising and marketing companies
74500	Labour and personnel recruitment offices
74600	Investigation and security service companies
74701	Cleaning companies
74702	Disinfecting and exterminating service companies
74703	Chimney sweeps
74811	Portrait photographers
74812	Advertising photographers
74813	Press and other photographers
74814	Photographic laboratories
74820	Packaging companies
74830	Secretarial and translation service companies
74841	Graphical design firms
74842	Other designers
74843	Debt collecting and credit rating agencies
74844	Companies for exhibition, trade fair, congress and day conference activities
74849	Various other business service companies
75111	Executive and legislative authorities of central and local government
75112	Inspecting, controlling and licensing authorities of central and local government
75113	Fiscal authorities
75114	Public information agencies
75121	Agencies for the administration of primary and secondary education
75122	Agencies for the administration of higher education and research
75123	Agencies for the administration of health care
75124	Agencies for the administration of social welfare
75125	Agencies for the administration of culture, environment, housing etc. programmes
75131	Agencies for the administration of infrastructure programmes
75132	Agencies for the administration of programmes relating to agriculture, forestry and fishing
75133	Agencies for the administration of labour market programmes
75134	Agencies for the administration of other business, industry and trade programmes
75140	Supporting service agencies for the government as a whole
75211	Foreign affairs authorities
75212	Foreign aid authorities
75221	Military operative command authorities
75222	The Army
75223	The Navy
75224	The Air Force
75225	Military support authorities
75226	Civil defence authorities and organizations
75231	Public prosecution authorities
75232	Law courts
75233	Prisons
75240	Police authorities
75250	Fire-brigades
75300	Social security offices
80100	Primary education establishments
80210	General secondary education establishments
80220	Technical and vocational secondary education establishments
80301	Higher education establishments for technical occupations
80302	Higher education establishments for occupations in administration, economics and social work
80303	Higher education establishments for teaching occupations
80304	Higher education establishments for health occupations
80305	Higher education establishments for occupations in the field of humanities and information
80309	Establishments of other higher education
80410	Driving schools
80421	Municipal adult education establishments
80422	Labour market training establishments
80423	Folk high schools
80424	Adult education associations
80425	Staff training establishments
80426	Municipal music schools
80427	Educational service establishments
80429	Other education establishments

85110	Hospitals
85120	Medical practices
85130	Dental practices
85140	Other health establishments
85200	Veterinary clinics
85311	Service homes and homes for the aged
85312	Homes for the mentally handicapped
85313	Other establishments for institutional care
85314	Refugee camps
85315	Hostels
85321	Pre-primary schools
85322	Other child day care establishments
85323	Day care establishments for the aged and handicapped
85324	Welfare and counselling centres
85325	Humanitarian relief organisations
90001	Sewage plants
90002	Establishments for the collection and sorting of non-hazardous waste
90003	Plants for composting and anaerobic digestion of non-hazardous waste
90004	Depots for non-hazardous waste
90005	Establishments for handling and interim storage of hazardous waste
90006	Treatment plants and final depots of hazardous waste
90007	Other refuse disposal plants
90008	Street cleaning and other sanitation establishments
91111	Business organizations
91112	Employers organizations
91120	Professional organizations
91200	Trade unions
91310	Religious congregations
91320	Political organizations
91330	Other membership organizations n.e.c.
92110	Motion picture and video production companies
92120	Motion picture and video distribution companies
92130	Motion picture projection companies
92200	Radio and television companies
92310	Performing artists and producers of artistic and literary works
92320	Theatre and concert hall companies etc.
92330	Fairs and amusement parks
92340	Dancing and other entertainment establishments
92400	News agencies
92511	Public libraries
92512	Research and specialist libraries
92513	Archives
92520	Museums and institutions for the preservation of historical sites and buildings
92530	Botanical and zoological gardens and nature reserves
92611	Ski facilities
92612	Golf courses
92613	Motor racing tracks
92614	Horse race tracks
92615	Arenas, stadiums and other sports facilities
92621	Sportsmen and sports clubs
92622	Horse racing stables
92623	Sports schools, boat clubs etc.
92624	Sports events organizers
92625	Sports activities administrators
92710	Gambling and betting companies
92721	Riding schools and stables
92722	Recreational fishing waters facilities
92729	Various other recreational establishments
93011	Laundries and drycleaning establishments for businesses and institutions
93012	Laundries and drycleaning establishments for households
93021	Haidressers
93022	Beauty parlours
93030	Undertakers etc.
93040	Physical well-being establishments

93050	Other service establishments n.e.c.
95000	Private households with employed persons
99000	Extra-territorial organizations and bodies

Appendix C. Key SNI92 to NSTR

The table gives the proportion of outputs in each SNI category that can be allocated to the 34 commodity groups (with their associated NSTR classifications). The proportions are based on the Foreign Trade Statistics, using the actual distribution of KN products, which are linked to both NSTR and SNI-products.

Each data item in the FTS is allocated to a matrix of SNI-product by NSTR-product (the latter is based on an equivalence key between the KN code and the NSTR code as explained in section 3.5, footnote 14). From this matrix the fraction of each SNI-product going into an NSTR-product is constructed by dividing each cell-value by the corresponding row sum.

Note that of the 57 SNI sectors, only 29 are included here. With some minor exceptions, the omitted sectors relate to **services** (see discussion in §5.3.2).

The key can be derived separately for Import (M) and Export (X), but the table shows the average for X and M. This is considered to be the most suitable key for **domestic** flows.

Key SNI92 to NSTR (average of all observations, separate combined? keys for X and M)												
Sum of shares	NSTR											
	10	20	31	32	41	42	43	44	45	50	60	70
	k											
SNI92	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**31**	**9**	**10**	**11**
1	0.1994	0.4482	0.0167							0.1626	0.1309	0.0422
2					0.9063		0.0097	0.0001	0.0516	0.0218		
5		0.0034								0.0010	0.9950	
10												
11												
13												
14												
15	0.0076	0.0224		0.0429						0.0273	0.8433	0.0292
16											1.0000	
17										0.0045		0.0003
18										0.0042		
19										0.0006		
20						0.6228	0.0239	0.0022	0.0000			
21												
22												
23												
24								0.0004		0.0090	0.0029	0.0055
25										0.0003		
26												
27												
28												
29												
30												
31												
32												

33												
34												
35												
36												
Totalt	0.2070	0.4740	0.0167	0.0429	0.9063	0.6228	0.0336	0.0026	0.0516	0.2314	2.9721	0.0772

Key SNI92 to NSTR (average of all observations, separate keys for X and M)												
Sum of shares	NSTR											
	80	90	100	110	120	130	140	151	152	160	170	180
	k											
SNI92	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**	**22**	**23**
1												
2												
5												
10	1.0000											
11		0.9605	0.0395						0.0000			
13				0.5173	0.4827							
14								0.1415	0.8431	0.0154		
15												0.0272
16												
17												
18												
19												
20							0.2814					
21												0.0014
22												
23	0.0107		0.9342			0.0154					0.0014	
24			0.0040	0.0000					0.0000	0.0113	0.0113	0.9219
25							0.0207					0.3163
26							0.2875		0.0092			0.0106
27				0.0240	0.0607	0.8957						0.0050
28						0.1091	0.0191					
29												0.0080
30												
31												0.0061
32												
33												
34												
35												
36									0.0079			0.0001
Totalt	1.0107	0.9605	0.9777	0.5414	0.5434	1.0202	0.6088	0.1415	0.8602	0.0267	0.0126	1.2966

Key SNI92 to NSTR (average of all observations, separate keys for X and M)											
Sum of shares	NSTR										
	190	200	201	210	220	231	232	233	240	250	Totalt
	k										
SNI92	**24**	**25**	**32**	**26**	**27**	**28**	**29**	**33**	**30**	**34**	
1											1
2							0.0106				1
5					0.0006						1
10											1
11											1
13											1
14											1
15											1
16											1
17							0.9941			0.0012	1
18							0.9958				1
19				0.2042			0.7952				1
20							0.0515			0.0182	1
21	0.1915					0.6749	0.0002	0.1321			1
22			0.0082				0.6013	0.3904			1
23			0.0383								1
24					0.0006		0.0330				1
25			0.0052	0.0021			0.5448			0.1105	1
26			0.0168	0.0052	0.5075		0.1632				1
27									0.0147		1
28			0.0147	0.8361			0.0209				1
29		0.0038	0.9816	0.0055			0.0011				1
30			0.9658				0.0342				1
31			0.9307	0.0616			0.0016				1
32			0.9833				0.0167				1
33			0.6894				0.3106				1
34		0.8680	0.1320								1
35		0.5872	0.4128								1
36			0.0222		0.0003		0.9693		0.0001		1
Totalt	0.1915	1.4590	5.2011	1.1148	0.5090	0.6749	5.5442	0.5225	0.0148	0.1299	29

Appendix D(a). Supply table at basic prices.

The table below holds 57 product groups / sectors used from SCB [2004a].
Reference
SCB (2004a): *Table 7: Supply table at basic prices, including a transformation into purchasers' prices.* Data concerning the year 2001 in the file: SupplyAndUseTables19952001.xls.

This data is used as one component to derive production of different product groups, allocated regionally and per product group. The data is given as mill NAC, i e millions of national currency [SEK]. The total used per product group / sector is taken from row number 61.

		INDUSTRIES (NACE)	Agriculture, hunting and related service activities	Forestry, logging and related service activities		Private households with employed persons	Total	Imports cif	Total supply at basic prices	Trade and transport margins	Taxes less subsidies on products	Total supply at purchasers' prices
	Code	PRODUCTS (CPA)	01	02	....	95						
No			1	2		57	58	59	60	61	62	63
1	01	Products of agriculture, hunting and related services	37 674	0		0	39 169	12 746	51 915	13 338	- 1 019	64 234
2	02	Products of forestry, logging and related services	0	27 311		0	27 789	3 941	31 730	152	56	31 938
3	05	Fish and other fishing products; services incidental of fishing	0	0		0	1 330	2 616	3 946	1 182	180	5 308
4	10	Coal and lignite; peat	164	0		0	1 201	1 836	3 037	248	316	3 601
5	11	Crude petroleum and natural gas; services incidental to oil and gas extraction excluding surveying	0	0		0	51	37 972	38 023	0	0	38 023
6	12	Uranium and thorium ores	0	0		0	0	8	8	0	0	8

7	13	Metal ores	0	0		0	7 099	2 273	9 372	641	0	10 013
8	14	Other mining and quarrying products	0	0		0	5 785	2 372	8 157	3 252	432	11 841
9	15	Food products and beverages	0	0		0	113 101	36 500	149 601	44 568	29 171	223 340
10	16	Tobacco products	0	0		0	2 554	848	3 402	3 114	11 613	18 129
11	17	Textiles	0	0		0	9 017	13 307	22 324	8 435	4 334	35 093
12	18	Wearing apparel; furs	0	0		0	2 534	18 054	20 588	19 034	8 922	48 544
13	19	Leather and leather products	0	0		0	1 566	5 986	7 552	4 698	2 412	14 662
14	20	Wood and products of wood and cork (except furniture); articles of straw and plaiting materials	0	683		0	62 388	6 951	69 339	5 066	1 116	75 521
15	21	Pulp, paper and paper products	0	0		0	105 700	11 041	116 741	12 788	1 936	131 465
16	22	Printed matter and recorded media	0	0		0	64 969	7 210	72 179	7 377	5 221	84 777
17	23	Coke, refined petroleum products and nuclear fuels	0	0		0	46 777	20 310	67 087	13 994	51 052	132 133
18	24	Chemicals, chemical products and man-made fibres	0	0		0	95 706	70 002	165 708	24 486	4 627	194 821
19	25	Rubber and plastic products	0	0		0	33 751	21 087	54 838	5 126	1 542	61 506
20	26	Other non-metallic mineral products	0	0		0	22 681	9 105	31 786	5 869	1 279	38 934
21	27	Basic metals	0	0		0	77 772	39 718	117 490	13 402	165	131 057
22	28	Fabricated metal products, except machinery and equipment	0	0		0	87 257	19 387	106 644	9 496	1 807	117 947
23	29	Machinery and equipment n.e.c.	0	0		0	145 899	68 902	214 801	30 704	3 368	248 873
24	30	Office machinery and computers	0	0		0	7 414	31 526	38 940	8 511	2 790	50 241
25	31	Electrical machinery and apparatus n.e.c.	0	0		0	42 886	33 254	76 140	8 544	1 697	86 381
26	32	Radio, television and communication equipment and apparatus	0	0		0	132 589	53 742	186 331	8 754	3 504	198 589
27	33	Medical, precision and optical instruments, watches and clocks	0	0		0	37 952	24 942	62 894	8 067	4 000	74 961
28	34	Motor vehicles, trailers and semi-trailers	0	0		0	160 324	65 823	226 147	23 327	11 076	260 550

29	35	Other transport equipment	0	0		0	29 966	20 158	50 124	2 026	2 596	54 746
30	36	Furniture; other manufactured goods n.e.c.	0	0		0	31 026	18 039	49 065	16 141	7 877	73 083
31	37	Secondary raw materials	0	0		0	3 530	0	3 530	49	0	3 579
32	40	Electrical energy, gas, steam and hot water	0	0		0	75 108	1 069	76 177	0	26 893	103 070
33	41	Collected and purified water, distribution services of water	0	0		0	10 260	0	10 260	0	1 619	11 879
34	45	Construction work	310	0		0	176 343	0	176 343	0	25 522	201 865
35	50-52	Trade, maintenance and repair services of motor vehicles and motorcycles; retail sale of automotive fuel. Wholesale trade and commission trade services. Retail trade services, repair services of personal and household goods.	0	0		0	364 429	5 103	369 532	- 306 424	4 005	67 113
36	55	Hotel and restaurant services	75	0		0	77 655	1 523	79 178	0	11 665	90 843
37	60	Land transport; transport via pipeline services	195	0		0	122 192	1 418	123 610	0	- 5 817	117 793
38	61	Water transport services	0	0		0	30 286	8 101	38 387	0	9	38 396
39	62	Air transport services	0	0		0	24 689	9 825	34 514	0	158	34 672
40	63	Supporting and auxiliary transport services; travel agency services	0	0		0	103 425	8 344	111 769	0	1 023	112 792
41	64	Post and telecommunication services	0	0		0	96 858	7 277	104 135	0	10 706	114 841
42	65	Financial intermediation services, except insurance and pension funding services	0	0		0	80 437	5 782	86 219	0	2 778	88 997
43	66	Insurance and pension funding services, except compulsory social security services	0	0		0	28 265	2 400	30 665	0	69	30 734
44	67	Services auxiliary to financial intermediation	0	0		0	9 149	305	9 454	0	0	9 454
45	70	Real estate services	0	0		0	379 887	64	379 951	0	11 833	391 784

46	71	Renting services of machinery and equipment without operator and of personal and household goods	118	36		0	40 327	2 494	42 821	0	1 704	44 525
47	72	Computer and related services	2	0		0	126 523	10 168	136 691	2 533	4 356	143 580
48	73	Research and development services	0	0		0	50 644	16 288	66 932	0	185	67 117
49	74	Other business services	0	0		0	323 623	84 876	408 499	0	13 874	422 373
50	75	Public administration and defence services; compulsory social security services	0	0		0	178 951	41	178 992	0	0	178 992
51	80	Education services	0	0		0	158 252	0	158 252	0	740	158 992
52	85	Health and social work services	0	0		0	288 677	0	288 677	0	170	288 847
53	90	Sewage and refuse disposal services, sanitation and similar services	750	0		0	15 603	100	15 703	0	3 035	18 738
54	91	Membership organisation services n.e.c.	0	0		0	44 050	0	44 050	0	0	44 050
55	92	Recreational, cultural and sporting services	105	0		0	71 889	1 959	73 848	1 502	5 771	81 121
56	93	Other services	0	0		0	14 812	0	14 812	0	2 693	17 505
57	95	Private households with employed persons	0	0		298	298	0	298	0	0	298
58		Total	39 393	28 030	....	298	4 292 415	826 793	5 119 208	0	285 061	5 404 269
59		Cif/ fob adjustments on imports						- 2 270	- 2 270			- 2 270
60		Direct purchases abroad by residents						72 553	72 553			72 553
61		Total	39 393	28 030		298	4 292 415	897 076	5 189 491	0	285 061	5 474 552
62		Total of which:										
63		- Market output	38 435	27 372		298	3 451 678					
64		- Output for own final use	958	658		0	174 138					
65		- Other non-market output	0	0		0	666 599					

SupplyAndUseTables19952001.xls

Below is the full matrix for supply, *sup01*, is displayed in the form of an enhanced metafile. Details can only be seen by zooming in.

Table 7: Supply table at basic prices, including a transformation into purchasers' prices

Year 2001 — Sweden — Mill. NAC — current prices

OUTPUT OF INDUSTRIES (NACE)

No	Code	INDUSTRIES (NACE) / PRODUCTS (CPA)	Agriculture, hunting and related service activities	Forestry, logging and related service activities	Fishing, operating of fish hatcheries and fish farms; service activities incidental to fishing	Mining of coal and lignite; extraction of peat	Extraction of crude petroleum and natural gas; service activities incidental to oil and gas extraction excluding surveying	Mining of uranium and thorium ores	Mining of metal ores	Other mining and quarrying	Manufacture of food products and beverages	Manufacture of tobacco products	Manufacture of textiles	Manufacture of wearing apparel; dressing and dyeing of fur	Tanning and dressing of leather; manufacture of luggage, handbags, saddlery, harness and footwear	Manufacture of wood and of products of wood and cork, except furniture; manufacture of articles of straw and plaiting materials	Manufacture of pulp, paper and paper products	Publishing, printing and reproduction of recorded media	Manufacture of coke, refined petroleum products and nuclear fuels	Manufacture of chemicals and chemical products	Manufacture of rubber and plastic products	Manufacture of other non-metallic mineral products	Manufacture of basic metals
	Code		01	02	05	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27
No			1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
1	01	Products of agriculture, hunting	37 674	0	0	2	0	0	0	0	72	0	0	0	0	7	0	0	0	0	0	0	0
2	02	Products of forestry, logging an	0	27 311	0	0	0	0	0	0	0	0	0	0	0	163	0	0	0	0	0	0	0
3	05	Fish and other fishing products;	0	0	1 320	0	0	0	0	0	10	0	0	0	0	0	0	0	0	0	0	0	0
4	10	Coal and lignite; peat	164	0	0	1 008	0	0	0	0	0	0	0	0	0	29	0	0	0	0	0	0	0
5	11	Crude petroleum and natural ga	0	0	0	51	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6	12	Uranium and thorium ores	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7	13	Metal ores	0	0	0	0	0	0	7 099	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8	14	Other mining and quarrying pro	0	0	0	8	0	0	0	3 942	0	0	0	0	0	0	0	0	0	3	0	547	4
9	15	Food products and beverages	0	0	0	0	0	0	0	0	112 614	0	0	0	0	0	29	0	0	313	0	0	0
10	16	Tobacco products	0	0	0	0	0	0	0	0	0	2 554	0	0	0	0	0	0	0	0	0	0	0
11	17	Textiles	0	0	0	0	0	0	0	0	0	0	8 685	50	7	0	3	0	0	0	5	0	0
12	18	Wearing apparel; furs	0	0	0	0	0	0	0	0	0	0	84	2 420	4	0	0	0	0	0	0	0	0
13	19	Leather and leather products	0	0	0	0	0	0	0	0	0	0	50	0	1 509	0	0	0	0	0	0	0	0
14	20	Wood and products of wood an	0	683	0	2	0	0	0	0	0	0	0	0	0	61 412	57	0	0	17	4	0	0
15	21	Pulp, paper and paper products	0	0	0	0	0	0	0	0	0	38	8	0	0	14	105 067	33	0	209	190	2	3
16	22	Printed matter and recorded me	0	0	0	0	0	0	0	0	0	0	0	0	0	0	343	62 668	0	0	36	2	0
17	23	Coke, refined petroleum produc	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	46 405	272	0	0	100
18	24	Chemicals, chemical products a	0	0	0	4	0	0	0	0	36	0	77	0	0	0	343	0	112	94 044	158	11	61
19	25	Rubber and plastic products	0	0	0	0	0	0	0	0	0	0	17	0	7	37	234	7	0	1 873	30 286	14	224
20	26	Other non-metallic mineral prod	0	0	0	0	0	0	0	47	0	0	0	0	0	60	116	0	0	141	34	22 130	3
21	27	Basic metals	0	0	0	0	0	0	33	0	0	0	0	0	0	0	4	2	0	51	331	0	76 418
22	28	Fabricated metal products, exce	0	0	0	0	0	0	0	0	0	0	0	0	0	31	0	20	212	84	258	71	975
23	29	Machinery and equipment n.e.c	0	0	0	0	0	0	0	0	94	0	0	0	0	45	88	0	0	18	164	0	438
24	30	Office machinery and computer	0	0	0	0	0	0	0	0	0	0	0	0	0	0	12	0	0	0	0	0	0
25	31	Electrical machinery and appara	0	0	0	0	0	0	0	0	0	0	0	0	0	11	127	3	0	27	131	0	4
26	32	Radio, television and communic	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	0	0	0	0	0
27	33	Medical, precision and optical ir	0	0	0	0	0	0	0	0	0	0	0	0	0	0	10	0	531	181	3	0	0
28	34	Motor vehicles, trailers and sem	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	12	0	0
29	35	Other transport equipment	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	0
30	36	Furniture; other manufactured g	0	0	0	0	0	0	0	0	0	0	6	0	0	27	12	1	0	0	72	26	4
31	37	Secondary raw materials	0	0	0	0	0	0	0	0	0	0	0	0	0	33	0	0	0	0	1	0	0
32	40	Electrical energy, gas, steam a	0	0	0	3	0	0	0	0	17	0	0	0	0	32	2 168	0	125	40	0	6	388
33	41	Collected and purified water, dis	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	0	0	0
34	45	Construction work	310	0	0	0	0	0	0	0	0	0	0	0	0	782	0	0	0	241	35	932	10
35	50-52	Trade, maintenance and repair	0	0	0	44	0	0	1	5	5 936	123	298	226	5	644	1 927	335	52	5 458	1 235	1 111	761
36	55	Hotel and restaurant services	75	0	0	0	0	0	0	0	2	0	0	0	0	0	0	2	0	0	0	0	13
37	60	Land transport; transport via pip	195	0	0	1	0	0	0	35	109	0	0	0	0	176	165	53	0	126	6	393	13
38	61	Water transport services	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
39	62	Air transport services	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
40	63	Supporting and auxiliary transpo	0	0	0	0	0	0	0	10	633	0	0	0	0	8	0	9	4	11	0	3	0
41	64	Post and telecommunication se	0	0	0	0	0	0	0	0	7	0	0	0	0	0	0	7	0	0	0	0	0
42	65	Financial intermediation service	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
43	66	Insurance and pension funding	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
44	67	Services auxiliary to financial in	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
45	70	Real estate services	0	0	0	1	0	0	18	12	162	18	7	2	0	77	69	130	4	49	21	54	73
46	71	Renting services of machinery a	118	36	2	2	0	0	13	11	300	12	39	10	4	116	149	307	10	257	119	82	122
47	72	Computer and related services	2	0	0	0	0	0	13	13	622	10	6	2	2	106	309	975	118	180	49	12	155
48	73	Research and development ser	0	0	0	0	0	0	0	0	32	0	0	0	0	1	306	0	0	199	4	21	22
49	74	Other business services	0	0	0	0	0	0	69	22	821	0	76	0	0	119	2 345	1 092	22	7 115	420	222	1 996
50	75	Public administration and defen	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
51	80	Education services	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	25	0	0	0	0	0
52	85	Health and social work services	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0
53	90	Sewage and refuse disposal se	750	0	0	7	0	0	0	0	120	0	0	0	0	7	0	0	0	0	0	0	0
54	91	Membership organisation servic	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
55	92	Recreational, cultural and sport	105	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1	0	0	0	0	0
56	93	Other services	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
57	95	Private households with employ	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
58		Total	39 393	28 030	1 322	1 133	0	0	7 246	4 097	121 590	2 755	9 353	2 710	1 538	63 937	113 883	65 674	47 595	110 913	33 574	25 643	81 787
59		Cif/ fob adjustments on imports																					
60		Direct purchases abroad by residents																					
61		Total	39 393	28 030	1 322	1 133	0	0	7 246	4 097	121 590	2 755	9 353	2 710	1 538	63 937	113 883	65 674	47 595	110 913	33 574	25 643	81 787
62		Total of which:																					
63		- Market output	38 435	27 372	1 322	1 133	0	0	7 166	4 067	120 968	2 745	9 347	2 708	1 536	63 831	113 574	64 779	47 477	110 733	33 525	25 631	81 635
64		- Output for own final use	958	658	0	0	0	0	80	30	622	10	6	2	2	106	309	895	118	180	49	12	152
65		- Other non-market output	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Table 7: Supply table at basic prices, including a transformation into purchasers' prices — Sweden — Mill. NAC — current prices

OUTPUT OF INDUSTRIES (NACE)

No	Code	PRODUCTS (CPA)	Manufacture of fabricated metal products, except machinery and equipment	Manufacture of machinery and equipment n.e.c.	Manufacture of office machinery and computers	Manufacture of electrical machinery and apparatus n.e.c.	Manufacture of radio, television and communication equipment and apparatus	Manufacture of medical, precision and optical instruments, watches and clocks	Manufacture of motor vehicles, trailers and semi-trailers	Manufacture of other transport equipment	Manufacture of furniture; manufacturing n.e.c.	Recycling	Electricity, gas, steam and hot water supply	Collection, purification and distribution of water	Construction	Sale, maintenance and repair of motor vehicles and motorcycles; retail sale services of automotive fuel. Wholesale and commission	Hotels and restaurants	Land transport; transport via pipelines	Water transport	Air transport	Supporting and auxiliary transport activities; activities of travel agencies	Post and telecommunications	Financial intermediation, except insurance and pension funding
	Code		28	29	30	31	32	33	34	35	36	37	40	41	45	50-52	55	60	61	62	63	64	65
No			22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42
1	01	Products of agriculture, hunting	0	0	0	0	0	0	0	0	73	0	0	0	0	1 273	0	0	0	0	0	0	0
2	02	Products of forestry, logging an	0	0	0	0	0	0	0	0	30	0	0	0	0	0	0	0	0	0	0	0	0
3	05	Fish and other fishing products;	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4	10	Coal and lignite; peat	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5	11	Crude petroleum and natural ga	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6	12	Uranium and thorium ores	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7	13	Metal ores	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8	14	Other mining and quarrying pro	0	0	0	0	0	0	0	0	0	13	0	0	454	0	0	0	0	0	814	0	0
9	15	Food products and beverages	0	0	0	0	0	0	0	0	12	0	0	0	0	0	0	0	0	0	0	0	0
10	16	Tobacco products	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
11	17	Textiles	87	0	0	0	0	0	0	0	132	0	0	0	0	0	0	0	0	0	0	0	0
12	18	Wearing apparel; furs	18	0	0	0	0	0	0	0	8	0	0	0	0	0	0	0	0	0	0	0	0
13	19	Leather and leather products	7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
14	20	Wood and products of wood an	12	0	0	0	0	0	0	1	176	0	0	0	0	0	0	0	0	0	0	0	0
15	21	Pulp, paper and paper products	16	0	0	0	0	0	0	0	75	0	0	0	0	0	0	0	0	0	0	0	0
16	22	Printed matter and recorded me	6	46	0	0	0	1	0	0	95	0	0	0	0	0	0	0	0	0	40	0	0
17	23	Coke, refined petroleum produc	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18	24	Chemicals, chemical products a	0	39	32	12	0	431	0	0	91	7	0	0	0	0	0	0	0	0	0	0	0
19	25	Rubber and plastic products	331	100	0	18	30	231	37	0	305	0	0	0	0	0	0	0	0	0	0	0	0
20	26	Other non-metallic mineral prod	95	22	0	5	0	7	0	17	4	0	0	0	0	0	0	0	0	0	0	0	0
21	27	Basic metals	463	236	0	20	0	0	200	7	7	0	0	0	0	0	0	0	0	0	0	0	0
22	28	Fabricated metal products, exce	82 284	1 257	101	138	17	31	532	153	811	0	0	0	0	239	0	0	0	0	0	0	0
23	29	Machinery and equipment n.e.c	1 439	132 795	269	742	24	287	3 387	587	244	4	0	0	0	5 274	0	0	0	0	0	0	0
24	30	Office machinery and computer	9	13	5 743	190	257	39	0	0	30	0	0	0	0	0	0	0	0	0	0	0	0
25	31	Electrical machinery and appara	64	209	67	40 889	38	69	2	19	1 134	0	0	0	0	0	0	0	0	0	0	0	0
26	32	Radio, television and communic	74	1	76	378	131 430	58	31	1	288	0	0	0	0	248	0	0	0	0	0	0	0
27	33	Medical, precision and optical ir	33	145	67	602	2 876	32 699	2	17	31	0	0	0	0	239	0	0	0	0	0	0	0
28	34	Motor vehicles, trailers and sem	113	558	0	4	25	7	159 510	23	72	0	0	0	0	0	0	0	0	0	0	0	0
29	35	Other transport equipment	8	271	240	0	0	122	24	28 997	218	0	0	0	0	0	0	0	0	82	0	0	0
30	36	Furniture; other manufactured g	194	18	0	0	0	1	356	68	30 184	0	0	0	0	0	0	0	0	0	4	0	0
31	37	Secondary raw materials	0	0	0	0	0	0	0	0	0	3 496	0	0	0	0	0	0	0	0	0	0	0
32	40	Electrical energy, gas, steam a	2	61	0	13	0	0	3	0	0	7	71 601	0	0	28	0	0	0	0	0	0	0
33	41	Collected and purified water, dis	5	0	0	0	0	0	0	0	0	0	0	10 251	0	0	0	0	0	0	0	0	0
34	45	Construction work	1 419	152	0	4	0	243	0	0	65	20	1 393	200	166 688	2 259	0	0	0	0	899	0	0
35	50-52	Trade, maintenance and repair	947	6 640	172	925	5 002	2 192	20 986	472	1 187	31	0	0	681	292 612	1 419	49	396	521	243	1 262	0
36	55	Hotel and restaurant services	0	0	0	0	0	0	0	0	161	0	0	0	0	2 876	69 492	0	850	0	159	0	0
37	60	Land transport; transport via pip	74	17	0	5	5	8	2	1	19	0	0	0	0	0	0	111 679	0	0	7 171	1 886	0
38	61	Water transport services	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	30 286	0	0	0	0
39	62	Air transport services	0	0	0	0	0	0	0	66	0	0	0	0	0	0	0	0	0	24 301	0	322	0
40	63	Supporting and auxiliary transpo	3	109	0	1	0	0	0	0	19	0	0	0	0	0	0	2 011	231	1 185	97 142	1 112	0
41	64	Post and telecommunication se	0	0	0	0	0	0	0	0	0	0	144	0	0	0	0	0	0	0	0	96 469	0
42	65	Financial intermediation service	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1 993	78 444
43	66	Insurance and pension funding	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
44	67	Services auxiliary to financial in	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	48	0	0	0
45	70	Real estate services	317	181	0	15	0	10	12	9	89	1	210	4	1 916	4 331	0	851	0	378	974	266	0
46	71	Renting services of machinery a	335	1 116	18	126	170	132	608	73	108	24	80	1	757	5 722	154	395	45	388	297	284	146
47	72	Computer and related services	211	309	81	144	487	95	374	21	36	6	75	1	49	6 326	87	467	20	134	530	179	545
48	73	Research and development ser	4	5 050	0	405	973	48	8 990	277	0	0	0	0	0	0	0	0	0	0	0	0	0
49	74	Other business services	1 386	4 150	21	3 427	1 755	148	5 022	102	851	0	205	5	6 625	3 240	0	230	98	146	96	2 550	0
50	75	Public administration and defen	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	908	0	0
51	80	Education services	0	32	0	0	0	7	0	0	3	0	0	0	0	0	0	0	0	177	76	0	0
52	85	Health and social work services	0	0	0	0	0	0	0	0	11	0	0	0	0	0	0	0	0	0	0	0	0
53	90	Sewage and refuse disposal se	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1 327	0	0
54	91	Membership organisation servic	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
55	92	Recreational, cultural and sport	0	0	0	0	0	0	0	0	19	0	0	0	0	0	1 369	0	0	0	0	0	0
56	93	Other services	0	0	0	0	0	0	0	0	10	0	0	0	0	0	0	0	0	0	0	0	0
57	95	Private households with employ	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
58		Total	89 956	153 527	6 887	48 063	143 089	36 866	200 078	30 911	36 598	3 609	73 708	10 462	177 170	324 667	72 521	115 682	31 926	27 360	110 680	106 323	79 135
59		Cif/ fob adjustments on imports																					
60		Direct purchases abroad by residents																					
61		Total	89 956	153 527	6 887	48 063	143 089	36 866	200 078	30 911	36 598	3 609	73 708	10 462	177 170	324 667	72 521	115 682	31 926	27 360	110 680	106 323	79 135
62		Total of which:																					
63		- Market output	89 745	153 235	6 816	47 922	142 603	36 808	199 704	30 890	36 574	3 603	73 633	10 461	163 525	323 661	72 434	115 444	31 906	27 320	83 443	106 144	78 590
64		- Output for own final use	211	292	71	141	486	58	374	21	24	6	75	1	13 645	1 006	87	238	20	40	530	179	545
65		- Other non-market output	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	26 707	0	0

Table 7: Supply table at basic prices, including a transformation into purchasers' prices — Sweden — Mill. NAC — current prices

OUTPUT OF INDUSTRIES (NACE) / IMPORTS / VALUATION

No	Code	PRODUCTS (CPA)	Insurance and pension funding, except compulsory social security	Activities auxiliary to financial intermediation	Real estate activities	Renting of machinery and equipment without operator and of personal and household goods	Computer and related activities	Research and development	Other business activities	Public administration and defence; compulsory social security	Education	Health and social work	Sewage and refuse disposal, sanitation and similar activities	Activities of membership organisation n.e.c.	Recreational, cultural and sporting activities	Other service activities	Private households with employed persons	Total	Imports cif	Total supply at basic prices	Trade and transport margins	Taxes less subsidies on products	Total supply at purchasers' prices
	Code		66	67	70	71	72	73	74	75	80	85	90	91	92	93	95						
No			43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63
1	01	Products of agriculture, hunting	0	0	0	0	0	0	0	0	68	0	0	0	0	0	0	39 169	12 746	51 915	13 338	- 1 019	64 234
2	02	Products of forestry, logging an	0	0	0	0	0	0	0	267	18	0	0	0	0	0	0	27 789	3 941	31 730	152	56	31 938
3	05	Fish and other fishing products;	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1 330	2 616	3 946	1 182	180	5 308
4	10	Coal and lignite; peat	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1 201	1 836	3 037	248	316	3 601
5	11	Crude petroleum and natural ga	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	51	37 972	38 023	0	0	38 023
6	12	Uranium and thorium ores	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	8	8	0	0	8
7	13	Metal ores	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	7 099	2 273	9 372	641	0	10 013
8	14	Other mining and quarrying pro	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5 785	2 372	8 157	3 252	432	11 841
9	15	Food products and beverages	0	0	0	0	0	0	0	0	28	105	0	0	0	0	0	113 101	36 500	149 601	44 568	29 171	223 340
10	16	Tobacco products	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2 554	848	3 402	3 114	11 613	18 129
11	17	Textiles	0	0	0	0	0	0	0	28	0	20	0	0	0	0	0	9 017	13 307	22 324	8 435	4 334	35 093
12	18	Wearing apparel; furs	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2 534	18 054	20 588	19 034	8 922	48 544
13	19	Leather and leather products	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1 566	5 986	7 552	4 698	2 412	14 662
14	20	Wood and products of wood an	0	0	0	0	0	0	0	14	0	10	0	0	0	0	0	62 388	6 951	69 339	5 066	1 116	75 521
15	21	Pulp, paper and paper products	0	0	0	0	0	0	0	42	3	0	0	0	0	0	0	105 700	11 041	116 741	12 788	1 936	131 465
16	22	Printed matter and recorded me	0	0	0	0	0	0	960	273	356	0	0	0	143	0	0	64 969	7 210	72 179	7 377	5 221	84 777
17	23	Coke, refined petroleum produc	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	46 777	20 310	67 087	13 994	51 052	132 133
18	24	Chemicals, chemical products a	0	0	0	0	0	0	0	0	0	248	0	0	0	0	0	95 706	70 002	165 708	24 486	4 627	194 821
19	25	Rubber and plastic products	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	33 751	21 087	54 838	5 126	1 542	61 506
20	26	Other non-metallic mineral prod	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	22 681	9 105	31 786	5 869	1 279	38 934
21	27	Basic metals	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	77 772	39 718	117 490	13 402	165	131 057
22	28	Fabricated metal products, exce	0	0	0	0	0	0	0	43	0	0	0	0	0	0	0	87 257	19 387	106 644	9 496	1 807	117 947
23	29	Machinery and equipment n.e.c	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	145 899	68 902	214 801	30 704	3 368	248 873
24	30	Office machinery and computer	0	0	0	0	1 121	0	0	0	0	0	0	0	0	0	0	7 414	31 526	38 940	8 511	2 790	50 241
25	31	Electrical machinery and appara	0	0	0	0	0	0	0	92	0	0	0	0	0	0	0	42 886	33 254	76 140	8 544	1 697	86 381
26	32	Radio, television and communic	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	132 589	53 742	186 331	8 754	3 504	198 589
27	33	Medical, precision and optical ir	0	0	0	0	0	0	0	0	516	0	0	0	0	0	0	37 952	24 942	62 894	8 067	4 000	74 961
28	34	Motor vehicles, trailers and sem	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	160 324	65 823	226 147	23 327	11 076	260 550
29	35	Other transport equipment	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	29 966	20 158	50 124	2 026	2 596	54 746
30	36	Furniture; other manufactured g	0	0	0	0	0	3	0	6	1	37	0	0	6	0	0	31 026	18 039	49 065	16 141	7 877	73 083
31	37	Secondary raw materials	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3 530	0	3 530	49	0	3 579
32	40	Electrical energy, gas, steam a	0	0	267	0	0	0	0	0	0	0	347	0	0	0	0	75 108	1 069	76 177	0	26 893	103 070
33	41	Collected and purified water, dis	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	10 260	0	10 260	0	1 619	11 879
34	45	Construction work	0	0	691	0	0	0	0	0	0	0	0	0	0	0	0	176 343	0	176 343	0	25 522	201 865
35	50-52	Trade, maintenance and repair	0	0	0	439	4 873	181	3 420	0	85	96	71	1 116	250	0	0	364 429	5 103	369 532	- 306 424	4 005	67 113
36	55	Hotel and restaurant services	0	0	0	0	0	0	0	402	1 076	1 945	0	50	539	13	0	77 655	1 523	79 178	0	11 665	90 843
37	60	Land transport; transport via pip	0	0	0	0	0	0	0	0	45	8	0	0	0	0	0	122 192	1 418	123 610	0	- 5 817	117 793
38	61	Water transport services	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	30 286	8 101	38 387	0	9	38 396
39	62	Air transport services	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	24 689	9 825	34 514	0	158	34 672
40	63	Supporting and auxiliary transpo	0	0	0	0	0	0	0	615	0	319	0	0	0	0	0	103 425	8 344	111 769	0	1 023	112 792
41	64	Post and telecommunication se	0	0	0	0	0	0	0	231	0	0	0	0	0	0	0	96 858	7 277	104 135	0	10 706	114 841
42	65	Financial intermediation service	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	80 437	5 782	86 219	0	2 778	88 997
43	66	Insurance and pension funding	28 173	0	0	0	0	0	0	92	0	0	0	0	0	0	0	28 265	2 400	30 665	0	69	30 734
44	67	Services auxiliary to financial in	0	8 988	0	0	0	0	0	113	0	0	0	0	0	0	0	9 149	305	9 454	0	0	9 454
45	70	Real estate services	0	0	341 283	0	98	153	0	25 587	457	1 080	4	586	378	0	0	379 887	64	379 951	0	11 833	391 784
46	71	Renting services of machinery a	46	77	266	20 375	2 310	90	1 970	760	81	597	25	35	973	34	0	40 327	2 494	42 821	0	1 704	44 525
47	72	Computer and related services	258	34	0	340	108 441	126	2 034	1 145	498	512	247	0	130	7	0	126 523	10 168	136 691	2 533	4 356	143 580
48	73	Research and development ser	0	0	0	0	0	31 623	0	962	1 612	115	0	0	0	0	0	50 644	16 288	66 932	0	185	67 117
49	74	Other business services	74	0	256	249	2 338	551	268 494	3 723	615	34	2	0	2 911	0	0	323 623	84 876	408 499	0	13 874	422 373
50	75	Public administration and defen	0	0	0	0	0	936	0	176 149	579	360	0	0	19	0	0	178 951	41	178 992	0	0	178 992
51	80	Education services	0	0	0	0	1 719	0	0	1 107	153 623	16	0	1 273	194	0	0	158 252	0	158 252	0	740	158 992
52	85	Health and social work services	0	0	0	0	0	6	0	175	5 040	282 089	0	1 313	41	0	0	288 677	0	288 677	0	170	288 847
53	90	Sewage and refuse disposal se	0	0	0	0	0	0	0	0	0	0	13 392	0	0	0	0	15 603	100	15 703	0	3 035	18 738
54	91	Membership organisation servic	0	0	0	0	0	0	0	197	0	0	0	43 853	0	0	0	44 050	0	44 050	0	0	44 050
55	92	Recreational, cultural and sport	0	0	0	0	0	0	0	28	0	767	0	3 564	66 035	0	0	71 889	1 959	73 848	1 502	5 771	81 121
56	93	Other services	0	0	0	0	0	0	0	132	0	157	0	52	0	14 461	0	14 812	0	14 812	0	2 693	17 505
57	95	Private households with employ	0	0	0	0	0	0	0	0	0	0	0	0	0	0	298	298	0	298	0	0	298
58		Total	28 551	9 099	342 763	21 403	120 900	33 669	276 878	212 183	164 185	289 031	14 088	51 842	71 619	14 515	298	4 292 415	826 793	5 119 208	0	285 061	5 404 269
59		Cif/ fob adjustments on imports																	- 2 270	- 2 270			- 2 270
60		Direct purchases abroad by residents																	72 553	72 553			72 553
61		Total	28 551	9 099	342 763	21 403	120 900	33 669	276 878	212 183	164 185	289 031	14 088	51 842	71 619	14 515	298	4 292 415	897 076	5 189 491	0	285 061	5 474 552
62		Total of which:																					
63		- Market output	28 293	9 065	198 444	21 063	120 266	16 404	274 844	22 056	21 838	59 613	13 841	7 879	50 821	14 508	298	3 451 678					
64		- Output for own final use	258	34	144 319	340	634	126	2 034	773	498	266	247	0	2 363	7	0	174 138					
65		- Other non-market output	0	0	0	0	0	17 139	0	189 354	141 849	229 152	0	43 963	18 435	0	0	666 599					

Appendix D(b). Input-output table at basic prices.

The table below holds 57 product groups / sectors used from SCB [2004b]: SCB (2005b): *Table 4: Input-output table at basic prices.* Data concern the years 1995 and 2000. This data is used as one component to derive a demand for input into intermediate production, allocated regionally and per product group. The data is given as mill NAC, i e millions of national currency [SEK]. The total used per product group / sector is taken from row number 69.

SCB (2004b): *Table 4: Input-output table at basic prices.* Data concerning the year 2000 in the file: InputOutputTables1995o2000.xls

No	Code	PRODUCTS (CPA)
1	01	Products of agriculture, hunting and related services
2	02	Products of forestry, logging and related services
3	05	Fish and other fishing products; services incidental of fishing
4	10	Coal and lignite; peat
5	11	Crude petroleum and natural gas; services incidental to oil and gas extraction excluding surveying
6	12	Uranium and thorium ores
7	13	Metal ores
8	14	Other mining and quarrying products
9	15	Food products and beverages
10	16	Tobacco products
11	17	Textiles
12	18	Wearing apparel; furs
13	19	Leather and leather products
14	20	Wood and products of wood and cork (except furniture); articles of straw and plaiting materials
15	21	Pulp, paper and paper products
16	22	Printed matter and recorded media
17	23	Coke, refined petroleum products and nuclear fuels
18	24	Chemicals, chemical products and man-made fibres
19	25	Rubber and plastic products
20	26	Other non-metallic mineral products
21	27	Basic metals
22	28	Fabricated metal products, except machinery and equipment
23	29	Machinery and equipment n.e.c.
24	30	Office machinery and computers
25	31	Electrical machinery and apparatus n.e.c.
26	32	Radio, television and communication equipment and apparatus
27	33	Medical, precision and optical instruments, watches and clocks
28	34	Motor vehicles, trailers and semi-trailers
29	35	Other transport equipment
30	36	Furniture; other manufactured goods n.e.c.
31	37	Secondary raw materials
32	40	Electrical energy, gas, steam and hot water
33	41	Collected and purified water, distribution services of water
34	45	Construction work

35	50-52	Trade, maintenance and repair services of motor vehicles and motorcycles; retail sale of automotive fuel. Wholesale trade and commission trade services. Retail trade services, repair services of personal and household goods.
36	55	Hotel and restaurant services
37	60	Land transport; transport via pipeline services
38	61	Water transport services
39	62	Air transport services
40	63	Supporting and auxiliary transport services; travel agency services
41	64	Post and telecommunication services
42	65	Financial intermediation services, except insurance and pension funding services
43	66	Insurance and pension funding services, except compulsory social security services
44	67	Services auxiliary to financial intermediation
45	70	Real estate services
46	71	Renting services of machinery and equipment without operator and of personal and household goods
47	72	Computer and related services
48	73	Research and development services
49	74	Other business services
50	75	Public administration and defence services; compulsory social security services
51	80	Education services
52	85	Health and social work services
53	90	Sewage and refuse disposal services, sanitation and similar services
54	91	Membership organisation services n.e.c.
55	92	Recreational, cultural and sporting services
56	93	Other services
57	95	Private households with employed persons
58		*Total*
59		*Direct purchases abroad by residents*
60		*Purchases on the domestic territory by non-residents*
61		*Taxes less subsidies on products*
62		*Total intermediate consumption/Final use at purchasers' prices*
63		*Compensation of employees*
64		*Other net taxes on production*
65		*Consumption of fixed capital*
66		*Operating surplus, net*
67		*Operating surplus, gross*
68		*Value added at basic prices*
69		Output at basic prices

Appendix E. Excerpt from the input-output table.

Input/Output matrix IO from SCB, 2000: National Accounts (first four aggregate sectors). Available tables from SCB concerning the year 2000 are:

Table 4: Input-output table at basic prices
Table 5: Input-output table for domestic output at basic prices
Table 6: Input-output table for imports at basic prices

Excerpt from table 4:

		HOMOGENEOUS BRANCHES	Products of agriculture, hunting and related services	Products of forestry, logging and related services	..	Wood and of products of wood and cork (except furniture); articles of straw and plaiting materials	Pulp, paper and paper products	Printed matter and recorded media	Coke, refined petroleum products and nuclear fuels	Chemicals and chemical products	Rubber and plastic products	Other non-metallic mineral products	..	Private households with employed persons	..	Final consumption expenditure
	Code	PRODUCTS (CPA)	01	02	…	20	21	22	23	24	25	26	…	95	…	
No			1	2	…	14	15	16	17	18	19	20	…	57	…	65
1	01	Products of agriculture, hunting and related services	3 200	45		1	4	3	0	44	91	0		0		10 622
2	02	Products of forestry, logging and related services	6	723		13 515	8 306	20	0	78	96	24		0		794
3	05	Fish and other fishing products; services incidental of fishing	10	1		0	0	0	0	0	0	0		0		323
4	10	Coal and lignite; peat	360	0		1	53	1	12	8	5	116		0		155
5	11	Crude petroleum and natural gas; services incidental to oil and gas extraction excluding surveying	1	0		0	0	0	37 803	82	0	0		0		0
6	12	Uranium and thorium ores	0	0		0	0	0	0	0	0	0		0		0
7	13	Metal ores	0	0		0	0	0	5	3	13	0		0		0
8	14	Other mining and quarrying products	134	1		1	324	1	33	333	44	1 399		0		58
9	15	Food products and beverages	4 469	1		1	555	38	18	565	54	2		0		74 069
10	16	Tobacco products	0	0		0	0	0	0	0	0	0		0		2 989
			SNI 01	*SNI 02*		*SNI 20*	*SNI 21*	*SNI 22*	*SNI 23*	*SNI 24*	*SNI 25*	*SNI 26*		*SNI 95*		*Final cons*

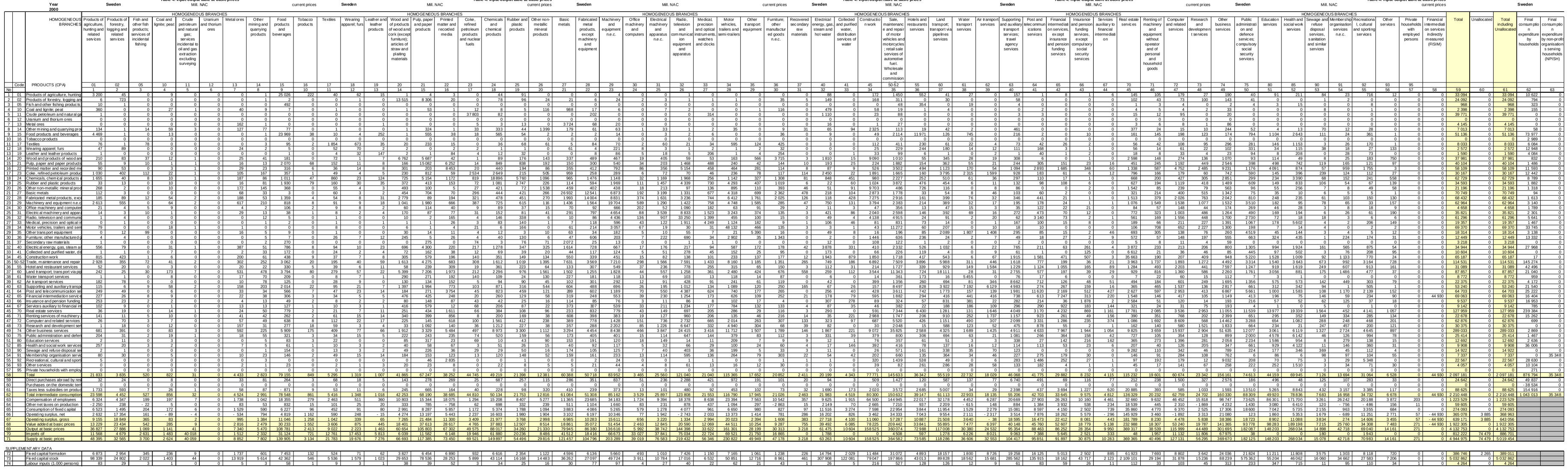
11	17	Textiles	76	1		20	233	15	0	36	68	61		0		6 084
12	18	Wearing apparel; furs	47	89		2	0	2	2	1	1	0		0		12 948
13	19	Leather and leather products	1	0		2	1	84	4	12	32	0		0		4 084
14	20	Wood and products of wood and cork (except furniture); articles of straw and plaiting materials	210	83		6 762	5 687	42	1	89	176	143		0		832
15	21	Pulp, paper and paper products	55	9		166	15 082	6 252	14	849	838	192		0		1 763
16	22	Printed matter and recorded media	90	53		301	203	8 453	20	440	194	86		0		11 593
17	23	Coke, refined petroleum products and nuclear fuels	1 030	402		230	812	59	2 534	2 649	215	505		0		12 442
18	24	Chemicals, chemical products and man-made fibres	1 655	40		725	5 154	1 172	819	18 896	5 760	1 096		0		19 295
19	25	Rubber and plastic products	33	13		372	413	153	72	1 081	2 747	226		0		2 225
20	26	Other non-metallic mineral products	268	2		493	100	5	27	421	72	1 538		0		1 318
21	27	Basic metals	112	3		454	704	70	296	444	421	266		0		94
22	28	Fabricated metal products, except machinery and equipment	185	89		2 779	89	194	321	478	451	270		0		1 613
23	29	Machinery and equipment n.e.c.	2 613	555		1 041	1 980	666	387	725	615	116		0		3 140
24	30	Office machinery and computers	21	4		60	114	40	9	89	37	15		0		1 789
25	31	Electrical machinery and apparatus n.e.c.	14	3		170	87	77	31	152	81	41		0		2 301
26	32	Radio, television and communication equipment and apparatus	1	4		10	2	165	4	146	338	6		0		5 641
27	33	Medical, precision and optical instruments, watches and clocks	0	1		1	1	26	3	83	140	1		0		1 876
28	34	Motor vehicles, trailers and semi-trailers	79	0		6	1	4	21	6	166	0		0		33 745
29	35	Other transport equipment	0	12		30	14	11	4	12	3	10		0		3 138
30	36	Furniture; other manufactured goods n.e.c.	4	4		245	5	26	4	40	130	6		0		13 332
31	37	Secondary raw materials	1	0		0	275	0	74	3	76	71		0		0
32	40	Electrical energy, gas, steam and hot water	556	79		696	4 300	220	217	1 278	347	325		0		27 968
33	41	Collected and purified water, distribution services of water	1	1		72	162	38	12	69	39	20		0		0
34	45	Construction work	815	423		305	579	196	140	351	149	134		0		17
35	50-52	Trade, maintenance and repair services of motor vehicles and motorcycles; retail sale of automotive fuel. Wholesale trade and commission trade services. Retail trade services, repair services of personal and household goods.	2 928	355		1 613	4 275	683	308	1 612	1 019	1 395		0		150 943

			SNI 01	SNI 02	SNI 20	SNI 21	SNI 22	SNI 23	SNI 24	SNI 25	SNI 26	SNI 95	Final cons
36	55	Hotel and restaurant services	52	20	58	239	309	19	361	223	64	0	42 496
37	60	Land transport; transport via pipeline services	242	25	5 399	7 206	1 973	212	2 296	976	1 561	0	22 946
38	61	Water transport services	1	1	290	271	192	140	109	24	130	0	959
39	62	Air transport services	182	78	130	134	152	5	94	90	45	0	4 172
40	63	Supporting and auxiliary transport services; travel agency services	115	6	1 397	1 994	773	103	871	316	544	0	45 376
41	64	Post and telecommunication services	249	49	184	271	3 754	45	823	459	121	0	25 222
42	65	Financial intermediation services, except insurance and pension funding services	227	26	476	425	248	20	260	129	58	0	16 404
43	66	Insurance and pension funding services, except compulsory social security services	253	23	80	148	87	43	42	25	16	0	16 953
44	67	Services auxiliary to financial intermediation	102	9	416	579	12	68	206	87	22	0	785
45	70	Real estate services	36	19	251	434	1 611	66	384	108	96	0	239 384
46	71	Renting services of machinery and equipment without operator and of personal and household goods	141	11	340	399	856	8	200	169	38	0	15 262
47	72	Computer and related services	26	70	225	145	618	100	1 561	412	238	0	699
48	73	Research and development services	1	18	33	1 092	140	36	1 212	227	38	0	13 384
49	74	Other business services	681	391	1 912	3 329	5 484	497	8 973	3 300	1 112	0	3 707
50	75	Public administration and defence services; compulsory social security services	204	31	222	243	235	74	520	159	56	0	155 323
51	80	Education services	2	11	85	317	23	69	10	43	90	0	135 511
52	85	Health and social work services	257	20	40	58	67	3	51	26	15	0	258 126
53	90	Sewage and refuse disposal services, sanitation and similar services	2	1	49	226	36	29	29	50	16	0	0
54	91	Membership organisation services n.e.c.	80	30	184	153	123	13	120	148	52	0	35 381
55	92	Recreational, cultural and sporting services	5	0	0	46	2 835	0	0	1	0	0	44 696
56	93	Other services	0	0	20	23	8	0	22	8	5	0	10 104
57	95	Private households with employed persons	0	0	0	0	0	0	0	0	0	0	271
58		Total	21 833	3 835	41 865	67 247	38 252	44 745	49 219	21 398	12 381	0	1 494 352
59		*Direct purchases abroad by residents*	*32*	*24*	143	278	269	25	687	257	115	*0*	*49 837*
60		*Purchases on the domestic territory by non-residents*	*0*	*0*	0	0	0	0	0	0	0	*0*	*- 38 534*
			SNI 01	SNI 02	SNI 20	SNI 21	SNI 22	SNI 23	SNI 24	SNI 25	SNI 26	SNI 95	Final cons

61	*Taxes less subsidies on products*	*1 733*	*593*	245	665	164	40	228	98	320	*0*	*156 143*
62	*Total intermediate consumption/Final use at purchasers' prices*	*23 598*	*4 452*	42 253	68 190	38 685	44 810	50 134	21 753	12 816	*0*	*1 661 798*
63	*Compensation of employees*	*6 324*	*4 347*	10 803	15 344	18 075	1 294	15 208	8 407	5 277	*203*	
64	*Other net taxes on production*	*- 2 250*	*238*	333	785	- 758	62	698	332	239	*11*	
65	*Consumption of fixed capital*	*6 523*	*1 495*	2 991	8 287	5 857	1 172	5 374	1 788	1 094	*0*	
66	*Operating surplus, net*	*2 632*	*17 354*	4 274	13 197	5 443	2 237	16 603	1 980	1 904	*57*	
67	*Operating surplus, gross*	*9 155*	*18 849*	7 265	21 484	11 300	3 409	21 977	3 768	2 998	*57*	
68	*Value added at basic prices*	*13 229*	*23 434*	18 401	37 613	28 617	4 765	37 883	12 507	8 514	*271*	
69	Output at basic prices	36 827	27 886	60 654	105 803	67 302	49 575	88 017	34 260	21 330	271	

InputOutputTables1995o2000.xls

Below the full matrix is displayed in the form of an enhanced metafile. Details can only be seen by zooming in.



Appendix G Export/Import Allocation in CFS 2001

Source: Memo "OD-matriser till STAN – regionalisering, prognos för inrikes transporter och utrikeshandel", Revision May 2005, H. Edwards, SIKA

9.3.6.1.1.1.1 Export allocation CFS 2001

	STAN product groups											
NUTS2	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
1	0	0	0	20.3	0	2	0	0	0.8	0	2.8	10.5
2	2.2	0	0	8	0	1.5	0.1	10.9	13.6	0.5	3	7.5
3	0	0	14.9	2.7	36.4	0	2.2	3.3	10.1	41.1	0.6	25.5
4	93.7	0	1.1	40.8	0.1	0	1	12	8.8	23.9	44.4	11
5	1.3	0	17.6	13.1	47.3	96.6	0.4	2.8	24	9.4	40.1	20.5
6	2.8	81	32.1	4.6	0	0	0	53.3	19.9	2.6	2.1	10.3
7	0	19	9.3	1.7	0	0	1	1.6	8.4	0	3.6	2.9
8	0	0	16.7	3.1	0	0	93.6	3.5	9.5	0.2	3.1	4.4
9	0	0	8.3	5.7	16.2	0	1.6	12.7	4.9	22.1	0.3	7.4
9.3.6.1.1.2 Current base data in SAMGODS' OD-model												
Allocation at NUTS2-level 1 = CFS 2 = rAps	2	2	1	1	1	1	1	2	2	1	1	1
Allocation inside NUTS2 between communities 1 = rAps syss 2 = Population	1	1	1	1	1	1	1	1	1	1	1	1

9.3.6.1.1.2.1 Import allocation CFS 2001

	STAN product groups											
NUTS2	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
1	3.1	0	0	21.5	5.1	19.9	0	3.3	14.8	1.3	17.5	17.8
2	0.4	3.8	8.3	2.5	0.2	0.6	3.8	17.6	12.4	3.7	6.9	7.2
3	0	24.2	9.8	6	0.8	0	0	14.6	10	20.6	3.4	19.7
4	91.2	1.1	8.1	33.7	0	3.3	4.8	6.5	7.1	11.3	37.2	12.4
5	3.2	4.5	0	20.3	93.8	36.5	6.3	21.9	41.7	30.7	15.3	31.6
6	0.7	47.7	73.9	5.5	0	24.2	38	6.1	7.9	19.7	1.8	3.5
7	0	17.6	0	2.9	0	12.3	0	2.2	0.1	2.4	2.3	0.8
8	0.9	1.1	0	4.2	0.2	1.3	47.1	6.8	1.1	4.3	5.9	1.6
9	0.6	0	0	3.5	0	1.9	0	21	4.9	6	9.7	5.3
9.3.6.1.1.3 Current base data in SAMGODS' OD-model												
Allocation at NUTS2-level 1 = CFS 2 = rAps	2	1	2	1	1	1	1	1	1	1	1	1
Allocation inside NUTS2 between communities 1 = rAps syss 2 = Population	1	1	1	2	1	2	1	1	1	2	1	2

Appendix H. EOQ-calculation for input data to RAND using CFS

H.1 Introduction

The purpose of this Appendix is to provide suggestions for what inventory holding and order setup costs to use in the Swedish SAMGODS Logistics model. The data source is the swedish CFS 2001.

The basic model, balancing order setup and inventory holding, is

$$EOQ = sqrt(2 \cdot o \cdot Q / (\omega \cdot v)) \quad \text{(H.1)}$$

H.2 Method

We use an inventory holding cost rate[57], ω, equal to 0.2. This should be multiplied by the price (in SEK/tonne for example) and the result will be a cost for holding one tonne in inventory during one year. It is supposed to cover bank interest rate (appr 0.05 today), company profit expectations above bank interest rate, costs for handling and storage etc. Range of ω found in literature will typically be in the range 0.1 to 0.4.

Using eq (H.1) we obtain the order setup cost as:

$$o = EOQ^2 \cdot (\omega \cdot v) / (2 \cdot Q) \quad \text{(H.2)}$$

From the CFS we obtain observations on *EOQ* and an estimated upscaled demand $Q_{upscale}$ for the firms taking part. There are two important matters causing problems here:

1. The variations in the observed quantities, EOQ_{obs}, are huge, from less than 1 kg to thousends of tonnes, see Table H.1 (columns 3 and 4).
2. We do not know *Q* for the individual receiving companies, which is needed for modeling their balancing of inventory holding and setup costs.

In order to deal with problem 1 we have calculated *o*-values using different average values on EOQ, namely the traditional arithmetic mean, the geometric mean and the harmonic mean (see defintions). The latter ones are better at reflecting a typical value and to scale down the weight of the very large maximal EOQobs values.

[57] Note: In the logistics model, the relevant costs here are defined as the inventory cost I^k_q given as $w^k.(q^k/2)$ where w^k is the unit storage cost, and q^k is the average shipment size, and the capital costs of inventory K^k_q given as $i.v^k.(q^k/2)$ where i is the rate of interest. Taken together, this gives a total cost of $[w^k + i.v^k]. (q^k /2)$. In the description here, the symbol ω is equivalent to $[w^k/v^k + i]$.

When dealing with problem 2 we have calculated *o*-values assuming that the number of firm to firm relations either is the number of different senders, *Ns*, or the number of different receiivers, *Nr*. Estimates of the number senders and receivers defined according to the definitions. Probably the number of observations over-estimates the number of different receivers, but we judge that number to be closer to the number of firm to firm relations than the number of senders.

Definitions:

o = ORDER_SET_UP_COST [SEK per setup]

ω = INVENTORY_HOLDING_COST_RATE [share of price/(year and tonne)] = 0.2

v = Price in SEK per ton

FlowTotObs = Total observed demand in tonnes

FlowTotUpscaled = Total upscaled, observed demand in tonnes per year

$Q_{s/r}$ = Average demand in tonne per year per Sender or Receiver [tonnes per year]

Ds = FlowTotObs / Ns

Dr = FlowTotObs / Nr

EOQ = sqrt(2*o* $Q_{s/r}$ / (ω*v)) => o = EOQobs**2 * (ω*v)/(2*$Q_{s/r}$)

EOQobs = observed order quantities

N = number of observations

Ns = estimated nbr of senders = number of different combinations of SNI and postal code (under-estimate)

Nr = estimated nbr of receivers = number of observations (over-estimate) = N

E[EOQobs] = average of observed order quantities [tonnes]

GeomE[EOQobs] = geometric average of observed order quantities [tonnes] = sqrt(EOQobs1 * EOQobs2 * ... * EOQobsN)

HarmE[EOQobs] = harmonic average of observed order quantities [tonnes] : 1/HarmE[EOQobs] = 1/N * SUM (1/EOQobs[j])

The result of this discussion is that we apply eq (H.3) for determining the setup cost using the definitions above:

$$o = [\text{expected value of } EOQ]^2 \cdot (\omega \cdot v) / (2 \cdot D_r) \qquad \text{(H.3)}$$

The type of expected value used is marked in Table I.1, the most frequent one is the traditional arithmethic mean. However, in a few cases we find it more reasonable to use one of the alternative mean values.

Prod	NSTR	min[EOQobs]	max[EOQobs]	E[EOQobs]	Geom E[EOQobs]	Harm E[EOQobs]	FlowTotObs	Price_v	Ns	Nr	FlowTotUpscale	E:o(Ns)	E:o(Nr)	GeoE:o(Ns)	GeoE:o(Nr)	HarmE:o(Ns)	Harm E:o(Nr)
1	10	0.001	16650	84.8	18.75	0.32	36799	1922	27	434	327846	113.8	1829.0	5.6	89.5	0	0.03
2	20	0.003	300	7.6	2.09	0.23	12861	15418	33	1703	736043	3.9	203.4	0.3	15.6	0	0.18
4	32	48.000	234760	52870	21598	1817.4	2643518	427	5	50	2643518	225597.8	2255978.3	37648	376489	267	2665.7
5	41	0.300	209457	2659.0	479.29	72.91	21963636	336	60	8260	25832440	552.5	76054.3	18.0	2471.0	0.42	57.19
6	42	0.035	1361	32.2	22.61	8.34	163234	3009	134	5074	2415870	17.3	654.1	8.5	323.0	1.16	44
7	43	0.126	32734	314.7	55.09	16.35	639702	695	74	2033	1823766	279.2	7670.5	8.6	235.1	0.75	20.7
9	50	0.000	369	3.0	0.11	0.01	10914	19837	119	3679	147555	14.1	435.3	0.0	0.6	0	0.01
10	60	0.000	35417	21.3	0.34	0.03	3765831	13452	696	176710	17062071	24.9	6327.3	0.0	1.6	0	0.01
12	80	0.001	3060	50.0	13.18	0.30	67656	881	50	1353	1925564	5.7	154.8	0.4	10.8	0	0.01
13	90	226.335	320591	23330.	8026.8	2819.6	1026541	2597	4	44	13493409	41895.9	460855.3	4959.2	54551	612	6731.2
14	100	0.001	31302	88.0	3.08	0.26	1553307	2132	135	17645	27433866	8.1	1062.6	0.0	1.3	0	0.01
15	110	0.001	13400	1242.4	222.20	0.05	1480958	519	31	1192	21376620	116.2	4467.2	3.7	142.9	0	0
16	120	0.305	20991	260.9	13.56	3.63	58431	2914	34	224	774496	870.3	5733.6	2.4	15.5	0.17	1.11
17	130	0.000	13323	4.8	0.18	0.02	317310	10089	488	66063	11140326	1.0	138.0	0.0	0.2	0	0
18	140	0.000	39109	24.9	0.21	0.01	536147	926	201	21555	9614444	1.2	128.5	0.0	0.0	0	0
19	151	0.015	5377	80.7	22.38	2.70	52891	150	64	655	1715873	3.7	37.4	0.3	2.9	0	0.04
20	152	0.001	65608	155.1	7.92	0.13	199641	261	97	1287	3045890	20.0	264.9	0.1	0.7	0	0
21	160	0.002	1554	38.8	13.62	0.14	16677	2026	19	430	526954	11.0	248.7	1.4	30.7	0	0
23	180	0.000	14847	5.2	0.06	0.00	216686	9946	634	41643	9728442	1.8	115.3	0.0	0.0	0	0
24	190	0.000	5184	79.7	31.35	0.02	133293	4453	59	1672	3507861	47.6	1349.1	7.4	208.6	0	0
25	200	0.000	920	3.5	0.07	0.00	86987	78868	210	25216	1989830	9.9	1189.4	0.0	0.4	0	0
26	210	0.000	15680	5.1	0.03	0.00	185110	24474	1042	36373	2728753	24.2	844.9	0.0	0.0	0	0
27	220	0.000	750	3.3	0.14	0.01	14099	10279	185	4306	600074	3.4	79.1	0.0	0.1	0	0
28	231	0.001	6133	45.9	8.49	0.13	204032	6430	67	4449	6430848	14.1	935.6	0.5	32.1	0	0.01
29	232	0.000	2610	1.3	0.02	0.00	236110	25336	2046	176873	6137208	1.5	130.1	0.0	0.0	0	0
31	45	0.100	78472	2688.4	523.56	23.13	6933349	387	93	2579	9445511	2752.0	76316.1	104.4	2894.5	0.2	5.65
32	201	0.000	315	0.6	0.01	0.00	84841	103773	998	148761	2240206	1.5	224.1	0.0	0.1	0	0
33	233	0.000	6261	1.4	0.02	0.00	181592	18188	548	125589	5409465	0.4	88.3	0.0	0.0	0	0
34	250	0.001	49	4.3	1.19	0.13	5932	14461	182	1388	157775	30.5	232.4	2.36	17.99	0.03	0.22

Table H.1Alternative values on the order setup cost K depending on the product group. EOQ- and flow- related values are in tonnes

Due to the rather large setup cost for product 43 and 60 the demand has been split up into ½ and 1/8 of the *Nr*-values for these producs, which means a change in the setup costs with the same proportions.

H.3 Conclusions

Using the two methods from the previous section for handling the problems 1 and 2 we get the results as shown in Table H.1.

Thus we suggest to use as inventory holding cost:
*0.2 * Price_v*
where Price_v is obtained from Table H.1.

We suggest to use as order setup cost the values marked with a yellow background in the columns *E:o(Nr). GeoE:o(Nr)* and *HarmE:o(Nr)* in Table H.1.

Table H.1 data are supplied in an Excel-file, *EOQ-01.xls*, sheet *Results*. Example data is supplied in the sheet *Analysis* for product group 1. Data for all products can be obtained on request in a text file for members of the SAMGODS group.

Since there are assumptions made relating to the average observed order quantities and the number of senders and receivers, we are obviously open to suggestions on alternative ways to handle the matters at hand.

Finally, there are, in general, a huge spread in the data for different products and companies dealing with a certain product group. In principle we should use different parameters for firm to firm relations depending on the magnitude of the yearly demand. Selecting a single value for a product group is clearly a compromise.

Appendix I. Product group values used for conversion to tonnes.

Ser Nbr	NST/R	Name	Vaue [SEK/ton]
1	10	Cereals	1350
2	20	Potatoes, other vegetables, fresh or frozen, fresh fruit	3631
3	31	Live animals	8224
4	32	Sugar beet	427
5	41	Timber for paper industry (pulpwood) (Old: Wood in the rough)	289
6	42	Wood roughly squared or sawn lengthwise, sliced or peeled	6352
7	43	Wood chips and wood waste	592
8	44	Other wood or cork	452
9	50	Textiles, textile articles and manmade fibres, other raw animal and vegetable materials	158131
10	60	Foodstuff and animal fodder	19558
11	70	Oil seeds and oleaginous fruits and fats	2576
12	80	Solid mineral fuels	713
13	90	Crude petroleum	2597
14	100	Petroleum products	3309
15	110	Iron ore, iron and steel waste and blast-furnace dust	496
16	120	Non-ferrous ores and waste	7444
17	130	Metal products	9762
18	140	Cement, lime, manufactured building materials	2169
19	151	Earth, sand and gravel	74
20	152	Other crude and manufactured minerals	1114
21	160	Natural and chemical fertilizers	2020
22	170	Coal chemicals, tar	1210937
23	180	Chemicals other than coal chemicals and tar	15959
24	190	Paper pulp and waste paper	2155
25	200	Transport equipment, whether or not assembled, and parts thereof	70281
26	210	Manufactures of metal	21041
27	220	Glass, glassware, ceramic products	15183
28	231	Paper, paperboard; not manufactures	4637
29	232	Leather textile, clothing, other manufactured articles than paper, paperboard and manufactures thereof	24920
30	240	Mixed and part loads, miscellaneous articles etc	19521
31	45	Timber for sawmill (old 41)	356
32	201	Machinery, apparatus, engines, whether or not assembled, and parts thereof (old 200)	47132
33	233	Paper, paperboard and manufactures thereof (old 231)	15894
34	250	Product wrappings/coverage/protection material. Second hand goods.	2250
35	247	Air freight (2006 model)	561026