

# Can Taxes Shape an Industry? Evidence from the Implementation of the “Amazon Tax”

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## Abstract

Online retailers have maintained a price advantage over brick-and-mortar retailers since they did not collect sales tax. Recently, several states have required that the online retailer Amazon collect sales tax during checkout. Using transaction-level data, we document that households living in these states reduce Amazon purchases by 8% after sales taxes were implemented, implying an elasticity of  $-1.1$ . The effect is more pronounced for large purchases, for which we estimate a reduction of 11% in purchases and an elasticity of  $-1.5$ . Studying competitors in the electronics field, we detect some evidence of substitution of the lost purchases towards competing retailers.

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## 1 Introduction

Taxes are often considered a factor that motivates business decisions, such as adjusting capital structure and engaging in acquisitions (e.g., DeAngelo and Masulis 1980; Graham 1996; Hayn 1989; Devos, Kadapakkam, and Krishnamurthy 2009). The reason is that managers attempt to minimize their corporations' tax liability. Taxes might also shape the growth and organization of businesses because they affect the attractiveness of firms' products and services in the eyes of their customers. Previous empirical work shows that consumers are indeed 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. Although the customers' channel could be of first order importance in determining firm performance, there has been scant research about the effects of taxes on household purchasing behavior and the aggregate effect on firms.

In this study we explore the effect of individual states requiring Amazon.com to collect sales tax from its customers. We examine nineteen cases in which states<sup>1</sup> began a permanent collection of taxes on Amazon purchases between 2012 and 2015. Our dataset contains high-frequency household-level transaction data for 422,452 households, allowing us to closely track 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. Since little prior empirical evidence has been gathered about the effects of wide implementation of such a tax on retail and as more and more states begin to implement Amazon Tax laws, we contribute also to the understanding its consequences.

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<sup>1</sup> 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, Florida, Maryland, Minnesota, and Illinois.

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 2015, many states have responded by requiring that Amazon begin to collect sales tax.

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 Oregon and Alaska) to as high as 21.0% of state revenues for Washington.<sup>2</sup> 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.<sup>3</sup> 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

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<sup>2</sup> 2011 U.S. Census Annual Survey of State & Local Government Finance: <https://www.census.gov/govs/local/>

<sup>3</sup> The text and status of the bill are found here: <https://www.govtrack.us/congress/bills/113/s743>

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.”<sup>4</sup> 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 and contains transaction-level information similar to what is found on bank and credit card statements.

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.” Our results show that the introduction of the Amazon Tax resulted in a permanent decline of 8.3% in the amount spent on products (net of sales tax, which we will hereafter refer to as the tax-exclusive price) on Amazon, corresponding to an average elasticity is  $-1.1$ . The magnitude of the elasticity is somewhat lower than that documented by 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 there are no changes for the tax-inclusive spending on

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<sup>4</sup> <http://articles.latimes.com/2011/jan/20/business/la-fi-internet-tax-20110120>

Amazon in the wake of the law's implementation. Households spend the same amount of money at Amazon, but receive less in return. However, even with gross spending, we find that households remain sensitive to higher sales taxes.

We find that low income households reduce their spending on Amazon by a larger amount than high income households. Low income households reduce their spending by around 12% while high income households reduce their spending by around 9% in the longer term. Both low income and high income households reduce their spending into the long term.

Consistent with the idea that consumers trade off sales tax with search costs, we find that the decline in Amazon purchases is more pronounced for larger purchases, as consumers would garner the greatest savings by avoiding tax on such purchases. We document 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 11.4% on purchases of at least \$250 implying an elasticity of  $-1.5$ .

Finally, we study substitution effects. Since many of Amazon's large competitors are companies with product scopes that are larger than that of Amazon (e.g., Walmart, Costco), we focus on a particular industry – electronics retailers. We find that Amazon's direct competitors, Best Buy (brick-and-mortar and online) and Newegg (online), experienced an increase in sales thanks to the implementation of the Amazon Tax. In the long term, Best Buy's sales increased by 7.1% and Newegg's sales increased by 11.5%.

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.<sup>5</sup> Even when this legislation has proven to be constitutional by 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 February 2015, Amazon was collecting sales tax in 24 states, comprising more than half of the U.S. population. Over our sample period, nineteen 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.

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<sup>5</sup> 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.

Our study investigates the impact of the Amazon Tax in nineteen 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), Florida (5/1/2014), Maryland (10/1/2014), Minnesota (10/1/2014), and Illinois (2/1/2015).

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.<sup>6</sup>

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 taxes, and only 0.3% of households in California and New Jersey report use taxes. However,

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<sup>6</sup> 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. Amazon could, in theory, entice buyers to purchase by offering coupons instead of lowering prices and thus preempt buyers from shopping elsewhere. Unfortunately, we do not have information about coupons (we observe only the final transaction price); the use of coupons, however, might have a mitigating effect on consumers’ reaction.

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.<sup>7</sup> 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 that the service can extract relevant bank and credit card information.

The information we use consists of daily transactions for 2.7 million households from January 1, 2011 to May 25, 2015, 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.

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<sup>7</sup> 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.

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 nineteen treatment states that were affected by an Amazon Tax. We identify the state of residence of households in our dataset by requiring that 75% of transactions occur within a given state. We then assign the most common city as the city of residence of the household.

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 \$200 at Amazon during 2011, though the results are robust to using alternative spending thresholds. After applying these two filters, our sample size is reduced to 422,452 households, 275,349 of which live in one of the nineteen states that implemented the Amazon Tax over our sample period.

The unit of observation in our analyses is the household-month. For each household-month, we sum all expenditures for Amazon. 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 nineteen states, we only adjust transactions after the law has been implemented.<sup>8</sup> All variables are winsorized at the 99<sup>th</sup> percentile.

Summary statistics of monthly Amazon spending before and after the sales tax implementation are presented in Table 1. In general, the change in dollar amount of expenditures at Amazon appears to be stronger for the control group. We analyze this formally in the subsequent sections.

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<sup>8</sup> For two states (Pennsylvania and California), the implementation of the Amazon tax took place at the middle of the month. In these cases, we removed the household-month observations from the transition month.

#### **4 States Implementing the Amazon Tax**

States that decide to implement the Amazon Tax are, of course, not drawn randomly. This fact raises the concern that the decline in Amazon sales that we document take place due to an unobservable confounding factor that pushes states to embrace the Amazon Tax and at the same time causes a decline in Amazon sales. Perhaps the most obvious potential latent factor is a state-level economic weakness which leads states to adopt the Amazon Tax in order to increase revenues, and at the same time causes a decline in consumption.

We address this concern in three fashions. First, we explore whether states that implement the Amazon Tax experience a significantly different gross domestic product (GDP) growth around the implementation of the tax than states that did not implement the tax. We form a sample of 5-year GDP growth data around the implementation year. Then, we test whether the average GDP growth is different for state-quarters following the implementation of the Amazon Tax. In Table 2, Columns (1) and (2) we present the results. The regressions shows that there is no significant difference in state-level GDP following the Amazon Tax implementation.

Second, we test whether households' income changed around the implementation of the tax. We extract household's income from household's cash flows. We use household-month data to conduct the test. The results are presented in Table 2, Columns (3) and (4). We regress household income on time dummies, surrounding the implementation of the Amazon Tax. In addition, we include month fixed effects and household fixed effects. The table shows that households did not experience a meaningful change in income around the implementation of the tax. Hence, it is not likely that the main results in the study are due to the changes in the purchasing power of households.

Third, since a state-level slowdown commends a general decline in consumption, we examine also whether there was change in the pattern of purchasing at electronics retailers (Section 5.5). Our analysis indicates that there was no such decline in consumption.

In sum, we conclude that our results are not likely to be driven by a state-level economic weakness that caused states to implement the Amazon Tax and at the same time caused a slowdown in consumption.

## 5 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 using both the tax-exclusive price and the tax-inclusive price. In addition, we examine and income split, as well as a split by Amazon historical spending intensity. Finally, we examine also the effect on large purchases exclusively.

We use a diff-in-diff methodology in which we measure the consumption effects after states start imposing sales tax on Amazon purchases. Our basic empirical specification is:

$$Y_{ht} = \beta_0 + \beta_1 \times \textit{After Transition}_{h,t} \times \textit{Treated State}_h + \\ + \textit{Month Fixed Effects}_t + \textit{Household Fixed Effects}_h + \varepsilon_{h,t}$$

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).  $\textit{After Transition} \times \textit{Treated State}$  is an indicator variable that takes the value of 1 for treated households after implementation of the Amazon Tax and 0 otherwise. In a slightly modified empirical specification, we divide the  $\textit{After Transition} \times \textit{Treated State}$  term into a more granular

interactive term to investigate short- versus long-term responses to the treatment at a quarterly frequency.

### **5.1 Average Value of Purchased Goods (Tax-Exclusive Price)**

We begin our analysis by examining whether the average monthly amount that households purchased 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 impact of the sales tax on Amazon's sales and the value to households, so we create the tax-exclusive price by dividing by one plus the local tax rate.

Table 3 presents the results of this analysis. In Column (1) we present the effect of the Amazon Tax on the average monthly Amazon spending after the tax was implemented, where Treated State is a dummy variable for the states that implemented that Amazon Tax and  $I(t \geq Q)$  is a dummy variable for all months following the tax implementation. The results show that consumers in affected states reduce their average monthly purchases at Amazon by \$6.58, a 9.0% reduction in purchases relative to mean monthly spending among the treated states before the tax was implemented. 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 the affected states.

In Column (2), we examine the timing of the Amazon purchases in the quarter preceding and in the quarters following the tax implementation.  $I(t = Q_{-1})$ ,  $I(t = Q)$ , and  $I(t \geq Q_{+1})$  are dummy variables for the quarter(s) before, quarter after, and subsequent quarters following the tax implementation, respectively. We find some evidence of a buildup of purchases before the Amazon Tax was implemented, corresponding to an increase of 2.4%.



In the quarter following the sales tax implementation, consumers in the affected states reduced their monthly Amazon purchases by \$5.85, corresponding to an 8.0% reduction from the pre-treatment mean. The reduction in purchases remains at a similar level in the quarters following the first quarter. The regression in Column (2) shows that following a sales tax implementation, households exhibit a permanent reduction in monthly Amazon purchases of \$6.10, corresponding to an 8.3% reduction from the pre-treatment mean. Given that the average sales tax for the treated households was 7.6%, this coefficient corresponds to an elasticity of – 1.1.<sup>9</sup>

In Column (3), we interact with the local tax rates of each household, to examine whether the households that lived in localities with high sales taxes were more sensitive to the implementation of Amazon taxes. Indeed, we find that in the immediate quarter following the implementation, every 1% increase in sales taxes leads to a reduction in monthly Amazon spending of around \$2.85, corresponding to a 3.9% reduction from the pre-treatment mean. The effect is long-lasting, with 1% increase in taxes leading to a statistically significant \$2.26 reduction in spending in the subsequent quarters.

## **5.2 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 difficult to predict

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<sup>9</sup>  $(\$6.10 / \$73.4) / 7.6\% = -1.09$ .

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 Columns (4) through (6), we repeat the previous tests using as the dependent variable the tax-inclusive Amazon expenditures. With the exception of Column (6), the effects are no longer significant. Hence, household spend the same amount of money at Amazon, but get less in return since they now have to pay sales taxes. However, we still find that households in high sales tax jurisdictions remain more sensitive to sales taxes. They reduce Amazon spending, inclusive of tax, by \$2.46 per month for every 1% increase in sales taxes in the immediate quarter following the tax and \$1.78 per month for the following quarters.

### **5.3 The Cross-Section of Households**

Different households may react to the inclusion of sales tax differently. In this section, we explore heterogeneity in household responses along two dimensions: income and historical purchases at Amazon. The analysis in Table 4 repeats the main specification, but to subsets of the population.

First, we compare high income households to low income households. Columns (1) to (3) of Table 4 show that the low income households are the most sensitive to the Amazon tax. Low income households reduce Amazon purchases by 11.5% over the long-term. In contrast, high income households reduce their purchases only by 8.8% over the long-term. These results are consistent with low income households being more price sensitive than high income households. Further, the idea is also consistent with lower income households having lower opportunity costs and being willing to bear search costs to substitute to alternative retailers.

We also split households by the total amount of Amazon purchases in 2011, to see whether households that are heavier Amazon customers act differently from light Amazon customers. Columns (4) through (6) of Table 4 present the results. While we find that the dollar reduction in spending varies greatly across households, though the mean-adjusted varies little across groups.

#### **5.4 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 5, where we repeat the base regressions (from Table 3) with samples that are limited to purchases of at least \$250. Specifically, for each household in the sample, we use only Amazon transactions of at least \$250 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. Column (1) shows the average decline in Amazon sales is 12.9%. In the more granular specification, Column (2) shows that there is some buildup in purchases before the tax took effect, and that the decline in purchases following the tax implementation is permanent at a rate of  $-11.4\%$ . This figure is equivalent to an average elasticity of  $-1.5$ . In Figure 2, we plot the coefficients for the regression using month dummies instead of the quarter dummies which shows the buildup of purchases before the implementation of the Amazon tax.

In Table 6, we conduct further analysis of the response of large purchases to the tax increase, by subpopulations. As before, we split the sample by income and by historical Amazon purchases. We detect similar patterns to those we found in Table 4. Column (3) shows that low income households reduce their large purchases at Amazon by  $15.3\%$  after implementation of the Amazon Tax. In contrast, high income households reduce their consumption of large purchases only by  $12.1\%$ .

As before, purchase history has little effect on the response of households. Columns (4) through (6) of Table 6 show that the permanent decline in Amazon purchase is similar across purchasing-history groups: between  $11.5\%$  to  $12.4\%$ .

## **5.5 Substitution to Electronics Retailers**

We are interested to examine whether the foregone sales of Amazon went to competing firms and whether these firms are brick and mortar shops or other online retailers. We face, however, a data issue. While we observe transactions amounts at Amazon and the competing firms, we cannot identify the nature of the products. Furthermore, it is likely that if there is substitution to other retailers, it is spread among several competitors rather than one retailer.

Finally, it is empirically difficult to detect an increase in sales in giant competitors like Walmart, Costco, or Target, that sell a wide array of products including lines of products that are not provided by Amazon (e.g., groceries).

Nevertheless, we can provide some evidence about substitution in specific areas. We choose to focus on electronics products for several reasons. First, in general these are often large purchases which are likely to worth the time of shoppers to find a good deal. Second, these products are easily identifiable by brand and model, hence price-sensitive shoppers can easily compare prices across outlets. Third, competing retailers in the electronics space specialize in electronics only, hence sharpening the empirical test. Our analysis, therefore, looks at largest competing electronics stores: Best Buy and Newegg. Best Buy is the largest electronics retailer in the United States, and Newegg is the second largest online-only retailer, trailing only to Amazon. Best Buy has physical presence in most states, hence collects sales tax both for physical and online sales. Newegg, however, is headquartered in California and has limited operations in three other states, so it is only required to collect sales tax from purchases in four states.<sup>10</sup>

To test for the possibility that competing electronics retailers benefited from some of Amazon's forgone sales, we regress total spending of Best Buy and Newegg on the *After Transition*  $\times$  *Treated State* variable, respectively. As with the previous regressions, we also include household and month fixed effects. The results of the substitution analysis are presented in Table 7. We find no significant results for Best Buy over the whole period in Column (1), but in Column (2) we find that the long-term effect of substitution exists, of around 7.1% of Best Buy's sales. We find much stronger results for Newegg. In Column (3), we find that households increase their long-term spending in Newegg by 11.3% after the Amazon Tax. The stronger

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<sup>10</sup> <http://kb.newegg.com/FAQ/Article/1360>

result for Newegg may be attributed to the fact that it retains its tax advantage over Amazon, which makes it a more favorable substitute than Best Buy.

## **5.6 Substitution to Amazon Marketplace**

We also analyze potential substitution of Amazon customers to Amazon Marketplace. Amazon Marketplace is a platform which allows third-party sellers to sell products directly on Amazon's web site. Many products on Amazon are sold by both Amazon.com as well as Amazon Marketplace within a single product page. Amazon handles the billing and oftentimes shipping of these orders, so Amazon Marketplace sellers are an almost perfect substitute to Amazon. Since these third-party Amazon Marketplace sellers have limited geographical footprints and are not subject to the Amazon Tax laws, products sold by these sellers are not generally taxed, making these retailers an attractive substitute to Amazon. On the other hand, the sales tax advantage of these Marketplace sellers may not be immediately evident to the casual shopper who mistakenly assumes that the Amazon Tax laws apply to both Amazon and Amazon Marketplace transactions.

We test the effect of the Amazon Tax on Marketplace sales in Columns (5) and (6) of Table 7 and find there to be no effect of the Amazon Tax on demand for Amazon Marketplace retailers. This result can be driven by the lack of knowledge of shoppers that an Amazon platform allows them to avoid paying sales tax. Thus, any positive effects of more attractive treatment of sales tax of Marketplace transactions appear to be offset by the negative effects of the perceived increases in Amazon taxes by the casual shopper.

## **6 Conclusion**

Taxes affect not only business decisions by managers, but also purchasing decisions by customers. In the aggregate, purchasing decisions have significant effects on corporations. In this study we analyze the effects implementing the Amazon Tax law in various states. The law requires Amazon to collect sales tax, which in turn make Amazon's products less competitive.

Using transaction-level data of 422,452 households, we identify the effects of Amazon Taxes on the purchasing behavior of residents living in nineteen states that adopted such laws from 2012 to 2015. We find that Amazon sales fall by 8.3% after implementation of an Amazon Tax, corresponding to an elasticity of  $-1.1$ . We find the effect to be more concentrated in large purchases, such as those of at least \$250. For this subset of purchases, we find that Amazon sales fall by 11.4% after implementation of the Amazon Tax, corresponding to an elasticity of  $-1.5$ .

To understand whether Amazon's competitors benefit from the law, we examine the sales of its Amazon's competitors in the electronics industry. We document that the largest brick-and-mortar, Best Buy, and the largest online competitor, Newegg, experienced a significant increase in their sales because of the Amazon Tax law.

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

This summary table presents average spending at Amazon in the +/-3-month window before and after implementation of Amazon Tax laws. We include households that spent over \$200 on Amazon during 2011. If an Amazon transaction occurs after the tax law changes and the household resides in one of the nineteen affected states, we adjust the post-implementation transactions by dividing by the local sales tax rate to create the tax exclusive amount. Control states are the 31 states that do not change their Amazon tax status during our sample period.

	States (3-month window)									
	All	TX	PA	CA	AZ	NJ	VA	GA	WV	CT
Pre-tax implementation										
Treated state(s)	\$83.26	\$63.00	\$69.71	\$71.35	\$99.44	\$72.09	\$88.93	\$75.49	\$83.99	\$87.27
Control states	\$77.90	\$60.70	\$63.27	\$63.27	\$95.16	\$72.46	\$74.55	\$74.55	\$76.03	\$77.32
Post-tax implementation										
Treated state(s)	\$82.06	\$58.86	\$68.19	\$83.79	\$64.60	\$69.42	\$91.93	\$72.61	\$130.86	\$129.50
Control states	\$85.85	\$64.02	\$70.48	\$90.81	\$68.66	\$76.03	\$82.72	\$82.72	\$111.05	\$113.69
	MA	WI	IN	NV	TN	NC	FL	MD	MN	IL
Pre-tax implementation										
Treated state	\$82.32	\$85.16	\$123.99	\$111.72	\$120.20	\$114.04	\$87.30	\$97.25	\$92.27	\$128.18
Control states	\$77.32	\$77.32	\$111.05	\$111.05	\$111.05	\$113.69	\$80.61	\$88.30	\$88.30	\$133.36
Post-tax implementation										
Treated state	\$109.48	\$115.83	\$83.82	\$77.79	\$76.95	\$75.18	\$83.28	\$139.75	\$118.73	\$84.32
Control states	\$113.69	\$113.69	\$81.95	\$81.95	\$81.95	\$80.61	\$85.16	\$129.90	\$129.90	\$98.47

**Table 2. State GDP Growth and household income around Amazon Tax Implementation**

This table explores whether states that implemented the Amazon Tax experienced a different GDP growth (Columns (1) and (2)) or a change in household income (Columns (3) and (4)) than states that did not implement the tax. All regressions are OLS regressions and include time and state fixed effects. The unit of observation in Columns (1) and (2) is the state quarter. The regression in Column (1) is weighted by the GDP of the each state. The regression in Column (2) is weighted by the relative number of households in each state in the sample. The unit of observation in Columns (3) and (4) is the household month. Column (3) looks at household income after the tax implementation in the treated states. Column (4) looks at the short-term and long-term changes in household income after the tax implementation in the treated states. Standard errors are clustered by state and time. Treated State is a dummy variable for the states that implemented the Amazon tax.  $I(t \geq Q)$  is a dummy variable for all months after tax implementation.  $I(t = Q_{-1})$ ,  $I(t = Q)$ ,  $I(t \geq Q_{+1})$  are dummy variables for the quarter(s) before, quarter after, and subsequent quarters following the tax implementation, respectively. Standard errors are reported in parentheses. \*\*\*, \*\*, and \* denote statistical significance at the 1%, 5%, and 10% levels, respectively.

Dependent variable:	State-level GDP growth (%)		Income	
	(1)	(2)	(3)	(4)
Treated State $\times I(t \geq Q)$	-0.18 (0.44)	-0.10 (0.47)	79.10 (149.92)	
Treated State $\times I(t = Q_{-1})$				-323.71 (208.39)
Treated State $\times I(t = Q)$				140.91 (190.65)
Treated State $\times I(t \geq Q_{+1})$				-85.14 (214.64)
State Fixed Effect	Yes	Yes	Yes	Yes
Time Fixed Effect	Yes	Yes	Yes	Yes
Weighting	GDP	#Households		
Obs	757	757	14,899,090	14,899,090
R <sup>2</sup>	47.7%	52.4%	28.9%	28.9%

**Table 3. Effect of Amazon Tax on Monthly Amazon Expenditures**

This table explores the effect of the Amazon Tax on Amazon expenditures. The unit of observation is the household month and the dependent variable is the sum of monthly Amazon transactions per household. Columns (1) through (3) evaluate tax-exclusive expenditures, while Columns (4) through (6) evaluate tax-inclusive expenditures. Treated State is a dummy variable for the states that implemented the Amazon tax.  $I(t \geq Q)$  is a dummy variable for all months after tax implementation.  $I(t = Q_{-1})$ ,  $I(t = Q)$ ,  $I(t \geq Q_{+1})$  are dummy variables for the quarter(s) before, quarter after, and subsequent quarters following the tax implementation, respectively. All regressions are OLS regressions and include household and year-month fixed effects. Standard errors are clustered by state and time. Standard errors are reported in parentheses. \*\*\*, \*\*, and \* denote statistical significance at the 1%, 5%, and 10% levels, respectively.

Dependent variable:	Amazon spending (tax-exclusive)			Amazon spending (tax-inclusive)		
	(1)	(2)	(3)	(4)	(5)	(6)
Treated State $\times I(t \geq Q)$	-6.58*** (1.07)			-1.27 (1.09)		
Treated State $\times I(t = Q_{-1})$		1.76** (0.78)	2.88 (4.91)		1.56* (0.79)	3.79 (5.34)
Treated State $\times I(t = Q)$		-5.85*** (1.26)	14.56*** (3.38)		-0.80 (1.22)	16.89*** (3.77)
Treated State $\times I(t \geq Q_{+1})$		-6.10*** (1.13)	9.97* (5.04)		-0.79 (1.16)	11.85** (5.53)
Treated State $\times I(t = Q_{-1}) \times$ Tax rate			-0.23 (0.72)			-0.37 (0.78)
Treated State $\times I(t = Q) \times$ Tax rate			-2.85*** (0.49)			-2.46*** (0.51)
Treated State $\times I(t \geq Q_{+1}) \times$ Tax rate			-2.26*** (0.68)			-1.78** (0.73)
Household Fixed Effect	Yes	Yes	Yes	Yes	Yes	Yes
YYYYMM Fixed Effect	Yes	Yes	Yes	Yes	Yes	Yes
Obs	15,604,084	15,604,084	15,604,084	15,604,084	15,604,084	15,604,084
R <sup>2</sup>	34.3%	34.3%	34.3%	34.4%	34.4%	34.4%
Mean spending	\$73.40	\$73.40	\$73.40	\$73.54	\$73.54	\$73.54
Treated State $\times I(t \geq Q_1)$ / Mean	-9.0%			-1.7%		
Treated State $\times I(t = Q_{-1})$ / Mean		2.4%			2.1%	
Treated State $\times I(t = Q_1)$ / Mean		-8.0%			-1.1%	
Treated State $\times I(t \geq Q_2)$ / Mean		-8.3%			-1.1%	
Treated State $\times I(t = Q_{-1}) \times$ Tax rate / Mean			-0.3%			-0.5%
Treated State $\times I(t = Q_1) \times$ Tax rate / Mean			-3.9%			-3.3%
Treated State $\times I(t \geq Q_2) \times$ Tax rate / Mean			-3.1%			-2.4%

**Table 4. Effect of Amazon Tax on Different Types of Households**

This table explores the effect of the Amazon Tax on different types of households. The unit of observation is the household month and the dependent variable is the tax-exclusive sum of monthly Amazon transactions per household. Households are divided into 3 groups depending on their monthly income and total Amazon spending in 2011. If the transaction occurs after the tax law changes and the household resides in one of the nineteen affected states, we adjust the post-law transactions by the sales tax rate to create the tax exclusive amount. Treated State is a dummy variable for the states that implemented the Amazon tax.  $I(t = Q_{-1})$ ,  $I(t = Q)$ ,  $I(t \geq Q_{+1})$  are dummy variables for the quarter(s) before, quarter after, and subsequent quarters following the tax implementation, respectively. All regressions are OLS regressions and include household and year-month fixed effects. Standard errors are clustered by state and time. Standard errors are reported in parentheses. \*\*\*, \*\*, and \* denote statistical significance at the 1%, 5%, and 10% levels, respectively.

Dependent variable:	Amazon spending					
	Income terciles			Amazon spending terciles		
	High	Mid	Low	High	Mid	Low
	(1)	(2)	(3)	(4)	(5)	(6)
Treated State $\times I(t = Q_{-1})$	1.63** (0.72)	1.57 (1.07)	0.59 (0.74)	2.45** (0.97)	1.45* (0.72)	1.07 (0.89)
Treated State $\times I(t = Q)$	-7.67*** (1.76)	-6.39*** (1.12)	-4.70*** (0.70)	-10.33*** (2.15)	-4.69*** (0.99)	-2.96*** (0.94)
Treated State $\times I(t \geq Q_{+1})$	-8.67*** (0.92)	-6.38*** (0.96)	-5.90*** (0.86)	-10.45*** (1.29)	-5.13*** (1.04)	-3.11** (1.26)
Household Fixed Effect	Yes	Yes	Yes	Yes	Yes	Yes
YYYYMM Fixed Effect	Yes	Yes	Yes	Yes	Yes	Yes
Obs	4,683,591	4,614,520	4,384,403	5,259,348	5,205,850	5,139,612
R <sup>2</sup>	2.9%	2.1%	1.2%	2.1%	2.5%	2.3%
Mean spending	\$99.02	\$70.34	\$51.30	\$127.30	\$54.96	\$36.38
Treated State $\times I(t = Q_{-1})$ / Mean	1.6%	2.2%	1.2%	1.9%	2.6%	2.9%
Treated State $\times I(t = Q_1)$ / Mean	-7.7%	-9.1%	-9.2%	-8.1%	-8.5%	-8.1%
Treated State $\times I(t \geq Q_2)$ / Mean	-8.8%	-9.1%	-11.5%	-8.2%	-9.3%	-8.6%

**Table 5. Effect of Amazon Tax on Large Amazon Expenditures**

This table explores the effect of the Amazon Tax on large Amazon expenditures. The unit of observation is the household month and the dependent variable is the sum of monthly Amazon transactions per household that are at least \$250. Columns (1) through (3) evaluate tax-exclusive expenditures, while Columns (4) through (6) evaluate tax-inclusive expenditures. Treated State is a dummy variable for the states that implemented the Amazon tax.  $I(t \geq Q)$  is a dummy variable for all months after tax implementation.  $I(t = Q_{-1})$ ,  $I(t = Q)$ ,  $I(t \geq Q_{+1})$  are dummy variables for the quarter(s) before, quarter after, and subsequent quarters following the tax implementation, respectively. All regressions are OLS regressions and include household and year-month fixed effects. Standard errors are clustered by state and time. Standard errors are reported in parentheses. \*\*\*, \*\*, and \* denote statistical significance at the 1%, 5%, and 10% levels, respectively.

Dependent variable:	Amazon spending $\geq$ \$250 (tax-exclusive)			Amazon spending $\geq$ \$250 (tax-inclusive)		
	(1)	(2)	(3)	(4)	(5)	(6)
Treated State $\times$ $I(t \geq Q)$	-1.81*** (0.33)			-0.87** (0.32)		
Treated State $\times$ $I(t = Q_{-1})$		0.60** (0.28)	0.73 (1.44)		0.55* (0.29)	0.97 (1.50)
Treated State $\times$ $I(t = Q)$		-1.68*** (0.39)	3.25*** (1.00)		-0.77* (0.39)	3.66*** (1.07)
Treated State $\times$ $I(t \geq Q_{+1})$		-1.61*** (0.32)	1.62 (1.06)		-0.67** (0.33)	1.81* (1.07)
Treated State $\times$ $I(t = Q_{-1}) \times$ Tax rate			-0.03 (0.20)			-0.07 (0.21)
Treated State $\times$ $I(t = Q) \times$ Tax rate			-0.68*** (0.15)			-0.61*** (0.15)
Treated State $\times$ $I(t \geq Q_{+1}) \times$ Tax rate			-0.45*** (0.14)			-0.35*** (0.14)
Household Fixed Effect	Yes	Yes	Yes	Yes	Yes	Yes
YYYYMM Fixed Effect	Yes	Yes	Yes	Yes	Yes	Yes
Obs	15,604,084	15,604,084	15,604,084	15,604,084	15,604,084	15,604,084
R <sup>2</sup>	10.6%	10.6%	10.6%	10.6%	10.6%	10.6%
Mean spending	\$14.05	\$14.05	\$14.05	\$14.07	\$14.07	\$14.07
Treated State $\times$ $I(t \geq Q_1)$ / Mean	-12.9%			-6.2%		
Treated State $\times$ $I(t = Q_{-1})$ / Mean		4.2%			3.9%	
Treated State $\times$ $I(t = Q_1)$ / Mean		-12.0%			-5.5%	
Treated State $\times$ $I(t \geq Q_2)$ / Mean		-11.4%			-4.8%	
Treated State $\times$ $I(t = Q_{-1}) \times$ Tax rate / Mean			-0.2%			-0.5%
Treated State $\times$ $I(t = Q_1) \times$ Tax rate / Mean			-4.9%			-4.4%
Treated State $\times$ $I(t \geq Q_2) \times$ Tax rate / Mean			-3.2%			-2.5%

**Table 6. Effect of Amazon Tax on Different Types of Households for Large Purchases**

This table explores the effect of the Amazon Tax on different types of households for large purchases. The unit of observation is the household month and the dependent variable is the tax-exclusive sum of monthly Amazon transactions per household that are at least \$250. Households are divided into 3 groups depending on their monthly income and total Amazon spending in 2011. If the transaction occurs after the tax law changes and the household resides in one of the nineteen affected states, we adjust the post-law transactions by the sales tax rate to create the tax exclusive amount. Treated State is a dummy variable for the states that implemented the Amazon tax.  $I(t = Q_{-1})$ ,  $I(t = Q)$ ,  $I(t \geq Q_{+1})$  are dummy variables for the quarter(s) before, quarter after, and subsequent quarters following the tax implementation, respectively. All regressions are OLS regressions and include household and year-month fixed effects. Standard errors are clustered by state and time. Standard errors are reported in parentheses. \*\*\*, \*\*, and \* denote statistical significance at the 1%, 5%, and 10% levels, respectively.

Dependent variable:	Amazon spending $\geq$ \$250					
	Income terciles			Amazon spending terciles		
	High	Mid	Low	High	Mid	Low
	(1)	(2)	(3)	(4)	(5)	(6)
Treated State $\times I(t = Q_{-1})$	0.67 (0.53)	0.41 (0.44)	0.31 (0.29)	0.89** (0.42)	0.36 (0.24)	0.30 (0.29)
Treated State $\times I(t = Q)$	-2.25*** (0.60)	-1.86*** (0.42)	-1.10*** (0.35)	-3.40*** (0.82)	-1.21*** (0.28)	-0.70*** (0.25)
Treated State $\times I(t \geq Q_{+1})$	-2.27*** (0.33)	-1.53*** (0.38)	-1.38*** (0.27)	-3.17*** (0.54)	-1.16*** (0.33)	-0.69** (0.29)
Household Fixed Effect	Yes	Yes	Yes	Yes	Yes	Yes
YYYYMM Fixed Effect	Yes	Yes	Yes	Yes	Yes	Yes
Obs	4,683,591	4,614,520	4,384,403	5,259,348	5,205,850	5,139,612
R <sup>2</sup>	0.002	0.001	0.001	0.002	0.001	0.001
Mean spending	\$18.72	\$12.00	\$9.02	\$26.40	\$9.34	\$6.03
Treated State $\times I(t = Q_{-1})$ / Mean	3.6%	3.4%	3.4%	3.4%	3.9%	5.0%
Treated State $\times I(t = Q_1)$ / Mean	-12.0%	-15.5%	-12.2%	-12.9%	-12.9%	-11.6%
Treated State $\times I(t \geq Q_2)$ / Mean	-12.1%	-12.8%	-15.3%	-12.0%	-12.4%	-11.5%

**Table 7. Substitution Effects from the Amazon Tax**

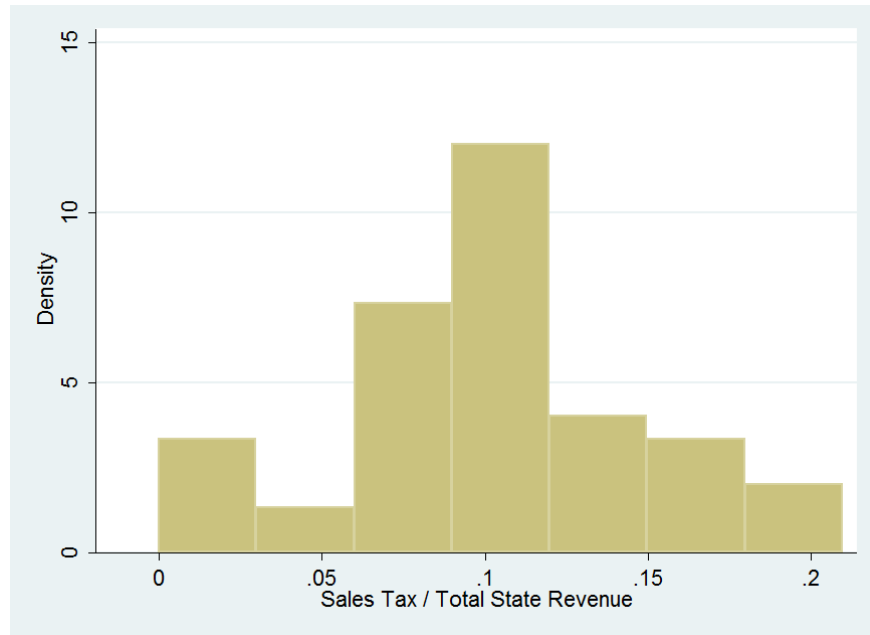
This table explores the effect of the Amazon Tax on the sales of Best Buy, Newegg and Amazon Marketplace. The unit of observation is the household month and the dependent variable is the tax-inclusive sum of monthly retail transactions for a given retailer. We include households that spent on Amazon during 2011. Treated State is a dummy variable for the states that implemented the Amazon tax.  $I(t \geq Q)$  is a dummy variable for all months after tax implementation.  $I(t = Q_{-1})$ ,  $I(t = Q)$ ,  $I(t \geq Q_{+1})$  are dummy variables for the quarter(s) before, quarter after, and subsequent quarters following the tax implementation, respectively. All regressions are OLS regressions and include household and year-month fixed effects. Standard errors are clustered by state and time. Standard errors are reported in parentheses. \*\*\*, \*\*, and \* denote statistical significance at the 1%, 5%, and 10% levels, respectively.

Dependent variable:	Best Buy		Newegg		Marketplace	
	(1)	(2)	(3)	(4)	(5)	(6)
Treated State $\times I(t \geq Q)$	0.73 (0.45)		0.24*** (0.03)		-0.30 (0.74)	
Treated State $\times I(t = Q_{-1})$		0.31 (0.50)		-0.041 -0.05		0.79 (0.48)
Treated State $\times I(t = Q)$		0.11 (0.48)		0.18*** (0.06)		-0.23 (0.84)
Treated State $\times I(t \geq Q_{+1})$		1.11** (0.46)		0.25*** (0.04)		0.02 (-0.80)
Household Fixed Effect	Yes	Yes	Yes	Yes	Yes	Yes
YYYYMM Fixed Effect	Yes	Yes	Yes	Yes	Yes	Yes
Obs	15,604,084	15,604,084	15,604,084	15,604,084	15,604,084	15,604,084
R <sup>2</sup>	10.6%	10.6%	12.1%	12.1%	27.0%	27.0%
Mean spending	\$15.52	\$15.52	\$2.14	\$2.14	\$36.97	\$36.97
Treated State $\times I(t \geq Q_1)$ / Mean	4.7%		11.3%		-0.8%	
Treated State $\times I(t = Q_{-1})$ / Mean		2.0%		-1.9%		2.1%
Treated State $\times I(t = Q_1)$ / Mean		0.7%		8.5%		-0.6%
Treated State $\times I(t \geq Q_2)$ / Mean		7.1%		11.5%		0.1%



### 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.



## Figure 2: Amazon Spending Before and After Taxation

This figure illustrates the trend of the regression coefficients of monthly Amazon spending in the +/-12-month window before and after implementation of Amazon tax laws. The regression specification used is  $Y_{h,t} = \beta_0 + \beta_1 \times \text{months before / after transition}_{h,t} \times \text{treated state}_h + \text{month fixed effects}_t + \text{household fixed effects}_h + \varepsilon_{h,t}$ , where the household month dummies that are more than a year before the transition are omitted. The dependent variable for the top graph is the sum of monthly Amazon transactions per household, and the dependent variable for the bottom graph is the sum of monthly Amazon transactions per household that are at least \$250. The dotted vertical line in the middle of the chart shows when the Amazon tax was implemented.

