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and enforcement is low, so in effect, these transactions are tax-free (Manzi 2015).
 prevailing sales tax rate), but most consumers are not aware of this requirement, few self-report, and one's home tax rate must be remitted to the tax authorities as a use tax (usually equal to the avoid taxes by shopping in low-tax jurisdictions. Legally, any difference between the tax rate paid behavior. Since tax rates differ across states and localities, consumers have many opportunities to measure how demand changes in response to changes in the tax rate, assuming no tax avoidance respect to the tax rate has important policy implications. This elasticity could be estimated by total tax revenue (U.S. Census Bureau 2016). As a result, estimating the elasticity of demand with sales taxes form an important part of state and local finances and account for up to 60% of a state's

1 Introduction

Since 2000, online shopping has grown dramatically as a share of total expenditures and until recently, it was an easy way to avoid sales taxes. Using household-level shopping data, sales tax data, and uneven enforcement of sales tax collection online, I identify tax elasticities for households. I find household elasticities are -0.3 to -0.5 with respect to tax rates on Amazon. This is a much lower response than found in the literature. Additionally, households spend more time searching Amazon's untaxed competitors after Amazon begins collecting sales tax. Finally, when looking at total households expenditures, households increase overall spending after Amazon collects sales tax, indicating that households are shifting spending to offline channels after the policy change. Enforcing sales tax online may help recapture lost tax revenue, but it will likely not provide the local economic boost state and local governments are hoping for.

Abstract

31 May, 2017

E. Mallik Hosseini

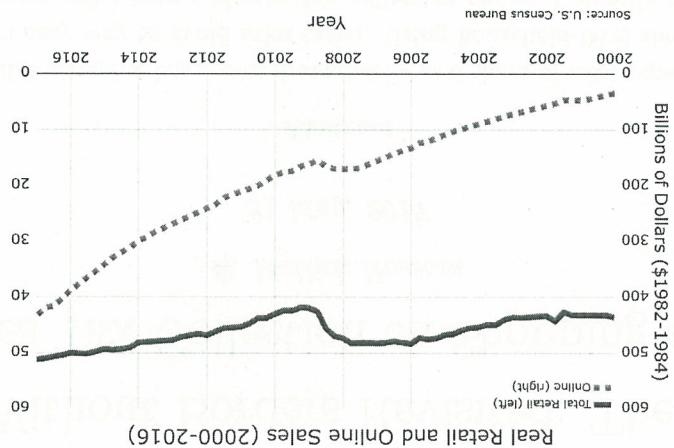
A World Without Borders Revisited: The Impact of Online Sales Tax Collection on Shopping and Search

This paper explores how consumers respond to the increased enforcement of sales tax collection in online shopping, particularly by Amazon. It analyzes how different groups of consumer spending are affected and identifies the relevant margins on which consumers are substituting. Until this point, identifying how much of the changes in online spending were actual reductions in spending versus shifts to offline stores has been difficult. Furthermore, it looks at whether individuals are shifting between taxed and untaxed online shopping or whether individuals are shifting between online shopping. I find that consumers reduce their expenditures on Amazon by 0.3-0.5% for each offline shopping. While consumers are responding slightly to Amazon's policy change, they are spending more time searching on Amazon's untaxed competitors and less time searching on Amazon. When looking at percentage point of sales tax Amazon collects, which is much lower than previously estimated.

Understanding how consumers respond to sales taxes and how this affects their online shopping behavior has large implications for state and local finances. If most online shopping is a result of consumers shifting their spending to avoid sales taxes, then enforcing sales taxes online will help recapture some of the lost revenue and potentially encourage individuals to move their spending back offline and provide the local economic boost that states and localities desire. However, if consumers are shifting their spending online for other reasons, such as convenience or improved user experience, then increased tax enforcement will recover some revenue, but it will not incentivize consumers to patronize their local stores. Because state and local governments have a dual goal of increasing tax revenues and improving local business conditions, enforcing the sales tax would ideally do both, but it may be that it will only increase tax revenues. I find that while households from online-only retailers to offline retailers in response to Amazon's sales tax collection.

Online shopping has made tax avoidance easier. Over the past two decades, online shopping has grown rapidly, reaching 8.5% of total retail sales in the first quarter of 2017 (See Figure 1).

Figure 1



³See ccs.com for an example.

²The Court held that tabulating tax liabilities for over 6,000 different tax jurisdictions would place an undue

¹Legally, consumers should remit the owed sales tax, but compliance and enforcement were low (Manzi 2015).

2004 ranging from \$7-\$11 billion (Goodshee 2001; Bruce and Fox 2000; US Government Accountability Office 2003 and commerce was forecast to grow rapidly over the next few years with estimated losses by 2003 and catalog sales (Goldsbee 2001; US Government Accountability Office 2000). However, internet catalog, or about 0.3% of total sales tax revenues compared to an estimated \$6 billion loss from being generated by retailers. In 1999, losses from e-commerce were estimated at \$500-\$600 put tax losses from internet commerce as relatively small compared to the already existing losses How dramatic was this threat compared with the well-established catalog industry? Initial estimates

threatened by insurance vendors.

that customers were responsible for remitting sales tax.³ A reliable state revenue stream was being often advise that customers would pay no sales tax on purchases, often without mentioning of the opportunity to offer consumers lower prices because no sales tax would be charged. Websites online firms did not have a physical presence in many states. Online retailers quickly took advantage purchases. With the advent of the internet, it became even easier to avoid sales tax because most States were forced to rely upon self-reported use taxes to capture sales taxes on these untaxed retailers did not have to collect sales taxes in states where they did not have a physical presence.² cases—*National Bellas Hess v. Illinois* in 1967 and *Quill Corp. v. North Dakota* in 1992—ruled that shopping in lower tax districts or by purchasing goods from catalogs.¹ Two landmark Supreme Court began threatening state and local revenues. Historically, consumers could avoid taxes only by In the late 1990's and early 2000's, widespread internet adoption and the growth of online retailers

2.1 History

2 Background

The rest of the paper proceeds as follows. Section 2 discusses the background of sales tax collection in online retail and reviews the literature related to online shopping, cross-border shopping, and sales tax. Section 3 describes the data. Section 4 analyzes tax responsibility across different websites. Section 5 analyzes tax responsibility across all consumer spending modes. Section 6 discusses directions for future research and concludes.

Evidence that consumers are shifting their spending offline. Spending increases when sales tax is enforced online, while slightly decreasing on Amazon, providing effects are even stronger for individuals bordering states without sales tax. Furthermore, overall that the benefit of immediate consumption outweighs the convenience of online shopping. These tax changes, but this effect is dominated if consumers live near a lower taxed jurisdiction implying overall household expenditures, I find that consumers spend more at online-only retailers when sales

⁶See Appendix A for details.

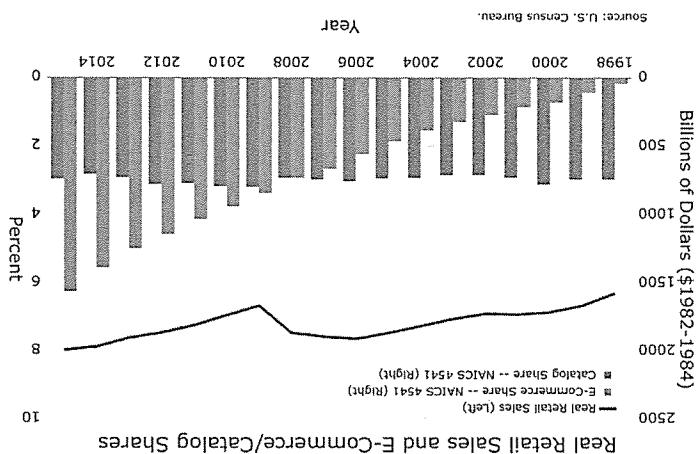
⁵Amazon does not have to collect taxes on goods sold by third-party sellers through its Marketplace platform.
⁴Alaska does not have state sales taxes, but it does have local taxes. See Appendix for timeline of Amazon sales tax collections by state.

arrangements can differ by state.⁶

taxes and the District of Columbia.^{4,5} However, Amazon may not collect local sales taxes and these laws. As of April 1, 2017, Amazon collects state sales taxes in all 45 states that have state sales taxes upheld in court. Since then, online retailers have become less aggressive in challenging similar requirements cleverly sidestepping the rulings of the Supreme Court and Colorado's effort to do this notably customers of their tax liability or to collect and remit the sales taxes themselves. These since then, some states have become more aggressive online retailers to either

retailers (notably Amazon and Overstock) shut down their affiliate programs. Most states did this by claiming that if a retailer had an "affiliate" (e.g. a blog or paid to refer readers to the online retailer) in the state, that was sufficient. However, in response, most online which forced online retailers to collect sales taxes by broadening the definition of "physical presence," sales for shipments to residents. This began a cascade of other "Amazon Laws," some of were effectively tax-free. However, in 2008, New York passed a law forcing online retailers to collect sales, by 2001, a majority of households had access to online storefronts where their purchases were effectively tax-free. Hence, between 1997 and 2001, home internet access jumped from 18% to 50% (U.S. Census Bureau 2015).

Figure 2



Issue compared to the behemoth of catalog shopping, it would likely overtake catalog shopping and continue expanding rapidly. In fact, this is what eventually happened with catalog sales stabilizing around 3% of total retail sales while e-commerce would surge (See Figure 2). Private research companies, academics, and government agencies had predicted that internet commerce would grow rapidly and overtake catalog sales and their predictions were eventually borne out.

(US Government Accountability Office 2000). While internet shopping was (at the time) a small Office 2000) while losses from catalog sales would only grow modestly to between \$6 to \$8 billion

After shopping?

5

Early research focused on how taxes influenced the binary decision of whether or not to make an online purchase. Subsequent research has looked at how sales taxes affect actual online expenditures or quantities purchased. In order to delineate between these, I use "tax-price elasticity" to refer to the effect on the actual online purchase quantities and "tax-quantity elasticity" and "tax-prize elasticity" refers to the effect on the effect on the purchase decision while consumers are already more sensitive to sales taxes. Elliston and Elliston (2009) used a cross-section analysis of sales taxes and memory module purchases to estimate a tax-quantity elasticity of -6.

More recent analyses has found higher elasticities when looking at purchase quantities. Using a differences-in-differences analysis, Anderson et al. (2010) find that internet sale quantities decreased by 11.6% when a large direct seller began collecting sales tax. Given the 4%-6% sales tax increased they analyzed, this implies a tax-quantity elasticity of -1.9 to -2.9. However, their analysis focused on customers living on the border with a state that did not collect sales tax, so it is likely these differences in differences analysis are already more sensitive to sales taxes. Elliston and Elliston (2009) used a cross-section analysis of sales taxes and memory module purchases to estimate a tax-quantity elasticity of -6.

From 18% to 50%. Lee (2007) included the 1997 CPS as well. However, internet penetration exploded over this period other research (except for Elmav et al. (2014)) generally used data from the 2001 CPS (Ballaard and Goolsbee (2000a) used data from a proprietary 1997 survey while the time period. In particular, Goolsbee (2000a) used data from a survey while the data being used and the extrapolation for the variance in estimated elasticities could arise from the fact being used and the and a large share of eBay users are likely to have a lot of experience as well. Furthermore, another it is likely that a large share of users are more technically literate than even 5-10 years previous more computer experience and more internet experience were more sensitive to tax rates. By 2010, related to both Goolsbee (2000b) and Scamman (2007) because they found that individuals with estimates a tax-quantity elasticity of about -1.8, closer to Goolsbee (2000a). This estimate could untaxed varieties of their desired good. Furthermore, when looking at total transaction counts, they will back out of transactions when they find that sales tax is added to their purchase and search for to the estimate of Alm and Melnik (2005). Most recently, Elmav et al. (2014) found that consumers to get an estimate of about -0.2. If they ignore cross-border effects, they get about -0.4, close as well as the decision to purchase nearby (through cross-border shopping proxied by nearby tax exhibit some sensitivity. Ballard and Lee (2007) incorporate both the decision to purchase online into high- and low-tax regions, then low-tax areas are not responsive while high-tax areas tend to tax data, Scamman (2007) finds that elasticities are generally insignificant, but if regions are split up Melnik (2005) find an estimate closer to -0.5 using CPS data. Using more granular, county-level assuming that all consumers in a state pay the lowest combined state and local tax rate, Alm and decrease by about 24%. However, subsequent analyses found much lower tax-purchase elasticities. one of the first to do this. He estimated that online shopping induces a tax-purchase elasticity of 2.3 and he predicted that if sales taxes were imposed online, then the number of online sales would taxes might influence the decision of whether or not to purchase online and Goolsbee (2000a) was taxes and how the internet may have affected that sensitivity. Initial research focused on how sales Online shopping has provided a novel way for economists to explore how sensitive consumers are to

2.2 Related Literature

While estimated elasticities vary widely, by and large, there is a strong indication that consumers are relatively elastic when it comes to avoiding sales taxes. However, an appropriate policy response needs a more comprehensive answer. It is not enough to find that consumers are reducing expenditures in response to the imposition of sales taxes. The important question for policymakers is how much of these expenditure reductions are actual reductions versus substitutions to other channels? In

The literature's estimated elasticities cover a relatively wide range (see Table I) with cross-border search costs being slightly higher than online shopping elasticities. If search costs were the driving sensitivities because search costs are lower online and hence, consumers should be more sensitive to tax rates factor, the opposite relationship between cross-border shopping and online shopping would hold because search costs are lower online and hence, consumers should be more sensitive to tax rates

In general, the literature on cross-border shopping has found higher tax sensitivities than the online shopping literature. One early analysis by Miklessell (1970) finds that cities lose about 6.3% in per capita city retail sales per percentage point of city sales tax. Since then, other analyses have estimated lower tax-price elasticities when looking at cross-border shopping. Using data on alcohol prices in Sweden, Asplund, Fibiger, and Willander (2007) estimates an elasticity of -0.2 to -1.3 with respect to domestic prices and of 0.2 to 0.5 with respect to the foreign prices, demonstrating that consumers respond differently to domestic price changes versus foreign price changes. Many other papers have found similar elasticities using discountinuities in tax rates at borders. Overall, there is substantial empirical evidence that individuals are sensitive to changes in sales tax rates, but the magnitude of this response is still unclear.

In theory, online shopping is a new iteration of the old problem of cross-border shopping. However, now, consumers do not have to travel to lower tax jurisdictions or cross borders, they just have to order their desired product online, and wait for it to be delivered to their door tax-free.

As better data become available, researchers have revisited this question to answer more important policy questions on the fiscal effects of collecting sales tax online and measuring how sensitive actual dollars are to tax rates instead of just the binary purchase decision. Hu and Tang (2014) use data collected from a catalog and internet retailer to estimate tax sensitivity when New York City exempted clothing from its 4% local sales tax. They find that customer spending decreases by 15-18%, which implies a tax-price elasticity of about -3.75 to -4.5. This would indicate that a substantial portion of internet and catalog retail is linked to sales tax savings. While their analysis uses more recent data and is quite comprehensive there could be some issues arising from this being only a single company and only focused on consumers in New York City and Connecticut. While suggestive, it is unclear whether consumers are shifting their spending to online competitors, off-line retailers, or reducing their spending overall. Using broader proprietary online shopping data, Houdé, Newberry, and Seim (2017) estimate an elasticity of about -1.3. Most recently, using detailed transaction data from an online account aggregator, Baugé, Ben-David, and Park (2016) find estimates of about -1.2 to -1.4, but this is heavily dependent upon the size of the purchase.

⁸For more details on comScore's data collection methodology, please see Appendix B.

The primary data source used in this paper is the comScore Web Behavior database. This database contains the online browsing and transaction activity of between 50,000 and 100,000 US households that have explicitly consented to having this data collected by comScore. The browsing data records how long and how many pages were viewed on each website. In the transaction data, the website, product name, product category, price, quantity, and basket total (including shipping and taxes) are recorded. Over 5 million transactions are in the data and about 10%-25% of households make a purchase each month.⁸ Previous studies have only estimated the effect of taxes on purchasing a particular good (Ellison and Ellison 2009; Asplund, Friberg, and Wiliander 2007; Agarwall, Marwell, and McGranahan 2017) or purchases through particular companies (Einau et al. 2014; Anderson et al. 2010; Hu and Tang 2014). However, this does not enable a more comprehensive understanding of how consumers are adjusting their spending either by shifting to other channels or reducing their expenditures. Baumgärtner, Ben-David, and Park (2016) look at substitution effects, but are limited by not being able to directly observe the products being purchased. The comScore data

3.1 comScore Web Behavior Database

3 Data Description

particularly, are consumers shifting their spending to taxable channels, thereby helping governments recapture some lost revenues? Furthermore, are consumers shifting their spending to offline channels, thereby reviving local economies?

Type	Paper	Estimate	Price-Expenditure	Tax-Purchase	Tax-Quality	Tax-Price
Cross-border	Asplund, Friberg, Williamson (2007) – Foreign price	0.2 to 0.5	Asplund, Friberg, Williamson (2007) – Domestic price	-0.2 to -1.3	Mikessell (1970)	0.0
	Davies (2011)	-2.2 to -3.0	Agarwala, Chomsisengphete, Qian, Xu (2017)	-2.3	Scandinam (2007)	-6.3
	Agarwala, Marwell, McGranahan (2017)	-2 to -30	Agarwala, Chomsisengphete, Qian, Xu (2017)	-2.2 to -3.0	Ballard & Lee (2007)	-0.2
	Davis (2011)	-2 to -30	Mikessell (1970)	-6.3	Alm & Melnik (2005)	-0.5
			Scandinam (2007)	-6.3	Finav, Knoedle, Levitt, Sundaresan (2014)	-1.8
			Ballard & Lee (2007)	-0.2	Goolsbee (2000)	-2.3
			Alm & Melnik (2005)	-0.5	Anderson, Fong, Simester, Tucker (2010)	-1.9 to -2.9
			Finav, Knoedle, Levitt, Sundaresan (2014)	-1.8	Ellison & Ellison (2009)	-6
			Ballard & Lee (2007)	-0.2	Baugh, Ben-David, Park (2017)	-1.2 to -1.4
			Alm & Melnik (2005)	-0.5	Houde, Newberry, Seim (2017)	-1.3
			Finav, Knoedle, Levitt, Sundaresan (2014)	-1.8	Hu and Tang (2014)	-3.75 to -4.5

Table 1: Estimated Elasticities

⁹ Some of this decrease could also be a data quirk because comScore uses website-specific “agents” to capture the full “long tail” of internet transactions. And they only update it if the website has at least 50 panelist buyers within a month. Therefore, comScore does not transaction data on each website. When websites are redesigned, they must update the website’s corresponding “agent” population.

In terms of race, there are fewer Asians and whites compared to the general population. Furthermore, there are many fewer panelists making over \$100,000 compared to the Census population. In particular, there are more middle-aged and more middle-income than the general comScore’s panelists do tend to be more middle-aged and more middle-income than the general 2002-2016 is almost identical to the Census population (See Appendix Figure 7 and Figure 8). Demographically, the geographic and racial composition of households in comScore’s panel between

concentration of sales (Figure 5 and Figure 6).

Ebay, and Etsy) instead of setting up individual websites.⁹ Overall, there is evidence of increasing activity has become more concentrated (i.e. consumers are looking at fewer sites) over time, which commerce relative to desktop shopping (Figure 4). Another explanation is that online shopping being a player in online shopping since about 2010 and it remains a small share of total online only be made through a mobile app instead of a website). However, mobile shopping only started done on mobile devices and therefore are not being picked up in this data (if the transaction could has remained relatively flat (Figure 3). One possible explanation is that more shopping is being at least 1 transaction. This number has been dropping steeply over time, while per user transactions while there are millions of unique websites visited each year, only a few hundred websites recorded

after including taxes and shipping.

Therefore, I can more accurately examine changes in pre-tax spending versus changes in spending records both the pre-tax price as well as the final purchase total (including taxes and shipping). and Park (2016) can only observe the final price paid for the whole transaction, while comScore better identification of substitution effects resulting from taxation. Additionnally, Baum, Ben-David, have information on the product as well as the retailer that it was purchased from which enables

Figure 4

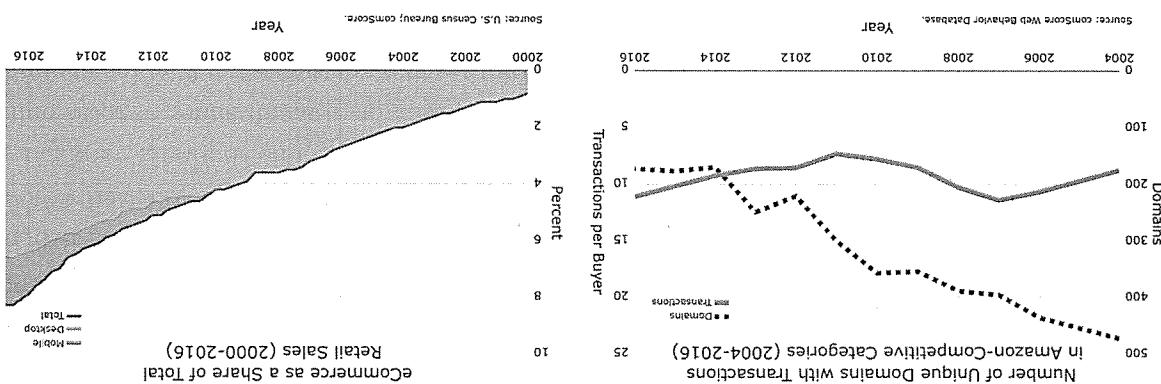
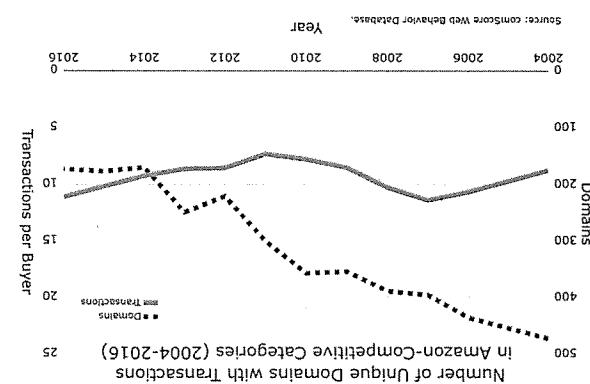


Figure 3



Online shopping will be stores with only an online presence.¹⁰ The purchase at a brick-and-mortar retailer was made online or offline. The channel type will refer to the store and not the purchase. If someone bought something from Target, we have no way of knowing whether it is offline or online.

¹⁰ Correspondence with Kitis Center for Marketing. "Unfortunately, there is no good way to distinguish whether a retailer's classified as "Online Shopping" are those firms that solely have an online presence.¹⁰

retailers purchased from target.com and the retailer would be classified as a "Discount Store". Therefore, purchases from target.com, department purchased from Target would appear identical to department chains. For example, department purchased from Target does not distinguish between purchase retailers with both online and offline presence, Nielsen does not distinguish between purchase categories is enough to conduct a similar analysis as I do with the comScore data. For this classification is into broad categories such as "Grocery Stores", "Electronics Store", and "Online Shopping"; any discounts were applied. Unlike the comScore data, store identities are anonymized, but they are where they went as well as price, quantity, and description of goods they purchased and whether for personal, in-home use. The panel covers 2004-2015. Panelists provide information on when and U.S. households that use in-home scanners to record all of their purchases from any outlet, intended Nielsen HomeScan Consumer Panel, which is a longitudinal, representative panel of 40,000-60,000 To further analyze consumer responses to the enforcement of sales tax collection online, I use the Nielsen HomeScan Consumer Panel, which is a longitudinal, representative panel of 40,000-60,000

3.2 Nielsen Consumer HomeScan Panel Data

This leaves me with 2.7 million transactions across almost 250,000 households. competitor (no plane tickets, dating services, etc.) and focus on products that cost more than \$1. my analysis to transactions in categories which are subject to sales taxes and in which Amazon is a focus on online transactions and the corresponding household characteristics. Furthermore, I restrict In order to look at the spending response to increased enforcement of sales tax collections, I only the 75th percentile is about 12 months) so this distribution may shift slightly from year to year.

Panel with the median tenure being about 11 months (the 25th percentile is about 6 months and but this is likely made up in the "Other" category. Panelists frequently rotate through comScore's but this is likely made up in the "Other" category. Panelists frequently rotate through comScore's

Figure 6

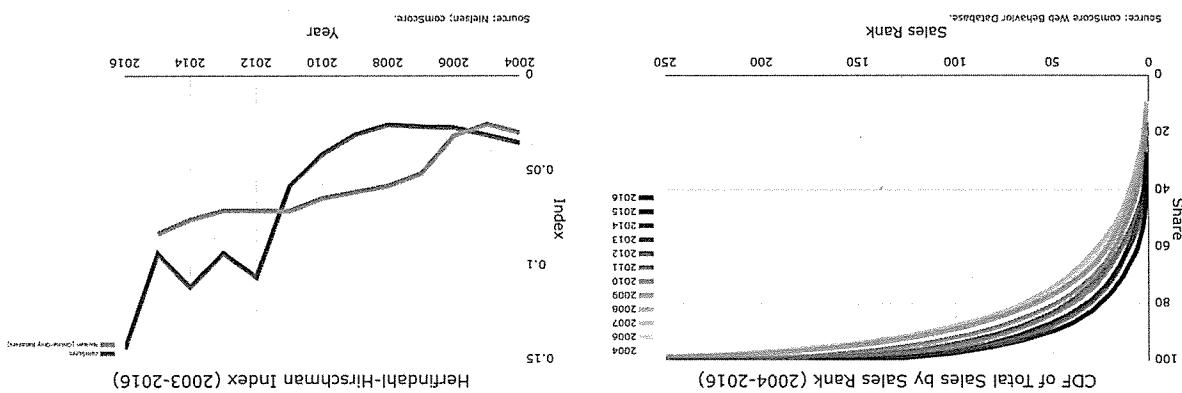
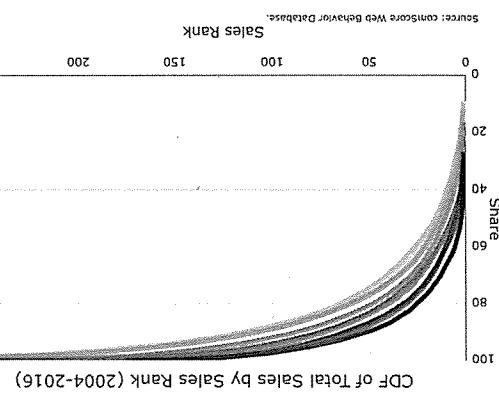


Figure 5



I use comScore data to estimate how consumers respond when Amazon begins collecting sales tax. Consumer purchases can be made in one of 3 different channels: Amazon, taxed Amazon's untaxed competitors, and untaxed Amazon competitors. If consumers are shopping online primarily for tax purposes, we would expect Amazon's untaxed competitors to capture a large share of Amazon's customers after Amazon starts collecting sales tax.

11 There are instances where the total sales tax and the use tax rates differ. Since compliance with the use tax is low, it consumers are responding to tax rates, they are likely responding to the sales tax rate instead of the use tax rate. Under this assumption, I only do my analysis with the total sales tax rate instead of the use tax rate.

12 More data and source material on online taxes are available from the author upon request.

13 See Appendix B for details on how these datasets were combined.

4 Online Shopping Analysis

I compiled information on state law changes and aggregate sales taxes from each state's Department of Revenue and the National Conference of State Legislatures. This information was gathered from a wide range of local, state, and national news sources. As of April 1, 2017, most states do not require online retailers to collect sales taxes. They have only been able to collect sales taxes from Amazon because of separate agreements or because Amazon has opened warehouses in their state. For states that do have laws, they primarily apply to online retailers with "affiliate" programs, which are programs under which online retailers partner with other websites (primarily blogs) to promote their site and they pay the blogs based on referrals. Early on, most online retailers stopped their affiliate programs when these laws were passed. The only states that have passed laws forcing online retailers to collect sales taxes regardless of physical presence are Alabama, Colorado, Louisiana, Oklahoma, and Vermont.

(2014) Geographic Correspondence Engine to match ZIP codes from 2010 with their corresponding Federal Information Processing Standards (FIPS) code, which uniquely identifies counties. Furthermore, using the U.S. Census Bureau's County Addressency File from the 2010 Census, I identify adjacent counties that consumers could use to minimize their sales tax burden (U.S. Census Bureau 2010).¹³

3.4 Additional Data Sources

I obtained state, county, and local sales tax rates from Tax Data Systems, now part of Thomson Reuters. This data provides monthly tax rates at the ZIP code level. Tax jurisdiction boundaries and ZIP code boundaries are created separately, so there are instances where one ZIP code has multiple applicable tax rates depending on where in the ZIP code someone is located.¹¹

3.3 Tax Data Systems

where this predicts the probability that a purchase of y household h in county i in product category j at time t is made on Amazon or one of its competitors. I incorporate the effective tax rate by county as well as an indicator of whether or not Amazon collects the sales tax rate by household income, race, and age and include fixed effects for the country, product category, control for household income, and age and include fixed effects for the county, product category, and month-year. This regression does not control for price, but includes product category fixed effects and time fixed effects helps capture price changes and price dispersion across categories. Monthly level to better capture the tax changes since these changes are often made effective in particular months, rather than delayed until the start of the new year and consumers may respond rapidly to such changes. I find that purchase probabilities decrease with the sales tax rate only if the policy change is plausibly exogenous. While it could potentially be related to the underlying economic fundamentals of a state, Baumgärtner, Ben-David, and Park (2016) show that sales tax collection by Amazon is not significantly related to state GDP growth, household income changes, or consumption decisions.

14 The policy change is plausibly exogenous. While it could potentially be related to the underlying economic fundamentals of a state, Baumgärtner, Ben-David, and Park (2016) show that sales tax collection by Amazon is not significantly related to state GDP growth, household income changes, or consumption decisions.

15 Amazon began collecting sales tax in California in the middle of the month. Because of this, I have removed the observations from housesholds in California during the transition month.

16 There is a high correlation (around 0.98) between the collection indicator and the interaction term. Because of this, I cannot include both of them in the regression.

$$Pr(A_{ohit} = 1) = \beta_0 + \beta_1 \ln(1 + \tau^u) + \beta_2 \ln(1 + \tau^u \mathbb{I}_{\text{collect}}) + \beta_3 TaxDif^u + \beta_4 TaxDiff^u * \mathbb{I}_{\text{collect}}$$

I estimate the propensity of making either an Amazon purchase, a taxed non-Amazon purchase, or an untaxed non-Amazon purchase using a linear probability model. After controlling for time, county, household, and product category characteristics, I show that sales tax only affects online behavior after Amazon collects sales tax.^{14,15} Furthermore, cross-border shopping incentives such as lower nearby sales tax rates are not contrite to the Amazon purchasing decision but do contribute to the purchasing decision at Amazon's untaxed competitors. I run the following linear probability regression:¹⁶

4.1 Transaction Level Analysis

First, I estimate a simple linear probability model and show that consumers are significantly less likely to make purchases on Amazon only after Amazon collects sales taxes. I then look at how Amazon's sales tax collection affects consumer expenditures and their browsing. Browsing and search are important because if Amazon delivers value outside of cost savings (such as their review system), then we would expect customers to still spend time on Amazon even if they were not spending their dollars on Amazon. With the comScore data, I am only limited to consumer's online behavior, but this gives a strong indication of how consumers are shifting their spending across online stores. In Section 5, I extend my analysis to the full range of consumer spending options.

What other controls are in there?

the more interesting question is how consumers are changing their spending and whether they are shifting to Amazon's competitor websites or whether they may be moving their spending offline. Overall, consumers are adjusting their behavior when Amazon begins collecting sales tax. However,

immediately instead of having to wait for delivery.

savvies from ordering online is outweighed by the convenience of being able to consume the good marginally significant effect of the tax difference. One explanation is that the sales tax purchases also show no significant change in response to Amazon collecting taxes, but there is a association with delivery or warranties on those items. Surprisingly, the untaxed non-Amazon can systematically differ from normal online purchases, so this could arise from other amenities response to Amazon collecting sales tax, except for high-priced items. Once again, these items should be relatively unaffected. As expected, taxed non-Amazon purchases show no significant tax, then untaxed, non-Amazon purchase probability will increase and taxed non-Amazon purchases as well as taxed non-Amazon websites. If consumers are responding to the implementation of the I also run the same regressions on the propensity to purchase from untaxed, non-Amazon websites

delivered to one's home even if there is a nearby way to reduce one's sales tax bill.

(televisions, furniture, exercise equipment, etc.), so there is additional value from having these items average. Upon inspection, these items tend to be much larger and heavier than cheaper items price" cutoff, while the coefficient on the tax and collection interaction is stable, but higher on collecting sales tax. This is puzzling, but this coefficient is quite sensitive to my choice of a "high goods, there is also evidence that consumers are more likely to buy on Amazon after Amazon begins collecting sales tax. When purchasing higher priced items, I restrict my sample to products greater than \$150 and find that consumers respond more strongly to sales tax when Amazon collects it. For these high-priced

Finally, Baugh, Ben-David, and Park (2016) showed that consumers are more sensitive to sales tax individuals since firms in zero sales tax states often advertise that they do not charge sales tax. retailers, which other consumers cannot do. Furthermore, sales taxes may be more salient to these avoid taxes, then they have the additional option of shifting all of their purchases to untaxed offline quantities". As expected, the sensitivity is much higher. If these consumers were using Amazon to option), I restrict my analysis to counties that border states without sales tax (called "border To see if consumers living near a zero tax state respond differently (since they still have an untaxed

option. In the full sample, tax differences do not significantly influence purchasing decisions. reduce their propensity to shop on Amazon by even more than consumers without this outside still have an outside option that offers more tax savings than shopping in their county and may reduce their online shopping if they live near a low-tax jurisdiction. Consumers near lower tax areas include a measure of tax differences between counties to capture the fact that individuals may also since online shopping and cross-border shopping are different ways of avoiding sales taxes, I also

Hodge, Newberry, and Seim (2017) and obtain similar results. When Amazon begins collecting sales tax. As a validation exercise, I run the same regression as

Table 2: Probability of Amazon Purchase

	<i>Dependent variable:</i>						
	Amazon Probability			High Price			Border Counties
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Log(1 + Sales Tax)	-0.088 (0.276)	-0.043 (0.268)	-0.317 (0.327)	-0.321 (0.328)	-0.328 (0.329)	-0.092 (0.597)	-1.846 (1.623)
Log(1 + Sales Tax * Collect)		-0.238*** (0.058)	-0.241*** (0.059)	-0.218*** (0.065)		-0.347*** (0.111)	-0.922** (0.376)
Tax Diff			0.583 (0.407)	0.654 (0.408)	0.653 (0.412)	0.403 (0.829)	
Tax Diff * Collect				-0.160 (0.197)	-0.247 (0.199)	0.781*** (0.230)	
Collect					-0.013*** (0.005)		
Observations	2,460,142	2,460,142	2,460,142	2,460,142	2,460,142	93,758	69,599
R ²	0.315	0.315	0.315	0.315	0.315	0.182	0.339
Adjusted R ²	0.314	0.314	0.314	0.314	0.314	0.158	0.337

Note:

*p<0.1; **p<0.05; ***p<0.01
 Household race, income, and age as well as month-year, county, and product category fixed effects are included. Standard errors are clustered at the year-month and county level.

Table 3: Probability of Taxed Non-Amazon Purchase

	<i>Dependent variable:</i>						
	Taxed Non-Amazon Probability			High Price Border Counties			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Log(1 + Sales Tax)	0.270 (0.379)	0.247 (0.378)	0.065 (0.448)	0.067 (0.448)	0.069 (0.449)	-0.269 (0.867)	3.536 (2.444)
Log(1 + Sales Tax * Collect)			0.119 (0.084)	0.118 (0.084)	0.105 (0.093)	0.105 (0.157)	0.558 (0.511)
Tax Diff			0.387 (0.552)	0.348 (0.558)	0.360 (0.560)	-0.433 (1.077)	
Tax Diff * Collect				0.088 (0.306)	0.105 (0.302)	-0.330 (0.406)	
Collect					0.008 (0.006)		
Observations	2,460,142	2,460,142	2,460,142	2,460,142	2,460,142	93,758	69,599
R ²	0.241	0.241	0.241	0.241	0.241	0.176	0.278
Adjusted R ²	0.240	0.240	0.240	0.240	0.240	0.152	0.275

Note:

*p<0.1; **p<0.05; ***p<0.01
 Household race, income, and age as well as month-year, county, and product category fixed effects are included. Standard errors are clustered at the year-month and county level.

Table 4: Probability of Untaxed Non-Amazon Purchase

	<i>Dependent variable:</i>						
	Untaxed Non-Amazon Probability			High Price		Border Counties	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Log(1 + Sales Tax)	-0.182 (0.452)	-0.204 (0.450)	0.252 (0.542)	0.254 (0.542)	0.259 (0.542)	0.361 (0.976)	-1.690 (1.998)
Log(1 + Sales Tax * Collect)	0.119 (0.088)	0.123 (0.088)	0.123 (0.099)	0.113 (0.099)	-0.041 (0.140)	0.364 (0.426)	
Tax Diff	-0.971* (0.585)	-1.002* (0.601)	-1.013* (0.602)	0.030 (1.201)			
Tax Diff * Collect	0.072 (0.306)	0.142 (0.301)	-0.451 (0.399)				
Collect		0.006 (0.007)					
Observations	2,460,142	2,460,142	2,460,142	2,460,142	93,758	69,599	
R ²	0.178	0.178	0.178	0.178	0.205	0.183	
Adjusted R ²	0.177	0.177	0.177	0.177	0.181	0.180	

Note:

*p<0.1; **p<0.05; ***p<0.01
 Household race, income, and age as well as month-year, county, and product category fixed effects are included. Standard errors are clustered at the year-month and county level.

Amazon demand model

larger than its untaxed competitors.
taxed competitors make up comparable amounts. Amazon is slightly smaller than its taxed competitors and slightly taxed is likely not driven by size. In terms of expenditures, Amazon's untaxed competitors, and Amazon's

Marketplace after Amazon begins collecting sales taxes.

Amazon Marketplace (2016) provides evidence that there is a marginally significant reduction in expenditures on the Ben-David, and Park (2016) and shippers' expenditures are unchanged, consumers are likely not gaining from this switch. Furthermore, Baumgärtner individuals are shifting their spending within Amazon to the Amazon Marketplace, but given that post-tax be that individuals are not responsible for collecting sales tax on goods sold through the Amazon Marketplace. It could sell, Amazon is not responsible for collecting sales tax on goods Amazon Marketplace which is a platform for third-party sellers. Even though Amazon collects sales tax on goods Amazon Marketplace observes is whether consumers are shifting their purchases to the

One potential behavioral change that I cannot observe is whether consumers are shifting their purchases to the on sales taxes, one would expect Amazon's untaxed competitors to capture an additional share of purchases away from Amazon, just reducing expenditures.¹⁸ If consumers were shopping based affected by the policy change either, further supporting that individuals are not shifting their consumer expenditures on Amazon's competitors (whether taxed or untaxed) are not significantly

Houde, Newberry, and Seim (2017).

substantially less responsive than previously estimated by Baumgärtner, Ben-David, and Park (2016) or sales, but this spending is not made up on Amazon's competitors.¹⁷ Overall, consumers are decisions. Hence, it appears that consumers are spending less on Amazon after Amazon collects jurisdictions, which makes sense if consumers are consciously factoring sales tax into their purchase expenditures on Amazon. This effect is even more pronounced in areas that border zero sales tax tax and shipping) they are slightly less negative, but still consumers are reducing their overall these sales tax collections. When looking at a consumer's total Amazon expenditures (including tax rate is about 6.7%, this translates into about a 3% decrease in Amazon sales as a result of

a percentage point tax change conditional on Amazon collecting sales tax. Given that the average changes in tax policy and reduce their pre-tax expenditures by about 0.4-0.5% in response to to the changes in response to the tax Policy. As expected, households are moderately sensitive expenditures in response to the tax Policy change. As expected, households are moderately sensitive effects. Based on the previous results, we would expect households to reduce their Amazon adjacent county. I control for household income, age, and race, as well as county and year-month including a measure of the tax difference between the consumer's home county and the lowest taxed by household in county at month to the prevailing tax rate and an indicator of whether or This regression relates the log expenditures made in channel j (Amazon or one of its competitors)

$$\ln E_{jii} = \beta_0 + \beta_1 \ln(1 + \tau_{ii}) + \beta_2 \ln(1 + \tau_{ii} L_{i\text{collect}}) + \beta_3 TaxDiff_{ji} + \beta_4 TaxDiff_{ji} * L_{i\text{collect}} + \beta_5 Race_h + \beta_6 Income_h + \beta_7 Age_h + \beta_8 + \beta_9 + \epsilon_{hii}$$

$$\ln E_{jii} = \beta_0 + \beta_1 \ln(1 + \tau_{ii}) + \beta_2 \ln(1 + \tau_{ii} L_{i\text{collect}}) + \beta_3 TaxDiff_{ji} + \beta_4 TaxDiff_{ji} * L_{i\text{collect}} +$$

I then analyze how consumer spending on Amazon and Amazon's competitors change in response to sales tax collection. Using a similar regression as above, I estimate consumer's tax-price elasticities.

4.2 Household Level Expenditure Analysis

tax

*Amazon becomes more attractive in more areas
due to and through the
adoption of Amazon tax
so not about*

*middle point apart
from trials -*

to would be much to

Anotther interesting finding is that in response to increases in their local sales tax rate, consumers in border counties reduce their Amazon spending and increase their spending on Amazon's untaxed competitors. Finally, consumer spending on Amazon's untaxed competitors decreases as the difference in tax rates increases between a consumer's home county and a neighboring county. It is puzzling why this would take effect only after Amazon began collecting sales tax, but one explanation is that consumers inferred that the Amazon decision applied broadly (or would soon apply broadly) to other untaxed online retailers, so they shifted their spending to offline retailers that would be less taxed and less at risk of becoming taxed in the near future. Overall, while Amazon spending is affected, overall online spending is not significantly affected by the change.

consumer spending, but this is not the case.

Table 5: Amazon Expenditures

	<i>Dependent variable:</i>							
	Log Expenditures				Post-Tax			
	All Counties				Border Counties		Post-Tax	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Log(1 + Sales Tax)	0.055 (1.023)	0.193 (1.024)	0.827 (1.266)	0.805 (1.266)	0.801 (1.266)	1.331 (1.131)	-13.423** (5.761)	-10.644** (5.187)
Log(1 + Sales Tax * Collect)		-0.458*** (0.164)	-0.454*** (0.165)	-0.368** (0.183)		-0.274* (0.164)	-2.595** (1.161)	-2.075** (1.046)
Tax Diff			-1.206 (1.416)	-0.854 (1.454)	-0.955 (1.455)	-1.518 (1.298)		
Tax Diff * Collect			-0.611 (0.571)	-0.554 (0.556)	-0.053 (0.510)			
Collect				-0.032*** (0.012)				

Observations	156,367	156,367	156,367	156,367	156,367	156,332	5,393	5,392
R ²	0.067	0.067	0.067	0.067	0.067	0.070	0.081	0.091
Adjusted R ²	0.051	0.051	0.051	0.051	0.051	0.054	0.049	0.059

Note:

*p<0.1; **p<0.05; ***p<0.01
Household race, income, and age as well as month-year and county fixed effects are included.

Table 6: Taxed Non-Amazon Expenditures

	<i>Dependent variable:</i>								
	Log Expenditures				Post-Tax		Border Counties		Post-Tax
	(1)	(2)	(3)	(4)	(5)	(6)	(7)		(8)
Log(1 + Sales Tax)	-0.113 (0.737)	-0.131 (0.738)	0.140 (0.894)	0.144 (0.894)	0.153 (0.894)	-0.180 (0.848)	3.604 (4.534)	1.560 (4.302)	
Log(1 + Sales Tax * Collect)	0.066 (0.141)	0.067 (0.141)	0.045 (0.162)		0.185 (0.153)	-0.060 (1.212)		0.062 (1.151)	
Tax Diff	-0.561 (1.048)	-0.622 (1.070)	-0.649 (1.071)	-0.244 (1.015)					
Tax Diff * Collect	0.148 (0.522)	0.225 (0.505)	-0.121 (0.495)						
Collect		-0.0003 (0.011)							
Observations	227,506	227,506	227,506	227,506	227,444	7,061	7,060		
R ²	0.044	0.044	0.044	0.044	0.044	0.045	0.057	0.055	
Adjusted R ²	0.032	0.031	0.031	0.031	0.032	0.032		0.030	

Note:

*p<0.1; **p<0.05; ***p<0.01
Household race, income, and age as well as month-year and county fixed effects are included.

Table 7: Untaxed Non-Amazon Expenditures

	<i>Dependent variable:</i>							
	Log Expenditures				Post-Tax			
	All Counties				Border Counties			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Log(1 + Sales Tax)	-0.930 (0.805)	-0.925 (0.806)	-0.655 (0.969)	-0.707 (0.969)	-0.720 (0.969)	-0.904 (0.909)	17,820*** (5,094)	14,525*** (4,767)
Log(1 + Sales Tax * Collect)	-0.021 (0.160)	-0.020 (0.160)	0.190 (0.183)		0.182 (0.172)	-0.772 (1.284)	-0.082 (1.202)	
Tax Diff	-0.575 (1.144)	0.015 (1.172)	0.091 (1.172)	0.251 (1.099)				
Tax Diff * Collect	-1.422** (0.607)	-1.521*** (0.585)	-1.104* (0.570)					
Collect		0.020 (0.012)						

Observations	213,651	213,651	213,651	213,651	213,646	6,127	6,127
R ²	0.037	0.037	0.037	0.037	0.044	0.056	0.061
Adjusted R ²	0.024	0.024	0.024	0.024	0.031	0.027	0.032

Note:

*p<0.1; **p<0.05; ***p<0.01
Household race, income, and age as well as month-year and county fixed effects are included.

Table 8: Total Online Expenditures

	<i>Dependent variable:</i>								
	Log Expenditures			Post-Tax					
	All Counties	(1)	(2)	(3)	(4)	(5)	(6)	Border Counties	Post-Tax
Log(1 + Sales Tax)		-0.112 (0.538)	-0.114 (0.539)	0.006 (0.653)	-0.017 (0.653)	-0.006 (0.653)	-0.109 (0.609)	9.111*** (3.313)	7.401** (3.089)
Log(1 + Sales Tax * Collect)		0.009 (0.100)	0.010 (0.100)	0.105 (0.114)			0.161 (0.106)	-1.219 (0.779)	-0.914 (0.726)
Tax Diff		-0.247 (0.758)	0.042 (0.776)	0.023 (0.776)		-0.028 (0.723)			
Tax Diff * Collect		-0.651* (0.370)	-0.575 (0.358)	-0.414 (0.345)					
Collect			0.004 (0.008)						

Observations	512,430	512,430	512,430	512,430	512,430	512,359	15,480	15,478
R ²	0.034	0.034	0.034	0.034	0.034	0.037	0.048	0.049
Adjusted R ²	0.028	0.028	0.028	0.028	0.028	0.031	0.036	0.038

Note:

*p<0.1; **p<0.05; ***p<0.01
Household race, income, and age as well as month-year and county fixed effects are included.

this is a broader trend, this effect should be picked up in the month-year fixed effects.
²⁰If this was due to consumers search more on their mobile phones instead of on their computer, to the extent that measures search if people are reading reviews or comparing products.

¹⁹Doing this analysis based on page views has similar results. I prefer browsing duration because reducing expenditures might be associated with less checkouts, dropping page views naturally. Browsing duration more closely measures how much time spent on Amazon's competitor websites, especially in border countries.

Amazon collecting it, it would imply that tax sensitive shoppes generally look at other websites when searching for tax-free items. Interestingly, while we did not see an increase in consumer

considering the strong response to both the sales tax rate and the sales tax rate conditional on untaxed state.

Border counties decrease their browsing on Amazon by a much larger amount and increase their browsing on Amazon's taxed competitors. Since a large share of these taxed competitors are firms with an offline presence (like Wal-Mart and Target), it is likely that consumers are looking at their prices and then driving across the border to purchase the good from a Wal-Mart or Target in an untaxed state.

this effect is augmented when Amazon begins collecting sales taxes.

²⁰ As a result, they browse on Amazon's untaxed competitors as well and purchase from Amazon. It is likely that they are browsing more when sales taxes become more salient, but ultimately still increases. This can be explained because browsing on Amazon's untaxed competitors increases, so however, households surprisingly reduce the time they spend browsing on Amazon collecting sales tax. 0.4-0.6% in response to a 1 percentage point tax change conditional on Amazon searching by about households are sensitive to the changes in tax policy and reduce their Amazon searching by about households reduce their time spent on Amazon in response to the tax policy change. As expected, households are sensitive to the changes in tax policy and reduce their Amazon searching by about income, age, and race, as well as county and year-month fixed effects. The hypothesis is that between the consumers' home county and the lowest taxed adjacent county. I control for household behavior, I also control for cross-border shopping by including a measure of the tax difference in county to an indicator of whether or not Amazon collects sales tax in that county. This relates the log browsing duration made in channel j (Amazon or its competitors) by household

$$B_{it} = \beta_0 + \beta_1 \ln(1 + \tau_{it}) + \beta_2 \ln(1 + \tau_{it} L_{collect}) + \beta_3 TaxDiff_{it} + \beta_4 TaxDiff_{it} * L_{collect} + \beta_5 Race_h + \beta_6 Income_h + \beta_7 Age + \gamma_i + \epsilon_{it}$$

changes in response to Amazon collecting sales taxes.¹⁹ Look at how time spent on Amazon, untaxed non-Amazon websites, and taxed non-Amazon websites behave? In particular, are they searching more or less as a result of tax changes? To do this, I From above, we see that consumers are spending less on Amazon, but are they changing their

4.3 Household Level Search and Browsing

Table 9: Amazon Browsing Duration

	<i>Dependent variable:</i>						
	Log Duration (Minutes)				Border Counties		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Log(1 + Sales Tax)	-1.622* (0.950)	-1.492 (0.951)	-3.112*** (1.175)	-3.065*** (1.176)	-3.100*** (1.175)	-24.778*** (5.522)	-23.672*** (5.561)
Log(1 + Sales Tax * Collect)	-0.430*** (0.153)	-0.442*** (0.153)	-0.625*** (0.170)				-1.860* (1.121)
Tax Diff	3.082** (1.314)	2.333* (1.349)	2.308* (1.350)				
Tax Diff * Collect		1.301** (0.530)	1.134** (0.517)				
Collect			-0.039*** (0.011)				
Observations	156,367	156,367	156,367	156,367	156,367	5,393	5,393
R ²	0.078	0.078	0.078	0.078	0.078	0.113	0.113
Adjusted R ²	0.062	0.062	0.062	0.062	0.062	0.082	0.082

Note:

*p<0.1; **p<0.05; ***p<0.01

Household race, income, and age as well as month-year and county fixed effects are included.

Table 10: Taxed Non-Amazon Browsing Duration

	<i>Dependent variable:</i>						
	Log Duration (Minutes)						
	All Counties			Border Counties			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Log(1 + Sales Tax)	0.072 (0.648)	0.030 (0.648)	0.311 (0.786)	0.325 (0.786)	0.327 (0.786)	11.739*** (3.888)	11.207*** (3.934)
Log(1 + Sales Tax * Collect)		0.163 (0.124)	0.164 (0.124)	0.081 (0.142)			0.929 (1.052)
Tax Diff		-0.581 (0.921)	-0.811 (0.941)	-0.803 (0.941)			
Tax Diff * Collect		0.553 (0.459)	0.563 (0.444)				
Collect		0.006 (0.010)					

Observations	227,506	227,506	227,506	227,506	227,506	7,061	7,061
R ²	0.046	0.046	0.046	0.046	0.046	0.055	0.055
Adjusted R ²	0.033	0.033	0.033	0.033	0.033	0.030	0.029

Note:

*p<0.1; **p<0.05; ***p<0.01

Household race, income, and age as well as month-year and county fixed effects are included.

Table 11: Non-Taxed Non-Amazon Browsing Duration

	<i>Dependent variable:</i>					
	Log Duration (Minutes)			Border Counties		
	(1)	(2)	(3)	(4)	(5)	(6)
Log(1 + Sales Tax)	1.598*	1.516	1.904*	1.962*	1.983*	2.269
	(0.930)	(0.931)	(1.119)	(1.119)	(1.119)	(5.970)
Log(1 + Sales Tax * Collect)	0.364**	0.365**	0.132			
	(0.184)	(0.184)	(0.212)			
Tax Diff	-0.827	-1.483	-1.541			
	(1.322)	(1.354)	(1.354)			
Tax Diff * Collect		1.582**	1.746***			
		(0.702)	(0.676)			
Collect		0.002				
		(0.014)				
Observations	213,651	213,651	213,651	213,651	6,127	6,127
R ²	0.077	0.077	0.077	0.077	0.093	0.093
Adjusted R ²	0.065	0.065	0.065	0.065	0.065	0.064

Note:

*p<0.1; **p<0.05; ***p<0.01

Household race, income, and age as well as month-year and county fixed effects are included.

Table 12: Total Browsing Duration

	<i>Dependent variable:</i>						
	Log Duration (Minutes)						Border Counties
	All Counties						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Log(1 + Sales Tax)	0.304 (0.509)	0.307 (0.510)	0.205 (0.618)	0.245 (0.618)	0.240 (0.618)	-2.870 (3.082)	-1.684 (3.118)
Log(1 + Sales Tax * Collect)	-0.015 (0.095)	-0.015 (0.095)	-0.179* (0.108)				-1.824** (0.733)
Tax Diff	0.210 (0.717)	-0.290 (0.734)	-0.307 (0.734)				
Tax Diff * Collect	1.123*** (0.350)	1.098*** (0.339)					
Collect	-0.013* (0.007)						

Observations	512,430	512,430	512,430	512,430	512,430	15,480	15,480
R ²	0.041	0.041	0.041	0.041	0.041	0.056	0.056
Adjusted R ²	0.035	0.035	0.035	0.035	0.035	0.044	0.045

Note:

*p<0.1; **p<0.05; ***p<0.01

Household race, income, and age as well as month-year and county fixed effects are included.

sales taxes. There are (barely) significant effects when Amazon begins collecting sales tax, which is point increase in the tax rate, which is consistent with consumers shifting spending online to avoid face and as a result, they increase expenditures at online-only stores by about 2.4% per percentage sales tax rate could potentially have two effects. First, it increases the sales tax rate that consumers could be generating omitted variable bias when estimating sales tax sensitivities. An increase in the Amazon collects sales taxes. It also reveals that relative tax differences are an important factor that data provides much stronger evidence of how household's overall spending picture is changing when compared to the comScore results, which only revealed changed purchases in Amazon purchasing, the Nielsen

control for household income, age, and race, as well as county and year-month fixed effects. I of the tax difference between the consumer's home county and the lowest taxed adjacent county. I sales tax in that county. As before, I also control for cross-border shopping by including a measure county at month t to the prevailing tax rate and an indicator of whether or not Amazon collects This regression relates the log expenditures made in channel j (online or offline) by household h in

$$\ln E_{hjt} = \beta_0 + \beta_1 \ln(1 + \tau_{jt}) + \beta_2 \ln(1 + \tau_{ht} \text{Collect}) + \beta_3 \text{TaxDiff}_{jt} + \beta_4 \text{TaxDiff}_{ht} * \text{Collect} + \beta_5 \text{Race}_h + \beta_6 \text{Income}_h + \beta_7 \text{Age}_h + \alpha_j + \epsilon_{ht}$$

(likely untaxed) and offline retailers in response to the changes in sales tax enforcement online. I divide up retailers into online-only To identify changes in consumer expenditures, I run the same analysis on how expenditures change will collect sales taxes.

likely untaxed (except for Amazon when it begins collecting sales tax), while any offline retailer provide a similar categorization that I did with the comScore data in that the online-only retailers which retailers only exist online versus those that have an offline presence. This distinction helps from other retailers. However, Nielsen does categorize retailers into broad categories and I know in response to these online tax changes. Retailers are anonymized, so I cannot isolate Amazon all goods that they purchase. This enables me to see how overall household expenditure is changing To answer these questions, I use the Nielsen HomeScan Consumer Panel in which households record is there evidence that this increased search behavior is translating into more offline purchases?

how are overall households' expenditures changing in response to Amazon collecting sales tax? Second, are shopping around more on Amazon's competitors. This final section answers two questions. First, we see evidence that border counties respond more strongly and there is evidence that consumers when Amazon begins collecting sales tax. While, overall online spending is not significantly affected, Using the comScore data, I have established that consumers reduce their Amazon expenditures

5 Total Consumer Expenditure Analysis

21 The relationship between the sales tax rate and the tax differential for border counties. Overall, the correlation between sales increases would only generate in the tax differential for border counties. State-level sales taxes and the tax differential is not perfectly collinear.

22 Recall that tax differentials are computed as the lowest rate available in an adjacent country. Traveling between countries is relatively easy compared with traveling across states.

23 Breaking this down by product category would give a better indication of consumer response since many states exempt particular categories of goods such as food and clothing from sales tax. It could be that households are shifting expenditure between taxed and untaxed product categories.

24 I cannot definitively say whether these are local retailers or the websites of local retailers.

Overall household expenditures demonstrate similar patterns to offline expenditures indicating that households increase spending in response to sales tax changes, but households that have access to lower tax jurisdictions are able to offset these increases likely through cross-border shopping. Furthermore, when Amazon collects sales taxes, there is an additional increase in household expenditures coming through the offline retailer channel, supporting the idea that households are moving their spending from online to offline channels.

I then look at consumer expenditures at offline retailers. I find that expenditures increase by about 0.5% for each percentage point that sales tax increases, indicating that households are cutting back on spending, but not enough to fully offset the increase in sales tax.²³ Furthermore, households spend more in additional bump after Amazon begins collecting sales tax. This provides further evidence that households are spending more in taxed channels after Amazon begins collecting sales tax. Tax and in particular, they are increasing spending at retailers with an offline presence.²⁴ Finally, we see a marginally significant decrease in spending for households that border lower taxed jurisdictions. Coupling that with the strong decrease in spending in border counties, once again we see that households consider nearby untaxed retailers as substitutes for both online shopping and taxed local

Second, an increase in the sales tax rate increases the tax differential with nearby jurisdictions. We see that online purchases decrease by about 4% per percentage point when there is a lower taxed jurisdiction nearby, much larger than the increase in online shopping. Both of these pieces support that individuals consider the tax advantages of online shopping as well as nearby offline retailers. In particular, for households without lower tax jurisdictions nearby, they rely on online shopping to reduce their tax bill. However, for households with lower tax jurisdictions nearby, they prefer to shop nearby, likely because the benefit of immediate consumption outweighs the travel costs.²² Looking at border counties further boosts this argument because even when Amazon begins collecting sales tax, these households still have a zero tax option. They decrease their online spending by 2.7% in response to Amazon collecting sales tax. Given the average tax rate in a border county is 6.2%, this corresponds to an elasticity of about -0.4; however, this reduction in spending

expected since I cannot separate Amazon expenditures from the rest of a household's online-only purchases.

Table 13: Online Expenditures

	<i>Dependent variable:</i>						
	Log Expenditures			Border Counties			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Log(1 + Sales Tax)	0.069 (0.532)	0.053 (0.533)	2.380*** (0.696)	2.363*** (0.696)	2.373*** (0.696)	-1.817 (3.667)	-1.207 (3.669)
Log(1 + Sales Tax * Collect)	0.090 (0.087)	0.110 (0.087)	0.165* (0.100)				-2.694*** (0.682)
Tax Diff		-4.096*** (0.789)	-3.965*** (0.797)	-3.950*** (0.798)			
Tax Diff * Collect		-0.395 (0.345)	-0.391 (0.335)				
Collect			0.012* (0.007)				
Observations	574,685	574,685	574,685	574,685	574,685	15,940	15,940
R ²	0.064	0.064	0.064	0.064	0.064	0.093	0.094
Adjusted R ²	0.059	0.059	0.059	0.059	0.059	0.082	0.083

Note:

*p<0.1; **p<0.05; ***p<0.01

Household race, income, and age as well as month-year and county fixed effects are included in the above regressions.

Table 14: Offline Expenditures

	<i>Dependent variable:</i>						
	Log Expenditures				Border Counties		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Log(1 + Sales Tax)	0.308*** (0.109)	0.293*** (0.109)	0.454*** (0.138)	0.452*** (0.138)	0.459*** (0.138)	-2.991*** (0.747)	-3.051*** (0.750)
Log(1 + Sales Tax * Collect)	0.131*** (0.020)	0.132*** (0.020)	0.141*** (0.023)				0.141 (0.160)
Tax Diff		-0.307* (0.162)	-0.288* (0.164)	-0.286* (0.164)			
Tax Diff * Collect			-0.066 (0.084)	-0.024 (0.081)			
Collect				0.009*** (0.002)			

Observations	5,198,052	5,198,052	5,198,052	5,198,052	5,198,052	134,657	134,657
R ²	0.087	0.087	0.087	0.087	0.087	0.093	0.093
Adjusted R ²	0.086	0.086	0.086	0.086	0.086	0.092	0.092

Note:

*p<0.1; **p<0.05; ***p<0.01
 Household race, income, and age as well as month-year and county
 fixed effects are included in the above regressions.

Table 15: Total Expenditures

	<i>Dependent variable:</i>						
	Log Expenditures				Border Counties		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Log(1 + Sales Tax)	0.398*** (0.109)	0.381*** (0.109)	0.574*** (0.137)	0.576*** (0.137)	0.583*** (0.137)	-3.024*** (0.745)	-3.138*** (0.749)
Log(1 + Sales Tax * Collect)	0.155*** (0.020)	0.156*** (0.020)	0.146*** (0.023)				0.267* (0.160)
Tax Diff	-0.370** (0.161)	-0.391** (0.163)	-0.390** (0.163)				
Tax Diff * Collect		0.072 (0.083)	0.122 (0.081)				
Collect			0.009*** (0.002)				

Observations	5,202,429	5,202,429	5,202,429	5,202,429	5,202,429	134,777	134,777
R ²	0.087	0.087	0.087	0.087	0.087	0.093	0.093
Adjusted R ²	0.086	0.086	0.086	0.086	0.086	0.091	0.091

Note:

*p<0.1; **p<0.05; ***p<0.01
 Household race, income, and age as well as month-year and county fixed effects are included in the above regressions.

Overall, this paper provides strong evidence that households change their shopping behavior in response to sales tax changes, Amazon's collection of sales tax, and cross-border shopping incentives and that these responses differ in magnitude across these different channels. There are many different directiations that future work can explore. First, the differing responses across channels in sales tax immediacy suggests a search cost story. Search costs are much lower online and the sensitivities are much higher. The opposite is true for offline retailers. Furthermore, sensitivities in border countries are overall larger than the general population supporting the fact that their search costs are much lower. They know they can immediately save 6% by crossing the border. Constructing and estimating a model of consumer search behavior would help explain this kind of behavior and provide a better comparison of search costs across different spending channels. Additionally, I find that even though households do not change their online shopping significantly after Amazon collects sales tax, they are looking around at other websites. Border countries in particular change their searching substantially. This line of inquiry coupled with the search costs story would help shed light on how much online shopping serves as a substitute for traditional retail and how much of it serves as a complement. In particular, most traditional retailers have websites and theorectically, this would enable online and offline shopping to converge to similar search costs

When looking at overall household expenditures, I find that expenditures slightly increase in websites to sales tax changes. With an additional effect occurring when Amazon begins collecting response to sales tax changes. In the online-only channel, consumers spend more when sales taxes tax. In the online-only channel, they reduce their online-only expenditures, indicating that the benefit of taxed jurisdictions nearby, they reduce their online-only expenditures, indicating that the benefit of immediate consumption from cross-border shopping outweighs the travel costs. Furthermore, they prefer that to the convenience of online shopping, but with the associated delay in consumption. Households in border counties are the most strongly sensitive to tax changes, reducing expenditures by about 3% for every one percentage point increase in sales tax. Given that these households' proximity to zero tax locations, this provides strong evidence that consumers are saving money by reducing their tax bill as opposed to actually reducing their consumption. Further work on the types of goods being purchased would provide a more comprehensive picture of how consumer expenditures are changing compared to their actual consumption bundles.

online shopping and browsing activity, I find that consumers reduce their spending on Amazon by 2% on average, corresponding with an elasticity of -0.3 to -0.4, which is much lower than previously estimated. Furthermore, while spending at other online retailers is not significantly affected by sales tax or Amazon's collection of sales tax, households do spend more time searching on competitor

6 Future Research and Conclusion

- Thus you will see a section on time varying variables
- A short section on possible sources of error

- Baugch, Brian, Itzhak Ben-David, and Hoonsuk Park. 2016. "Can Taxes Shape an Industry?"
- Taxes," *National Tax Journal LX* (4): 711-26.
- Ballard, Charles L., and Jaimin Lee. 2007. "Internet Purchases, Cross-Border Shopping, and Sales imposts-tax-cases-quill-corp-v-north-dakota-and-physical-presence-rule-sales-tax-collection." *Presence Rule for Sales Tax Collection*. Tax Foundation, Online. July. <https://taxfoundation.org/presence-rule-for-sales-tax-collection/>
- Atkins, Chris. 2005. "Important Tax Cases: Quill Corp. v. North Dakota and the Physical Presence Rule," *Journal of Public Economics* 91: 141-57.
- Asplund, Marcus, Richard Friborg, and Frederik Willander. 2007. "Demand and Distance: Evidence on Cross-Border Shopping," *Journal of Public Economics* 91: 141-57.
- Research 47 (2). American Marketing Association (AMA): 229-39. doi:10.1509/jmkr.47.2.229.
- Taxes Affect Customer and Firm Behavior: The Role of Search on the Internet," *Journal of Marketing Research* 47 (2). American Marketing Association (AMA): 229-39. doi:10.1509/jmkr.47.2.229.
- Andersson, Eric T., Nathan M. Fong, Duncan I. Simester, and Catherine E. Tucker. 2010. "How Sales Finance Review 33 (2): 184-212. doi:10.1177/1091142104267929.
- Alm, James, and Mikhael I. Melnik. 2005. "Sales Tax and the Decision to Purchase Online," *Public Economic Policy*.
- Agarwall, Sumit, Nathan Malarwell, and Leslie McGrawahan. 2017. "Consumption Response to Temporary Tax Incentives: Evidence from State Sales Holidays," *American Economic Journal -*

7 References

- This paper has shown estimated effects of collecting sales taxes online are moderate, which suggests that this is not the case-all for state and local tax revenues or budgets. Online shopping is here to stay and more empirical work will be necessary to understand how to adapt to this brave new world.
- Finally, this research has strong policy implications as well. Online retail is a rapidly growing industry contributing to these trends is imperative to inform good policy.
- The Economist (2017). Understanding the labor market implications of online shopping and what shrinking. Popular press has explored potential labor consequences of online retail (Semuels (2017), and delivery times decrease, then there is a strong indication that traditional retail may begin with online shopping poised to rapidly expand, especially as supply chains become more efficient retail employment. Retail employment (~16 million) is larger than manufacturing (~12 million) and share of sales (reaching 8.5% of total retail sales) and its growth has substantial implications for consumers discoumt future utility when compared with immediate consumption.
- This tradeoff likely differs by product category, but it would give another way of estimating how consumption is delayed. This paper provides some evidence of that consumers consider that tradeoff, costs, but has the benefit of immediate consumption while online shopping has no travel costs, but over prices. If this is the case, then the tradeoff for consumers is that offline shopping imposes travel

- Evidence from the Implementation of the Amazon Tax.” *Dice Center Working Paper*, no. 2014-05 (September). <http://ssrn.com/abstract=2422403>.
- Bruce, Donald, and William F. Fox. 2000. “E-Commerce in the Context of Declining State Sales Taxes Bases.” *National Tax Journal* 53 (4). National Tax Association: 1373–88.
- Emava, Liran, Dan Knoepfle, Jonathan Levin, and Neel Sundaresan. 2014. “Sales Taxes and Internet Commerce.” *American Economic Review* 104 (1): 1–26. <http://dx.doi.org/10.1257/aer.104.1.1>.
- Ellison, Glenn, and Sara Fisher Ellison. 2009. “Tax Sensitivity and Home State Preferences in Internet Purchasing.” *American Economic Journal: Economic Policy* 1 (2). American Economic Association: 53–71. doi:10.1257/pol.1.2.53.
- Goodabee, Austin. 2000a. “In a World Without Borders: The Impact of Taxes on Internet Commerce,” *Quarterly Journal of Economics* 115 (2): 561–76. <http://dx.doi.org/10.1162/003355300554854>.
- . 2000b. “Internet Commerce, Tax Sensitivity, and the Generation Gap.” In *Tax Policy and the Economy*, Volume 14, 45–66. MIT Press. <http://www.nber.org/chapters/c10846>.
- . 2001. “The Implications of Electronic Commerce for Fiscal Policy (and Vice Versa).” *Journal of Economic Perspectives* 15 (1). American Economic Association: 13–24. doi:10.1257/jep.15.1.13.
- Houde, Jean-François, Peter Newberry, and Katja Seim. 2017. “Economies of Density in E-Commerce: A Study of Amazon’s Fullfillment Center Network.” *Working Paper* 23361. Working Paper Series. National Bureau of Economic Research. doi:10.3386/w23361.
- Hu, Yu Jeffrey, and Zhiwei Tang. 2014. “The Impact of Sales Tax on Internet and Catalog Sales: Evidence from a Natural Experiment.” *International Journal of Industrial Organization* 32 (January): 84–90. doi:<https://doi.org/10.1016/j.ijindorg.2013.11.003>.
- Mianzai, Niina. 2015. “Use Tax Collection on Income Tax Returns in Other States.” Research Report. 600 State Office Building St. Paul, MN 55155: Minnesota House of Representatives.
- Milkesell, John L. 1970. “Central Cities and Sales Tax Rate Differentials: The Border City Problem.” *National Tax Journal* 23 (2): 206–13.
- Missouri Census Data Center. 2014. “MABEL/Geocorr14, Version 1.0: Geographic Correspondence Engine.” Web Application. <http://mcdc.missouri.edu/websas/geocorr14.html>.
- Scamman, Mark A. 2007. “Tax Sensitivity in Electronic Commerce.” *Fiscal Studies* 28 (4): 417–36.
- Semuels, Alana. 2017. “The Vicarious Cycle of Retail’s Decline.” May. The Atlantic. <https://www.theatlantic.com/business/>.
- Vicarious Cycle of Retail’s Decline, May. The Atlantic. <https://www.theatlantic.com/business/>.

- The Economist. 2017. "Sorry, We're Closed: The Decline of Established American Retailing Threatens Jobs," Edited by Zanny Minton Beddoes. Sorry, We're Closed: The Decline of Established American Retailing Threatens Jobs. <http://www.economist.com/news/21721900-love-affair-shopping-has-gone-online-decline-established-american-retailing-briefing>.
- U.S. Census Bureau. 2010. "County Adjacency File." Online. <https://www.census.gov/geo/reference/county-adjacency.html>.
- . 2015. "American Community Survey: Presence of a Computer and Type of Internet Subscription in Households." Online. <https://www.census.gov/popest/community-surveys/asrh/2015/asrh-Subscriptions.html>.
- . 2016. "Quarterly Summary of State and Local Government Tax Revenue." Online. <https://www.census.gov/govs/qtax/>.
- U.S. Government Accountability Office. 2000. "Sales Taxes: Electronic Commerce Growth Presents Challenges; Revenue Losses Are Uncertain." Report to Congressional Requesters, no. GAO/GGD/OCE-00-165 (June).

Year	States	Washington	North Dakota	Kansas	Kentucky	New York	06/01/2008
1995							
2001							
2004							
2005							

Table 16: Timeline of Amazon Sales Tax Collections

A.3 Timeline

There have been two main initiatives to improve sales tax collection from online retailers. Congres-sional action has taken the form of the Marketplace Fairness Act of 2011, 2013, and 2015. It was introduced in the Senate on April 27, 2017 and has been referred to committee. A more grassroots effort has been the Streamlined Sales Tax Project, started in 2000. This was created to help reduce the complexity in sales taxes that led to the *Bellas Hess v. Illinois and Quill Corp.* V. *North Dakota* decisions. By simplifying rules around sales tax, the hope is that complexity will no longer be a factor and there will be more fairness across the board (as well as higher revenues for states and localities). Currently, the project has 24 participating states that are working to create state-level administration of taxes, a uniform tax base, simplified tax rates, and uniform state sourcing rules.

A.2 Legislative Action

The collection of sales taxes can differ within states due to state laws. First and foremost, some states do not collect sales taxes, others have a uniform sales tax state-wide, some allow counties to collect additional sales tax, but not cities, and others allow any locality (e.g., cities, special districts) to impose additional sales taxes. Furthermore, states can also decide whether they are an origin-based or destination-based sales tax state. In origin-based states, sales tax is collected based upon the location of the company selling the product. For example, Pennsylvania is an origin-based sales tax state, so Amazon does not collect the 2% Philadelphia county sales tax because its warehouse is not located in Philadelphia county. As a result, consumers in Philadelphia only pay 6% sales tax on Amazon versus 8% sales tax at brick-and-mortar retailers, but they still are responsible for remitting a 2% use tax to the county. Destination-based sales tax (which is more common) states require sales tax to be collected based upon the location of the buyer.

A.1 Sales Tax Heterogeneity

A Appendix A: Tax Law

Year	States
07/01/2012	Texas
09/01/2012	Pennsylvania
09/15/2012	California
02/01/2013	Arizona
07/01/2013	New Jersey
09/01/2013	Georgia, Virginia
10/01/2013	West Virginia
11/01/2013	Connecticut, Massachusetts, Wisconsin
01/01/2014	Indiana, Nevada, Tennessee
02/01/2014	North Carolina
05/01/2014	Florida
10/01/2014	Maryland, Minnesota
02/01/2015	Illinois
06/01/2015	Ohio
10/01/2015	Michigan
01/01/2016	South Carolina
02/01/2016	Colorado
10/01/2016	DC
11/01/2016	Alabama
01/01/2017	Iowa, Louisiana, Nebraska, Utah
02/01/2017	Mississippi, Missouri, Rhode Island, South Dakota, Vermont
03/01/2017	Oklahoma, Wyoming
04/01/2017	New Mexico

The data is reported on a machine level and is associated with the demographic information of the household that owns the machine. Households may have more than one machine, but the demographic information is of the associated household. It should be noted that the unique identifier is on the machine level. There is no household identifier, so two machines in the same household will not be denoted as being in the same household, but the ZIP code of each machine will be reported. As a result, we can confidently associate machines with the same demographic information to a specific ZIP code, but no more accurately than that.

B.1.2 Demographic Data

Affiliate Program comScore also recruits panelists through their Affiliate Program which consists of a broad network of web entities that recruit potential panelists through text or banner ads that make one of two types of appeals: (1) Make your voice heard by joining the panel or (2) Get an incentive for joining the panel (such as productivity software, online file storage, games, and media applications). comScore specifically avoids putting ads on sites that source people from access panels or "take a survey" type sites in order to reduce the skewness in the panelist sample. They also avoid giving monetary incentives for the same reason.

Third-party Providers This is the major source of comScore panelists. comScore has many partnerships with third-party application providers that offer visitors a wide range of free software, applications, and utilities in exchange for "eyes on", which generally means an advertisement. In comScore's case, this means that visitors can get free software in exchange for viewing comScore's recruitment solicitation. Visitors are not required to join comScore's panel in order to receive the free software; they can still receive the software even if they decline to join comScore's panel.

Panelists are recruited exclusively via the internet through two channels, the Affiliate Program and through Third-party Providers.

B.1.1 Recruiting Panelists

comScore, Inc. is a private cross-platform measurement company that measures audiences and consumer behavior. Their Web Behavior data captures browsing and buying behavior for over 50,000 users across the United States. The data is a random sample from more than 2 million global consumers that have given comScore explicit permission to confidentially track their online browsing and transaction behavior at the domain level.

B.1 comScore

B Appendix B: Data

State	Data	US Census	Data - US Census	comScore Panelists
Alabama	0.2%	0.2%	0.00%	
Alaska	1.7%	1.5%	0.18%	
Arizona	1.0%	0.9%	0.06%	
Arkansas	1.7%	2.1%	-0.42%	
California	11.0%	12.1%	-1.05%	
Colorado	1.4%	1.6%	-0.25%	
Connecticut	1.2%	1.2%	0.00%	
Delaware	0.3%	0.3%	0.03%	
Florida	6.7%	6.1%	0.62%	
Georgia	3.5%	3.1%	0.34%	
Hawaii	0.4%	0.4%	-0.05%	
Idaho	0.9%	1.0%	-0.06%	
Illinois	0.5%	0.5%	-0.04%	
Indiana	3.9%	4.2%	-0.27%	
Iowa	2.2%	2.1%	0.07%	
Kansas	0.9%	0.9%	0.01%	
Kentucky	1.5%	1.4%	0.08%	
Louisiana	1.7%	1.5%	0.23%	
Maine	2.0%	2.1%	-0.18%	
Maryland	2.1%	1.9%	0.23%	
Massachusetts	0.5%	0.4%	0.03%	
Michigan	3.2%	3.2%	-0.05%	

Table 17: Geographic Distribution of comScore Panelists

B.1.3 Demographic Comparison

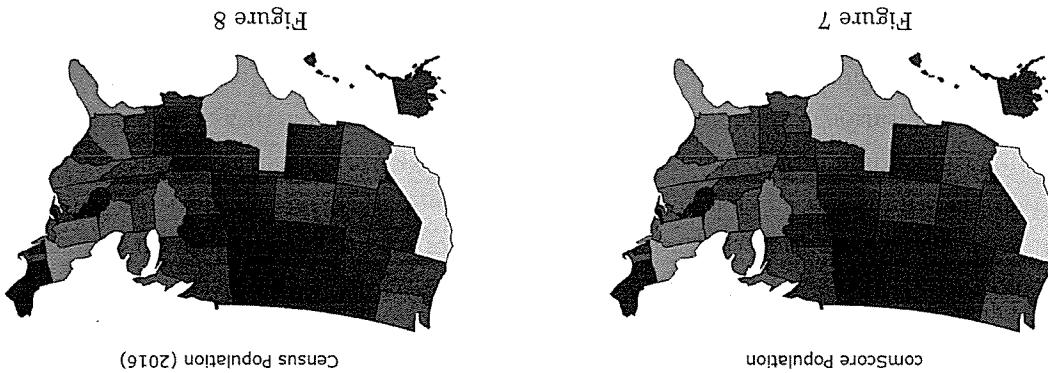
- Household income
- Oldest age – head of household
- Household size (1, 2, 3, 4, 5, 6+)
- Censuses region (North East, North Central, South, West)
- Highest education level – head of household
- The household demographic information includes the following:
- Presence of children (not quantity)
- Household income
- Race/ethnic background (white, black, Asian, other)
- Connection speed (broadband or not)
- Country of origin (Hispanic or not)
- ZIP code

Monitoring Software The monitoring software is installed directly on the panelist's computer (not on a particular browser). As a result, the software can record the activity of any program

During the recruitment process, prospective panelists are informed that they are joining a marketing research panel that will monitor their browsing and purchasing behavior and are explicitly presented with comScore's privacy policy. After agreeing to participate in the panel, panelists are directed to install comScore's monitoring software on their computer.

B.1.4 Monitoring Web Behavior

State	Data	US Census	Data - US Census
Minnesota	1.4%	1.7%	-0.29%
Mississippi	1.9%	1.9%	0.00%
Missouri	1.1%	1.0%	0.11%
Montana	0.3%	0.3%	-0.02%
Nebraska	3.2%	3.1%	0.14%
Nevada	0.2%	0.2%	0.01%
New Hampshire	0.6%	0.6%	-0.03%
New Jersey	0.4%	0.4%	0.00%
New Mexico	3.0%	2.9%	0.20%
New York	0.6%	0.7%	-0.10%
North Carolina	0.9%	0.9%	0.06%
North Dakota	6.6%	6.3%	0.34%
Ohio	4.0%	3.7%	-0.22%
Oklahoma	1.2%	1.2%	0.04%
Oregon	1.1%	1.2%	-0.11%
Pennsylvania	4.3%	4.1%	0.18%
Rhode Island	0.3%	0.3%	0.01%
South Carolina	1.6%	1.5%	0.06%
South Dakota	0.2%	0.3%	-0.02%
Tennessee	2.2%	2.1%	0.10%
Texas	8.0%	8.2%	-0.19%
Utah	0.8%	0.9%	-0.14%
Vermont	2.7%	2.6%	0.12%
Virginia	0.2%	0.2%	-0.01%
Washington	2.0%	2.2%	-0.19%
West Virginia	1.7%	1.8%	-0.15%
Wisconsin	0.6%	0.6%	0.02%
Wyoming	0.2%	0.2%	0.00%



Recording Page Views The monitoring software also records the number of pages viewed on each website. In order to accurately capture user behavior, comScore filters out pages that are not requested by the user such as all URLs in a redirect chain and banner and pop-up advertisements. Furthermore, comScore works to identify web pages that auto-refresh (such as news or shopping sites) and does not count the auto-refreshes as a new page view.

Recording Browsing Duration The monitoring software records the time spent browsing on each site. In order to accurately record actual user behavior, comScore has a wide range of rules and practices to help ensure accuracy. The software can determine the active window and/or browser tab so that when a user switches their focus (opening a new window, switching tabs, etc.), the program pauses the recorded duration for the previous tab or window. When the user switches back, the software will resume counting the time spent on that website. comScore also has implemented periods of time (depending on the characteristics of the website), the user will be deemed inactive and their browser duration will be adjusted appropriately. For example, if a search engine page is open for 30 minutes without activity, the software will only add another minute to the browsing duration and then note that the browsing session ended. For various website categories (video, news, games, etc.), these inactivity thresholds and time-added rules are appropriately adjusted to better characterize user activity.

that accesses the internet such as browsers, desktop email clients, and instant messaging clients. Furthermore, the software is also able to capture activity connected to the computer. For example, if a panelist connects their phone and uses it as an internet hotspot, that activity will also be recorded and vice versa (if the connection is used to let the phone access the internet through the computer's connection). The software also enables users to track active windows and tabs during browsing to accurately measure panelist behavior and attention. The software is compatible with both Windows and Mac operating systems.

Figure 12

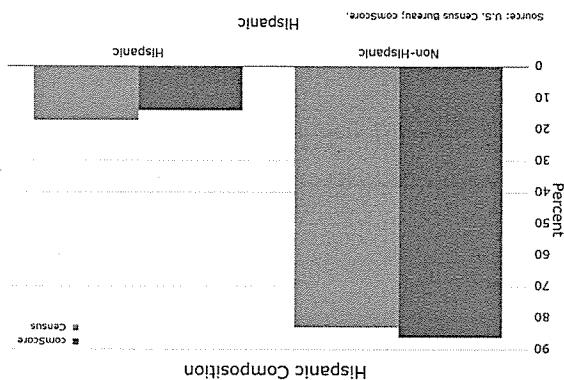


Figure 11

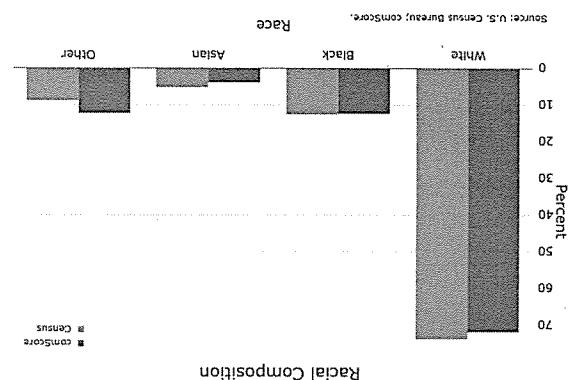


Figure 10

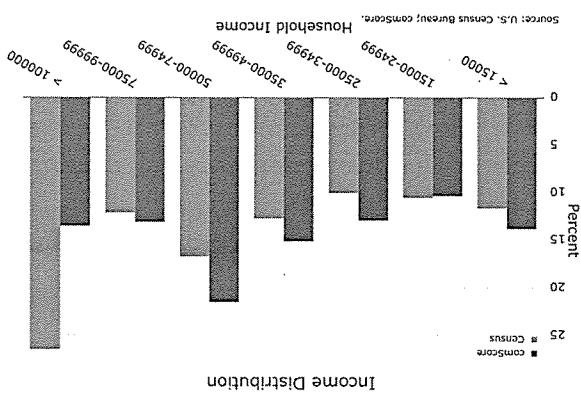
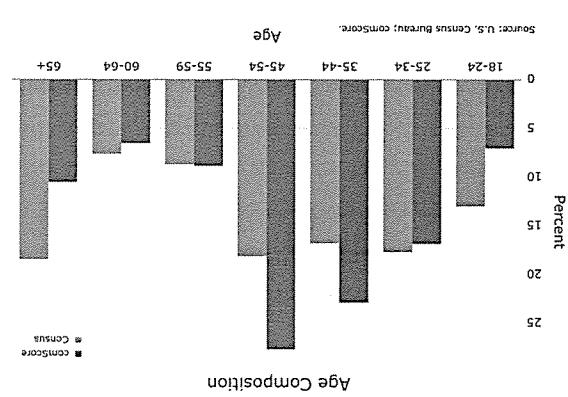


Figure 9



Since my focus is on the Amazon tax and sales tax on e-commerce in general, I also remove products in categories that are not generally taxed or Amazon does not compete in such as food and beverages, movie and event tickets, travel, and services like dating and other online services. Finally, I remove any products that are less than \$1 since these are likely free downloads, add-ons, or other purchases for which sales tax is not considered. This leaves me with about 2.7 million unique transactions.

That causes difficulties for comScore's collection software. Most of these removed transactions are "edge cases" million transactions of the original 5 million. I also remove any transactions for which the basket price was more than 75% off of the sum of the product prices. This leaves me with about 4.8 million transactions for which the conservative upper bound for shipping costs). I also remove any transactions for which the basket total was larger than 110% of the product price plus \$200 (including taxes, shipping, and discounts), I remove transactions for which the basket total was larger than 110% of the product price plus sum of all products purchased and the final basket total (including taxes, shipping, and discounts), categories 0, 66, and 377 do not exist). To account for price recording discrepancies between the product price was recorded as NA, negative as well as products that do not have valid categories and same time, I count it as a duplicated transaction). Then, I remove any transactions for which a transaction is recorded multiple times for the same product, same household, same price, same date, I remove these "hugey" transactions as follows. First, I remove any duplicated transactions (if a The transaction data requires more cleaning because of data collection quirks and other discrepancies.

The household data is generally untouched, but I do remove about 14,000 households that have missing or invalid codes for various categories. However, education is often specifically coded as some time I condition on. Ultimately, I am left with about 840,000 households after filtering the "missing" because it is not a characteristic that is required for many households, and this is not something I can do directly from WRDS. I also download the corresponding demographic data (specifically education, product category, product price, product name, basket total, and date and time of purchase) name, product category, product price, product name, basket total, and date and time of purchase) I download all transaction data from 2002, 2004, and 2006-2016 (specifically machine ID, domain household size, age, income, child indicator, race, Hispanic origin, and ZIP code)

I obtain the comScore transaction and demographic data through Wharton Research Data Services. While I will publish the replication scripts alongside this paper, I will not be able to make (WRDS). While I will publish the replication scripts alongside this paper, I will not be able to make the data available as it is a proprietary dataset. Those wishing to replicate the findings must obtain the data either directly from comScore or through a subscription with Wharton Research Data Services. I obtain either directly from comScore or through a subscription with Wharton Research Data either directly from comScore or through a subscription with Wharton Research Data Services. I also download the corresponding demographic data (specifically education, product category, product price, product name, basket total, and date and time of purchase) name, product category, product price, product name, basket total, and date and time of purchase) I download all transaction data from 2002, 2004, and 2006-2016 (specifically machine ID, domain household size, age, income, child indicator, race, Hispanic origin, and ZIP code)

B.1.5 Data Procurement and Cleaning

25 ZIP codes are occasionally divided or changed or new ones are introduced and ZIP codes may sometimes cross county lines. In those cases, I uniquely assign ZIP codes to one county.

adjacent counties (U.S. Census Bureau 2010).
average tax rate of the county of the household as well as the minimum average tax rate among collects sales tax, but newegg.com may not). Finally, I match up each transaction with the prevailing not the website has an offline presence, which would trigger a sales tax liability (e.g. walmart.com in order to better identify which transactions would be taxed, I generate an indicator of whether or

taxes. After the law was held up in court, many retailers opted to collect sales taxes.
track consumer purchases and report purchases to state tax authorities so they could collect use companies without a physical presence to collect sales tax, they required online retailers to enact broader laws such as Colorado. In Colorado, to get around the rule that states cannot respond to these laws, I do not count these as forcing sales tax collection. Other states have paid bloggers linking to the sites. Since Amazon and Overstock often cut their affiliate program in various states as well as when states passed laws requiring online retailers to collect sales tax. Many states passed laws defining a physical presence as having affiliates in the state, which combined that with information on when Amazon and Overstock began collecting sales taxes I then combine the online transaction data with the corresponding household data. Then I match the household ZIP codes with the county FIPS codes using the Missouri Census Data Center (2014).²⁵ I combine the online transaction data with the corresponding household data. Then I match the For reference, I start with about 2.7 million transactions across almost 250,000 households. First, with its own limitations.

Ultimately, my analysis relates online spending behavior with household demographics, tax law changes, and local tax rates. In order to do this, I must combine various datasets together, each finds, and local tax rates. In order to do this, I must combine various datasets together, each

C Combining Data

I obtained the Nielsen data from the Kit's Marketing Data Center at the University of Chicago Booth School of Business. As above, I shall make my replication scripts available, but since the data is proprietary, I will not be able to make the data available. Those wishing to replicate my findings will have to obtain the data either from Nielsen or through a subscription with the Kit's Marketing Data Center.

B.2.1 Data Procurement

B.2 Nielsen Consumer Homescan Panel Data