

Research Note

Does Greater Online Assortment Pay? An Empirical Study Using Matched Online and Catalog Shoppers

Junzhao Ma*

Department of Marketing, Monash University, 26 Sir John Monash Drive, Caulfield East, Victoria 3145, Australia

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Abstract

Most multichannel retailers offer larger assortment in their online channel than in the offline channels. Conventional belief holds that larger assortment leads to more sales. However, offering more products could also cannibalize the sales of the retailer's main product offerings, hence reducing efficiency in assortment management and increasing cost. Recent behavioral research suggests that excessive assortment can lead to customer cognitive overload and deter them from purchasing. In this paper, we investigate the effect of large online assortment on customer spending. We empirically estimate the effect of large online assortment by exploiting the natural experiment of channel migration, which allows us to compare the spending of customers who migrated to the retailer's online channel with that of a holdout group of pure catalog shoppers. We find that online customers outspend those catalog shoppers by 10.7 percent on the retailer's mainline products. We provide evidence that the increased spending by online customers is due to lower product search cost in the online channel. Lastly, our research suggests that the online sales of low-volume niche products can be an important source of revenue for the retailer.

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Keywords: Retail assortment management; Propensity score matching; Electronic commerce; The long tail; Multichannel retailing

Introduction

Traditionally, retailers could often make only a fraction of their total product lineup available due to limited retail space. The situation is changed with the rise of multichannel retailing. Internet offers practically limitless retail space and makes it possible for retailers to offer their entire product assortment to customers in the web channel (Brynjolfsson, Hu, and Smith 2003; Zhang et al. 2009). This has proven to be a boon to consumer welfare. Greater selection of products online, along with the ease to search through products on a website, has been shown to spur the sales of niche and previously hard-to-find products (Anderson 2004; Brynjolfsson, Hu, and Rahman 2009). Greater product selection is among the top reasons for consumers to engage in e-commerce (Brynjolfsson, Hu, and Smith 2003; Noble, Griffith, and Weinberger 2005).

On the other hand, to what extent retailers also benefit from offering larger assortment online is yet to be determined. Managing large online assortment introduces additional complexity and cost for multichannel retailers (Rabinovich, Sinha, and Laseter 2011; Zhang et al. 2009). Niche products could cannibalize sales from the retailer's main product offerings and reduce scale economies. Moreover, behavioral research has shown that having too many choices can lead to choice overload and reduce purchase probability and customer satisfaction (Huffman and Kahn 1998; Iyengar and Lepper 2000). Hence what the net effect of offering large assortment for retailers is remains an empirical question.

In this paper, we investigate the effect of greater online assortment on consumer spending using a consumer panel dataset from a large US retailer that specializes in apparel. The retailer operates both an online channel and a paper catalog channel. In the data, we observe all the marketing communications and transactions of hundreds of thousands of customers in both channels. We decompose the impact of product assortment on spending into two effects. The first effect is on customer spending on the retailer's main product offerings that are available in both the

* Tel.: +61 3 9903 1428; fax: +61 3 9903 2900.
E-mail address: junzhao.ma@monash.edu

online and catalog channel. The second effect is on the purchase of niche products that are available online but difficult to access through catalogs. Collectively, these two effects account for the impact of offering larger product assortment on consumer spending.

Our empirical strategy relies on comparing the spending of online shoppers who face the retailer's entire assortment through the company website with that of catalog shoppers who at any given time can only access a subset of the retailer's assortment via paper catalogs. Our empirical approach overcomes several obstacles that make it difficult to isolate the effect of larger online assortment. Firstly, it is well known that customers who order products online are different from other customers. In general, Internet buyers are younger, more affluent and tend to live in larger metropolitan areas. We use both propensity score and difference-and-difference methods to address customer self-selection and make causal inferences. Secondly, most retailers maintain a database of customer emails and use this as a channel for marketing. We control for this potential difference in marketing communication between online and catalog customers by constituting our sample with customers who opt out of email marketing.

Findings from previous empirical research on the relationship between assortment size and customer spending are mixed. Some studies—[Dreze, Hoch, and Purk \(1995\)](#) and [Boatwright and Nunes \(2001\)](#)—report a negative relationship, while others—[Borle et al. \(2005\)](#) and [Sloot, Fok, and Verhoef \(2006\)](#)—identify a positive relationship. The lack of agreement in the empirical findings suggests that the relationship between assortment size and customer spending is moderated by other factors, such as product category and retail channel. Our research strives to close this gap in the literature and shed light on the moderating role of retail channel in assortment effect. We hypothesize that consumer search cost varies by channel and the superior information capability of the online channel lowers customers' search cost and allows them to process assortment more efficiently and spend more. We then test this hypothesis empirically.

We find that the retailer can substantially increase their revenue by offering larger assortment online. Online customers spend two and half times more than catalog shoppers on the niche products that can be accessed more easily online. More significantly, we find that online customers also spend significantly more than catalog customers on the retailer's main product offerings, suggesting that the retail website is a more efficient channel for customers to search and locate products, the benefit of which outweighs the negative effect of sales cannibalization from the additional assortment. In addition, we also provide evidence that the increased spending can be attributed to lower search cost in the online channel. Our findings highlight the economic significance of Internet's low information cost and show that greater online assortment generates significant gains in retail revenue and consumer welfare.

The rest of the paper is organized as follows. We first review related literature. Then we discuss how the provision of greater assortment online might affect the sales of the retailer's mainline and niche products. Following that, we present the empirical

analysis, where we describe in detail the empirical setting, the main identification issue and its solutions, and the main results. Lastly, we conclude the paper with a discussion of the main findings of the paper and their managerial implications.

Related Literature

It has been well documented that online retailers offer substantially larger assortment size than offline ones ([Zhang et al. 2009](#)). A typical Barnes and Noble bookstore carries between 40,000 and 100,000 unique titles while the book seller's website provides access to millions of titles ([Brynjolfsson, Hu, and Smith 2003](#)). Similarly, a typical video retailer carries around 5,000 DVD titles, in contrast to about 80,000 titles offered by the online retail giant Amazon ([Elberse and Oberholzer-Gee 2008](#)). Total sales from the low-selling niche products can be substantial. For example, it has been estimated that book sales for niche titles that are not available at typical brick-and-mortar bookstores are \$578 million in 2000, or about 39 percent of total Internet book sales for that year ([Brynjolfsson, Hu, and Smith 2003](#)).

The attraction of large assortment for consumers has been widely touted in the previous literature. The theory of rational choice posits that greater assortment is inherently more preferable to consumers because it is more likely to include an option that matches her preference ([Baumol and Ide 1956](#)). Consumer surveys, choice experiments and field studies have established that assortment size is among customers' main considerations in retail outlet choice ([Boyd and Bahn 2009](#); [Pan and Zinkhan 2006](#)).

While consumers clearly prefer greater assortment choices, the benefit for the retailer to offer larger assortment is not clear. Offering additional assortment can cannibalize the sales of retailers' main product offerings. Most consumers face constraints in time and budget. Every 1980s cult kung-fu film watched potentially replaces a viewing opportunity for the newest martial arts blockbuster. Secondly, recent advances in consumer behavior research has shown that having too many choices can make consumers feel overwhelmed and deter them from purchasing: consumers find large assortment to be confusing and require more cognitive resources to process ([Huffman and Kahn 1998](#); [Iyengar and Lepper 2000](#)); larger assortment also raises customers' expectation of finding an ideal match and makes their shopping goal more difficult to attain ([Schwartz et al. 2002](#)).

Echoing the literature on consumer choice overload, findings from several field studies using consumer transaction data suggest that the size of actual retail assortment is often significantly above what is economically optimal. Using both lab and field experiments, [Broniarczyk, Hoyer, and McAlister \(1998\)](#) report that significant reductions in lower-selling SKUs have no noticeable negative effect on revenue. A major study on shelf space management finds that SKU reductions can actually increase sales for most of the main grocery categories ([Dreze, Hoch, and Purk 1995](#)). Assortment reductions have also been tied to greater perceived search efficiency and shorter consumer search time ([Broniarczyk, Hoyer, and McAlister 1998](#); [Sloot, Fok, and](#)

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