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Modeling the acceptability of crowdsourced goods deliveries: Role of context and experience effects

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ABSTRACT

Crowdshipping is a frontier in logistics systems designed to allow citizens to connect via online platforms and organize goods delivery along planned travel routes. The goal of this paper is to highlight the factors that influence the acceptability and preferences for crowdshipping. Through a survey using stated choice scenarios discrete choice models controlling for context and experience effects are specified. The results suggest that distinct preference patterns exist for distance classes of the shipment. In the local delivery setting, senders value transparency of driver performance monitoring along with speed, while longer shipments prioritize delivery conditions and driver training and experience. The model developed in this paper provides first key insights into the factors affecting preferences for goods delivery with occasional drivers.

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1. Introduction

The shipping industry is increasingly penetrated by digitization and technological change that gives shape to new delivery concepts. Anticipating new technologies is one of the critical components to improve performance and decrease negative impacts of goods deliveries (Macharis and Kin, 2017). The next wave of goods delivery innovation is likely to be impacted by emerging paradigms such as, delivery by ground drones, e-scooters, vehicle automation, pick-up boxes and crowd logistics (Savelsbergh and Van Woensel, 2016). For each of these innovations, a range of operational, business, legal and behavioral problems, need to be tackled. This paper provides an investigation of crowdsourced goods delivery, which has been defined as a 'frontier' (Wang et al., 2016) or 'revolutionary change in city distribution' (Macharis and Kin, 2017). Crowd-inspired logistics with delivery by occasional drivers has received growing attention in both industry and research communities. The study of crowdshipping is challenging due to the novelty, lack of operational uniformity and the lack of consolidated real-world systems that disseminate operational data. While there is no single formal definition of crowdshipping, in this paper we work with the following definition: a goods delivery service that is outsourced to occasional carriers drawn from the public of private travellers and is coordinated by a technical platform to achieve benefits for the involved stakeholders.

The emergence of crowdsourced solutions in the shipping industry has the potential to radically alter the way shipments are organized, who will be the carriers of the future, and how the public expects package deliveries to be performed (Rougès and Montreuil, 2014). Service firms, which frequently originate as startups from outside the traditional logistics industry, manage online crowdshipping platforms where senders and drivers connect and negotiate the service. The platforms generally focus on shipments to individual households (B2C) or between consumers (B2B). The crowdship-

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ping firm is responsible for recruitment, matching and pricing algorithms. Ensuring security of the shipment and the pick-up/delivery is a crucial component. Firms variably deal with this by vetting and verification of participants, particularly drivers, making payment conditional on delivery, providing guarantees on delivery performance with basic and optional insurance and helping to organize safe public pick-ups/drop-offs. Technology and digitization allows detailed tracking, alerts and monitoring of performance that is leveraged in various ways by the platforms. Among the added value is the ability to track shipments in real time or to have detailed performance disclosure of other users. Payments are typically handled like ride-hailing firms, via credit card with the actual payment charged either at confirmed driver pickup or upon delivery.

The main assets and disadvantages related to crowdshipping will take different forms for the various stakeholders. For *senders*, advantages relate to added value features such as tracking, transparency or flexibility in pick-up and delivery conditions, along with lower shipping costs. The potential *carriers*, on the other hand, are able to add an income to his/her commute in exchange for picking up a shipment (Miller et al., 2017). For *service companies*, the advantage of crowdshipping is the lower operating costs compared to traditional logistics operators. This is due to increased flexibility of assets, that is, storing facilities, supply stocks, vehicles and drivers (Rougès and Montreuil, 2014). From a broader *societal* perspective, the innovation has the potential to reduce traffic and energy-footprints of deliveries (McKinnon et al., 2015).

At the same time, many challenges have been identified. They relate to trust and liability issues, maintaining a critical mass of couriers and customers in tandem, and fostering acceptability of new delivery models (Rougès and Montreuil, 2014). The overall re-organization of deliveries from traditional logistics to crowdshipping could even lead to negative impacts on the energy footprint of deliveries. The potential risk for rebound effects, such as increased travel and fuel consumption that might ultimately offset the benefits are discussed in Paloheimo et al. (2016).

Crowdshipping is a growing contender in the shipping industry often promoted by non-traditional shipping companies, such as technology firms and retailers. Despite virtually no companies existing before 2012, at present there is a wave of interest in crowdshipping companies (Vuylsteke, 2016). For instance, companies such as US Deliv and Zipments (later acquired by Deliv) raised $7.85 million and $2.25 million respectively in 2013 (Office of Inspector General, 2014). Chinese crowdshipping pioneer Renren Kuaidi obtained $15 million in 2014 (German Industry and Commerce (HK), 2016). Crowdshipping concepts are launched by established firms, e.g. retailers like Walmart or logistics firm like DHL Myway trial in Stockholm) and as independent companies. While the majority of crowdshipping start-ups have emerged in the US (e.g. Postmates, Deliv, Roadie, Kaargo, UberRush), crowdshipping platforms are spread globally; with examples in Australia (e.g. PostRope, PPost), Colombia (Rappi), Nigeria (Max), China (Renren Kuaidi), and in Europe (e.g. Nimber in UK and Norway, Trunkrs in the Netherlands, PiggyBaggy in Finland) or across countries (Parcelio, Quincus). Despite the strong market interest, only a fraction of new crowdshipping companies succeed in establishing a lasting market by attracting and maintaining users within the system (Dablanc, 2016). The above highlights the critical role that behavior and acceptance plays in the viability, efficiency and maturing of crowdshipping delivery concepts.

The goal of this paper is to study the determinants of crowdshipping acceptance among senders. The objectives are to (1) identify the representation and preference for the unique attributes related to crowdshipping (e.g. tracking of driver performance, increased control over delivery conditions), (2) use choice models to identify the factors that drive consumer preferences and acceptance of crowdshipping options, with focus on the role of; (i) shipping attributes, (ii) socio-demographic segments, (iii) user shipping experiences, (iv) different contexts, ranging from local to long-distance shipments. Finally, (3) the models will supply the first policy measures to assess sender behavior and early viability of the crowdshipping market in the US. Discrete choice models are estimated based on newly collected stated choice data to investigate the factors that influence the selection of crowdshipping alternatives. Competing crowdshipping delivery options are framed in terms of the utility each provides to senders and three different contexts are tested namely a local, medium and long-distance shipment. Various model structures accounting for absolute (scale) and relative preference for crowdshipping attributes, as well as correlated alternatives and random heterogeneity are investigated.

The contribution of this paper is to provide a first investigation of crowdshipping acceptability. The innovativeness of the crowdshipping movement calls for an emergent research agenda on public reactions and acceptability. Understanding the acceptance of crowdshipping, both in the general public (senders/receivers) and among potential carriers is crucial for a number of reasons. It uncovers consumer preferences for an innovative shipping service, it allows us to forecast demand in the context of emerging logistics initiatives, company practices and policy variables related to crowdsourcing. Furthermore, the behavioral insights will contribute to improving operational models exploring crowd-sourcing and will help advance the underlying business models of crowdshipping logistics. This will improve recruitment, sender-driver-receiver experiences and help control external impacts and unintended effects. In a broader sense, it will contribute to building the "critical mass" necessary to establish a sustainable human-centered delivery system that ensures societal benefits (Rougès and Montreuil, 2014).

The paper is organized as follows. Section 2 presents a literature summary to highlight the features that are likely to impact the use of crowdshipping. User characteristics, shipping attributes, experiences by the sender and the context of the delivery are analyzed. Section 3 describes the design of the survey, while the fourth section presents sample descriptive statistics. Section 5 presents the model structure to study senders' preferences and acceptance toward using a crowdsourced delivery service. Section 6 summarizes and outlines future research directions.

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