Sales Tax Holidays: Evidence on Incidence

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Abstract

Sales Tax Holidays are temporary suspensions of tax rates applicable to certain types of goods. States frequently employ to realize a variety of objectives, including economic stimulus and arranging financial support to certain types of taxpayers. Critics of these policies often raise the concern that the intended benefits of these policies will be undermined if retailers respond to these policies with increases in pretax prices, but previous research has surprisingly found the opposite to be true and that retailers overshift the tax savings back to consumers. This paper investigates the tax incidence question using a dataset of high frequency scanner data on school supplies from 35,000 retailers across the US from 2006 to 2014. While the overshifting results of previous literature are replicated on a long panel covering 117 sales tax holidays, the richer data allows us to uncover seasonal shifts in the market around school start dates that likely biases the findings into this result. When we focus on cases where this seasonality does not occur the overshifting does not manifest, and pretax prices either increase or stay the same. Ultimately, we conclude that the concern of retailers capturing the tax holiday savings to be unsubstantiated by the data, and that the holidays' market weighted average effect on pretax prices is zero. However, we use complementary data that demonstrate tax holidays to be poorly targeted if judged by the intention of arranging transfers to low income households or households with children. These findings should be helpful to policymakers in weighing the policy's trade-offs.

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1. Introduction

Sales tax holidays are temporary suspensions of sales tax rates applicable to certain types of goods and services. They have become annual events for several American states since New York promoted a sales tax holiday in 1997.[1] In 2017, 13 states will host a sales tax holiday program that had iterations in previous years. Six of these states hold multiple tax holidays in the year that generally take a seasonal pattern by applying to clothing and school supplies in the fall and storm preparedness or energy star products in the late spring. The public commentary on the objectives of these policies includes a variety of rationales that include economic stimulus, marketing, and providing a subsidy to certain types of consumers. Their popularity is an interesting contrast to their apparent widespread condemnation from expert sources of public finance commentary in both academia and public think tanks.[2] Both the left-leaning Institute on Taxation and Economic Policy and right-leaning Tax Foundation regularly issue special reports criticizing these policies for violating various good tax principles. Writing in *State Tax Notes*, professors Hawkins and Mikesell (2001: 802) liken them to "a Soviet-style state-directed price reduction on items selected by the state."

Perhaps the most consistent concern of tax holiday critics is they represent a policy often motivated as a kind of welfare program whose resources may be captured by retailers. The reasoning of the concern is apparent from the classic supply and demand model whereby the abolition of a tax eliminates the wedge between consumer and producer prices, with the

[1] See Cole (2009) for a comprehensive history of the sales tax holiday. The Federation of Tax Administrators maintains an annual database of state sales tax holiday programs that indicate the coverage.
[2] Ross (2016) reviews public finance think tanks across different ideologies and documents uniform opposition to sales tax holidays, albeit with differing rationales.

consequence that the producer prices rise to match the consumer price. Henchman and Malm (2014: 10) are illustrative of this widely held belief:

> When lawmakers create sales tax holidays, the assumption is that the benefit will be passed on to consumers in the form of lower prices. In reality, retailers often absorb those benefits for themselves.

School sales tax holidays seem particularly sensitive to this concern because they seem to be especially motivated by an interest in arranging transfers to families with back-to-school expenses.

It is far from clear, however, that this relatively clean theory actually bears out in the data. There are two studies on sales tax holidays that address the question of incidence in state tax holidays, and interestingly both suggest that tax holidays actually result in lower rather than higher pretax prices.[3] The earliest evidence is reported in Harper et al. (2003) when the state sales tax holiday phenomena was just beginning. Their paper provides descriptive evidence by following a basket of ten goods over a three-week period surrounding the Florida sales tax holiday in 2001 at five large department stores in the Pensacola (FL) and Mobile (AL) Metropolitan Statistical Areas. These goods primarily consisted of clothing and apparel, and if the taxes had been waived prior to the sales tax holiday it would have resulted in $125 in savings. Based on pretax prices during the sales tax holiday, however, Harper et al. (2003) found only $100.06 in saved taxes on the same basket of goods under their posted prices. This was the result of the total pretax price of the basket rising by a little over one percent during the tax holiday in Florida. However, the same basket of goods in Mobile, where no tax holiday occurred, also increased in pretax price by about three percent, which was a larger increase than Pensecola

[3] There are many additional studies on the effect of tax holidays on other research questions. These topics include welfare effects (Phillips, 2016), household expenditures (Agrawal et al., Forthcoming; Mogab and Pisani, 2007), and state revenue loss (Cole, 2009).

under the holiday. While this study has the advantage of following the same products at the same retailers, it suffers from sample size, geographic coverage, and duration that prevents causal investigative techniques. Furthermore, following posted prices overlooks the myriad of ways in which retailers are capable of altering their prices, including membership discounts, coupons, in-store special sales, bundling, etc. For many goods, retailers can withhold these price discrimination strategies and raise effective prices without changing the posted price.

Arguably, the best evidence is found in Cole (2009), and as a result our research will contrast with it repeatedly. The Cole study employed weekly data on the number of retail sales of desktop and laptop computers in the 48 states over 30 weeks from May to December in 2007 during which nine sales tax holidays occurred. Cole's empirical strategy employs computer model, state, and week fixed effects in estimating the effect of the sales tax holiday on the average pretax price. The estimation results indicated that the average pretax price of a computer model decreased by 0.27 percent in response to an average tax rate cut of 4.76 percent during the holiday. While the effect was not statistically significant, Cole interprets the pretax price decrease to provide evidence that the sales tax is overshifted onto consumers.

While it seems unlikely that the relevant elasticities that would determine the economic incidence of a sales tax holiday would resemble the longer-run elasticities determining the market for the rest of the year, Cole's (2009) finding is nevertheless a surprising result that is consistent with the Harper et al. (2003) comparison between Pensacola and Mobile. One possibility is that the result in Cole (2009) is an artifact of the Great Recession, the timing of which coincided with the study. Another possibility is that the finding is limited to computers. A third possibility is that the finding reveals a widespread practice of retailers adopting simple mark-up rules that dictate retail price to be some fixed mark-up over a tax-inclusive wholesale

price. If retailers with mark-up rules behave as if consumers have the same price elasticity at all prices within the considered price range, then a tax decrease will result in a more than proportionate decrease in the consumer's price. One final possibility for the Cole (2009) finding is the aggregation of the data into statewide totals masks shifts in the composition of sellers across the periods. That is, if computer models are sold at different prices across retailers and sales tax holidays are correlated with consumer pattern shifts to the lower cost retailers, there would exist a negative bias in the point estimates of the effect of sales tax holidays on pretax prices.

This paper advances the previous literature by employing retail scanner data to further scrutinize sales tax holidays.[4] This is a long panel of weekly product data from about 35,000 participating retailers across the entire US on 2.6 million Universal Product Codes (UPC) for a wide range of product categories. This allows us to pick specific products and follow the retailers' tax-exclusive price throughout each year on a weekly basis from 2006 to 2014. Whereas Harper et al. (2006) were limited to following ten products at five stores in a pair of metropolitan areas and Cole (2009) was able to track total sales for computer models across the 48 states for 30 weeks in 2007, we can follow an array of 63 holiday eligible school supplies on a weekly basis across 48 states for nine years that includes 117 sales tax holidays. This allows us to overcome the aforementioned limitations. Ultimately, we are able to show that retailer school supplies similarly demonstrate Cole's (2009) main finding of retailers overshifting the tax savings through lower pretax price adjustments. However, the ability to disaggregate underlying trends among subgroups of retailers also reveals subsector divergences in sales and pricing

[4] Results in this article are based ondata from The Nielsen Company (US), LLC and marketing databases provided by the Kilts Center for Marketing Data Center at The University of Chicago Booth School of Business." Information about the data and access are available at http://research.chicagobooth.edu/nielsen/. .

trends. We show that subsectors without this problem demonstrate either no pretax price changes or an increase that would recapture some of the tax savings. We then explore a set of off-season school sales tax holidays in Tennessee in spring of 2007 and 2008. In this setting, we find overshifting is qualitatively eliminated and that consumers save just the amount of the tax waived by the holiday.

The next section provides more introduction to sales tax holidays and the Nielsen data. Section 3 provides wave of analysis of all school sales tax holidays before proceeding to the case of Tennessee in section 4. Section 5 summarizes the findings in a policy context, complements the findings with other data on relevant distributional considerations, and discusses the implications for public policy on issuing tax holidays. The paper concludes with a summary and discussion in section 6.

2. Nielsen Data and State Sales Tax Holidays

This paper employs the Nielsen Marketing Retail Scanner Data ("the Nielsen data") from 2006 to 2014. The Nielsen data consists of weekly purchase and pricing data from participating retail stores across all continental markets in the U.S. The data are weekly reports summarizing transactions occurring in retailers' point-of-sale systems registered when a product UPC code is scanned, capturing both the price and quantity. The UPC codes identify a specific product, e.g. "BIC Correction Fluid (0.7 OZ bottle)" or "Crayola Markers (10 Pack)", that are applicable to any store from which they can be sold.[5] About 35,000 retailers participate and cover a set of Nielsen-tracked product categories that includes food, non-food grocery, health and beauty aids,

[5] The description of the product at the UPC level in the Nielsen data does indicate the brand, size, packaging, and style information, but the labeling is still broad enough that these descriptions could apply to multiple specific products. The UPC code is product item specific, but the Nielsen name is not.

and selected general merchandise. The weekly (Sunday to Saturday) reports the total quantity sold by UPC code and the information required for a per unit price calculation that accommodates the various retailer options for packaging, bundling, promotional sales, and other discount pricing.[6] This is relatable to a database of store characteristics that includes information on the retailer, geographic identifier at the three-digit zip code level, and the type of distribution channel (grocery stores, drug stores, mass merchandisers, and convenience stores).

In using scanner data, the Nielsen reports offer the advantage of capturing the effective price paid by the consumer, which is the posted price less any of the variety of discounting strategies the retailer may have employed (couponing, sales, bundling, etc.). A disadvantage of this data is that we do not have price data on products that went unsold during the week, and consequently our product analysis is limited to high frequency items. We selected UPC codes with at least 200,000 weekly observations in 2014 and one million weekly observations over the entire 2006 to 2014 period. This criteria provides us over 175 million weekly observations, which is large enough that even a simple regression can take a day to complete on a high-throughput computing cluster.[7]

Table 1 summarizes school sales tax holidays in the U.S. from 2006 to 2014. While states use tax holidays more broadly than school supplies, those are less common, more varied, and generally less likely to be the types of products appearing in the Nielsen data. For example, in addition to the school sales tax holiday, Texas has an early spring holiday for hurricane and

[6] This is a limitation of the data as STH happening during a weekend will span over two different weeks. Previous studies have also faced this problem. Cole (2009) eliminated the smaller of the two weekends, which was perhaps clearer because computers represent a relatively big ticket item. These patterns are not as clear in our data of school supplies that spans over a longer period of time and over a broader range of items.

[7] This was using Stata 14's multicore processor version on a system comprised of 228 general-access compute nodes, where each node was equipped with two Intel Xeon E5-2650 v2 8-core processors containing 32 gigabytes of RAM.

disaster preparedness supplies, and an early summer tax holiday for energy star products and air conditioners. The hurricane and disaster supplies are not items that appear with enough frequency to construct long and wide panels of sales data, while energy store products are not in Nielsen participating retailer data. School supplies are the most commonly included product category among sales tax holidays, and they are the most frequently appearing types of products in the Nielsen data.

The Nielsen data does not indicate the sales taxes collected by the stores on the products. Generally, states define tax law and require stores report UPC codes if they use UPC codes in determining taxability, but cases of states listing taxable UPC codes are limited. Stores with guidance from the state interpret the legislation for both sales taxes and tax holidays to determine the status of a particular product. For the purposes of this research, we drew UPC codes from product modules that were included in "School Supplies" group of general merchandise. **Table 2** lists the module descriptions and associated codes. The 63 products identified by UPC codes are found in these twelve modules after applying the aforementioned frequency criteria that resulted in 175 million observations. Because retailers have discretion in applying the tax holiday exemptions, it is possible that we have drawn products that were not actually eligible for the school sales tax holidays. However, we think the selected product modules represent a conservative list that avoids such measurement error. If we were to use this list to produce an estimate of state tax revenue lost to the holiday, we would certainly produce an underestimate as we likely miss items that stores do include as part of the holiday.

3. Empirical Evidence from All States, 2006-2014

Estimation Strategy

The archetypical study on commodity tax incidence commodities specify the tax-exclusive price (p) received by the seller of a good to be some mark-up over marginal cost.[8] Because a retailer must collect the ad valorem sales tax of rate τ at the point of sale, the tax inclusive price of $p(1+\tau)$ determines the quantity demanded by their consumers. Consequently, the tax exclusive price can be specified as an unknown function of both cost and tax rate. A semilog specification provides a linear approximation of the unknown function to determine the pretax price of good i in store s in week w in the form of

$$(1)\ \ln(p_{isw}) = \gamma\tau_{isw} + \mu_i + \mu_s + \mu_{tx} + \mu_m + \mu_Y + \varepsilon_{isw},$$

where the use of a series of fixed effects in μ is intended to capture the cost structure. Specifically, month fixed effects (μ_m) capture seasonality, year fixed effects (μ_Y) capture annual events, while store (μ_s) and UPC (μ_i) fixed effects are intended to sweep away time-invariant cost and demand influences. Finally, this paper introduces the idea of a state-tax-regime fixed effect in (μ_{tx}), which is defined to be a unique identifier for each observed state-sales tax rate combination that appears in the data set. The potential value of a sales tax holiday rises directly with the state's general tax rate. This varies across states, and for some states this varies over time. Therefore, direct estimation of γ in (1) using only state fixed effects would result in τ offering variation from both sales tax holidays and general changes in the tax rate. Since the ultimate aim of the paper is to produce evidence only on the temporary tax cuts created by sales tax holidays, we introduce the state tax regime concept so that the only variation in τ occurs by

[8] Belsey and Rosen (1999) serve as an example of this motivated specification.

the holiday when it falls to zero. The other within variation in state sales tax rates will be swept away by the tax regime fixed effects.[9]

The within variation on the tax rate is negative as tax holidays cause rates to decline to zero. Retailers recapturing the tax savings through higher prices is evidenced by $\hat{\gamma}$ revealing a negative correlation. A percentage point decrease in the sales tax rate ($\Delta\tau$ = -0.01) on the tax holiday yields a $\hat{\gamma}$ percent change in pretax price, allowing for a direct interpretation on the share of shifting. If $\hat{\gamma} = -1$, for example, then the waiving of a sales tax rate of 4% would be matched with a 4% increase in pretax price and the retailers would recapture the entirety of the tax savings. Consumers receive the full tax savings or more when $\hat{\gamma} \geq 0$.

One potentially problematic issue with specification (1) is that monthly fixed effects might not adequately address the back-to-school season because of variation in the dates students return to school. Judging from the observed pattern of consumer purchases of school supplies, targeting the start of school is probably why annual tax holidays within states shift on a year-to-year basis. Even with these movements, year-by-year there is significant overlap in the adopted dates among states that use tax holidays for school supplies. In an effort to recenter the regression more closely with the return to school, for each state we attempt to identify with a "detrending" counter or a weekly dummy variable series of leads and lags towards the most common tax holiday dates, represented as θ_d in equation (2):

[9] Using **Table 1** to illustrate the tax regime fixed effects, Alabama represents only one single tax regime as it never changed the sales tax rates during the entire time. The same is true of the District of Columbia, Florida, Georgia, Louisiana, Illinois, Missouri, Tennessee, Texas, and Vermont. Arkansas represents two tax regimes, one for their six percent period (2011-2012) and one for their 6.5 percent phase (2013-2014). Other states with two tax regimes include Massachusetts, New Mexico, South Carolina, and Virginia. Only North Carolina has more than two tax regimes for this fixed effect specification.

(2) $\ln(p_{isw}) = \gamma\tau_{isw} + \mu_i + \mu_s + \mu_{tx} + \mu_m + \mu_Y + \theta_d + \varepsilon_{isw}$.

Including these detrending variables on top of the month-year fixed effects has a tendency to oversaturate the model to the point it cannot be estimated in all specifications. Nevertheless, we will present results that employ it as a first pass at a problem that we will show to be a significant lurking concern as a source of bias.

Data

Stores from all 48 continental states and the District of Columbia are reflected in our sample. We have 36,258 stores requiring fixed effects in addition to our 63 UPC fixed effects. About 37% of the stores are drug stores, 34% are mass merchandisers, 28% are grocery stores, and the rest Nielsen labels as "convenience" stores. **Table 3** provides some summary statistics on prices, quantities, and sales by different sample splits. School tax holidays waived an average tax rate of 5.4 percent (0.054) over the 117 events in our data.

Main Results for All School Sales Tax Holidays

Table 4 presents the results of estimating equations (1) and (2) against different counterfactuals.[10] All specifications report heteroskedastic standard errors clustered by state in parentheses and include fixed effects for UPC, store, state tax regime, month, and year. The coefficients report the effect of the state's sales tax rate falling to zero for the holiday on the pretax price per unit. The specifications in **Table 4** differ according to their counterfactual source of variation based on sample splitting and alternative indicators to adjust for differences in state school start dates. Specification (A) reports results for all states with no variables that would

[10] These results are generated with the estimator described in Correia (2016) using "reghdfe" in Stata Version 13.

center the groups across consistent school start dates, so variation arises from differences in the magnitude of the tax rate cut caused by the holiday, the timing of the holiday relative to school start date, and the existence of a sales tax holiday. Specification (B) includes the school start date counter and is intended to detrend the data relative to the start dates. In specifications (C) through (E) include only states that hold tax holidays at some point in the year, so their variation is generated from differences in the magnitude of the tax rate change, but only specification (C) adds additional variation arising from the timing of the holiday relative to school start dates by excluding those detrend variables. While these specifications will be useful for understanding robustness and the potential influence of choices in the counterfactual, the specification most relevant for understanding the policy implications of adopting a tax holiday is in specification (B).

The findings of **Table 4** indicate that pretax prices are directly correlated with the tax holiday changes in tax rates. For every percentage point decrease in the states sales tax rate caused by the holiday, the pretax price decreases by something in the range of 0.4 to 2 percent. These effects are statistically significant at conventional levels in all specifications. These findings are not consistent with the conventional expectation from partial equilibrium supply and demand models of tax incidence under perfect competition, but are similar to Cole's (2009) findings in computer models during 2007. Specification A and C in **Table 4** is the most comparable to the main findings of Cole (2009) in modeling. This suggests that Cole's finding was not an artifact of the 2007 Great Recession nor the choice of computers, as the same result manifests for an entire group of school supplies over the years 2006 to 2014.

It is also worth noting that the results found so far hold up to a battery of robustness checks that are not reported, but available upon request. For instance, reducing the time period

under study to a shorter range surrounding the sales tax holiday weeks (e.g. ten to six weeks) where most of the variation is observed produces almost identical magnitudes in effect size to **Table 4** with statistical power declining as the time band narrows. Another possibility is that results are driven by measurement error caused by unobserved local tax rates. States vary on whether it is mandatory for local governments with sales taxes to participate in the tax holiday, and Nielsen data does not provide geographic data that allows for matching to a particular local sales tax rate. However, if the sample is pared down to states with no-local sales taxes, the results are nearly identical to those reported in **Table 4**. This suggests that the findings are not driven by correlated measurement error related to missing local tax sales tax rates.

We turn attention now into structural shifts within the market around the back-to-school season. **Figure 1** illustrates per unit prices and volumes in this time period by different retailer types. This figure demonstrates that there is substantial seasonal market structure changes in both holiday and non-holiday states, likely owing to retailer changes in consumer demand patterns surrounding the endof summer and the return of fall schooling. For instance, drug stores and mass merchandisers have similar sales volumes prior to the holiday season, but only the drug stores demonstrate a visible decrease in per unit prices during the lead-up to the school start season. Grocery stores have similar prices to drug stores and similarly track their patterns in sales volume, while convenience stores contribute negligible volumes of sales and are visually unresponsive in price adjustments to the changing seasons.

Table 5 splits the sample for the model in specification (B) of **Table 4** into the different retailer types. This decomposition demonstrates that the positive correlation on sales tax rate hid heterogeneity in the responses across retailer types. In particular, mass merchandisers actually increased their pretax prices by 0.283 percent, an effect that was statistically significant at the ten

percent level. Convenience stores also increased their prices by 0.161 percent, but this is statistically insignificant in the substantially smaller group. It is grocery and drug stores that drive the positive point estimates, and notably these are the two retailer types **Figure 1** reveals to undertake very large seasonal changes. Since this seasonal adjustment occurs for drug and grocery stores in both holiday and non-holiday states, it is unlikely that the overall seasonal pattern is driven by the holiday itself. Rather, the point estimates indicate that drug and grocery stores seasonal price declines are larger on the order of 0.788 to 0.998 percent per percentage point waived by the tax holidays.[11]

Observing that the tax holiday effect is directly correlated with pretax prices only in the industries where there are large seasonal adjustments raises concerns about the success of the specification in netting out this large seasonal fluctuation. Policy makers might reasonably target tax holidays to be near the dates students return to school and parents wish to shop, which also coincides with when retailers would be running their own back-to-school sales and motivated the inclusion of controls for proximity to school start date.[12] Since states overwhelmingly allow school districts some flexibility in determining their own start-date, a statewide tax holiday might only serve as a focal point for narrowing the dispersion of dates over which retailers run their back-to-school specials for local consumers. A concern then raised by the results presented so far is that the specifications for drug and grocery stores do not adequately capture this seasonal adjustment, and we obtain reverse causality in the results because the low prices predict sales tax holidays.

[11] For example, consider a pack of pens retailing $2 pretax and taxed at 5% for a postax price of $2.10. During the seasonal Sales Tax Holidays, on average, the point estimates imply that consumers are spared the tax plus they receive an additional $0.10 off the pretax price to bring the pens to $1.90 per pack.

[12] Another gain from targeting the holiday in this way is that the holiday has the lowest revenue impact if it is set for days where retailer prices are lowest.

4. Case of Tennessee

If the underlying problem is an endogenous targeting of low prices via deliberate timing of sales tax holidays for back-to-school sales, then revealed cleaner set of results might be found in at tax holidays that are inclusive of these school supplies but which are not a part of the back-to-school season. An example of this is found in Tennessee, which added a spring sales tax holiday to its schedule in 2007 and 2008. Tennessee's first tax holiday on school supplies was held in fall of 2006. This makes Tennessee a somewhat late-adopter of tax holidays, and the popularity of the fall holiday along with robust tax collections made the legislature willing to try to return money to taxpayers with an additional spring tax holiday in 2007 and 2008. While obviously these could not be regarded as back-to-school tax holidays, the authorizing statutory language specified the same set of goods for the holiday and were inclusive of school supplies, and we can find examples of retailers advertising them in their marketing material.[13] Starting in 2009, Tennessee reverted to the more regular practice of a single end-of-summer or beginning-of-fall holiday. **Figure 2** illustrates that school supplies underwent no similar seasonal changes that differed across subsectors. Furthermore, the general price and sales trends surrounding the Tennessee tax holiday are similar for both Tennessee and all other states. Tennessee's 2007 and 2008 spring tax holidays offer the advantage of stripping away the seasonal variation, while admittedly only offering a case study that may be of limited external validity.

Table 6 presents the regression results by retailer type for the Tennessee case. To avoid the inclusion of other school tax holidays, we limit the sample to only the first half of the calendar years in 2007 and 2008. The evidence is consistent with increasing pretax prices in

[13] The authorizing language can be found in Tennessee state legislative summaries Public Chapters 1019 (June 27, 2006), 600 (June 27, 2007), and 617 (March 11, 2008).

response to the tax holiday for convenience, drug, and grocery stores, albeit the effect for drug stores is extremely small and statistically insignificant. For convenience stores, the tax holiday induced pretax price increases by 0.636 percent per point of sales tax reduction.[14] Mass merchandisers break the trend with a positive and statistically significant finding, but it is qualitatively a zero response. This is in contrast to the behavior of Mass merchandisers in the full sample results of **Table 5**, where they increased pretax prices in response to holiday by 0.3 percent. To facilitate the contrasting of the results of the full sample in **Table 5** and the Tennessee case in **Table 6**, **Figure 3** plots the 90 percent confidence intervals for the sales tax rate coefficient. The precision on the point estimates for Tennessee is quite high, so even where statistically different zero it is difficult to conclude that the price is qualitatively different, with convenience stores being the exception. Furthermore, where the estimate is not statistically different from zero it is a precisely estimated zero.

5. Discussion of Findings and Public Policy

The results when studying all state tax holidays from 2006 to 2014 yielded mixed evidence on retailer behavior. In particular, the point estimates indicate that grocery and drug stores lowered the price by the full amount of the tax plus an extra 80 to 100 percent, whereas mass merchandisers and convenience stores raised their prices to capture 28.3 and 16.1 percent, respectively. While we have already laid out our concerns about seasonality bias driving the overshifting result, it is worth contextualizing these behavioral responses according to their market shares. Using the Nielsen data to apportion the market shares during the sales tax holiday periods by retailer type, we can produce a sales-weighted estimate of shifting, the results of

[14] Since the waived tax rate in Tennessee was 7 percent, this implies a 4.45% increase in pretax prices.

which are reported in **Table 7**. For the states issuing tax holidays during 2006 to 2014, the market weighted average pretax price shift implies retailers returned the full tax savings plus an extra 10.6%.

The same analysis can be applied to the Tennessee case, where seasonality was unlikely to similarly impact the results. These produced precise estimates that were favorable to the hypothesis that retailers recapture the taxes with higher prices, but qualitatively they indicated zero shifting in all store types except convenience stores, where the retailers captured 63% of the tax savings through higher prices. However, convenience stores are trivial in their market share, and so the market weighted average pretax price shift parameter is -0.01, implying consumers receive 99% of the tax savings. The summary take away from our findings is that, in the bulk of the marketplace, the bounty of the evidence suggests consumers gain all of the revenue lost to the state during the back-to-school tax holidays.

To the extent that the purpose of the holiday is to transfer public revenues to shoppers of in-state stores, our results suggest this is a largely successful strategy because retailer prices remain constant. If the policy's purpose is to transfer funds from the government to households with children around the time schooling resumes, these households would similarly benefit from the absence of retailer price adjustments. However, a comparable policy more targeted to this aim might be to simply mail checks to these households. The Nielsen database includes a complementary dataset on households' daily expenditures that allows us to extract some distributional statistics. In the dataset of over 150,000 households during the 2006 to 2014 period of study, about 15,350 of them made purchases of school supplies in states on tax holidays, with

the average household saving about $0.77.[15] These households collectively saved about $11,828 during the tax holidays, and Nielsen's sampling weights estimate that this implies $26.8 million for the represented population. **Figure 4** illustrates the distribution of tax holiday savings based on whether or not children are present in the household.[16] Over half (57 percent) of the households reaping savings from the tax holiday contained no children. While households with children roughly outspent childless households at a 5 to 3 rate on average, nevertheless about 32 percent ($8.6 million) of the states' revenue losses went to childless households. A targeted transfer program therefore would have substantively larger state savings or considerable household impact with the same revenue cost.

Another potentially appealing prospect of the sales tax holiday may be that it is a temporary suspension of a tax perceived to be regressive. A similarly comparable policy would be one that is a means tested cash transfer. The Nielsen data groups households into bins, and Panel A of **Figure 5** reports the mean amount of tax holiday savings among the participants by income bin and plots them along the bin's midpoint. This panel demonstrates that tax holiday savings climb continuously with income, albeit at a diminishing rate. Panel B similarly plots the savings by tax holiday participants per $10,000 of income and demonstrates that the policy appears progressive because the proportional savings decline with income. Calculating directly from the data, just 10% of the states' holiday revenue losses went to households under $20,000, and 50% of the revenue losses are attributable to households earning more than $50,000.[17] It is

[15] This is referring to all scanned products in the "School Supplies" product module, not just the 63 employed in the regression analysis.
[16] "Children" here is defined as persons aged 17 and under in the household at the time of the survey.
[17] As justification for these thresholds, the 2017 Federal Poverty Level (FPL) for a three-person household is $20,160, and the Affordable Care Act provides marketplace subsidies to these households up to $50,400, or 250% of the FPL.

therefore fair to conclude the policy is consequentially progressive in distribution, but it is not a well-targeted system per dollar of state revenue cost.[18]

While this paper has investigated distributional effects of tax holidays, it is not the only goal by which this policy can be judged (see Phillips, 2016). Increasing economic activity and encouraging expenditures on the item, for instance, may be a policy goal and the previous literature contains supporting evidence. Agrawal et al. (Forthcoming) employs two data sets, the Household Diary portion of the Consumer Expenditure Survey from 1997 to 2011 and proprietary data from a credit card company in 2003, to estimate the effect of sales tax holidays on daily household expenditures. They generally find evidence that expenditures increase in each data set. A similarly interested study by Mogab and Pisani (2007) conducts a survey of 710 mall shoppers in Texas during a 2004 sales tax holiday, and finds that the holiday increased self-reported planned expenditures. As a determinant for why these shoppers were at the mall, the tax holiday was most important to consumers with household incomes between $10,000 and $40,000. These conclusions cumulative indicate some trade-off to policy makers between stimulating expenditures and distributional equity among housholds.

6. Conclusion

This paper advances the literature on the consumer incidence of state sales tax holidays by exploiting the richness of the Nielsen retail scanner dataset for school supplies from 2006 to 2014. In contrast to concerns that retailers will capture tax savings through higher prices, previous research in this topic found retailers to respond to these holidays by overshifting the tax savings to consumers by lowering the pretax price of the goods sold. This finding is replicated

[18] Unfortunately, the occupational codes for households in the database do not sufficiently identify teachers or other education professionals that might be purchasing their own classroom supplies on tax holidays.

with a more expansive panel of the 48 states over nine years that includes 117 sales tax holidays, ruling out concerns that those findings were artifacts of their times and locations. However, the richness of the data allows us to further scrutinize the context of these events, particularly with respect to the endogenous timing of the sales tax holidays, whereby seasonal market changes coincide with price declines among certain retailers. We demonstrate that overshifting is not present in subgroups of retailers that do not undertake these changes. Furthermore, we study an unusual case where the same goods were eligible for a spring tax holiday in Tennessee. In this case, we produce estimates of zero pretax price changes with high levels of precision in retailers that represent over 99 percent of the sales volume. While we conclude that the best available evidence does not substantiate the concern that retailers will capture the tax savings through higher prices, we complement our regression analysis with a household dataset that highlights distributional issues that are problematic if judging the policy as a welfare program; almost 60% of the tax holiday participants have no children, and over half of the lost revenues went to households with annual income over $50,000.

While the richness of the data allowed for improvement on the previous research, there remain limitations that future work might address. First, the geographic identifiers on the retail stores did not allow us to tie in local sales tax rates. A robustness check that examined only states without local sales tax rates produced similar results to those presented here, but rectifying this potential source of measurement error would be reassuring. Second, the dataset only records the prices of items sold, which forces us to follow items with high levels of within group frequency. A "posted" price approach could expand the number of items studied, albeit stores employ a variety of price discrimination tactics so that consumers may pay different effective prices, so it would be both challenging and fruitful as an investigation. Third, and perhaps most importantly,

is a research design that could further disentangle potential endogeneity in the timing of the back-to-school season. Pursuing out-of-season tax holidays offered a set occurring in just one state, but another research design may be discovered that could add states or permit the study of multiple cases. Finally, exploring the behavior of different producers and retailers could inform policymakers of the best channels to use holiday-style transfers to specific consumer groups. This paper was the first of its kind to explore this form of heterogeneity, and a deeper theory driven investigation may be informative to policy makers.

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Table 1: Tax Rate Waived in States Implementing Back-to-School Sales Tax Holidays

	2006	2007	2008	2009	2010	2011	2012	2013	2014
ALABAMA	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
ARKANSAS	X	X	X	X	X	6.0	6.0	6.5	6.5
DISTRICT OF COLUMBIA	5.75	5.75	5.75	X	X	X	X	X	X
FLORIDA	6.0	6.0	X	X	6.0	6.0	6.0	6.0	6.0
GEORGIA	4.0	4.0	4.0	4.0	X	X	4.0	4.0	4.0
ILLINOIS	X	X	X	X	6.25	X	X	X	X
LOUISIANA*	X	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0
MASSACHUSSETS*	5.0	5.0	5.0	X	6.25	6.25	6.25	6.25	6.25
MISSOURI	4.225	4.225	4.225	4.225	4.225	4.225	4.225	4.225	4.225
NEW MEXICO	5.0	5.0	5.0	5.0	5.125	5.125	5.125	5.125	5.125
NORTH CAROLINA	4.5	4.25	4.25	4.25	5.75	4.75	4.75	X	X
SOUTH CAROLINA	5.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0
TENNESSEE	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0
TEXAS	6.25	6.25	6.25	6.25	6.25	6.25	6.25	6.25	6.25
VERMONT*	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0
VIRGINIA	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.3	4.3

X' indicates the state did not hold a sales tax holiday in that year.

* Massachusetts, Louisiana and Vermont held Sales Tax Holidays of Tangible Property Products which included school supplies.

Table 2: Nielsen Product Modules Containing UPCs Categorized as "School Supplies"

Product Module Code	Product Module Description
7630	School and office paper forms
7631	Report covers and sheet protectors
7632	Correction fluid and erasers
7633	Personal planners binders and folders
7634	Dividers, tabs, labels, and tags
7635	School and office storage and dispenser
7636	Home school and office combinations
7646	Adhesive note pads
7652	Crayons
7653	Pencils - colored
7659	Markers
7660	Pens & pencils

All items come are found in General Merchandise department files of the Nielsen data.

Table 3: Selected Statistics on Market Composition by Sample

Sample	N	Unit Price (USD)		Quantity		Report Size (USD)	
		Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.
Total	175,089,295	2.43	1.43	81	504.9	6.49	16.36
STH States & Years	52,499,327	2.32	1.37	72	430.0	5.84	14.12
Non-STH States & Years	122,589,968	2.47	1.45	85	533.7	6.76	17.22
Tennessee	4,512,999	2.23	1.34	64	392.0	5.28	11.84
Convenience Stores	159,600	3.46	0.63	29	39.2	4.91	2.74
Drugstores	85,631,219	2.55	1.53	55	153.9	5.15	6.48
Groceries Stores	39,933,834	2.52	1.32	52	259.3	5.21	8.96
Mass Merchandisers	49,364,642	2.13	1.30	149	895.6	9.84	28.22

Note: N stands for the number of weekly reports in the Nielsen database. Q counts for the volume in units of the containing package.

Table 4: Regression Results For Tax Holiday Price Effects, 2006-2014

	Dependent Variable: ln(Pre-Tax Price Per Unit)				
	All States		Only States with Tax Holidays		
Control Variables	**(A)**	**(B)**	**(C)**	**(D)**	**(E)**
Sales Tax Rate	0.400*	0.589**	0.400*	0.400*	2.044***
	(0.224)	(0.224)	(0.253)	(0.253)	(0.415)
School Start Detrend		Y		Y	
School Start Dummy Detrend					Y
R^2	0.664	0.661	0.672	0.672	0.673
N (Millions)	175.1	182.7	52.8	52.5	52.8
Number of Clusters	49	49	16	16	16

Notes: All specifications include UPC, retailer, state tax regime, month, and year fixed effects. Statistical significance reported at the 1 percent (***), 5 percent (**), and 10 percent (*) level. Heteroskedastic robust standard errors clustered by state reported in parentheses.

Table 5: Regression Results for Tax Holiday Price Effects by Retailer Type, 2006-2014

Dependent Variable: ln(Pre-Tax Price Per Unit)

Control Variables	Convenience Stores	Drug Stores	Grocery Stores	Mass Merchandisers
Sales Tax Rate	-0.161	0.788***	0.998***	-0.283*
	(0.115)	(0.240)	(0.394)	(0.156)
School Start Detrend	Y	Y	Y	Y
R^2	0.35	0.63	0.69	0.826
N (Millions)	0.16	85.6	39.9	49.4
Number of Clusters	45	49	49	49

Notes: All specifications include UPC, retailer, state tax regime, month, and year fixed effects. Statistical significance reported at the 1 percent (***), 5 percent (**), and 10 percent (*) level. Heteroskedastic robust standard errors clustered by state reported in parentheses.

Table 6: Regression Results for 8 Weeks Surrounding TN Spring Tax Holiday, 2007 and 2008

Dependent Variable: ln(Pre-Tax Price Per Unit)

Control Variables	Convenience Stores	Drug Stores	Grocery Stores	Mass Merchandisers
Sales Tax Rate	-0.6360***	-0.01490	-0.1360**	0.0704***
	(0.1860)	(0.0212)	(0.0598)	(0.0097)
School Start Detrend	Y	Y	Y	Y
R^2	0.384	0.764	0.762	0.923
N (Thousands)	5.439	8023.4	3931.1	5162.2
Number of Clusters	42	49	49	49

Notes: All specifications include UPC, retailer, state tax regime, month, and year fixed effects. Statistical significance reported at the 1 percent (***), 5 percent (**), and 10 percent (*) level. Heteroskedastic robust standard errors clustered by state reported in parentheses.

Table 7: Market Weighted Estimates of Tax Shifting

	All Tax Holiday States, 2006-2014		Tennessee, 2007 & 2008	
	Market Share	**Shift Parameter**	**Market Share**	**Shift Parameter**
Convenience	0.00	-0.161	0.13%	-0.636
Drugstores	0.26	0.788	46.58%	-0.0149
Groceries	0.09	0.998	19.45%	-0.136
Mass	0.65	-0.283	33.84%	0.0704
Market Weighted Mean Shifting		0.106		-0.010

Shift parameters by store type are the sales tax rate elasticities from **Tables 5 and 6**.

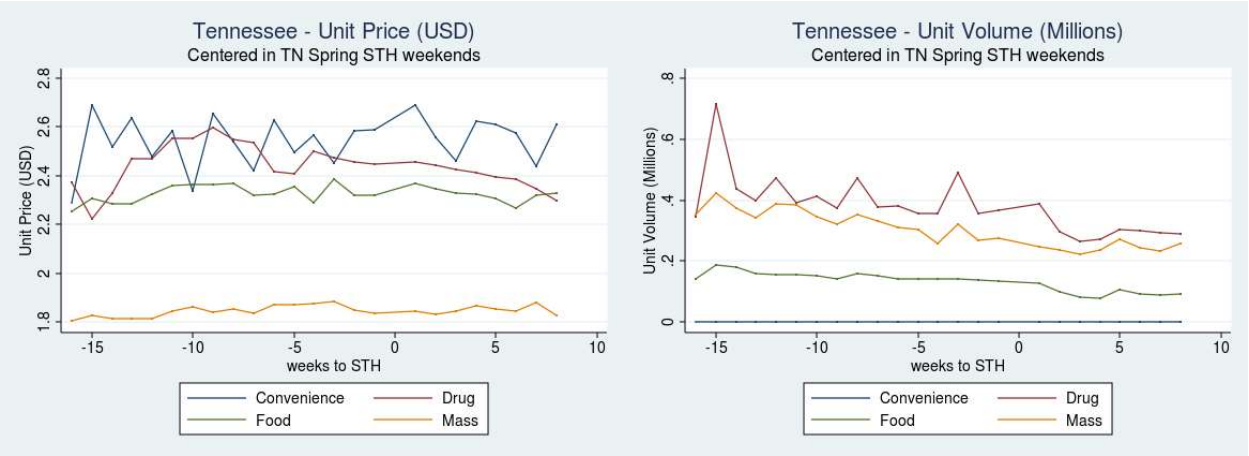
Figure 1: Mean Per Unit Price and Total Quantity Sold for School Supplies, 2006 to 2014

Panel A: States with Sales Tax Holidays

Panel B: States without Sales Tax Holidays

Figure 2: Mean Per Unit Price and Total Quantity Sold for School Supplies, 2007 & 2008

January 1 to June 30 in Tennessee



January 1 to June 30 in All Other States

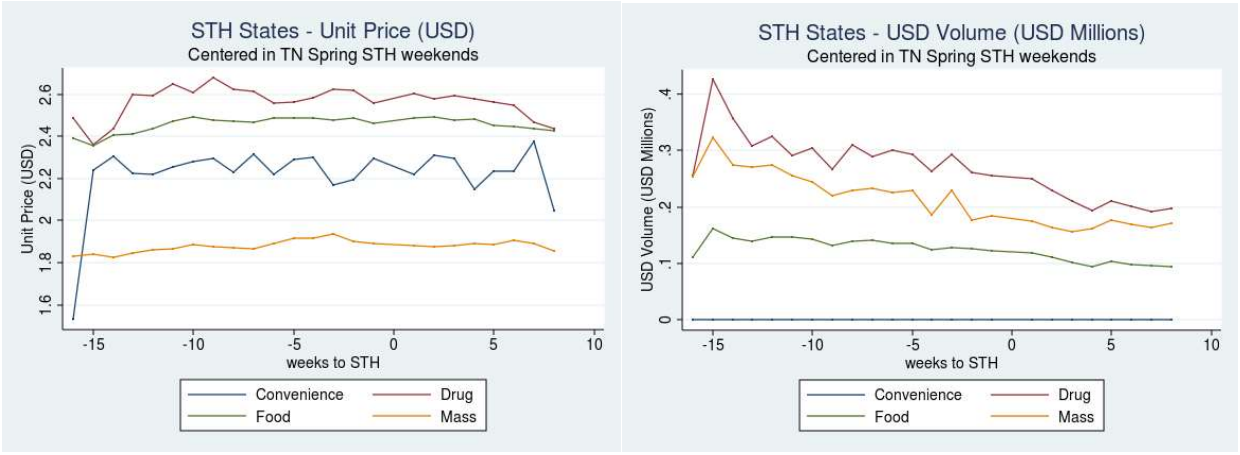
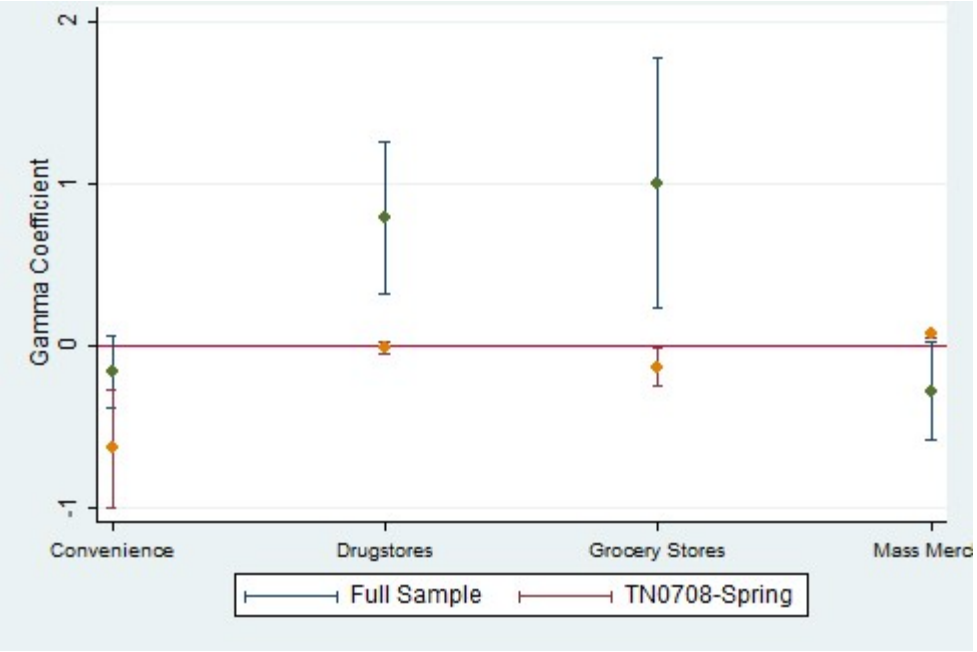
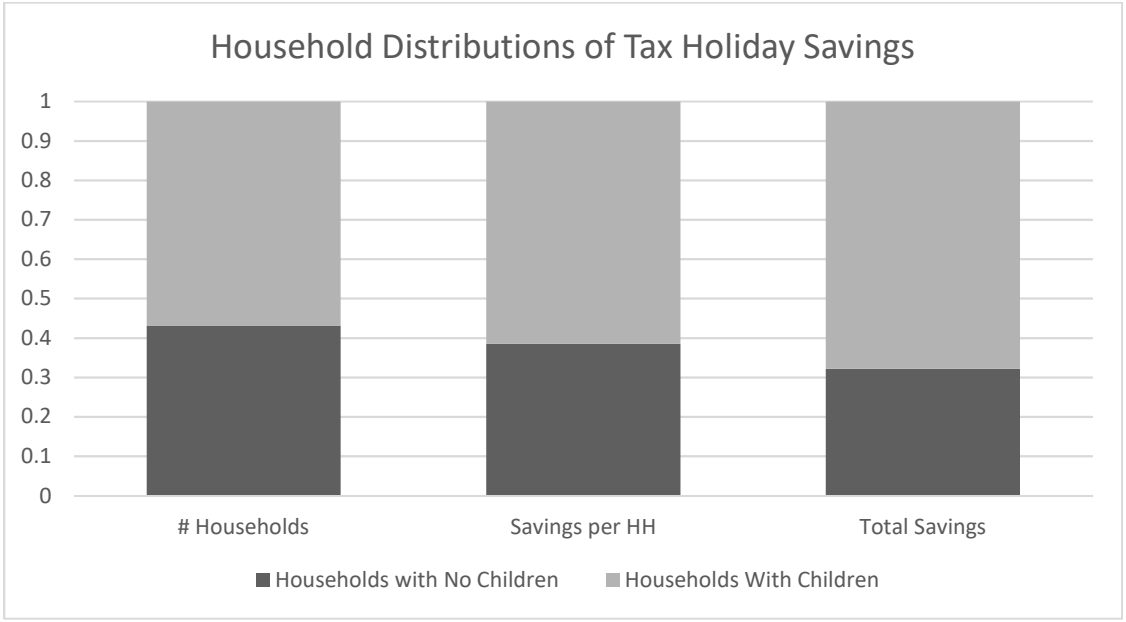


Figure 3: Point Estimates and Confidence Intervals for Sales Tax Rate by Channel



Notes: Point estimates and standard errors reported in Tables 5 (Full Sample) and 6 (Tennessee 2007-2008).

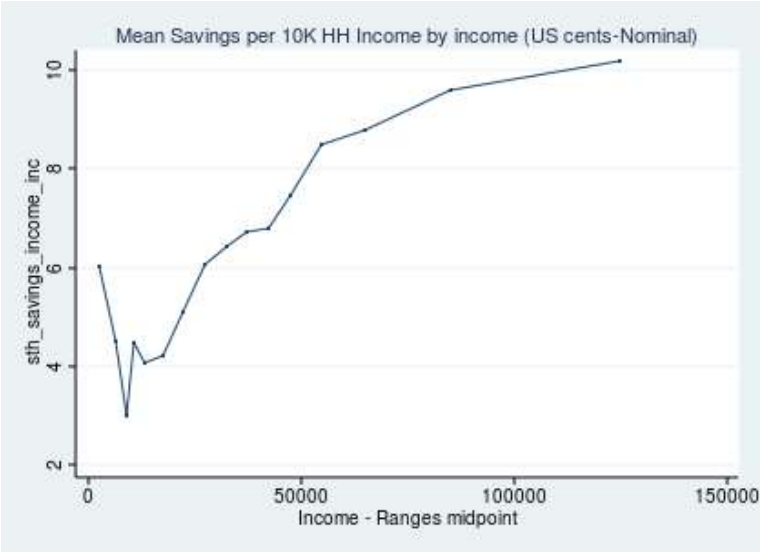
Figure 4: Child Presence Among Households Participating in Tax Holiday, 2006-2014



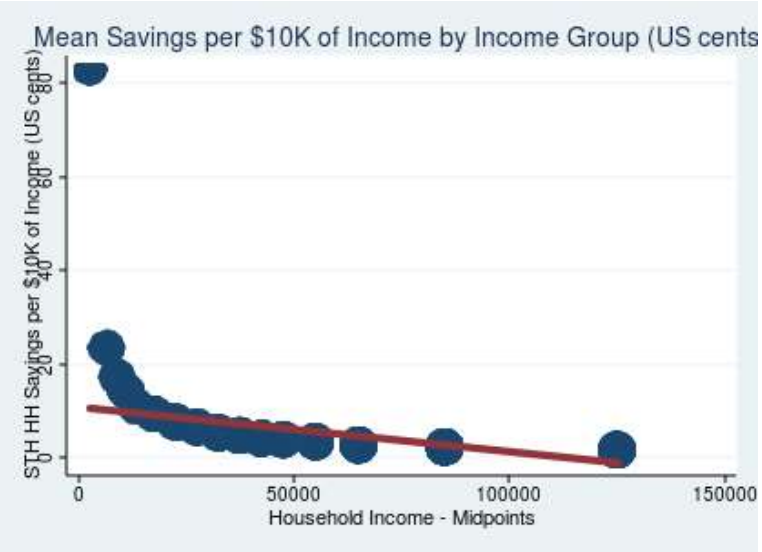
Notes: Calculated from Nielsen household survey using representative sample weights.

Figure 5: Tax Holiday Savings by Household Income Profiles, 2006-2014

Panel A



Panel B



Notes: Calculated from Nielsen household survey using representative sample weights.