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How to translate economic activity into freight transportation?

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Abstract

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) their 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 statistically about 91% of the amount of the transported goods by economic activity in Germany. Therefore we can state that the developed indicator is suited to translate economic activity into freight transportation. On the one hand, the findings might contribute to the coupling/decoupling discussion. Using the developed indicator we see how coupled the transport volume to economic development really is. 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. Models without an explicit freight generation module can use the economic indicator to derive the transport demand from economic development. Models with an advanced freight generation approach such as SCGE or MRIO can use the method to obtain a control variable for their model outcomes.

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1. Introduction

Freight transportation is induced 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

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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, namely on the amount of type of goods.

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. (1998)).

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 finally 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 the product type metal products is provided. 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 (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 an empirical 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

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