HOW TO TRANSLATE ECONOMIC ACTIVITY INTO FREIGHT TRANSPORTATION?

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ABSTRACT

Economic activities imply freight transportation. However, the major question is: how much freight transportation is generated by which activities? In some analysis, the relationship between GDP and mileage or transport intensity is evaluated. There are different views, though, on whether such a coupling of these values is justified and needed or not.

In this paper, the relationship between the amount of transported goods and economic activities by industries is investigated. Using historical EUROSTAT supply-use tables for Germany, we developed an economic indicator with which the interdependency between 59 industries (NACE classified), 59 products (CPA classified) and the amount of 24 types of transported goods (NST/R classified) can be shown. In the results, we can observe a strong interdependency between the majority of the transported goods and the developed economic indicator. This enables us to explain over 75% of the amount of the transported goods by economic activity. Therefore we can state that the developed indicator is suited to translate economic activity into freight transportation.

On the one hand, the findings contribute to the coupling/decoupling discussion. On the other hand, the outcome and the developed economic indicator are highly relevant for the freight modelling community because the proper translation of economic activity into freight transportation is still a challenge.

Keywords: *SCGE freight modelling, freight generation, economic indicator, goods transportation*

1. INTRODUCTION

Freight transportation is implied by economic activities. However, the major question is: how much freight transportation is generated by which activities? In some analysis, the relationship between the growths of GDP and mileage or transport intensity is evaluated. There are different views, though, on whether such a coupling of these values is justified and needed or not. However, a discussion of disaggregated GDP per industry is proposed in the literature. There is less focus placed on the step before: the generated amount and type of goods that has to be transported and can be directly explained by specific economic activity. We place more attention on the meso-level underneath the relationship between the aggregated GDP and a macroscopic transport indicator in this paper.

In freight transport models there is a strong need for the assessment of the generated amount of freight that is transported. Most models are based on the description of the economy. “Essential for a model is the notion that developments in freight flow demand are the result of changes in economic structures that create a demand and a supply of goods in specific geographic regions and form the basis for transport flows between regions” (Tavasszy et al. 1999, p. 4).

The model types currently considered as most advanced, MRIO (multi-region input–output models) and SCGE (spatial computable general equilibrium model), use input-output tables to describe the economic interaction between industries and zones. As a result the money flow between zones is described in these models. However the translation of money flows into freight transportation is still a challenge. This leads to the guiding research question of this paper: How can we translate economic activity into freight transportation?

In this paper we provide a new indicator based on input-output tables, which enables the translation of the gross value added (GVA) of 59 distinguished industries into the amount of 24 types of transported goods. First we discuss the relevance of input-output tables and other data for transportation concerns, and provide a short overview on the coupling of economic and transportation activities. In chapter 3 we describe the derivation of the new economic indicator. An example of the calculation for ‘metal products’ is provided too. Afterwards we can show the explanatory power of this indicator for the amount of transported goods in the case of Germany. Finally, we discuss the correlation between economic activity and freight transportation and close with an outlook on further research needs.

2. DISCUSSION OF ECONOMIC DATA ACCORDING TO FREIGHT TRANSPORTATION MODELLING

A challenge for the freight modelling community is the availability of data. Economic data are described in different classifications and units to transportation data. The first describe money flows, the latter freight and service flows. In modelling philosophies, the transformation from money flows to freight flows, the filter in between, is done by introducing logistics issues (e.g. Tavasszy et al. 1998). For the economy and transportation activities, macroscopic data are provided by statistical offices. This is not the case for logistics and therefore there is a gap in the translation from economic activity into freight transportation.

2.1. Relationship of economy and freight transportation

The relation between economic activity and freight transportation has been analysed in the international literature from different points of view. On the one hand the suitability of GDP as economic indicator is discussed, on the other the question of the coupling or decoupling between economy and freight transport is analysed. We will give an overview on significant literature and show that there is a lack of useful economic indicators other than GDP for such analysis and that the disaggregated use of GDP or GVA proves to be a suitable solution.

Pastowski (1997) concluded that statistical trends show a close relation between freight transport and growth in GDP in past decades. But this is not a proof of a continuation of this trend in the future. McKinnon (2007) analysed GDP development and the volume of freight movement in the UK. Before giving his analysis, McKinnon reviews further literature on the decoupling issue. For the UK McKinnon concludes that three causes out of a possible twelve are responsible for two-thirds of decoupling, which could be seen from aggregated data. The causes are the number of foreign road haulage operators, a decline in road transport's share of the modal split and increases in road freight cargo rates. All these three causes produce an apparently stronger decoupling than in other European countries and the USA. Lehtonen (2006) states that it is an apparent start of decoupling between GDP and road freight growth which is only partly to be seen.

Kveiborg (2007) analysed economic growth and the development in freight traffic and freight transport in Denmark and points out that it is important to

distinguish between industries. Furthermore the direct link between industries and goods in input-output analysis should not be a cause of great concern.

Meersman and Van de Voorde analysed the relation between economic activity and freight transport. By using stability and co-integration tests they show that the aggregated use of GDP is not the best indicator for freight transport. They suggest alternatives to estimate the link between freight and economic-activity indicators, and conclude that disaggregated methods based on the microeconomic analysis of the behaviour of shippers and freight transport companies are needed. To bring such approaches to success, insights into developments in logistics are required (Meersman and Van de Voorde 2013).

The German traffic prognosis used regional data on the structure and development of the economy (IWH 2006) and partly the population to explain freight volume, whereas freight transport is a result of the model used. Different methods were used for the calculation of the development of inland traffic and transit traffic (ITP, BVU 2007). Similar approaches were used for the current traffic prognosis (Intraplan, BVU 2014). Unfortunately there is no statement on the quality of the resulting explanation. The authors will follow the given analysis and carry out their own regression analyses, clearly stating each single step for further discussion.

In the literature there is no better indicator given for the analysis of freight transport development and economic activity at the national level. In the next chapters, the data need of freight models concerning the freight generation modelling step and the suitability of supply-use tables are shown.

2.2. What do transportation models need and what do they use?

We investigated European large-scale freight models for their approaches to the translation of the economy into freight transport demand. We analysed models with an explicit freight generation approach and not those European models with external freight demand matrices as input. The models in our scope were the Italian National Model System (SIMPT) (e.g. Wang 2012), the Netherlands model SMILE+ (e.g. Tavasszy et al. 1998), the German model for national planning (ITP, BVU 2007), the Norwegian model NEMO (e.g. Hovi and Vold 2003), the Swedish model SAMGODS (e.g. Karlsson et al. 2012, SAMPLAN 2001) the European model ASTRA (e.g. Schade et al. 2010) and finally the Austrian model ETMOS (e.g. WIFO 2010). Five models using (regional) input-output tables to describe the economic interaction of industries and regions. Values of goods are applied to translate money flows

into freight flows. To find the right value of goods is a challenge because their values vary strongly between regions, industries, value-chain levels, etc. Supply-use tables are used in SMILE+ to create product chains and production networks. The next step in SMILE+ handles trade and describes economic activity. Thereafter a complex consideration of logistics translates economic activities into transportation. The German national planning model has integrated functions of the generation and attraction of goods. Within these functions for each good structure, values are weighted. The structure values consist of the GVA of up to three industries and sometimes the population. There is no publication on how the used structural values correlate to the freight volume demand, so the status assessment is not possible for externals.

The major indicator in models is GDP. “There are good reasons to use GDP, or any other indicator of economic output, as the freight flows are nothing more than the physical representation of the trade patterns captured in these indicators” (Holguin-Veras et al. 2011, p. 19). Moreover we see that these models need a conversion from money into freight. However, this conversion is crucial and affected by a lack of suitable data. A methodology to overcome this data lack is helpful therefore.

2.3. The relevance of supply-use tables for freight transportation

Economy interaction occurs with money flows, information flows and product exchange. For freight transportation concerns, we are interested in the product exchange or, more precisely, in the goods flows. Money flows and freight flows can be different. For example: when the freight has interim stops for consolidation or a mode shift, each single trip will be counted in the statistics. That means the same ton of freight can be counted several times. This logistics dimension between economic relation and economic freight exchange is difficult to capture. There is a natural difference in statistics on the production of goods and their transport.

The general information how an industry is related to which products on the supply and on the use side is contained in supply-use tables (also known as make-use tables). Supply-use tables are a subset of input-output tables. While, in input-output-tables, the relationship between business sectors to business sectors is shown, in supply-use tables the business sectors are related to products. Supply tables consider the cost of production from a business sector to a product. Use tables reveal the use of products by industry with delivery costs. Reading supply tables row by row (product by product), it is possible to evaluate the contribution of an economic sector to

the production of a particular product group. The unit in which the relation is expressed is generally basic prices. Use tables, read product by product, show the input of products to industries at purchasers' prices (EUROSTAT 2008, p. 138 and pp. 18-29).

To overcome the gap between economic and transport statistics we need a synthetic indicator. This indicator translates economic activity into related freight transport demand. The development of such an indicator is applied in the next chapter. A detailed example of the calculation process is given for the type of good 'metal products'.

3. THE DEVELOPMENT OF AN ECONOMIC INDICATOR TO EXPLAIN FREIGHT TRANSPORTATION DEMAND

In this chapter we provide the methodology to the developed indicator and utilized data. We did two major steps of work for the economic indicator. The first step was the use of the information on how much the industries supply or use specific products. GVA is our main descriptive factor for economic development. The second step is the reference of products to transported goods.

3.1. Added value with products

The database of supply-use tables is available at EUROSTAT for the years 1995-2007 (EUROSTAT 2013a). In this period the industries are classified in NACE rev. 1.1 (Nomenclature statistique des activités économiques dans la Communauté européenne) and the products are classified in CPA 2002 (*Classification* of Products by Activity). The GVA in the NACE rev. 1 classification is also available for this period on EUROSTAT (EUROSTAT 2013b). In our research, we used a sample of these data for Germany.

First we had to build a production function and a consumption function with the variable GVA in form of Eq. 1 for each product.

Using the supply tables' information per row enables us to know which industries produce the same products. To obtain α we scaled each row to 1. This was done for each year. We then processed a specific α for each industry-product combination which can be used in the production function. The scaling was done in the same way for the use tables. Here the value α expresses the share of an industry to use a product group for value adding. Please note that two separated α were calculated, one is based on supply tables and one is based on use tables.

Equation 1:

$$\widehat{\mathrm{EI}}_i = \sum_j \left(\alpha_{i,j} \cdot \mathrm{GVA}_j\right)$$

$\widehat{EI}$: CPA classified economic indicator (€)
i: index for products (CPA divisions)
j: index for economic activities (NACE division)
α: relevance of economic activity j for transportation of product i (for each option: use based, supply based, core industry based)
$\sum_j \alpha_{i,j} = 1$ for each product i

Multiplying α per industry with the GVA per industry and the summing up per product group finalises the first step of the set-up of the indicator. Please note: because of the two versions of α, we also obtained two versions of the indicator. Both are used to investigate the relationship between the indicator and freight transportation. However, up to now we have used economic products instead of transport goods, classified in CPA which is an economic classification. Therefore the next step is to refer economic products to transported goods.

3.2. Reference of economic products to transported goods

Transported freight is referred to the classification NST/R until 2007 and economic information is referred to CPA. The first one is counted in tons, the latter one in euros. There is no unique reference of CPA to NST/R. Thus we had to construct a bridge matrix to overcome this data gap [WIFO 2010, pp. 19]. In our case, we want to achieve the level of NST/R-24 where 24 types of goods are distinct. The challenge is to refer 59 products (CPA) to 24 transport goods. A basic notation is that not all economic goods are transported goods. We have to exclude services which may generate traffic but no freight transportation. The CPA contains 59 products numbered from 1 to 95. The physical goods which we may refer to freight transportation on road, rail or waterway, are goods up to number 37 (secondary raw materials). All products thereafter have negligible relevance for freight transportation because of their service character. By the use of relevant literature [Statistisches Bundesamt (2008), Amtsblatt der Europäischen Gemeinschaften (1998), WIFO (2010), TRAFICO et al. (2009), Eurostat (2014) and STATISTIK AUSTRIA (2014)] we created a bridge matrix with a key that enables us to refer CPA classified goods to NST/R-24 classified goods. The reference key is hard to validate because there is no opportunity to prove it because of the lack of data. In the future this will have less relevance because the NST-2007 classification has been introduced since 2007 and can be referred directly to CPA classified

goods. Unfortunately at the moment we are lacking time-series data for NST-2007 classified goods which are necessary for the statistical analysis. The bridge matrix we developed and applied is shown in Table 1 and can be read using Eq. 2.

Equation 2:

$$EI_k = \sum_i \left(\widehat{EI}_i \cdot \beta_{i,k}\right)$$

EI: economic indicator (€)
$\widehat{EI}$: CPA classified economic indicator (€)
i: index for products (CPA divisions 1-37)
k: index for commodities (NST/R-24 with 24 sub-chapters)
β: weight of product (CPA) for commodity (NST)
$\sum_i \beta_{i,k} = 1$ for each commodity k

Table 1: Bridge matrix from CPA to NST/R-24 classified goods

NSTR24	CPA	β	NSTR24	CPA	β	NSTR24	CPA	β
01	01	0.33	13	27	0.51	24	01	0.1
02	01	0.36	14	26	0.88	24	05	0.2
03	01	0.12	15	14	1	24	12	1
03	05	0.34	16	24	0.09	24	15	0.1
04	02	1	16	25	0.06	24	16	0.8
04	20	1	17	24	0.01	24	17	0.3
05	17	0.07	17	25	0.01	24	18	0.3
05	18	0.07	18	24	0.85	24	19	0.3
05	19	0.07	18	25	0.59	24	21	0.2
05	36	0.06	19	21	0.8	24	22	1
05	37	0.07	20	29	0.8	24	24	0.05
06	15	0.9	20	30	0.33	24	25	0.34
06	16	0.2	20	31	0.7	24	26	0.05
07	01	0.09	20	32	0.33	24	27	0.05
07	05	0.46	20	33	0.33	24	28	0.1
08	10	1	20	34	0.9	24	29	0.2
09	11	0.01	20	35	0.9	24	30	0.67
09	23	0.01	21	28	0.22	24	31	0.3
10	11	0.99	21	27	0.16	24	32	0.67
10	23	0.99	22	26	0.07	24	33	0.67
11	13	0.92	23	17	0.63	24	34	0.1
11	27	0.25	23	18	0.63	24	35	0.1
12	13	0.08	23	19	0.63	24	36	0.34
12	27	0.03	23	36	0.6	24	37	0.25
13	28	0.68	23	37	0.68			

For the correlation analysis between economic activity and freight transportation, we used EUROSTAT data for the transport modes of road (EUROSTAT 2012), rail (EUROSTAT 2013c) and inland waterways (EUROSTAT 2013d) as the transported tonnage in our research. The data covers domestic German freight transport, the import and the export of freight. In Table 2 the amount of freight per type of good and the development of the sum of transported tons over the transport modes for the available period

1999-2007 is shown. These data are the reference for freight transport in the correlation analysis.

In the next chapter, we demonstrate the calculation of the economic indicator for the product group NST/R-13 (metal products). The correlation of the economic indicator for all types of goods and the transported freight is shown in chapter 4.

Table 2: Transported type of goods in Germany by road, rail and inland waterways in sum from 1999-2007

Type of good	Amount in 1000t									Share in 2007
	1999	2000	2001	2002	2003	2004	2005	2006	2007	
1	41,639	43,424	41,210	40,711	35,825	34,453	40,930	39,969	39,309	1.0%
2	30,418	43,711	35,025	32,902	32,275	34,359	34,308	35,020	36,093	0.9%
3	16,495	17,854	15,163	17,612	18,185	18,971	20,141	15,978	22,418	0.6%
4	74,146	81,702	75,938	68,958	66,411	72,076	80,760	88,860	97,940	2.6%
5	17,226	24,958	20,259	19,379	15,716	17,875	17,432	17,676	20,452	0.5%
6	325,180	337,310	336,953	337,692	350,715	360,428	371,603	375,967	390,881	10.2%
7	14,782	14,363	16,259	16,082	17,012	18,488	20,987	22,722	26,743	0.7%
8	103,520	104,727	99,007	98,062	99,826	102,576	95,339	100,639	103,930	2.7%
9	2,091	1,857	2,108	1,652	1,510	1,432	1,734	1,376	1,288	0.0%
10	200,885	187,886	197,611	176,074	178,611	184,701	190,171	198,824	190,144	5.0%
11	93,579	103,144	91,824	89,896	84,530	91,824	87,013	97,141	98,258	2.6%
12	11,476	14,931	12,618	10,197	8,486	8,313	8,516	9,190	10,115	0.3%
13	153,967	150,479	160,020	148,537	148,769	158,734	150,849	171,428	182,684	4.8%
14	255,411	241,917	227,601	202,186	204,309	211,719	198,255	207,097	194,629	5.1%
15	1,673,506	1,448,918	1,369,343	1,285,500	1,249,811	1,224,658	1,190,481	1,247,546	1,276,588	33.4%
16	35,242	36,989	33,552	33,637	33,995	35,539	34,260	36,949	39,215	1.0%
17	3,882	3,555	3,058	3,671	3,823	3,546	4,068	4,509	4,298	0.1%
18	243,928	239,406	221,310	213,079	226,677	233,575	234,360	243,762	256,980	6.7%
19	33,910	35,737	36,731	33,908	34,956	36,439	35,803	36,957	37,982	1.0%
20	107,225	114,580	123,745	118,624	122,117	131,651	136,294	146,764	153,078	4.0%
21	38,289	43,986	47,669	47,155	44,458	46,516	46,015	53,039	56,830	1.5%
22	25,125	23,137	20,775	22,816	21,424	21,138	20,809	21,922	20,930	0.5%
23	148,768	145,166	145,870	148,999	155,305	165,473	165,492	172,589	185,922	4.9%
24	214,405	248,249	250,911	240,629	263,069	276,675	318,362	346,893	375,090	9.8%
Total	3,865,093	3,707,985	3,584,561	3,407,959	3,417,812	3,491,158	3,503,983	3,692,815	3,821,798	100.0%

3.3. Example of the calculation of the indicator for the NST/R-24 product group 6

In this chapter, the processing steps to obtain the indicator are demonstrated for the NST/R-24 type of good 13 (metal products) to provide a comprehensible tool to repeat our methodology. The processing is the same for supply and for use tables (SUT), therefore we limit our depiction to the calculation based on supply tables.

As we can see inTable 1, the CPA products ‘27’ and ‘28’ are relevant for NST/R-24 product 13.

The first processing step is the calculation of the weighting factors (α). The SUT are evaluated horizontally: the contribution of each industry to each product group is measured in production values (PV) and consumption values (CV). The weighting factor is the percentage of a PV to the sum over the PV or the CV to the sum over the CV. The row sum of the weighting factors per

product group is 1. The resulting weighting factors for the product group 13 when using the supply table for the years 1999-2007 are shown in Table 3. Please note that we have turned all following tables by 90° to obtain a better depiction1.

The second processing step is the set-up of a production and a consumption function for each product group. The function has the form as shown in Eq. 1. The GVA of an industry (EUROSTAT 2013b, see Table 9 in attachment) is multiplied with the specific weighting factors $\alpha_{i,j}$. Thereafter the sum over the production function or the consumption function was built to obtain the indicator classified per CPA (see Table 4).

The third processing step is the transformation of the CPA classified indicator to an NST/R-24 classified indicator under the use of Table 1. The specific formula for the NST/R-24 group 13 is given in Eq. 3.

Equation 3:

$$\mathbf{EI}_{13,y} = \widehat{\boldsymbol{EI}}_{27,y} \cdot \mathbf{0.51} + \widehat{\boldsymbol{EI}}_{28,y} \cdot \mathbf{0.68}$$

EI: economic indicator (€)
$\widehat{EI}$: CPA classified economic indicator (€)
y: year

The final indicator for NST/R-24 (13), based on the supply tables, is shown in Table 4 for each year. The related tonnage of the NST/R-24 type of good 13 is referred to the years (see Table 2).

A linear regression between the indicator and the tonnage of NST/R-24 (13) can be done now. The result of the correlation analysis in our example is R2=0.8244 (see Fig. 1).

In the following section, we show the results of the described methodology applied for Germany and for all 24 types of transported goods.

[1] Normally SUTs have the products in the rows and industries in the columns.

Table 3: Table of the supply-table based weighting factors ($\alpha_{i,j}$)

NACE	1999 CPA 27	1999 CPA 28	2000 CPA 27	2000 CPA 28	2001 CPA 27	2001 CPA 28	2002 CPA 27	2002 CPA 28	2003 CPA 27	2003 CPA 28	2004 CPA 27	2004 CPA 28	2005 CPA 27	2005 CPA 28	2006 CPA 27	2006 CPA 28	2007 CPA 27	2007 CPA 28
1-10																		0
11	0	0	0	0	0	0	0	0	0	0	0	2.181E-05	0	2.072E-05	0	3.771E-05	0	0
12-13																		0
14	0.00004	0.00002	0.00009	0.00001	0.00003	0.00001	0	0.00004	0	0	0.00001	0	0.00001	0	0.00001	0	0.00001	0
15	0.00023	0.00013	0.00019	0.00015	0.00015	0.00020	0.00018	0.00013	0.00018	0.00014	0.00012	0.00014	0.00011	0.00013	0.00008	0.00013	0.00011	0.00012
16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
17	0	0.00013	0	0.00015	0	0.00021	0	0.00042	0	0.00042	0	0.00025	0	0.00045	0	0.00045	0	0.00042
18	0	0.00001	0	0.00001	0	0.00001	0	0.00001	0	0.00001	0	0.00001	0	0.00001	0	0.00001	0	0.00001
19	0	0.00007	0	0.00008	0	0.00009	0	0.00008	0	0.00008	0	0.00009	0	0.00005	0	0.00005	0	0.00004
20	0	0.00149	0	0.00155	0	0.00155	0	0.00181	0	0.00111	0	0.00103	0	0.00093	0	0.00082	0	0.00073
21	0.00002	0.00011	0	0.00008	0	0.00008	0	0.00006	0.00032	0.00006	0.00024	0.00005	0	0.00007	0	0.00006	0	0.00004
22	0	0.00001	0	0	0	0	0	0.00012	0	0.00001	0	0.00001	0	0.00001	0	0.00001	0	0
23	0	0.00002	0	0.00002	0	0.00002	0	0.00002	0	0.00003	0	0.00003	0	0.00003	0	0.00003	0	0.00002
24	0.01802	0.00027	0.00895	0.00031	0.00537	0.00031	0.00566	0.00045	0.00547	0.00043	0.00552	0.00034	0.00515	0.00028	0.00613	0.00026	0.00525	0.00035
25	0.00113	0.00650	0.00164	0.00622	0.00170	0.00586	0.00102	0.00788	0.00113	0.00866	0.00149	0.00692	0.00089	0.00739	0.00096	0.00733	0.00094	0.00715
26	0.00062	0.00203	0.00101	0.00190	0.00045	0.00192	0.00053	0.00205	0.00046	0.00181	0.00036	0.00154	0.00017	0.00155	0.00012	0.00162	0.00012	0.00184
27	0.93253	0.01508	0.94620	0.01667	0.95381	0.01587	0.95775	0.01519	0.95866	0.01374	0.96014	0.01610	0.96389	0.01587	0.96435	0.01665	0.96353	0.01705
28	0.01899	0.92104	0.01906	0.92076	0.01560	0.92730	0.01331	0.91630	0.01355	0.91247	0.01120	0.91667	0.01076	0.92047	0.01133	0.92172	0.01247	0.92323
29	0.00625	0.02139	0.00600	0.01557	0.00724	0.01553	0.00650	0.01918	0.00642	0.01807	0.00635	0.01781	0.00581	0.01617	0.00374	0.01555	0.00410	0.01458
30	0	0.00037	0	0.00085	0	0.00058	0	0.00060	0.00002	0.00023	0.00001	0.00029	0.00001	0.00034	0.00001	0.00053	0	0.00041
31	0.00381	0.00409	0.00392	0.00404	0.00349	0.00356	0.00317	0.00352	0.00300	0.00374	0.00324	0.00399	0.00308	0.00474	0.00396	0.00501	0.00378	0.00489
32	0.00045	0.00021	0.00044	0.00021	0.00041	0.00039	0.00040	0.00052	0.00041	0.00061	0.00046	0.00020	0.00040	0.00016	0.00040	0.00044	0.00003	0.00011
33	0	0.00153	0.00042	0.00164	0	0.00165	0.00019	0.00072	0	0.00054	0.00013	0.00061	0.00012	0.00064	0.00014	0.00058	0.00001	0.00061
34	0.00225	0.00733	0.00228	0.00696	0.00298	0.00788	0.00233	0.01111	0.00118	0.00959	0.00095	0.00728	0.00122	0.00839	0.00169	0.00597	0.00156	0.00442
35	0.00058	0.00196	0.00058	0.00151	0.00045	0.00158	0.00063	0.00175	0.00083	0.00179	0.00074	0.00137	0.00048	0.00161	0.00029	0.00167	0.00033	0.00190
36	0.00021	0.00337	0.00005	0.00321	0.00003	0.00315	0.00004	0.00342	0	0.00296	0.00003	0.00275	0.00003	0.00246	0.00002	0.00230	0.00051	0.00577
37	0	0	0.00014	0	0.00014	0	0.00016	0.00001	0.00016	0.00003	0.00016	0.00003	0.00015	0.00002	0.00011	0	0.00074	0
40	0	0.00044	0	0.00040	0	0.00045	0	0.00046	0	0.00052	0	0.00031	0	0.00032	0	0.00033	0	0.00032
41	0	0.00007	0	0.00009	0	0.00009	0	0.00009	0	0.00010	0	0.00010	0	0.00009	0	0.00008	0	0.00007
45	0.00676	0.00928	0	0.01123	0	0.00844	0	0.00647	0	0.01547	0	0.01580	0	0.01153	0	0.01237	0	0.01035
50	0	0	0	0	0	0	0.00047	0	0.00048	0	0.00040	0	0	0	0	0	0	0
51	0.00497	0.00077	0.00677	0.00139	0.00587	0.00171	0.00508	0.00171	0.00512	0.00165	0.00616	0.00116	0.00578	0.00126	0.00488	0.00126	0.00478	0.00114
52	0	0.00084	0	0.00028	0	0.00017	0	0.00086	0	0.00083	0	0.00024	0	0.00023	0	0.00018	0	0.00018
55	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
60	0	0.00084	0	0.00139	0	0.00082	0	0.00142	0	0.00132	0	0.00129	0	0.00132	0	0.00126	0	0.00116
61-62																		0
63	0	0.00018	0	0.00299	0	0.00022	0	0.00323	0	0.00318	0	0.00318	0	0.00310	0	0.00295	0	0.00272
64-73																		0
74	0.003154	0.00041	0.00227	0.00034	0.00227	0.00033	0.00261	0.00040	0.00263	0.00039	0.00228	0.00038	0.00194	0.00034	0.00178	0.00035	0.00174	0.00035
75-95																		0
sum	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1	1.0	1.0	1.0

Table 4: Table of the supply-table-based CPA classified indicator ($f(GVA)_{[27,28],j}$)

NACE	1999 CPA 27	1999 CPA 28	2000 CPA 27	2000 CPA 28	2001 CPA 27	2001 CPA 28	2002 CPA 27	2002 CPA 28	2003 CPA 27 [in Mio. €]	2003 CPA 28	2004 CPA 27	2004 CPA 28	2005 CPA 27	2005 CPA 28	2006 CPA 27	2006 CPA 28	2007 CPA 27	2007 CPA 28
1-10																		0.00
11	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.04	0.00	0.02	0.00	0.05	0.00	0.08
12-14																		0.00
15	7.71	4.44	6.93	5.26	5.09	6.59	5.93	4.37	6.42	4.94	4.33	5.16	3.93	4.98	2.76	4.74	2.65	4.54
16	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
17	0.00	0.70	0.00	0.85	0.00	1.18	0.00	2.20	0.00	2.09	0.00	1.22	0.00	2.20	0.00	2.23	0.00	2.13
18	0.00	0.04	0.00	0.04	0.00	0.03	0.00	0.03	0.00	0.03	0.00	0.03	0.00	0.03	0.00	0.03	0.00	0.03
19	0.00	0.08	0.00	0.08	0.00	0.09	0.00	0.09	0.00	0.08	0.00	0.09	0.00	0.05	0.00	0.05	0.00	0.05
20	0.00	12.00	0.00	12.66	0.00	11.68	0.00	13.37	0.00	7.65	0.00	7.53	0.00	6.66	0.00	5.95	0.00	5.47
21	0.20	1.02	0.00	0.74	0.00	0.74	0.00	0.60	3.31	0.59	2.54	0.58	0.00	0.77	0.00	0.60	0.00	0.58
22	0.00	0.27	0.00	0.00	0.00	0.00	0.00	2.47	0.00	0.23	0.00	0.23	0.00	0.23	0.00	0.21	0.00	0.21
23	0.00	0.11	0.00	0.14	0.00	0.18	0.00	0.11	0.00	0.12	0.00	0.15	0.00	0.15	0.00	0.17	0.00	0.10
24	709.02	10.73	371.39	13.00	229.57	13.35	249.41	19.65	244.52	19.24	257.18	15.76	248.45	13.48	303.28	13.06	316.03	13.61
25	22.29	127.71	34.31	130.17	33.98	116.98	21.32	165.43	23.40	179.50	33.66	156.71	20.07	166.57	22.60	173.25	22.44	172.08
26	10.18	33.39	16.99	31.95	6.98	29.91	7.65	29.90	6.57	25.95	4.93	21.25	2.40	21.60	1.80	24.18	1.76	23.59
27	15,773.71	255.10	14,155.10	249.34	16,701.18	277.97	16,808.49	266.55	15,635.67	224.04	15,640.72	262.21	17,571.74	289.34	21,186.80	365.80	20,656.40	356.64
28	697.56	33,839.11	769.93	37,189.41	616.35	36,628.50	501.82	34,553.57	531.65	35,796.39	450.64	36,886.89	431.19	36,883.43	530.08	43,108.78	533.48	43,385.29
29	353.01	1,208.79	371.25	963.53	461.22	988.90	408.28	1,205.17	408.26	1,148.75	425.10	1,192.10	399.42	1,112.66	273.31	1,134.61	300.01	1,245.46
30	0.00	2.19	0.00	5.02	0.00	3.32	0.00	2.75	0.08	0.98	0.07	1.40	0.06	1.44	0.04	2.06	0.06	3.07
31	114.28	122.57	130.67	134.47	101.98	103.84	93.84	104.18	91.16	113.57	108.03	132.99	98.50	151.65	142.73	180.23	134.48	169.81
32	4.62	2.17	5.84	2.85	4.22	3.99	4.08	5.22	4.77	7.19	6.25	2.66	5.88	2.29	6.01	6.73	7.26	8.14
33	0.00	21.39	6.99	27.48	0.00	27.90	3.15	11.70	0.00	9.70	2.49	11.36	2.36	12.70	3.07	12.36	3.25	13.08
34	107.57	350.78	112.45	342.46	170.39	451.22	134.63	642.06	76.32	619.14	61.64	471.76	79.68	547.06	119.05	420.09	133.70	471.77
35	5.14	17.43	4.94	12.96	4.33	15.34	5.99	16.62	7.67	16.55	6.53	12.06	5.17	17.34	3.03	17.69	3.14	18.36
36	2.36	38.56	0.61	37.69	0.39	36.00	0.36	35.14	0.00	30.53	0.30	28.17	0.28	25.44	0.25	26.52	0.25	26.34
37	0.00	0.00	0.10	0.00	0.17	0.00	0.15	0.01	0.11	0.02	0.12	0.02	0.17	0.02	0.10	0.00	0.15	0.00
40	0.00	15.93	0.00	13.88	0.00	12.47	0.00	14.03	0.00	16.16	0.00	11.53	0.00	12.19	0.00	12.47	0.00	14.98
41	0.00	0.37	0.00	0.48	0.00	0.50	0.00	0.53	0.00	0.58	0.00	0.57	0.00	0.56	0.00	0.51	0.00	0.52
45	671.40	921.80	0.00	1,077.60	0.00	766.01	0.00	570.99	0.00	1,305.73	0.00	1,302.23	0.00	914.06	0.00	983.64	0.00	1,017.78
50	0.00	0.00	0.00	0.00	0.00	0.00	16.34	0.00	18.61	0.00	15.56	0.00	0.00	0.00	0.00	0.00	0.00	0.00
51	458.52	71.13	658.35	134.95	554.62	161.25	461.93	155.77	432.83	139.84	518.62	97.37	530.91	116.12	448.46	116.19	488.98	126.69
52	0.00	64.41	0.00	22.03	0.00	14.51	0.00	69.33	0.00	69.08	0.00	19.70	0.00	18.28	0.00	14.79	0.00	14.53
55	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
60	0.00	24.02	0.00	38.10	0.00	23.18	0.00	42.29	0.00	37.55	0.00	38.22	0.00	38.50	0.00	37.59	0.00	40.19
61-62	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
63																		0.00
64-73	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
74	450.87	59.32	355.28	52.59	364.02	53.61	419.94	64.18	443.98	65.02	385.74	64.70	348.74	61.47	337.24	66.12	357.27	70.05
75-95	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	19,388.45	37,205.56	17,001.15	40,499.71	19,254.49	39,749.25	19,143.32	37,998.31	17,935.32	39,841.22	17,924.44	40,744.71	19,748.95	40,421.29	23,380.60	46,730.69	22,961.32	47,205.17

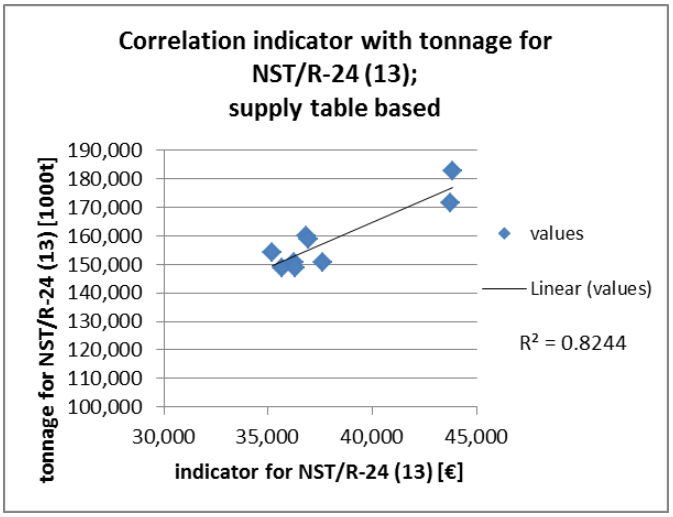

Figure 1: Correlation between the tonnage of transported metal products and the indicator

Table 5: Processed indicators (supply-table-based) for each year and the tonnage of NST/R-24 group 13

	Indicator [Mio. €]	Tonnage [1000t]
1999	35190.65	153,966.60
2000	36260.85	150,479.00
2001	36853.41	160,020.00
2002	35664.69	148,537.00
2003	36304.04	148,769.00
2004	36918.72	158,734.00
2005	37631.09	150,849.00
2006	43775.16	171,428.00
2007	43885.81	182,683.72

4. THE CORRELATION BETWEEN ECONOMIC ACTIVITY AND FREIGHT TRANSPORTATION

The data processing described in chapter 3 is done for all NST/R-24 in a database (postgreSQL). The resulting indicators based on supply and use tables are shown in the following tables (see Table 6 and 7).

Table 6: Supply-table-based indicators for Germany

	Type of good (NST/R-24)	1999 [Mio. €]	2000 [Mio. €]	2001 [Mio. €]	2002 [Mio. €]	2003 [Mio. €]	2004 [Mio. €]	2005 [Mio. €]	2006 [Mio. €]	2007 [Mio. €]
Supply table based indicators	1	7,785.95	6,497.70	7,368.90	7,243.50	6,210.60	7,365.60	5,652.90	4,887.30	4,900.50
	2	8,493.76	7,088.40	8,038.80	7,902.00	6,775.20	8,035.20	6,166.80	5,331.60	5,346.00
	3	2,898.78	2,441.00	2,734.00	2,691.80	2,353.60	2,756.60	2,120.20	1,858.80	1,867.00
	4	11,809.99	12,557.25	11,210.08	10,953.92	10,320.21	11,193.42	10,211.91	10,400.88	10,270.25
	5	1,968.60	1,866.12	1,841.01	1,886.96	1,895.90	2,014.75	2,002.61	2,061.55	2,130.47
	6	31,496.15	33,656.57	30,847.99	31,770.03	33,711.25	33,746.61	34,206.46	33,292.55	32,029.76
	7	2,214.80	1,877.90	2,083.30	2,053.70	1,822.60	2,114.60	1,629.10	1,443.30	1,451.50
	8	4,639.28	6,195.08	5,088.53	4,980.00	3,890.80	4,178.27	3,326.26	4,187.73	4,971.16
	9	74.70	93.13	107.95	83.10	62.38	73.16	64.84	82.20	66.41
	10	7,395.08	9,220.32	10,687.47	8,227.32	6,176.03	7,242.93	6,419.65	8,138.21	6,574.75
	11	72,316.58	4,250.29	4,813.62	4,785.83	4,483.83	4,481.11	4,937.24	5,845.15	5,740.33
	12	6,448.56	510.03	577.63	574.30	538.06	537.73	592.47	701.42	688.84
	13	35,190.65	36,260.85	36,853.41	35,664.69	36,304.04	36,918.72	37,631.09	43,775.16	43,885.81
	14	16,931.64	16,843.55	15,462.40	14,290.80	14,070.30	13,541.74	13,541.52	14,524.52	14,327.20
	15	8,850.98	7,436.60	6,973.90	5,795.55	6,776.40	6,108.56	7,121.66	7,506.42	7,725.30
	16	4,773.03	5,035.61	5,089.88	5,276.45	5,314.85	5,561.71	5,687.80	5,874.62	6,056.21
	17	601.33	634.68	637.56	661.81	665.99	698.85	712.98	738.09	758.57
	18	45,575.58	48,084.73	48,575.17	50,361.91	50,723.92	53,093.45	54,285.18	56,079.94	57,797.16
	19	8,017.08	7,799.53	8,019.94	8,633.29	8,796.48	9,011.78	8,775.64	8,796.19	8,511.36
	20	132,841.14	144,398.20	151,559.48	150,004.11	157,792.75	161,497.67	165,899.21	177,468.13	192,320.86
	21	11,288.27	11,646.45	11,826.89	11,442.86	11,655.75	11,854.67	12,076.02	14,045.65	14,083.54
	22	1,346.84	1,339.83	1,229.96	1,136.77	1,119.23	1,077.18	1,077.17	1,155.36	1,139.66
	23	18,712.00	17,767.88	17,545.60	18,000.39	18,103.54	19,266.78	19,154.15	19,739.24	20,409.00
	24	110,094.41	122,809.32	119,805.90	116,821.55	118,560.22	121,265.86	125,957.41	131,567.89	137,944.75

Table 7: Use-table-based indicator for Germany

	Type of good (NST/R-24)	1999 [Mio. €]	2000 [Mio. €]	2001 [Mio. €]	2002 [Mio. €]	2003 [Mio. €]	2004 [Mio. €]	2005 [Mio. €]	2006 [Mio. €]	2007 [Mio. €]
Use table based indicators	1	12,604.94	13,437.25	12,686.71	13,256.15	14,195.96	14,070.03	14,043.97	14,391.81	14,129.18
	2	13,750.84	14,658.82	13,840.05	14,461.25	15,486.50	15,349.12	15,320.70	15,700.15	15,413.65
	3	16,750.92	17,474.99	16,597.21	17,176.20	18,448.08	18,318.91	18,868.18	19,115.65	18,949.45
	4	61,465.85	62,048.66	59,815.78	57,313.07	55,180.57	54,762.51	49,850.87	51,121.25	52,279.96
	5	7,676.08	8,013.68	8,070.18	8,233.28	8,990.36	8,362.49	8,370.69	8,580.61	8,961.00
	6	41,368.20	42,467.54	41,862.70	43,490.32	43,900.51	45,099.27	46,156.23	45,721.04	46,109.05
	7	19,899.36	20,696.50	19,673.47	20,331.96	21,846.68	21,699.53	22,448.38	22,706.93	22,539.65
	8	27,585.33	29,108.58	24,315.36	26,196.81	26,256.99	30,960.07	31,539.83	31,824.14	36,986.54
	9	696.64	646.85	679.55	646.32	646.51	630.25	630.48	681.67	692.52
	10	68,967.63	64,038.02	67,275.52	63,985.94	64,004.75	62,395.13	62,417.79	67,485.45	68,559.91
	11	27,494.00	25,236.61	27,708.92	27,311.13	26,673.42	26,722.46	28,509.35	32,400.44	32,564.97
	12	2,704.06	2,504.59	2,731.10	2,692.94	2,648.68	2,652.87	2,812.47	3,174.84	3,206.97
	13	52,840.61	54,104.98	54,682.62	53,749.78	55,270.01	55,757.02	55,913.26	59,923.77	63,339.75
	14	60,906.58	58,496.24	54,759.88	52,960.35	52,075.16	51,024.72	49,100.57	49,819.94	51,733.41
	15	52,512.30	45,899.55	42,662.57	40,301.63	40,415.69	38,941.55	38,193.66	38,814.10	39,598.76
	16	7,092.06	7,119.01	7,128.83	7,285.67	7,465.08	7,594.84	7,559.74	7,852.46	8,209.50
	17	972.65	973.78	973.48	989.69	1,014.43	1,027.55	1,022.95	1,061.04	1,112.16
	18	68,273.07	68,514.57	68,597.54	70,070.28	71,798.36	73,014.81	72,678.42	75,481.87	78,934.14
	19	29,092.75	27,516.96	28,077.79	28,178.56	28,727.73	29,236.17	29,670.76	29,675.51	30,252.05
	20	183,308.57	203,331.38	209,399.67	216,908.44	221,836.73	225,857.59	229,966.44	234,242.85	249,889.53
	21	16,905.88	17,316.86	17,496.76	17,197.12	17,682.19	17,839.80	17,887.79	19,170.77	20,265.16
	22	4,844.84	4,653.11	4,355.90	4,212.76	4,142.34	4,058.78	3,905.73	3,962.95	4,115.16
	23	72,443.86	74,877.49	75,588.74	77,086.20	84,115.58	78,440.63	78,628.66	80,642.88	84,279.41
	24	299,415.76	293,774.98	294,094.32	302,749.49	312,283.20	313,232.39	314,564.79	325,422.36	338,661.08

We conducted a linear regression analysis with R2 as the indicator for the fitness. The regression analysis was done in two ways. The first is looking for the correlation between the transported tons per type of good with the economic indicator based on the supply tables. The second analysis used the indicator based on the use tables. The results of the correlation for both

analyses are shown in Table 8. We can observe that some products can be explained by the indicator based on the supply tables, others based on the use tables, some products have a strong correlation to both indicators. 11 explainable product groups (chosen threshold: R2 > 0.5) represent 75% of the transported amount of goods in Germany in 2007. These types of goods and the best R2 value are marked bolt in Table 8 and graphical examples are provided in Fig. 2. However the remaining 25% of the transported amount of goods cannot be explained by any of both indicators.

Table 8: Correlation between transported tons per type of good and the economic indicator

	Type of good (NST/R-24)	R^2 supply table based	R^2 use table based	Importance in Germany (share of tons in 2007 [%])
1	Cereals	0.001	0.3048	1.0%
2	Potatoes, other fresh or frozen fruits and vegetables	0.0673	0.0125	0.9%
3	Live animals, sugar beet	0.2306	0.3611	0.6%
4	Wood and cork	0.0463	0.1643	2.6%
5	Textiles, textile articles and man-made fibres, other raw animal and vegetable materials	0.0689	0.0875	0.5%
6	Foodstuff and animal fodder	0.1529	**0.89**	**10.2%**
7	Oil seeds and oleaginous fruits and fats	**0.7004**	0.6675	**0.7%**
8	Solid minerals fuels	0.3696	0.0928	2.7%
9	Crude petroleum	0.3305	0.0264	0.0%
10	Petroleum products	0.1017	0.4825	5.0%
11	Iron ore, iron and steel waste and blast furnace dust	0.0017	0.049	2.6%
12	Non-ferrous ores and waste	0.0277	0.1334	0.3%
13	Metal products	0.8244	**0.8333**	**4.8%**
14	Cement, lime, manufactured building materials	0.8436	**0.8569**	**5.1%**
15	Crude and manufactured minerals	0.4795	**0.9856**	**33.4%**
16	Natural and chemical fertilizers	0.2735	0.4327	1.0%
17	Coal chemicals, tar	0.461	**0.542**	**0.1%**
18	Chemicals other than coal chemicals and tar	0.1775	0.3447	6.7%
19	Paper pulp and waste paper	0.0221	0.2132	1.0%
20	Transport equipment, machinery, apparatus, engines, whether or not assembled, and parts thereof	**0.9663**	0.8728	**4.0%**
21	Manufactures of metal	0.7882	**0.8278**	**1.5%**
22	Glass, glassware, ceramic products	0.5633	**0.6526**	**0.5%**
23	Leather, textile, clothing, other manufactured articles	**0.9046**	0.5294	**4.9%**
24	Miscellaneous articles	**0.917**	0.8348	**9.8%**
			Explained tonnage	75.0%

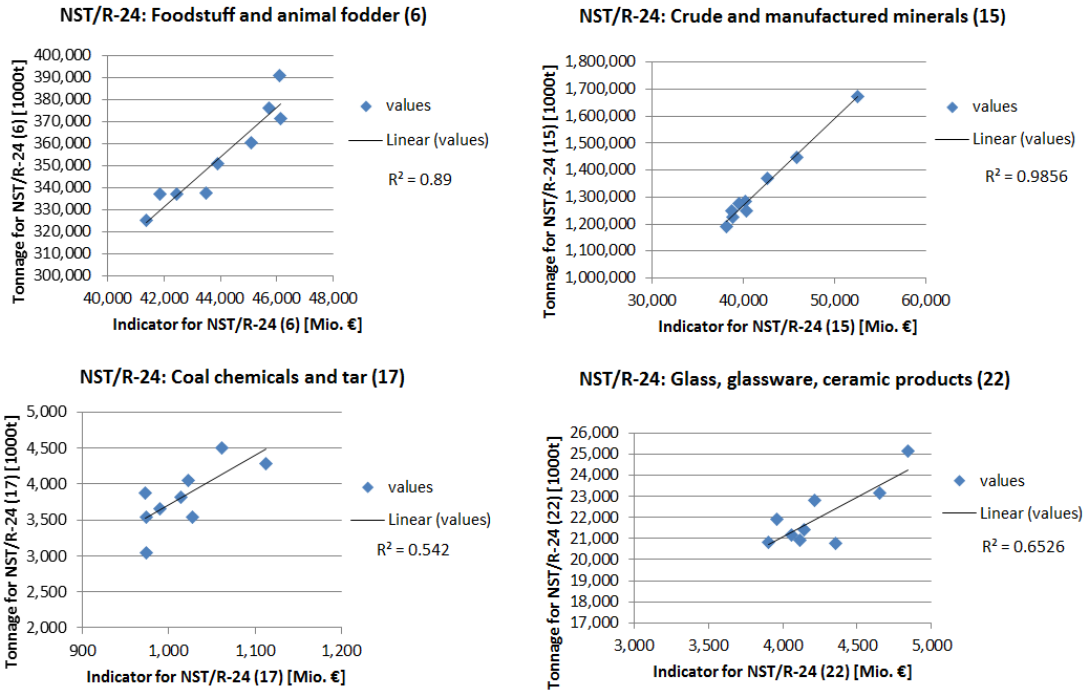

Figure 3: Graphical examples of the regression analysis referred to Table 8

What is behind the power of explanation for the correlations? We discuss this in the next chapter.

5. DISCUSSION OF THE RESULTS OF THE METHOD OF DISAGGREGATED WEIGHTED GVA

It is noticeable for the commodities which have a high R2 that the correlation is mostly given in the supply- as well in the use-based calculations. However, in the consideration of both results, the use tables reveal better results in total in terms of R2. This could be because the weighting of different industries plays a more important role in use tables than in supply tables, where just 1-3 industries are relevant (mainly were CPA = NACE). The weighting of different industries seems to be a relevant and better method than to use just one or a few main industries. Moreover, upon closer examination of the data, we see that the tonnage is less volatile in that case than in those of commodities with a low R2 (e.g. Type of good nr. 10 ‘vs.’ 24). Furthermore we have done another test where we analysed the correlation between the indicator and just the domestic German tonnage (without import and export contributions). In this case the results are similar for the explainable commodities, in tendency slightly worse, however. But this result is expected with an SUT and GVA including imports and exports.

In fact, we are lacking empirically in some areas, and cannot definitively say why some commodities are explainable and others are not. However, with the described observations we can discuss aspects of the answer.

- Natural resources are more expensive when they become scarce, and cheaper when they are plentiful. For example, in the case of vegetable goods (e.g. types of goods 1 and 2), a bad season means high prices but less transported goods and a good season means the opposite. The price itself is negotiated on the market, sometimes influenced by speculation on the stock market. Companies can use stored input materials to reduce the influence of market prices by season or speculations. That could explain why either the SUT or GVA contains the familiar fluctuations rather than the tonnage.
- Price decrease/increase for commodities over years is another possible reason. For example, cereals (NST/R-24 type of good 1), whose tonnage is nearly constant (-5%, see Table 2) between 1999 and 2007 in Germany; the indicator, however, sank by 37% on the supply side (see Table 6) and is slightly growing (+12%) on the use side (see Table 7). Displacement of production and value added change as a consequence of globalization/international division of labour; increasing efficiencies etc. are possible influencing factors.
- Taking into account the handling in the transport of goods. In economic tables, the commodity is counted if the owner changes what influences the developed indicator. In transport tables the commodity is counted in each transport leg. Therefore the same unit of commodity can be counted several times. Logistics matters here: the logistics concepts and handlings behind the commodity groups have to be investigated more to come to an adequate consideration of complex transport chains. We can observe a general increasing integration of logistics functions in transport processes.
- The bridge matrix, which converts CPA-classified goods into NST/R-24-classified goods, is a great uncertainty. As noted before, there is no opportunity to prove the factors.

  We applied the transported tons in our research. That implies that all the handlings of a commodity over all modes and means is included, although not logistics. The use of a logistics network, the choice of mode and means as well as the creation of forwarder-receiver-pairs are examples for remaining modelling tasks and logistics modules inside transport models. In our perspective, to use the transported tons and not the produced tons eases the modelling process partly because the amount which has to be transported is congruent to the official transport statistics.

Ultimately we found correlations with our methodology for 75% of the amount of transported goods in the case of Germany. For the remaining 25% the methodology does not work – new approaches are needed. Furthermore, the empirical knowledge must be enhanced to explain the correlations and the non-correlations as well.

In the last chapter we outline the upcoming research task from this investigation.

6. CONCLUSION

We investigated the correlation of disaggregated GVA and the amount of transported goods in this paper. A method was introduced where the weighted GVA of industries to specific products is used to describe economic activity. In the case of Germany, a correlation between this economic indicator and the amount of total transported type of goods is significantly high for 75% of the goods. This correlation is also robust, as an additional analysis has shown – the analysis with the domestic German amount of transported goods.

The guiding research question in this paper was: How can we translate economic activity into freight transportation? With the provided methodology, a possible solution is shown which is able to translate 75% of the 24 transported types of goods (NST/R-24 classified) in Germany by the economic activity of 59 industries. The identified correlations are strong and therefore we can expect to be suited for forecast intensions. No correlations are found for 25% of the goods. Both the correlation and the non-correlation open a need for further research.

- We discussed the results but ultimately we see importance in giving further attention to the reasons why some product groups can still be explained while others cannot. A deeper look to specific market data, market characteristics, production accounts but also the constitution of classes of goods (e.g. NST/R-24) and transportation characteristics including logistics issues are necessary and a future scientific task.
- Moreover it is important to test the methodology and the indicator for other European countries than Germany. A comparison of the result will be possible because we deployed just public available data from EUROSTAT.
- A regional investigation, on federal state or NUTS 3 level would also be desirable. Especially for SCGE or MRIO modelling needs and for European wide model needs is this investigation reasonable.

- The logistics issue, which is a separated module in most of the freight models, has to be investigated in terms of the implementation of our empirical findings into freight models. Logistics as a sensible reactive module must sustain in freight models. However, its significance as the translation toolbox ‘from money flows to transport flows’ could be changed.
- In future we will be able to use new statistic data, based on the NST-2007 classification. This classification will ease the elaboration of economic statistical data and transport statistical data because of a simplified transformation key. In our research, we needed help from a bridge matrix to overcome the mismatch of both statistics and unfortunately that introduces a source of uncertainty. However, the availability of time series with new classifications still needs time.

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ATTACHMENT:

Table 9: GVA per year and industry (own presentation based on EUROSTAT 2013b)

NACE-Code	1999	2000	2001	2002	2003	2004	2005	2006	2007
					[Mio. €]				
01	22,258.70	19,690.00	22,330.00	21,950.00	18,820.00	22,320.00	17,130.00	14,810.00	14,850.00
02	2,224.90	2,220.00	1,860.00	2,010.00	1,840.00	2,130.00	1,840.00	1,910.00	2,310.00
05	198.60	230.00	160.00	170.00	280.00	230.00	190.00	240.00	250.00
10	4,638.50	4,800.00	3,730.00	4,980.00	3,890.00	4,110.00	3,270.00	4,130.00	4,910.00
11	784.70	1,160.00	1,270.00	2,170.00	1,720.00	1,960.00	810.00	1,280.00	2,060.00
12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
13	2,661.90	2,630.00	2,590.00	2,620.00	2,180.00	2,370.00	2,300.00	2,520.00	2,460.00
14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
15	34,008.80	36,140.00	32,850.00	33,890.00	36,360.00	36,430.00	37,000.00	35,920.00	34,410.00
16	1,887.20	2,060.00	2,300.00	2,540.00	1,780.00	1,360.00	1,290.00	1,500.00	1,340.00
17	5,343.70	5,820.00	5,590.00	5,220.00	5,000.00	4,860.00	4,930.00	4,920.00	4,700.00
18	3,128.70	3,260.00	2,990.00	2,730.00	2,810.00	2,870.00	2,570.00	2,670.00	2,790.00
19	1,072.70	1,060.00	1,040.00	1,120.00	1,000.00	1,040.00	930.00	970.00	970.00
20	8,035.40	8,140.00	7,540.00	7,400.00	6,890.00	7,350.00	7,140.00	7,250.00	6,670.00
21	9,604.70	9,440.00	9,430.00	10,210.00	10,430.00	10,660.00	10,630.00	10,650.00	10,270.00
22	22,596.40	23,850.00	22,710.00	21,080.00	20,390.00	21,230.00	22,190.00	21,830.00	21,840.00
23	4,797.40	6,360.00	8,000.00	4,590.00	3,450.00	4,640.00	4,850.00	5,980.00	3,500.00
24	39,352.40	41,510.00	42,770.00	44,100.00	44,700.00	46,610.00	48,200.00	49,490.00	51,570.00
25	19,656.40	20,930.00	19,950.00	20,990.00	20,720.00	22,630.00	22,550.00	23,650.00	23,490.00
26	16,468.00	16,800.00	15,600.00	14,570.00	14,320.00	13,820.00	13,900.00	14,910.00	14,550.00
27	16,915.00	14,960.00	17,510.00	17,550.00	16,310.00	16,290.00	18,230.00	21,970.00	21,420.00
28	36,740.20	40,390.00	39,500.00	37,710.00	39,230.00	40,240.00	40,070.00	46,770.00	47,070.00
29	56,515.70	61,880.00	63,680.00	62,850.00	63,560.00	66,940.00	68,800.00	72,980.00	80,110.00
30	5,959.50	5,900.00	5,730.00	4,600.00	4,310.00	4,760.00	4,220.00	3,910.00	5,820.00
31	29,966.30	33,300.00	29,200.00	29,610.00	30,390.00	33,320.00	31,960.00	36,000.00	33,920.00
32	10,190.70	13,390.00	10,220.00	10,120.00	11,750.00	13,560.00	14,760.00	15,190.00	18,370.00
33	13,984.90	16,710.00	16,910.00	16,360.00	17,840.00	18,600.00	19,770.00	21,490.00	22,750.00
34	47,874.50	49,220.00	57,250.00	57,810.00	64,550.00	64,760.00	65,190.00	70,390.00	79,050.00
35	8,909.40	8,580.00	9,690.00	9,510.00	9,250.00	8,780.00	10,800.00	10,600.00	11,000.00
36	11,452.10	11,740.00	11,410.00	10,260.00	10,330.00	10,250.00	10,360.00	11,530.00	11,450.00
37	715.10	730.00	1,260.00	930.00	710.00	730.00	1,130.00	890.00	1,400.00
40	36,303.20	34,470.00	27,960.00	30,670.00	31,020.00	37,750.00	37,970.00	37,790.00	45,390.00
41	5,254.30	5,340.00	5,570.00	5,610.00	5,700.00	5,760.00	5,960.00	6,010.00	6,130.00
45	99,294.90	95,950.00	90,770.00	88,200.00	84,410.00	82,410.00	79,270.00	79,520.00	82,280.00
50	29,936.50	30,420.00	30,800.00	34,570.00	39,070.00	38,740.00	37,980.00	38,070.00	35,580.00
51	92,292.50	97,290.00	94,540.00	90,970.00	84,580.00	84,230.00	91,870.00	91,970.00	100,280.00
52	76,519.70	78,770.00	86,750.00	80,980.00	83,560.00	82,120.00	80,210.00	82,590.00	81,130.00
55	26,877.30	29,330.00	30,370.00	29,200.00	30,670.00	31,140.00	32,760.00	33,110.00	36,040.00
60	28,536.00	27,470.00	28,100.00	29,800.00	28,340.00	29,700.00	29,260.00	29,750.00	31,810.00
61	3,734.60	3,200.00	5,570.00	6,520.00	3,470.00	6,130.00	6,500.00	6,090.00	8,430.00
62	6,406.40	7,360.00	5,210.00	5,190.00	5,330.00	5,860.00	5,550.00	6,730.00	7,160.00
63	22,834.70	24,850.00	27,230.00	28,610.00	30,040.00	32,720.00	34,490.00	36,970.00	37,880.00
64	42,779.10	37,770.00	38,410.00	40,460.00	41,750.00	45,230.00	40,010.00	43,500.00	42,810.00
65	58,859.80	70,740.00	50,190.00	57,270.00	59,490.00	67,180.00	70,750.00	74,590.00	65,670.00
66	17,918.20	13,570.00	15,960.00	14,210.00	7,100.00	14,830.00	9,590.00	14,830.00	16,430.00
67	8,541.90	8,570.00	8,970.00	9,950.00	9,370.00	8,810.00	13,710.00	15,980.00	18,550.00
70	198,718.90	205,560.00	217,650.00	228,140.00	236,700.00	231,430.00	237,910.00	243,970.00	256,130.00
71	30,254.30	34,750.00	34,440.00	33,860.00	36,790.00	36,890.00	40,070.00	38,120.00	40,790.00
72	25,228.50	28,350.00	32,570.00	31,740.00	29,800.00	30,000.00	31,290.00	31,810.00	34,870.00
73	5,979.30	7,400.00	6,610.00	6,970.00	7,250.00	7,440.00	7,060.00	7,450.00	8,500.00
74	142,948.10	156,700.00	160,300.00	160,960.00	168,860.00	169,520.00	179,800.00	189,550.00	200,810.00
75	114,521.30	117,900.00	117,050.00	119,200.00	119,850.00	121,020.00	121,330.00	122,730.00	123,280.00
80	78,069.20	82,810.00	82,840.00	85,610.00	88,000.00	90,150.00	89,600.00	93,350.00	90,380.00
85	121,156.20	123,630.00	127,660.00	138,360.00	139,500.00	139,680.00	147,050.00	153,050.00	155,730.00
90	11,879.20	12,320.00	11,740.00	11,940.00	12,570.00	13,180.00	13,830.00	14,330.00	15,950.00
91	15,027.80	15,610.00	15,640.00	16,050.00	16,360.00	16,760.00	16,210.00	16,230.00	16,510.00
92	35,756.90	36,980.00	37,610.00	37,420.00	36,520.00	36,490.00	37,020.00	37,640.00	38,360.00
93	23,579.70	24,610.00	25,810.00	26,060.00	27,090.00	28,330.00	28,800.00	28,580.00	29,370.00
95	5,949.50	6,010.00	6,200.00	6,190.00	6,280.00	6,500.00	6,630.00	6,900.00	7,030.00