

# Measuring CO<sub>2</sub>-emissions induced by online and brick-and-mortar retailing

Kenneth Carling<sup>♦</sup>, Mengjie Han, Johan Håkansson, Xiangli Meng, Niklas Rudholm

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**Abstract:** In this paper, we develop a method for empirically measuring the difference in carbon footprint from traditional retailing and e-tailing from point of entry to a geographical area and to the consumers residence. The method only requires knowledge about the location of brick-and-mortar stores and online delivery points, the location of the residences of the population in the region, and the transportation networks used to transport goods in the region under study. Such data is readily available in most countries, and the method is therefore not country or region specific. The method has been evaluated using data from the Dalecarlia region in Sweden, and is shown to be robust to all assumptions made. In our empirical example, the results show that the average distance from the consumers residence to a brick-and-mortar consumer retailer is 48.54 kilometers in the region under study, while the average distance to an online delivery point is 6.7 kilometers. The results also show that e-tailing causes the average distance traveled from the port of entry into the region to the delivery point to increase from 47.15 kilometers for a mortar-and-brick store to 122.75 kilometers for the online delivery points. However, since professional carriers transports the products in bulk to the stores or online delivery points, and this is more efficient than when consumers transport the products to their residence, the results show that a consumer that switches from traditional retailing to e-tailing on average reduces their CO<sub>2</sub>-fotprint by 84%.

**Keywords:** Firm location, spatial distribution of firms,  $p$ -median model, emission reduction.

**JEL codes:** D22, L13, L81, R12

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<sup>♦</sup> Kenneth Carling is a professor in Statistics, Mengjie Han is a PhD in Microdata Analysis, Johan Håkansson is a professor in Human Geography, Xiangli Meng is a PhD-student in Microdata Analysis, and Niklas Rudholm is professor in Economics at the School of Technology and Business Studies, Dalarna university, SE-791 88 Falun, Sweden. Niklas Rudholm is also at HUI Research, Stockholm, Sweden. *Corresponding author:* Niklas Rudholm, e-mail:nru@du.se, phone: +46-70-6254627.

