Dynamic freight flow modelling for risk evaluation in food supply
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Extended abstract

Objectives and motivation
Supplying the population with food is an essential task of the economy. To avoid shortfalls, it is necessary to know where supply disruptions could occur. Having enough transport capacity is one of the main weak spots in the food supply system. To understand the demand for transport capacity it is important to understand how production, sourcing and consumption are changing during a disturbance and how commodity flows are rerouted. A freight transport demand simulation covering the effects of a disturbance and determining the additionally needed transport capacity could therefore be extremely helpful for economic decision makers and the government. It would help making the right decisions to ensure the food supply for the population. In this paper, such a freight transport demand model will be presented.

General description
The research presented in the paper defines a new dynamic model of food supply. The model includes 51 food categories including four different temperature ranges. It differentiates between the different actors in a supply chain: food producers, food retailers, wholesalers, logistics service providers, and the consumer. It works on an aggregate level of 402 regions within Germany as well as the most important trading nations. In the model, inventories for every food category, every group of actors, and every region are recorded in a single data cube. This data cube is recalculated incrementally every day, considering the production, relocation of food products, and consumption. Gravity models calibrated with data of the Federal Transport Plan generate the aggregate commodity flows between the regions. A detailed sectorial input output model for food is estimated for the year 2012 based on data from public authorities, food-related associations, and professional data providers.

Results and conclusions
It will be shown that it is possible to design a dynamic freight transport demand model that can operate with available data. Planned analysis include the determination of alternatives for food supply considering capacity restrictions of the logistics systems of the different actors, the estimation of demand for transport resources, and the identification of critical time paths during a food supply disruption. These analyses will increase the transparency on the food supply system and its elements making a risk evaluation possible. Thereby, dependencies and vulnerabilities within the food supply system can be uncovered.

Keywords: freight transport demand modelling; dynamic freight flow; risk evaluation; German food supply.