Computers and Electronics in Agriculture 151 (2018) 126–135

Contents lists available at ScienceDirect

Computers and Electronics in Agriculture

journal homepage: www.elsevier.com/locate/compag

Original papers

E-commerce in agriculture – The case of crop protection product purchases in a discrete choice experiment

Wilm Fecke*, Michael Danne, Oliver Musshoff

Department of Agricultural Economics and Rural Development, Georg-August-Universität Göttingen, Platz der Göttinger Sieben 5, D-37073 Göttingen, Germany

ARTICLE INFO

Keywords:
Internet use
E-commerce
Input purchasing
Online merchants
German farmers

ABSTRACT

The internet is playing an increasing role in the development of rural areas. Farmers in particular, can benefit from new opportunities concerning farm management decisions. Hence, the goal of this study was to investigate German farmers' willingness to accept (WTA) e-commerce. Primary data of 165 farmers was collected by conducting a discrete choice experiment about the purchase of crop protection products. WTA estimates show that farmers are willing to switch to an online merchant if they are offered a significantly lower price. However, word-of-mouth-reputation and consultation offered via traditional media do not influence farmers' WTA for an online merchant. In contrast, delivery time significantly affects farmers' WTA for inputs purchased online. We also show that farmers' risk attitudes, prior online shopping experiences, and education are influential factors for the WTA for an online merchant. Surprisingly, age and farm size do not impact farmers' WTA. Since e-commerce has not been widely established in agriculture yet, these results are of great practical importance. The findings of this study demonstrate that online merchants of agricultural inputs should focus on trust, service quality and timely delivery. Furthermore, it might be useful to introduce farmers to e-commerce during their education.

1. Introduction

Nowadays, in most rural areas in Europe, the internet is no longer a new territory. The Digital Agenda driven by the European Commission aims to achieve nationwide coverage of high-speed internet (30 Mbps) for all member countries by 2020 (European Commission, 2016). This improvement of the internet infrastructure is promising for the future development of agriculture since the availability of the internet plays an important role for farmers regarding business purposes (e.g. Canavari et al., 2010; Hennessy et al., 2016). Farmers can improve farm income and performance by benefiting from the capabilities of the internet (Chang and Just, 2009) in order to reduce transaction costs (Hennessy et al., 2016; Mishra et al., 2009). In this respect, the internet facilitates acquisition of price and product information and supports interaction with a broader pool of both suppliers and customers (e.g. Zapata et al., 2016). Therefore, e-commerce is an interesting field for agriculture (e.g. Mueller, 2001).

The New Media Tracker provides first numbers on German farmers' online purchases. In 2015, machine parts were bought online by 71% of German farmers, whereas only a small share bought fertilizers and crop protection products online (Kleffmann Group, 2016). In this context, the agriculture industry's economic barometer gives insights into German farmers' intentions to use the internet for business purposes in the future. Interestingly, around 70% of farmers stated that selling and purchasing by means of e-commerce are conceivable for future decision making (Rentenbank, 2015). In addition, the internet was used by 95% of German farmers in 2016, of which more than two thirds were online daily (Kleffmann Group, 2016).

However, it is surprising that, as of yet, few German farmers buy production inputs online, although the growing internet infrastructure opens up new markets. Against this background, the objective of this paper is to analyze German farmers' preferences for the use of e-commerce for input purchases. Our research contribution is further highlighted by prior studies, which have mentioned that recent literature in the field of internet use by farmers is rather rare (Mishra et al., 2009) and that the vast majority of studies in this field concentrate on US farm businesses (Hennessy et al., 2016). Although Batte and Ernst (2007) delivered first experimental results on US farmers' internet purchasing behavior concerning herbicides and machine parts, their study is now several years old. To derive recommendations for both online merchants and policy makers, new research is necessary since the development of internet infrastructure in rural areas is a great political goal in the European Union. Furthermore, Batte and Ernst (2007) did not consider how merchant reputation and the buyer-supplier relationship impact e-commerce behavior of farmers. To the best of our knowledge, we are the first to focus on this topic.

* Corresponding author.
E-mail address: wilm.fecke@agr.uni-goettingen.de (W. Fecke).

https://doi.org/10.1016/j.compag.2018.05.032
Received 11 July 2017; Received in revised form 19 February 2018; Accepted 28 May 2018

To get first insights into the acceptance of e-commerce in German agriculture, we conducted a discrete choice experiment (DCE). In a hypothetical scenario, farmers were invited to imagine that they had to decide today where they will buy all their crop protection products for the upcoming year. In addition to choosing to stick with their current merchant, farmers could alternatively choose a local merchant or an online merchant. Farmers' preferences and willingness to accept (WTA) e-commerce were investigated using a generalized multinomial logit model (GMNL) in WTA space. With this approach, we build on previous studies in the fields of agricultural research estimating farmers' WTA (e.g. Schulz et al., 2014). All of these prior studies estimated the WTA in preference space, which, unfortunately, often leads to unrealistic and invalid WTA estimations (Hensher and Greene, 2011; Scarpa et al., 2008). Nevertheless, models in WTA space have been found to produce more realistic estimations (Train and Weeks, 2005). Therefore, the model estimation in WTA space is an important feature in our study. Compared to Batte and Ernst (2007), this is also a further improvement made by our study.

This paper is organized as follows. In the next section, research hypotheses are derived on the basis of a review of literature in the fields of e-commerce and technology adoption by farmers. In Section 3, the idea of the DCE approach is explained, followed by a presentation of the experimental setting and the introduction of the econometric model. Findings are presented and discussed in Section 4. Finally, the paper ends up with a conclusion section.

2. Factors influencing e-commerce activities

In the following section, we derive our research hypotheses from a literature review. Firstly, we concentrate on literature related to attributes characterizing merchants (Hypotheses 1a-1d). Subsequently, we formulate hypotheses concerning the influence of personal characteristics on e-commerce (Hypotheses 2a-2c).

2.1. Price in e-commerce

Reibstein (2002) showed that price influences a customer's initial decision to buy from an online store. First evidence in the agricultural context was provided by Batte and Ernst (2007). They conducted a joint analysis on U.S. farmers' herbicide and machine parts purchasing behavior. They found, among other things, that farmers are willing to buy from an online or national merchant outside their community if they can expect a significantly lower price. As an example, the estimated price advantage to justify an online purchase has to be around 10% in the case of herbicides. Additionally, around 34% of those surveyed stated that price influences their decision to purchase inputs online. Similar findings are conceivable for German farmers' behavior regarding online purchasing. Also taking into account that e-commerce introduces risk compared to traditional commerce (Chang et al., 2005; Hong, 2015; Wu and Chang, 2007), we therefore hypothesize that:

Hypothesis 1a. *Farmers have a higher WTA for an online merchant than for a local merchant.*

2.2. Trust in e-commerce

Aside from price, trust is also an important factor in the online shopping context. Lack of trust is often discussed as an important reason for consumers' avoidance of online shopping (Kim and Benbasat, 2003; Perea y Monsuwé et al., 2004). Doney and Cannon (1997) described that the salesman is the most important source of trust in the buyer-supplier relationship. Unfortunately, this physical salesman is not available in the online shopping context (e.g. Hong, 2015). In this respect, Walsh et al. (2017) suggested that a positive reputation of an online merchant reduces consumers' perceived risk and engenders trust. Hence, merchant reputation can serve as an important trust-building factor (e.g. Eisenbeiss et al., 2014). Cheung and Lee (2012) argued that word-of-mouth reputation in particular plays a prominent role in the e-commerce setting. In more detail, recommendations of acquaintances can influence a consumer's evaluation of merchant competence and reduce perceived risks (Senecal and Nantel, 2004). According to the diffusion of innovations theory, individuals spread the word among their acquaintances after they have adopted a new technology (Rogers, 2003). In line with this, Jarvis (1990) found that the adoption of computers is affected by the actions of peers and family. Underpinned by the fact that 43% of German farmers stated in a recent survey that they distrust e-commerce (Kleffmann Group, 2016), we hypothesize that:

Hypothesis 1b. *Recommendations of peers reduce the farmer's WTA for the online merchant.*

2.3. Service quality in e-commerce

Kolesar and Galbraith (2000) argued that the internet is a poor service delivery medium, and, hence, service quality experience is influenced by the relationship between buyer and supplier. Thus, the interaction between buyer and supplier is important in an e-commerce setting since there is uncertainty about whether ordered products will meet prior expectations (Weathers et al., 2007). For instance, Basso et al. (2001) provided evidence that consultation via richer communication media can reduce this uncertainty. In the agricultural context, Schulze et al. (2006) suggested that communication is a very important determinant of the buyer-supplier relationship. In line with this, service quality was found to influence farmers' relationship satisfaction (Aji, 2016). Furthermore, 45% of German farmers stated the lack of personal consultation makes online purchasing unattractive (Kleffmann Group, 2016). Similarly, Briggeman and Whitacre (2008) noted that the acceptance of e-commerce in agriculture is impeded by a lack of personal interaction. We therefore hypothesize that:

Hypothesis 1c. *The more personal the consultation offered by the online merchant, the lower the farmers' WTA for the online merchant.*

2.4. Delivery time in e-commerce

Furthermore, a good delivery service plays a decisive role in e-commerce as well (San Martín and Camarero, 2009). Batte and Ernst (2007) provided evidence regarding the importance of delivery in the agricultural context. Their investigation showed that, besides price, improved delivery service influences a farmer's decision to buy outside his/her community. More concretely, farmers are around 51% less likely to choose an online or national merchant if they expect longer waiting times for urgently needed machine parts. Surprisingly, they did not find an influence of delivery time on herbicide purchases outside farmers' communities. However, the delivery service would logically seem to be an important criterion for farmers' merchant selection, especially regarding crop protection products. This can be illustrated with an example: concerning cost-effective crop protection, farmers often refer to economic thresholds. These thresholds are critical infestation levels at which measures should be implemented to avoid economic losses (Ramsden et al., 2017); therefore, delayed delivery would waste valuable time. In this respect, issues with timely delivery could cause the failure of merchants in e-commerce (Briggeman and Whitacre, 2008). Hence, we hypothesize that:

Hypothesis 1d. *A shorter delivery time reduces farmers' WTA for the online merchant.*

2.5. Risk aversion of consumers and e-commerce

Chang et al. (2005) showed that consumers' risk aversion affects e-