

Main Street versus Cyberspace: Consumers' Substitution Between Online and Offline Retail

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Extended Abstract

Last year, online retail accounted for \$450 billion in the United States and grew at a rate of about 16% (U.S. Census Bureau, 2017). Initial predictions suggested that consumers would migrate online and turn away from traditional retail, but Hortaçsu and Syverson (2015) present evidence indicating that innovations in traditional retail sales channels such as warehouse clubs and supercenters have had a greater effect on consumer retail over the past 15-20 years. While online sales accounted for half of retail sales growth in 2017, they still make up only 10% of total retail sales in the United States. This paper examines a consumer's motivation to purchase a good online versus offline. Using a unique data set covering both online and offline purchases, I estimate a flexible demand system where consumers have the option to purchase goods online and offline. Understanding a consumer's preferences over products and retail channels provides insight into the links between online and offline retailing and illustrates how they vary across market and consumers.

This paper uses granular data from online and offline sales to estimate a model of consumer retail channel choice, explore consumer preference heterogeneity, and compute the welfare gains from the opening of the online sales channel. Data challenges have previously limited our ability to understand online retail markets from a consumer's perspective. A consumer-focused analysis of retail markets requires granular sales data for both online and offline purchases which has previously been unavailable. I match product-level data from AC Nielsen and eBay with consumer and product characteristics to create a dataset containing 60 million transactions at the 3-digit ZIP code ("ZIP3") level. My analysis focuses on two very different products that are consumed online and offline in large quantities between 2010 and 2015 – movies and perfume. These were chosen due to their broad availability in both offline and online sales channels across the entire United States. Following Berry (1994), Cardell (1997), and Hausman (1996), I estimate a discrete choice model of demand for these products, taking into account consumer demographics such as average household income. Identification stems from the variation in individuals' movie and perfume choice across markets in different locations and from varying internet subscription rates.

In aggregate, I find that customers in the electronic market are two to four times more price sensitive than customers in traditional markets, which makes sense given the low cost of price searches online. I also find that urban shoppers are more price sensitive than rural shoppers when shopping online, but the reverse holds when shopping offline. One potential explanation is that urban consumers are more

experienced comparing prices online, while convenience might be more important for urban consumers when shopping offline. I then use the estimated price elasticities for each market to predict the total welfare gained from the availability of electronic retail. Assuming a fixed price, product variety, and offline supply, I find that a total of \$2.4 billion per year is gained nation-wide by selling physical movies through online channels. This amounts to 40% of physical movie retail. For perfume sales, I find a total nation-wide gain of \$2 billion per year, or 25% of the perfume industry.

I am working to extend this paper in multiple directions. First, I am planning to further explore the links between demographics and preferences. At the moment, the paper estimates the relationship between population density and price sensitivity controlling for median household income in the ZIP3 area. Other demographic characteristics that can influence households' propensity to shop online include the number of children, the availability of a car, and the average number of retail establishments in its vicinity. I also intend to extend the paper's welfare estimates in two directions. First, I plan to investigate the source of the welfare gains. For example, I plan on using the ZIP3s' density of retail establishments to compute the welfare effects of increased convenience in terms of lower travel costs. I also intend to estimate the welfare gains from the broader variety of goods that are available online relative to the selection of products that can be purchased in local, offline establishments. Second, I plan to implement a supply-side model that accounts for the counterfactual changes in the prices offline establishments charge when the online sales channel is eliminated.

Related Literature

This paper most closely relates to Chintagunta et al. (2012), Chu et al. (2008), and Einav et al. (2017). Chintagunta et al. (2012) and Chu et al. (2008) observe households that shop interchangeably online and offline at the same Spanish grocery chain and investigate their purchase behavior in specific product categories. Chintagunta et al. (2012) introduces a retail channel choice framework and empirically quantify the relative transaction costs when households choose between the online and offline channels of the same grocery chain. They find that transaction costs for grocery shopping play an important role in the choice between online and offline channels. Chu et al. (2008) estimates that households exhibit lower price sensitivities online than offline. Einav et al. (2017) uses credit card expenditure data to estimate the welfare generated by the convenience of using a retail chain's online compared to its offline channel. All three papers estimate the consumer's decision between the online and offline channel within the retail chain and do not include competitors or retailers that only use one of the sales channels. This necessarily means that the models cannot say much about retailers active in only one sales channel, the effect of price competition between the two channels, or the fact that online and offline retailers might offer different products.

This paper is also related to a large body of research studying the effects of online retail on offline retail and consumer choices. Bhatnagar and Papatla (2016), Grewal et al. (2004), Jin and Kato (2007), Laroche et al. (2005), and Rajamma et al. (2007) study the advantages and shortcoming of internet retail and explore consumers' motivations to shop online based on surveys and case studies. In addition, Bhatnagar et al. (2000), Chiang and Dholakia (2003), Passyn et al. (2011) analyze the characteristics of consumers that shop online. The effect of brands' online activity on their brick and mortar presence is studied in Bialogorsky and Naik (2003), Kukar-Kinney et al. (2009), and Toufaily et al. (2013). Goolsbee (2000), Ellison and Ellison (2009b), Baugh et al. (2014), and Einav et al. (2014) study the impacts of online sales taxes. Chevalier and Goolsbee (2003) analyzes price sensitivity of Amazon and Barnes and Noble customers purchasing book online and offline, respectively. Clay et al. (2002) uses book prices collected from Amazon.com and brick and mortar locations to investigate how price competition and product differentiation differ between the online and offline retailers. Forman et al. (2009) also uses book prices collected from Amazon.com to show that when a brick and mortar store opens locally, people substitute away from online purchasing.

There is a large and growing literature studying online pricing strategy, competition, and search, but this literature generally uses very simple models of consumer behavior. The Billion Prices Project (Cavallo, 2012) has led to several publications using internet prices. Cavallo (2017), for example, compares the online and offline prices of multichannel retailers and finds that these are identical 70% of the time. Gorodnichenko and Talavera (2014) examine substitution behavior between online and offline retailers as the locally available options for offline retailers change. Lal and Sarvary (1999) challenge the assumption that internet competition will lead to lower prices, and they formulate a model of how the internet can decrease price competition. Lynch and Ariely (2000) find in an experiment that lowering the cost of information reduced price sensitivity for differentiated products like wines. Ellison and Ellison (2009a) explore the relationship between a group of internet retailers and a dominant price search engine. Bakos (1997) looks at the impact of the search cost reduction in electronic markets on allocational efficiencies, and Iyer and Pazgal (2003) explore the effects of internet shopping agents. Shankar and Bolton (2004) find that attributes of competition explain most of the variance in retailer pricing strategies.

This paper is also related to several papers that attempt to quantify the welfare gains from the introduction of the online sales channel, which is related to the literature on welfare gains from new product introductions. Goolsbee and Klenow (2006) base their analysis on the opportunity cost of time spent online and find that the surplus for the median consumer exceeded \$3,000 per year in 2005. Brynjolfsson and Oh (2012) builds on this analysis and also considers internet speed and the share of time spent on different websites, and they estimate the increase in consumer surplus created

by free internet services to be over \$100 billion per year in the United States. Broda and Weinstein (2010) estimate the value of variety using the AC Nielsen scanner data. Brynjolfsson, Hu, and Smith (2003) look at the gains for consumers from accessing additional book titles at online booksellers. Quan and Williams (2016) show that if demand is location-specific representative consumer frameworks overestimate the variety gains.

More broadly, this paper also relates to the large literature of online pricing and price dispersion. Baye et al. (2006) and Pan et al. (2002) study the price dispersion across products in consumer electronics, text books, and compact discs and find that, generally speaking, price dispersion is difficult to explain without including regressors such as seller-specific fixed effects. Ancarani and Shankar (2004) find that internet retailers of books and compact discs have lower price dispersions relative to traditional retailers. Ratchford et al. (2003) use BizRate.com data to argue that online price dispersion decreased between 2000 and 2001, which the authors attribute to the market maturing.

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