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ABSTRACT

Online retailers have gained a total price advantage over brick-and-mortar retailers since the formers generally are not required to collect sales tax. Recently, several states have implemented laws requiring that Amazon collect sales tax during checkout. Using transaction-level data, we document that households living in these states reduce Amazon purchases by 11%, implying an elasticity of –1.5. The effect is more pronounced for large purchases (e.g., ≥ $250), for which we estimate a reduction of 25% in purchases and an elasticity of –3.5. We find some weak evidence of substitution of the lost purchases towards other online and brick-and-mortar retailers.

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1 Introduction

Over the past decade, online retail transactions have increased dramatically in volume. Many factors have contributed to this growth in online sales, one of which is that out-of-state online retailers do not charge sales tax, which has generally given them a price advantage over retailers with a presence in the state. This sales tax collection loophole has not gone unnoticed by state governments or by competing retailers. Because online retailers are not obliged to collect sales tax at point of sale and therefore have a total price advantage relative to local retailers, state governments are concerned about depressed local employment and eroded tax revenues. From 2012 to 2014, many states have responded by requiring that Amazon begin to collect sales tax.

Previous empirical work shows that consumers are sensitive to sales tax. Agarwal, Chomsisengphet, Ho, and Qian (2013) show that consumers are making cross-border trips to save on sales tax. In the online retail arena, Einav, Knoepfle, Levin, and Sundaresan (2014) find that eBay customers avoid transactions in which they need to pay sales tax. Yet little empirical evidence has been gathered about the effects of wide implementation of such a tax on online and brick-and-mortar retail. As more and more states begin to implement Amazon Tax laws, it is important to study their effects on the Internet and local retail landscapes.

In this study, we examine at sixteen states[1] that began a permanent collection of taxes on Amazon purchases between 2012 and 2014. We analyze the impact of the tax on Internet commerce as well as on brick-and-mortar retail activity. Our initial dataset contains high-frequency household-level transaction data for 2.7 million households, allowing us to closely examine consumers' purchase behavior around the introduction of the tax. Our results shed light on the effects of the Amazon Tax on the demand for Amazon products as well as the demand for products sold by local competitors.

State governments have increased their attention to the issue of sales tax collection in light of the Great Recession and the recent growth in online retail volume. General sales taxes represent an important part of state revenue: for example, in 2011, the collection of general sales tax constituted 10.4% of revenues. Figure 1 shows that the importance of this tax varies considerably across states, ranging from 0% of state revenues in states without sales tax (such as

[1] In the order of implementation in our study period: Texas, Pennsylvania, California, Arizona, New Jersey, Georgia, Virginia, West Virginia, Connecticut, Massachusetts, Wisconsin, Indiana, Nevada, Tennessee, North Carolina, and Florida.

Oregon and Alaska) to as high as 21.0% of state revenues for Washington.[2] Recently, the issue has received federal attention. The Marketplace Fairness Act of 2013, which would enable all states to force retailers to collect sales tax on purchases made to out-of-state customers, has been approved by the Senate and is currently being debated in the House of Representatives.[3] The recent recession has added fuel to the debate: proponents of the online sales tax collection bill often tout the elimination of the Internet retailer sales tax advantage as "leveling the playing field" and helping to restore business and jobs to local economies.

Online retailers, including Amazon, that are not required to collect sales tax enjoy a price advantage. As a result, we hypothesize that the introduction of the Amazon Tax would lead to a decline in Amazon's sales and substitution to alternative retailers. With effective sales tax rates as high as 10% in some jurisdictions (after accounting for state, county, and city taxes), this price advantage can be sizable. Gene DeFelice, vice president of Barnes and Noble, the largest book retailer in the United States, summarized the issue succinctly: "We are at a serious competitive disadvantage against out-of-state, online retailers who pay no taxes."[4] An additional factor that is likely to facilitate customer migration from Amazon to alternative outlets is the low search cost of online shopping.

In the analysis of the effects of the Amazon Tax on purchasing behavior we use the data from an online financial account aggregator. This is a financial service that offers subscribers to concentrate all their accounts in one place for viewing and monitoring purposes. Our base dataset includes data on 2.7 million households. Households enter information about bank account and credit cards that they wish to track. Our analysis uses all transactions from these accounts.

We begin our analysis by using a traditional difference-in-differences (diff-in-diff) methodology to test whether households decreased their purchases in Amazon following the introduction of the law. Each state that adopted the Amazon Tax is considered as "treated" following the adoption, where other states are considered "controls." We run our specifications in a pooled sample, as well as, state-by-state. Our results show that the introduction of the Amazon Tax resulted in a large decline of 10.7% in the amount spent on products (net of sales tax, which we'll hereafter refer to as the tax-exclusive price) on Amazon, corresponding to an average elasticity is –1.5. The magnitude of the elasticity is consistent with that documented by

[2] 2011 U.S. Census Annual Survey of State & Local Government Finance: https://www.census.gov/govs/local/
[3] The text and status of the bill are found here: https://www.govtrack.us/congress/bills/113/s743
[4] http://articles.latimes.com/2011/jan/20/business/la-fi-internet-tax–20110120

Einav, Knoepfle, Levin, and Sundaresan (2014) of –1.7. We show that the effect is stronger for states with higher sales tax rates.

We next investigate whether consumers decreased their gross spending (including taxes) on Amazon. Our results show that the tax-inclusive spending on Amazon decreased by 3.5% in the wake of the law's implementation.

Our analysis shows that the decline in Amazon purchases is driven by larger purchases, as consumers would garner the greatest savings by avoiding tax on such purchases. We find strong evidence that the effect of the Amazon Tax increases with the size of the purchase, suggesting that households are particularly likely to utilize Internet shopping to avoid sales tax for large purchases. Consumers decrease their spending by 24.9% on purchases larger than $250, and by 32.5% on purchases equal to or larger than $500. These figures imply elasticities of –3.5 and –4.6, respectively.

Finally, we explore whether households substitute away from Amazon to competing retailers, whether brick-and-mortar or online. Unfortunately, several of specifications that we use have low statistical power with large standard errors (akin to Johnson, Parker, and Souleles (2006)). Nonetheless, based on the point estimates, it appears that there is some substitution (up to about 50% of the lost Amazon sales) to brick-and-mortar retailers, however, not to other online retailers.

Overall, our study shows that Amazon experiences a dramatic decline in sales following the implementation of an Amazon Tax. We present some evidence (with statistical power limitations) of some substitution of the Amazon lost sales to brick-and-mortar retailers.

Our work relates to two recent strands of the literature. First, several empirical studies have documented that consumers are price and tax sensitive, and thus attempt to avoid sales taxes. Poterba (1996) and Besely and Rosen (1999) find that price levels in locations with high sales tax are lower than those in locations with lower sales tax. Agarwal, Chomsisengphet, Ho, and Qian (2013) find that consumers who live near state borders often shop in the neighboring state when there are positive sales tax differences. Agarwal, Marwell, and McGranahan (2013) show that consumers increase their purchases during sales tax holidays. Chetty, Looney, and Kroft (2009) use an experimental setting to show that sales tax that is salient to consumers reduces the demand for the product.

Second, several studies explore the sensitivity to sales tax in the specific context of online retail. Goolsbee (2000a, 2000b) uses survey data to estimate that the number of online shoppers would drop by 24% if the tax-advantaged status of Internet retailers were removed. Alm and Melnik (2005), Ballard and Lee (2007), and Scanlan (2007) address the question as well, though they find smaller magnitudes for the effect. Goolsbee, Lovenheim, and Slemrod (2010) ascertain that the penetration of the Internet is correlated with lower sensitivity of cigarette sales to local taxes, suggesting that smokers use the Internet to purchase tax-free cigarettes. Ellison and Ellison (2009) explore the price elasticity of memory modules sold by a particular retailer and determine that consumers are price sensitive both to tax-exclusive prices and to state taxes. Einav, Knoepfle, Levin, and Sundaresan (2014) document a strong preference among eBay customers for out-of-state sellers, for whom sales taxes do not apply. Anderson, Fong, Simester, and Tucker (2010) show that when retail chains open their first store in a new state, they experience a decline in their Internet sales shipped to that state because of the sales tax, but the researchers find no similar effect on catalog sales. Finally, Hoopes, Thornock, and Williams (2014) find that internet retailers exhibit negative stock market returns following legislative proposals to collect sales tax from customers, such as the Marketplace Fairness Act of 2013.

2 Background and Empirical Setting

Sales tax is not collected on purchases from online retailers due to the Commerce Clause in the U.S. Constitution. Current interpretation of the law, which has been consistently upheld by the U.S. Supreme Court, is that online retailers must only collect sales tax on out-of-state purchases if the retailer has a nexus (or a substantial physical presence) in the state. Due to the nature of their business structure, online retailers have a physical presence in very few states. Ten years ago, Amazon would have been required only to collect sales taxes in states in which it had a nexus (for example, where it was headquartered or had fulfillment centers).

In recent years, states have attempted to collect sales taxes by broadening the definition of a nexus. Legislation by these states has defined the presence of affiliate programs or subsidiaries to constitute a nexus.[5] Even when this legislation has proven to be constitutional by

[5] Online retailers such as Amazon and Overstock will often advertise on websites such as blogs. If a blog reader clicks on the advertisement and subsequently purchases the Amazon product, the website owner will receive a commission on the sale. These website owners who allow Amazon to advertise on their websites are referred to as affiliates.

the state courts, the effectiveness of this method of tax collection has been mixed. Overstock.com, for example, has responded to these laws by simply dropping its affiliates in these states. Amazon has acted similarly in some states, but has chosen to accede to the Amazon Tax laws due to various political and operational issues in other states.

As of January 2015, Amazon was collecting sales tax in 23 states, comprising more than half of the U.S. population. Over our sample period, sixteen states implemented Amazon Tax laws, resulting in the beginning of sales tax collection at well-defined dates for each of these states. (Subsequently, many more states have already or are scheduled to follow suit.) Our diff-in-diff study relies on this change in tax policy over time for these states, relative to a control group of the other states that did not change tax policy contemporaneously.

Our study investigates the impact of the Amazon Tax in sixteen states in which Amazon started collecting sales taxes between 2012 and 2014. These states are Texas (7/1/2012), Pennsylvania (9/2/2012), California (9/16/2012), Arizona (2/1/2013), New Jersey (7/1/2013), Virginia (9/1/2013), Georgia (9/1/2013), West Virginia (10/1/2013), Connecticut (11/1/2013), Massachusetts (11/1/2013), Wisconsin (11/1/2013), Indiana (1/1/2014), Nevada (1/1/2014), Tennessee (1/1/2014), North Carolina (2/1/2014), and Florida (5/1/2014).

A critical assumption of the diff-in-diff methodology is the parallel trends assumption. A violation of this assumption can happen if Amazon charges different prices to different states in reaction to the introduction of sales taxes. Though some online retailers are known to engage in price discrimination, we doubt that this is the case for Amazon during our sample period. After a controversy regarding price discrimination in 2000, Amazon has declared that it has not and will not use demographic information to differentiate prices.[6]

Another concern with our setting is that many states require that households pay sales taxes that are not collected at the time of purchase. These taxes are referred to as "use taxes" and are collected by states annually at the time of tax filing. However, compliance with this use tax has been abysmal. Manzi (2012) finds that only 22 states have "use tax" provisions in their state income tax forms and that the vast majority of households residing in these states do not report any "use tax" liability. For example, only 0.2% of households in Rhode Island report any use

[6] In 2000, there was a controversy surrounding Amazon when a user found that the prices for DVDs dropped after deleting cookies on his web browser. Jeff Bezos, the CEO of Amazon, responded to the incident by confirming that the company would not utilize demographic information to differentiate prices. Following the incident, Amazon refunded an average of $3 to the 6,896 customers involved in the experiment, and the company announced a new policy that if it ever again tests differential pricing, it will subsequently charge all buyers the lowest price.

taxes, and only 0.3% of households in California and New Jersey report use taxes. However, some states have higher participation rates, such as Vermont and Maine, with 7.9% and 9.8% of households in each state reporting use taxes, respectively. Unlike income tax reporting, there are weak systems in place to track and enforce collection of these sales taxes.[7] It is also worth noting, that these figures do not necessarily represent the percentage of compliance with the law. The quoted numbers do not account for underreporting of use taxes conditional on reporting a use tax liability.

3 Data

The data that we use were provided by an online account aggregator. This institution allows subscribers to view their financial information in one place, e.g., view spending by category, monitor investments etc. The service also provides alerts for upcoming bills and for approaching credit limits etc. Households join the service for free and provide their username and passwords to various financial institutions so the service can extract relevant bank and credit card information. After the account is opened, the financial information is updated regularly from the subscribers' accounts.

The information we use consists of daily transactions for 2.7 million households from July 1, 2011 to September 30, 2014, and includes both banking (i.e., checking, savings, and debit card) and credit card transactions. We observe the date, amount, and description of each transaction. Thus, our dataset contains transaction-level data similar to those typically found on monthly bank or credit card statements. Because each household is assigned a unique identifier, we are able to follow each household through time. Many of the transactions contain merchant category codes (MCCs) which allow for the identification of a transaction as retail, restaurants, travel, etc.

Identifying the state of residence of the household is integral to our analysis, because this allows us to determine whether the household lived in one of the sixteen treatment states that was affected by an Amazon Tax. To estimate the city and state of residence for each household, we first require at least 100 transactions for which city and a state can be identified. We then require

[7] For example, Colorado's version of the Amazon Tax legislation tried to force online retailers to report to both customers and the state tax authority summaries of use tax incurred, but it was later declared unconstitutional by the District Court. However, Amazon makes annual spending reports available to residents of South Carolina and Tennessee to aid households in tax filing, though this information is not reported to state tax authorities by Amazon.

at least 75% of these transactions to occur within a single state. Once this filter is applied, we assign the most common city as the city of residence of the household. After applying this filter, our sample consists of 1.0 million households.

Because we are primarily interested in how Amazon customers respond after the implementation of the Amazon Tax, we focus our analysis on households who have had some spending at Amazon prior to implementation. We include households that spent more than $100 at Amazon during the second half of 2011 when we measure the average effects over the sixteen states. After applying this filter, our sample size is reduced to 210,956 households, 123,407 of which live in one of the sixteen states that implemented the Amazon Tax over our sample period. We also analyze the effects of the Amazon Tax for a shorter period of three months before and after the implementation of the tax for each state. In these regressions we focus on households that spent more than $50 in the three months beginning from the sixth month before the implementation of the Amazon Tax for each state and the 34 control states. This leaves us with 18,183 households in Texas, 2,037 in Pennsylvania, 33,665 in California, 3,639 in Arizona, 3,967 in New Jersey, 9,208 in Virginia, 5,973 in Georgia, 174 in West Virginia, 2,476 in Connecticut, 5,455 in Massachusetts, 720 in Wisconsin, 790 in Indiana, 1,971 in Nevada, 2,398 in Tennessee, 5,899 in North Carolina, and 18,314 in Florida.

The analysis requires that we identify transactions at Amazon as well at competitors in banking and credit card statements. Such transactions are easily identified through the transaction descriptions. We discuss the identification of competing retail transactions in Section 5.

The unit of observation in our analyses is the household-month. For each household-month, we sum all expenditures for each of the retailers. To reduce the effect of outliers, we truncate any observed month in which the monthly total exceeds $2,000 in value, which represent less than 0.02% of all household-months.

For all transactions in our database, we adjust by the households' sales tax to determine the tax-exclusive amount of goods purchased. In the case of Amazon, where laws change over time for sixteen states, we only adjust transactions after the law has been implemented. In the case of brick and mortar retailers such as Walmart and Target, we adjust every transaction to arrive at the tax-exclusive price.

For each household in our sample period, we define a consumption period which starts from the month in which we observe the household making its first retail consumption in the data and ends in the month in which we observe the household making its last retail consumption in the data. To protect against households with scant data (e.g., if they shifted to consumption through unlinked credit cards which are not recorded by the service), we require that households have non-zero spending in at least half of the observed months.

Summary statistics of monthly household spending are presented in Table 1. Panel A shows the average monthly spending at Amazon for the 3 months before and after the Amazon Tax is implemented in a given state. In general, the change in dollar amount of expenditures at Amazon appears to be stronger for the control group. Panels B and C shows the average brick-and-mortar and online spending at competing retailers in the 6 months surrounding the implementation of the Amazon Tax. The increase in spending at competing retailers in the control states is similar to that of the treatment states, making it difficult to estimate the substitution effects to competing retailers of the Amazon Tax from the summarized data. We analyze this formally in the subsequent sections.

4 The Effect of the Amazon Tax on Amazon Sales

In this section, we examine the effects of the Amazon Tax on Amazon's sales in the treated states and compare them to the sales in states that did not change their laws. We perform this analysis in several forms: using the tax-exclusive price, using the tax-inclusive price, pooled over the whole sample period, and for each state individually.

We use a diff-in-diff methodology in which we measure the consumption effects after states start imposing sales tax on Amazon purchases. We create a *Treated state (TS)* dummy variable, which takes a value of one if the household resides in one of the sixteen states that began to impose the tax during the 2012–2014 time period. We also create an *After transition* dummy variable, which takes a value of one if the month falls after the Amazon Tax implementation in a treated state and zero otherwise. The interaction term, *After transition* × *Treated state*, takes a value of one for households residing in one of the affected states in the household-months after implementation of the Amazon Tax. Our basic empirical specification is:

$$Y_{ht} = \beta_0 + \beta_1 * After\ transition_{h,t} \times Treated\ state_h +$$
$$+ Month\ Fixed\ Effects_t + Household\ Fixed\ Effects_h + \varepsilon_{h,t}$$

where Y_{ht} is the dependent variable of interest and takes on the value of monthly Amazon expenditures (both tax-exclusive or tax-inclusive spending on Amazon). To determine whether large purchases are more sensitive to the law change, Y_{ht} also takes the sum of monthly Amazon expenditures for the subset of purchases that are over $250 and $500 using tax-exclusive pricing.

4.1 Average Value of Purchased Goods (Tax-Exclusive Price)

We begin our analysis by examining whether the average monthly amount that households spend on Amazon changes as a result of the new sales tax. For each household in the sample, we aggregate the dollar amount spent on Amazon products within each month. Because we are interested in the value of the purchases for the household, so we create the tax-exclusive price by diving by the tax rate. (In Table 3, we provide a robustness test that uses the tax-inclusive prices.)

Table 2 presents the results of this analysis. In Columns (1) we present the main regression in which the interaction dummy (*After transition* × *Treated state*) captures the effect of the Amazon Tax on the average monthly Amazon spending the treatment state. The results show that consumers in affected states reduce their average monthly spending at Amazon by $4.94, relative to mean monthly spending among the treated states of $46.21. This result is statistically and economically significant. Since these values reflect are tax-exclusive, the drop in spending reflect a drop in Amazon's revenues.

In Column (2) we interact the variable of interest with the local sales tax rate. The results show that the higher the tax rate, the larger the drop in spending. This result further confirms that the elasticity of demand is increasing in the amount of sales tax. The coefficient of -1.93 on the interaction term *After* × *TS* × *Tax* suggests that each one percentage point increase in sales tax reduces the monthly tax-exclusive spending on Amazon by $1.93.

In Columns (3) to (18), we break down the sample by state, and present results from samples based on +/–3 months windows. In these regressions, the sample includes household-months in the treated state as well as household-months in other states that did not transition in the six-month window. In 13 of the 16 regressions the coefficients are negative and statistically significant, meaning that households in affected states reduced their shopping amounts at Amazon. In the other three cases, the coefficients are statistically indistinguishable from zero.

Based on our regressions, we can estimate the price elasticity as the change in demand (ΔQ) scaled by the change in price (ΔP), i.e., the tax rate. Our pooled results in Column (1) imply an average elasticity of -1.5. Our state-level estimates of elasticities vary wildly between states, ranging between –2.4 and 0.0 with a median value of –1.1. In general, our results are consistent with previous literature. For example, Einav, Knoepfle, Levin, and Sundaresan (2014) estimated the elasticity to sales tax to be –1.7.

4.2 Average Spending (Tax-Inclusive Price)

We also assess whether households changed their overall expenditure in Amazon (tax-inclusive price, including the effect of sales tax on price). In the previous section we discussed the tax-exclusive sales amount, because we were interested in measuring the change in the value of goods that are purchased by households following implementation of the tax. Next, we rerun the same analysis using the tax-inclusive price. This analysis examines whether households spend less money overall at Amazon when the Amazon Tax is in effect. It is hard to predict ex ante the direction of the results in this analysis, since households may increase their overall expenditure, keep it the same, or even decrease it in the wake of sales tax.

In Table 3, we repeat the main tests of Table 2 using as the dependent variable the tax-inclusive Amazon expenditures. The average effect (Column (1)) is negative with a coefficient of –1.61, implying an elasticity of –0.5. However this result is not statistically significant at the 5% level. We observe that the decline in tax-inclusive expenditures is greater in states with high sales tax rate (Column (2)), which in contrast is statically significant. The coefficient of -1.62 on the interaction term *After* × *TS* × *Tax* suggests that each one percentage point increase in sales tax reduces the monthly tax-inclusive spending on Amazon by $1.62. Put together, these results can be taken to mean that households still make similar expenditures at Amazon, though they are more likely to have adjusted expenditures downward if they were living in states with high sales taxes.

The state regressions (Columns (3) to (18)) show that elasticities range from –1.3 to 1.2, with a median of –0.3. Seven states have significantly negative coefficients, six have coefficients that are statistically indistinguishable from zero, and two have coefficients that are significantly positive.

4.3 Large Purchases

Given that the amount of sales tax charged on an item is proportional to its price, we can expect households to be more sensitive to sales taxes when the size of the purchase increases, especially when assuming some sort of fixed search costs. For example, assume a household living in California, and has a sales tax rate of 10%. If the household were to purchase a $10 item at a local brick-and-mortar retailer (or from the website of a national retailer), it would result in a $1 sales tax charge. Similarly, the purchase of a $1,000 item would result in a $100 sales tax charge. When there is a fixed search cost associated with finding the tax savings, this household would be more likely to purchase the $1,000 item online as opposed to the $10 item. However, after implementation of the Amazon Tax, the tax avoidance incentive to make large purchases online is removed, and any observed change in behavior surrounding this event could be attributed to the Amazon Tax.

We test this prediction in Table 4, where we repeat the base regressions (from Table 2) with samples that are limited to purchases of at least $250 (Panel A) or $500 (Panel B). Specifically, for each household in the sample, we use only Amazon transactions that are equal to or greater than $250 (Panel A) or $500 (Panel B) using tax-exclusive prices. Transactions below these amounts are set to zero. Then, we aggregate the large transactions at the household-month level.

The results show that the effects are substantially stronger for large purchases. In the pooled regression test (Column (1) in both panels), which uses the pooled data for the entire sample period without any windows. For the sample with purchases of $250 or higher, we document an average decline of 24.9% in purchases and an average elasticity of –3.5.[8] For the sample with purchases of $500 or higher, we document an average decline of 32.5% in purchases and an average elasticity of –4.6.

Further evidence for the sensitivity of households to the dollar amount of sales tax is in Column (2). The interaction of the treatment state, with the time period and the tax rate is negative and statistically significant, suggesting that the decline in Amazon purchases is more dramatic in states in which the sales tax rate is higher.

[8] We note that the sample mean is relatively small because in most household-months, there are no purchases greater than $250, in which case the dependent variable is set to zero.

Columns (3) to (18) of both Panels A and B show the results for samples split by state with +/–3-month window. The elasticity for large purchases ranges from –7.6 to 1.5, with a median elasticity of –2.6. For large purchases greater than $500, the elasticity ranges from –10.4 to 2.5, with a median elasticity of –3.6.

5 Substitution to Other Retailers

The original purpose of the different Amazon Tax state legislations was to capture forgone sales tax and to level the playing field so that online retailers do not have a price advantage over brick-and-mortar retailers due to taxes. In making their case for the Amazon Tax, legislators repeatedly made the case that the law is expected to boost the local economy and increase in-state sales. For example, U.S. Senator Jack Reed (D-RI) said "Rhode Island businesses and workers suffer from an unfair tax disparity that harms many local small businesses and benefits large out-of-state e-retailers. [The Marketplace Fairness Act of 2013] would correct that inequity and help Main Street businesses compete. At a time when states like Rhode Island are struggling with their budgets, this bill would be a significant boost. It has bipartisan support in Congress and broad support from both mom and pop shops and even large online retailers." U.S. Representative Peter Welch (D-VT) said "[The Marketplace Fairness Act of 2013] gives Main Street businesses a fighting chance. When a consumer can walk into a store, try out a product and then go home and buy it online without paying sales tax, Main Street businesses and downtowns lose out. Our bill will level the playing field and bring much-needed fairness, strengthen our Main Street businesses, create jobs, and revitalize our downtowns."

It is natural therefore to ask whether local businesses indeed benefited from the Amazon Tax. To test this proposition, we first need to identify an appropriate comparison group of retailers that are reasonable substitutes for Amazon. Given the wide array of products sold by Amazon, we use MCCs to extract all retailers, but we remove retailers who do not directly compete with Amazon. For example, we remove grocery stores and pharmacies, neither of which competes very closely with Amazon's core business. Since we are interested in how the Amazon Tax effects both the online and the brick-and-mortar operations of competing retailers, we identify subsets of retailers as being brick-and-mortar or online. The list of brick and mortar retailers includes Walmart, Target, Home Depot, Lowest, Costco, Sam's Club, etc. The list of

online retailers includes Bestbuy.com, Newegg.com, Macys.com, HomeDepot.com, Overstock.com, etc.

To understand whether the Amazon Tax differentially affects retailers of varying sizes, we divide the competing retailers into three groups. The large group is comprised of retailers in the top 30% of total retail dollar sales (in our sample), the medium group is comprised of the subsequent 30% of total retail dollar sales, and the small group is comprised of the remaining 40% of retail dollar sales. The latter group can be considered the "mom and pop" shops that many of the politicians cared about (e.g., see Senator Jack Reed's quote above).

Our empirical analysis resembles the analysis in the previous section; the main difference is that the dependent variable is average monthly expenditure on competing retailers whereas before the dependent variable was average monthly expenditure on Amazon. Hence, the basic empirical specification is:

$$Y_{ht} = \beta_0 + \beta_1 * After\ transition_{h,t} \times Treated\ state_h + \\ + Month\ Fixed\ Effects_t + Household\ Fixed\ Effects_h + \varepsilon_{ht}$$

where Y_{ht} is the dependent variable of interest and takes on the value of monthly tax-exclusive competing retailers expenditures. As before, we examine total sales, as well samples in which we limit the transactions to large transactions only.

In Table 5, Panel A, we regress non-Amazon retail transactions aggregated at the household-month level on the treatment variable. We classify transactions as brick-and-mortar or online. Column (1) uses a dependent variable that is based on both brick-and-mortar or online transactions. Columns (2) and (3) use dependent variables that are based on either brick-and-mortar or online transactions, respectively. Columns (4) to (6) use dependent variables that are based on large, medium, or small brick-and-mortar retailers, respectively.

Unfortunately, in some specifications our ability to detect substitution in the data is limited due to power. When testing for substitution, we expect a substitution effect that is up to 100% of the sales lost in Amazon. In other words, in the absence of wealth effects due to the Amazon Tax and assuming no search costs, consumers shift 100% of the lost Amazon purchases to other retailers. To measure our ability to detect the effect, we calculate the minimal size of the effect that will trigger statistical significance at the 5% level, in the terms of Amazon lost sales:

$$1.96 * \frac{Regression's\ Standard\ Error}{Amazon\ Lost\ Sales\ Coefficient}.$$

To illustrate this measure, consider Column (1) at Table 5, Panel A. The measure of statistical power is 434.0% meaning that we are able to detect a significant effect only when brick-and-mortar and online transactions have a change that is greater than 434.0% of Amazon's sales. This is, of course, not likely given that households are expected to substitute only up to 100% of the Amazon lost sales. The regression in Column (2) has greater statistical power. The measure of statistical power is 22.4%, meaning that as long as at least 22.4% of the lost sales in Amazon go to other online retailers, we should be able to detect it in the data. Using this measure of statistical power, it appears that we should be able to reject substitution in Table 5, Panel A, with credible statistical significance only in Column (2) (online purchases).

The coefficients in Columns (1), (3), (4), and (6) are positive, however, we do not have sufficiently power to tell whether they are statistically different from zero. The economic magnitude of the coefficients is relatively large: e.g., households increase their spending at brick-and-mortar retailers by an amount that is over 50% of the amount lost in Amazon sales (Column (3)). Splitting the results by retailer size, it appears that large retailers (e.g., Walmart) and small mom and pop shops enjoy an increase in sales in the magnitude of 40% of Amazon's lost sales each. Online and medium-size brick and mortar retails see small decline in their sales.

Panel A allows us to reject the hypothesis that more than 22.4% of Amazon's lost sales were channeled to competing online retails. The results in Column (2) show a small negative coefficient that is not statistically different from zero, suggesting that there is no large substitution towards other online retailers.

The statistical power improves when analyzing large purchases, in Table 5, Panels B and C, where we can credibly reject substitution for online transactions and somewhat for medium and small retailers. We focus on transactions greater than $500 (Table 5, Panel C). Column (2) rejects the hypothesis that more than 11.1% of Amazon's lost sales were performed via other online retailers. Column (5) rejects the hypothesis that more than 43.7% of Amazon's lost large sales went to medium retailers and Column (6) rejects the hypothesis that more than 27.6% of Amazon's lost large sales went to smaller retailers.

Despite rejecting the hypotheses of large substitution effects towards online, and medium-size and small-size retailers, there is some evidence of general substitution towards brick-and-mortar retailers. Columns (1), (3), and (4) show positive coefficients in all panels, with magnitudes of 10% to 56% of the relevant lost Amazon sales, indicating potentially on some

substitution. Again, we are not able to comment on the statistical significance of these results due to the low power of these regressions.

Overall, while we low statistical power on some of the specifications, we can reject the hypotheses that (1) there was substitution of lost Amazon sales to online retailers, and (2) there was substitution of lost Amazon *large* sales to medium and small brick-and-mortar retailers. We do measure some substitution to brick-and-mortar retailers in general, however, our empirical setting does not allow us to comment on the statistical significance of the effect.

6 Conclusion

Internet taxation is an important issue that will continue to be debated for years to come. Despite the importance of widespread Amazon Tax laws, little is currently known about their effect on the demand for Internet retailers such as Amazon.com and whether the implementation of such laws leads to substitution effects such as bolstering local sales at brick-and-mortar stores when online retailers' sales tax price advantage is removed.

Using transaction-level data of over 210,000 households, we identify the effects of Amazon Taxes on the purchasing behavior of residents living in sixteen states that adopted such laws over 2012–2014. We find that Amazon sales fall by 10.7% after implementation of an Amazon Tax, corresponding to an elasticity of –1.5. We find the effect to be more concentrated in large purchases, such as those over $250. For this subset of purchases, we find that Amazon sales fall by 24.9% after implementation of the Amazon Tax, corresponding to an elasticity of –3.5. In addition to reductions in the dollar amounts of Amazon spending, we find a statistically significant reduction in the probability and frequency of Amazon spending.

We find mixed evidence regarding substitution of Amazon's lost sales. We find no evidence that Amazon shoppers change their purchases to competing online platforms. We do find some evidence of substitution of up to about 50% of substitution of Amazon's lost sales to brick-and-mortar retailers, however, these results are statistically insignificant due to specifications with low statistical power.

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Table 1. Average Monthly Expenditures Before and After Sales Tax Change

This summary table presents sample statistics for various retailers in the +/–3-month window before and after implementation of Amazon Tax laws. We include households that spent more than $50 in the three months beginning from the sixth month before the implementation of the Amazon Tax. We present the average dollar spending at a particular retailer in a given month. If an Amazon transaction occurs after the tax law changes and the household resides in one of the sixteen affected states, we adjust the post-implementation transactions by dividing by the local sales tax rate to create the tax exclusive amount. "Brick-and-mortar" transactions are those from competing brick and mortar retailers. "Online" transactions are those from the online operations of competing retailers. See Section 3 for a detailed discussion of these categories.

Panel A: Univariate Monthly Amazon Expenditure Statistics

	Average monthly spending on Amazon (3-month window)							
	TX	PA	CA	AZ	NJ	VA	GA	WV
Pre-tax implementation								
Treated state	$45.97	$60.19	$51.31	$73.71	$55.73	$66.30	$55.68	$66.23
34 Control states	$47.23	$51.31	$57.64	$74.64	$55.66	$57.27	$57.27	$57.99
Post-tax implementation								
Treated state	$40.23	$59.00	$64.16	$46.70	$50.28	$65.94	$54.76	$87.37
34 Control states	$46.64	$54.86	$69.14	$51.48	$54.70	$60.56	$60.56	$81.02
	CT	MA	WI	IN	NV	TN	NC	FL
Pre-tax implementation								
Treated state	$64.90	$64.91	$66.07	$89.82	$75.40	$89.29	$86.36	$52.16
34 Control states	$58.48	$58.48	$58.48	$82.43	$82.43	$82.43	$84.05	$49.32
Post-tax implementation								
Treated state	$88.45	$85.05	$81.66	$57.49	$49.54	$52.98	$51.55	$46.63
34 Control states	$82.72	$82.72	$82.72	$56.75	$56.75	$56.75	$56.45	$50.81

Panel B: Univariate Monthly Brick-and-Mortar Retail Expenditure Statistics

	Average monthly spending on brick-and-mortar retailers (3-month window)							
	TX	PA	CA	AZ	NJ	VA	GA	WV
Pre-tax implementation								
Treated state	$459.37	$364.32	$406.44	$516.11	$415.60	$593.13	$527.21	$599.97
34 Control states	$369.85	$406.44	$374.17	$431.44	$442.82	$441.44	$441.44	$439.38
Post-tax implementation								
Treated state	$517.35	$374.62	$415.85	$497.54	$388.57	$583.96	$521.44	$586.36
34 Control states	$399.95	$412.74	$448.71	$384.48	$430.21	$437.29	$437.29	$478.07
	CT	MA	WI	IN	NV	TN	NC	FL
Pre-tax implementation								
Treated state	$479.93	$369.47	$478.06	$597.39	$595.14	$599.92	$599.51	$453.16
34 Control states	$437.42	$437.42	$437.42	$481.30	$481.30	$481.30	$465.65	$409.94
Post-tax implementation								
Treated state	$534.10	$430.56	$515.28	$468.94	$509.35	$513.40	$535.81	$459.99
34 Control states	$466.30	$466.30	$466.30	$386.72	$386.72	$386.72	$400.22	$446.30

Table 1. Average Monthly Expenditures Before and After Sales Tax Change (Cont.)

Panel C: Univariate Monthly Online Retail Expenditure Statistics, Excluding Amazon

	Average monthly spending on non-Amazon online retailers (3-month window)							
	TX	PA	CA	AZ	NJ	VA	GA	WV
Pre-tax implementation								
Treated state	$23.87	$25.05	$29.01	$28.31	$26.20	$24.58	$21.77	$22.26
34 Control states	$29.49	$29.01	$24.23	$40.72	$32.25	$29.56	$29.56	$30.36
Post-tax implementation								
Treated state	$22.33	$28.97	$32.84	$19.00	$24.40	$28.97	$22.55	$31.84
34 Control states	$28.38	$34.62	$39.33	$31.18	$28.92	$33.60	$33.60	$40.76

	CT	MA	WI	IN	NV	TN	NC	FL
Pre-tax implementation								
Treated state	$32.92	$30.20	$24.77	$31.18	$27.26	$30.20	$33.32	$22.26
34 Control states	$31.76	$31.76	$31.76	$41.52	$41.52	$41.52	$40.24	$26.91
Post-tax implementation								
Treated state	$46.07	$40.28	$31.38	$23.33	$20.28	$21.94	$22.34	$21.98
34 Control states	$39.77	$39.77	$39.77	$27.71	$27.71	$27.71	$28.68	$25.74

Table 2. Effect of Amazon Tax on Monthly Amazon Expenditures

This table explores the effect of the Amazon Tax on monthly Amazon expenditures. The dependent variable is the sum of all Amazon transactions over the course of a month. We include households that spent more than $100 at Amazon during the second half of 2011 for specification (1) and (2), and households that spent more than $50 in the three months beginning from the sixth month before the implementation of the Amazon Tax for specifications (3) through (18). If the transaction occurs after the tax law changes and the household resides in one of the sixteen affected states, we adjust the post-law transactions by the sales tax rate to create the tax exclusive amount. The regressions employ a diff-in-diff setting in which the control group is the 34 states that did not initiate an Amazon Tax during our sample and the treated groups are the individual states (in Specifications (3) through (18)) or the sixteen that implemented the tax over our sample period (Specification (1) and (2)). We limit observations to a +/–3-month window surrounding the implementation of the law, with the exception of Specification (1) and (2), which looks at transactions after January 2012. Mean monthly expenditures are provided in each column, as are the average tax rate change for the treated states as well as an estimate of elasticity. All regressions are OLS regressions and include household and year-month fixed effects. Standard errors are clustered at the state level. Standard errors are reported in parentheses. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

Dependent variable:	Monthly Amazon expenditures (Adjusted for change in sales tax)								
Sample:	2011-2014		+/- 3 Month window						
State:	All		TX	PA	CA	AZ	NJ	VA	GA
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
After × TS	-4.936***	9.244***	-5.155***	-4.917***	-11.36***	-3.807***	-4.627***	-3.420***	-3.942***
	(1.013)	(2.486)	(0.244)	(0.481)	(1.149)	(0.584)	(0.517)	(0.684)	(0.683)
After × TS × Tax		-1.928***							
		(0.360)							
Obs	6,519,031	6,519,031	531,756	413,616	667,506	462,864	506,120	534,923	515,617
R^2	0.273	0.273	0.405	0.415	0.403	0.410	0.428	0.422	0.424
Mean for affected state(s)	$46.21		$45.97	$60.19	$57.64	$73.71	$55.73	$66.30	$55.68
Coef/Mean	-10.7%		-11.2%	-8.2%	-19.7%	-5.2%	-8.3%	-5.2%	-7.1%
Avg Tax Rate Change	7.1%		8.0%	6.3%	8.2%	9.0%	7.0%	5.0%	6.9%
Price elasticity	-1.5		-1.4	-1.3	-2.4	-0.6	-1.2	-1.0	-1.0

Dependent variable:	Monthly Amazon expenditures (Adjusted for change in sales tax)								
Sample:	+/- 3 Month window								
State:	WV	CT	MA	WI	IN	NV	TN	NC	FL
	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)
After × TS	-1.847	-0.568	-4.141*	-8.239***	-6.132***	0.207	-10.43***	-6.922***	-6.959***
	(2.272)	(2.182)	(2.180)	(2.177)	(1.357)	(1.358)	(1.357)	(1.204)	(0.841)
Obs	478,664	492,570	510,179	482,202	499,869	506,872	509,462	537,220	782,414
R^2	0.421	0.421	0.421	0.422	0.422	0.421	0.422	0.414	0.421
Mean for affected state(s)	$66.23	$64.90	$64.91	$66.07	$89.82	$75.40	$89.29	$86.36	$52.16
Coef/Mean	-2.8%	-0.9%	-6.4%	-12.5%	-6.8%	0.3%	-11.7%	-8.0%	-13.3%
Avg Tax Rate Change	6.1%	6.4%	6.3%	5.4%	7.0%	8.0%	9.4%	6.9%	6.6%
Price elasticity	-0.5	-0.1	-1.0	-2.3	-1.0	0.0	-1.2	-1.2	-2.0

Table 3. Effect of Amazon Tax on Monthly Amazon Expenditures (Tax Inclusive)

This table explores the effect of the Amazon Tax on monthly Amazon expenditures. The dependent variable is the sum of all Amazon transactions over the course of a month. Unlike Table 2, if the transaction occurs after the tax law changes and the household resides in one of the sixteen affected states, we do not adjust the post-law transactions by dividing by the sales tax rate. We include households that spent more than $100 at Amazon during the second half of 2011 for specification (1) and (2), and households that spent more than $50 in the three months beginning from the sixth month before the implementation of the Amazon Tax for specifications (3) through (18). The regressions employ a diff-in-diff setting in which the control group is the 34 states that did not initiate an Amazon Tax during our sample and the treated groups are the individual states (in Specifications (3) through (18)) or the sixteen that implemented the tax over our sample period (Specification (1) and (2)). We limit observations to a +/–3-month window surrounding the implementation of the law, with the exception of Specification (1) and (2), which looks at transactions after January 2012. Mean monthly expenditures are provided in each column, as are the average tax rate change for the treated states as well as an estimate of elasticity. All regressions are OLS regressions and include household and year-month fixed effects. Standard errors are clustered at the state level. Standard errors are reported in parentheses. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

Dependent variable:	Monthly Amazon expenditures (Unadjusted for change in sales tax)								
Sample:	2011-2014		+/- 3 Month window						
State:	All		TX	PA	CA	AZ	NJ	VA	GA
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
After × TS	-1.613*	10.29***	-2.058***	-1.273**	-6.236***	0.312	-1.183**	-0.170	-0.282
	(0.938)	(2.530)	(0.244)	(0.481)	(1.148)	(0.584)	(0.517)	(0.684)	(0.683)
After × TS × Tax		-1.618***							
		(0.359)							
Obs	6,519,031	6,519,031	531,756	413,616	667,506	462,864	506,120	534,923	515,617
R^2	0.274	0.274	0.405	0.415	0.404	0.410	0.428	0.423	0.423
Mean for affected state(s)	$46.21		$45.97	$60.19	$57.64	$73.71	$55.73	$66.30	$55.68
Coef/Mean	-3.5%		-4.5%	-2.1%	-10.8%	0.4%	-2.1%	-0.3%	-0.5%
Avg Tax Rate Change	7.1%		8.0%	6.3%	8.2%	9.0%	7.0%	5.0%	6.9%
Price elasticity	-0.5		-0.6	-0.3	-1.3	0.0	-0.3	-0.1	-0.1

Dependent variable:	Monthly Amazon expenditures (Unadjusted for change in sales tax)								
Sample:	+/- 3 Month window								
State:	WV	CT	MA	WI	IN	NV	TN	NC	FL
	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)
After × TS	3.420	4.942**	1.056	-3.949*	-2.168	4.066***	-5.514***	-3.407***	-4.010***
	(2.272)	(2.183)	(2.180)	(2.177)	(1.357)	(1.358)	(1.357)	(1.204)	(0.841)
Obs	478,664	492,570	510,179	482,202	499,869	506,872	509,462	537,220	782,414
R^2	0.421	0.421	0.421	0.422	0.422	0.421	0.422	0.414	0.422
Mean for affected state(s)	$66.23	$64.90	$64.91	$66.07	$89.82	$75.40	$89.29	$86.36	$52.16
Coef/Mean	5.2%	7.6%	1.6%	-6.0%	-2.4%	5.4%	-6.2%	-3.9%	-7.7%
Avg Tax Rate Change	6.1%	6.4%	6.3%	5.4%	7.0%	8.0%	9.4%	6.9%	6.6%
Price elasticity	0.9	1.2	0.3	-1.1	-0.3	0.7	-0.7	-0.6	-1.2

Table 4. Effect of Amazon Tax on Large Amazon Expenditures

This table explores the effect of the Amazon Tax on large Amazon expenditures. The dependent variable is the sum of all Amazon large transactions over the course of a month. Panel A examines at transactions over $250, and Panel B examines transactions over $500. We include households that spent more than $100 at Amazon during the second half of 2011 for specification (1) and (2), and households that spent more than $50 in the three months beginning from the sixth month before the implementation of the Amazon Tax for specifications (3) through (18). If the transaction occurs after the tax law changes and the household resides in one of the sixteen affected states, we adjust the post-law transactions by the sales tax rate to create the tax exclusive amount. The regressions employ a diff-in-diff setting in which the control group is the 34 states that did not initiate an Amazon Tax during our sample and the treated groups are the individual states (in Specifications (3) through (18)) or the sixteen that implemented the tax over our sample period (Specification (1) and (2)). We limit observations to a +/–3-month window surrounding the implementation of the law, with the exception of Specification (1) and (2), which looks at transactions after January 2012. Mean monthly expenditures are provided in each column, as are the average tax rate change for the treated states as well as an estimate of elasticity. All regressions are OLS regressions and include household and year-month fixed effects. Standard errors are clustered at the state level. Standard errors are reported in parentheses. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

Panel A: Effect of Amazon Tax on Monthly Large (≥$250) Expenditures at Amazon

Dependent variable:	Monthly Amazon expenditures ≥ $250 (Adjusted for change in sales tax)								
Sample:	2011-2014		+/- 3 Month window						
State:	All		TX	PA	CA	AZ	NJ	VA	GA
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
After × TS	-2.360***	1.903**	-2.942***	-3.363***	-4.438***	-1.550***	-2.097***	-1.389***	-0.980**
	(0.200)	(0.806)	(0.162)	(0.160)	(0.130)	(0.338)	(0.159)	(0.198)	(0.198)
After × TS × Tax		-0.580***							
		(0.118)							
Obs	6,519,031	6,519,031	531,756	413,616	667,506	462,864	506,120	534,923	515,617
R^2	0.065	0.087	0.211	0.208	0.194	0.205	0.209	0.203	0.211
Mean for affected state(s)	$9.49		$9.55	$13.87	$13.45	$15.16	$10.38	$10.55	$9.87
Coef/Mean	-24.9%		-30.8%	-24.2%	-33.0%	-10.2%	-20.2%	-13.2%	-9.9%
Avg Tax Rate Change	7.1%		8.0%	6.3%	8.2%	9.0%	7.0%	5.0%	6.9%
Price elasticity	-3.5		-3.9	-3.8	-4.0	-1.1	-2.9	-2.6	-1.4

Dependent variable:	Monthly Amazon expenditures ≥ $250 (Adjusted for change in sales tax)								
Sample:	+/- 3 Month window								
State:	WV	CT	MA	WI	IN	NV	TN	NC	FL
	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)
After × TS	1.027**	-2.013***	-1.790***	-5.262***	-3.092***	-2.318***	-4.570***	-0.486**	-3.591***
	(0.379)	(0.334)	(0.334)	(0.334)	(0.251)	(0.251)	(0.251)	(0.186)	(0.345)
Obs	478,664	492,570	510,179	482,202	499,869	506,872	509,462	537,220	782,414
R^2	0.231	0.231	0.231	0.233	0.233	0.234	0.234	0.228	0.234
Mean for affected state(s)	$11.47	$11.96	$11.21	$12.77	$20.66	$18.67	$17.92	$15.93	$12.02
Coef/Mean	9.0%	-16.8%	-16.0%	-41.2%	-15.0%	-12.4%	-25.5%	-3.1%	-29.9%
Avg Tax Rate Change	6.1%	6.4%	6.3%	5.4%	7.0%	8.0%	9.4%	6.9%	6.6%
Price elasticity	1.5	-2.7	-2.6	-7.6	-2.1	-1.6	-2.7	-0.4	-4.5

Table 4. Effect of Amazon Tax on Large Amazon Expenditures (Cont.)

Panel B: Effect of Amazon Tax on Monthly Large (≥$500) Expenditures at Amazon

Dependent variable:	Monthly Amazon expenditures ≥ $500 (Adjusted for change in sales tax)								
Sample:	2011-2014		+/- 3 Month window						
State:	All		TX	PA	CA	AZ	NJ	VA	GA
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
After × TS	-1.472***	1.062*	-1.939***	-1.794***	-3.063***	-0.903**	-1.366***	-0.564***	-0.410**
	(0.200)	(0.600)	(0.162)	(0.160)	(0.130)	(0.338)	(0.159)	(0.198)	(0.198)
After × TS × Tax		-0.345***							
		(0.0889)							
Obs	6,519,031	6,519,031	531,756	413,616	667,506	462,864	506,120	534,923	515,617
R^2	0.065	0.065	0.211	0.208	0.194	0.205	0.209	0.203	0.211
Mean for affected state(s)	$4.53		$4.48	$7.68	$7.30	$7.33	$4.89	$4.37	$4.31
Coef/Mean	-32.5%		-43.3%	-23.4%	-42.0%	-12.3%	-27.9%	-12.9%	-9.5%
Avg Tax Rate Change	7.1%		8.0%	6.3%	8.2%	9.0%	7.0%	5.0%	6.9%
Price elasticity	-4.6		-5.4	-3.7	-5.1	-1.4	-4.0	-2.6	-1.4

Dependent variable:	Monthly Amazon expenditures ≥ $500 (Adjusted for change in sales tax)								
Sample:	+/- 3 Month window								
State:	WV	CT	MA	WI	IN	NV	TN	NC	FL
	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)
After × TS	-0.840***	-1.038***	-1.345***	-3.680***	-3.080***	-1.885***	-2.641***	0.960***	-2.320***
	(0.229)	(0.206)	(0.206)	(0.206)	(0.312)	(0.312)	(0.312)	(0.234)	(0.130)
Obs	478,664	492,570	510,179	482,202	499,869	506,872	509,462	537,220	782,414
R^2	0.202	0.202	0.202	0.204	0.209	0.210	0.209	0.204	0.209
Mean for affected state(s)	$7.05	$4.74	$4.86	$6.49	$11.34	$8.87	$7.92	$5.50	$5.94
Coef/Mean	-11.9%	-21.9%	-27.7%	-56.7%	-27.2%	-21.3%	-33.3%	17.5%	-39.1%
Avg Tax Rate Change	6.1%	6.4%	6.3%	5.4%	7.0%	8.0%	9.4%	6.9%	6.6%
Price elasticity	-2.0	-3.4	-4.4	-10.4	-3.9	-2.7	-3.5	2.5	-5.9

Table 5. Substitution Effects from the Amazon Tax

This table explores the effect of the Amazon Tax on the sales of competing retailers. The dependent variable is the sum of all transactions over the course of a month for a particular group of retailers. We include households that spent more than $100 at Amazon during the second half of 2011. "Brick-and-mortar" transactions are those from competing brick and mortar retailers. "Online" transactions are those from the online operations of competing retailers. See Section 3 for a detailed discussion of these categories. The regressions employ a diff-in-diff setting in which the control group is the 34 states that did not initiate an Amazon Tax during our sample and the treated groups are the sixteen states that implemented the tax over our sample period. Mean monthly expenditures are provided in each column, as are the average tax rate change for the treated states as well as an estimate of elasticity. The dependent variable in Panel A is computed using all transactions at the relevant competing retailers. The dependent variable in Panel B is computed using transactions at or above $250 at the relevant competing retailers. The dependent variable in Panel C is computed using transactions at or above $500 at the relevant competing retailers. All regressions are OLS regressions and include household and year-month fixed effects. Standard errors are clustered at the state level. Standard errors are reported in parentheses. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

Panel A: All Competing Transactions

Dependent variable:	Monthly retail expenditures					
Brick&Mortar/Online:	Both	Online	Brick&Mortar	Brick&Mortar	Brick&Mortar	Brick&Mortar
Retailer type:	All	All	All	Large	Medium	Small
	(1)	(2)	(3)	(4)	(5)	(6)
After × TS	2.206	-0.541	2.762	1.865	-0.631	2.123
	(10.93)	(0.564)	(11.18)	(8.259)	(3.134)	(4.207)
Obs	6,519,031	6,519,031	6,519,031	6,519,031	6,519,031	6,519,031
R^2	0.522	0.270	0.525	0.439	0.333	0.422
1.96 * Std Error/Amazon Coef	434.0%	22.4%	443.9%	328.0%	124.4%	167.1%
Coef/Amazon Coef	44.7%	-11.0%	56.0%	37.8%	-12.8%	43.0%

Panel B: Effect of Amazon Tax on Monthly Large (≥$250) Expenditures at Amazon's Competitors

Dependent variable:	Monthly retail expenditures ≥ $250					
Brick&Mortar/Online:	Both	Online	Brick&Mortar	Brick&Mortar	Brick&Mortar	Brick&Mortar
Retailer type:	All	All	All	Large	Medium	Small
	(1)	(2)	(3)	(4)	(5)	(6)
After × TS	0.872	0.0309	0.847	0.639	-0.476	0.782
	(2.142)	(0.164)	(2.150)	(1.564)	(0.683)	(0.660)
Obs	6,519,031	6,519,031	6,519,031	6,519,031	6,519,031	6,519,031
R^2	0.207	0.097	0.206	0.180	0.114	0.167
1.96 * Std Error/Amazon Coef	177.9%	13.6%	178.6%	129.9%	56.7%	54.8%
Coef/Amazon Coef	17.7%	0.6%	17.2%	12.9%	-9.6%	15.8%

Table 5. Substitution Effects from the Amazon Tax (Cont.)

Panel C: Effect of Amazon Tax on Monthly Large (≥$500) Expenditures at Amazon's Competitors

Dependent variable:	Monthly retail expenditures ≥ $500					
Brick&Mortar/Online:	Both	Online	Brick&Mortar	Brick&Mortar	Brick&Mortar	Brick&Mortar
Retailer type:	All	All	All	Large	Medium	Small
	(1)	(2)	(3)	(4)	(5)	(6)
After × TS	0.506	-0.0306	0.521	0.390	-0.153	0.314
	(0.844)	(0.0837)	(0.834)	(0.559)	(0.328)	(0.207)
Obs	6,519,031	6,519,031	6,519,031	6,519,031	6,519,031	6,519,031
R^2	0.114	0.069	0.111	0.099	0.070	0.099
1.96 * Std Error/Amazon Coef	112.4%	11.1%	111.0%	74.4%	43.7%	27.6%
Coef/Amazon Coef	10.3%	-0.6%	10.6%	7.9%	-3.1%	6.4%

Figure 1: Histogram of (Sales Tax Revenue / Total State Revenue) for the 50 States in 2011

This figure illustrates the importance of sales tax revenues as a percentage of total state revenues. The data is provided from 2011 U.S. Census Annual Survey of State and Local Government Finance: https://www.census.gov/govs/local/. This figure shows that the importance of this tax varies considerably across states, ranging from 0% of state revenues in states without sales tax (such as Oregon and Alaska) to as high as 21.0% of state revenues for Washington.