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THE RISE OF BROADBAND AND THE RETAIL APOCALYPSE: EVIDENCE FROM U.S. RETAIL GROCERY

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For my family.

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ABSTRACT

I explore consumer behavior in during the proliferation of broadband internet from 2004 to 2018 for a specific subset of US retail: brick-and-mortar grocery. Using household and retail scanner data, I capture consumer behavior using seven outcomes: (1) trip frequency, (2) total spending, (3) unique chains visited, (4) unique brands purchased, (5) prices, (6) price dispersion, and (7) price elasticities of demand. Contrary to popular media reporting, I show aggregate retail trends in food and nonfood grocery during the rise of broadband are muted and do not support the hypothesis that the collapse of brick-and-mortar grocery retail is imminent. Only 2 of the 7 outcomes changed by more than 10%: The number of unique brands decreased by 12.5% and average prices grew at 24%, consistent with inflation. Exploiting the differential growth in broadband across counties, I estimate the effect of local broadband access on each of the seven outcomes. I find the direct effects of broadband are also muted: Across all outcomes, the estimates are centered at zero and the upper and lower bounds of the 95% confidence intervals are economically insignificant. These conclusions are consistent with estimates using within-household internet adoption. Taken together, my results show fears of the retail apocalypse are quantitatively unwarranted, at least in brick-and-mortar grocery.

CHAPTER 1

INTRODUCTION

The popular press has highlighted fears of the "Retail Apocalypse," predicting the end of brick-and-mortar retail with the proliferation of broadband internet.[1] The Internet can change consumer behavior in several ways. For example, the choice sets of consumers expand, which can intensify price competition and undermine firm profits. The expanded choices may also increase product discovery, choice overload, and niche consumption. The Internet also allows firms to directly connect to their consumers through new technologies such as digital advertising and omnichannel retailing (Akturk and Ketzenberg (2021); Gao and Su (2017); Bell et al. (2018)). The net effects on the retail sector are unclear.

In this paper, I study consumer behavior during the proliferation of broadband internet from 2004 to 2018 for a specific subset of US retail: brick-and-mortar grocery. This sample has costs and benefits. For costs, the data capture only 22% of nonfood retail.[2] This product group is often at the center of the retail apocalypse discussion, and rightfully so – in 2016, the e-commerce share of nonfood was 16% compared to food's 6%. For benefits, the data capture a representative sample of food (Beraja et al. (2019)) and include nonfood categories such as paper products and over-the-counter medication. In total, the data represent 47% of US retail consumption. Moreover, large-scale microdata on consumer behavior in grocery are available and can provide useful insights given its central importance to consumers.

Using household and retail scanner data of product purchases of food and nonfood grocery categories, I capture consumer behavior using seven outcomes: (1) trip frequency, (2) total spending, (3) unique chains visited, (4) unique brands purchased, (5) prices, (6) price dispersion, and (7) price elasticities of demand. I start by documenting aggregate retail trends

1. businessinsider.com/the-retail-apocalypse-has-officially-descended-on-america-2017-3, businessinsider.com/retail-apocalypse-amazon-accounts-for-half-of-all-retail-growth-2017-11, bloomberg.com/graphics/2017-retail-debt, or nytimes.com/2017/04/15/business/retail-industry.html.

2. For additional context and measures of retail sales, please see Appendix A.

in food and nonfood grocery during the rise of broadband, using Nielsen's household (HMS) and retailer (RMS) scanner data. I then combine these data with a novel broadband-access measure at the county-year level, constructed using information from the Census and the Federal Communications Commission (FCC). With this combination, I exploit the uneven rollout of broadband across counties from 2006 to 2016 to estimate how broadband affects consumer behavior in food and nonfood grocery categories.

My central contribution is to show that changes in consumer retail behavior, particularly in categories of food and nonfood grocery items, are muted during and because of the rise of broadband. To support this conclusion, I start by documenting how household spending and trip behavior has changed over time. The number of trips to brick-and-mortar stores is weakly decreasing, from 178 trips a year in 2006 to 166 in 2018. I document that household spending is not decreasing during this period. The number of unique brands purchased by a household decreased by 12.5%, but the total number of brands purchased by the union of household purchases has increased by 9.8%.

To understand how this household behavior translates to pricing, I document trends in prices, price dispersion, and price elasticities of demand for food and nonfood grocery. I find that prices roughly remain the same, growing around 24% over the panel, consistent with inflation. Price dispersion increases within product categories. I estimate demand elasticities using a standard log-log demand model and find that the average elasticity has not changed over time.[3]

These trends do not support the hypothesis that the collapse of retail is imminent in brick-and-mortar grocery. However, the trends cannot speak directly to the causal effect of broadband internet on consumer shopping behavior. Consequently, I turn to specifically measure the effect of local broadband access on the seven shopping outcomes. My identification

3. I estimate average elasticities for each brand, year, and county triplet. Though the elasticities for individual brands may move around, the distribution of elasticities is stationary. See my coauthored companion paper Rosenthal-Kay et al. (2021) for more on this result.

of the broadband effect on consumer behavior relies on the staggered timing and intensity of rollout due to geographic and institutional differences across counties.[4] To measure broadband access, I rely on usage data from the Census.[5] Because these data are not always available, I estimate a predictive model with FCC provider data[6] and local demographics to impute missing observations. The identification challenge is that broadband rollout could be correlated with local market characteristics observable by the internet service provider, but not the econometrician. To address this challenge, I use long difference regressions. I look to see if county-level changes in outcomes are related to county level changes in broadband access.

I find broadband does not have any economically significant effect on household trips to brick-and-mortar grocery retailers. Moreover, I find broadband does not directly affect consumer spending in these categories. I do not find evidence of households notably substituting to shopping online from 2006 to 2018. This finding is consistent with Hortaçsu and Syverson (2015), who report small growth in e-commerce relative to overall retail.

Finally, I estimate the effect of broadband on prices, price dispersion, and price elasticities of demand. My analysis finds a near-zero average broadband effect on prices and price dispersion.[7] The effect of broadband internet on price elasticities is heterogeneous across products. The distribution is centered at zero, the mean is -0.06. The first quartile is -1.04 and the third quartile is 0.92. The variation in the broadband effect on elasticities is larger within categories than between categories, which suggests specific brand characteristics determine broadband effects. On one hand, the range of effects highlights the potential

4. Lelkes et al. (2017) use a similar identification strategy. Google provides an example of these internet service provider entry frictions in its Google Fiber ready checklist: https://fiber.google.com/blog/2014/our-fiber-ready-checklist/.

5. https://techdatasociety.asu.edu/broadband-data-portal/home

6. https://socialscience.msu.edu/news-events/news/2021-06-01-3.html

7. I use the empirical Bayes procedure to adjust my estimates of broadband effects on consumer behavior for measurement error.

for publication bias depending on the product. On the other hand, these results leave considerable room for additional research on specific products and understanding the external validity limits.

A key reason my central contribution is valuable is that my paper examines the direct effects of broadband on consumer purchase behavior in a wide-scale, systematic way across brick-and-mortar grocery retail. Most existing empirical settings and research designs focus on indirect effects of broadband through mechanisms such as reduced information frictions (e.g., price information in homogeneous product categories, such as in Ellison and Ellison (2009) and Spence and Tran (2018)). Some papers zoom in exclusively on online market comparisons or platform optimization (Dinerstein et al. (2018); Long et al. (2021)). Other papers are case studies on specific product-characteristic information, in product categories with a high degree of heterogeneity (Brynjolfsson et al. (2011)). Though the current literature provides useful insights into the various mechanisms, it does not directly measure the effect of broadband internet on the retail sector. Moreover, getting a clear picture of the net effect on the retail sector in general is also difficult because previous literature tends to be product-specific case studies. The data used in the empirical analysis in this paper, though imperfect, provides a broader perspective on US retail in brick-and-mortar grocery.

CHAPTER 2

MEASURING CONSUMER BEHAVIOR

This chapter describes how I measure and estimate consumer behavior. I select seven measures of consumer behavior. I construct four measures using household scanner data and three measures using retail scanner data. In this section, I first discuss the household panel measures of consumer behavior. Second, I describe the retail scanner data measures of consumer behavior through prices, price dispersion, and price elasticities.

2.1 Consumer Panel Data

I analyze the Nielsen Homescan (HMS) consumer panel from 2004 to 2019. The data provide information on shopping trips and purchases.[1]

The raw data include 715,753,410 purchases between 2004 and 2019 made by nearly 200,000 households. Households scan a Universal Product Code (UPC) barcode for each of the consumer packaged goods (CPG) purchased. By collecting data this way, the HMS captures household purchases from supermarkets, convenience stores, mass merchandisers, club stores, and drug stores; the scans include retailers that may not be in the Nielsen retailer data (RMS).

Nielsen also provides sampling weights for each household. Nielsen's sampling method selects households according to their household characteristics compared to the population. The sampling of panelists is geographically dispersed and demographically balanced. The panel itself, however, is not balanced relative to the overall population. To balance the panel, I use projection factors as sampling weights to correct for the sampling bias; that is, the sum of the projection factors is roughly equal to the number of households in the United States.

1. HMS is available through the James M. Kilts Center for Marketing at the University of Chicago Booth School of Business in conjunction with the Nielsen Company.

For each household transaction, I observe product attributes including brand, UPC, prices paid, and a retailer code. The purchases cover over 2,018,622 unique UPCs from 974 Nielsen product modules that represent the different product categories across several departments. In this analysis, I use aggregate measures of all purchases to construct a measure of consumer behavior at the county-year level.

I use the HMS data to construct four outcomes that speak to the retail-apocalypse hypothesis: (1) trip frequency, (2) total spending, (3) unique retail chains, and (4) unique brands. I discuss each in turn.

Households decide to frequent brick-and-mortar grocery retailers. I measure the number of trips a household makes in a year. I use data from HMS to calculate the total number of trips a household in a county makes in a year. I weight the household by the Nielsen-provided projection factor and calculate the average number of trips for a household in each county each year.[2]

Similarly, households decide how much to spend at brick-and-mortar grocery retailers. I calculate the average annual spending for a household in each county-year pair. In my analysis, I adjust for inflation using the Consumer Price Index (CPI) and inflation data from the Federal Reserve Economic Data database maintained by the Federal Reserve Bank of St. Louis.[3]

Households may also change where they go and how much they spend on groceries. To measure the number of unique retail chains a household goes to, I count the number of retailer chain codes in the data for each household in each year. When aggregating these estimates for analysis, I weight each household's measure of the number of unique retail chains according to its projection factor.

2. Nielsen adjusts the projection factors yearly. Nielsen constructs these weights to match aggregate demographic moments. As a robustness check, I check that the aggregate weights for each county for each year are well correlated with the population of the county and year. I provide more detail in the Appendix.

3. https://fred.stlouisfed.org/series/CPIAUCSL

Households decide which products to buy. To measure the number of unique products purchased, I count the number of unique brands a household buys in a year. Brand in the primary analysis for unique products is measured at the manufacturer-category level.[4] The variable for the number of unique products variable is therefore a measure of the number of unique products the average household in a county buys in a year.

2.2 Retail Scanner Data

I use the Nielsen retail scanner data (RMS) in my analysis of prices, price dispersion, and price elasticities of demand. The Nielsen RMS data include store-level data for quantities sold, prices, and promotions that cover nearly 40,000 stores. The stores range from gas stations to big retail chains and cover many types of retailer store channels. Note, however, that some large retailers are still missing from the data. For this research, the selection of retailers should not affect results substantially, because the data cover over 50% of all spending at grocery and drugstores. The retail scanner dataset includes data from 30,000-50,000 individual stores from approximately 90 retail chains.

For each store and UPC, Nielsen records quantity and prices at the week level. Prices are the quantity-weighted average price in the week. Nielsen RMS only records product prices for a store if at least one purchase of that product was made at that store that week. For frequently purchased top products, this problem is not salient. However, for less frequently purchased products, notably smaller products, the weeks without data are more frequent. To address this issue, I follow Hitsch et al. (2021) and impute missing prices using an approximated base price. They do so by first classifying prices as promoted prices and regular prices based on frequency and promotion flags, and then imputing missing prices with the regular price identified in the algorithm.

4. For example, I consider all Coca-Cola diet soft drinks as one brand. The results are robust to UPCs and Nielsen "brand_code_uc" measures.

I estimate demand models for the top 80% of brands according to revenue in over 500 product categories during my sample period between 2006 and 2019. I select this subset of brands to mitigate missing price and quantity observations in the raw data. The number of product categories and brands available in the RMS data is large, which allows me to evaluate whether readily generalizable results exist that are less susceptible to external validity concerns.

Following the vast majority of demand-estimation applications to scanner data in the marketing literature, I aggregate UPC-level sales to the brand level and use the result as my product definition. To account for differences in pack sizes, I standardize products within each category to the modal unit. For example, if the product is yogurt, the modal unit is ounces. I then measure the quantity as the number of ounces and the price as per ounce. I drop any units that are different, though they never account for more than 5% of the sample in any product category.

The four measures constructed from the HMS data give a high-level overview of overall physical shopping behavior at the household level. However, household behavior ultimately matters for retailers insofar as it affects demand curves. Next, I turn to the RMS data to look more closely at how broadband affects demand through three measures: (1) prices, (2) price dispersion, and (3) price elasticities of demand at the brand level. I discuss each in turn.

I calculate prices as the weighted average over all purchases for the same brand for a single unit of a product. For example, I measure the price of a Coca-Cola product as the average price per ounce of soda. For each county in each year for each product, I calculate the average price of the products purchased.

For price dispersion, I follow Hitsch et al. (2021). I document price dispersion at the product brand level. For each product, I use the standard deviation of the log of prices to measure the dispersion of prices in the year.

Finally, I estimate price elasticities for over 10,000 products. I use a log-linear demand model for each brand in each county in each year, using data at the brand-store-week level. Estimating it at this level gives me variation in my parameters of interest that I later match to my high-speed internet data. For each brand-county-year, the demand specification is as follows:

$$log(q_{jst}) = \beta_{jcy} log(p_{jst}) + \gamma_{jsy} + \gamma_{jcr} + \varepsilon_{jst} \tag{2.1}$$

My sample includes observations for brand j in store s in week t. I standardize quantities and prices within the brand to be the corresponding values of a single unit. For example, for diapers, the unit for a particular brand would be a count of one. For detergent, the unit for any particular brand would be ounces. Similarly, the price for diapers would be the price per diaper, and the price for detergent would be the price per ounce.

The elasticity, β_{jcy}, is the primary object of interest. γ_{jcr} is the time fixed effect to account for demand shocks observable to the retail chains, hence potentially correlated with store-level prices. Because I estimate my regression models by sub-setting for each brand, county, and year, the fixed effects subscript inherits the less granular subscript. γ_{jsy} is the store fixed effect.

As with most demand estimations, I carefully consider how to address the endogeneity of price. I address the endogeneity of prices in two ways. The first way is to include a specification of fixed effects. My primary strategy to avoid endogeneity bias, besides the time-invariant store-fixed effects, is the quarter fixed effects. I include the quarterly fixed effect to account for demand shocks. I can interpret the estimates as price elasticities if these fixed effects capture all the demand components that may be correlated with prices. These assumptions are not directly testable, but I can test the sensitivity of the demand estimates to the inclusion of these fixed effects.

The second way I address price endogeneity is to use the shift-share instrument suggested

by DellaVigna and Gentzkow (2019). Specifically, I instrument prices with the average log price across other stores in the same chain but in different designated marketing areas (DMA). The key assumption is that the timing of chain-level sales is unrelated to local demand shocks for a store, after controlling for the fixed effects discussed above. DellaVigna and Gentzkow (2019) present evidence supporting this assumption: chains price uniformly across their stores, with jagged and idiosyncratic sales and heterogeneous demand conditions faced by stores within chains. The first-stage regression results are strong, with coefficients around 1 and R^2s around 0.5.

Estimating this model yields estimates of β for each county-year: to understand the order of magnitude up to approximation, with 5,000 modules, 3,000 counties, and 11 years, over 400 million demand estimates exist. To adjust for statistical error, I apply two processes after estimation. First, I remove outliers according to Tukey's criterion, which are values that are over 1.5 times the interquartile range below or above the first and third quartiles. In practice, these values are nonsensical, suggesting either perfectly inelastic or upward-sloping demand curves. Second, I use an empirical Bayes method to shrink the estimated elasticities to their category-specific mean. I use the full distribution of estimates as the prior, and shrink estimates toward this prior depending on their standard error. Hitsch et al. (2021) and DellaVigna and Gentzkow (2019) use a similar procedure.

CHAPTER 3

MEASURING BROADBAND

This chapter provides the relevant details on broadband measurement. I discuss institutional reasons for the uneven rollout across the United States and describe the importance of internet speeds.

3.1 Institutional Details

In 2019, 157.3 million people in the United States, approximately 50% of the country's population, did not use the Internet at high speeds. There are multiple classifications for internet speeds used by internet Service Providers (ISPs). Internet speeds that do not qualify as high-speed service include (1) dial-up speeds of around 0.5 megabytes per second (Mbps) and (2) historical high-speed internet speeds of around 4 Mbps or faster before 2010.[1] Internet speeds which do currently qualify as high-speed service include (3) the new classification for high-speed internet at 25 Mbps, (4) ISP-augmented speeds of around 100 Mbps, and, finally, (5) high-speed internet service from new fiber technology of around 1,000 Mbps.

To show the differences in these different internet speeds, I collect load-time data of five popular shopping websites using the throttle feature in Google Chrome's developer tools and present my results in Figures 1 and 2.[2] I loaded each of the five shopping sites at the five different internet speeds defined above: (1) dial-up, (2) the historical threshold for high-speed internet, (3) the updated threshold, (4) ISP-augmented speeds, and (5) high-speed internet from new fiber technology.

In Figure 3.1, the five classifications of internet speed are on the x-axis, with the load times in seconds of each shopping website on the y-axis.

1. https://www.fcc.gov/document/fcc-finds-us-broadband-deployment-not-keeping-pace

2. I collected these data in April 2021.

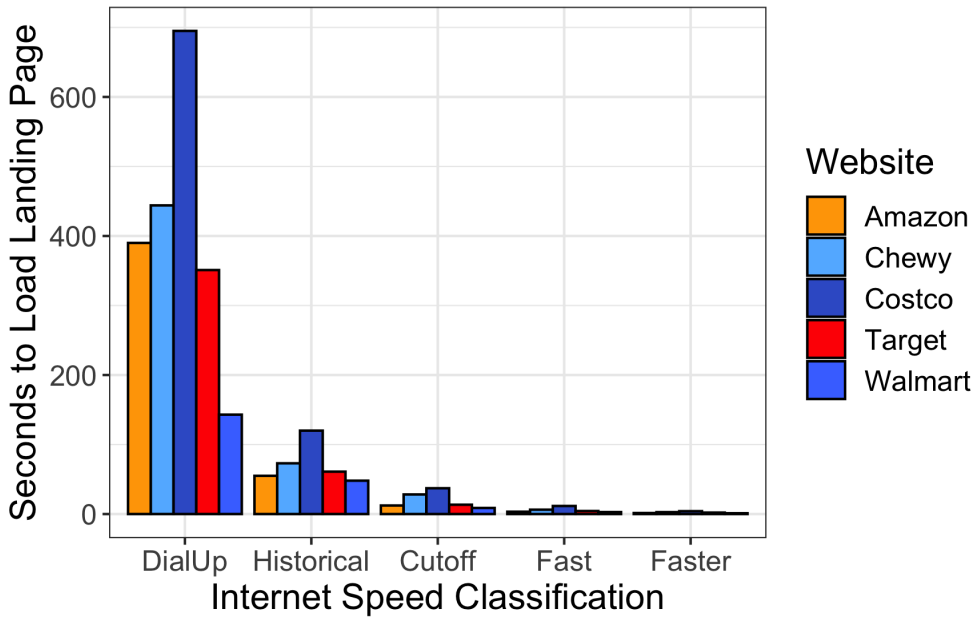

Figure 3.1: Loading Speeds

Figure 3.2 presents the same information to better illustrate the stark differences in speeds. For both panels, internet speed in megabits per second is along the x-axis. In the left panel, the y-axis is the average number of seconds to load each of the major shopping webpages. In the right panel, the y-axis denotes the difference in seconds it takes to load each webpage compared to the high-speed threshold speed of 25 Mbps.

Moreover, this degree of effect for a two-second delay is meaningful and represents real

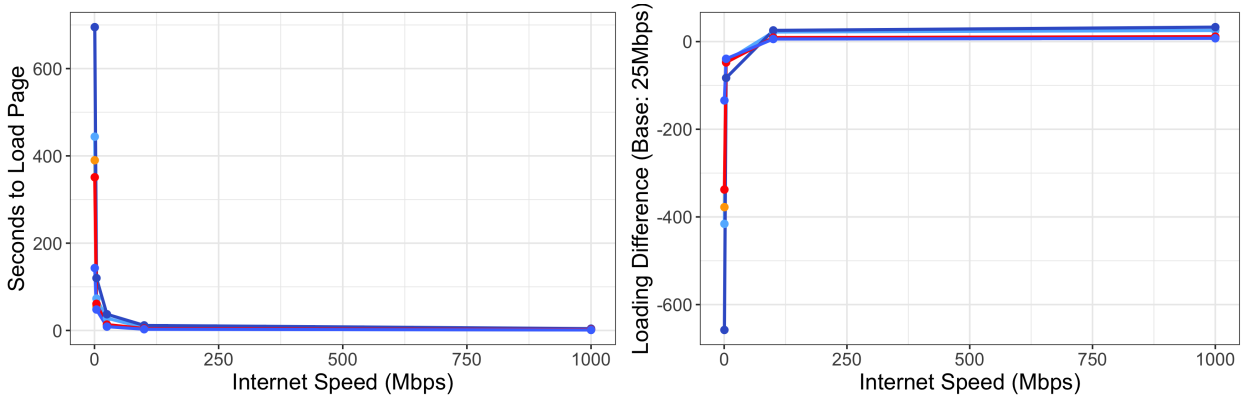

Figure 3.2: Loading Speeds

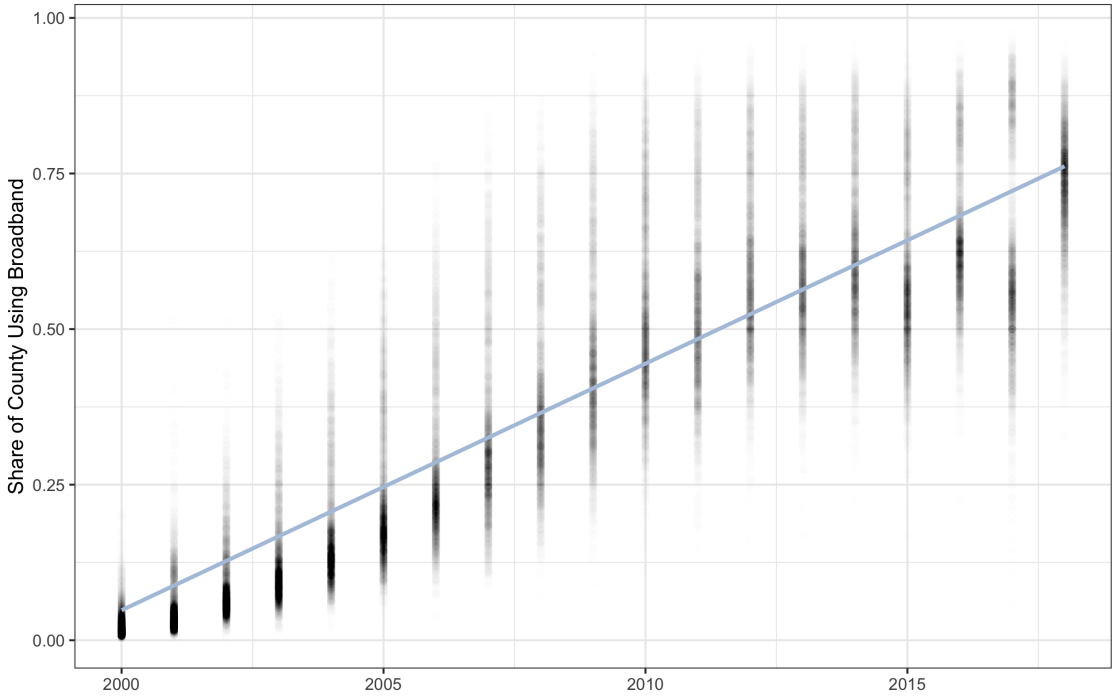

Figure 3.3: Broadband Availability Over Time

and significant information frictions. Considering an increase in page loading time from 1 second to 5 seconds increases the probability of website abandonment by 90%, the differences in load times are substantial.[3] The speed of dial-up or even 3 Mbps is magnitudes slower than what we define as high-speed internet today, and the difference is noticeable for consumers and online users.

Nationwide, high-speed internet availability increased steeply between 2010 and 2013. Figure 3.3 is a graph of the internet trends from 2000 to 2019. This figure includes the time-series variation in access through my sample years of 2004 to 2019. Each dot represents the aggregated share between 0 and 1 in a county in a year, and the line is a linear fit.

This illustrates that there is significant growth and variation in high-speed internet availability in the panel. Additionally, the dispersion of high-speed internet penetration has

3. "Find out How You Stack up to New Industry Benchmarks for Mobile Page Speed." Google. Google. Accessed June 6, 2021. https://www.thinkwithgoogle.com/marketing-strategies/app-and-mobile/mobile-page-speed-new-industry-benchmarks/.

increased significantly since the early 2000s. The highest share counties early in the panel in 2006 still have higher access than the lowest counties in 2018.

3.2 Census Data

Measuring broadband access, adoption, and availability accurately is difficult. Distinguishing between these three different measures is even more difficult. For the purposes of this work, I use broadband access, adoption, and availability interchangeably. I construct a measure of broadband internet at the county-year level from 2006 to 2018 to match the RMS panel. The data come primarily from two distinct sources: the Census and the FCC. From the FCC, I use two distinct sources of data: (1) the number of ISPs in a geographic area and (2) the number of households with a high-speed connection.

I use Census data, specifically the harmonized high-speed internet dataset provided through a partnership between the University of Iowa and Arizona State University.[4] This partnership derives high-speed internet use rates from the Current Population Survey and the American Community Survey internet supplements. The latest update provides data from 2000 to 2018.

The Census data provide information on the reported adoption of high-speed internet. The Iowa-ASU data are different from just the Census data, as they use estimates of broadband subscriptions in US counties from 2000 to 2012 to estimate and fill data gaps prior to 2013. The "County Time Series" data contain an estimate of the percentage of internet use in the approximately 3,000 counties in the United States from 1997 to 2018. From 1997 to 2014 the data measure the proportion of households that have internet at home. From 2000 to 2018 the data include a measure of the proportion of households that have broadband internet at home. From 2011 to 2014 the data include a measure of mobile internet.

4. https://techdatasociety.asu.edu/broadband-data-portal/home

3.3 Federal Communications Commission Data

The FCC collects data twice a year through its Form 477.[5] Form 477 is designed to collect information about broadband connections to end-users and their locations throughout the US, the District of Columbia, and US Territories. The types of broadband connections include wired and wireless local telephone services and interconnected Voice over Internet Protocol (VoIP) services. From these filings, the FCC produces several measures of broadband deployment include: infrastructure, competition, and connectivity. For 477 has evolved and changed over time; some panels provide data spanning from 1999 to 2019 depending on the measure. I leverage the Service Provider Deployment.[6] I use the harmonized data generously provided by Michigan State University.[7]

The FCC requires that all service providers submit Form 477 detailing which ZIP codes in which they provide services for at least one customer. These data cover the entire US and provide a rare opportunity to study how the diffusion of high-speed internet has on consumer behavior. These data allow little distinction among different types of high-speed internet services and are subject to some measurement errors due to the nature of reporting. Firms may only serve one consumer in an area, but if this consumer reports their Census Block, it will appear as though everyone in that Census Block has access to the same high-speed internet.

A provider that reports the deployment of a particular technology and bandwidth in a particular census block may not necessarily offer that particular service everywhere in the

5. https://www.fcc.gov/economics-analytics/industry-analysis-division/form-477-resources

6. I am currently working on expanding the imputation to include information on residential connections. Similar to the ISP data, the residential fixed internet access data is connected using the FCC Form 477. These data provide information about residential internet access connections in the US as collected by FCC Form 477. These data include information on total and residential internet access connections by downstream and upstream speed, by technology, by geography, and over time. In this work, I mainly leverage the number of fixed connections per 1,000 households by census tract.

7. Mack EA, Helderop E, Ma K, Grubesic TH, Mann J, Loveridge S, et al. (2021) A broadband integrated time series (BITS) for longitudinal analyses of the digital divide. PLoS ONE 16(5): e0250732. https://doi.org/10.1371/journal.pone.0250732

census block. Accordingly, a list of providers deployed in a census block does not necessarily reflect the number of choices available to any particular household or business location in that block, and the number of such providers in the census block does not purport to measure competition. Moreover, none of the data from the FCC Form 477 includes local service prices, which is another barrier to broadband adoption.

3.4 Additional Sources of Data

To combine the different measures of broadband and provide sufficient controls at each stage of analysis, I collect additional data from the Consumer Financial Protection Bureau (CFPB) and the US Department of Agriculture (USDA).

I use the data from the CFPB to collect demographic variables at the Census tract level. The data from the CFPB data come from the Home Mortgage Disclosure Act (HMDA) which requires certain financial institutions to publicly provide mortgage data. These financial institutions must register with the Federal Financial Institutions Examination Council (FFIEC) through the CFPB, which processes the disclosure. These data combine elements of the FFIEC Census Flat File and the Office of Management and Budget (OMB) metropolitan statistical area (MSA) delineation files to construct Census tract-specific demographics.

The USDA categorizes counties on a rural-urban continuum. For metropolitan counties, the classification depends on the population size of their metro area. For non-metropolitan counties, the classification depends on the degree of urbanization and proximity to a metropolitan area. I use these data to control for observable county characteristics.

3.5 Combination with Imputation

The Census data from the Iowa-ASU initiative is the most direct measure of what I am interested in: the percentage of people in a county that report having access to high-speed

internet. Though these data span as far back as 2000, there are many missing values up until 2017. These missing values may be the result of disclosure restrictions, e.g., smaller counties and lower sampling rates that would put individuals at risk for being identified. The state-level data in the Iowa-ASU data is more complete back to 2014. However, given the additional sources of data from the FCC through the MSU project, I have clean and consistent measures of broadband availability from 2008 to 2018. The challenge here is to map the Census tract-level data to the county level data each year reliably.

To map the Census tract-level data to impute the county-level measure, I leverage the HMDA data from the CFPB. These data provide demographic tract-level data aggregated up from disaggregated restricted used Census data from the FFIEC. Combining these various datasets, I fit a multivariate normal model to the data. First, I transform all variables to make sure they have plausible support from $-\infty$ to ∞ and reasonable dispersion across the support.[8] The predictive variables at the tract level are population, median income, median age, density, and the number of service providers.

I fit a multivariate normal distribution to the data using the expectation-maximization algorithm. I do multiple imputations, but find that variation between imputations is negligible. This is not surprising as I am imputing the missing data at the tract level and then aggregating the measure to the county level.[9] This is akin to the multi-level regression with post-stratification (MRP) technique that is popular in the Political Science literature. Post-stratification is the process of adjusting the estimates based on weighted averages of the smaller components. Simply put, though there may be error and noise in the imputation process at the tract level, that noise is insignificant once I aggregate the 73,057 Census tracts up to 3,006 counties. Table 3.1 presents the summary quantiles for broadband after

8. Depending on the original support of the variable, I use logit transformations or log transformations. For the number of providers, I use sqrt(providers).

9. Census tracts average about 4,000 inhabitants with a minimum population of about 1,200 and a maximum population of about 8,000.

imputation.

Table 3.1: Summary Statistics of Broadband After Imputation

Year	p10	p25	p50	p75	p90
2006	0.383	0.431	0.487	0.535	0.579
2007	0.446	0.502	0.564	0.620	0.662
2008	0.512	0.564	0.623	0.672	0.713
2009	0.577	0.625	0.679	0.728	0.765
2010	0.622	0.673	0.725	0.770	0.803
2011	0.640	0.686	0.733	0.778	0.816
2012	0.689	0.733	0.777	0.818	0.852
2013	0.679	0.730	0.775	0.811	0.841
2014	0.694	0.743	0.787	0.823	0.854
2015	0.621	0.667	0.712	0.760	0.809
2016	0.616	0.670	0.722	0.781	0.837
2017	0.439	0.510	0.575	0.740	0.873
2018	0.604	0.671	0.734	0.787	0.836

3.6 Uneven Rollout

The gap between households with access to high-speed internet and households without is often called the "digital divide." The reasons for the digital divide include physical infrastructure, political climate, among many others. For this paper, I think of access, availability, and adoption interchangeably. This allows me to focus on addressing the effect of broadband on consumer behavior.[10]

Internet Service Providers have expanded across the US, concentrating initial rollout in wealthy, dense urban areas. As technology has become cheaper and the power of high-speed internet becomes more salient, municipalities and other agencies have lobbied to subsidize

10. The reasons for the digital divide in the US is complicated and outside the scope of this paper. However, I acknowledge that available download speed is no longer the only metric that matters and that there is a lot of information that is not being included in this analysis, including local details for why high-speed internet is not more universal. Future work should consider the cost of adoption for each household (e.g., subscription prices), the quality and reliability of the service, as well as the level of competition and infrastructure ownership.

and encourage additional expansion. This is illustrated by industry guidelines from ISPs like Google Fiber.[11] In this "Fiber Ready Checklist," Google enumerates the major reasons for the digital divide. First, the local government must provide information about existing infrastructure. Second, they must ensure government cooperation with providing access to existing infrastructure. Finally, the local government must ensure low cost of entry, including permits for construction. Additionally, Google Fiber will often determine their next pilot by the number of pre-contracted subscriptions by households.

Moreover, Section 253 of the Telecommunications Act of 1996 provides additional support for my identification strategy. This act gave municipalities control over public right-of-way used by ISPs.[12] There has been a significant amount of policy variation across states and municipalities which impose different fees and costs to ISPs. The assumptions for plausible exogeneity are also further documented in Lelkes et al. (2017).[13]

11. https://fiber.storage.googleapis.com/legal/googlefibercitychecklist2-24-14.pdf

12. https://www.congress.gov/104/plaws/publ104/PLAW-104publ104.pdf

13. I also use a slope terrain as an instrument for broadband growth. The details and results of the analysis are in Appendix D.

CHAPTER 4

TESTING THE RETAIL APOCALYPSE HYPOTHESIS

This chapter discusses my results in detail. I present two kinds of analyses. First, I show time trends of the various retail outcomes during the rise of broadband. Second, I show how changes in these outcomes relate to changes in broadband. In sum, I use the differential growth rates in the cross-section of counties to explore how broadband affects retail.

4.1 Time Trends of Consumer Behavior

I document time trends for spending, trips, retail chains, brands, prices, price dispersion, and price elasticities.

Trends in Spending

I examine how household spending has changed over the time of broadband internet proliferation. In Figure 4.1 the graph shows the average spending from 2004 to 2018. The y-axis is the average amount spent per household each year. Each point is the average spending for the average county in the year weighted by county population and adjusted for inflation using the Consumer Price Index (CPI).[1] The trend shows that average household spending at a brick-and-mortar retailer has not changed dramatically from 2006 to 2018. In 2016 dollars, the average household spent a little less than $7,300 in 2006, about $140 per week at brick-and-mortar retailers. In 2011, there was a spending spike of over $7900. In 2016, the household spent was a little over $7,600 about $146 per week, about a 4% increase in spending.

1. the US Bureau of Labor Statistics, Consumer Price Index for All Urban Consumers: Food and Beverages in the US City Average, retrieved from FRED, Federal Reserve Bank of St. Louis; https://fred.stlouisfed.org/series/CPIFABSL, November 27, 2021.

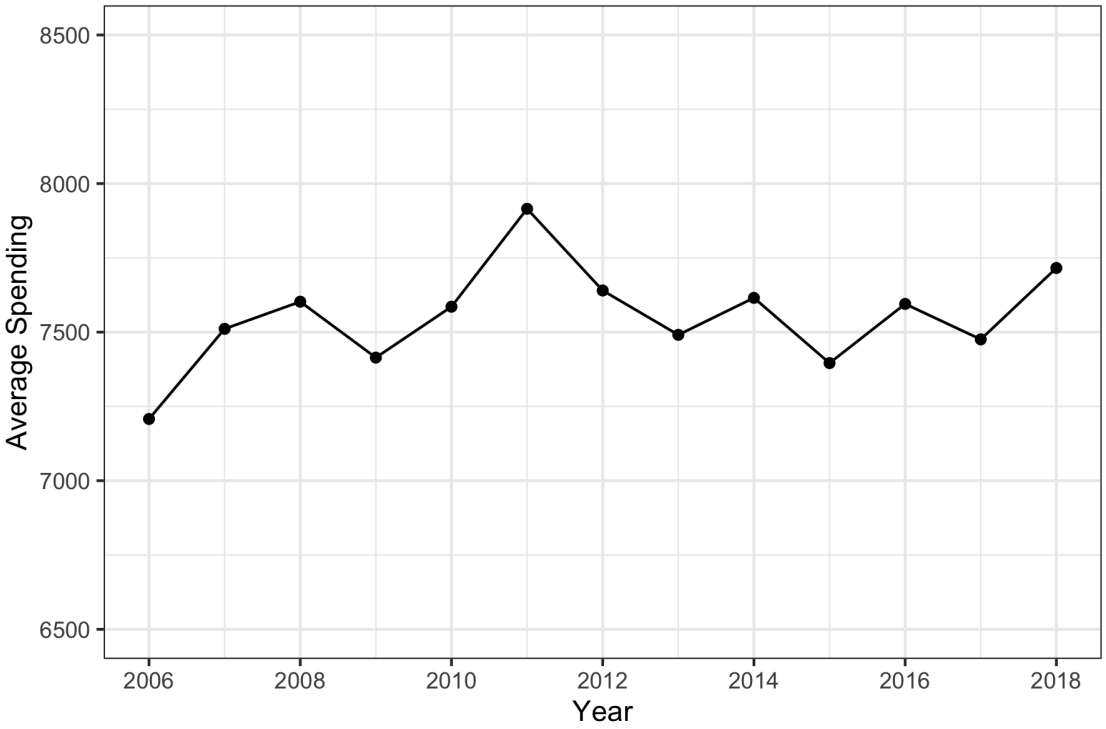

Figure 4.1: Time Trends in Spending

Trends in Trips

Next, I look at how the number of trips has changed over time. In Figure 4.2, the graph shows the average number of trips taken to brick-and-mortar retailers from 2006 to 2018 each year. In 2006, the average household went to the store a little less than 180 times, about 3.5 times a week. There is a steady decline in the number of trips per household. In 2018, the average household went to a brick-and-mortar store about 3 times a week, 166 times that year.

Trends in Retail Chain Choice

In Figure 4.3, plots the average number of retail chains each household visits from 2006 to 2018. In 2006 the average household visited a little less than 24 unique retail chains. By 2018, after a steady decline, the average household visited about 21 unique retail chains.

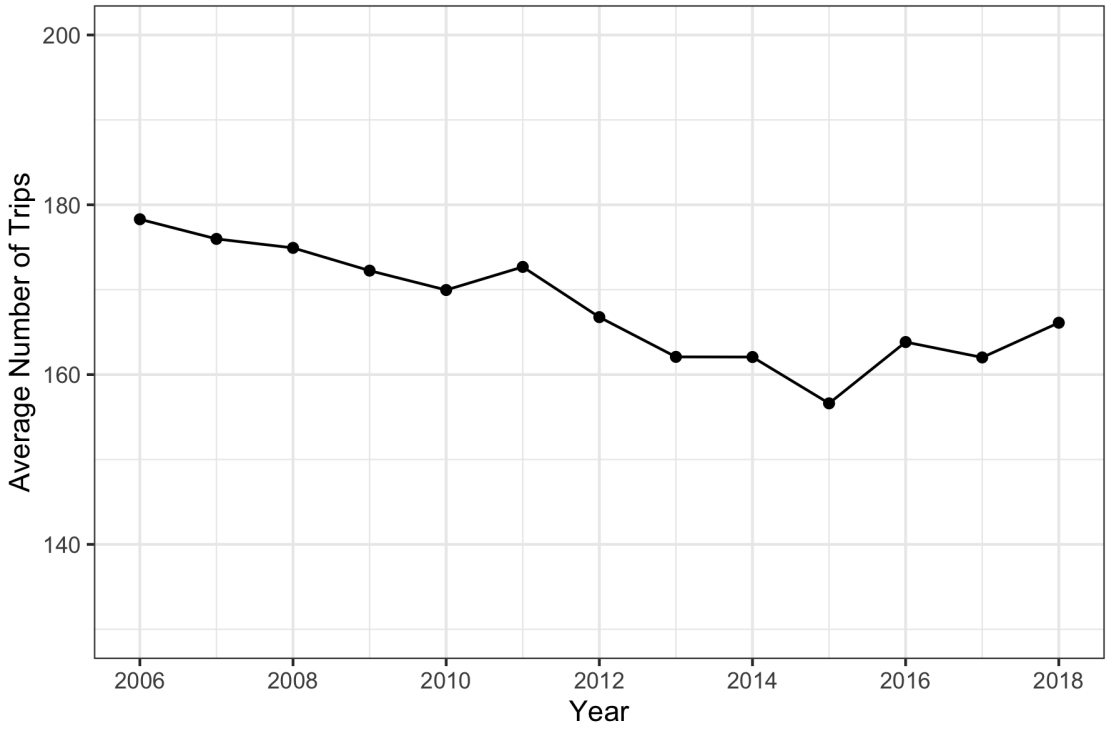

Figure 4.2: Time Trends in Trips

This is about an 8% decrease over 12 years.

Trends in Brand Choice

I look at the number of unique brands a household purchases during the year. The graph on the left is the average number of unique brands purchased by a household in the median county from 2006 to 2018. In 2007, the average household purchased just under 400 different brands in a single year. After a steady decline, the average household buys about 350 brands in a year in 2018, about a 12.5% decrease in unique brands. The graph on the right is the set of all unique brands purchased by any household between 2006 and 2018. In contrast to the graph on the left, the number of overall brands purchased has steadily increased, about 9.8%.[2]

2. I did not analyze from 2004 to 2006 because there is a discrete jump in the number of households in HMS from 2006 to 2007. The averages for the number of trips to the store and amount of spending are

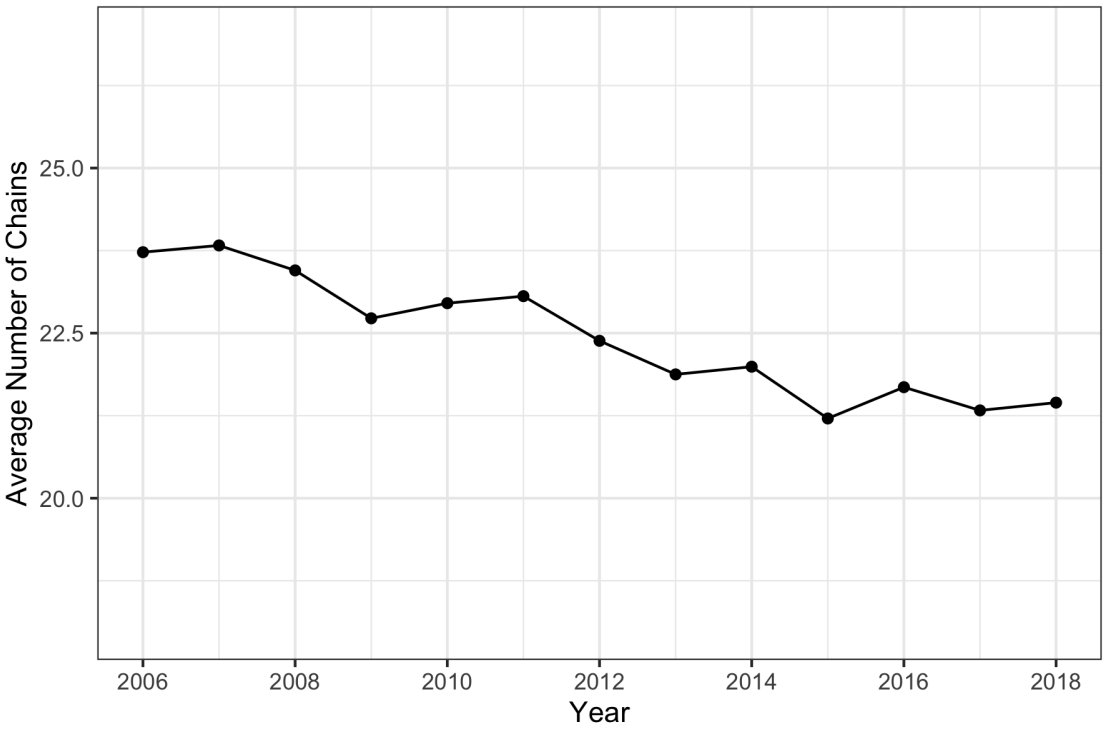

Figure 4.3: Time Trends in Unique Chains

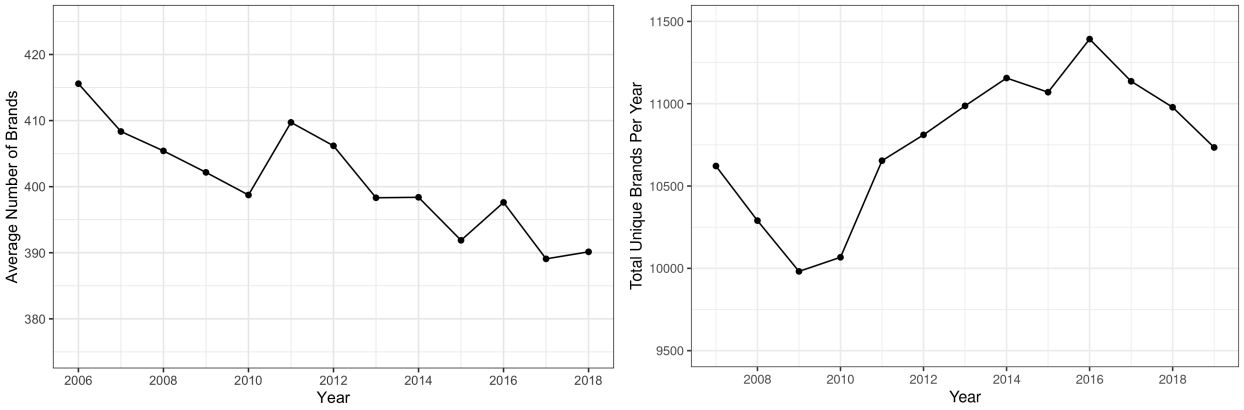

Figure 4.4: Time Trends in Brand Purchases

Trends in Prices

Next, I turn to examining how prices have evolved during the rise of broadband internet. Household measures of consumer behavior like spending, trips, chains, and brand choice may mask other changes in the retail sector. Firms may change their strategies to compensate for changes in consumer behavior. To examine the possibility of firm response, I look at transacted prices in 512 product categories across approximately 5,000 brands.

In figure 4.5 the prices are normalized to one in 2006. This figure shows how prices have changed relative to 2006. The distribution of prices is over brands in each year. I plot the 10th, 25th, 50th, 75th, and 90th percentiles for prices across brands in from 2006 to 2018. The median increases about 1.2 times the 2006 prices, consistent with 24% inflation from 2006 to 2018. Prices in the 10th percentile are decreasing. The median increases about 1.2 times the 2006 prices, consistent with 24% inflation from 2006 to 2018. Prices in the 10th percentile are decreasing.

Trends in Price Dispersion

I also look at how price dispersion changes during the rise of broadband. I calculate price dispersion at the brand level for each year. Figure 4.6 plots the 10th, 25th, 50th, 75th, and 90th percentiles for price dispersion across brands in from 2006 to 2018.

From 2006 to 2018, there is not a substantial change in the distribution of price dispersion.

Trends in Demand Elasticities

Finally, I example how demand elasticities are changing over time. Figure 4.7 plots the median, 25th, and 75th percentiles for estimated elasticities from 2006 to 2018. I find that the average demand elasticity for a brand in my data is about -5. Considering that many

not sensitive to this increase in panelists, but the number of unique brands total was sensitive. The steady decline in unique brands purchased by the households was consistent from 2004 to 2018. I provide the full 2004 to 2019 series in the Appendix.

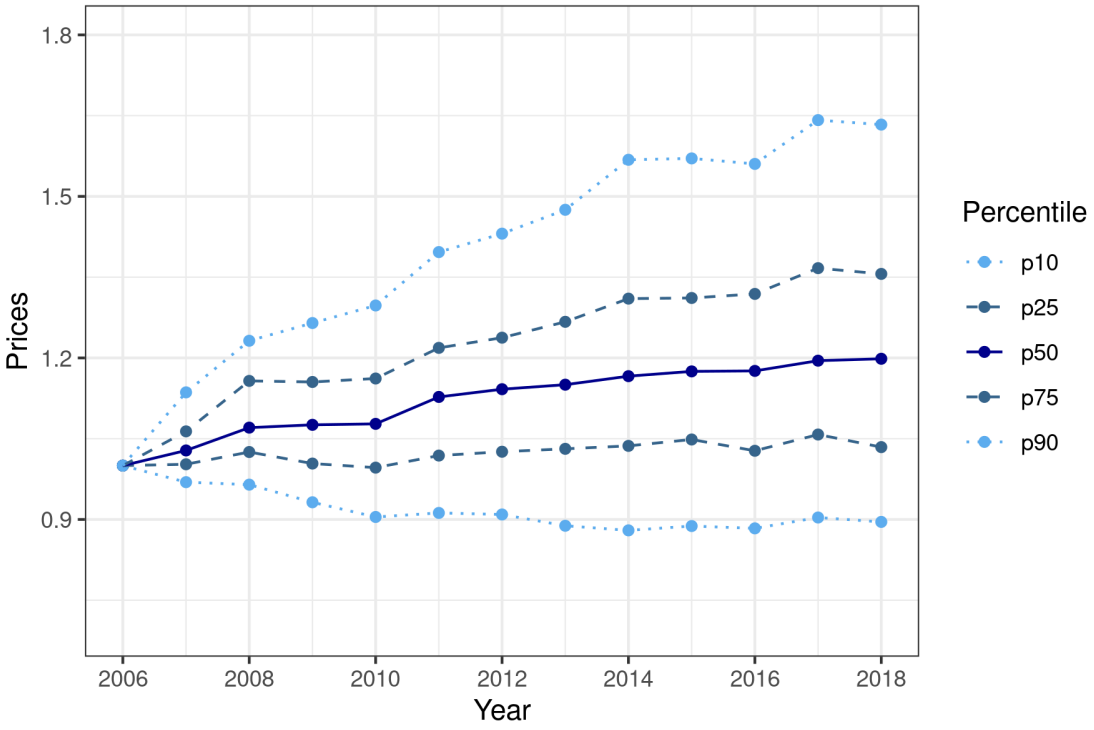

Figure 4.5: Time Trends in Prices

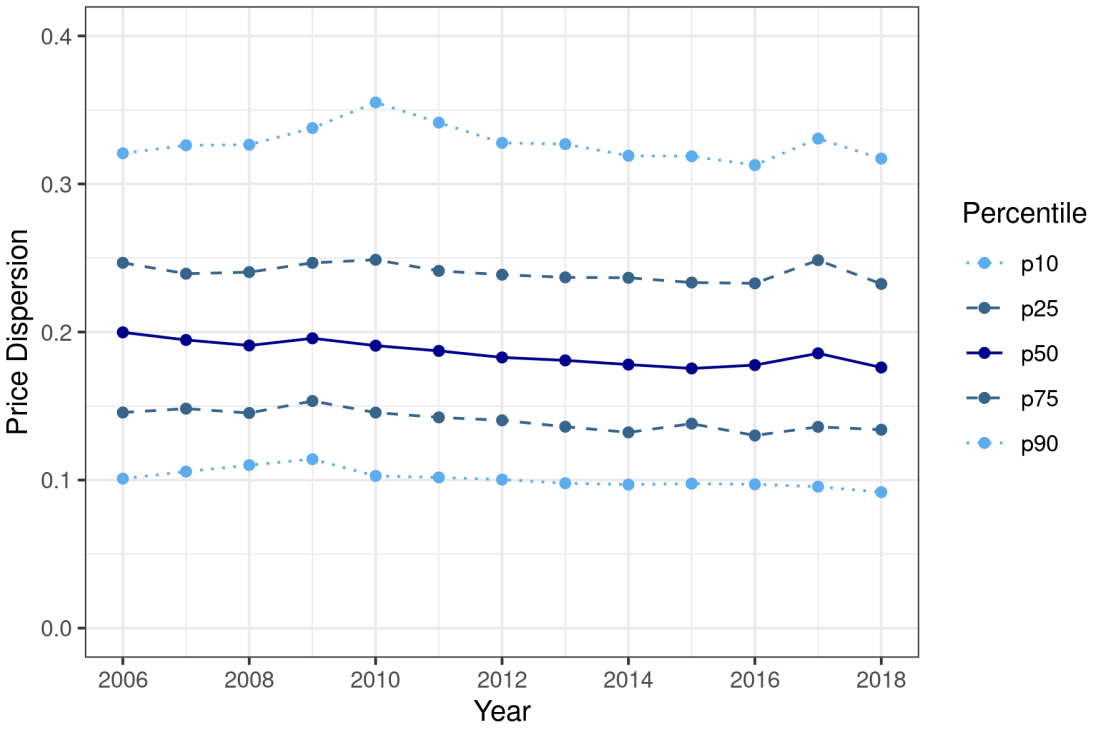

Figure 4.6: Time Trends in Price Dispersion

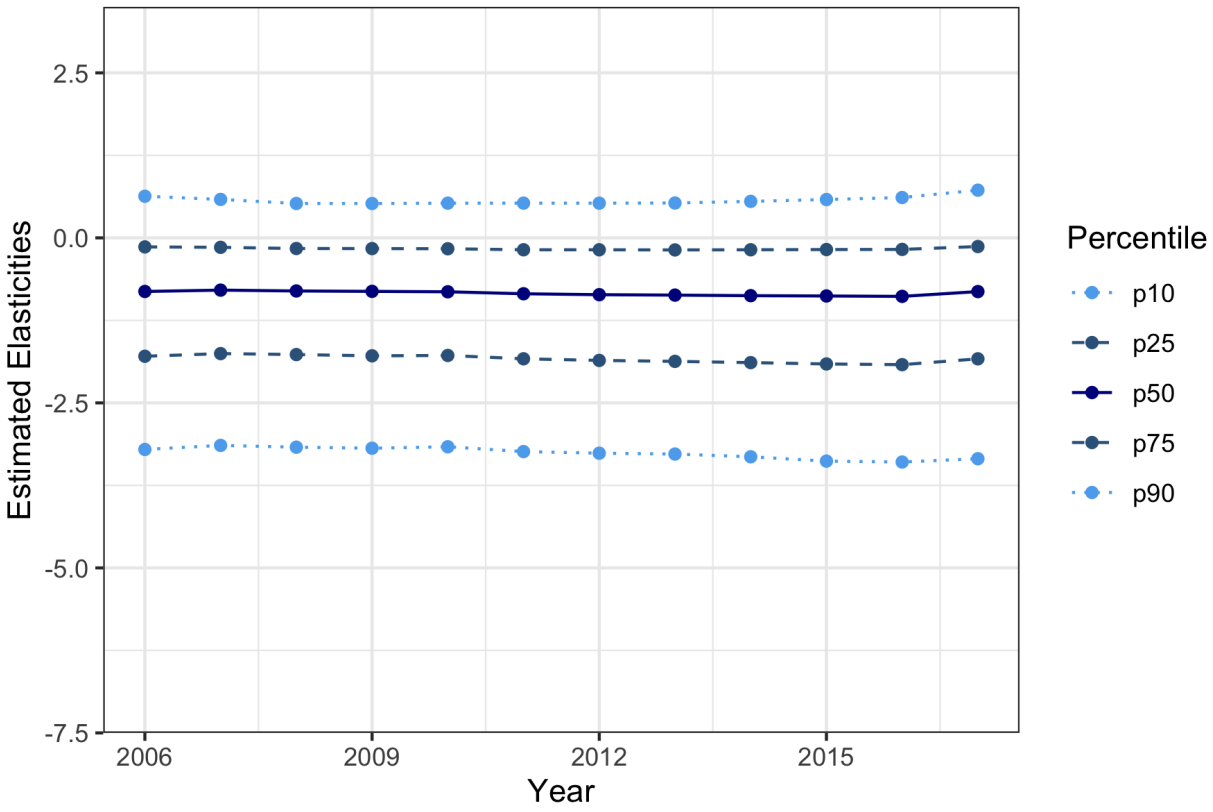

Figure 4.7: Trends in Elasticities

brands are small, this is a reasonable estimate. The estimated elasticity for Coca-Cola is about -1, consistent with other log-linear demand models.

Note however that those the distribution of elasticities looks relatively stable, the elasticity of a specific product can still be changing significantly over time.

4.2 Broadband Effects on Consumer Behavior

These trends do not support the hypothesis that there is an imminent collapse in brick-and-mortar retail. However, the trends cannot speak directly to the causal effect of broadband internet on consumer shopping behavior. Consequently, I turn to specifically estimate the effect of local broadband access on the seven shopping outcomes.

The fundamental challenge in estimating a causal model is that high-speed internet is

not randomly assigned. A naive model may try to estimate:

$$\beta_{cy} = \theta_{\beta} I_{cy} + \varepsilon_{cy}$$

The econometrician would be concerned that something causing changes in β_{cy} is also affected I_{cy}. ISPs may target market entry and service development in areas and at times that are most profitable and advantageous. There may be unobserved and therefore omitted factors that may be correlated with both high-speed internet availability and sales. That is, high-speed internet entry is itself the outcome of internet service providers' optimization. Provider optimization consequently depends on local demand for high-speed internet. Moreover, the local demand for high-speed internet is intricately related to the local demand for retail products.

I address this challenge in my main analysis using a long difference regression. I look to see if county level changes in outcomes are related to county level changes in broadband access over ten years. The long difference regression relies on the assumption that $E[\Delta\beta_{cy} \cdot \Delta\varepsilon_{cy}] = 0$. This specification has a few other advantages. First, the long difference in changes mitigate bias due to measurement errors (Griliches and Hausman (1986)). This is particularly useful since I am using a measure of internet access and adoption broadly and since this treatment is not acute, the effect over time is the object of interest. Second, I expect there to be serial correlation within a county. If I did not do long differences, I would need to cluster by counties anyway, and therefore I am not losing any observations by doing long differences. Finally, the long difference would control for time invariant confounders at the county level and I can add cross-sectional controls at the beginning of the panel that will not interact with observed treatment, i.e., are not obviously bad controls.

In addition to my main specification, I also run a two-way fixed effects model. This specification relies on a different set of assumptions using level moments. The identifying assumption is that the fixed effects span the relevant space of joint demographic drivers. To

control for persistent demand differences in a particular area, I employ county fixed effects. To control for aggregate trends in demand for a product, I employ time fixed effects. The main idea behind this approach is that the fixed effects and other controls span the space of factors that impact demand to which ISPs are responding. That is, if there is an unobserved confounder that is sufficiently correlated with my observed controls, this will not pose a threat to identification. Therefore, the remaining variation in access to high-speed internet (conditional on fixed effects and controls) does not represent planned variation in high-speed internet.

Effects on Spending

First, I look at how broadband effects household spending at brick-and-mortar stores. The x-axis is the change in broadband. Most counties have about a 20% to 40% increase in broadband penetration from 2006 to 2016. Change in spending is flat relative to growth in broadband.

The spending measure of consumer behavior captures spending at brick-and-mortar retail chains. The flat relationships between the change in internet and the change in spending from 2006 to 2016 is inconsistent with the retail-apocalypse hypothesis because broadband internet does not appear to be affecting spending.

Effects on Trips

Next, I look at how broadband effects household trips to brick-and-mortar stores. The x-axis is the change in broadband. Change in trips is slightly increasing relative to growth in broadband.

The trips measure of consumer behavior captures the number of trips households make to brick-and-mortar retail chains. The flat relationships between the change in internet and the change in trips from 2006 to 2016 is inconsistent with the retail-apocalypse hypothesis

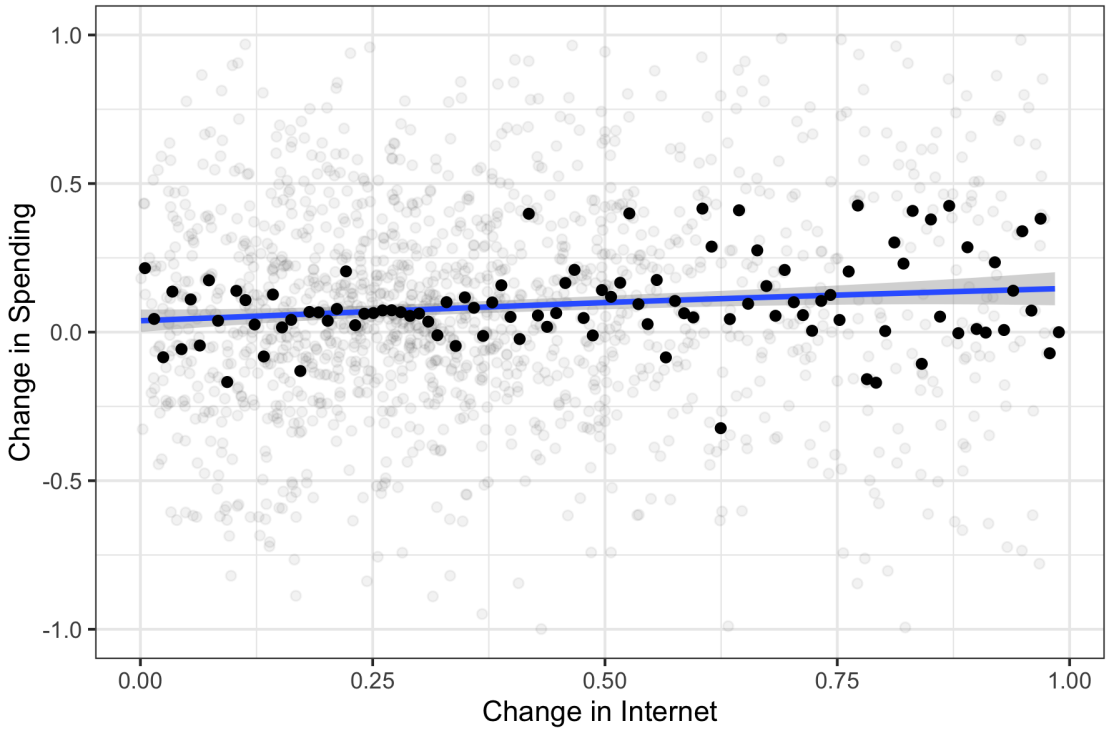

Figure 4.8: Growth in Broadband and Change in Spending

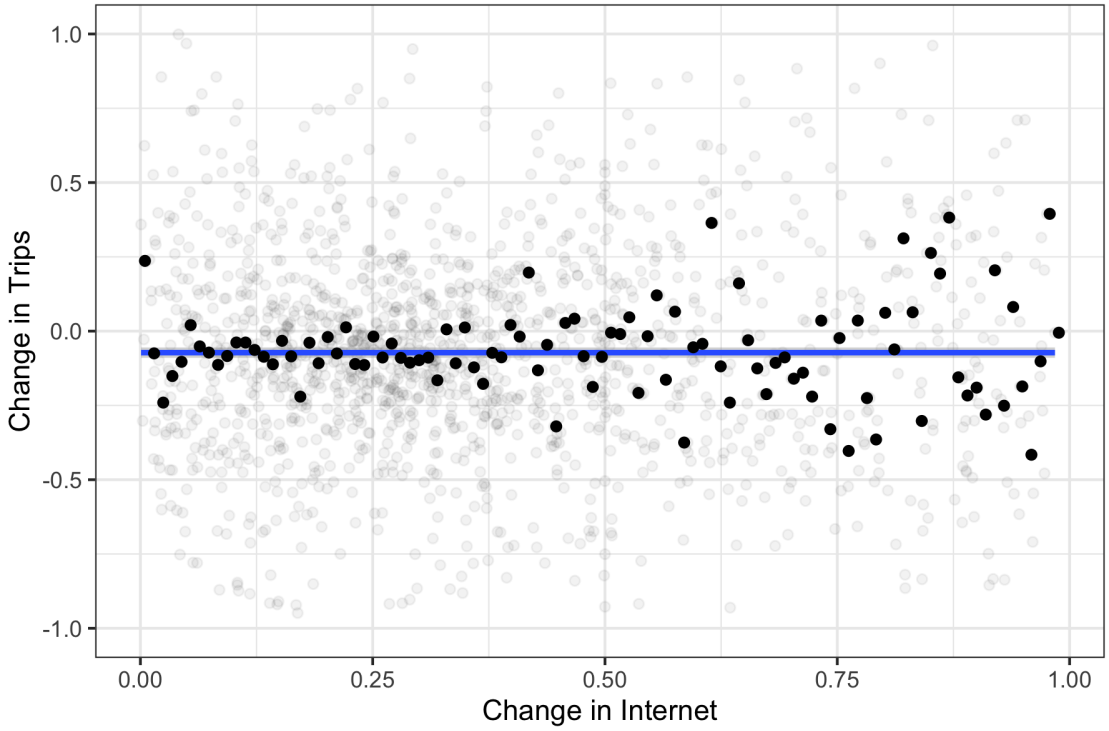

Figure 4.9: Growth in Broadband and Change in Trips

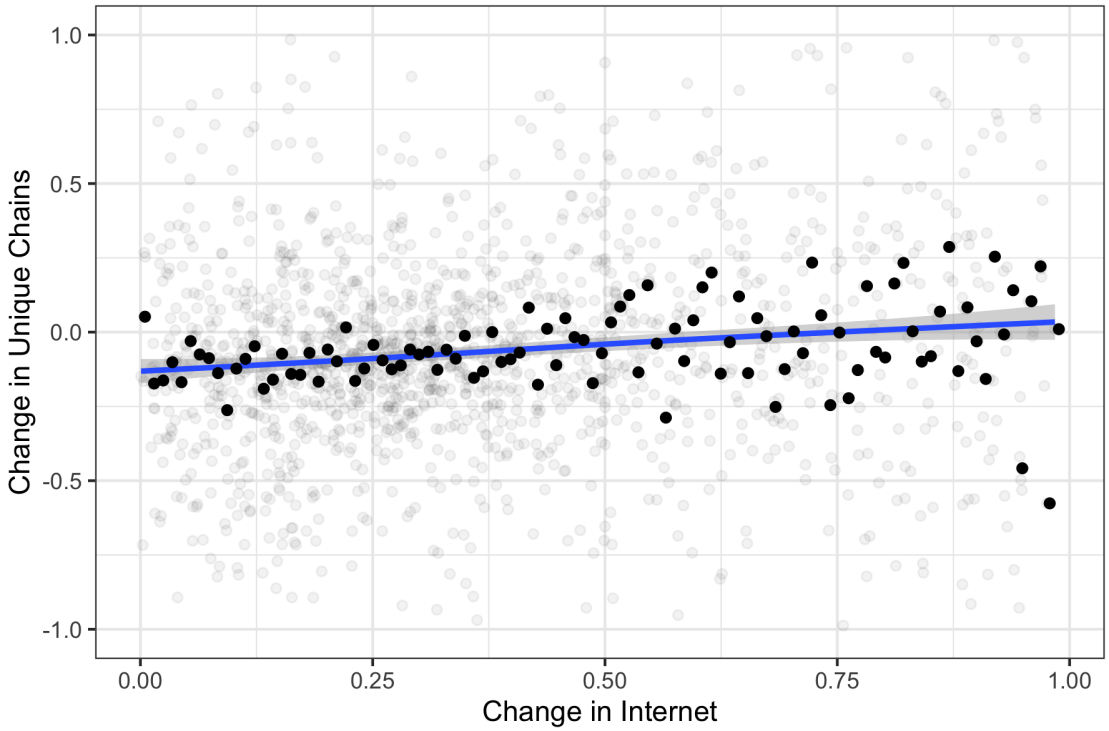

Figure 4.10: Growth in Broadband and Change in Unique Retail Chains

because broadband internet does not appear to be affecting frequency of trips to brick-and-mortar retailers.

Effects on Retailer Chain Choice

I look at how broadband effects household visits to unique stores. The x-axis is the change in broadband. Again, I find that broadband does not affect household unique retail chain visits.

The retail chain measure of consumer behavior captures the number of unique retail chains a household frequents throughout the year. The flat relationships between the change in internet and the change in unique retail chains from 2006 to 2016 is inconsistent with the retail-apocalypse hypothesis because broadband internet does not appear to be affecting retailer chain choice beyond the aggregate time trends.

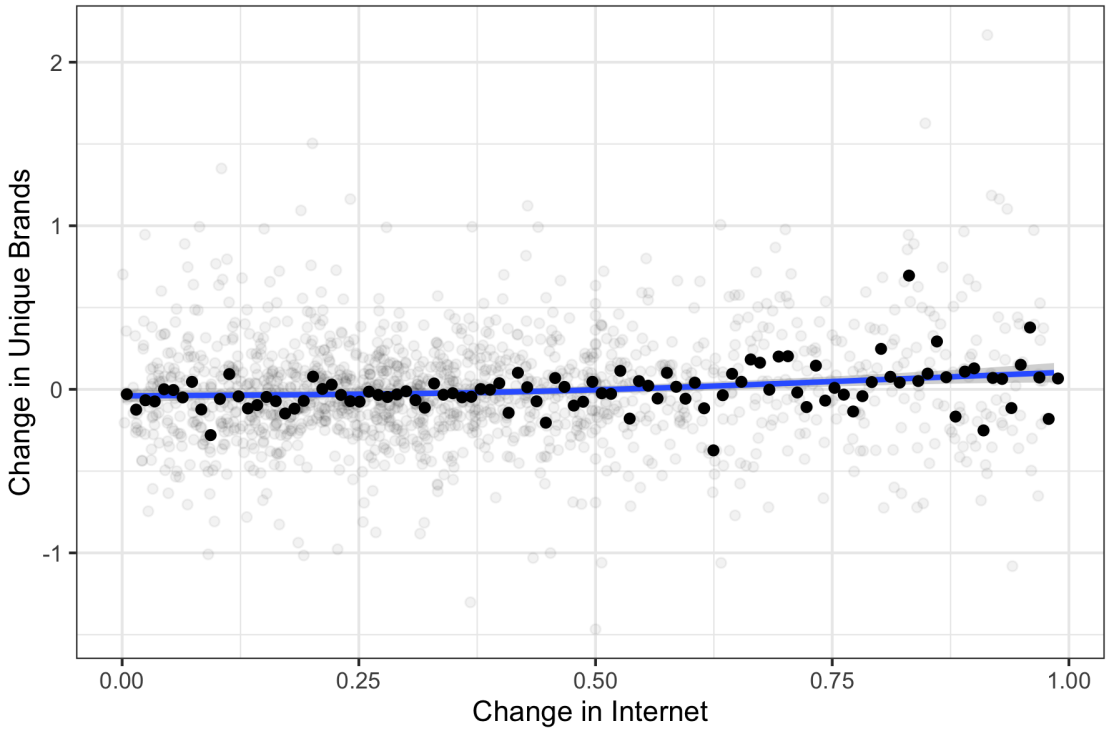

Figure 4.11: Growth in Broadband and Change in Unique Brands

Effects on Brand Choice

Next, I look at how broadband effects household spending at brick-and-mortar stores. The x-axis is the change in broadband. Though the overall time trend shows that household brand choice is becoming more niche, this change is flat relative to growth in broadband.

The unique brand measure of consumer behavior captures consumer choices at the brand level at brick-and-mortar retail chains. The flat relationships between the change in internet and the change in unique from 2006 to 2016 is inconsistent with the retail-apocalypse hypothesis because broadband internet does not appear to be affecting consumer brand choice beyond aggregate time trends.

Household-Level Analysis

As a robustness check, I also look at within-household variation in consumer variation with respect to changes in internet use. Nielsen's panelists report whether they have any internet connection at home. The resulting variable lacks information on internet speeds, which I show in my Institutional Details section are economically significant for outcomes such as page loading speeds. With that caveat, I look at households that switch from no internet to some internet, and compare them to households that never have internet or always have internet. I look at the same four shopping outcomes to find no statistically nor economically significant changes in household behavior after internet adoption that support the retail-apocalypse hypothesis.

Table 4.1: Estimated Effect of Internet on Consumer Behavior

	Dependent variable:			
	Δ log trips	Δ log chain	Δ log brand	Δ log spend
	(1)	(2)	(3)	(4)
Internet	-0.007	0.021^{**}	0.003	0.011
	(0.011)	(0.010)	(0.009)	(0.011)
R^2	0.00003	0.0003	0.00001	0.0001
Adjusted R^2	-0.00004	0.0002	-0.0001	0.00000
Note:	*p<0.1; **p<0.05; ***p<0.01			

The effect of internet at home is positive for change in unique brick-and-mortar retail chains frequented, which would run counter to the retail-apocalypse hypothesis because it suggests that household visit more retail brick-and-mortar retailers when they adopt internet at home. This is approximate one additional retail chain.

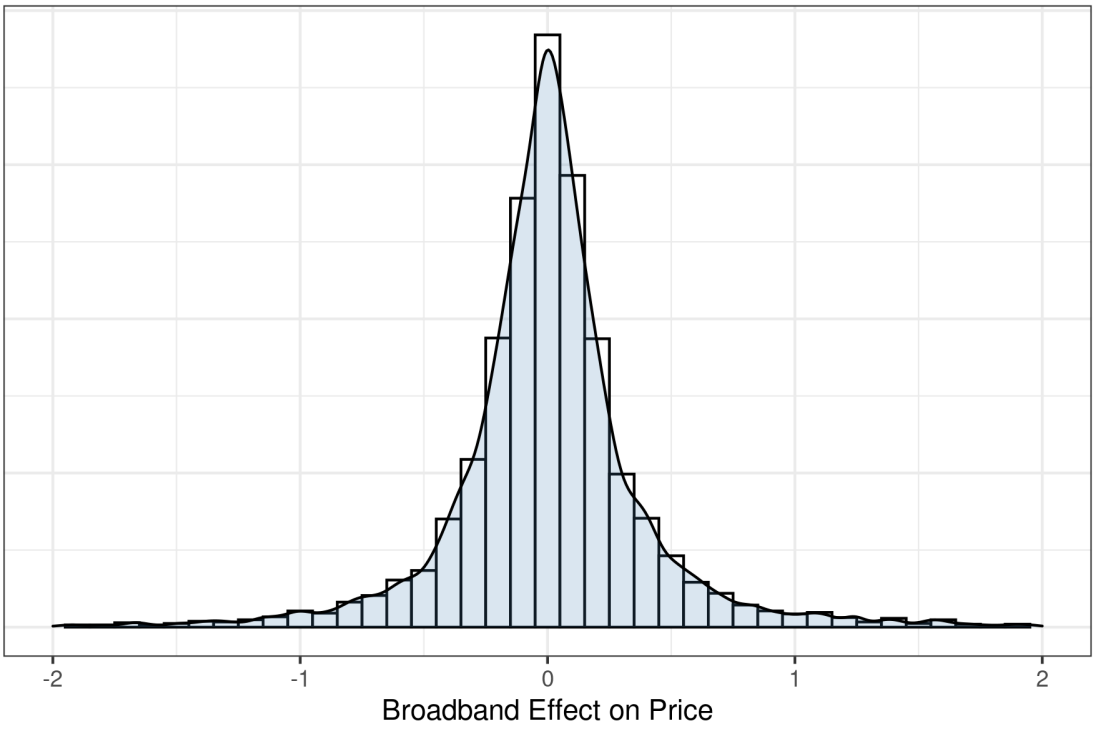

Figure 4.12: Growth in Broadband and Change in Prices

Effects on Prices

Next, I look at how broadband affects prices. For each brand in the sample, I run the following specification

$$\Delta y_c = \theta \Delta bb_c + \varepsilon_c$$

Where Δy_c is the difference in log price and Δbb_c is the change in broadband penetration. Figure 4.12 presents the distribution of broadband effects on prices (θ) across brands. Note that there is substantial heterogeneity across brands, but the effect is centered at zero. The first quartile is -0.16, the median is 0.00, the 3rd quartile is 0.16. While I document muted average changes and broadband effects, Figure 4.12 shows that there is substantial heterogeneity in the tails.

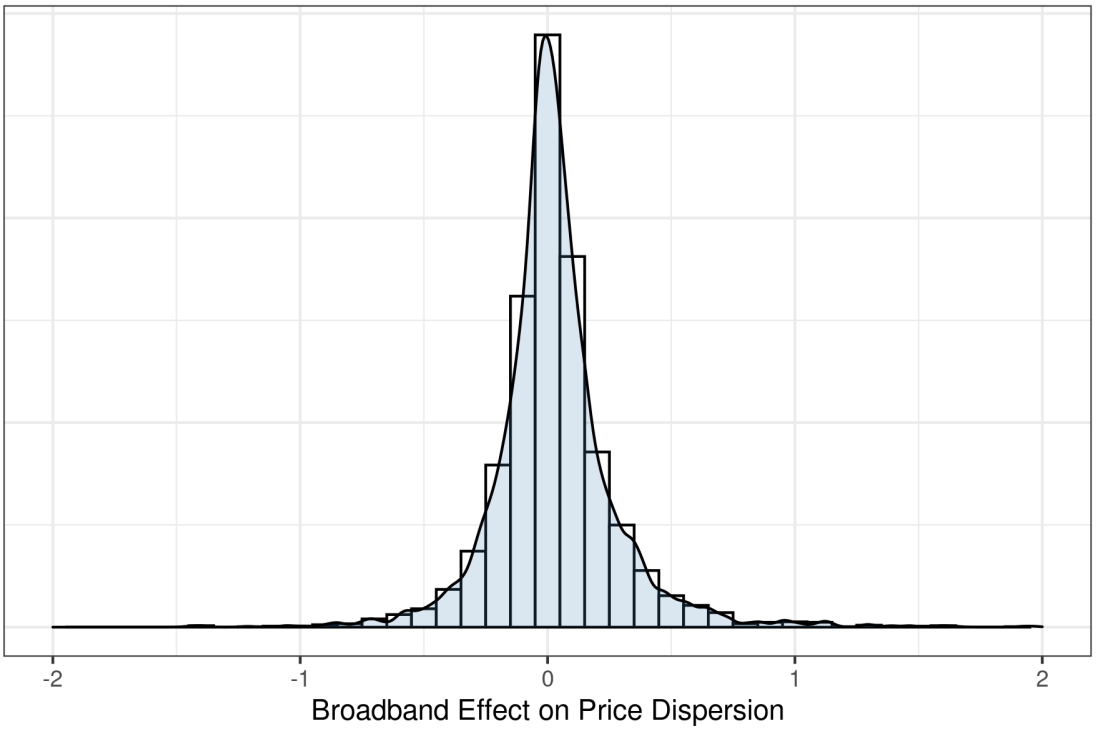

Figure 4.13: Growth in Broadband and Change in Price Dispersion

RMS data are from retail chains in different regions of the United States, and there may be evidence of retail chain level pricing. However, transacted prices due to promotions and sales often vary substantially at the store level. If broadband affected prices directly, we would expect to see these effects even at retail chains through local price promotions.

Effects on Price Dispersion

In Figure 4.13 is the distribution of broadband effect on price dispersion for brands in the sample. The distribution is centered at 0.01, the mean is 0.03. The first quartile is -0.08 and the third quartile is 0.12. Again, I document muted average changes and broadband effects, Figure 4.13 shows that there is substantial heterogeneity in the tails.

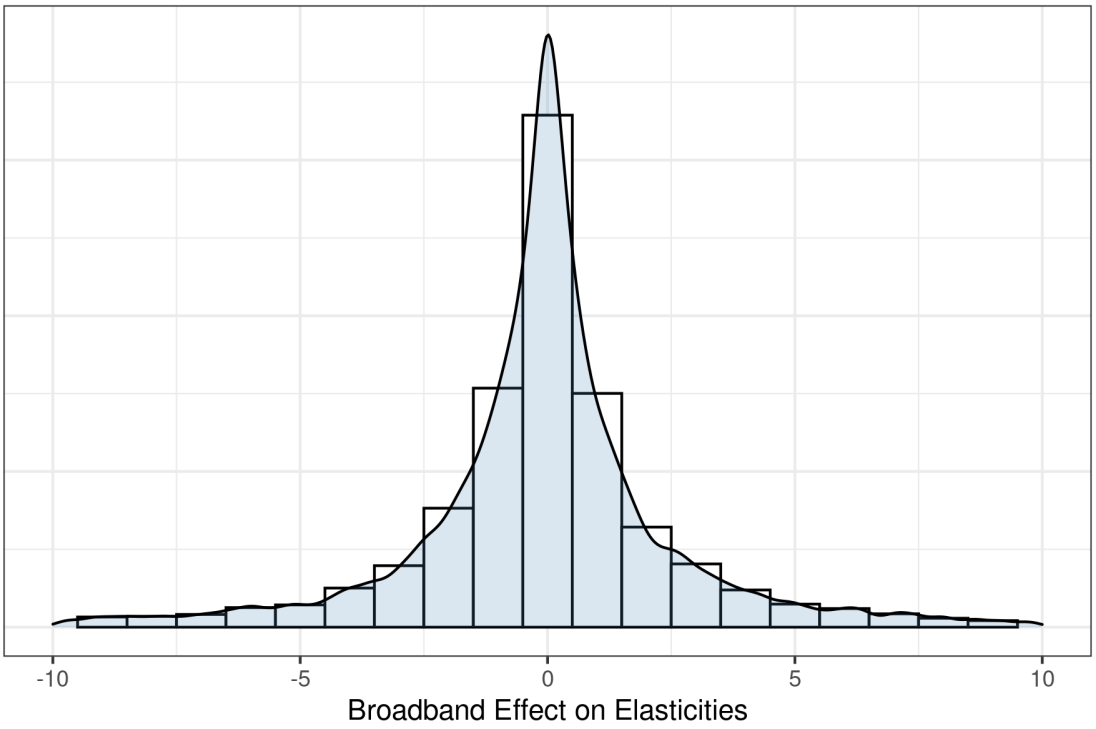

Figure 4.14: Growth in Broadband and Change in Elasticities

Effects on Demand Elasticities

In the histogram above is the distribution of broadband effect on elasticities for brands in the sample. The distribution is centered at zero, the mean is -0.06. The first quartile is -1.04 and the third quartile is 0.92. The variation in the broadband effect on elasticities is larger within categories than between categories, which suggests specific brand characteristics determine broadband effects. On one hand, the range of effects highlights the potential for publication bias depending on the product. On the other hand, these results leave considerable room for additional research on specific products and understanding the external validity limits.

CHAPTER 5

DISCUSSION AND CONCLUSION

In this paper, I study consumer behavior during the proliferation of broadband internet from 2004 to 2018 for a specific subset of US retail: brick-and-mortar grocery. I focus on seven outcomes of consumer behavior: trips, spending, unique retail chains visited, brand choice, price, price dispersion, and price elasticities. I first document trends in each measure and then estimate the direct effect of broadband internet on each outcome measure.

Counter to popular media reporting, I show that aggregate retail trends during the rise of broadband are muted in food and nonfood grocery categories. Trends in trips, spending, and unique stores visited are generally flat from 2004 to 2019. Trends for unique brands purchased are increasing in the aggregate, meaning the total number of brands available and being purchased across all households is increasing. By contrast, the number of unique brands purchased by an average household is decreasing, suggesting niche consumption. These trends do not support the hypothesis that the collapse of brick-and-mortar grocery retail is imminent.

Though these trends provide some insights on what is happening to brick-and-mortar grocery during the rise of broadband internet, they cannot speak to the direct effect of broadband internet on consumer behavior in these categories. To identify this impact, I exploit the uneven rollout of broadband internet from 2006 to 2018. Again, I see muted effects on consumer behavior. Changes in spending, trips, unique stores, and unique brands are uncorrelated with growth in broadband. Changes in prices and price dispersion are centered at zero. Interestingly, I find average elasticities do not change from 2006 to 2018 and the average effect of broadband on elasticities is near zero. This fact, however, masks substantial heterogeneity across the nearly 5,000 brands in my sample. The tails display substantial effects: the first quartile is -1.04 and the third quartile is 0.92. An important next step in this line of research is to explore the sources of heterogeneity in brands.

These results suggest the retail apocalypse is not universal. Broadband internet may be increasing consumer welfare for match value even in offline shopping, differentially affecting some brands more than others. The heterogeneity in broadband effects on brands begs the question of why some brands are affected more than others. I leave these questions for future research.

The scanner data used in the empirical analysis is an imperfect laboratory because the data used in the empirical analysis capture some, but not all, of US retail. This paper focuses on a specific subset of US retail: brick-and-mortar grocery. Future work might focus on acquiring data to better capture all of general merchandise, offering a sharper test for the most-affected category groups. Additional insights can be gained from using more general retail data.

REFERENCES

Ackerberg, D. A. (2001). Empirically distinguishing informative and prestige effects of advertising. *RAND Journal of Economics*, 316–333.

Akturk, M. S. and M. Ketzenberg (2021). Exploring the competitive dimension of omnichannel retailing. *Management Science*.

Amaldoss, W. and C. He (2010). Product variety, informative advertising, and price competition. *Journal of Marketing Research 47*(1), 146–156.

Bell, D. R., S. Gallino, and A. Moreno (2018). Offline showrooms in omnichannel retail: Demand and operational benefits. *Management Science 64*(4), 1629–1651.

Beraja, M., E. Hurst, and J. Ospina (2019). The aggregate implications of regional business cycles. *Econometrica 87*(6), 1789–1833.

Berry, S., J. Levinsohn, and A. Pakes (1995). Automobile prices in market equilibrium. *Econometrica 63*(4).

Brand, J. (2021). Differences in differentiation: Rising variety and markups in retail food stores. Working paper, Social Science Research Network.

Brown, J. R. and A. Goolsbee (2002). Does the Internet make markets more competitive? Evidence from the life insurance industry. *Journal of Political Economy 110*(3), 481–507.

Brynjolfsson, E., Y. Hu, and D. Simester (2011). Goodbye Pareto principle, hello long tail: The effect of search costs on the concentration of product sales. *Management Science 57*(8), 1373–1386.

Chandra, A., A. Finkelstein, A. Sacarny, and C. Syverson (2016). Health care exceptionalism? Performance and allocation in the US health care sector. *American Economic Review 106*(8).

Chetty, R., J. Friedman, and J. Rockoff (2014). Measuring the impacts of teachers I: Evaluating bias in teacher value-added estimates. *American Economic Review 104*(9).

Clemons, E. K., I.-H. Hann, and L. M. Hitt (2002). Price dispersion and differentiation in online travel: An empirical investigation. *Management Science 48*(4), 534–549.

Das, G., S. P. Jain, D. Maheswaran, R. J. Slotegraaf, and R. Srinivasan (2021). Pandemics and marketing: Insights, impacts, and research opportunities. *Journal of the Academy of Marketing Science*, 1–20.

DellaVigna, S. and M. Gentzkow (2019). Uniform pricing in US retail chains. *Quarterly Journal of Economics 134*, 2011–2084.

Dinerstein, M., L. Einav, J. Levin, and N. Sundaresan (2018). Consumer price search and platform design in internet commerce. *American Economic Review 108*(7), 1820–59.

Döpper, H., A. MacKay, N. Miller, and J. Stiebale (2021). Rising markups and the role of consumer preferences. Working paper, Social Science Research Network.

Ellison, G. and S. F. Ellison (2009). Search, obfuscation, and price elasticities on the Internet. *Econometrica 77*(2), 427–452.

Gao, F., V. V. Agrawal, and S. Cui (2021). The effect of multichannel and omnichannel retailing on physical stores. *Management Science*.

Gao, F. and X. Su (2017). Omnichannel retail operations with buy-online-and-pick-up-in-store. *Management Science 63*(8), 2478–2492.

Goldfarb, A. and C. Tucker (2019). Digital economics. *Journal of Economic Literature 57*(1), 3–43.

Griliches, Z. and J. A. Hausman (1986). Errors in variables in panel data. *Journal of Econometrics 31*(1), 93–118.

Hausman, J. (1996). Valuation of new goods under perfect and imperfect competition. *The Economics of New Goods*.

Helm, S., S. H. Kim, and S. Van Riper (2020). Navigating the 'retail apocalypse': A framework of consumer evaluations of the new retail landscape. *Journal of Retailing and Consumer Services 54*, 101683.

Hitsch, G. J., A. Hortaçsu, and X. Lin (2021). Prices and promotions in US retail markets. *Quantitative Marketing and Economics*, 1–80.

Hortaçsu, A. and C. Syverson (2015). The ongoing evolution of US retail: A format tug-of-war. *Journal of Economic Perspectives*, 89–112.

Kahn, B. E. and D. C. Schmittlein (1989). Shopping trip behavior: An empirical investigation. *Marketing Letters 1*(1), 55–69.

Kane, T. and D. Staiger (2008). Estimating teacher impacts on student achievement: An experimental evaluation. Working paper, National Bureau of Economic Research.

King, G., J. Honaker, A. Joseph, and K. Scheve (2001). Analyzing incomplete political science data: An alternative algorithm for multiple imputation. *American Political Science Review 95*(1), 49–69.

Knittel, C. and K. Metaxoglou (2014). Estimation of random-coefficient demand models: Two empiricists' perspective. *Review of Economics and Statistics 96*(1).

Kolko, J. (2012). Broadband and local growth. *Journal of Urban Economics 71*(1), 100–113.

Lelkes, Y., G. Sood, and S. Iyengar (2017). The hostile audience: The effect of access to broadband internet on partisan affect. *American Journal of Political Science 61*(1), 5–20.

Long, F., K. Jerath, and M. Sarvary (2021). Designing an online retail marketplace: Leveraging information from sponsored advertising. *Marketing Science*.

Mack, E. A., E. Helderop, K. Ma, T. H. Grubesic, J. Mann, S. Loveridge, and R. Maciejewski (2021). A broadband integrated time series (bits) for longitudinal analyses of the digital divide. *PloS one 16*(5), e0250732.

Mende, M. (2019). Retail apocalypse or golden opportunity for retail frontline management? *Journal of Retailing 95*(2), 84.

Morris, C. (1983). Parametric empirical bayes inference: Theory and applications. *Journal of the American Statistical Association 78*(381), 47–55.

Neiman, B. and J. Vavra (2021). The rise of niche consumption. Working paper, National Bureau of Economic Research.

Oster, E. (2019). Unobservable selection and coefficient stability: Theory and evidence. *Journal of Business and Economic Statistics 37*(2), 187–204.

Rosenthal-Kay, J., J. Traina, and U. Tran (2021). Seven million demand elasticities. Working paper, Social Science Research Network.

Shapiro, B. T., G. J. Hitsch, and A. E. Tuchman (2021). TV advertising effectiveness and profitability: Generalizable results from 288 brands. *Econometrica*.

Spence, F. and U. Tran (2018). Does information mitigate behavioral gaps due to market inexperience? Evidence from a field experiment. Working paper, Social Science Research Network.

Ward, M. R. and M. J. Lee (2000). Internet shopping, consumer search and product branding. *Journal of Product & Brand Management*.

Zettelmeyer, F., F. S. Morton, and J. Silva-Risso (2006). How the Internet lowers prices: Evidence from matched survey and automobile transaction data. *Journal of Marketing Research 43*(2), 168–181.

APPENDIX A

ESTIMATED ANNUAL RETAIL TRADE SALES

The data used from HMS and RMS come from the Kilts Center. The variables constructed use all the products included in the Nielsen-tracked categories of food and nonfood items. Products include purchases across all retail outlets in all markets, even products not explicitly in RMS. Though HMS and RMS data are extensive, the data does not cover the entire retail sector. Below is a breakdown of the US retail sector to provide additional context.

I calculate the following tables using data from US Census Retail E-stats. Table A.1, shows the percent of e-commerce for each industry from 2004 to 2019. I computed shares of e-commerce for each product category by dividing the sum of all e-commerce sales by the total sales for the category.

The 'Total Retail' column indicates that there has been a steady increase in e-commerce across all product categories, however the growth has been slow and is consistent with the central finding of this paper. Similarly, the 'Food & b beverage' and 'Health & personal care' columns indicates slow growth in these industries. Finally, the most notable growth in e-commerce is the last column, 'Nonstore retailer'. Even the nature of these retailers, the percent of e-commerce sales, is unsurprising. I note, however, that the Nonstore retailer industry is still a small share of overall retail.

	Total Retail	Motor vehicle & parts	Furniture & home furnishings	Electronics & appliance	Building materials equip. & supplies	Food & beverage	Health & personal care	Clothing & accessories	Sporting goods & books, etc	Miscellaneous	Nonstore retailers
2019	10.69%	3.44%	1.79%	2.01%	0.58%	1.07%	0.28%	4.69%	3.96%	3.97%	65.51%
2018	9.63%	3.15%	1.68%	1.99%	0.57%	0.63%	0.27%	4.20%	3.46%	3.65%	64.69%
2017	8.79%	2.82%	1.57%	2.04%	0.57%	0.46%	0.32%	3.59%	2.98%	3.20%	63.07%
2016	7.91%	2.71%	1.18%	2.03%	0.55%	0.33%	0.27%	3.13%	2.69%	3.04%	60.58%
2015	7.15%	2.74%	0.93%	1.79%	0.47%	0.26%	0.22%	3.00%	2.46%	2.83%	57.72%
2014	6.42%	2.70%	0.79%	1.64%	0.43%	0.23%	0.26%	2.46%	2.63%	2.56%	54.39%
2013	5.86%	2.73%	0.71%	1.47%	0.39%	0.19%	0.21%	1.90%	2.40%	2.29%	51.31%
2012	5.40%	2.66%	0.55%	1.43%	0.35%	0.18%	0.17%	1.53%	2.08%	2.07%	48.14%
2011	4.88%	2.55%	0.46%	1.39%	0.30%	0.13%	0.18%	1.16%	2.12%	1.85%	45.07%
2010	4.45%	2.43%	0.38%	1.22%	0.26%	0.12%	0.13%	0.90%	1.96%	1.64%	42.08%
2009	4.03%	2.25%	0.37%	1.09%	0.22%	0.11%	0.09%	0.88%	1.75%	1.42%	39.47%
2008	3.60%	2.22%	0.36%	1.08%	0.22%	0.12%	0.08%	0.77%	1.57%	1.40%	36.50%
2007	3.42%	2.37%	0.34%	1.06%	0.20%	0.15%	0.10%	0.65%	1.34%	1.26%	34.84%
2006	2.93%	2.09%	0.33%	0.92%	0.15%	0.13%	0.11%	0.55%	1.25%	1.10%	31.01%
2005	2.48%	1.81%	0.32%	1.06%	0.16%	0.09%	N/A	0.62%	1.01%	0.99%	27.16%
2004	2.09%	1.51%	0.32%	1.12%	0.15%	0.08%	N/A	0.59%	0.86%	0.84%	23.70%

Table A.1: Industry-Specific E-Commerce Share of Total Sales

	Total Retail	Motor vehicle & parts	Furniture & home furnishings	Electronics & appliance	Building materials equip. & supplies	Food & beverage	Health & personal care	Clothing & accessories	Sporting goods & books, etc	Miscellaneous	Nonstore retailers
2019	$5,411,037	22.91%	2.23%	1.67%	6.88%	14.30%	6.33%	4.97%	1.49%	2.43%	14.08%
2018	$5,253,037	22.94%	2.27%	1.79%	6.97%	14.28%	6.43%	5.08%	1.54%	2.44%	12.87%
2017	$5,040,214	23.52%	2.29%	1.83%	6.93%	14.46%	6.43%	5.19%	1.66%	2.44%	12.07%
2016	$4,848,213	23.76%	2.32%	1.94%	6.97%	14.48%	6.58%	5.39%	1.78%	2.49%	11.22%
2015	$4,728,119	23.35%	2.28%	2.12%	6.85%	14.54%	6.55%	5.43%	1.81%	2.51%	10.54%
2014	$4,641,927	22.12%	2.17%	2.22%	6.75%	14.45%	6.37%	5.41%	1.80%	2.48%	10.00%
2013	$4,459,848	21.57%	2.15%	2.32%	6.72%	14.38%	6.28%	5.49%	1.86%	2.51%	9.64%
2012	$4,302,229	20.61%	2.13%	2.41%	6.54%	14.60%	6.37%	5.57%	1.89%	2.56%	9.49%
2011	$4,102,952	19.81%	2.13%	2.49%	6.57%	14.85%	6.62%	5.57%	1.92%	2.64%	9.17%
2010	$3,818,048	19.46%	2.23%	2.61%	6.82%	15.20%	6.82%	5.59%	2.05%	2.73%	8.93%
2009	$3,612,471	18.60%	2.35%	2.71%	7.24%	15.73%	7.00%	5.66%	2.15%	2.82%	8.61%
2008	$3,935,315	19.97%	2.51%	2.75%	7.67%	14.47%	6.27%	5.48%	2.05%	2.81%	8.11%
2007	$3,995,182	22.78%	2.78%	2.76%	8.03%	13.71%	5.94%	5.54%	2.03%	2.91%	7.73%
2006	$3,871,573	23.25%	2.91%	2.84%	8.63%	13.57%	5.77%	5.51%	2.03%	2.94%	7.34%
2005	$3,689,283	24.08%	2.96%	2.88%	8.70%	13.78%	5.69%	5.45%	2.04%	2.91%	6.93%
2004	$3,473,048	24.95%	2.99%	2.88%	8.50%	14.12%	5.74%	5.48%	2.11%	3.00%	6.59%

Table A.2: Industry-Specific Share of Total Sales

Table A.2 shows the change in industry-specific retail sales across channels (e-commerce and not). Nonstore retailers sales from 6.59% of all retails sale to 14.08% of all retail sales. Industries that are more e-commerce intensive are media based industries: music, video, books, magazine, etc. Computer hardware and software, toys and other hobby categories are close to follow. These statistics suggest that though the retail apocalypse is not universally affecting retailers in the main analysis, that there are unsurprisingly large effects for retailers who exclusively offer products in these industry categories.

To evaluate how much HMS may be over-weighting the food and beverage categories, I calculate the proportion of spending in each of the categories in HMS and compare them to similar breakdowns in the Census data. First, I focus on the categories that are relevant to this study. I exclude "Motor vehicle and parts dealers," "Furniture and home furnishings stores," "Building material and garden equipment and supplies dealers," "Gasoline stations," and "Nonstore retailers" to get an estimate of brick-and-mortar stores that may be susceptible to the retail apocalypse. Next, I sum up all the spending in the remaining categories and designate them to one of three categories: (I) Health and Beauty, (II) Food and Beverage, and (III) General Merchandise.

Similarly, I sum up spending in the HMS data. In these data, I sum spending by department code. Department codes are as follows: (0) Health and Beauty Aids, (1) Dry Grocery, (2) Frozen Foods, (3) Dairy, (4) Deli, (5) Packaged Meat, (6) Fresh Produce, (7) Nonfood

Category	HMS	Census
Health and Beauty	10%	14%
Food and Beverage	65%	32%
General Merchandise	25%	54%

Table A.3: HMS versus Census

Grocery, (8) Alcohol, (9) General Merchandise, and (99) Magnet Data Products. I map these 11 categories into the three above. Health and Beauty (0) is mapped to Health and Beauty (I). All food and beverage department codes in HMS (1, 2, 3, 4, 5, 6, 8, and 99) are mapped to Food and Beverage (II). Finally, all remaining HMS department codes (7 and 9) are mapped to General Merchandise (III).

I did this analysis for 2012 because it is a Census year and data is less likely to be heavily imputed. Additionally, because the purpose of this exercise is to determine how much HMS may be over-weighting some categories rather than examining particularly trends, a cross-section is sufficient. The proportion of sales for each category in 2012 are as follows:

As a thought experiment, if we assume that HMS is capturing 100% of the Food and Beverage category, then a back of the envelope calculation would be that HMS may be capturing about 23% of General merchandise. This can help provide additional context on how externally valid these results are outside the HMS data.

APPENDIX B

LIST OF PRODUCT CATEGORIES

Table B.1: Products Categorization

	Category	Category Description	Product Group	Product Group Description	Department	Department Description
1	1004	CONFECTIONERY PASTE	503	CANDY	1	DRY GROCERY
2	1030	FRUIT DRINKS & JUICES-CRANBERRY	507	JUICE, DRINKS - CANNED, BOTTLED	1	DRY GROCERY
3	1031	CIDER	507	JUICE, DRINKS - CANNED, BOTTLED	1	DRY GROCERY
4	1032	FRUIT JUICE - GRAPEFRUIT - OTHER CONTAINERS	507	JUICE, DRINKS - CANNED, BOTTLED	1	DRY GROCERY
5	1033	FRUIT JUICE - APPLE	507	JUICE, DRINKS - CANNED, BOTTLED	1	DRY GROCERY
6	1034	FRUIT JUICE - GRAPE	507	JUICE, DRINKS - CANNED, BOTTLED	1	DRY GROCERY
7	1035	FRUIT JUICE-GRAPEFRUIT-CANNED	507	JUICE, DRINKS - CANNED, BOTTLED	1	DRY GROCERY
8	1036	FRUIT JUICE - LEMON/LIME	507	JUICE, DRINKS - CANNED, BOTTLED	1	DRY GROCERY
9	1037	FRUIT JUICE-ORANGE-CANNED	507	JUICE, DRINKS - CANNED, BOTTLED	1	DRY GROCERY
10	1038	FRUIT JUICE - PINEAPPLE	507	JUICE, DRINKS - CANNED, BOTTLED	1	DRY GROCERY
11	1039	FRUIT JUICE-PRUNE	507	JUICE, DRINKS - CANNED, BOTTLED	1	DRY GROCERY
12	1040	FRUIT JUICE - ORANGE - OTHER CONTAINER	507	JUICE, DRINKS - CANNED, BOTTLED	1	DRY GROCERY
13	1041	FRUIT DRINKS-CANNED	507	JUICE, DRINKS - CANNED, BOTTLED	1	DRY GROCERY
14	1042	FRUIT DRINKS-OTHER CONTAINER	507	JUICE, DRINKS - CANNED, BOTTLED	1	DRY GROCERY
15	1044	FRUIT JUICE-REMAINING	507	JUICE, DRINKS - CANNED, BOTTLED	1	DRY GROCERY
16	1045	FRUIT JUICE-NECTARS	507	JUICE, DRINKS - CANNED, BOTTLED	1	DRY GROCERY
17	1046	FRUIT PUNCH BASES & SYRUPS	1,508	SOFT DRINKS-NON-CARBONATED	1	DRY GROCERY
18	1048	BREAKFAST DRINKS - POWDERED	1,508	SOFT DRINKS-NON-CARBONATED	1	DRY GROCERY
19	1049	REMAINING DRINKS & SHAKES-NON REFRIGERATED	1,508	SOFT DRINKS-NON-CARBONATED	1	DRY GROCERY
20	1050	SOFT DRINKS - POWDERED	1,508	SOFT DRINKS-NON-CARBONATED	1	DRY GROCERY
21	1051	CLAM JUICE	507	JUICE, DRINKS - CANNED, BOTTLED	1	DRY GROCERY
22	1052	ICE POPS - UNFROZEN	1,508	SOFT DRINKS-NON-CARBONATED	1	DRY GROCERY
23	1054	VEGETABLE JUICE - TOMATO	507	JUICE, DRINKS - CANNED, BOTTLED	1	DRY GROCERY
24	1055	VEGETABLE JUICE AND DRINK REMAINING	507	JUICE, DRINKS - CANNED, BOTTLED	1	DRY GROCERY
25	1184	DIP - MIXES	1,507	SNACKS	1	DRY GROCERY
26	1185	DIP - CANNED	1,507	SNACKS	1	DRY GROCERY
27	1191	COOKING SPRAYS	1,016	SHORTENING, OIL	1	DRY GROCERY
28	1192	SALAD AND COOKING OIL	1,016	SHORTENING, OIL	1	DRY GROCERY
29	1193	OLIVE OIL	1,016	SHORTENING, OIL	1	DRY GROCERY
30	1196	SHORTENING	1,016	SHORTENING, OIL	1	DRY GROCERY
31	1270	SNACKS - PORK RINDS	1,507	SNACKS	1	DRY GROCERY
32	1271	SNACKS - MEAT	1,507	SNACKS	1	DRY GROCERY
33	1272	BABY MILK AND MILK FLAVORING	501	BABY FOOD	1	DRY GROCERY
34	1274	BABY CEREAL & BISCUITS	501	BABY FOOD	1	DRY GROCERY
35	1277	BABY JUICE	501	BABY FOOD	1	DRY GROCERY
36	1282	BABY FOOD - JUNIOR	501	BABY FOOD	1	DRY GROCERY
37	1290	SOUP-CANNED	513	SOUP	1	DRY GROCERY
38	1292	STEW MIXES - DRY	513	SOUP	1	DRY GROCERY
39	1293	SOUP MIXES - DRY & BASES	513	SOUP	1	DRY GROCERY
40	1295	BOUILLON	513	SOUP	1	DRY GROCERY
41	1299	PET CARE - DOMESTIC BIRD FOOD	508	PET FOOD	1	DRY GROCERY
42	1300	PET CARE - WILD BIRD FOOD	508	PET FOOD	1	DRY GROCERY
43	1301	PET CARE - PET FOOD	508	PET FOOD	1	DRY GROCERY
44	1303	CAT FOOD - WET TYPE	508	PET FOOD	1	DRY GROCERY
45	1304	CAT FOOD - MOIST TYPE	508	PET FOOD	1	DRY GROCERY
46	1306	CAT FOOD - DRY TYPE	508	PET FOOD	1	DRY GROCERY
47	1309	DOG FOOD - WET TYPE	508	PET FOOD	1	DRY GROCERY
48	1310	DOG FOOD - MOIST TYPE	508	PET FOOD	1	DRY GROCERY
49	1311	DOG FOOD - DRY TYPE	508	PET FOOD	1	DRY GROCERY
50	1313	DOG & CAT TREATS	508	PET FOOD	1	DRY GROCERY
51	1318	SNACKS - PUFFED CHEESE	1,507	SNACKS	1	DRY GROCERY
52	1323	SNACKS - POTATO CHIPS	1,507	SNACKS	1	DRY GROCERY
53	1324	SNACKS - POTATO STICKS	1,507	SNACKS	1	DRY GROCERY
54	1325	SNACKS - CORN CHIPS	1,507	SNACKS	1	DRY GROCERY
55	1326	SNACKS - TORTILLA CHIPS	1,507	SNACKS	1	DRY GROCERY
56	1327	SNACKS - REMAINING	1,507	SNACKS	1	DRY GROCERY
57	1328	POPCORN - POPPED	1,507	SNACKS	1	DRY GROCERY
58	1329	POPCORN - UNPOPPED	1,507	SNACKS	1	DRY GROCERY
59	1330	SNACKS - PRETZEL	1,507	SNACKS	1	DRY GROCERY
60	1332	SNACKS - CARAMEL CORN	1,507	SNACKS	1	DRY GROCERY
61	1333	SNACKS - VARIETY PACKS	1,507	SNACKS	1	DRY GROCERY
62	1338	INSTANT MEALS	513	SOUP	1	DRY GROCERY
63	1341	CRACKERS - SANDWICH & SNACK PACKS	1,507	SNACKS	1	DRY GROCERY
64	1344	CEREAL - READY TO EAT	1,005	CEREAL	1	DRY GROCERY

	Category	Category Description	Product Group	Product Group Description	Department	Department Description
65	1346	CEREAL - GRANOLA & NATURAL TYPES	1,005	CEREAL	1	DRY GROCERY
66	1348	CEREAL - HOT	1,005	CEREAL	1	DRY GROCERY
67	1349	WHEAT GERM	1,005	CEREAL	1	DRY GROCERY
68	1362	COOKIES	1,505	COOKIES	1	DRY GROCERY
69	1365	ICE CREAM CONES & CUPS	1,505	COOKIES	1	DRY GROCERY
70	1366	HOMINY GRITS	1,005	CEREAL	1	DRY GROCERY
71	1422	TRAIL MIXES	1,507	SNACKS	1	DRY GROCERY
72	1452	SNACKS - HEALTH BARS & STICKS	1,507	SNACKS	1	DRY GROCERY
73	1463	GROUND AND WHOLE BEAN COFFEE	1,006	COFFEE	1	DRY GROCERY
74	1464	COFFEE - SOLUBLE FLAVORED	1,006	COFFEE	1	DRY GROCERY
75	1465	COFFEE - SOLUBLE	1,006	COFFEE	1	DRY GROCERY
76	1466	COFFEE - LIQUID	1,006	COFFEE	1	DRY GROCERY
77	1467	COFFEE SUBSTITUTES	1,006	COFFEE	1	DRY GROCERY
78	1481	COCKTAIL PRODUCTS-BITTERS & HEADS	1,508	SOFT DRINKS-NON-CARBONATED	1	DRY GROCERY
79	1482	COCKTAIL MIXES-LIQUID	1,508	SOFT DRINKS-NON-CARBONATED	1	DRY GROCERY
80	1483	COCKTAIL MIXES-DRY	1,508	SOFT DRINKS-NON-CARBONATED	1	DRY GROCERY
81	1484	SOFT DRINKS - CARBONATED	1,503	CARBONATED BEVERAGES	1	DRY GROCERY
82	1487	WATER-BOTTLED	1,508	SOFT DRINKS-NON-CARBONATED	1	DRY GROCERY
83	1489	BREATH SWEETENERS	503	CANDY	1	DRY GROCERY
84	1490	COUGH DROPS	6,003	COUGH AND COLD REMEDIES	0	HEALTH & BEAUTY CARE
85	1491	CANDY-HARD ROLLED	503	CANDY	1	DRY GROCERY
86	1492	CANDY-CHOCOLATE-MINIATURES	503	CANDY	1	DRY GROCERY
87	1493	CANDY-CHOCOLATE	503	CANDY	1	DRY GROCERY
88	1494	CANDY-CHOCOLATE-SPECIAL	503	CANDY	1	DRY GROCERY
89	1497	CANDY-NON-CHOCOLATE-MINIATURES	503	CANDY	1	DRY GROCERY
90	1498	CANDY-NON-CHOCOLATE	503	CANDY	1	DRY GROCERY
91	1501	CANDY-LOLLIPOPS	503	CANDY	1	DRY GROCERY
92	1503	MARSHMALLOWS	503	CANDY	1	DRY GROCERY
93	1511	CANDY-KITS	503	CANDY	1	DRY GROCERY
94	1533	CANDY-DIETETIC - NON-CHOCOLATE	503	CANDY	1	DRY GROCERY
95	1536	CANDY-DIETETIC - CHOCOLATE	503	CANDY	1	DRY GROCERY
96	1553	SOFT DRINKS - LOW CALORIE	1,503	CARBONATED BEVERAGES	1	DRY GROCERY
97	2603	MEAL STARTERS	2,008	PREPARED FOODS-FROZEN	2	FROZEN FOODS
98	2606	ENTREES - REMAINING - 2 FOOD - FROZEN	2,008	PREPARED FOODS-FROZEN	2	FROZEN FOODS
99	2609	ENTREES - SEAFOOD - 2 FOOD - FROZEN	2,008	PREPARED FOODS-FROZEN	2	FROZEN FOODS
100	2611	ENTREES - MEAT - 2 FOOD - FROZEN	2,008	PREPARED FOODS-FROZEN	2	FROZEN FOODS
101	2612	ENTREES - POULTRY - 2 FOOD - FROZEN	2,008	PREPARED FOODS-FROZEN	2	FROZEN FOODS
102	2613	ENTREES - MULTI PACK - FROZEN	2,008	PREPARED FOODS-FROZEN	2	FROZEN FOODS
103	2614	ENTREES - ITALIAN - 2 FOOD - FROZEN	2,008	PREPARED FOODS-FROZEN	2	FROZEN FOODS
104	2615	DINNERS-FROZEN	2,008	PREPARED FOODS-FROZEN	2	FROZEN FOODS
105	2616	ENTREES - MEXICAN - 2 FOOD - FROZEN	2,008	PREPARED FOODS-FROZEN	2	FROZEN FOODS
106	2617	POT PIES-FROZEN	2,008	PREPARED FOODS-FROZEN	2	FROZEN FOODS
107	2619	ENTREES - MEAT - 1 FOOD - FROZEN	2,008	PREPARED FOODS-FROZEN	2	FROZEN FOODS
108	2621	ENTREES - POULTRY - 1 FOOD - FROZEN	2,008	PREPARED FOODS-FROZEN	2	FROZEN FOODS
109	2622	ENTREES - ORIENTAL - 1 FOOD - FROZEN	2,008	PREPARED FOODS-FROZEN	2	FROZEN FOODS
110	2623	ENTREES - ITALIAN - 1 FOOD - FROZEN	2,008	PREPARED FOODS-FROZEN	2	FROZEN FOODS
111	2624	ENTREES - MEXICAN - 1 FOOD - FROZEN	2,008	PREPARED FOODS-FROZEN	2	FROZEN FOODS
112	2625	ENTREES - REMAINING - 1 FOOD - FROZEN	2,008	PREPARED FOODS-FROZEN	2	FROZEN FOODS
113	2626	ENTREES - SEAFOOD - 1 FOOD - FROZEN	2,008	PREPARED FOODS-FROZEN	2	FROZEN FOODS
114	2627	ENTREES - ORIENTAL - 2 FOOD - FROZEN	2,008	PREPARED FOODS-FROZEN	2	FROZEN FOODS
115	2628	FROZEN/REFRIGERATED HORS D' OEUVRES & SNACKS	2,007	PIZZA/SNACKS/HORS DOEURVES-FRZN	2	FROZEN FOODS
116	2631	PIZZA-FROZEN	2,007	PIZZA/SNACKS/HORS DOEURVES-FRZN	2	FROZEN FOODS
117	2632	PIZZA CRUST-FROZEN	2,007	PIZZA/SNACKS/HORS DOEURVES-FRZN	2	FROZEN FOODS
118	2671	YOGURT - FROZEN	2,005	ICE CREAM, NOVELTIES	2	FROZEN FOODS
119	2672	ICE CREAM - BULK	2,005	ICE CREAM, NOVELTIES	2	FROZEN FOODS
120	2673	ICE MILK AND SHERBET	2,005	ICE CREAM, NOVELTIES	2	FROZEN FOODS
121	2675	FROZEN NOVELTIES	2,005	ICE CREAM, NOVELTIES	2	FROZEN FOODS
122	2692	PASTA-PLAIN-FROZEN	2,008	PREPARED FOODS-FROZEN	2	FROZEN FOODS
123	2693	CORN DOGS-FROZEN/REFRIGERATED	2,008	PREPARED FOODS-FROZEN	2	FROZEN FOODS
124	2694	SOUP-FROZEN-REFRIGERATED	2,008	PREPARED FOODS-FROZEN	2	FROZEN FOODS
125	2695	SAUCES & GRAVIES-FROZEN/REFRIGERATED	2,008	PREPARED FOODS-FROZEN	2	FROZEN FOODS
126	3360	PASTA - REFRIGERATED	3,001	DRESSINGS/SALADS/PREP FOODS-DELI	4	DELI
127	3544	PRECUT FRESH SALAD MIX	3,001	DRESSINGS/SALADS/PREP FOODS-DELI	4	DELI
128	3545	CHEESE-NATURAL-MUENSTER	2,502	CHEESE	3	DAIRY

	Category	Category Description	Product Group	Product Group Description	Department	Department Description
129	3546	CHEESE - NATURAL - MOZZARELLA	2,502	CHEESE	3	DAIRY
130	3547	CHEESE - NATURAL - BRICK	2,502	CHEESE	3	DAIRY
131	3548	CHEESE - NATURAL - REMAINING	2,502	CHEESE	3	DAIRY
132	3549	CHEESE - NATURAL - AMERICAN COLBY	2,502	CHEESE	3	DAIRY
133	3550	CHEESE - NATURAL - AMERICAN CHEDDAR	2,502	CHEESE	3	DAIRY
134	3553	CHEESE - GRATED	2,502	CHEESE	3	DAIRY
135	3554	CHEESE - PROCESSED SLICES - REMAINING	2,502	CHEESE	3	DAIRY
136	3555	CHEESE - PROCESSED - LOAVES	2,502	CHEESE	3	DAIRY
137	3556	CHEESE - PROCESSED - SNACK	2,502	CHEESE	3	DAIRY
138	3560	FRUIT-REFRIGERATED	3,001	DRESSINGS/SALADS/PREP FOODS-DELI	4	DELI
139	3562	GELATIN SALADS-REFRIGERATED	3,001	DRESSINGS/SALADS/PREP FOODS-DELI	4	DELI
140	3563	FRUIT SALADS-REFRIGERATED	3,001	DRESSINGS/SALADS/PREP FOODS-DELI	4	DELI
141	3564	REMAINING-READY MADE SALADS	3,001	DRESSINGS/SALADS/PREP FOODS-DELI	4	DELI
142	3565	SAUERKRAUT-REFRIGERATED	3,001	DRESSINGS/SALADS/PREP FOODS-DELI	4	DELI
143	3567	BRATWURST & KNOCKWURST	3,002	PACKAGED MEATS-DELI	5	PACKAGED MEAT
144	3568	SALAD DRESSING-REFRIGERATED	3,001	DRESSINGS/SALADS/PREP FOODS-DELI	4	DELI
145	3569	MEAT & SANDWICH SPREADS-REFRIGERATED	3,001	DRESSINGS/SALADS/PREP FOODS-DELI	4	DELI
146	3571	HORSERADISH	3,001	DRESSINGS/SALADS/PREP FOODS-DELI	4	DELI
147	3572	SAUSAGE-DINNER	3,002	PACKAGED MEATS-DELI	5	PACKAGED MEAT
148	3573	CHILI-REFRIGERATED	3,001	DRESSINGS/SALADS/PREP FOODS-DELI	4	DELI
149	3574	LUNCHMEAT-SLICED-REFRIGERATED	3,002	PACKAGED MEATS-DELI	5	PACKAGED MEAT
150	3576	FRANKFURTERS-REFRIGERATED	3,002	PACKAGED MEATS-DELI	5	PACKAGED MEAT
151	3577	BACON-REFRIGERATED	3,002	PACKAGED MEATS-DELI	5	PACKAGED MEAT
152	3578	SAUSAGE-BREAKFAST	3,002	PACKAGED MEATS-DELI	5	PACKAGED MEAT
153	3580	ENTREES-REFRIGERATED	3,001	DRESSINGS/SALADS/PREP FOODS-DELI	4	DELI
154	3581	HAM-CANNED-REFRIGERATED	3,002	PACKAGED MEATS-DELI	5	PACKAGED MEAT
155	3582	FRANKS-COCKTAIL-REFRIGERATED	3,002	PACKAGED MEATS-DELI	5	PACKAGED MEAT
156	3584	BACON-BEEF & CANNED	3,002	PACKAGED MEATS-DELI	5	PACKAGED MEAT
157	3585	HAM PATTIES-CANNED	3,002	PACKAGED MEATS-DELI	5	PACKAGED MEAT
158	3586	CHEESE-PROCESSED SLICES-AMERICAN	2,502	CHEESE	3	DAIRY
159	3587	CHEESE-NATURAL-SWISS	2,502	CHEESE	3	DAIRY
160	3588	CHEESE - SPECIALTY/IMPORTED	2,502	CHEESE	3	DAIRY
161	3589	CHEESE - NATURAL - VARIETY PACK	2,502	CHEESE	3	DAIRY
162	3590	CHEESE - SHREDDED	2,502	CHEESE	3	DAIRY
163	3592	DAIRY-FLAVORED MILK-REFRIGERATED	2,506	MILK	3	DAIRY
164	3597	SANDWICHES-REFRIGERATED/FROZEN	3,001	DRESSINGS/SALADS/PREP FOODS-DELI	4	DELI
165	3598	COMBINATION LUNCHES	3,001	DRESSINGS/SALADS/PREP FOODS-DELI	4	DELI
166	3601	CRACKLINS - REFRIGERATED	3,001	DRESSINGS/SALADS/PREP FOODS-DELI	4	DELI
167	3603	YOGURT-REFRIGERATED	2,510	YOGURT	3	DAIRY
168	3606	CHEESE - PROCESSED - CREAM CHEESE	2,502	CHEESE	3	DAIRY
169	3610	LARD	1,016	SHORTENING, OIL	1	DRY GROCERY
170	3612	YOGURT-REFRIGERATED-SHAKES & DRINKS	2,510	YOGURT	3	DAIRY
171	3616	PIZZA-REFRIGERATED	3,001	DRESSINGS/SALADS/PREP FOODS-DELI	4	DELI
172	3617	LUNCHMEAT-NONSLICED-REFRIGERATED	3,002	PACKAGED MEATS-DELI	5	PACKAGED MEAT
173	3618	LUNCHMEAT-DELI POUCHES-REFRIGERATED	3,002	PACKAGED MEATS-DELI	5	PACKAGED MEAT
174	3625	DAIRY-MILK-REFRIGERATED	2,506	MILK	3	DAIRY
175	3626	DAIRY-BUTTERMILK-REFRIGERATED	2,506	MILK	3	DAIRY
176	3627	DAIRY-CREAM-REFRIGERATED	2,506	MILK	3	DAIRY
177	3628	REMAINING DRINKS & SHAKES-REFRIGERATED	2,506	MILK	3	DAIRY
178	3650	EGGNOG - FRESH & CANNED	2,506	MILK	3	DAIRY
179	4000	BAKERY - BREAD - FRESH	1,501	BREAD AND BAKED GOODS	1	DRY GROCERY
180	4001	BAKERY-BUNS-FRESH	1,501	BREAD AND BAKED GOODS	1	DRY GROCERY
181	4002	BAKERY-ROLLS-FRESH	1,501	BREAD AND BAKED GOODS	1	DRY GROCERY
182	4003	BAKERY-MUFFINS-FRESH	1,501	BREAD AND BAKED GOODS	1	DRY GROCERY
183	4004	BAKERY-CAKES-FRESH	1,501	BREAD AND BAKED GOODS	1	DRY GROCERY
184	4005	BAKERY-BREAKFAST CAKES/SWEET ROLLS-FRESH	1,501	BREAD AND BAKED GOODS	1	DRY GROCERY
185	4006	BAKERY-DOUGHNUTS-FRESH	1,501	BREAD AND BAKED GOODS	1	DRY GROCERY
186	4007	BAKERY-PIES-FRESH	1,501	BREAD AND BAKED GOODS	1	DRY GROCERY
187	4008	BAKERY-BAGELS-FRESH	1,501	BREAD AND BAKED GOODS	1	DRY GROCERY
188	4009	BAKERY-BISCUITS-FRESH	1,501	BREAD AND BAKED GOODS	1	DRY GROCERY
189	4010	FRESH APPLES	4,001	FRESH PRODUCE	6	FRESH PRODUCE
190	4011	BAKERY - REMAINING - FRESH	1,501	BREAD AND BAKED GOODS	1	DRY GROCERY
191	4012	BAKERY-CHEESECAKE-FRESH	1,501	BREAD AND BAKED GOODS	1	DRY GROCERY
192	4015	FRESH SPROUTS	4,001	FRESH PRODUCE	6	FRESH PRODUCE

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193	4020	FRESH HERBS	4,001	FRESH PRODUCE	6	FRESH PRODUCE
194	4023	FRESH MUSHROOMS	4,001	FRESH PRODUCE	6	FRESH PRODUCE
195	4050	FRESH CARROTS	4,001	FRESH PRODUCE	6	FRESH PRODUCE
196	4055	FRESH CAULIFLOWER	4,001	FRESH PRODUCE	6	FRESH PRODUCE
197	4060	FRESH CELERY	4,001	FRESH PRODUCE	6	FRESH PRODUCE
198	4085	FRESH CRANBERRIES	4,001	FRESH PRODUCE	6	FRESH PRODUCE
199	4100	EGGS-FRESH	2,505	EGGS	3	DAIRY
200	4140	FRESH GARLIC	4,001	FRESH PRODUCE	6	FRESH PRODUCE
201	4180	FRESH GRAPEFRUIT	4,001	FRESH PRODUCE	6	FRESH PRODUCE
202	4225	FRESH FRUIT-REMAINING	4,001	FRESH PRODUCE	6	FRESH PRODUCE
203	4230	FRESH KIWI	4,001	FRESH PRODUCE	6	FRESH PRODUCE
204	4275	FRESH LETTUCE	4,001	FRESH PRODUCE	6	FRESH PRODUCE
205	4280	FRESH VEGETABLES-REMAINING	4,001	FRESH PRODUCE	6	FRESH PRODUCE
206	4350	FRESH ONIONS	4,001	FRESH PRODUCE	6	FRESH PRODUCE
207	4355	FRESH ORANGES	4,001	FRESH PRODUCE	6	FRESH PRODUCE
208	4400	FRESH POTATOES	4,001	FRESH PRODUCE	6	FRESH PRODUCE
209	4415	FRESH RADISHES	4,001	FRESH PRODUCE	6	FRESH PRODUCE
210	4460	FRESH SPINACH	4,001	FRESH PRODUCE	6	FRESH PRODUCE
211	4470	FRESH STRAWBERRIES	4,001	FRESH PRODUCE	6	FRESH PRODUCE
212	4475	FRESH TOMATOES	4,001	FRESH PRODUCE	6	FRESH PRODUCE
213	5000	BEER	5,001	BEER	8	ALCOHOLIC BEVERAGES
214	5001	NEAR BEER/MALT BEVERAGE	5,001	BEER	8	ALCOHOLIC BEVERAGES
215	5005	STOUT AND PORTER	5,001	BEER	8	ALCOHOLIC BEVERAGES
216	5010	LIGHT BEER (LOW CALORIE/ALCOHOL)	5,001	BEER	8	ALCOHOLIC BEVERAGES
217	5015	ALE	5,001	BEER	8	ALCOHOLIC BEVERAGES
218	5020	MALT LIQUOR	5,001	BEER	8	ALCOHOLIC BEVERAGES
219	5041	WINE-VERMOUTH	5,003	WINE	8	ALCOHOLIC BEVERAGES
220	5049	WINE-APERITIFS	5,003	WINE	8	ALCOHOLIC BEVERAGES
221	5050	WINE-DOMESTIC DRY TABLE	5,003	WINE	8	ALCOHOLIC BEVERAGES
222	5052	WINE-IMPORTED DRY TABLE	5,003	WINE	8	ALCOHOLIC BEVERAGES
223	5053	WINE-FLAVORED/REFRESHMENT	5,003	WINE	8	ALCOHOLIC BEVERAGES
224	5054	WINE-KOSHER TABLE	5,003	WINE	8	ALCOHOLIC BEVERAGES
225	5055	WINE-SAKE	5,003	WINE	8	ALCOHOLIC BEVERAGES
226	5056	WINE-SANGRIA	5,003	WINE	8	ALCOHOLIC BEVERAGES
227	5057	WINE-SPARKLING	5,003	WINE	8	ALCOHOLIC BEVERAGES
228	5058	WINE-SWEET DESSERT-DOMESTIC	5,003	WINE	8	ALCOHOLIC BEVERAGES
229	5059	WINE-SWEET DESSERT-IMPORTED	5,003	WINE	8	ALCOHOLIC BEVERAGES
230	5060	WINE - NON ALCOHOLIC	5,003	WINE	8	ALCOHOLIC BEVERAGES
231	6001	HOUSEHOLD APPLIANCE ACCESSORIES	5,513	HOUSEWARES, APPLIANCES	9	GENERAL MERCHANDISE
232	6010	ARTIST AND HOBBY PAINT AND SUPPLY	5,522	STATIONERY, SCHOOL SUPPLIES	9	GENERAL MERCHANDISE
233	6011	MAILING SUPPLY	5,522	STATIONERY, SCHOOL SUPPLIES	9	GENERAL MERCHANDISE
234	6014	BATHROOM ACCESSORY	4,505	HOUSEHOLD SUPPLIES	7	NON-FOOD GROCERY
235	6028	SMOKING ACCESSORY	4,510	TOBACCO & ACCESSORIES	7	NON-FOOD GROCERY
236	6033	SCHOOL AND OFFICE BASICS	5,522	STATIONERY, SCHOOL SUPPLIES	9	GENERAL MERCHANDISE
237	6034	SCHOOL AND OFFICE FASTNER AND PUNCH	5,522	STATIONERY, SCHOOL SUPPLIES	9	GENERAL MERCHANDISE
238	6035	SCHOOL AND OFFICE MEASURES SHARPENERS	5,522	STATIONERY, SCHOOL SUPPLIES	9	GENERAL MERCHANDISE
239	6036	DRY ERASE BULLETIN BOARD AND ACCESORY	5,522	STATIONERY, SCHOOL SUPPLIES	9	GENERAL MERCHANDISE
240	6037	FALSE EYELASH AND ACCESSORY	6,002	COSMETICS	0	HEALTH & BEAUTY CARE
241	7003	DETERGENTS-PACKAGED	4,501	DETERGENTS	7	NON-FOOD GROCERY
242	7008	DETERGENTS - LIGHT DUTY	4,501	DETERGENTS	7	NON-FOOD GROCERY
243	7012	DETERGENTS - HEAVY DUTY - LIQUID	4,501	DETERGENTS	7	NON-FOOD GROCERY
244	7015	LAUNDRY TREATMENT AIDS	4,506	LAUNDRY SUPPLIES	7	NON-FOOD GROCERY
245	7020	AUTOMATIC DISHWASHER COMPOUNDS	4,501	DETERGENTS	7	NON-FOOD GROCERY
246	7025	DISHWASHER RINSING AIDS	4,501	DETERGENTS	7	NON-FOOD GROCERY
247	7030	LAUNDRY BAR SOAP	4,505	HOUSEHOLD SUPPLIES	7	NON-FOOD GROCERY
248	7040	WATER SOFTENERS & CONDITIONERS	4,505	HOUSEHOLD SUPPLIES	7	NON-FOOD GROCERY
249	7041	DETERGENT BOOSTERS	4,506	LAUNDRY SUPPLIES	7	NON-FOOD GROCERY
250	7043	SALT-WATER SOFTENING	4,505	HOUSEHOLD SUPPLIES	7	NON-FOOD GROCERY
251	7045	FABRIC WASHES - SPECIAL	4,506	LAUNDRY SUPPLIES	7	NON-FOOD GROCERY
252	7060	FABRIC SOFTENERS-LIQUID	4,506	LAUNDRY SUPPLIES	7	NON-FOOD GROCERY
253	7061	FABRIC SOFTENERS-AEROSOL	4,506	LAUNDRY SUPPLIES	7	NON-FOOD GROCERY
254	7062	FABRIC SOFTENERS-DRY	4,506	LAUNDRY SUPPLIES	7	NON-FOOD GROCERY
255	7065	FABRIC FINISHERS	4,506	LAUNDRY SUPPLIES	7	NON-FOOD GROCERY
256	7070	FABRIC PROTECTORS	4,506	LAUNDRY SUPPLIES	7	NON-FOOD GROCERY

	Category	Category Description	Product Group	Product Group Description	Department	Department Description
257	7075	BLEACH - DRY	4,506	LAUNDRY SUPPLIES	7	NON-FOOD GROCERY
258	7080	BLEACH - LIQUID/GEL	4,506	LAUNDRY SUPPLIES	7	NON-FOOD GROCERY
259	7085	BLUINGS	4,506	LAUNDRY SUPPLIES	7	NON-FOOD GROCERY
260	7090	STARCH - AEROSOL & SPRAY	4,506	LAUNDRY SUPPLIES	7	NON-FOOD GROCERY
261	7095	STARCH - DRY	4,506	LAUNDRY SUPPLIES	7	NON-FOOD GROCERY
262	7098	STARCH - LIQUID	4,506	LAUNDRY SUPPLIES	7	NON-FOOD GROCERY
263	7100	AMMONIA	4,504	HOUSEHOLD CLEANERS	7	NON-FOOD GROCERY
264	7105	DISINFECTANTS	4,504	HOUSEHOLD CLEANERS	7	NON-FOOD GROCERY
265	7106	CLEANERS - DISINFECTANTS	4,504	HOUSEHOLD CLEANERS	7	NON-FOOD GROCERY
266	7115	TOILET BOWL - CLEANERS	4,504	HOUSEHOLD CLEANERS	7	NON-FOOD GROCERY
267	7117	CLEANERS-SEPTIC TANK	4,504	HOUSEHOLD CLEANERS	7	NON-FOOD GROCERY
268	7118	RUST REMOVERS	4,504	HOUSEHOLD CLEANERS	7	NON-FOOD GROCERY
269	7120	DRAIN PIPE OPENERS	4,505	HOUSEHOLD SUPPLIES	7	NON-FOOD GROCERY
270	7125	ABRASIVE CLEANSERS-POWDERED	4,504	HOUSEHOLD CLEANERS	7	NON-FOOD GROCERY
271	7126	ABRASIVE CLEANSERS-LIQUID	4,504	HOUSEHOLD CLEANERS	7	NON-FOOD GROCERY
272	7130	SCOURING PADS	4,505	HOUSEHOLD SUPPLIES	7	NON-FOOD GROCERY
273	7135	CLEANERS - WINDOW	4,504	HOUSEHOLD CLEANERS	7	NON-FOOD GROCERY
274	7140	CLEANERS-METAL	4,504	HOUSEHOLD CLEANERS	7	NON-FOOD GROCERY
275	7142	CLEANERS-HUMIDIFIERS/VAPORIZERS	4,504	HOUSEHOLD CLEANERS	7	NON-FOOD GROCERY
276	7145	OVEN CLEANERS	4,504	HOUSEHOLD CLEANERS	7	NON-FOOD GROCERY
277	7150	CLEANERS - NON-DISINFECTANT	4,504	HOUSEHOLD CLEANERS	7	NON-FOOD GROCERY
278	7155	CLEANERS - POWDERS	4,504	HOUSEHOLD CLEANERS	7	NON-FOOD GROCERY
279	7160	CLEANERS - BATHROOM	4,504	HOUSEHOLD CLEANERS	7	NON-FOOD GROCERY
280	7161	POLISHES	4,505	HOUSEHOLD SUPPLIES	7	NON-FOOD GROCERY
281	7170	UPHOLSTERY CLEANERS	4,504	HOUSEHOLD CLEANERS	7	NON-FOOD GROCERY
282	7175	RUG CLEANERS	4,504	HOUSEHOLD CLEANERS	7	NON-FOOD GROCERY
283	7176	SPOT & STAIN REMOVERS	4,506	LAUNDRY SUPPLIES	7	NON-FOOD GROCERY
284	7180	SPONGES AND SQUEEGEES - HOUSEHOLD	4,505	HOUSEHOLD SUPPLIES	7	NON-FOOD GROCERY
285	7182	INSECTICIDE - ANT -TRAPS	5,514	INSECTICDS/PESTICDS/RODENTICDS	9	GENERAL MERCHANDISE
286	7183	INSECTICIDE - ROACH - TRAPS & MOTELS	5,514	INSECTICDS/PESTICDS/RODENTICDS	9	GENERAL MERCHANDISE
287	7184	INSECTICIDE - HOUSE & GARDEN - AEROSOL	5,514	INSECTICDS/PESTICDS/RODENTICDS	9	GENERAL MERCHANDISE
288	7185	INSECTICIDE - FLEA & TICK - AEROSOL	5,514	INSECTICDS/PESTICDS/RODENTICDS	9	GENERAL MERCHANDISE
289	7186	INSECTICIDE - FLEA & TICK - FOGGER	5,514	INSECTICDS/PESTICDS/RODENTICDS	9	GENERAL MERCHANDISE
290	7187	INSECTICIDE - MISCELLANEOUS FLY PRODUCTS	5,514	INSECTICDS/PESTICDS/RODENTICDS	9	GENERAL MERCHANDISE
291	7188	INSECTICIDE - MISCELLANEOUS ROACH PRODUCTS	5,514	INSECTICDS/PESTICDS/RODENTICDS	9	GENERAL MERCHANDISE
292	7190	FURNITURE POLISH	4,505	HOUSEHOLD SUPPLIES	7	NON-FOOD GROCERY
293	7194	FLOOR CARE-CLEANERS	4,504	HOUSEHOLD CLEANERS	7	NON-FOOD GROCERY
294	7195	FLOOR CARE - WAXES	4,505	HOUSEHOLD SUPPLIES	7	NON-FOOD GROCERY
295	7200	WAX REMOVER	4,505	HOUSEHOLD SUPPLIES	7	NON-FOOD GROCERY
296	7201	INSECTICIDE-FLYING INSECT-AEROSOL	5,514	INSECTICDS/PESTICDS/RODENTICDS	9	GENERAL MERCHANDISE
297	7202	INSECTICIDE-FLYING/CRAWLING INSECT-STRIP SOLID	5,514	INSECTICDS/PESTICDS/RODENTICDS	9	GENERAL MERCHANDISE
298	7203	INSECTICIDE-FLYING INSECT-LIQUID	5,514	INSECTICDS/PESTICDS/RODENTICDS	9	GENERAL MERCHANDISE
299	7204	INSECTICIDE-ANT & ROACH-REGULAR AEROSOL	5,514	INSECTICDS/PESTICDS/RODENTICDS	9	GENERAL MERCHANDISE
300	7208	INSECTICIDE-ANT & ROACH-LIQUID	5,514	INSECTICDS/PESTICDS/RODENTICDS	9	GENERAL MERCHANDISE
301	7209	INSECTICIDE - ANT & ROACH - OTHER CONTINUOUS PRODUCTS	5,514	INSECTICDS/PESTICDS/RODENTICDS	9	GENERAL MERCHANDISE
302	7210	PESTICIDES - REMAINING	5,514	INSECTICDS/PESTICDS/RODENTICDS	9	GENERAL MERCHANDISE
303	7212	INSECTICIDE-ANT & ROACH-POWDER	5,514	INSECTICDS/PESTICDS/RODENTICDS	9	GENERAL MERCHANDISE
304	7213	INSECTICIDE-INDOOR FOGGER	5,514	INSECTICDS/PESTICDS/RODENTICDS	9	GENERAL MERCHANDISE
305	7214	INSECTICIDE - HOUSE &/OR GARDEN - OTHER FORMS	5,514	INSECTICDS/PESTICDS/RODENTICDS	9	GENERAL MERCHANDISE
306	7216	INSECTICIDE - FLEA & TICK - LIQUID	5,514	INSECTICDS/PESTICDS/RODENTICDS	9	GENERAL MERCHANDISE
307	7217	INSECTICIDE-OUTDOOR FOGGER	5,514	INSECTICDS/PESTICDS/RODENTICDS	9	GENERAL MERCHANDISE
308	7218	INSECTICIDE - REMAINING MISCELLANEOUS PRODUCTS	5,514	INSECTICDS/PESTICDS/RODENTICDS	9	GENERAL MERCHANDISE
309	7219	INSECTICIDE-WASP & HORNET	5,514	INSECTICDS/PESTICDS/RODENTICDS	9	GENERAL MERCHANDISE
310	7221	SNAIL & SLUG KILLERS	5,514	INSECTICDS/PESTICDS/RODENTICDS	9	GENERAL MERCHANDISE
311	7222	INSECT REPELLENTS	5,514	INSECTICDS/PESTICDS/RODENTICDS	9	GENERAL MERCHANDISE
312	7223	MOUSE & RAT & MOLE TRAPS	5,514	INSECTICDS/PESTICDS/RODENTICDS	9	GENERAL MERCHANDISE
313	7225	RODENTICIDES	5,514	INSECTICDS/PESTICDS/RODENTICDS	9	GENERAL MERCHANDISE
314	7240	DYE AND DYE REMOVER	4,506	LAUNDRY SUPPLIES	7	NON-FOOD GROCERY
315	7242	PRE-MOISTENED TOWELETTES	4,507	PAPER PRODUCTS	7	NON-FOOD GROCERY
316	7245	FACIAL TISSUE	4,507	PAPER PRODUCTS	7	NON-FOOD GROCERY
317	7250	PAPER NAPKINS	4,507	PAPER PRODUCTS	7	NON-FOOD GROCERY
318	7260	TOILET TISSUE	4,507	PAPER PRODUCTS	7	NON-FOOD GROCERY
319	7275	ALUMINUM FOIL	4,511	WRAPPING MATERIALS AND BAGS	7	NON-FOOD GROCERY
320	7280	WAX PAPER	4,511	WRAPPING MATERIALS AND BAGS	7	NON-FOOD GROCERY

	Category	Category Description	Product Group	Product Group Description	Department	Department Description
321	7284	BAGS - OVEN	4,511	WRAPPING MATERIALS AND BAGS	7	NON-FOOD GROCERY
322	7285	PLASTIC WRAP	4,511	WRAPPING MATERIALS AND BAGS	7	NON-FOOD GROCERY
323	7290	BAGS - SANDWICH	4,511	WRAPPING MATERIALS AND BAGS	7	NON-FOOD GROCERY
324	7295	BAGS - FOOD STORAGE	4,511	WRAPPING MATERIALS AND BAGS	7	NON-FOOD GROCERY
325	7301	BAGS - FREEZER	4,511	WRAPPING MATERIALS AND BAGS	7	NON-FOOD GROCERY
326	7302	BAGS - PAPER	4,511	WRAPPING MATERIALS AND BAGS	7	NON-FOOD GROCERY
327	7305	BAGS - TRASH/TRASH COMPACTOR	4,511	WRAPPING MATERIALS AND BAGS	7	NON-FOOD GROCERY
328	7306	BAGS - TALL KITCHEN	4,511	WRAPPING MATERIALS AND BAGS	7	NON-FOOD GROCERY
329	7307	BAGS - LAWN & LEAF	4,511	WRAPPING MATERIALS AND BAGS	7	NON-FOOD GROCERY
330	7308	BAGS - WASTE	4,511	WRAPPING MATERIALS AND BAGS	7	NON-FOOD GROCERY
331	7320	BAKING CUPS & LINERS	4,507	PAPER PRODUCTS	7	NON-FOOD GROCERY
332	7332	COFFEE & TEA FILTERS - DISPOSABLE	4,507	PAPER PRODUCTS	7	NON-FOOD GROCERY
333	7335	DISPOSABLE CUPS	4,507	PAPER PRODUCTS	7	NON-FOOD GROCERY
334	7340	DISPOSABLE DISHES	4,507	PAPER PRODUCTS	7	NON-FOOD GROCERY
335	7345	SODA STRAWS	4,507	PAPER PRODUCTS	7	NON-FOOD GROCERY
336	7380	LIGHTER FLUID & FLINTS	4,510	TOBACCO & ACCESSORIES	7	NON-FOOD GROCERY
337	7381	LIGHTERS	4,510	TOBACCO & ACCESSORIES	7	NON-FOOD GROCERY
338	7445	TAPE - MISCELLANEOUS	5,522	STATIONERY, SCHOOL SUPPLIES	9	GENERAL MERCHANDISE
339	7450	GLUE	5,522	STATIONERY, SCHOOL SUPPLIES	9	GENERAL MERCHANDISE
340	7460	CIGARETTES	4,510	TOBACCO & ACCESSORIES	7	NON-FOOD GROCERY
341	7462	CIGARS	4,510	TOBACCO & ACCESSORIES	7	NON-FOOD GROCERY
342	7464	TOBACCO-SMOKING	4,510	TOBACCO & ACCESSORIES	7	NON-FOOD GROCERY
343	7465	ANTI-SMOKING PRODUCTS	4,510	TOBACCO & ACCESSORIES	7	NON-FOOD GROCERY
344	7466	TOBACCO-CHEWING	4,510	TOBACCO & ACCESSORIES	7	NON-FOOD GROCERY
345	7500	BEER & WINE MAKING KITS	5,513	HOUSEWARES, APPLIANCES	9	GENERAL MERCHANDISE
346	7521	BRUSHES-KITCHEN & SCRUB	4,505	HOUSEHOLD SUPPLIES	7	NON-FOOD GROCERY
347	7522	BRUSHES-BATHROOM	4,505	HOUSEHOLD SUPPLIES	7	NON-FOOD GROCERY
348	7529	BRUSHES - MISCELLANEOUS	4,505	HOUSEHOLD SUPPLIES	7	NON-FOOD GROCERY
349	7630	SCHOOL AND OFFICE PAPER AND FORMS	5,522	STATIONERY, SCHOOL SUPPLIES	9	GENERAL MERCHANDISE
350	7631	REPORT COVERS AND SHEET PROTECTORS	5,522	STATIONERY, SCHOOL SUPPLIES	9	GENERAL MERCHANDISE
351	7632	CORRECTION FLUID AND ERASERS	5,522	STATIONERY, SCHOOL SUPPLIES	9	GENERAL MERCHANDISE
352	7633	PERSONAL PLANNERS BINDERS AND FOLDERS	5,522	STATIONERY, SCHOOL SUPPLIES	9	GENERAL MERCHANDISE
353	7634	DIVIDERS TABS LABELS AND TAGS	5,522	STATIONERY, SCHOOL SUPPLIES	9	GENERAL MERCHANDISE
354	7635	SCHOOL AND OFFICE STORAGE AND DISPENSER	5,522	STATIONERY, SCHOOL SUPPLIES	9	GENERAL MERCHANDISE
355	7636	HOME SCHOOL AND OFFICE COMBINATIONS	5,522	STATIONERY, SCHOOL SUPPLIES	9	GENERAL MERCHANDISE
356	7646	ADHESIVE NOTE PADS	5,522	STATIONERY, SCHOOL SUPPLIES	9	GENERAL MERCHANDISE
357	7652	CRAYONS	5,522	STATIONERY, SCHOOL SUPPLIES	9	GENERAL MERCHANDISE
358	7653	PENCILS - COLORED	5,522	STATIONERY, SCHOOL SUPPLIES	9	GENERAL MERCHANDISE
359	7659	MARKERS	5,522	STATIONERY, SCHOOL SUPPLIES	9	GENERAL MERCHANDISE
360	7660	PENS & PENCILS	5,522	STATIONERY, SCHOOL SUPPLIES	9	GENERAL MERCHANDISE
361	7702	THERMOMETERS-HOUSEHOLD/OUTDOOR	4,505	HOUSEHOLD SUPPLIES	7	NON-FOOD GROCERY
362	7722	LABEL MAKER TAPE	5,522	STATIONERY, SCHOOL SUPPLIES	9	GENERAL MERCHANDISE
363	7723	LABEL MAKERS AND LABEL PRINTERS	5,522	STATIONERY, SCHOOL SUPPLIES	9	GENERAL MERCHANDISE
364	7727	PAPER SHREDDERS	5,522	STATIONERY, SCHOOL SUPPLIES	9	GENERAL MERCHANDISE
365	7728	ELECTRONIC PENCIL SHARPENERS	5,522	STATIONERY, SCHOOL SUPPLIES	9	GENERAL MERCHANDISE
366	7734	PAPER TOWELS	4,507	PAPER PRODUCTS	7	NON-FOOD GROCERY
367	7742	HOUSEHOLD AREA ALLERGEN CONTROL	4,505	HOUSEHOLD SUPPLIES	7	NON-FOOD GROCERY
368	7744	BATHROOM SCALE	5,513	HOUSEWARES, APPLIANCES	9	GENERAL MERCHANDISE
369	7748	WATER FILTRATION STORAGE CONTAINER	4,505	HOUSEHOLD SUPPLIES	7	NON-FOOD GROCERY
370	7753	GARMENT STEAMER AND IRON APPLIANCE	5,513	HOUSEWARES, APPLIANCES	9	GENERAL MERCHANDISE
371	7754	BREADMAKER APPLIANCE	5,513	HOUSEWARES, APPLIANCES	9	GENERAL MERCHANDISE
372	7755	COFFEE AND TEA MAKER APPLIANCE	5,513	HOUSEWARES, APPLIANCES	9	GENERAL MERCHANDISE
373	7756	TOASTER AND TOASTER OVEN APPLIANCE	5,513	HOUSEWARES, APPLIANCES	9	GENERAL MERCHANDISE
374	7757	BLENDER APPLIANCE	5,513	HOUSEWARES, APPLIANCES	9	GENERAL MERCHANDISE
375	7758	MIXER APPLIANCE	5,513	HOUSEWARES, APPLIANCES	9	GENERAL MERCHANDISE
376	7759	CAN OPENER APPLIANCE	5,513	HOUSEWARES, APPLIANCES	9	GENERAL MERCHANDISE
377	7760	JUICER APPLIANCE	5,513	HOUSEWARES, APPLIANCES	9	GENERAL MERCHANDISE
378	7761	POPCORN POPPER APPLIANCE	5,513	HOUSEWARES, APPLIANCES	9	GENERAL MERCHANDISE
379	7762	ELECTRIC KNIFE AND PEELER APPLIANCE	5,513	HOUSEWARES, APPLIANCES	9	GENERAL MERCHANDISE
380	7763	FOOD PROCESSOR AND GRINDER APPLIANCE	5,513	HOUSEWARES, APPLIANCES	9	GENERAL MERCHANDISE
381	7764	GRIDDLE GRILL WAFFLE IRON APPLIANCE	5,513	HOUSEWARES, APPLIANCES	9	GENERAL MERCHANDISE
382	7766	FRYER SKILLET WOK APPLIANCE	5,513	HOUSEWARES, APPLIANCES	9	GENERAL MERCHANDISE
383	7767	COOKER STEAMER AND DEHYDRATOR APPLIANCE	5,513	HOUSEWARES, APPLIANCES	9	GENERAL MERCHANDISE
384	7768	ICE CREAM AND YOGURT MAKER APPLIANCE	5,513	HOUSEWARES, APPLIANCES	9	GENERAL MERCHANDISE

	Category	Category Description	Product Group	Product Group Description	Department	Department Description
385	7769	MICROWAVE OVEN APPLIANCE	5,513	HOUSEWARES, APPLIANCES	9	GENERAL MERCHANDISE
386	7770	REFRIGERATOR AND FREEZER APPLIANCE	5,513	HOUSEWARES, APPLIANCES	9	GENERAL MERCHANDISE
387	7771	BURNER AND RANGE APPLIANCE	5,513	HOUSEWARES, APPLIANCES	9	GENERAL MERCHANDISE
388	7772	VACUUM AND CARPET CLEANER APPLIANCE	5,513	HOUSEWARES, APPLIANCES	9	GENERAL MERCHANDISE
389	7773	HEATER APPLIANCE	5,513	HOUSEWARES, APPLIANCES	9	GENERAL MERCHANDISE
390	7776	POWER PRESSURE WASHER APPLIANCE	5,513	HOUSEWARES, APPLIANCES	9	GENERAL MERCHANDISE
391	7777	HUMIDIFIER AND VAPORIZER APPLIANCE	5,513	HOUSEWARES, APPLIANCES	9	GENERAL MERCHANDISE
392	7778	FAN AND CEILING FAN APPLIANCE	5,513	HOUSEWARES, APPLIANCES	9	GENERAL MERCHANDISE
393	7779	HOUSEHOLD SPECIALTY APPLIANCE	5,513	HOUSEWARES, APPLIANCES	9	GENERAL MERCHANDISE
394	7780	BODY MASSAGER APPLIANCE AND ACCESSORY	5,513	HOUSEWARES, APPLIANCES	9	GENERAL MERCHANDISE
395	7781	HAIR STYLING APPLIANCE AND ACCESSORY	5,513	HOUSEWARES, APPLIANCES	9	GENERAL MERCHANDISE
396	7782	ORAL HYGIENE APPLIANCE AND ACCESSORY	5,513	HOUSEWARES, APPLIANCES	9	GENERAL MERCHANDISE
397	7783	RAZOR TRIMMER APPLIANCE AND ACCESSORY	5,513	HOUSEWARES, APPLIANCES	9	GENERAL MERCHANDISE
398	7784	SKIN AND NAIL APPLIANCE AND ACCESSORY	5,513	HOUSEWARES, APPLIANCES	9	GENERAL MERCHANDISE
399	7787	AIR PURIFIER CONDITIONER FURNACE FILTER	5,513	HOUSEWARES, APPLIANCES	9	GENERAL MERCHANDISE
400	7788	AIR CONDITIONER APPLIANCE	5,513	HOUSEWARES, APPLIANCES	9	GENERAL MERCHANDISE
401	7789	AIR PURIFIER AND CLEANER APPLIANCE	5,513	HOUSEWARES, APPLIANCES	9	GENERAL MERCHANDISE
402	7790	BREATHING AIDS EXTERNAL	6,012	MEDICATIONS/REMEDIES/HEALTH AIDS	0	HEALTH & BEAUTY CARE
403	7791	MEDICAL WRAP AND BRACE	6,012	MEDICATIONS/REMEDIES/HEALTH AIDS	0	HEALTH & BEAUTY CARE
404	7795	MOTH PREVENTATIVES	4,505	HOUSEHOLD SUPPLIES	7	NON-FOOD GROCERY
405	7796	MILDEW REMOVERS & PREVENTATIVES	4,505	HOUSEHOLD SUPPLIES	7	NON-FOOD GROCERY
406	7798	CIGARETTE AND CIGAR PAPER	4,510	TOBACCO & ACCESSORIES	7	NON-FOOD GROCERY
407	7825	CLOTH-POLISHING/CLEANING	4,505	HOUSEHOLD SUPPLIES	7	NON-FOOD GROCERY
408	7845	BROOMS/ MOPS & WAX APPLICATORS	4,505	HOUSEHOLD SUPPLIES	7	NON-FOOD GROCERY
409	7846	DUSTPANS	4,505	HOUSEHOLD SUPPLIES	7	NON-FOOD GROCERY
410	7847	FEATHER DUSTERS	4,505	HOUSEHOLD SUPPLIES	7	NON-FOOD GROCERY
411	7850	LAUNDRY & IRONING ACCESSORIES	4,506	LAUNDRY SUPPLIES	7	NON-FOOD GROCERY
412	7851	LAUNDRY BASKETS & HAMPERS	4,506	LAUNDRY SUPPLIES	7	NON-FOOD GROCERY
413	7855	CLOTHESPINS	4,506	LAUNDRY SUPPLIES	7	NON-FOOD GROCERY
414	7870	BATTERIES	5,502	BATTERIES AND FLASHLIGHTS	9	GENERAL MERCHANDISE
415	7871	FLASHLIGHTS	5,502	BATTERIES AND FLASHLIGHTS	9	GENERAL MERCHANDISE
416	7885	WATER CONDITIONERS FILTERS AND UNITS	4,505	HOUSEHOLD SUPPLIES	7	NON-FOOD GROCERY
417	8300	CONTRACEPTIVES-FEMALE	6,012	MEDICATIONS/REMEDIES/HEALTH AIDS	0	HEALTH & BEAUTY CARE
418	8301	CONTRACEPTIVES-MALE	6,012	MEDICATIONS/REMEDIES/HEALTH AIDS	0	HEALTH & BEAUTY CARE
419	8350	PREGNANCY TEST KITS	6,012	MEDICATIONS/REMEDIES/HEALTH AIDS	0	HEALTH & BEAUTY CARE
420	8396	DAIRY DIGESTIVE AIDS	6,012	MEDICATIONS/REMEDIES/HEALTH AIDS	0	HEALTH & BEAUTY CARE
421	8402	TOOTH & GUM ANALGESICS	6,012	MEDICATIONS/REMEDIES/HEALTH AIDS	0	HEALTH & BEAUTY CARE
422	8403	ORAL HYGIENE BRUSHES	6,014	ORAL HYGIENE	0	HEALTH & BEAUTY CARE
423	8404	TOOTH CLEANERS	6,014	ORAL HYGIENE	0	HEALTH & BEAUTY CARE
424	8406	DENTURE CLEANSERS	6,014	ORAL HYGIENE	0	HEALTH & BEAUTY CARE
425	8409	BREATH FRESHENERS	6,014	ORAL HYGIENE	0	HEALTH & BEAUTY CARE
426	8410	COUGH AND COLD THROAT SPRAYS	6,014	ORAL HYGIENE	0	HEALTH & BEAUTY CARE
427	8412	ANTACIDS	6,012	MEDICATIONS/REMEDIES/HEALTH AIDS	0	HEALTH & BEAUTY CARE
428	8417	THROAT LOZENGES	6,003	COUGH AND COLD REMEDIES	0	HEALTH & BEAUTY CARE
429	8418	COLD REMEDIES - CHILDREN	6,003	COUGH AND COLD REMEDIES	0	HEALTH & BEAUTY CARE
430	8419	NASAL PRODUCT INTERNAL	6,003	COUGH AND COLD REMEDIES	0	HEALTH & BEAUTY CARE
431	8420	PAIN REMEDIES - HEADACHE	6,012	MEDICATIONS/REMEDIES/HEALTH AIDS	0	HEALTH & BEAUTY CARE
432	8421	LAXATIVES	6,012	MEDICATIONS/REMEDIES/HEALTH AIDS	0	HEALTH & BEAUTY CARE
433	8422	DIARRHEA REMEDIES	6,012	MEDICATIONS/REMEDIES/HEALTH AIDS	0	HEALTH & BEAUTY CARE
434	8423	COLD REMEDIES - ADULT	6,003	COUGH AND COLD REMEDIES	0	HEALTH & BEAUTY CARE
435	8424	DIURETIC REMEDIES	6,012	MEDICATIONS/REMEDIES/HEALTH AIDS	0	HEALTH & BEAUTY CARE
436	8425	COUGH SYRUPS & TABLETS	6,003	COUGH AND COLD REMEDIES	0	HEALTH & BEAUTY CARE
437	8427	ANALGESIC & CHEST RUBS	6,012	MEDICATIONS/REMEDIES/HEALTH AIDS	0	HEALTH & BEAUTY CARE
438	8429	LIP REMEDIES - SOLID	6,012	MEDICATIONS/REMEDIES/HEALTH AIDS	0	HEALTH & BEAUTY CARE
439	8430	RECTAL MEDICATION	6,012	MEDICATIONS/REMEDIES/HEALTH AIDS	0	HEALTH & BEAUTY CARE
440	8432	SLEEPING AIDS	6,012	MEDICATIONS/REMEDIES/HEALTH AIDS	0	HEALTH & BEAUTY CARE
441	8433	ANTI-SLEEP PRODUCTS	6,012	MEDICATIONS/REMEDIES/HEALTH AIDS	0	HEALTH & BEAUTY CARE
442	8434	CONTACT LENS SOLUTION	6,012	MEDICATIONS/REMEDIES/HEALTH AIDS	0	HEALTH & BEAUTY CARE
443	8436	EYE DROPS & LOTIONS	6,012	MEDICATIONS/REMEDIES/HEALTH AIDS	0	HEALTH & BEAUTY CARE
444	8437	FOOT PREPARATIONS-ATHLETE'S FOOT	6,012	MEDICATIONS/REMEDIES/HEALTH AIDS	0	HEALTH & BEAUTY CARE
445	8441	INSOLES	6,012	MEDICATIONS/REMEDIES/HEALTH AIDS	0	HEALTH & BEAUTY CARE
446	8442	MEDICATED PRODUCTS	6,012	MEDICATIONS/REMEDIES/HEALTH AIDS	0	HEALTH & BEAUTY CARE
447	8443	FOOT PREPARATIONS-REMAINING	6,012	MEDICATIONS/REMEDIES/HEALTH AIDS	0	HEALTH & BEAUTY CARE
448	8444	DISPOSABLE DIAPERS	4,502	DISPOSABLE DIAPERS	7	NON-FOOD GROCERY

	Category	Category Description	Product Group	Product Group Description	Department	Department Description
449	8450	FOOT COMFORTS PRODUCTS	6,012	MEDICATIONS/REMEDIES/HEALTH AIDS	0	HEALTH & BEAUTY CARE
450	8451	COSMETICS-BLUSHERS	6,002	COSMETICS	0	HEALTH & BEAUTY CARE
451	8453	TALCUM & DUSTING POWDER	6,002	COSMETICS	0	HEALTH & BEAUTY CARE
452	8455	COSMETICS-FOUNDATION-LIQUID	6,002	COSMETICS	0	HEALTH & BEAUTY CARE
453	8456	COSMETICS-FACE POWDER	6,002	COSMETICS	0	HEALTH & BEAUTY CARE
454	8457	COSMETICS-LIPSTICKS	6,002	COSMETICS	0	HEALTH & BEAUTY CARE
455	8462	COSMETICS-EYEBROW & EYE LINER	6,002	COSMETICS	0	HEALTH & BEAUTY CARE
456	8463	COSMETICS-EYE SHADOWS	6,002	COSMETICS	0	HEALTH & BEAUTY CARE
457	8467	COSMETICS-NAIL POLISH	6,002	COSMETICS	0	HEALTH & BEAUTY CARE
458	8468	COSMETICS-MASCARA	6,002	COSMETICS	0	HEALTH & BEAUTY CARE
459	8470	SHAMPOO-AEROSOL/ LIQUID/ LOTION/ POWDER	6,011	HAIR CARE	0	HEALTH & BEAUTY CARE
460	8471	CREME RINSES & CONDITIONERS	6,011	HAIR CARE	0	HEALTH & BEAUTY CARE
461	8472	WAVE SETTING PRODUCTS	6,011	HAIR CARE	0	HEALTH & BEAUTY CARE
462	8473	HAIR SPRAY - WOMEN'S	6,011	HAIR CARE	0	HEALTH & BEAUTY CARE
463	8474	HAIR SPRAY - MEN'S	6,011	HAIR CARE	0	HEALTH & BEAUTY CARE
464	8476	COSMETIC KITS	6,002	COSMETICS	0	HEALTH & BEAUTY CARE
465	8477	HOME PERMANENTS	6,011	HAIR CARE	0	HEALTH & BEAUTY CARE
466	8478	HAIR COLORING - WOMEN'S	6,011	HAIR CARE	0	HEALTH & BEAUTY CARE
467	8479	SHAMPOO-BARS/ CONCENTRATES/ AND CREAMS	6,011	HAIR CARE	0	HEALTH & BEAUTY CARE
468	8484	COSMETICS-REMAINING	6,002	COSMETICS	0	HEALTH & BEAUTY CARE
469	8485	HAIR PREPARATIONS - OTHER THAN MEN'S	6,011	HAIR CARE	0	HEALTH & BEAUTY CARE
470	8500	BRONCHIAL REMEDIES	6,012	MEDICATIONS/REMEDIES/HEALTH AIDS	0	HEALTH & BEAUTY CARE
471	8501	PAIN REMEDIES - URINARY TRACT	6,012	MEDICATIONS/REMEDIES/HEALTH AIDS	0	HEALTH & BEAUTY CARE
472	8502	SINUS REMEDIES	6,003	COUGH AND COLD REMEDIES	0	HEALTH & BEAUTY CARE
473	8510	EAR DROPS	6,012	MEDICATIONS/REMEDIES/HEALTH AIDS	0	HEALTH & BEAUTY CARE
474	8511	DENTURE ADHESIVES	6,014	ORAL HYGIENE	0	HEALTH & BEAUTY CARE
475	8513	PAIN REMEDIES - PRE MENSTRUAL	6,012	MEDICATIONS/REMEDIES/HEALTH AIDS	0	HEALTH & BEAUTY CARE
476	8514	PAIN REMEDIES - CHILDREN'S LIQUID	6,012	MEDICATIONS/REMEDIES/HEALTH AIDS	0	HEALTH & BEAUTY CARE
477	8515	PAIN REMEDIES - ALKALIZING EFFERVESCENTS	6,012	MEDICATIONS/REMEDIES/HEALTH AIDS	0	HEALTH & BEAUTY CARE
478	8516	PAIN REMEDIES - ARTHRITIS	6,012	MEDICATIONS/REMEDIES/HEALTH AIDS	0	HEALTH & BEAUTY CARE
479	8517	EYE CARE - REMAINING	6,012	MEDICATIONS/REMEDIES/HEALTH AIDS	0	HEALTH & BEAUTY CARE
480	8520	LIP REMEDIES - REMAINING	6,012	MEDICATIONS/REMEDIES/HEALTH AIDS	0	HEALTH & BEAUTY CARE
481	8522	DENTAL FLOSS	6,014	ORAL HYGIENE	0	HEALTH & BEAUTY CARE
482	8528	ADULT-INCONTINENCE	6,012	MEDICATIONS/REMEDIES/HEALTH AIDS	0	HEALTH & BEAUTY CARE
483	8529	HAIR PREPARATIONS-MEN'S	6,011	HAIR CARE	0	HEALTH & BEAUTY CARE
484	8534	PETROLEUM JELLY	6,012	MEDICATIONS/REMEDIES/HEALTH AIDS	0	HEALTH & BEAUTY CARE
485	8535	HAIR COLORING - MEN'S	6,011	HAIR CARE	0	HEALTH & BEAUTY CARE
486	8536	PSORIASIS & ECZEMA TREATMENTS	6,012	MEDICATIONS/REMEDIES/HEALTH AIDS	0	HEALTH & BEAUTY CARE
487	8538	JOCK ITCH PRODUCTS	6,012	MEDICATIONS/REMEDIES/HEALTH AIDS	0	HEALTH & BEAUTY CARE
488	8540	MOTION SICKNESS PREVENTATIVES	6,012	MEDICATIONS/REMEDIES/HEALTH AIDS	0	HEALTH & BEAUTY CARE
489	8541	TRANQUILIZERS/CALMATIVES	6,012	MEDICATIONS/REMEDIES/HEALTH AIDS	0	HEALTH & BEAUTY CARE
490	8542	ANTI-GAS PRODUCTS	6,012	MEDICATIONS/REMEDIES/HEALTH AIDS	0	HEALTH & BEAUTY CARE
491	8543	MEDICAL ACCESSORY-REMAINING	6,012	MEDICATIONS/REMEDIES/HEALTH AIDS	0	HEALTH & BEAUTY CARE
492	8544	ENEMAS-READY-TO-USE	6,012	MEDICATIONS/REMEDIES/HEALTH AIDS	0	HEALTH & BEAUTY CARE
493	8545	PAIN REMEDIES - BACK & LEG	6,012	MEDICATIONS/REMEDIES/HEALTH AIDS	0	HEALTH & BEAUTY CARE
494	8546	VAPORIZING PRODUCTS	6,003	COUGH AND COLD REMEDIES	0	HEALTH & BEAUTY CARE
495	8547	DENTAL ACCESSORIES	6,014	ORAL HYGIENE	0	HEALTH & BEAUTY CARE
496	8550	COSMETICS-NAIL POLISH REMOVER	6,002	COSMETICS	0	HEALTH & BEAUTY CARE
497	8554	SHAMPOO-COMBINATIONS	6,011	HAIR CARE	0	HEALTH & BEAUTY CARE
498	8557	HAIR COLORING - COSTUME	6,011	HAIR CARE	0	HEALTH & BEAUTY CARE
499	8601	SUNBURN AIDS	6,012	MEDICATIONS/REMEDIES/HEALTH AIDS	0	HEALTH & BEAUTY CARE
500	8603	COSMETICS-FOUNDATION-CREAM AND POWDER	6,002	COSMETICS	0	HEALTH & BEAUTY CARE
501	8605	IPECAC PRODUCT	6,012	MEDICATIONS/REMEDIES/HEALTH AIDS	0	HEALTH & BEAUTY CARE
502	8606	INSULIN SYRINGES	6,012	MEDICATIONS/REMEDIES/HEALTH AIDS	0	HEALTH & BEAUTY CARE
503	8607	COSMETICS - CONCEALERS	6,002	COSMETICS	0	HEALTH & BEAUTY CARE
504	8612	BLOOD URINE STOOL TEST PRODUCTS	6,012	MEDICATIONS/REMEDIES/HEALTH AIDS	0	HEALTH & BEAUTY CARE
505	8613	ORAL RINSE AND ANTISEPTIC	6,014	ORAL HYGIENE	0	HEALTH & BEAUTY CARE
506	8615	BLOOD PRESSURE KIT AND ACCESSORY	6,012	MEDICATIONS/REMEDIES/HEALTH AIDS	0	HEALTH & BEAUTY CARE
507	8617	ORAL CARE COMBINATIONS TREATMENTS AND PROGRAMS	6,014	ORAL HYGIENE	0	HEALTH & BEAUTY CARE
508	8618	ORAL HYGIENE TRAVEL PACKS	6,014	ORAL HYGIENE	0	HEALTH & BEAUTY CARE
509	8619	TOOTH WHITENERS	6,014	ORAL HYGIENE	0	HEALTH & BEAUTY CARE
510	8620	GIFT PACKAGE WITH CANDY OR GUM	503	CANDY	1	DRY GROCERY
511	8622	OVULATION AND FERTILITY TEST KITS	6,012	MEDICATIONS/REMEDIES/HEALTH AIDS	0	HEALTH & BEAUTY CARE
512	8777	HAIR GROWTH PRODUCT	6,011	HAIR CARE	0	HEALTH & BEAUTY CARE

APPENDIX C

PROJECTION FACTORS AND WEIGHTING

Nielsen's data provide projection factor weights to control for sampling and are representative of the population at the designated marketing area (DMA) level. The empirical analysis in this paper relies on county level variation. I check the correlation of the weights using county level population measures again the Nielsen projection factors to make sure cutting the data at the county level is reasonable. The correlation appears to be robust.

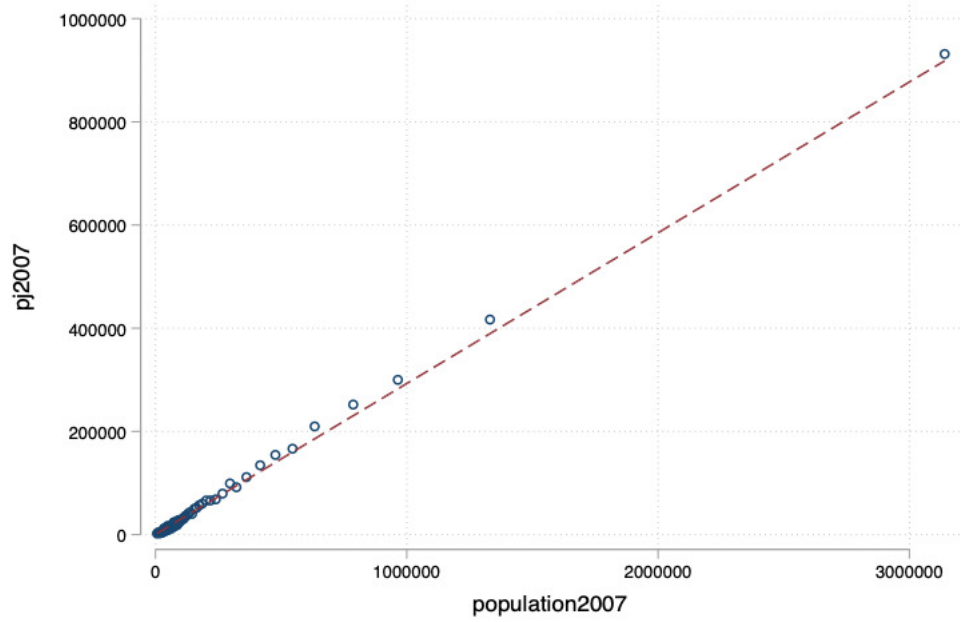


Figure C.1: Nielsen Projection Factor and County Population Weights

APPENDIX D

TERRAIN SLOPE AS AN INSTRUMENT

The main specification of analysis uses a long difference, a 10-year change on a 10-year change. In addition to being easier to interpret, there are several other benefits to this specification. First, the 10-year difference is robust to serially correlated measurement error (Griliches and Hausman (1986)). And importantly for this Appendix, I can use cross-sectional instruments for broadband. As a robustness check, I operationalize the slope of terrain as an instrument for broadband, consistent with Kolko (2012).

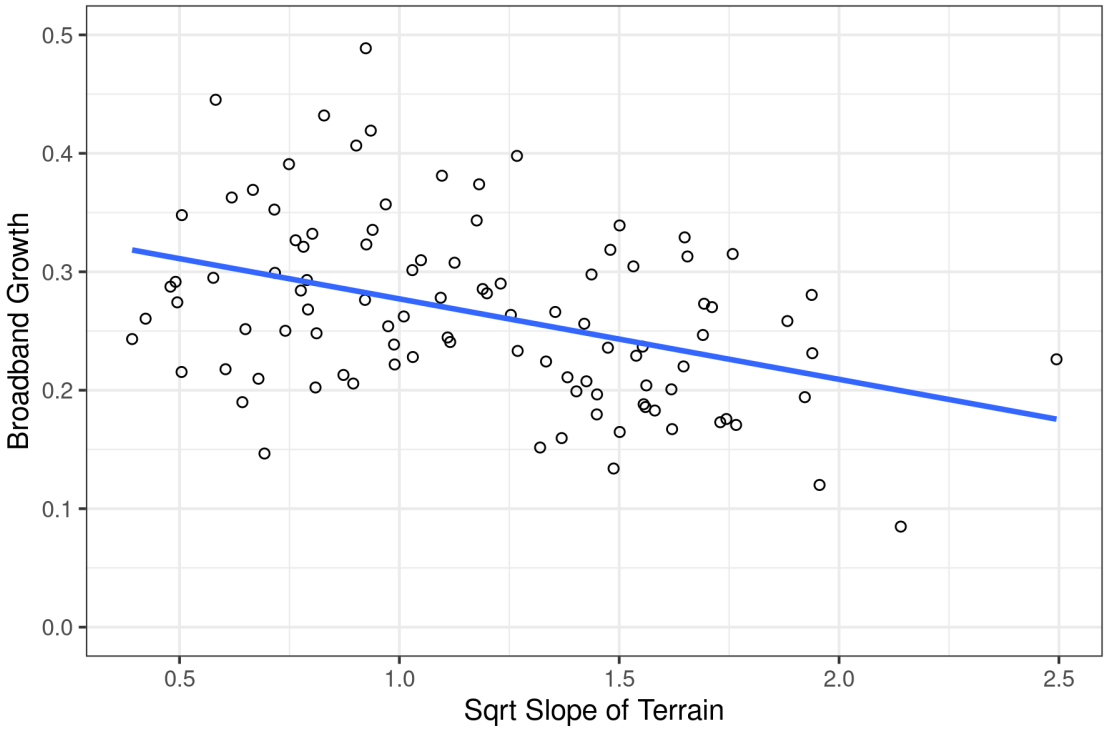
In order for slope to be a decent instrument for broadband roll-out, the slope should be correlated with broadband growth without being independently correlated with the other consumer-behavior outcomes. The key mechanism here is that it is more costly for ISPs to expand and provide service in counties where the terrain is steeper.

Table D.1: First Stage for Slope Instrument

	Dependent variable:
	Broadband Change
$\sqrt{slope}$	-0.010^{***}
	(0.001)
Observations	2,232
R^2	0.021
Note:	*p<0.1; **p<0.05; ***p<0.01

In the first stage, I show the steepness of terrain is negatively correlated with broadband growth, consistent with previous literature. The first stage has an F-statistic of 48.78.

Now, in order for this to be a valid instrument, it must satisfy the exclusion restriction. In other words, the slope of the terrain has no direct effect on ten year changes in the outcome variables. There are some possibility for how this may be violated. An example o this is that



slope may provide some views or other desirable amenities. I control for this using county fixed effects and county level demographics that might shift over time.

Table D.2: Demographic Correlations

	$\widehat{\Delta bb_c}$	$\widehat{\varepsilon_c}$
Minority	0.208	0.270
log(Income)	0.040	0.340
log(Age)	-0.113	-0.310
Density	-0.018	0.217

Another example is that steeper terrain might interact with changes in costs of delivery or shipping. To address this, I include road density as proxy for road infrastructure. Below is a summary of Broadband effect on HMS consumer behavior measures (long difference specification) with and without the instrument.

Though the IV does reduce power, there are no large swings in the estimates, suggesting the effect of broadband on consumer behavior is muted.

Table D.3: Estimates of Broadband Effect With and Without IV

	Dependent variable:							
	Δ Trips	Δ Trips	Δ Chain	Δ Chain	Δ Brand	Δ Brand	Δ Spend	Δ Spend
Δ Broadband	-0.026^{*}	-0.010	-0.046^{**}	0.105	-0.032^{***}	0.074	-0.047^{***}	-0.054
	(0.013)	(0.082)	(0.021)	(0.129)	(0.009)	(0.056)	(0.009)	(0.056)
Slope IV		Yes		Yes		Yes		Yes
Note:								*p<0.1; **p<0.05; ***p<0.01

APPENDIX E

TWO WAY FIXED EFFECTS APPROACH

The two-way fixed effects approach is based on different fixed effects and control variables. To control for persistent demand differences in a particular area, I employ county fixed effects. To control for aggregate trends in demand for a product, I employ time fixed effects. To control for seasonality that occurs within weeks in a given year, I employ week-of-year fixed effects. The model includes a product's own price and the prices for other major products in the same category. The main idea of this approach is that the fixed effects and other controls span the space of factors that affect demand to which ISPs are responding. That is, if there is an unobserved confounder that is nevertheless sufficiently correlated with my observed controls, this will not pose a threat to identification.Therefore, the remaining variation in high-speed internet (conditional on fixed effects and controls) does not represent planned variation in high-speed internet.

	Dependent variable:			
	Trips	Chain	Brand	Spend
Broadband	0.012	−0.013	−0.043***	−0.028
	(0.017)	(0.015)	(0.012)	(0.024)
Observations	34,704	34,704	34,704	34,704
R^2	0.486	0.583	0.560	0.526
Note:				*p<0.1; **p<0.05; ***p<0.01

APPENDIX F

ADDITIONAL DISCUSSION ON HETEROGENEITY

The results in the main specification assume that treatment is homogeneous. However, it is not unlikely there is some heterogeneity in treatment effects. Though heterogeneity is expected, how much it affects the estimate of our coefficient of interest depends on the nature of heterogeneity.

Figure F.1 helps illustrate and frame this discussion.[1] In this figure, it is easy to see that ignoring heterogeneity would affect the sign of the coefficient of interest. One way to address this issue is to try to split the data.

One possible solution is illustrated in figure F.2.[2] If the data are split into relevant groups and the sign of the coefficient changes, then there is a relevant level of heterogeneity in treatment effect. In other words, (1) estimate a treatment effect for each group, (2) take the average slope of the red lines, and then (3) recover the average treatment effect.

Strategies for correcting for this threat of heterogeneity are more well-developed for binary treatment. Strategies for correction for continuous treatment like in the case of broadband penetration are still developing. Additional challenges for continuous treatment include the "Strong Parallel Trends Assumption." Scott Cunningham's suggestion is to use sample split diagnostics.[3] If heterogeneity in the treatment effect is important: (1) we should see changes in treatment estimates even with coarse sample splits and (2) the estimates with the sample splits should be statistically and economically significant.

I explore heterogeneity in two possible dimensions, though there are several others: (1)

1. This graphic was sourced on April 24, 2022, from thyroidpatients.ca/wp-content/uploads/2018/12/Simpsons_paradox_-_animation.gif.

2. This graphic was sourced on April 24, 2022, from thyroidpatients.ca/wp-content/uploads/2018/12/Simpsons_paradox_-_animation.gif.

3. Cunningham, Scott. "Continuous treatment DiD." Continuous treatment DiD - by scott cunningham. Causal Inference: the Remix, December 31, 2021. https://causalinf.substack.com/p/continuous-treatment-did.

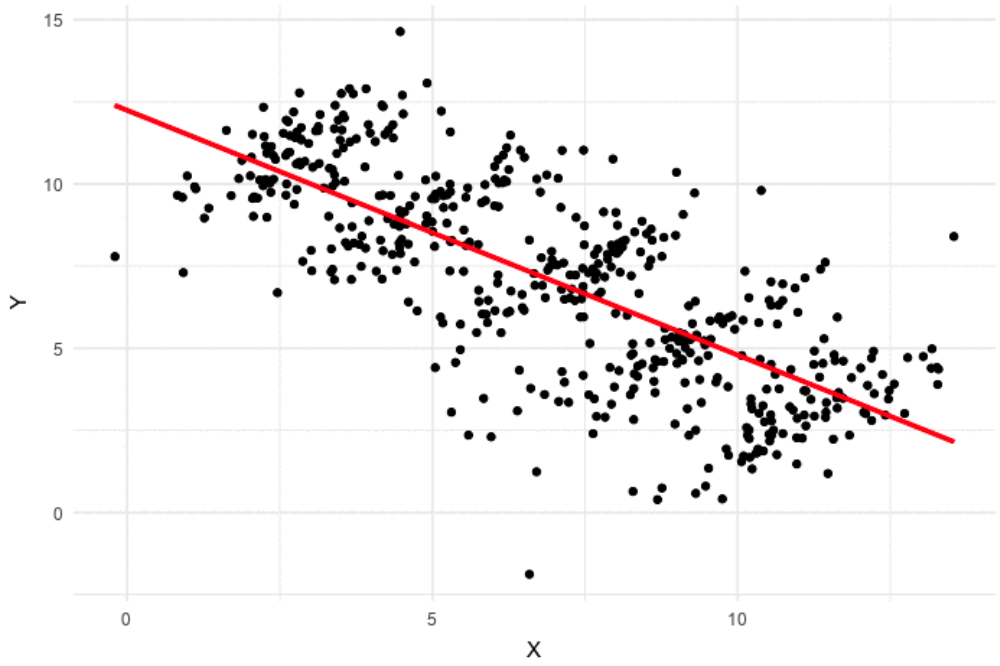


Figure F.1: Simpson's Paradox without Heterogeneity

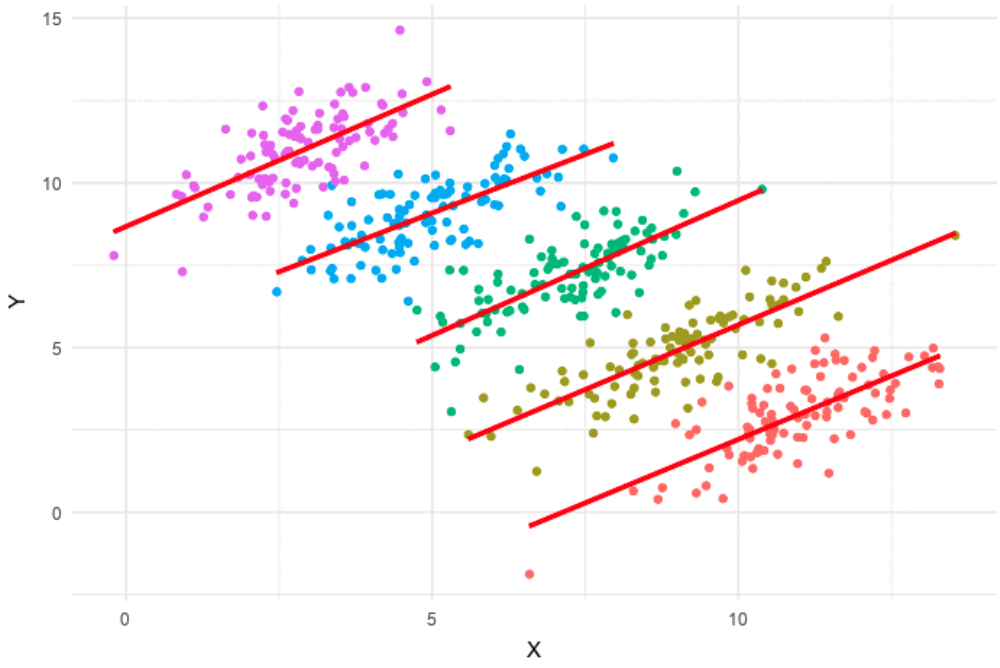


Figure F.2: Simpson's Paradox with Heterogeneity

timing of broadband growth and (2) intensity of broadband growth

Table F.1: Sample Split by Time Period (Early vs. Late)

	Dependent variable:			
	Trips	Chain	Brand	Spend
Main Specification	−0.026	0.105	0.074	−0.054
	(0.013)	(0.129)	(0.056)	(0.056)
Before 2011	−0.159	−2.316	−2.110	0.329
	(1.684)	(4.620)	(3.676)	(1.307)
After 2011	−0.048	0.050	0.017	0.011
	(0.061)	(0.098)	(0.038)	(0.039)
Note:				*p<0.1; **p<0.05; ***p<0.01

Table F.2: Sample Split by Internet Change (Granular)

	Trips	Chain	Brand	Spend
	(1)	(2)	(3)	(4)
Less than 15%	-0.829	-2.767	3.721	0.328
	(5.820)	(9.900)	(6.968)	(3.854)
15 to 20%	7.919	18.219	4.075	6.575
	(14.925)	(32.489)	(9.032)	(12.020)
20 to 25%	-21.159	-157.400	-55.938	-9.817
	(646.33)	(5323.9)	(1688.80)	(304.53)
25 to 30%	2.092	5.310	1.820	0.221
	(2.948)	(5.337)	(2.012)	(1.653)
Greater than 30%	-0.242	0.295	0.337	-0.154
	(0.273)	(0.383)	(0.205)	(0.184)

Table F.3: Sample Split by Internet Change Intensity (Median)

	Trips	Chain	Brand	Spend
	(1)	(2)	(3)	(4)
Less than 20%	0.339	0.970	0.485	0.227
	(0.743)	(1.261)	(0.527)	(0.515)
Greater than 20%	-0.056	0.321	0.231	-0.100
	(0.211)	(0.334)	(0.156)	(0.145)

Table F.4: Sample split by Internet Levels and Time

	Trips	Chain	Brand	Spend
	(1)	(2)	(3)	(4)
Early Low	0.504	-0.195	0.065	-0.127
	(0.454)	(0.835)	(0.300)	(0.488)
Late Low	-0.039	0.176	0.032	0.023
	(0.084)	(0.140)	(0.054)	(0.054)
Early High	-0.179	-2.978	-2.667	0.430
	(2.134)	(6.760)	(5.508)	(1.728)
Late High	-0.346	-0.658	0.005	-0.016
	(0.377)	(0.579)	(0.216)	(0.231)

Note: *p<0.1; **p<0.05; ***p<0.01