

DEVELOPMENT OF THE TIME SERIES OF CORE EXPORTS

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Changes in Estonia's exports have always been very rapid and volatile. For instance, from 2003 to 2008 Estonia's exports increased more than twice. The fast developments have also brought along extensive and rapid changes in the structure of exports. As the Estonian economy is relatively small, the dynamics of exports have been greatly influenced by outsourced production and transit related products. Their contribution to total exports is high but their import content is also relatively high, which is why their value added is quite low.

The high volatility of some components of Estonia's exports complicates the interpretation and forecasting of export indicators. Therefore, it has been necessary to develop an indicator describing export developments, which would be "cleaned" from the volatile components and would better characterise the impact of exports on Estonia's economy. Various indicators have been used before for a more detailed analysis of Estonia's export developments, for instance exports without mineral fuels or exports without fuels and electrical machinery. The purpose of the current study is to develop a more detailed concept for the measurement of core exports.

The development of time series of Estonia's core exports has been based on the input-output tables, the supply and use tables and data on external trade. The input-output tables and the supply and use tables have been the basis for calculating the added value of exports. The exclusion of components with high import content from total exports has drawn on the fact that the components of core exports are products with at least 50% of value added. Based on external trade data, this criterion has been applied to all components with four-digit code accuracy (see Appendix *Nomenclature*). The result is a relatively time-stable composition of components, which enables to better interpret at least the data of recent years. At this point, it should be stressed that the core exports indicator does not replace the general exports indicator – their parallel use provides additional opportunities for analysing exports.

Data

The current study aims to calculate the added value of exports through the import content. In order to establish the time series of core exports, the existing data has to be converted to a suitable form to find the import content of the export items. Data required for the conversion can be found in the input-output tables, the supply and use tables and external trade statistics compiled by Statistics Estonia. In order to calculate the import content on the basis of the input-output tables, these tables are required for each year. However, as these indicators have not been calculated for each year, the supply and use tables are used, which are converted to a suitable form.

The existing supply and use tables date from 1997 and 2000–2004. The added value of later years is derived on the basis of regression analysis and expert assessment.

Symmetric input-output tables have been compiled for 1997, 2000 and 2005 by Statistics Estonia. In addition, the supply and use tables for 2001–2005 are available. However, transition from the supply and use tables to symmetric input-output tables by economic sectors and products requires the regrouping of data as follows¹:

- distribution of secondary products in the supply table between the industries where they are the principal products;
- transition of the columns of the use table from inputs into industries to inputs into homogeneous industries.

This is a procedure that implies the use of supplementary statistics and technical information or, in the case of production technology, application of certain assumptions. A more widespread conversion technology is the so-called product technology, which assumes that all products in a chapter have the same input structure, regardless of the industry where they are produced. Yet in practice, the application of the product technology assumption entails the following problem: the input-output coefficients generated are negative. The solution is a technical algorithm based on certain assumptions², which has also been tested with Estonia's data³. It has been found that this gives relatively good results compared to the conversion with the help of supplementary information.

In the current paper, the input-output tables of 2001–2004 have been compiled on the basis of this algorithm. In interpreting the results (comparing different years), it should be taken into account that there are small differences between "actual" tables and those used in this paper⁴. In addition, there are significant differences between 1997 and 2000: the table from 1997 has been last updated in 2004 and, therefore, it may not be consistent with the statistics reviewed in the interim years. At the same time, the tables are in current prices, i.e. time changes can also be explained by changes in relative prices.

¹ For further information see the European System of Integrated Economic Accounts 1995.

² Almond, C. (1998). How to Make a Product-to-Product Input-Output Table.

³ Dedegkajeva, I., Parve, R. (2005). Compilation of a product-by-product input-output table for Estonia.

⁴ For instance, it is possible to compare the symmetric input-output tables of 2000 calculated by Statistics Estonia with the algorithm used in the current paper. For different products, the differences range between –9%...+4% on average. The differences are much bigger than average in the case of other transport equipment (–31%), basic metals (21%) and financial intermediation services (15%).

Methodology

The derivation of the time series of core exports involves three steps. The first is to calculate the import content and the value added on the basis of the existing input-output tables and the supply and use tables. The second step includes finding the value added of the missing years with the help of regression analysis and expert assessment. The third step entails the calculation of the time series of core exports by using external trade statistics and the derived value added.

The import content of exports with indirect influence factors shows as follows (by default, it is assumed that the production of both the unit of gross domestic production and the unit of export production require the same amount of imports):

$$X_M = (I - A)^{-1} M_Y,$$

where X_M – vector of the import content of one export unit;
 A – coefficient matrix of the direct input coefficients for domestic production;
 M_Y – vector of the import content of one production unit.

Making a simplified assumption that consumption and investment do not have indirect impact on exports, the value added of exports can be expressed as follows:

$$X_{VA} = 1 - X_M,$$

where X_{VA} – vector of the value added of one export unit.

The most difficult to find is the value added of exports for the years after 2005, as starting from 2005, there is no data on the input and output tables. The value added of the missing years is derived on the basis of regression analysis and also expert assessment.

The value added (VA) is calculated as a percentage, which is left of exports (M_E) after the import input used for the production of exports has been deducted. In the case of recent years, regression analysis has been used. The regression uses, based on external trade statistics, the quotient of total imports and exports ($\frac{M}{X}$) as the approximation of the import content of exports.

This can be presented as the following formulas:

$$VA = 1 - M_E$$

$$M_E = \alpha X \cdot \frac{M}{X} + c,$$

Expert assessment has been used for the adjustment of the value added when the results of the regression analysis do not appear realistic, i.e. when the time changes and the general knowledge about the development of the chapter do not coincide. For instance, the value added of basic metals and metal products has been adjusted according to expert assessment. For these chapters, it is more difficult than usual to reconcile industries (input-output tables) with chapters (external trade statistics). Therefore, the majority of metal products of external trade statistics have been placed in the group of metal products in the input-output table.

The value added of exports has been used for finding the time series of core exports. External trade data rows required for the calculation of the time series of core exports have been previously grouped as similarly as possible with the subdivision of the value added (see Appendix *Nomenclature*), using a code of up to four digits. In finding the time series of core exports, the current paper uses the 50% limit for the value added intensity. This means that the time series of core exports includes chapters whose value added exceeds 50%.

Results

The results together with the value added by chapters found in the course of regression analysis and, if necessary, adjusted according to expert assessment, are given in Table 1. Since the value added may change across periods, the basket has been fixed at the average data of 2009. However, these assessments have to be reviewed every year to consider the changes in external trade, and, if necessary, the structure of the basket has to be changed. Although for many chapters, the value added of recent years could be fixed on the basis of the last (i.e. 2005) input-output table, there are also articles in the case of which the use of regression analysis would change the basket of core exports, which is why the value of recent years has been established with both the regression analysis and the expert assessment.

As at 2009, Estonia's core exports include the following chapters: agricultural products; fish and fishing products; coal, peat, etc.; other mining products; food and beverages; timber and timber products; paper products, printed matter and recorded media; other non-metallic mineral products; metal products; furniture, and electricity.

After Estonia's accession to the European Union, the exports of coke and oil products have picked up strongly together with imports. This is not domestic production but the so-called transit-related component, in the case of which the value added per production

unit remains low. Therefore, the value added has been reduced on the basis of expert assessment. Since 2006, this chapter has been excluded from core exports. The classification of basic metals and metal products according to the nomenclature of the input-output table is relatively complicated; thus, the value added of basic metals is marked as zero and the value added of metal products is higher than 50%. This also explains why the exports of scrap metal in recent years have raised also the value added.

In order to establish the time series of core exports, the exports of chapters for which the value added has been created in Estonia and exceeds 50% (shown in bold in the table), are totalised. Annual growth of these indicators is shown in Figure 1.

Table 1. Exports value added (%)

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Agricultural products	72	70	66	69	68	70	69	68	68	69
Fish and fishing products	66	57	60	66	60	63	62	61	61	62
Coal, peat, oil shale, natural gas and crude oil	75	76	76	76	76	76	76	76	76	76
Metal ores										
Other mining products	70	72	72	71	72	73	73	71	69	70
Food and beverages	58	56	55	58	56	56	56	56	56	56
Tobacco products										
Textiles	40	43	40	41	38	42	39	39	39	38
Clothing and fur	32	33	33	35	38	38	23	23	23	23
Leather and leather products	28	20	21	23	25	31	25	25	25	25
Timber and timber products	66	65	66	66	61	58	57	55	60	64
Pulp, paper and paper products	54	54	58	58	55	50	60	62	62	61
Printed matter and recorded media	66	65	64	64	64	69	66	66	66	66
Coke, refined oil products	66	73	73	79	77	75	49	49	49	49
Chemicals and chemical products	44	48	44	41	36	37	43	41	40	42
Rubber and plastic products	40	45	46	42	43	38	41	41	40	40
Other non-metallic mineral products	59	54	52	54	54	59	56	55	59	61
Basic metals	0	0	0	0	0	0	0	0	0	0
Fabricated metal products	51	51	51	51	51	52	52	53	54	54
Machinery and equipment	44	51	54	54	52	50	47	46	45	43
Office machinery and computers	22	14	9	17	16	20	20	28	26	24
Electrical machinery and apparatus	25	26	28	26	30	32	29	30	30	30
Radio, television and communication equipment	4	3	3	4	5	6	4	3	2	3
Medical and optical instruments	37	29	34	39	41	36	32	39	48	44
Motor vehicles	53	49	46	42	44	40	42	41	38	34
Other transport equipment	65	24	37	37	36	54	45	46	46	46
Furniture, other manufactured goods	55	54	53	54	50	52	54	55	54	52
Electricity, gas, steam and hot water	65	68	68	71	71	74	70	70	69	70



Figure 1. Growth in core exports

Until the end of 2006, the developments of core exports were quite similar to the developments of oil exports, but in 2007, the growth rate of core exports was higher. However, in light of the events of the second half of 2009, exports as well as core exports have decreased, even though the latter has declined somewhat slower (see Figure 1).

There have been no major changes in the structure of core exports from 2001. Lately, the share of timber has decreased a little, but the shares of electricity, paper products and agricultural products have increased to the same extent (see Figure 2).

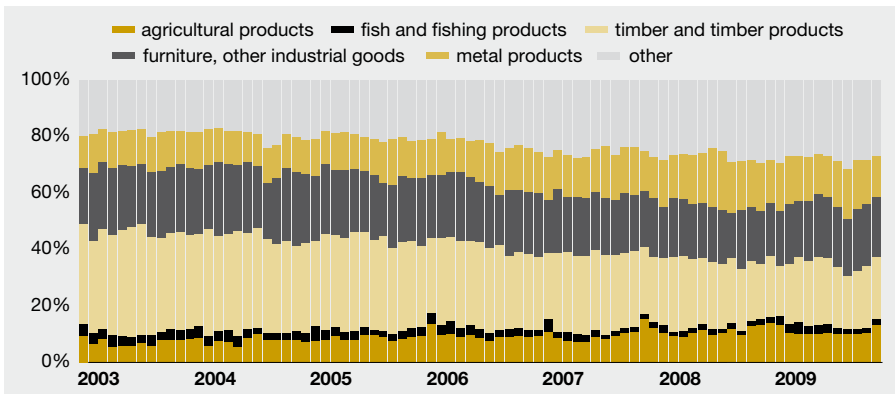


Figure 2. Structure of core exports

Growth in Estonia's core exports has been largely driven by timber products, but last year's changes in the timber industry have affected also core export growth. Agricultural and food products have also played an important role through times, but the export volumes of these chapters have declined as well during the economic crisis (see Figure 3). From 2006 to 2007, also pulp and paper products contributed significantly to Estonia's core export growth, when the pulp factory in Kunda (Eastern Estonia) gradually achieved a considerable production output. At this point, core export growth is driven by food products, printed matter and electricity.

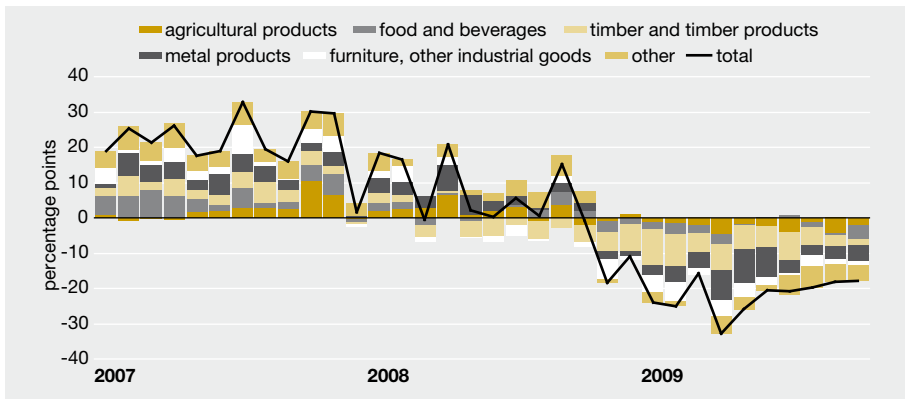


Figure 3. Contribution of products to core export growth

As a result of the development of the time series of core exports, it is somewhat easier to explain the high volatility of Estonia's exports. The exports of transit-related products, which increased abruptly after Estonia's accession to the European Union, also complicated the interpretation of total exports. Yet the core exports indicator reduces such volatility and enables to better explain export developments during both the monthly monitoring and the preparation of economic forecasts.

Appendix. Nomenclature

Nomenclature of input-output tables		Nomenclature of foreign trade statistics					
		Group 21		Group 99		4-digit code	
1	Agricultural products	2	Vegetable products	1	Live animals		
		3	Animal or vegetable fats and oils and their cleavage products	2	Meat and edible meat offal		
				4	Dairy produce; birds' eggs; natural honey; edible products of animal origin, not elsewhere specified or included		
				5	Products of animal origin, not elsewhere specified or included		
2	Fish and fishing products			3	Fish and crustaceans, molluscs and other aquatic invertebrates		
3	Coal, peat, oil shale, natural gas and crude oil					2703	Peat (including peat litter), whether or not agglomerated
						2706	Tar distilled from coal, from lignite or from peat, and other mineral tars, whether or not dehydrated or partially distilled, including reconstituted tars
						2707	Oils and other products of the distillation of high temperature coal tar; similar products in which the weight of the aromatic constituents exceeds that of the non-aromatic constituents
4	Metal ores	14	Natural or cultured pearls, precious or semi-precious stones, precious metals, metals clad with precious metal, and articles thereof	26	Ores, slag and ash		
5	Other mining products			25	Salt; sulphur; earths and stone; plastering materials, lime and cement		
6	Food products and beverages	4	Prepared foodstuffs; beverages, spirits and vinegar				
7	Tobacco products			24	Tobacco and manufactured tobacco substitutes		
8	Textiles			50	Silk		
				51	Wool, fine coarse animal hair; horsehair yarn and woven fabric		
				52	Cotton		

Nomenclature of input-output tables		Nomenclature of foreign trade statistics				
		Group 21		Group 99		4-digit code
				53	Other vegetable textile fibres; paper yarn and woven fabrics of paper yarn	
				54	Man-made filaments; strip and the like of man-made textile materials	
				55	Man-made staple fibres	
				56	Wadding, felt and nonwovens; special yarns; twine, cordage, ropes and cables and articles thereof	
				57	Carpets and other textile floor coverings	
				58	Special woven fabrics; tufted textile fabrics; lace; tapestries; trimmings; embroidery	
				59	Impregnated, coated, covered or laminated textile fabrics; textile articles of a kind suitable for industrial use	
				60	Knitted or crocheted fabrics	
9	Wearing apparel; furs			43	Furskins and artificial fur; products thereof	
				61	Clothing and accessories, knitted or crocheted	
				62	Clothing and accessories, not knitted or crocheted	
				63	Other made-up textile articles; sets; worn clothing and worn textile articles; rags	
10	Leather and leather products	12	Footwear, headgear, umbrellas, etc.	41	Raw hides and skins (other than furskins) and leather	
				42	Articles of leather; saddlery and harness; travel goods, handbags and similar containers; articles of animal gut (other than silkworm gut)	
11	Timber and timber products	9	Timber and timber products			
12	Pulp, paper and paper products			47	Pulp of wood or of other fibrous cellulosic material; recovered (waste and scrap) paper or paperboard	
				48	Paper and paperboard; articles of paper pulp, of paper or of paperboard	

Nomenclature of input-output tables		Nomenclature of foreign trade statistics					
		Group 21		Group 99		4-digit code	
13	Printed matter and recorded media			49	Printed books, newspapers, pictures and other products of the printing industry; manuscripts, typescripts and plans		
14	Coke, refined petroleum products					The rest of mineral products, excl. 2716, 2703, 2706, 2707	
15	Chemicals and chemical products	6	Products of the chemical or allied industries				
16	Rubber and plastic products	7	Plastics and articles thereof; rubber and articles thereof				
17	Other non-metallic mineral products	13	Articles of stone, plaster, cement, asbestos, mica or similar materials; ceramic products; glass and glassware				
18	Basic metals			72	Iron and steel		
19	Fabricated metal products			73	Articles of iron or steel		
				74	Copper and articles thereof		
				75	Nickel and articles thereof		
				76	Aluminium and articles thereof		
				78	Lead and articles thereof		
				79	Zinc and articles thereof		
				80	Tin and articles thereof		
				81	Other base metals; cermets; articles thereof		
				82	Tools, implements, cutlery, spoons and forks, of base metal; parts thereof of base metal		
				83	Miscellaneous articles of base metal		
20	Machinery and equipment					The rest of nuclear reactors, etc., excl. 8470, 8471, 8472	
21	Office machinery and computers					8470	Calculating machines and pocket-size data-recording, reproducing and displaying machines with calculating functions; accounting machines, postage-franking machines, ticket-issuing machines and similar machines, incorporating a calculating device; cash registers

Nomenclature of input-output tables		Nomenclature of foreign trade statistics					
		Group 21		Group 99		4-digit code	
						8471	Automatic data-processing machines and units thereof; magnetic or optical readers, machines for transcribing data onto data media in coded form and machines for processing such data, not elsewhere specified or included
						8472	Other office machines (for example, hectograph or stencil duplicating machines, addressing machines, automatic banknote dispensers, coin-sorting machines, coin-counting or -wrapping machines, pencil-sharpening machines, perforating or stapling machines)
22	Electrical machinery and apparatus					The rest of electrical equipment, excl. 8517, 8518, 8519, 8521, 8522, 8523, 8525, 8526, 8527, 8528, 8529	
23	Radio, television and communication equipment					8517	Telephone sets, including telephones for cellular networks or for other wireless networks; other apparatus for the transmission or reception of voice, images or other data, including apparatus for communication in a wired or wireless network (such as a local or wide area network), other than transmission or reception apparatus of heading 8443, 8525, 8527 or 8528
						8518	Microphones and stands thereof; loudspeakers, whether or not mounted in their enclosures; headphones and earphones, whether or not combined with a microphone, and sets consisting of a microphone and one or more loudspeakers; audio-frequency electric amplifiers; electric sound amplifier sets
						8519	Sound recording or sound reproducing apparatus
						8521	Video recording or reproducing apparatus, whether or not incorporating a video tuner
						8522	Parts and accessories suitable for use solely or principally with the apparatus of headings 8519 to 8521
						8523	Discs, tapes, solid-state non-volatile storage devices, 'smart cards' and other media for the recording of sound or of other phenomena, whether or not recorded, including matrices and masters for the production of discs, but excluding products of Chapter 37
						8525	Transmission apparatus for radio-broadcasting or television, whether or not incorporating reception apparatus or sound recording or reproducing apparatus; television cameras, digital cameras and video camera recorders
						8526	Radar apparatus, radio navigational aid apparatus and radio remote control apparatus

Nomenclature of input-output tables		Nomenclature of foreign trade statistics				
		Group 21		Group 99		4-digit code
					8527	Reception apparatus for radio-broadcasting, whether or not combined, in the same housing, with sound recording or reproducing apparatus or a clock
					8528	Monitors and projectors, not incorporating television reception apparatus; reception apparatus for television, whether or not incorporating radio-broadcast receivers or sound or video recording or reproducing apparatus
					8529	Parts suitable for use solely or principally with the apparatus of headings 8525 to 8528
24	Medical and optical instruments	18	Optical, photographic, cinematographic, measuring, checking, precision, medical or surgical instruments and apparatus			
25	Motor vehicles			87	Vehicles other than railway or tramway rolling stock, and parts and accessories thereof	
26	Other transport equipment			86	Railway or tramway locomotives, rolling stock and parts thereof; railway or tramway track fixtures and fittings and parts thereof; mechanical (including electromechanical) traffic signalling equipment of all kinds	
				88	Aircraft, spacecraft, and parts thereof	
				89	Ships, boats and floating structures	
27	Furniture, other manufactured goods			94	Furniture; bedding, mattresses, mattress supports, cushions and similar stuffed furnishings; lamps and lighting fittings, not elsewhere specified or included; illuminated signs, illuminated nameplates and the like; prefabricated buildings	
				95	Toys, games and sports requisites; parts and accessories thereof	
				96	Miscellaneous manufactured articles	
28	Electricity, gas, steam and hot water				2716	Electricity (optional heading)