REPORT

PWC Matrices: new method and updated Base Matrices

Technical report

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Analysis & Strategy

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1 Introduction

This document is a technical appendix to the method report *PWC Matrices; new method and updated Base Matrices (2015-02-06)*. In the method report, the general methodology is described for the various steps to obtain base matrices for the Samgods model. The method can very briefly be summarised by the following steps:

1. Using various official data sources to estimate total Swedish
    a. Production
    b. Consumption
    c. Wholesale
    d. Import
    e. Export

    per commodity type (Samgods 34 commodities), all in economic value (SEK, year 2010)
2. Allocate a. – c. to municipalities using detailed employment data and allocate d. – e. to zones abroad using official statistics and commodity flow survey (CFS) data.
3. Estimate corresponding values for 2012 based on 2010 results and data on the economic development 2010-2012
4. Estimate corresponding values for goods weight (tons) using municipality- and commodity-specific value-weight ratios (SEK/ton) for 2012, thus obtaining boundary conditions for each matrix (row- and column sums and corresponding conditions for matrix elements representing foreign trade)
5. Estimate models to predict commodity flows (matrix elements) based on various prediction variables such as the boundary conditions, but also socioeconomic data such as employment. The models are derived mainly from CFS data.
6. Apply the models to ton data for 2012, to make predictions of flows for the base year.

In this technical report, some of the steps and/or related data material is presented more in detail. In order to put the descriptions in its context, please refer to the Method report. The following information is given here:

- Chapter 2: A PM delivered within the project concerning the connection between different industries and different types of commodities. Existing categorisations of industries and commodities are described along with the connection between them. The purpose is to derive new correspondence keys in order to translate development in different parts of the industry and other businesses to the amount of commodities produced and consumed, and which these commodities are.

- Chapter 3: The Samgods 34 commodities are constructed based on the NST\R nomenclature (described in Chapter 2). In Chapter 3 presents a table showing the aggregation of NST\R commodities to Samgods commodities.
- Chapter 4: the keys discussed in Chapter 2 were later derived within the project from official production and consumption statistics for the industry. However, in deriving the boundary conditions for *all sectors* of the economy, statistics from complementary data sources has been used as well, where other nomenclatures for their commodity classifications are used. These classifications have been connected to the Samgods commodities manually, and in Chapter 4 tables with all connections are given.
- Chapter 5: When estimating total goods flows in the wholesale sector, official statistics give the average value of commodities for resale purchased by the businesses. In Chapter 5 a table gives the relative distribution over Samgods commodities for each wholesale sub-sector. In cases where the name of the sub-sector clearly indicates which commodity that is mainly traded, the share has been set to 100 % manually. In the cases where two or more commodities are relevant, the distribution has been made according to the relative total supply (production + import) of the commodities.
- Chapter 6: This chapter describes the PWC matrix model estimations in more detail with references to the program performing the estimations. It provides detailed definitions of the variables used for the regressions as well as for predictions. Also, the programs used for estimation and prediction are commented. The estimation is based on the pseudo poisson maximum likelihood method, combined with a stepwise regression framework in order to automatically generate PWC models supported by the Commodity Flow Survey data. Using the models, predictions of PWC matrix flows are made for the base year 2012.

2 New correspondence keys for associating industries with commodities

Purpose of the key

To create the PWC matrices, which are giving the demand of freight transport between Swedish municipalities (and regions abroad); several different statistical data sets are used. The PWC matrices are defined for a number of separate commodity groups. Part of the statistics needed for the calculations are available for some kind of classification of commodities. But the major part instead describes different aspects of industries, such as employment, production value, trade and export, etc. To be able to use this information to analyse trade with different commodities, each industry has to be associated with a number of commodity types. More specifically, the production value per industry in each region has to be distributed over a set of commodity types.

In order to do this, a key is needed, that for each industry provides a distribution of the production value over the specified commodity types, in a way that the sum of all fractions is 100 % for every industry (this applies to the production of goods and not services, electricity or other products that are not transported).

The key should be defined on a detailed level, so that e.g. differences in the composition of products derived from agricultural units in northern and southern Sweden are taken into account. This way, regional differences are included in the calculations.

The key will be applied on data defined on the industry classification SNI 2007 and give output divided into the commodity groups of the Samgods model.

Existing key

In ”Swedish Base Matrices Report” (Edwards et al, 2008-03-11) , the construction of the currently used key is described. This key has been used to create the existing base matrices. The key is applied on data on SNI 92 2-digit level and allocates the values into the 34 Samgods commodities (these can be aggregated into the 12 STAN commodity groups).

The 34 Samgods commodities are based on the European commodity classification NST/R (Standard Goods Classification for Transport Statistics/Revised, 1967). The existing key has two parts, where the first step is a key associating SNI 92 with the Combined Nomenclature (CN, in Swedish KN) which classifies commodities on a detailed level (using 8-digit codes), and the second step is a key associating CN with NST/R .

The first sub-key (SNI-CN) has been calculated using the foreign trade statistics 1998-2004, which is reported with both industry codes (SNI) and commodity codes (CN) for all import to and export from Sweden. An average of import and export flows has been used and applied to all flows including the domestic trade.

The second sub-key (CN-NST/R) was derived in the 90's and was updated to the current version of CN in 2005by Statistics Sweden. There was also a demand for a distinction for round wood and pulp wood in the key, which was not provided by the CN classification. The product group was split into fractions by identifying differences in the SEK per ton prices in the Foreign Trade Statistics.

Available data

A number of data sets that could be used for creating new keys have been identified, and are briefly described here.

Production of commodities and industrial services (Industrins varuproduktion, IVP)

The Production of commodities and industrial services (IVP) is a yearly survey that has been conducted since 1996. The IVP reports production of commodities using CN on an 8-digit level registered in values and quantities. The population of entities that are being surveyed are defined by the following criteria's

- Workplaces with a minimum of 10-20 employees with their main branch in the industry sector.
- Workplaces with their main branch in the industry sector with less than 10-20 employees and a net turnover that is 50 million SEK or more per year.
- Workplaces with their secondary branch in the industry sector if the secondary branch have a minimum of 10-20 employees.

In 2011 the population consisted of approximately 4000 workplaces and the survey had a weighted response frequency of 99 percentages. The production of commodities in those workplaces that do not fulfil the criteria's are model estimated, since they are not a part of the survey population. For each workplace the main and secondary industry branch can be identified on an SNI 5-digit level. Given that the IVP reports production of commodities on a CN 8-digit level for each workplace a key can be generated, that links economic activity on a SNI 5-digt level with production of commodities and industrial services on a CN 8-digit level.

Foreign trade statistics

For export flows, the foreign trade statistics could be used the same way as has been done for the existing key (except that only the export part of the statistics should be used). The composition of commodities in the production for export is assumed to differ from the production for domestic trade. Therefore, a separate key for export will be derived from the foreign trade statistics. The data is reported using both industry codes (SNI) and commodity codes (CN) and consequently provides a key between these classifications.

Eurostat correspondence table

The Eurostat Metadata Server RAMON provides correspondence tables for several statistical classifications. The NST/R to NST2007 conversion table could be used here. NST2007 is the new version of NST/R, but since these two versions are derived from different origins[1], the conversion has to be made via CN and an additional commodity classification, CPA. The NST/R-NST2007 conversion table thus includes a correspondence table between CN and NST/R, and between CN and NST2007 (via CPA)[2]. However, the correspondence between NST/R and NST2007 are not 1:1, i.e. one NST/R code corresponds to several NST2007 codes, and vice-versa. The advantage of using the detailed information of CN 8 is that each commodity group only correspond to one group in NST/R and NST2007, hence the correspondence goes from many to one.

Suggestion for new key(s)

As mentioned above, the existing Samgods commodities are based on the NST/R classification. However, this classification has been replaced by NST2007, meaning that NST/R is being abandoned for transport statistics. We therefore suggest that the new key will use NST2007 (at some aggregation level that also may be slightly adjusted to fit the purposes of the Samgods model) as commodity classification.

There is no key available for converting NST2007 data to the Samgods commodities and vice-versa. The conversion between NST/R and NST2007 is not straightforward, see the final chapter. This means that if NST2007 is chosen for the new key, the option to adjust the Samgods commodity classification should be considered. The drawbacks would be that some of the tables and parameter values in the Samgods model have to be re-calculated, and it will be more complicated to compare new model results to previous results. In return, model results may be validated using new transport statistics directly without the need for transformation between product classifications, but also, extra uncertainties in the calculation of the PWC matrices due to additional conversion between product classifications are avoided.

The calculations of the new key could then be done according to the following schematic picture:

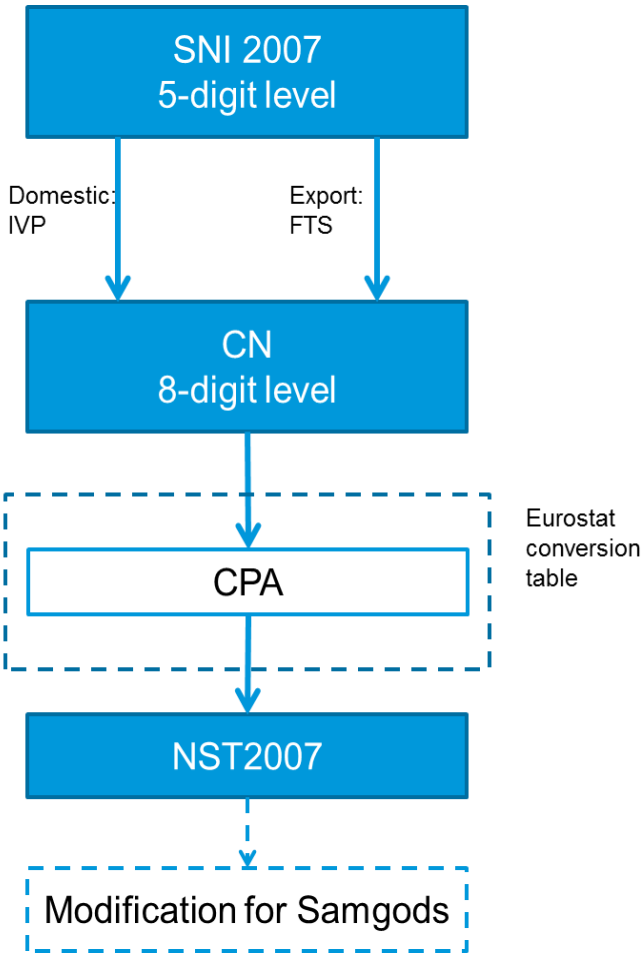
1) SNI 2007 values on the 5-digit level are converted to CN on the 8-digit level. The 5-digit level for SNI 2007 is detailed enough to take most regional differences within industries into account. This step is done separately for the domestic part of the key, using the statistics for Production of

[1] For more information, see final section

[2] "Maintenance of the NST/R – NST2007 conversion table", Artemis Information Management, September 2008

commodities and industrial services (IVP), and for the part concerning exports, using the foreign trade statistics (FTS).

2) CN is converted to NST2007 using the Eurostat conversion table as a basis.
3) Depending on the demands for the Samgods model, the NST2007 classification can be adjusted e.g. by aggregating some codes and leaving other codes disaggregated.



More technically, the keys could be described the following way.

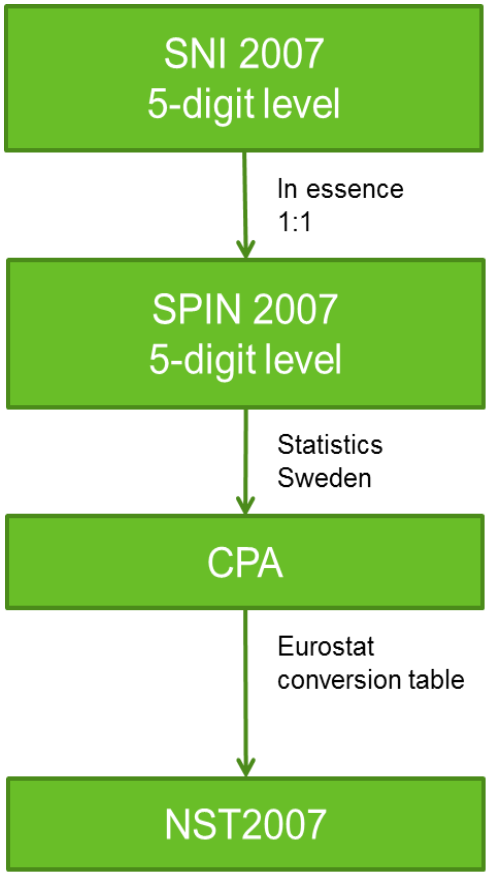
SNI industries, 5-digit level:	821 industries, index *h*
CN commodities, 8-digit level:	9600 commodities, index *u*
CPA commodities, 6-digit level:	3142 commodities, index *w*
NST2007 commodities, 3-digit level:	81 commodities, index *z*

Sub-key SNI – CN, domestic:	$SNICN^D$	821 × 9600

	Element (h, u) gives the fraction of the production value (for domestic trade) of industry h that consists of CN commodity u, so that $\sum_{u=1:9600} SNICN^D(h,u) = 1$ for all h = 1:821	
Sub-key SNI – CN, exports:	$SNICN^X$	821 × 9600
	Element (h, u) gives the fraction of the production value (for exports) of industry h that consists of CN commodity u, so that $\sum_{u=1:9600} SNICN^X(h,u) = 1$ for all h = 1:821	
Sub-key CN – CPA:	$CNCPA$	9600 × 3142
	Element (u, w) gives the fraction of CN commodity u that is included in CPA commodity w (in terms of economic value), so that $\sum_{w=1:3142} CNCPA(u,w) = 1$ for all u = 1:9600	
Sub-key CPA – NST2007:	$CPANST$	3142 × 81
	Element (w, z) gives the fraction of CPA commodity w that is included in NST2007 commodity z (in terms of economic value), so that $\sum_{z=1:81} CPANST(w,z) = 1$ for all w = 1:3142	
"Total key" SNI – NST2007, domestic:	$SNINST^D$	821× 81
	Element (h, z) gives the fraction of the production value (for domestic trade) of industry h that consists of NST2007 commodity z, so that $\sum_{z=1:81} SNINST^D(h,z) = 1$ for all h = 1:821	
	$SNINST^D = SNICN^D\ CNCPA\ CPANST$	
"Total key" SNI – NST2007, exports:	$SNINST^X$	821× 81
	Element (h, z) gives the fraction of the production value (for exports) of industry h that consists of NST2007 commodity z, so that $\sum_{z=1:81} SNINST^X(h,z) = 1$ for all h = 1:821	
	$SNINST^X = SNICN^X\ CNCPA\ CPANST$	

Alternative calculation methods

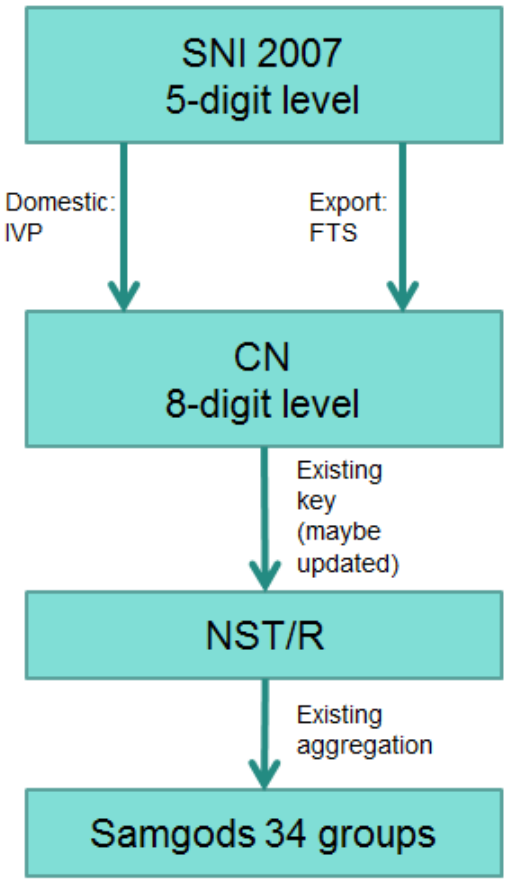
If, for some reason, one or more steps in the calculation described above are not possible to make, an option could be to skip the use of the CN classification. Instead, the connection between the SPIN and CPA classifications could be utilised. SPIN is a commodity classification that is tightly connected to the industry classification SNI[3] and is the Swedish version of the CPA classification. The correspondence between SPIN and CPA is not 1:1, but differences could maybe be solved if necessary. A description of the correspondence can be found at Statistics Sweden. From CPA to NST2007, the same method as described above can be used. The drawback here is that the detailed information of IVP and FTS is not utilised.



A third option could be to use the same method that has been used for the existing key, but with updated values and completed with the IVP statistics. The first step of the calculation is thus the same for this option as for the first option described above. Keeping the existing key for the following steps would imply that the NST/R connection to Samgods is preserved, meaning that no update of the Samgods commodities is needed. The drawback is that any conversion to NST2007

[3] See final section

(e.g. for validating model results to current transport statistics) would be more complicated.



Classifications of industries and commodities

SNI – classification of industries

SNI (Standard för Svensk Näringsgrensindelning) is the label for the Swedish Standard Industrial Classification. According to the webpage of Statistics Sweden [4], SNI is based on the EU standard NACE Rev.2. Production units are classified according to the type of activity pursued. Those units can be companies or other units registered as workplaces. A unit can have several SNI codes, if more than one activity is pursued there. 2008 a new set of SNI codes were introduced; SNI2007. Earlier versions are SNI2002 and SNI92. There are relatively big differences between SNI2007 and the earlier versions.

[4] http://www.scb.se/Pages/List____257409.aspx, 2013-05-02

The SNI2007 classification divides industries into 21 sections, denoted by letters. Those are divided into 88 main groups (2-digit codes), 272 groups (3-digit codes), 615 subgroups (4-digit codes) and 821 detail groups (5-digit codes)[5].

CN – Combined Nomenclature

The Combined Nomenclature is used by all EU countries in their foreign trade statistics and common custom tariff, in Sweden it is also used in the production of commodities and industrial services, IVP. CN 8 is the most detailed level of commodity classification consisting of 8 digits. In 2009 the CN 8 consisted of 9 600 commodity groups. In Sweden a large share of all production and foreign trade is connected to relatively few CN 8 commodity groups, while the rest of the commodity groups have very small values or are equal to zero. The CN 8 is summed hierarchically to the more aggregated commodity groups CN 6, CN 4 and CN 2 which consist of 6 respectively 4 and 2 digits.

Every year small changes are made in the description and classification of the CN 8 commodity groups. Approximately every fifth year the CN 6, CN 4 and CN 2 are revised which implies larger changes to the CN 8 commodity groups. The changes are made to harmonise the commodity classification with technical development and changes in trade patterns.

NST/R

NST/R is the version of the standard goods classification for transport statistics, which was in use from 1967 to 2007, by e.g. member states of the EU. According to the documentation[6],

"the NST/R takes the form of a list with 176 heading for goods which are classified as far as possible on the basis of their nature, processing stage, methods of transport and total tonnage transported; (...) The analytical structure of the NST/R divides the 176 headings of the classification into 10 chapters and 52 main groups, according to a system which consists of:

- *one digit for the chapters,*
- *two digits for the groups,*
- *three digits for the headings."*[7]

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[5] http://www.scb.se/Pages/List____257220.aspx, 2013-05-02

[6] "Standard goods classification for transport statistics – NST/R", can be found in "Introduction to the classification" at http://ec.europa.eu/eurostat/ramon/nomenclatures/index.cfm?TargetUrl=LST_CLS_DLD&StrNom=NSTR_1967&StrLanguageCode=EN&StrLayoutCode=HIERARCHIC

[7] The classification can be found at http://ec.europa.eu/eurostat/ramon/nomenclatures/index.cfm?TargetUrl=LST_NOM_DTL

The commodity type classifications used for the Samgods model is based on NST/R, with some modifications, see the Samgods/STAN chapter below.

NST2007 – classification of commodities

According to the webpage of Eurostat[8]:

"The Standard goods classification for transport statistics abbreviated as NST (2007), is a statistical nomenclature for the goods transported by four modes of transport: road, rail, inland waterways and sea (maritime).

As NST 2007 considers the economic activity from which the goods originate, each of its items is strongly connected to an item of the European Union product and activity classifications Classification of products by activity (CPA) and Statistical classification of economic activities (NACE), which themselves are consistent with their counterparts at UN level, CPC and ISIC."

NST2007 divides commodities into 20 main groups and 81 subgroups[9] and has been in use since 2008. As described above, NST2007 is based on the production process where the goods are coming from, while NST/R is based on the physical characteristics of the goods[10]. Therefor the conversion between the two versions is not straight-forward, but has to be done via CN and CPA[11].

Samgods34 and STAN12 – classification of commodities

The Samgods model operates with 34 commodity groups separately. Those 34 groups can be directly aggregated to the 12 commodity types of the old STAN model. As mentioned above, the Samgods34 commodities are based on the NST/R classification. More specifically, the Samgods34 classification is an aggregation of NST/R on the most detailed level – the 176 headings have been aggregated into 33

&StrNom=NSTR_1967&StrLanguageCode=EN&IntPcKey=&StrLayoutCode=HIERARCHIC

[8] http://epp.eurostat.ec.europa.eu/statistics_explained/index.php/Glossary:NST, 2013-04-15

[9] The classification can be found at http://ec.europa.eu/eurostat/ramon/nomenclatures/index.cfm?TargetUrl=LST_NOM_DTL&StrNom=NST_2007&StrLanguageCode=EN&IntPcKey=&StrLayoutCode=HIERARCHIC&IntCurrentPage=1

[10] http://epp.eurostat.ec.europa.eu/cache/ITY_SDDS/en/road_go_esms.htm, 2013-04-15

[11] For more information, see "Maintenance of the NST/R – NST2007 conversion table", Artemis Information Management, September 2008. The conversion table can be found at http://ec.europa.eu/eurostat/ramon/relations/index.cfm?TargetUrl=LST_REL&StrLanguageCode=EN&IntCurrentPage=8 (NST/R 1967 – NST 2007)

groups (the last group of the 34 is for air freight). The Samgods34 classification can be found in the Samgods documentation[12].

SPIN – classification of commodities

SPIN is a product classification for goods, services and other products such as electricity. It is based on the production activity that the products come from and is closely connected to the industry classification SNI. With the exception for the education sector, the five first digits of the SPIN2007 codes are identical with the 5-digit codes if the SNI activity the product group is derived from. The SPIN classification is also connected to its European counterpart, CPA (see the next subsection). The 2007 version of SPIN contains quite big differences compared to the 2002 version.[13]

CPA – classification of commodities

CPA – Classification of Products by Activity – is EU's product classification based on the production process that results in the products. The products can be goods or services. CPA is linked to the EU industry classification the same way as SPIN is linked to SNI. The current version is CPA2008. SPIN is adjusted to CPA so that the first four digits in the respective codes are equal.[13]

CN on the 8-digit level are linked to the 6-digit CPA2008 codes which are linked to the classification of commodities NST2007on a 3-digit level. The linkage is done through existing Eurostat correspondence tables[14].

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[12] See e.g. "Representation of the Swedish transport and logistics system", VTI notat 17A-2009, page 14-15 (please note that the NSTR codes given in the table on page 15 do not equal the official NST/R codes given by Eurostat – the groups are an aggregate of NST/R but the notation used for the codes is another). The document can be found at e.g. http://www.trafikverket.se/PageFiles/64819/representation-av-det-svenska-godstransport--och-logistiksystemet-logistikmodell-version-200.pdf

[13] http://www.scb.se/Pages/List____303898.aspx, 20130515

[14] More information and an index of existing and downloadable correspondence tables can be found at http://ec.europa.eu/eurostat/ramon/relations/index.cfm?TargetUrl=LST_REL

3 Connection NST\R – Samgods commodities

Table 1 Connection between NST\R commodities and Samgods commodities

NSTR Code	Description	Sam-gods	Description
001	Live animals	3	Live animals
011	Wheat, spelt and meslin	1	Cereals
012	Barley	1	Cereals
013	Rye	1	Cereals
014	Oats	1	Cereals
015	Maize	1	Cereals
016	Rice	1	Cereals
019	Other cereals	1	Cereals
020	Potatoes	2	Potatoes, other vegetables, fresh or frozen, fresh fruit
031	Citrus fruit	2	Potatoes, other vegetables, fresh or frozen, fresh fruit
035	Other fruit and nuts, fresh	2	Potatoes, other vegetables, fresh or frozen, fresh fruit
039	Other vegetables, fresh/frozen	2	Potatoes, other vegetables, fresh or frozen, fresh fruit
041	Wool and other animal hair	9	Textiles, textile articles and manmade fibres, other raw animal and vegetable materials
042	Cotton	9	Textiles, textile articles and manmade fibres, other raw animal and vegetable materials
043	Man-made fibres	9	Textiles, textile articles and manmade fibres, other raw animal and vegetable materials
045	Silk, flax, jute,true hemp and other vegetable textile materi-als	9	Textiles, textile articles and manmade fibres, other raw animal and vegetable materials
049	Rags and waste of textile ma-terials	9	Textiles, textile articles and manmade fibres, other raw animal and vegetable materials

051	Paper pulp wood	5	Timber for paper industry (pulpwood)
052	Pit props	6	Wood roughly squared or sawn lengthwise, sliced or peeled
055	Other wood in the round	31	Timber for sawmill
056	Railway or tramway sleepers of wood and other wood roughly squared, half squared or sawn	6	Wood roughly squared or sawn lengthwise, sliced or peeled
057	Fuel wood, wood charcoal, wood waste, cork unworked, waste cork	7	Wood chips and wood waste
060	Sugar-beet	4	Sugar beet
091	Raw hides and skins, raw fur-skins, waste	9	Textiles, textile articles and manmade fibres, other raw animal and vegetable materials
092	Rubber, natural and synthetic, raw or reclaimed	9	Textiles, textile articles and manmade fibres, other raw animal and vegetable materials
099	Other non-edible raw vegeta-ble and animal materials, n.e.s.	9	Textiles, textile articles and manmade fibres, other raw animal and vegetable materials
111	Raw sugar	10	Foodstuff and animal fodder
112	Refined sugar	10	Foodstuff and animal fodder
113	Molasses	10	Foodstuff and animal fodder
121	Wine of fresh grapes, grape must	10	Foodstuff and animal fodder
122	Beer made from malt	10	Foodstuff and animal fodder
125	Other alcoholic beverages	10	Foodstuff and animal fodder
128	Non-alcoholic beverages	10	Foodstuff and animal fodder
131	Coffee	10	Foodstuff and animal fodder
132	Cocoa and chocolate	10	Foodstuff and animal fodder
133	Tea, maté, spices	10	Foodstuff and animal fodder
134	Unmanufactured tobacco and tobacco refuse	10	Foodstuff and animal fodder
135	Manufactured tobacco	10	Foodstuff and animal fodder
136	Glucose, dextrose; other sug-	10	Foodstuff and animal fodder

	ars; sugar confectionery; honey		
139	Food preparations, n.e.s.	10	Foodstuff and animal fodder
141	Meat, fresh, chilled or frozen	10	Foodstuff and animal fodder
142	Fish, crustaceans and molluscs, fresh, frozen, dried, salted or smoked	10	Foodstuff and animal fodder
143	Milk and cream, fresh	10	Foodstuff and animal fodder
144	Butter, cheese, other dairy produce	10	Foodstuff and animal fodder
145	Margarine, lard and edible fats	10	Foodstuff and animal fodder
146	Eggs	10	Foodstuff and animal fodder
147	Meat, dried, salted, smoked; prepared or preserved meat	10	Foodstuff and animal fodder
148	Fish, crustaceans and molluscs, prepared or preserved	10	Foodstuff and animal fodder
161	Flour, cereal meal and groats	10	Foodstuff and animal fodder
162	Malt	10	Foodstuff and animal fodder
163	Other cereal preparations	10	Foodstuff and animal fodder
164	Fruit, frozen, dried, dehydrated; prepared and preserved fruit	10	Foodstuff and animal fodder
165	Fried vegetables	10	Foodstuff and animal fodder
166	Prepared and preserved vegetables	10	Foodstuff and animal fodder
167	Hops	10	Foodstuff and animal fodder
171	Cereal straw, hay and husks	10	Foodstuff and animal fodder
172	Oil-cake and residues resulting from the extraction of vegetable oils	10	Foodstuff and animal fodder
179	Bran, cereal by-products and other animal food, n.e.s.; waste from the food industries	10	Foodstuff and animal fodder
181	Oilseed fats, oilnuts and oil	11	Oil seeds and oleaginous fruits and fats

	kernels		
182	Animal and vegetable fats and oils, and products derived therefrom	11	Oil seeds and oleaginous fruits and fats
211	Coal (ECSC)	12	Solid mineral fuels
213	Coal briquettes (ECSC)	12	Solid mineral fuels
221	Lignite (ECSC)	12	Solid mineral fuels
223	Lignite briquettes (ECSC)	12	Solid mineral fuels
224	Peat	12	Solid mineral fuels
231	Coke and semi-coke of coal (ECSC)	12	Solid mineral fuels
233	Coke and semi-coke of lignite (ECSC)	12	Solid mineral fuels
310	Crude petroleum	13	Crude petroleum
321	Motor spirit	14	Petroleum products
323	Kerosene, jet fuel and white spirit	14	Petroleum products
325	Distillate fuels	14	Petroleum products
327	Residual fuel oils	14	Petroleum products
330	Gaseous hydrocarbons, liquid or compressed	14	Petroleum products
341	Lubricating oils and greases	14	Petroleum products
343	Petroleum bitumen and bitu-minous mixtures	14	Petroleum products
349	Other non-fuel petroleum de-rivatives	14	Petroleum products
410	Iron ore and concentrates, except roasted iron pyrites (ECSC)	15	Iron ore, iron and steel waste and blast-furnace dust
451	Non-ferrous metal waste	16	Non-ferrous ores and waste
452	Copper ore and concentrates; copper matte	16	Non-ferrous ores and waste
453	Aluminium ore and concen-trates; bauxite	16	Non-ferrous ores and waste

455	Manganese ore and concentrates (ECSC)	16	Non-ferrous ores and waste
459	Other non-ferrous ores and concentrates	16	Non-ferrous ores and waste
462	Iron and steel waste for re-melting (ECSC)	15	Iron ore, iron and steel waste and blast-furnace dust
463	Iron and steel waste not for re-melting (non-ECSC)	15	Iron ore, iron and steel waste and blast-furnace dust
465	Iron slag for re-melting (non-ECSC)	15	Iron ore, iron and steel waste and blast-furnace dust
466	Blast-furnace dust (ECSC)	15	Iron ore, iron and steel waste and blast-furnace dust
467	Roasted iron pyrites (non-ECSC)	15	Iron ore, iron and steel waste and blast-furnace dust
512	Pig iron, spiegeleisen and carburized ferro-manganese (ECSC)	17	Metal products
513	Ferro-alloys other than carburized ferro-manganese (non-ECSC)	17	Metal products
515	Crude steel (ECSC)	17	Metal products
522	Semi-finished rolled steel products (blooms, billets, slabs, sheet bars, coils) (ECSC)	17	Metal products
523	Other semi-finished steel products (non-ECSC)	17	Metal products
532	Hot-rolled or -shaped steel (ECSC)	17	Metal products
533	Cold-rolled or -shaped steel (non-ECSC)	17	Metal products
535	Wire rod (ECSC)	17	Metal products
536	Steel iron and steel wire (non-ECSC)	17	Metal products
537	Steel rails and railway and tramway track construction	17	Metal products

	material (ECSC)		
542	Sheets and plates of steel for re-rolling; universal plates (ECSC)	17	Metal products
543	Other steel plates and sheets (non-ECSC)	17	Metal products
545	Steel hoop and strip, tinplate (ECSC)	17	Metal products
546	Steel hoop and strip, other (non-ECSC)	17	Metal products
551	Tubes, pipes and fittings	17	Metal products
552	Iron and steel castings and forgings	17	Metal products
561	Copper and copper alloys, unwrought	17	Metal products
562	Aluminium and aluminium alloys, unwrought	17	Metal products
563	Lead and lead alloys, unwrought	17	Metal products
564	Zinc and zinc alloys, unwrought	17	Metal products
565	Other non-ferrous metals and alloys thereof, unwrought	17	Metal products
568	Finished and semi-finished products of non-ferrous metals (except manufactures)	17	Metal products
611	Sand for industrial use	19	Earth, sand and gravel
612	Ordinary sand and gravel	19	Earth, sand and gravel
613	Pumice stone, incl. pumiceous sand and gravel	19	Earth, sand and gravel
614	Clay and clay earth	19	Earth, sand and gravel
615	Slag not for recovery of metals; ash and dross	19	Earth, sand and gravel
621	Salt, crude or refined	20	Other crude and manufactured minerals
622	Unroasted iron pyrites	20	Other crude and manufactured minerals

623	Sulphur	20	Other crude and manufactured minerals
631	Crushed or broken stone, pebbles, macadam, tarred macadam	20	Other crude and manufactured minerals
632	Building and monumental stone, unworked	20	Other crude and manufactured minerals
633	Calcareous stone for industrial purposes	20	Other crude and manufactured minerals
634	Chalk	20	Other crude and manufactured minerals
639	Other crude minerals	20	Other crude and manufactured minerals
641	Cement	18	Cement, lime, manufactured building materials
642	Lime	18	Cement, lime, manufactured building materials
650	Plasters	18	Cement, lime, manufactured building materials
691	Pumice stone agglomerates; concrete, cement and similar building materials	18	Cement, lime, manufactured building materials
692	Bricks, roofing tiles and other ceramic buiding materials; refractory building materials	18	Cement, lime, manufactured building materials
711	Sodium nitrate, natural	21	Natural and chemical fertilizers
712	Phosphates, crude, natural	21	Natural and chemical fertilizers
713	Potassium salts, crude, natural	21	Natural and chemical fertilizers
719	Other natural fertilizers	21	Natural and chemical fertilizers
721	Basic slag (Thomas slag)	21	Natural and chemical fertilizers
722	Other phosphatic fertilizers	21	Natural and chemical fertilizers
723	Potassic fertilizers	21	Natural and chemical fertilizers
724	Nitrogenous fertilizers	21	Natural and chemical fertilizers
729	Composite and other manufac-tured fertilizers	21	Natural and chemical fertilizers
811	Sulphuric acid; oleum	23	Chemicals other than coal chemicals and tar
812	Caustic soda and soda lye	23	Chemicals other than coal chemicals and tar
813	Sodium carbonate (soda ash)	23	Chemicals other than coal chemicals and tar
814	Calcium carbide	23	Chemicals other than coal chemicals and tar

819	Other basic chemicals	23	Chemicals other than coal chemicals and tar
820	Aluminium oxide and hydroxide	23	Chemicals other than coal chemicals and tar
831	Benzole	22	Coal chemicals
839	Pitch, mineral tar and other crude mineral chemical derivatives from coal and natural gas	22	Coal chemicals
841	Paper pulp	24	Paper pulp and waste paper
842	Waste paper and scrap articles of paper	24	Paper pulp and waste paper
891	Plastic materials, unworked	23	Chemicals other than coal chemicals and tar
892	Dyeing, tanning and colouring materials	23	Chemicals other than coal chemicals and tar
893	Medicinal and pharmaceutical products; perfumery and cleansing preparations	23	Chemicals other than coal chemicals and tar
894	Manufactured explosives, fireworks and other pyrotechnic articles, sporting ammunition	23	Chemicals other than coal chemicals and tar
895	Starches and gluten	23	Chemicals other than coal chemicals and tar
896	Other chemical products and preparations	23	Chemicals other than coal chemicals and tar
910	Transport equipment, whether or not assembled, parts thereof	25	Transport equipment, whether or not assembled, and parts thereof
920	Tractors; agricultural machinery and equipment, whether or not assembled; parts thereof	32	Machinery, apparatus, engines, whether or not assembled, and parts thereof
931	Electrical machinery, apparatus, appliances and engines; parts thereof	32	Machinery, apparatus, engines, whether or not assembled, and parts thereof
939	Non-electrical machinery, apparatus, appliances and engines; parts thereof	32	Machinery, apparatus, engines, whether or not assembled, and parts thereof
941	Finished structural parts and structures	26	Manufactures of metal

949	Other manufactures of metal	26	Manufactures of metal
951	Glass	27	Glass, glassware, ceramic products
952	Glassware, pottery and other manufactures of minerals	27	Glass, glassware, ceramic products
961	Leather, manufactures of leather and raw hides and skins	29	Leather textile, clothing, other manufactured articles than paper, paperboard and manufactures there
962	Textile yarn, fabrics, made-up articles and related products	29	Leather textile, clothing, other manufactured articles than paper, paperboard and manufactures there
963	Travel goods, clothing, knitted and crocheted goods, footwear	29	Leather textile, clothing, other manufactured articles than paper, paperboard and manufactures there
971	Semi-finished products and manufactured articles of rubber	29	Leather textile, clothing, other manufactured articles than paper, paperboard and manufactures there
972	Paper and paperboard, unworked	28	Paper, paperboard; not manufactures
973	Paper and paperboard manufactures	33	Paper, paperboard and manufactures thereof
974	Paper matter	33	Paper, paperboard and manufactures thereof
975	Furniture, new	29	Leather textile, clothing, other manufactured articles than paper, paperboard and manufactures there
976	Wood and cork manufactures, excluding furniture	29	Leather textile, clothing, other manufactured articles than paper, paperboard and manufactures there
979	Other manufactured articles, n.e.s.	29	Leather textile, clothing, other manufactured articles than paper, paperboard and manufactures there
991	Packing containers, used	34	Wrapping material, used
992	Construction materials, fairground vehicles and equipment, used	18	Cement, lime, manufactured building materials
993	Removal equipment	29	Leather textile, clothing, other manufactured articles than paper, paperboard and manufac-

			tures there
994	Gold, coins, medals	29	Leather textile, clothing, other manufactured articles than paper, paperboard and manufactures there
999	Other manufactured goods not classified according to kind	29	Leather textile, clothing, other manufactured articles than paper, paperboard and manufactures there

4 Commodity tables, complementary data sources

Table 2 Allocation of EAA commodity groups to Samgods commodities

EAA commodity group	Samgods commodity
01110 Vanligt vete och spelt	1 - Cereals
01120 Durumvete	1 - Cereals
01200 Råg och blandsäd av vete och råg	1 - Cereals
01300 Korn	1 - Cereals
01400 Havre och blandsäd	1 - Cereals
01500 Majskorn	1 - Cereals
01600 Ris	1 - Cereals
01900 Annan spannmål	1 - Cereals
02110 Rapsfrön och rybsfrön	11 - Oil seeds and oleaginous fruits and fats
02120 Solrosfrön	11 - Oil seeds and oleaginous fruits and fats
02130 Sojabönor	11 - Oil seeds and oleaginous fruits and fats
02190 Andra oljeväxtfrön och oljehaltiga frukter	11 - Oil seeds and oleaginous fruits and fats
02200 Proteingrödor	10 - Foodstuff and animal fodder
02300 Råtobak	10 - Foodstuff and animal fodder
02400 Sockerbetor	4 - Sugar beet
02910 Sånadsväxter	10 - Foodstuff and animal fodder
02920 Humle	10 - Foodstuff and animal fodder
02930 Övriga industrigrödor	10 - Foodstuff and animal fodder
03100 Fodermajs	10 - Foodstuff and animal fodder
03200 Foderrotfrukter (inklusive foderbetor)	10 - Foodstuff and animal fodder
03900 Andra foderväxter	10 - Foodstuff and animal fodder
04110 Blomkål	2 - Potatoes, other vegetables, fresh or frozen, fresh fruit
04120 Tomater	2 - Potatoes, other vegetables, fresh or frozen, fresh fruit
04190 Andra färska grönsaker	2 - Potatoes, other vegetables, fresh or frozen, fresh fruit

04210 Plantskoleväxter	9 - Textiles, textile articles, and manmade fibers, other raw animal and vegetable materials
04220 Blommor och växter för prydnadsändamål (inklusive julgranar)	9 - Textiles, textile articles, and manmade fibers, other raw animal and vegetable materials
04230 Planteringar	9 - Textiles, textile articles, and manmade fibers, other raw animal and vegetable materials
05000 POTATIS (inklusive utsäde)	2 - Potatoes, other vegetables, fresh or frozen, fresh fruit
06110 Äpplen	2 - Potatoes, other vegetables, fresh or frozen, fresh fruit
06120 Päron	2 - Potatoes, other vegetables, fresh or frozen, fresh fruit
06130 Persikor	2 - Potatoes, other vegetables, fresh or frozen, fresh fruit
06190 Annan färsk frukt	2 - Potatoes, other vegetables, fresh or frozen, fresh fruit
06210 Apelsiner	2 - Potatoes, other vegetables, fresh or frozen, fresh fruit
06220 Mandariner	2 - Potatoes, other vegetables, fresh or frozen, fresh fruit
06230 Citroner	2 - Potatoes, other vegetables, fresh or frozen, fresh fruit
06290 Andra citrusfrukter	2 - Potatoes, other vegetables, fresh or frozen, fresh fruit
06300 Tropiska frukter	2 - Potatoes, other vegetables, fresh or frozen, fresh fruit
06410 Bordsdruvor	2 - Potatoes, other vegetables, fresh or frozen, fresh fruit
06490 Andra druvor	2 - Potatoes, other vegetables, fresh or frozen, fresh fruit
06510 Bordsoliver	2 - Potatoes, other vegetables, fresh or frozen, fresh fruit
06590 Andra oliver	2 - Potatoes, other vegetables, fresh or frozen, fresh fruit
07100 Bordsvin	10 - Foodstuff and animal fodder
07200 Kvalitetsvin	10 - Foodstuff and animal fodder
08000 OLIVOLJA	10 - Foodstuff and animal fodder
09100 Vegetabiliska flätmaterial	9 - Textiles, textile articles, and manmade fibers, other raw animal and vegetable materials
09200 Utsäde	1 - Cereals
09900 Övrigt	9 - Textiles, textile articles, and manmade fibers, other raw animal and vegetable materials
11100 Nötkreatur	3 - Live animals
11200 Svin	3 - Live animals

11300 Hästar och åsnor	3 - Live animals
11400 Får och getter	3 - Live animals
11500 Fjäderfä	3 - Live animals
11900 Andra djur	3 - Live animals
12100 Mjölk	10 - Foodstuff and animal fodder
12200 Ägg	10 - Foodstuff and animal fodder
12910 Obehandlad ull	9 - Textiles, textile articles, and manmade fibers, other raw animal and vegetable materials
12920 Silkeskokonger	9 - Textiles, textile articles, and manmade fibers, other raw animal and vegetable materials
12930 Andra animaliska produkter	9 - Textiles, textile articles, and manmade fibers, other raw animal and vegetable materials

Table 3 Allocation of detailed NR product groups to Samgods commodities. Products considered as services are excluded from the table.

NR product group	Description (in Swedish)	Samgods commodity
A0111A	Spannmål	1
A0113001	Potatis	2
A01130EG	Potatis egna uttag	2
A0113A	Grönsaker	2
A0115	Råtobak	10
A0116	Fiberväxt bomull lin	9
A0119	Foder blommor utsäde	10
A011A	Bönor, frön mm	11
A011B	Sockerbetor	4
A0127	Kaffe te kakao humle	10
A012A	Frukt bär nötter	2
A0146	Gris	3
A01471	Ägg	10
A01471EG	Ägg egna uttag	10
A01472	Fjäderfän	3
A01491	Renar	3
A01492	Sällskapsdjur	3
A0149A	Ö animalprodukter	3
A014A	Mjölk	10
A014AEG	Mjölk egna uttag	10
A014B	Nötkreatur	3
A014C	Hästar, kameler	3
A014D	Får, getter	3
A014E	Lager- inv.djur avel	3
A01A	Ö växter o julgranar	9
A02101	Skog	5
A02109A	Energigrödor	7
A0220004	Brännved	7
A022A	Massaved	5
A022B	Sågtimmer	31
A023	Svamp skogsbär mossa	2
B05	Stenkol och brunkol	12
B061	Råpetroleum	13
B062	Naturgas	13
B071	Järnmalm	15
B0721	Uran- o toriummalm	16
B0729	Övrig malm	16
B0811	Natursten	20

B0812	Grus sand lera	19
B0891	Mineral f gödsel mm	21
B0892	Torv	12
B0893	Salt	20
B0899	Övrig utvinning	20
C1011	Behandlat kött	10
C1012	Behandlad fågel	10
C1013	Köttvaror	10
C102	Behandlad fisk mm	10
C103	Beh frukt o köksväxt	10
C1041	Oljor o fetter	11
C1042	Margarin o liknande	11
C10511	Ost och ostmassa	10
C10519	Övriga mejerivaror	10
C1052	Glass	10
C1061	Kvarnprodukter	10
C1062	Stärkelseprodukter	10
C107	Bageri mjölprodukter	10
C1081	Socker	10
C1082	Kakao o konfektyrer	10
C1083	Kaffe och te	10
C1084	Senap ketchup krydda	10
C1085	Lagad mat färdigrätt	10
C108A	Övrig livsmedel	10
C1091	Beredda fodermedel	10
C1092	Mat t sällskapsdjur	10
C1101	Destil. alkoholdryck	10
C1105	Öl	10
C1106	Malt	10
C1107	Läskedryck mineralva	10
C110A	Vin	10
C12	Tobaksvaror	10
C139A	Trikå textilv mattor	9
C139B	Övriga textilier	9
C13A	Garn tråd textilväv	9
C14	Kläder	29
C1511	Berett läder o päls	29
C1512	Väskor sadel- seldon	29
C152	Skodon	29
C161	Trä, sågat o hyvlat	6
C16231	Trähus	29
C1623A	Snickerier	29

C1624	Förpackningar av trä	29
C16291	Förädlat trädbränsle	7
C1629A	Trä- kork- halmvaror	29
C162A	Träskiva parkettgolv	18
C17111	Mekanisk massa	24
C1711A	Sulfit- sulfatmassa	24
C17121	Tidn- journalpapper	28
C17122	Övrigt tryckpapper	28
C17123	Kraft-papper o papp	28
C17129	Övrigt papper o papp	28
C1721	Wellpapp	28
C1722	HHs o hygienpapper	33
C1724	Tapeter	33
C172A	Ö varor av papp/-er	33
C191000A	Mineraltjära	22
C1920003	Energitorv	12
C192000B	Motorbensin ej flyg	14
C192000C	Flygbränsle	14
C192000D	Lätt- mellanoljor	14
C192000E	Dieselolja	14
C192000F	Tunn eldningsolja	14
C1920011	Tjock eldningsolja	14
C1920012	Smörjoljor	14
C1920013	Propan butan (vätska	22
C1920014	Eten o kolväten	22
C1920015	Vaselin mineralvax	22
C1920016	Petrokoks bitumen	22
C19A	Koks,stenkolsbrikett	12
C2011	Industrigaser	23
C2012	Färgämnen	23
C2013A	Uran radioaktiv ämne	12
C2013B	Oorganiska kemikalie	23
C2014A	Tallolja mm fr ved	23
C2014B	Etanol denatur sprit	23
C2014C	Ö organisk kemikalie	23
C2015	Gödselmedel	21
C2016	Plaster	23
C2017	Syntetgummi	23
C202	Bekämpningsmedel	23
C203	Lacker o färger	23
C204	Tvål tvättm parfym	23
C205	Ö kemiska produkter	23

C206	Konstfibrer	9
C211	Farmaceutisk basprod	23
C212	Läkemedel	23
C2211	Däck o slangar	23
C2219	Ö gummivaror	23
C2222	Plastförpackningar	23
C2223	Byggplastvaror	18
C222A	Övriga plastvaror	23
C2313	Butelj husgeråd i gl	27
C2314	Glasfiber	18
C2319	Ö inkl tekniskt glas	27
C231A	Planglas inkl bearb	27
C234	Ö keramiska produkt	27
C235	Cement, kalk, gips	18
C236	Cement-, gipsvaror	18
C237	Bearbetad sten	18
C239	Slipmatrial mm	18
C23A	Keramiska byggvaror	18
C241	Järn inkl legeringar	17
C242	Rör av stål	26
C243	Ö stålvaror	26
C2441	Ädelmetaller	17
C2442	Aluminium	17
C2443	Bly, zink, och tenn	17
C2444	Koppar	17
C2445	Andra metaller	17
C2446	Kärnbränslematerial	20
C251	Byggnadsmetallvaror	26
C252	Behållare av metall	26
C253	Ånggeneratorer	32
C254	Vapen o ammunition	26
C257	Verktyg bestick mm	26
C259	Ö metallvaror	26
C261	Elektroniska komp	32
C262	Datorer m tillbehör	32
C263	Kommunikationsutr	32
C264	Hemelektronik	32
C2651	Mätinstrument	32
C2652	Ur	32
C266	Strålningsutrustning	32
C267	Optik foto	32
C268	Lagringsmedier	32

C2711	Elmotorer	32
C2712	Eldistributionsutr	32
C272	Batteri	32
C273	Kablar o tillbehör	32
C274	Belysningsarmatur	32
C2751A	Vitvaror	32
C2751B	Elektriska HHmaskine	32
C2752	Ö hushållsmaskiner	32
C279	Övrig elapparatur	32
C281	Motor,pump, kullager	32
C2822	Lyft-, godshantering	32
C2823	Kontorsmaskiner	32
C282A	Ö allmänna maskiner	32
C283	Jord- skogsbr.maskin	25
C284	Maskin f metallbearb	32
C2891	Maskin f metallurgi	32
C2892	Gruv- o byggmaskiner	25
C2893	Maskin f livsmedel	32
C2894	Maskin f textil	32
C2895	Maskin f massa/papp	32
C2896	Mask f plast/gummi	32
C2899	Ö specialmaskiner	32
C291A	Motorfordon	25
C292	Karosserier	25
C2931	Bilel o elektronik	25
C2932	Ö fordonsdelar	25
C3011	Fartyg o flytmtrl	25
C3012	Fritidsbåtar	25
C302	Rälsfordon	25
C303	Flygplan	25
C304	Militära stridsfordo	25
C3091	Motorcyklar	25
C3092	Cyklar o invalidford	25
C3099	Ö transportmedel	25
C31	Möbler	29
C323	Sportartiklar	29
C324	Spel och leksaker	29
C32501	Medicinska instrum	32
C32502	Tandproteser	29
C329	Ö tillverkade varor	29
C32A	Smycken o musikinstr	29

5 Connection between SNI 46 codes and Samgods commodities

Table 4 Percentage of costs for goods for resale for 5-digit SNI codes, allocated to Samgods commodities

	Samgods commodities																													
SNI codes	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**	**22**	**23**	**24**	**25**	**26**	**27**	**28**	**29**	**31**	**32**	**33**
46.110 provisionshandel med jordbruksråvaror, levande djur, textilråvaror och textilhalvfabrikat		42	13	1				19		24																					
46.120 provisionshandel med bränsle, malm, metaller och industrikemikalier											1	11	22	5	4	25				1	,05	31									
46.130 provisionshandel med virke och byggmaterial						48											24	4	10							14					
46.141 provisionshandel med maskiner, industriell utrustning, fartyg och luftfartyg utom kontorsutrustning och datorer																														100	
46.142 provisionshandel med kontorsutrustning och datorer																														100	
46.150 provisionshandel med möbler, hushålls- och järnhandelsvaror																									21			63			16
46.160 provisionshandel med textilier, kläder, skodon och lädervaror																												100			
46.170 provisionshandel med livsmedel, drycker och tobak									100																						
46.180 provisionshandel med annat specialsortiment																												100			

	Samgods commodities																														
SNI codes	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**	**22**	**23**	**24**	**25**	**26**	**27**	**28**	**29**	**31**	**32**	**33**
46.190 provisionshandel med blandat sortiment																												100			
46.210 partihandel med spannmål, råtobak, utsäde och djurfoder										100																					
46.220 partihandel med blommor och växter								100																							
46.230 partihandel med levande djur			100																												
46.240 partihandel med hudar, skinn och läder								100																							
46.310 partihandel med frukt och grönsaker		97		3																											
46.320 partihandel med kött- och köttvaror									100																						
46.330 partihandel med mejeriprodukter, ägg, matolja och matfett									100																						
46.340 partihandel med drycker									100																						
46.350 partihandel med tobak									100																						
46.360 partihandel med socker, choklad och sockerkonfektyrer									100																						
46.370 partihandel med kaffe, te, kakao, kryddor									100																						
46.380 partihandel med andra livsmedel, bl.a. fisk samt skal- och blötdjur									100																						
46.390 icke specialiserad partihandel med livsmedel, drycker och tobak									100																						
46.410 partihandel med textilier								100																							
46.420 partihandel med kläder och skodon																												100			

	Samgods commodities																													
SNI codes	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**	**22**	**23**	**24**	**25**	**26**	**27**	**28**	**29**	**31**	**32**	**33**
46.431 partihandel med elektriska hushållsmaskiner och -apparater																														100	
46.432 partihandel med ljud- och bildanläggningar samt videoutrustning																														100	
46.433 partihandel med inspelade band och skivor för musik och bild																														100	
46.434 partihandel med elartiklar																														100	
46.435 partihandel med fotografiska och optiska produkter																														100	
46.440 partihandel med glas och porslin, rengöringsmedel																										100					
46.450 partihandel med parfym och kosmetika																						100									
46.460 partihandel med medicinsk utrustning och apoteksvaror																						100									
46.470 partihandel med möbler, mattor och belysningsartiklar																												100			
46.480 partihandel med ur och guldsmedsvaror																												100			
46.491 partihandel med sport- och fritidsartiklar																												100			
46.492 partihandel med kontorsförbrukningsvaror																															100
46.499 partihandel med övriga hushållsvaror																												100			
46.510 partihandel med datorer och kringutrustning samt programvara																														100	
46.521 partihandel med elektronikkomponenter																														100	

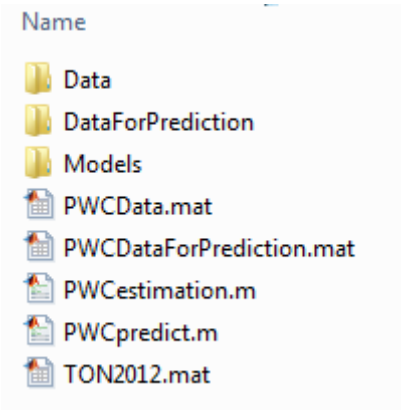
	Samgods commodities																														
SNI codes	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**	**22**	**23**	**24**	**25**	**26**	**27**	**28**	**29**	**31**	**32**	**33**
46.522 partihandel med teleprodukter																														100	
46.610 partihandel med jordbruksmaskiner och -utrustning																														100	
46.620 partihandel med verktygsmaskiner																														100	
46.630 partihandel med gruv-, bygg- och anläggningsmaskiner																														100	
46.640 partihandel med textil-, sy- och stickmaskiner																														100	
46.650 partihandel med kontorsmöbler																												100			
46.660 partihandel med andra kontorsmaskiner och kontorsutrustning																														100	
46.691 partihandel med mät- och precisionsinstrument																														100	
46.692 partihandel med datoriserad materialhanteringsutrustning																														100	
46.699 partihandel med diverse övriga maskiner och utrustning																														100	
46.710 partihandel med bränslen											3	32	65																		
46.720 partihandel med metaller och metallmalmer														13	11	75															
46.731 partihandel med virke och andra byggmaterial						56											28	5	11												
46.732 partihandel med sanitetsgods																										100					
46.741 partihandel med järnhandelsvaror																									100						

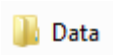
	Samgods commodities																													
SNI codes	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**	**22**	**23**	**24**	**25**	**26**	**27**	**28**	**29**	**31**	**32**	**33**
46.742 partihandel med vvs-varor																												100			
46.750 partihandel med kemiska produkter																				2	,15	98									
46.761 partihandel med industriförnödenheter																												100			
46.762 partihandel med emballage																															100
46.769 partihandel med övriga insatsvaror																												100			
46.771 partihandel med uttjänta fordon																100															
46.772 partihandel med metallavfall och metall-skrot														100																	
46.773 partihandel med avfall och skrot av icke-metall																															
46.900 övrig partihandel																												100			

6 Description of matrix estimation programme

Program files and functions

All files necessary to run the matrix estimation as described in the methodological report have been stored in a directory called “PWC”. The PWC directory contains the following folders and files





The Data folder contains data necessary for estimation of the PWC matrix models. This data includes files regarding: 1) the distribution of the warehouse sectors over municipalities, 2) municipalities having a port, 3) the location of big workplaces, 4) an interregional distance matrix, 5) and finally data on regular and singular interregional commodity flows, which also corresponds to the observations used in the previous PWC methodology for Sweden (Edwards et al 2008).

The data from these files is loaded and resaved in a Matlab-format in the workspace saved as “PWCData.mat” in the main directory.

Similar to the data for estimation, the data necessary for prediction is stored in a separate folder. The data includes files regarding: 1) municipalities having a port 2) New row and column constraints for the PWC models, i.e. production, consumption and warehouse data describing the regional distribution per commodity. This data also includes exports and imports by zone and commodity, the data relates to the year 2012 and is expressed in terms of tons. 3) an interregional distance matrix

The data from these files is loaded and resaved in a Matlab-format in the workspace saved as “PWCDataForPrediction.mat” in the main directory.

Models

The “Models” directory contains two excel files where the estimation results are stored. Models for matrices in value terms and those in tons are stored in two separate files, TonModels.xlsx and ValueModels.xlsx. The excel files contain one sheet per commodity group, where the parameters of the final estimated model is stored together with summary statistics from the estimation such as; the number of observations used, the adjusted R^2, and the correlation between observed and modelled flows.

PWCestimation.m

The “PWCestimation.m” is the executable matlab-program which performs the estimation of the PWC-models for the Samgods commodities. This program loads the data required for estimation, then it estimates models in accordance with the pseudo poisson maximum likelihood method, using a robust feature selection algorithm, i.e. stepwise regiression, as a means for model selection. The final models are stored in the “Models” directory.

The program file contains a main function controlling the computational flow on a very aggregate level, and a number of auxiliary functions where the actual work is carried out. The code is commented in the program file.

Note that the first lines of the main-function sets up Matlab for parallel computing using 12 logical cores, These lines may simply be commented out if for some reason one wish to run the code serially, or changed if one wants to use another level of parallel computing.

PWCpredict.m

The “PWCpredict.m” file contains the functionality to perform predictions. The program loads exogenously given data such as interregional distances, ports data, and most importantly new Production/Consumption data related to the row and column marginals of the PWC matrices to be predicted. The program applies the models stored in “TonModels.xlsx” to the prediction data. Finnally those predictions are calibrated using a RAS matrix balancing procedure in order to obtain matrices which are consistent with the row and column constraints for the PWC-matrices, which are provided by the Production/Consumption Data.

The final result is stored in the file “TON2012.mat”

TON2012.mat

The file "TON2012.mat" contains the predicted/calibrated PWC-matrices for 2012 expressed in tons. The Matlab variable TON2012 is an array of size 464*464*34, i.e. it contains predicted flows from zone r, to zone s, for 34 different Samgods commodities. It may be noticed that transit flows are not modelled at this stage and all cells in the array referring to such flows contains zeros.

Model

It is assumed that the expected flows between two regions, r and s, for any particular commodity group, can be expressed on the form

$$E[\mathrm{F}_{rs} \mid \mathrm{x}_{rs}] = \mathrm{m}(\beta, \mathrm{x}_{rs}) = \mathrm{e}^{\beta' \mathrm{x}_{rs}}, \tag{1}$$

given explanatory data. β is the parameter vector to be estimated. No further assumption related to the data is made. E.g. no particular distributional form, or particular structure of the variance of flows is assumed.

PPML

The Pseudo Poisson Maximum Likelihood (PPML) method is described in textbooks such as Wooldridge (2002), chapter 19, and its application to trade flows has been discussed by Santos Silva and Tenreyro (2006), Gourieroux, Monfort, and Trognon (1984) were the first to note that the model may be used for continuous data as well as discrete, possibly poisson, distributed count data, hence the terminology pseudo poisson.

Here we simply repeat the text from the Methodological Report:

" Given an observed flow f_{rs}, the pseudo log-likelihood of this observation is

$$l_{rs}(\beta) = f_{rs} \log(\mathrm{m}(\beta, \mathrm{x}_{rs})) - \mathrm{m}(\beta, \mathrm{x}_{rs})$$

where m is given in Equation (1). Taking the first order condition of l with respect to the parameter β, setting it to zero, and summing over all observations, the following system of equations is satisfied at the optimal parameters

$$\sum_{rs \in Obs} (\mathrm{f}_{rs} - \mathrm{m}(\beta, \mathrm{x}_{rs}))\, \mathrm{x}_{rs} = 0. \tag{2}$$

That is, solving the system of equations (2) for the parameter vector β provides the PPML estimates. These estimates are consistent and asymptotically normal under rather general conditions, see Wooldridge (2002).

In order to calculate the standard errors of the parameters, a robust sandwich estimate of the covariance matrix of the estimated parameters should be calculated. The robust covariance matrix is calculated as

$$C = A^{-1} S A^{-1} \tag{3}$$

where

$$\begin{aligned} A &= \sum_{rs \in Obs} \frac{1}{m(\beta, \mathrm{x}_{rs})} \frac{dm(\beta, \mathrm{x}_{rs})}{d\beta} \frac{dm(\beta, \mathrm{x}_{rs})}{d\beta}^{T}, \\ S &= \sum_{rs \in Obs} s_{rs} s_{rs}^{T}, \qquad \text{and} \qquad s_{rs} = (\mathrm{f}_{rs} - m(\beta, \mathrm{x}_{rs}))\, \mathrm{x}_{rs} \end{aligned} \tag{4}$$

The robust standard errors of the estimated parameters are then extracted as the square root of the diagonal of C. “

In the Matlab-code “PWCestimation.m” the estimation of any particular model, i.e. solving the system of equations in Eq. 2 for a specific model, is performed on the line tagged “tag:QPML-estimation” (line 444). This is performed in the auxiliary function called `Reestimate`, which also calculates the robust covariance matrix C (Eq. 3) at the line tagged “tag:RobustCovarianceMatrix” (line 459). The matrices A and S in Eq. 4 are calculated on lines tagged “tag:A” and “tag:S” respectively.

Stepwise Regression

The robust feature selection is programmed in the auxiliary function “`Robust-FeatSelect`”. Any reader interested in the details of the algorithm is referred to the commented code.

A verbal description of the algorithm was provided in the Methodological Report:
“A stepwise regression procedure typically starts out with an initial model, which may be the null model, and then iteratively considers entering or removing possible regressors. If a regressor is not yet included in the model, the null hypothesis is that if it is included it will be insignificant. All variables that are not included are scanned by including them separately and calculate their significance. If any of the non-included variables are significant, the null hypothesis is rejected and the most significant of the non-included variables is entered into the model. Correspondingly, for variables already included in the model, the null hypothesis is that these are significant, and if any included variable is not, remove the one which is least significant. The scheme provided above is iterated until no more variables can be entered into the model or removed from the model.”

The critical p-value for entering a variable is set at a 2. 5% and that for removing variables is set to 5%. Therefore, in the final model all included variables will be significant at the 5% level. This level may be set in the program and this is accomplished at the line tagged “tag:significance” (line 341).

Variable definitions

In the following we present variables and their definitions, all these variables carry a commodity index which is suppressed, since each commodity flow model is estimated separately.

Let r denote the sending region and s the receiving. Flow goes from r to s. The indices fall into the Samgods model regional description, such that regions 1,…,290 denote the domestic municipalities, and regions 290,…,464 denote foreign regions.

The following variables are used, in the stepwise regression, to explain an observed flow f_{rs} between region r and s:

VARIABLE	DESCRIPTION and UNITS
Const	Constant, scaling the model
$\ln P_r$	Log of Production (row sum of PWC matrix) where $P_r = \sum_s f_{rs}$ (1000 Tons) note: this P includes Warehouse "production"
$\ln C_s$	Log of Consumption (column sum of PWC matrix) where $C_s = \sum_r f_{rs}$ (1000 Tons) note: this C includes Warehouse "consumption"
$\ln D_{rs}$	Log of distance measure where D_{rs} (1000 km)
D_{rs}	Distance measure D_{rs} (1000 km)
Year01	Dummy for year 2001 $\begin{cases} 1 & if \;\; year = 2001 \\ 0 & if \;\; year = 2004/05 \end{cases}$
$Self_{rs}$	Dummy for flows within a municipality $\begin{cases} 1 & if \;\; r = s \;\; and \;\; domestic \\ 0 & otherwise \end{cases}$
Self_lnP	Interaction between $Self_{rs}$ and $\ln P_r$, i.e. ($Self_{rs}$ * $\ln P_r$)
Self_lnC	Interaction between $Self_{rs}$ and $\ln C_s$, i.e. ($Self_{rs}$ * $\ln C_s$)
$Neigh_{rs}$	Dummy for neigbouring municipalities D_{rs}<0.05 $\begin{cases} 1 & if \;\; D_{rs} < 0.05 \;\; and \;\; r \neq s \;\; and \;\; domestic \\ 0 & otherwise \end{cases}$
Neigh_lnP	Interaction between $Neigh_{rs}$ and $\ln P_r$ i.e. ($Neigh_{rs}$ *$\ln P_r$)
Neigh_lnC	Interaction between $Neigh_{rs}$ and $\ln C_s$, i.e. ($Neigh_{rs}$ *$\ln C_s$)
Acc_r	Accessibility score for production

	$Acc_r = \frac{b_r - mean(\mathrm{b})}{std(\mathrm{b})}, \quad where$ $b_r = \ln\left(\sum_{s \neq r} \mathrm{e}^{\ln \mathrm{C}_s / \sum_s \mathrm{C}_s - \ln \mathrm{D}_{rs}}\right)$
Agg_s	Accessibility score for consumption $Agg_s = \frac{a_s - mean(\mathrm{a})}{std(\mathrm{a})}, \quad where$ $a_s = \ln\left(\sum_{r \neq s} \mathrm{e}^{\ln P_r / \sum_r P_r - \ln \mathrm{D}_{rs}}\right)$
MainP_r	Dummy, main production municipalities P_r>0.1*sum(P) $\begin{cases} 1 & if\ P_r > 0.1\sum_{r=1}^{290} P_r,\ r < 290\ (\text{domestic}) \\ 0 & otherwise \end{cases}$
MainC_s	Dummy, main consumption municipalities C_s>0.1*sum(C) $\begin{cases} 1 & if\ C_s > 0.1\sum_{s=1}^{290} C_s,\ s < 290\ (\text{domestic}) \\ 0 & otherwise \end{cases}$
MainPC	Interaction between MainP_r and MainC_s, i.e. (MainP*MainC)
Big_{rs}	Dummy, Based on big sized workplaces both in *r* and *s* Let mp_r be the number of large workplaces in sending region r, producing a commodity. Let mp be the average number of large workplaces active in production. Averaged over r where $\mathrm{mp}_r > 0$. Let mc_s be the number of large workplaces in recieving region s, consuming a commodity. Let mc be the average number of large workplaces active in consumption. Averaged over s where $\mathrm{mc}_s > 0$. $Big_{rs} = \begin{cases} 1 & if\ mp_r > mp\ and\ mc_s > mc \\ 0 & otherwise \end{cases}$
BigToW_{rs}	Dummy, Big production sited to warehouse sites

	$\begin{cases} 1 & mp_r > mp \text{ and } wc_s > 0 \\ 0 & \text{otherwise} \end{cases}$ where wc_s denotes the activity of the warehouse sector in region s
Big_FrTo_{rs}	Dummy, Big interacted with FrTo. FrTo is 1 if $P_r > C_s$ and 0 otherwise.
$ToPortDom_{rs}$	Dummy, domestic flow to a municipality with a port $\begin{cases} 1 & \text{if } s \text{ has a port and, r and } s < 290 \text{ (domestic)} \\ 0 & \text{otherwise} \end{cases}$
$FrPortDom_{rs}$	Dummy, domestic flow from a municipality with a port $\begin{cases} 1 & \text{if } r \text{ has a port and, r and } s < 290 \text{ (domestic)} \\ 0 & \text{otherwise} \end{cases}$
$PortToPort_{rs}$	Dummy, domestic flow between municipalities with ports $\begin{cases} 1 & \text{if } r \text{ and } s \text{ have ports and, r and } s < 290 \text{ (domestic)} \\ 0 & \text{otherwise} \end{cases}$
Ex_{rs}	Dummy for export flows if municipality is exporter $\begin{cases} 1 & \text{if } r < 290 \text{ exports and } s > 290 \\ 0 & \text{otherwise} \end{cases}$
Ex_lnP_{rs}	Interaction between Ex and lnP, i.e. (Ex_{rs}*lnP_r)
Ex_lnC_{rs}	Interaction between Ex and lnC, i.e. (Ex_{rs}*lnC_s)
Ex_lnD_{rs}	Interaction between Ex and lnD, i.e. (Ex_{rs}*lnD_{rs})
Ex_D_{rs}	Interaction between Ex and D, i.e. (Ex_{rs}*D_{rs})
Ex_FrPort_{rs}	Interaction, export from a municipality with a port, i.e. (Ex_{rs}*$Port_r$)
Im_{rs}	Dummy for import flows if municipality is importer $\begin{cases} 1 & \text{if } r < 290 \text{ exports and } s > 290 \\ 0 & \text{otherwise} \end{cases}$
Im_lnP_{rs}	Interaction between Im and lnP, i.e. (Im_{rs}*lnP_r)
Im_lnC_{rs}	Interaction between Im and lnC, i.e. (Im_{rs}*lnC_s)
Im_lnD_{rs}	Interaction between Im and lnD, i.e. (Im_{rs}*lnD_{rs})
Im_D_{rs}	Interaction between Im and D, i.e. (Im_{rs}*D_{rs})

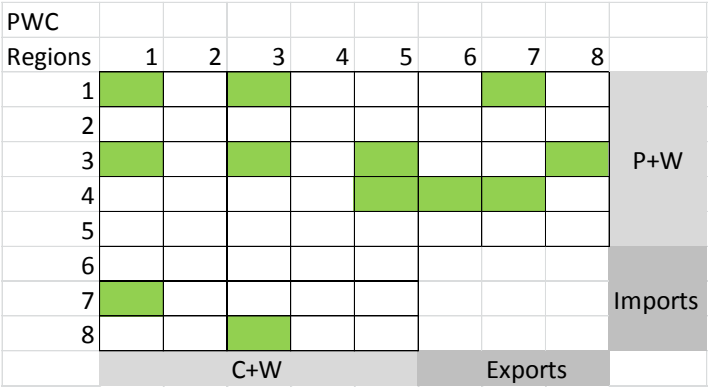
Im_ToPort_{rs}	Interaction, import to a municipality with a port, i.e. (Ex_{rs}*$Port_r$)

These are the variable definitions for the models expressed in terms of tons, for the models involving values, the corresponding variable definitions are used, but calculated in terms of mSEK.

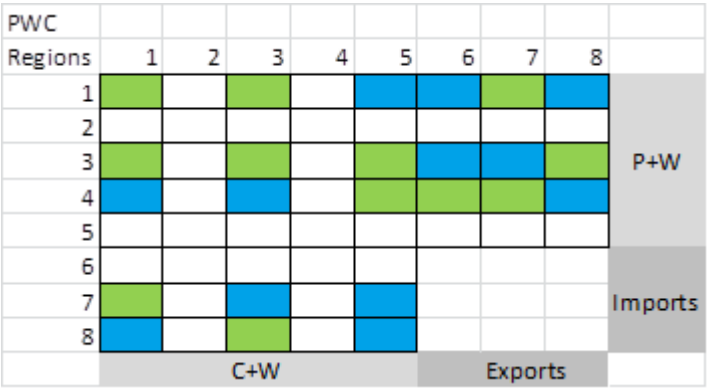
Through the stepwise regression, only a subset of the possible variables will be selected for each PWC-model.

A note on zero flows

First one may note that zero flows are not explicitly observed in the CFS. One way of defining zero flows could be to identify all possible trade relations and remove those where flows have actually been observed. Illustrated in the figure below is a number of observed flows in green and unobserved in white.



Rather than using all the unobserved flows as zero observations, only those unobserved flows which corresponds to trade relations where there is actually both production in the sending region and consumption in the receiving region will be regarded as "observed" zeros. These zeros are indicated in blue in the following figure.



The reason for this interpretation, or definition, of zero flows is that flows are derived demand from production and consumption, if there is either no production or no consumption, a flow is impossible, and hence should not be interpreted as a zero flow. For trade relations where both production and consumption is active, there is potentially a trade flow, and if no trade flow is observed in such a trade relation, this is recorded as a zero flow.

In the PWCestimation-program the cells which are counted as observations are represented by an indicator, see line tagged "tag:Iobs"

Estimation Results

See the estimated models in the supplementary files "TonModels.xlsx" and "ValueModels.xlsx".

Predictions

For the prediction of PWC-flows for 2012, the estimated model for each commodity is used together with explanatory data relating to the year of 2012. The required data is: 1) levels of production, consumption, and warehouse activites for the year 2012 (file "Skattning TON 2012_ForPrediction.xlsx"), 2) indicator of which municipalities have a port (file "Hamnar.xlsx"), 3) a distance matrix (file "dist_km.dat") and 4) Data related to the location of big sized workplaces handeling the particular commodity (file "Större arbetsställen 2004 och 2010-bearbetning.xlsx"). Given the prediction data, the exogenous predictions variables are calculated according to the variable definitions described earlier.

Technically, what is predicted is the expected value of flow in any particular trade relation. That is, given the estimated parameters and data related to the prediction year, expected flows are predicted using Eq. 1, i.e.

$$f_{rs}^{pred} = \mathrm{m}(\hat{\beta}, \mathrm{x}_{rs}^{2012}) = \mathrm{e}^{\hat{\beta}'\mathrm{x}_{rs}^{2012}}$$

This is performed in line tagged "tag:PWCPrediction" in the file "PWCpredict.m"

The predictions made by applying The PWC-models requires calibration. One reason is that the models contains a multiplicative constant "const" which sets the scale of the model predictions, and those scales are estimated for the years 2001 and 2004/05 and not to 2012. The other reason is that the predictions do not satisfy the row and column constraints provided by prediction data. In order to calibrate the model to those constraints a RAS-balancing procedure is performed such that the constraints are fulfilled (see function "RASBalancing" in "PWCpredict.m") . The RAS-procedure is equivalent to introducing origin and destination specific constants in the gravity-like PWC-models which are calibrated such that the marginal constraints are satisfied.

Thus the final predictions are on the form

$$f_{rs}^{2012} = \lambda_r \gamma_s f_{rs}^{pred},$$

where lambda and gamma represents the calibration constants.

The final predictions are stored in the file “TON2012.mat”

Supplmentary files

TonModels.xlsx

ValueModels.xlsx

PWCestimation.m

PWCpredict.m

References

Edwards, H., Bates, J., Swahn, H. (2008). Swedish Base Matrices Report. Estimates for 2004, estimation methodology, data, and procedures. SIKA.

Gourieroux, C., A. Monfort, and A. Trognon (1984). “Pseudo Maximum Likelihood Methods: Applications to Poisson Models,” *Econometrica* 52, 701–720.

Silva, J. S., & Tenreyro, S. (2006). The log of gravity. *The Review of Economics and statistics, 88(4)*, 641-658.

Wooldridge, J.M. (2002). Econometric Analysis of Cross Section and Panel Data, The MIT Press, Cambridge, Massachusetts, London, England (in particular ch. 19)