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Consumption Responses to Temporary Tax Incentives: Evidence from State Sales Tax Holidays†

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States offer sales tax holidays (STHs) temporarily exempting items like clothes, shoes, and school supplies from the state sales tax. Spending response to these temporary tax changes are investigated using two datasets: the Diary portion of the Consumer Expenditure Survey and a unique dataset of credit card transactions. Results based on a difference-in-differences methodology show that there are substantial increases in spending on covered goods during these holidays that are not offset by declines in spending before or after the holidays. (*JEL* D12, H25, H31, H71)

National and subnational governments frequently alter tax rates or provide bonuses or rebates in order to stimulate overall consumption, the consumption of particular items, or share government windfalls. For example, the 2009 US Car Allowance Rebate System, "cash for clunkers," program subsidized the trade-in of older vehicles for more efficient newer ones in hopes of stimulating economic activity through increased auto sales (Mian and Sufi 2012). George Bush provided tax rebates in 2008 to stimulate consumption in light of a sluggish economy (Shapiro and Slemrod 2009, Parker et al. 2013). The Singapore government shared the proceeds from the nation's economic growth in 2010 through one-time payouts of growth dividends to all adult Singaporeans (Agarwal and Qian 2014). A broad economics literature has looked at the consumption response to these and other government programs like: Social Security checks (Stephens 2003), food stamp receipts (Shapiro 2005), and the Alaska Permanent fund (Hsieh 2003). We add to this discussion by investigating the consumption response to sales tax holidays (STHs). Many US states seek to increase and support the consumption of back-to-school items through the use of STHs, which temporarily exempt particular items, usually apparel and school supplies, from the state level sales tax. For instance, in 2012, 18 states offered STHs impacting over 120 million consumers.

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In this paper we use two complementary datasets—the Consumer Expenditure Survey (CEX) Diary and credit card transactions, to analyze how consumer spending responds to STHs. The CEX includes 15 years of data and has detailed demographic information and consumption measures, but only follows households over two-week periods and is limited to self-reported spending. The credit card transaction data takes the form of monthly billing statements, allowing us to directly observe purchases absent measurement error, but is limited to one year of data from a single credit card issuer. While the two datasets have their own strengths and weaknesses, having access to both provides us with a robust setting to explore how households respond to STHs.

Using both datasets, we test whether spending on goods temporarily exempt from taxes during the STH increases during, before, and after the STH period by comparing consumption in states with STHs to consumption in other states on the same dates. Previewing the results, we find consumer spending increases during STHs to be statistically significant, economically meaningful, and concentrated in the categories that are tax exempt. For example, we find a $2.22 increase in overall daily spending on apparel in states with an apparel STH relative to spending on the same date in states without a STH, representing an increase in spending of 41 percent, relative to typical daily spending. Similarly, we find an increase in credit card spending at apparel merchants of $0.77 or 56 percent on apparel sales tax holiday dates. Further, we find that consumers do not offset this increased spending by reducing consumption in the periods before or after the STH. In fact, we find that spending changes before and after the STH are frequently positive, but primarily statistically insignificant.

The pattern of positive coefficients in the periods during, before, and after STHs raises concerns that we are picking up seasonal demand patterns. In particular, we worry that STHs are deliberately placed during periods of state-specific peak seasonal demand. If this is the case, our estimated effects will conflate the correlation between seasonal demand and spending and the effects of the STH itself. To confirm that seasonal demand patterns are not driving our results, we develop two alternative control groups using the credit card data. If there are seasonal demand peaks, then our baseline control group that uses consumers in all other states is not the right one. Shoppers in a sales tax holiday state should be compared with shoppers in other locations on the same date who are subject to the same demand patterns. We compare consumers in sales tax holiday states to others living in zip codes with the same average October temperature, and to others in states that start school in the same general time frame. Our results are unchanged with these alternative control groups.[1] These results give us confidence that we are picking up the causal effect of the STH on consumer spending.

Our paper contributes to several strands of a diverse literature. Our work directly contributes to the small body of work that evaluates the effects of the STH. Cole (2009b) analyzes the fiscal impact of these tax holidays and finds that there is about a 4 percent reduction in states' sales and use tax collection in the months with an STH.

[1] As an additional robustness check, we run a counterfactual analysis using the Diary data. This is detailed in the online Appendix (section 3).

His evidence is consistent with households shifting consumption within a month to take advantage of the STH, but he finds no evidence that households consume less in the months before and after the STH. Cole (2009a) studies consumption responses to sales tax holidays on computers and finds large increases in computer purchases during holidays.

We also contribute to the vast literature that studies consumption responses to various fiscal stimulus programs. Some recent studies include Shapiro and Slemrod (1995, 2002, 2003, 2009); Souleles (1999, 2000, 2002); Parker (1999); Browning and Collado (2001); Hsieh (2003); Stephens (2003, 2008); Johnson, Parker, and Souleles (2006); Agarwal, Liu, and Souleles (2007); Bertrand and Morse (2009); Stephens and Unayama (2011); Mian and Sufi (2012); Parker et al. (2013); Gelman et. al. (2014, 2015); Agarwal, Koo, and Qian (2016); and Agarwal and Qian (2014, 2017). The literature finds mixed evidence: some studies find a consumption response that is essentially zero, while others conclude that liquidity constrained consumers respond positively to the fiscal stimulus programs. Our work is more directly related to the work by Agarwal, Liu, and Souleles (2007) on the 2001 tax rebates. They exploit the random timing of the 2001 tax rebates to identify the dynamic response of credit card payments, spending, and debt to the rebates. They find that consumers initially saved much of the rebates, on average, by increasing their credit card payments and thereby paying down debt. But spending did subsequently increase, offsetting the initial extra payments, so that eventually debt rose back near its original level. One challenge in this research area is to find methods that allow the creation of a counterfactual path of consumption. Our comparison across states with differing policies at a point in time offers a sensible means of generating this counterfactual.

Finally, we also contribute to the broad literature that exploits the program design features of various fiscal programs and studies the effectiveness of these programs. Aaronson, Agarwal, and French (2012); Agarwal et. al. (2017); and Agarwal et. al. (2015) study the changes in minimum wage polices, the Home Affordable Modification Program (HAMP) and Home Affordable Refinancing Program (HARP) programs respectively. They find positive consumption response to the changes in the minimum wage policies and higher spending on durables due to the HAMP and HARP policies.

The rest of the paper is organized as follows. The next section provides a brief background about the STH policies. Section II describes the data. Section III presents the estimation model and results. Section IV discusses the implications of the findings and concludes.

I. Background Information about Sales Taxes, the STH, and Policy Objectives of STH

Sales taxes are levied on almost every tangible good—the exceptions being a few necessity items such as food and prescription drugs—and a number of services. The tax applies at the retail level, is ad valorem, and is remitted by vendors. Sales taxes are levied by different levels of subnational government; 45 states have some type of state-level sales tax, with counties, cities, and other local governments levying additional sales taxes. In 2010, the average state-level sales tax was 5.6 percent and

the median was 6.0 percent, with a range of 2.9 percent in Colorado to 8.25 percent in California. Just under a quarter of state own-source revenues are derived from the general sales tax. Sales taxes affect the vast majority of Americans almost every day of the year.

Sales tax holidays are state policies that suspend the state sales tax on targeted retail goods for a set period of time. These holidays have grown in popularity over the last 20 years. In 2012, 18 states offered STHs impacting over 120 million people living in these states.

There are three stated objectives of STHs. First, STHs aim to save consumers money by lowering the purchase price of retail goods. In keeping with this, the dates for STHs are often chosen to coincide with periods of high demand by specific types of households that are deemed worthy of tax relief by policymakers. In particular, most STHs occur during the back-to-school shopping period in order to benefit families with children, specifically those who are lower income or liquidity constrained. In justifying Illinois's 2010 holiday, the lead sponsor said that for "[w]orking families with kids going back to school, we want to give them a break." (Associated Press 2010). Second, lowering sales tax rates helps retailers increase their sales. Third, by targeting specific items for tax exemption, the STH encourages consumption of specific goods that policymakers believe have inherent social benefits. In this study, we primarily test whether STHs increase the consumption of covered goods.[2]

Despite the growing popularity of the STH, little formal evaluation has been conducted to determine whether they actually accomplish policymakers' stated goals. There are a number of reasons why instituting an STH may be ineffective, or why doing so may be considered flawed public policy. First, while the sales tax is eliminated for a brief period of time, consumers would not see any benefit if retailers increased the pretax price of items; the degree by which after-tax prices are lowered depends on the incidence of taxation. Second, even if after-tax prices do drop, consumers may not purchase any more of the targeted item—the degree of change in consumer response depends on the elasticity of demand for the eligible items. Third, the transient nature of the STH may cause consumers to alter their consumption patterns across time leaving their total consumption of the targeted good unchanged. In this case, retailers may not benefit from the holiday. Fourth, because the STH is available to all consumers, unintended recipients, such as those without children or wealthy households, may also take advantage of the holiday. Wealthy individuals may better take advantage of the STH's than the intended low-income beneficiaries because the wealthy have greater access to credit and discretionary income that allows them to time consumption to respond to tax incentives. In particular, this may be too blunt a policy instrument for subsidizing the consumption of targeted groups. Fifth, there have been complaints of onerous compliance costs for retailers who are forced to participate in an STH.[3]

[2] As the article from the Smart Money website documents, "consumers can shave up to $48 off the average spending of $689 on kids in grade school and up to $63 on college-bound teens' average $907 tab." http://www.marketwatch.com/story/making-the-most-of-salestax-holidays-1343336950640.

[3] For further criticisms, see Hawkins and Mikesell (2001).

The first STH occurred in 1997 in New York and was enacted to help apparel retailers compete with their tax-free competitors in neighboring New Jersey. Lasting seven days, the holiday exempted general use clothing and footwear priced under $500 from the statewide 4 percent sales tax. Florida enacted the next STH in 1998 followed by Texas in 1999 (Cole 2008). By 2011, 23 states and the District of Columbia had instituted at least one STH. STHs are state-level policies, although in a number of cases, localities have also suspended their sales tax during the state holiday. The duration of the STH, the type of exempted items, the price ceiling below which these items could be purchased tax-free, and even the number of STHs offered each year are all parameters set by the state legislative bodies; in a given year, no two STHs have been identical.

II. Data

We use two complementary datasets to evaluate the consumption response to sales tax holidays. The first dataset contains micro data on daily household consumption from the Diary portion of the US Bureau of Labor Statistics' (BLS) Consumer Expenditure Survey (CEX). The second dataset is a proprietary dataset of transactions on credit cards issued by a large financial institution. As discussed by Gross and Souleles (2002), credit cards play an important role in consumer finances, so they can be quite useful for studying consumer behavior. About 20 percent of aggregate personal consumption is purchased using credit cards. Moreover, for most households, credit cards represent the leading source of unsecured credit and about two-thirds of households have at least one bankcard.[4] These two datasets hence allow for a complimentary and comprehensive analysis of the effects of STHs on consumer behavior.

A. *CEX Diary Survey*

The CEX Diary survey tracks the spending patterns of households for two weeks based on diaries that households use to track daily spending on detailed items. The Diary survey instrument covers all purchases and expenses, but asks for extensive detail on spending on home food consumption, footwear purchases, and clothing. The BLS Consumer Price Index relies on Diary data for the measurement of these items. From the Diary data, we know the calendar date of a given purchase, the type of item purchased, the state where the household resides, and the after-tax cost.[5] For apparel items, we also know the age group (over or under 15) and sex of the person for whom the item was purchased. The Diary data also include detailed household and person level socio-demographic data.

[4] Moreover, Japelli, Pischke, and Souleles (1998) found that people with bankcards were better able to smooth their consumption past income fluctuations than were people without bankcards.

[5] The state of residence is available in the public use micro data for most households. It is omitted or recoded for some households. We delete households whose state of residence we are not certain of from our entire analysis. The CEX collects pretax data and then uses a program to add sales taxes to the purchased items before releasing the micro data. The resulting micro data are after-tax. However, the CEX program does not account for STHs and so incorrectly adds taxes to exempt items purchased during STHs. We adjust the micro data by removing the state sales tax from eligible items purchased during STH before performing our analysis.

TABLE 1—SALES TAX HOLIDAYS IN 1997–2011 CEX DIARY SAMPLE

State	Days	Items included—max allowable cost	First year	Most recent
Connecticut	7	Clothing and footwear—$300	2001	2011
District of Columbia	9	Clothing and footwear—$100 School supplies—$100	2004	2009
	17	Clothing and footwear—$100	2004	2009
Florida	3	School supplies—$15 Books, clothing, and footwear—$75	1998	2011
Georgia	4	School supplies—$20 Clothing and footwear—$100 Computer—$1,500	2004	2009
		Energy and water efficient products—$1,500	2006	
Illinois	10	Clothing, footwear, and school supplies—$100	2010	2010
Louisiana	2	All tangible personal property—$2,500	2007	2011
	2	Hurricane preparedness items—$1,500	2008	2011
	3	Firearms, ammunition, and hunting supplies	2009	2011
Maryland	7	Clothing and footwear—$100	2010	2011
	3	Energy star products	2011	2011
Massachusetts	2	All tangible personal property—$2,500	2008	2011
New York	7	Clothing and footwear—$110	1997	2006
North Carolina	3	Clothing and footwear—$100 School supplies—$100 Instructional material—$300 Computers—$3,500 Other comp.—$250 Sports equipment—$50	2001	2011
	3	Energy star products	2009	2011
Pennsylvania	8	Personal computers and accessories	2000	2002
South Carolina	3	Clothing and footwear School supplies Computers Other	2000	2011
Tennessee	3	Clothing and footwear—$100 School supplies—$100 Computers—$1,500	2006	2011
Texas	3	Clothing, footwear, backpacks, and school supplies—$100	1999	2011
	3	Energy star products Air conditioners—$6,000; other—$2,000	2008	2011
Vermont	1	Personal purchase—$2,000	2008	2010
Virginia	7	Hurricane preparedness items—$60 Generators—$1,000	2008	2011
	3	Clothing and footwear—$100 School supplies—$20	2006	2011
	4	Energy star products—$2,500	2006	2011

Notes: This includes all holidays in our Diary sample. Holidays in states where the state code is suppressed in the Consumer Expenditure Survey are not included. The clothing category usually includes some clothing accessories such as belts and gloves.

Source: Cole (2008) and Federation of Tax Administrators (2011)

We merge the Diary data with information on STHs from 1997 (the year of the inaugural STH) to 2011 based on the calendar date covered and state of residence reported in the Diary. We obtain information on STH dates and parameters for 1997–2007 from Cole (2008) and for the years 2008–2011 from the Federation of Tax Administrators (2011). Data on the STHs in our dataset are in Table 1. The five most popular items that are exempt from sales tax during an STH are clothing,

shoes, clothing accessories, computers, and school supplies. The modal price ceilings up to which these items are exempt is $100 for clothing, shoes, and clothing accessories; $2,500 for computers; and $75 for school supplies. As stated earlier, the dates for STHs are chosen to coincide with periods of high seasonal demand, the most popular being back-to-school season.

Using the merged data, we measure spending on a given day by a household, and hence the unit of analysis is a "household-date." Our dataset tracks the daily purchasing decisions of over 65,000 households, with over 700,000 household-date observations. On a given date, some households live in states where there is a STH, while other households live in states where sales taxes remain unchanged. Conceptually, our identification strategy is to use consumption patterns among individuals living in states without a sales tax holiday on a given date as a control for consumption patterns among individuals living in states where there is a sales tax holiday. This comparison is valid if consumers in states with and without sales tax holidays would have had the same consumption patterns had the STH not occurred. In order to facilitate this comparison, we assume that individuals purchase items (and thus pay sales taxes) in the state where they live. To identify the effect of the STH, we separately tabulate spending for the relevant categories of expenditures for which states have enacted sales tax holidays. In particular, we investigate the consumption effects of sales tax holidays for apparel (which combines footwear and clothing), school supplies, and computers.[6]

Summary statistics from the merged Diary data are presented in Table 2. The table shows the daily means of total household expenditures for all items, all exempt items, and separately for each of the exempt items that we investigate (i.e., apparel, school supplies, computers). Apparel expenditures are further divided into the age and gender of the person for whom the items are purchased.[7] On an average day, households spend $135, of which $6.77 is spent on items that are traditionally tax-exempt during STHs. Apparel is the most popular exempt category, with households spending a daily average of $5.40. We also find that there is a great amount of variation in the daily expenditure data, and that the differences in average spending can be explained in part by the frequency in which households make any purchases. While households spend on average almost 19 times as much on nonexempt items as exempt items, they are only 6 times as likely to make a purchase on nonexempt items on any given day. In general, though, the amount that households spend on items that are exempt during STH account for a small share of their total expenditures.

Not only do STHs cover a small percentage of the items purchased on a typical day, but they only affect a small percentage of days each year. The bottom of Table 2 shows the frequency of STHs in our data. The average STH lasts 4.8 days, a fact highlighted by the frequency in which we observe STHs in our data: while our dataset consists of over 700,000 household-date observations, we have only 2,814 observations where we observe household expenditures during an STH. STHs that exempt apparel are the most popular, applying to 2,547 of our household-date

[6] We do not look at expenditures on clothing accessories. The clothing accessory items exempted during STHs are not consistent across states and are far more specific than the broad "accessories" category available in the CEX.

[7] Spending on clothing accessories is included in total expenditure but excluded from all other calculations.

TABLE 2—SUMMARY STATISTICS FROM CEX DIARY DATA (1997–2011, 2008 *dollars*)

	Mean	SD	Percent nonzero
Spending ($)			
All categories	135.1	692.6	70.5
All STH categories	6.77	48.3	9.93
Apparel—All	5.39	36.1	7.95
Women	2.51	23.0	4.26
Men	1.43	19.6	2.38
Children	1.23	12.6	2.83
School	0.70	15.0	2.16
Computers	0.69	27.3	0.49
Demographics			
Age	48.6	17.1	
Family size	2.55	1.50	
Male (percent)	49.7	50.0	
White (percent)	82.4	38.0	
Single parent (percent)	5.96	23.6	
Married, no children	21.3	41.0	
Married, young children	19.2	39.4	
Married, old children	7.23	25.9	
Income			
Income $<$ \$30k	34.1	47.4	
Income $\in$ [\$30k, \$70k)	36.9	48.2	
Income $\geq$ \$70k	31.6	46.5	
Observations			
Total	784,993		
During STH—All	2,814		
STH—Apparel	2,547		
STH—School	1,433		
STH—Computer	782		
Households	65,496		

Notes: Summary statistics represent the sample means, standard deviations, and number of observations for the main dependent and independent variables for the sample used in the empirical analysis. The variables age, male, and white refer to the head of the household.

observations. The combination of the small share of daily consumption devoted to tax-exempt items on STHs and the infrequent occurrence of STHs suggest that STHs have a relatively small window for influencing household consumption. Table 2 also shows summary statistics for the demographic variables we include as controls in our analysis of consumption patterns.

B. *Credit Card Transactions*

Our second dataset is based on unique proprietary information for part of 2003 from a large financial institution that issues credit cards nationally. The bulk of the data consists of the main billing information listed on each account's monthly statement, including payments and spending, balances, and debt, as well as the credit limit. The dataset is essentially the same one used by Agarwal, Liu, and Souleles (2007) but with one key difference. In addition to the aggregate monthly billing information, we have access to the individual transaction information listed on each account's monthly statement. Specifically, we know the exact date, amount, and

type of every transaction (e.g., $83 at Hyatt Hotel, $489 purchase at Best Buy, and $218 purchase from US Airways, etc.), of the cardholder over the sample period. We also know the Merchant Category Code (MCC) of each transaction. This code indicates the broad merchant type (e.g., household appliances, women's ready to wear, dentists) and allows us to separate cardholder purchases into categories that can help us measure the differential response to STHs. Appendix 1 discusses the MCC in greater detail. The sample covers over 75,000 consumers representing all states.

We aggregate the transactions for each account holder on a day to create daily spending. As a result, in our dataset, an observation is an "account-date." We only have an observation for a household if some type of transaction occurred on a given date. In the event that the household did not use their credit card on a particular date, it would not be included in the underlying dataset. This is problematic because we would like to include households even if they choose not to engage in any credit card spending on a date. One way the sales tax holiday may influence spending is by inducing households that would not have otherwise gone shopping to do so. In order to capture this effect, we expand the sample to include households on every day between when we first and last observed them in the sample. On these added days, the household has no spending. Rather than being transactions based, we now have a sample that includes all open accounts. The transaction sample had 1.6 million observations; the open account sample has 10.3 million observations. This indicates that on most days when the account is open, no transactions occur.

We categorize spending based on the type of merchant where the item was purchased using the MCC. We do not know which items were purchased in a transaction, and so create a series of spending categories based on the merchant categories. We measure total spending and create eleven spending subcategories that we think are particularly relevant for investigating sales tax holidays. In parallel with our treatment of the Diary data, we create an apparel category combining spending at clothing and shoe merchants. We further divide apparel into four categories based on the MCCs: women's clothing, men's clothing, kids clothing, and general/unspecified apparel. Unspecified apparel includes shoes because the MCCs do not separate shoe merchants by the demographic group served, and includes department store purchases because the majority of spending at department stores is on apparel (see Nordstrom 2001). Spending at non-apparel merchants is further divided into big box retailers, book and school supply merchants, computer stores, appliance stores, and other. Big box retailers include merchants that sell a wide range of products often including groceries.[8] We separate books and school supplies and computers because some of the sales tax holidays specifically target these items. We separate out appliance stores because many computers are purchased at broad electronics retailers (Goolsbee 2001). Other non-apparel is the largest category and measures spending on travel and transportation and at grocery stores, restaurants, gas stations, drug stores, and other merchants that are unlikely to have many temporarily sales tax exempt items.

[8] According to Target's 2011 annual report, 19 percent of their sales were in the apparel and accessories category. The largest category was household essentials with 25 percent. Wal-Mart's sales mix was 7 percent apparel in 2011. The largest category was grocery at 55 percent (Wal-Mart Stores, Inc. 2012).

TABLE 3—SALES TAX HOLIDAYS IN 2003

State	Dates	Description	State tax rate
Connecticut	8/17/2003–8/23/2003	Clothing and footwear priced $300 or less (normally no tax on clothing under $75)	6
Georgia	7/31/2003–8/3/2003	Clothing and footwear priced under $100, school supplies and children's books under $20, computers and computer accessories under $1,500	4
Iowa	8/1/2003–8/2/2003	Clothing and footwear priced $100 or less	5
New York	8/26/2003–9/1/2003	Clothing, footwear, and clothing repair items priced less than $110	4
North Carolina	8/1/2003–8/3/2003	Clothing, footwear, and school supplies priced $100 or less, sports equipment $50 or less, computers priced $3,500 or less	4.5
South Carolina	8/1/2003–8/3/2003	Clothing, footwear, school supplies, computers, and bedding and bath items	5
Texas	8/1/2003–8/3/2003	Clothing and footwear priced $100 or less	6.25
Vermont	8/9/2003–8/11/2003	Computers and associated accessories up to $4,000	5
West Virginia	8/1/2003–8/3/2003	Clothing, footwear, and school supplies, priced $100 or less. Computers and accessories less than $750	6

Source: Cole (2008)

In addition to information on transactions by merchant category, we also have account identifiers, credit limit variables, and limited measures of the socio-demographics of the account holder, including FICO score, age, income, zip code and state of residence, and a dummy for whether there is a co-applicant on the account. We begin using data for 2003 covering February 6–October 24, choosing this period because it includes the heart of our data series where we have at least 1,000 observations each day.

During our sample period, there were nine STHs. Details are in Table 3. We note that clothing and footwear is exempt in eight of the sales tax holidays, school supplies in four, computers in five, and some home furnishings in one. We also note that these sales tax holidays vary in duration from two days to one week, and that all occur during the back-to-school shopping season. The first begins on July 31 and the last ends on September 1, with the majority covering the weekend of Friday, August 1–Sunday, August 3.

In a similar fashion to the Diary data, we link this information on STHs to our data on spending by the state of residence of the account holder and the date when the transaction occurred. In Table 4, we display variable means for the credit card sample. The first two columns report calculations for the entire sample. The third and fourth columns report statistics for a sample restricted to May 1 to September 30. On an average day, an account holder spends about $18 on his credit card, but there exists substantial variation across observations. Most of the spending is in the "other" category of non-apparel spending. The average amount of apparel spending is $1.43, with the majority at merchants that do not serve a narrow demographic. An

TABLE 4—SUMMARY STATISTICS, CREDIT CARD SAMPLE

	Full sample		Back to school sample	
	Mean	SD	Mean	SD
Total spending	$17.74	131.66	$17.08	129.21
Apparel merchants	$1.43	24.52	$1.36	23.60
Women's clothing	$0.23	9.24	$0.22	9.25
Men's clothing	$0.05	5.16	$0.05	5.24
Kid's clothing	$0.06	3.56	$0.06	3.51
General/unspecified apparel	$1.10	21.37	$1.04	20.32
Non-apparel merchants	$16.31	128.93	$15.72	126.59
Big box	$1.15	17.84	$1.12	16.19
Books and school supplies	$0.27	9.80	$0.27	9.79
Computer	$0.20	17.33	$0.19	16.88
Appliances	$0.65	30.30	$0.64	29.72
Other	$14.04	124.26	$13.51	122.07
Age of account holder	46.33	14.66	46.32	14.68
Income (thousands)	$72.88	130.42	$72.47	128.86
FICO score	743.89	45.17	743.11	45.44
Co-applicant flag (percent)	0.35	0.48	0.34	0.48
Observations during STH	63,346		63,346	
Observations during clothing/shoe STH	63,004		63,004	
Observations during school supply STH	8,736		8,736	
Observations during computer STH	9,078		9,078	
Observations	10,313,722		7,076,604	
Observations with non-missing income	8,095,244		5,576,530	

Notes: Summary statistics represent the sample means, standard deviations, and number of observations for the main dependent and independent variables used in the empirical analysis. The full sample covers the time period from February 6–October 24, 2003. The back-to-school sample covers May 1–September 30, 2003. All dollar amounts are in 2008 dollars.

Source: Authors' tabulations from proprietary credit card data

additional $1.15 is spent at big box retailers and $0.65 at appliance stores. Spending in the remainder of the categories is below $0.50 on the average day. The average account holder in our sample is 46 years old, earns $73,000 per year and has a FICO score of 744 (sample median is 750). Just over a third of the sample has a co-applicant. These summary statistics underscore that our sample is relatively well-off. Average income is above average household income in the United States of $68,000 in 2003 (in 2008 dollars) and the median FICO in the sample is above the US median of 723. In the final rows of the table, we show the frequency of observations that occur during STHs in the state where the account holder lives. Only 0.6 percent of our observations occur when there is a sales tax holiday in the state where the household lives, which, due to our large sample size, equals over 60,000 observations.

It is important for our identification strategy that the consumers in states that have a STH are similar to those in states that do not. We confirm that the distribution of observables for consumers in STH states looks remarkably similar to consumers in non-STH states in both datasets.

The two datasets have different strengths and weaknesses. The Diary data cover spending over a longer time horizon—15 years. In addition, we have information on spending independent of the payment method used and include all households, not just those with credit cards. Also, we have detailed information on the items that were purchased. For instance, we know what the household spent on children's clothing

and women's shoes. The data also provide a rich array of socio-demographic variables. However, the same household is only observed for at most two consecutive weeks, and there may be misreporting due to the fact that the data come from a survey.

The credit card dataset is much larger than the Diary dataset and suffers from little measurement error because it is administrative data. Also, we have a longer panel and observe the same consumers before, during, and after the STH. However, the credit card data contain information on the type of merchant where the transaction occurred, rather than the items purchased. This hinders our analysis since it is items rather than merchants that are temporarily exempt from the sales tax. The credit card data also only have transactions that are paid for by credit card. Fortunately, this is less of a problem for the STH categories than for others because consumers are more likely to use credit cards to buy apparel than most other items (see Johnson, Parker, and Souleles 2006). The credit card sample is also restricted to those households with credit cards, which is an advantaged sample. While the credit card data have some well measured socio-demographic variables—in particular, age, income, and FICO score—it lacks information on family structure aside from an indicator as to whether the account holder has a co-applicant.

III. Empirical Model and Results

We use the same estimation model and identification strategy for both datasets. Our analysis seeks to identify the consumer response to a sales tax holiday. Briefly, our model is as follows:

$$y_{ist} = \beta_0 + \beta_1 \times STH_{ist} + \gamma \times X_i + \theta_t + \varepsilon_{ist}, \tag{1}$$

where y_{ist} is an outcome measuring the purchases by household i in state s on date t; STH_{ist} is an indicator variable equal to 1 if there is a STH on date t in the state s where household i lives. The term X_i is a vector of household-level controls including state of residence. Further, θ_t are time fixed effects, and ε_{ist} is an error term. Our time fixed effects are calendar dates (for example, August 10, 2003).

We control for the calendar date of the observation because STHs are deliberately placed during times of high demand. STHs frequently occur on weekends and more shopping for covered items, such as clothing, occurs on Fridays, Saturdays, and Sundays than during the remainder of the week. In addition, sales tax holidays tend to be placed during the back-to-school shopping season from late July–early September when spending on the covered items tends to be high.

A. *Baseline Results*

Table 5A presents our baseline results from estimating model (1) on the CEX Diary data. The table presents the results from four separate regressions. Each column in the table represents the results from a separate regression, and we report our estimate of β_1, the marginal effect of a sales tax holiday on daily spending, y. The first column shows the results from combining all STH exempt items, and the

TABLE 5A—SPENDING RESPONSE TO SALES TAX HOLIDAYS (*CEX*)

	Any exempt (1)	Apparel (2)	School (3)	Computers (4)
STH any	2.009			
	(0.655)			
STH apparel		2.221		
		(0.640)		
STH school			−0.097	
			(0.318)	
STH computers				0.597
				(0.984)
Effect (percent)	29.7	41.2	−13.8	87.0
Observations	784,993	784,993	784,993	784,993
Adjusted R^2	0.014	0.015	0.009	0.008

Notes: Each column represents a separate regression where the dependent variable is spending in the category listed in the column heading. All regressions include controls for age, sex, and race of household head, household composition, income category, state of residence, and calendar date fixed effects. Standard errors are clustered by state. Effect (percent) is defined as the STH coefficient estimate divided by the mean of the dependent variable.

Source: Authors' tabulations from Consumer Expenditure Survey Diary, 1997–2011

subsequent regressions explore the effect of STHs on specific exempt categories. In the row titled "Effect," we divide this effect by mean daily expenditure in the category to give an indication of the magnitude of this increase. Our baseline results reveal that STHs have a positive and statistically significant effect that is driven by spending on apparel items. On days with an apparel STH, consumers increase spending on apparel-related items by $2.20 on average, representing an increase of 41 percent over average expenditures. In contrast, we do not find a statistically significant increase in spending on school supplies and computers. Given how infrequently we observe these purchases in the data, the limited observations we observe during a STH (see Table 2), and concerns with how accurately computer spending is measured in the data, we believe that the data are simply not comprehensive enough to identify an effect on these categories.[9] Cole (2009a) has scanner data better suited to studying computer spending during STHs and finds large spikes in purchases.

Table 5B presents the results from similar regressions as reported in Table 5A for the credit card sample for the May–September period.[10] The first column shows that spending at all merchants increases by $1.45 during sales tax holidays. About $0.77 of this increase is at apparel merchants, representing an increase of 56 percent over average expenditures. Similar to the Diary sample, we do not find a significant increase in consumption at computer stores. We do find an increase in spending at

[9]Expenditures on big ticket durables including computers are more accurately measured in the CEX Interview Survey, which does not have information on spending by date. Although the Diary does cover these items, the questionnaire is focused on food and clothing. The BLS uses the CEX Interview Survey to measure consumption of computers and similar items in the calculation of the Consumer Price Index (CPI). Our calculations suggest that Diary computer spending is about 27 percent of its level in the Bureau of Economic Analysis' measure of Personal Consumption Expenditure as opposed to 56 percent in the CEX Interview Survey.

[10]Results for the February–October period are nearly identical. We use the shorter period in our regressions because most accounts are consistently in the shorter sample.

TABLE 5B—SPENDING RESPONSE TO SALES TAX HOLIDAYS (*credit card*)

	Any exempt (1)	Apparel (2)	School (3)	Computers (4)
STH any	1.445			
	(0.283)			
STH apparel		0.768		
		(0.127)		
STH school			0.231	
			(0.040)	
STH computers				−0.006
				(0.078)
Effect (percent)	8.5	56.1	86.8	−3.4
Observations	5,414,254	5,414,254	5,414,254	5,414,254
Adjusted R^2	0.003	0.001	0.000	0.000

Notes: Data cover the time period from May–September 2003. Each column represents a separate regression where the dependent variable is spending at the merchant type listed in the column heading. All regressions include controls for age, age squared, income, income squared, FICO score, a co-applicant flag, and state of residence and transaction date fixed effects. Standard errors are clustered by state. Effect (percent) is defined as the STH coefficient estimate divided by the mean of the dependent variable.

Source: Authors' tabulations from proprietary credit card data

book and school supply merchants. (Online Appendix section 3 discusses expenditure changes for additional merchant groups). There are two issues in the credit card data that have us question the results of the computer and school supply regressions. First, since the credit card sample only includes expenditures in 2003, there are only five states that have a STH that exempts computers and school supplies. Second, the merchants that sell school items and computers likely also or primarily sell other items that are not exempt. As a result, the estimates from the regressions on these items are more difficult to interpret than the apparel regressions. We decide to focus on the apparel items in the following sections since they are exempt in more states and the results for both the Diary and credit card samples are more straightforward.

The Table 5 regressions show that households increase spending on apparel items during a STH. We further explore these effects by looking at spending on items for three distinct groups: men, women, and children. Table 6A presents the regression results for the Diary sample. The main finding is that the increase in spending on apparel items is strongest for items purchased for children (under 16). While the point estimates are positive for all the groups, the effect on children's apparel is the largest and the most precisely measured. In column 3 of Table 6A, we see that the baseline effect of a STH on spending on apparel for children is $1.60, or over 130 percent of the daily average. This finding is robust to including additional controls. For example, one may be concerned that that the increase in consumption found on days with STH is driven by unobserved, state-specific demand shocks. To address this, in column 4, we interact state fixed effects with month fixed effects. Doing so allows for state-specific demand shocks at the monthly level across all years in the sample. Including these additional controls, we still find that a STH results in a large statistically significant increase in spending on children's apparel.

TABLE 6A—SPENDING RESPONSE TO SALES TAX HOLIDAYS ON APPAREL ITEMS (*CEX*)

	Women (1)	Men (2)	Child (3)	Child (4)	Child (5)
STH apparel	0.137	0.523	1.602	1.478	1.181
	(0.383)	(0.346)	(0.215)	(0.244)	(0.364)
Fixed effects					
State	X	X	X		
State × month				X	
Household					X
Effect (percent)	5.45	36.5	130.3	120.3	96.1
Observations	784,993	784,993	784,993	784,993	909,889
Adjusted R^2	0.004	0.002	0.013	0.013	0.034

Notes: Each column represents a separate regression where the dependent variable is apparel spending for the demographic group listed in the column heading. Regressions (1)–(4) include controls for age, sex, and race of household head, household composition, and income category. All regressions include calendar date fixed effects. Standard errors are clustered by state. Effect (percent) is defined as the STH coefficient estimate divided by the mean of the dependent variable.

Source: Authors' tabulations from Consumer Expenditure Survey Diary, 1997–2011

Lastly, in column 5, we include household fixed effects allowing for the households that we observe during STHs to have stronger tastes for children's clothing; again, the coefficient on the STH treatment variable reduces slightly but is still measured precisely.

In Table 6B, we run similar regressions using the credit card sample. The pattern of results is consistent with our finding from the Diary data: spending increases across all categories, but the largest response is found for children's apparel merchants. On days with a STH, households increase spending at children's apparel merchants by \$0.118, an effect 217 percent of the daily mean. In the credit card data, choosing to differentiate spending by different types of apparel necessitated narrowing our focus to merchants that concentrate on selling to a specific demographic group. In doing so, we omitted other merchants that sell apparel to a broad population. As shown in Table 4, over three-quarters of apparel spending is at merchants who do not cater to a specific demographic. Hence, while the credit card data provide further evidence that the effect of a STH is strongest for children's apparel, for the remainder of the paper, we primarily present results from this data source for the broader apparel category.

In columns 4–7 of Table 6B, we introduce additional controls to test for robustness. As stated previously, in the credit data, we observe not only the state but also the zip code where the household resides. This information allows us to construct additional controls to account for unobserved demand shocks that may be correlated with the timing of a STH. First, in column 4, we replace state fixed effects with zip code fixed effects—the coefficient is practically unchanged from \$0.768 (column 2, Table 5B) to \$0.766 and remains statistically significant at the 1 percent level. In column 5, we use zip code level temperature data and interact it with the date fixed effects. Specifically, to compare zip codes with holidays to others where residents need to switch to a fall wardrobe in the same window, we divide zip codes into three groups, those with average October temperature below 52.5 degrees, between

TABLE 6B—SPENDING RESPONSE TO SALES TAX HOLIDAYS AT APPAREL MERCHANTS (*credit card*)

	Women (1)	Men (2)	Child (3)	All (4)	All (5)	All (6)	All (7)
STH apparel	0.062	0.022	0.118	0.766	0.716	0.807	0.651
	(0.027)	(0.016)	(0.016)	(0.126)	(0.135)	(0.268)	(0.112)
Fixed effects:							
State	X	X	X		X	X	
Zip code				X			
Household							X
Date × temp					X		
Date × school start						X	
Effect (percent)	28.0	48.4	217.3	55.9	52.3	58.9	47.7
Observations	5,414,254	5,414,254	5,414,254	5,414,254	5,386,645	3,807,874	7,076,604
Adjusted R^2	0.000	0.000	0.000	0.006	0.001	0.001	0.023

Notes: Data cover the time period from May–September 2003. Each column represents a separate regression where the dependent variable is spending at apparel merchants serving the demographic group in the column heading. Regressions (1)–(6) include controls for age, age squared, income, income squared, FICO score, and a co-applicant flag. Regressions (1)–(4) and (7) include transaction date fixed effects. Standard errors are clustered by state. Effect (percent) is defined as the STH coefficient estimate divided by the mean of the dependent variable. Sample sizes expand in column 7 because we can include accounts with missing income.

Source: Authors' tabulations from proprietary credit card data

52.5 and 58, and above 58.[11] We then replace date fixed effects with temperature group-date fixed effects. Our findings remain unchanged—the effect reduces slightly to \$0.716.

In column 6 of Table 6B, we create school start group-date fixed effects by interacting the date fixed effects with three ranges of state-level average school start dates. This allows us to compare STH states to other places where back-to-school shopping would occur at the same time. In most states, school start dates are determined at the district rather than the state level.[12] We determine the typical start of the 2003 school year based on data from the Council of Chief State School Officers (CCSSO 2004) and divide states based on the midpoint of the range of dates provided by the CCSSO. Data is only provided for 43 of the 50 states, and for the District of Columbia. Due to the lack of start date information, we lose one of our sales tax holiday states, New York. We also lose the populous state of California. Again, our goal in doing so is to control for unobserved demand shocks that also may coincide with the timing of the STH—in this case, back-to-school shopping needs. Our findings are consistent—comparing household spending on the same date and across states with the same school start date range, a household that faces a STH increases spending by \$0.807, or nearly 60 percent of the daily mean. Lastly, as shown in column 7, including household fixed effects to control for tastes for clothing reduces the coefficient, but it is still large and measured precisely.

[11] Here we are taking advantage of the fact that we have information about card holder zip codes, which we link to national weather service data for the nearest weather station. With these break points, we are approximately dividing the sample in thirds.

[12] Some states restrict the choice of the district by mandating that schools must start after a certain date, other states leave start dates completely at the discretion of the district.

TABLE 7—HETEROGENEITY IN SPENDING RESPONSE TO SALES TAX HOLIDAYS

	Income (CEX) (1)	Income (card) (2)	FICO (card) (3)	Credit limit (card) (4)	Credit use (card) (5)
STH	1.551	0.791	0.980	0.854	1.936
	(0.763)	(0.124)	(0.110)	(0.156)	(0.190)
STH × Income < $30k	−1.209	−0.116			
	(0.770)	(0.427)			
STH × Income ≥ $70k	2.513	−0.016			
	(2.403)	(0.161)			
STH × FICO < 710			−0.280		
			(0.094)		
STH × FICO ≥ 760			−0.426		
			(0.243)		
STH × credit limit < $7k				−0.393	
				(0.242)	
STH × credit limit ≥ $12k				0.094	
				(0.210)	
STH × credit use <15%					−1.741
					(0.107)
STH × credit use ≥ 50%					−1.338
					(0.277)
Effect lowest group (%)	11.4	62.5	59.3	43.8	15.2
Effect omitted group (%)	32.7	70.3	69.8	65.2	1.141
Effect highest group (%)	50.0	44.3	35.7	58.7	49.9
Observations	784,993	5,414,254	5,414,254	5,414,254	5,414,254
Adjusted R^2	0.001	0.001	0.001	0.001	0.001

Notes: The regression using the CEX sample in column 1 includes controls for income, gender, race, and household composition, and calendar date and state-month fixed effects. The dependent variable is apparel spending. All remaining regressions use the credit card sample and include controls for age, age squared, income, income squared, FICO score, a co-applicant flag, and state of residence and transaction date fixed effects. The dependent variable is spending at apparel merchants. Regression (4) also includes a control for the initial credit limit while regression (5) also includes a control for initial credit use. Households are divided into income, FICO, credit limit, and credit use groups based on the value of that variable when they are first observed in the sample. All standard errors are clustered by state. Effect (%) is defined as the baseline STH coefficient plus the STH × group interaction estimate for a group divided by the mean of the dependent variable for that group.

Source: CEX and authors' tabulations from proprietary credit card data

B. *Heterogeneous Responses*

The political rhetoric surrounding STHs focuses on the consumption needs of children, particularly those in lower income, working class households. We have demonstrated that the largest consumption responses are for children's clothes and for items purchased at children's apparel merchants.[13] We next investigate whether the targeted low income or liquidity constrained households have larger consumption responses to the holiday than other households. In Table 7, we do this by adding interactions between the sales tax holiday indictor variable and dummy variables measuring household income, credit scores, and liquidity to our regressions

[13] In keeping with this, if we estimate separate effects by household type reported in the CEX, we find the strongest response amongst households with young children.

predicting total apparel spending. In the first two columns of Table 7, we explore whether households with different income levels have differential responses to STH, with the first column reporting results using the CEX sample and the second column results from the credit card sample. In order to create a common measure of income across the two samples, we use $30,000 and $70,000 as thresholds to group the households.

In the CEX, we find that the consumption response in both dollar and percentage terms are largest among the highest income households. For the credit card sample, the results are broadly consistent in that low income households do not have larger responses than other households, although the point estimates for the different income groups are much smaller than in the CEX sample. In light of this, we conclude that low income households are not disproportionately responsive to the tax decrease.

Information in the credit card sample also allows us to test whether more credit constrained households have larger responses to the STH.[14] We do this by interacting the sales tax holiday indicator and three sets of household credit groupings. In particular, we divide households by their initial FICO score, by their credit limit when first observed in the sample, and by their initial credit use. We define credit use as the percent of their credit limit being used when initially observed.[15] We assume that households with lower FICO scores, lower credit limit, and higher credit use are more liquidity constrained. Results are presented in columns 3–5 of Table 7. We consistently find that more credit constrained households are less responsive to the STH than those in the middle credit group. While contrary to the stated goal of the sales tax holiday to help constrained households, it is not surprising that households with less access to credit would be less likely to use their credit card to fund additional consumption.

These regressions measure which types of households increase consumption most in response to the decreased tax rates. We are also interested in which households benefit the most from the tax break. STHs subsidize the consumption of eligible items when households do not make any *additional* purchases as a result of the STH. In Table 8, we tabulate the average daily tax benefits among households observed during the sales tax holiday. We measure tax savings in two ways—tax savings for purchases that households would have made had there been no holiday and tax savings for the actual purchases made during the holiday. This table shows that the higher income households receive a larger subsidy because they spend more on apparel. The results for the different credit groupings are more varied, but we consistently find that the largest subsidy goes to the middle or highest group.

C. *Consumption Shifting*

The findings from Tables 5 and 6 provide convincing evidence that STHs result in an increase in spending on apparel items during the STH. This increase is largest for

[14] There are no good measures of liquidity constraints in the CEX-Diary.

[15] We use initial credit measures so that these measures are exogenous to the spending responses we observe. Agarwal, Liu, and Souleles (2007) uses a similar measure.

TABLE 8—AVERAGE DAILY STH TAX SAVINGS, BY HOUSEHOLD TYPE

	Income (CEX) (1)	Income (card) (2)	FICO (card) (3)	Credit limit (card) (4)	Credit use (card) (5)
Excluding increased spending					
STH apparel × low	\$0.13	\$0.06	\$0.06	\$0.06	\$0.07
STH apparel × middle	\$0.25	\$0.06	\$0.07	\$0.07	\$0.10
STH apparel × high	\$0.45	\$0.09	\$0.08	\$0.09	\$0.06
p-value	0.00	0.00	0.00	0.00	0.00
Actual purchases					
STH apparel × low	\$0.20	\$0.10	\$0.10	\$0.10	\$0.09
STH apparel × middle	\$0.33	\$0.12	\$0.14	\$0.12	\$0.18
STH apparel × high	\$0.59	\$0.14	\$0.10	\$0.13	\$0.11
p-value	0.00	0.13	0.01	0.05	0.00

Notes: The estimates excluding increased spending are calculated by multiplying the average tax rate by average spending on STH dates by households in each of the groups in non-STH states. Estimates based on actual purchases are calculated by multiplying average tax rates by average actual spending during STHs in STH states. *p*-value refers to an *F*-test on the null that the means are the same across groups. The cut-off values that define the low/middle/high groups for each variables are as follows: income: <\$30k, \$30–\$70k, ≥\$70k; FICO score: <710, 710–759, ≥760; credit limit: <\$7k, \$7k–\$12k, ≥\$12k; initial credit use: <15 percent,15 percent–50 percent, ≥50 percent.

children's apparel items and at children's clothing merchants and robust to including a number of different controls that account for unobserved demand shocks that may coincide with the timing of a STH. In this section, we ask whether consumers offset this increased spending by decreasing consumption in the periods before or after the STH. For durable goods and semi-durable goods like apparel, purchases today may substitute for purchases tomorrow. As a result, we might expect increases in purchases during the STH to be partially offset by declines in purchases before or after the holiday. For example, Hendel and Nevo (2004, 2006) find that when households make purchases during sales, they are more likely to postpone their next purchase.[16]

In order to test whether households alter consumption in periods before and after the STH, we estimate the following equation:

$$(2)\quad y_{ist} = \beta_0 + \beta_1 \times STH_{ist} + \sum_r \beta_r \times STH\_Pre_{istr} + \sum_l \beta_l \times STH\_Post_{istr} + \gamma \times X_i + \theta_t + \varepsilon_{ist}.$$

Equation (2) is nearly identical to equation (1), but with the addition of indicator variables denoting dates either preceding (*STH_Pre*) or following (*STH_Post*) an STH. The identification strategy is the same as that used in equation (1); by still including the calendar date fixed effects, the variables *STH_Pre* and *STH_Post* examine the consumption patterns of households on the same calendar dates in states with an STH with those in states without one—the only difference is that

[16] In the online Appendix section 1, we introduce and solve a simple model of intertemporal consumption over durable goods. Our main finding is that depending on how durable the good is and the value of consumers elasticity of intertemporal consumption, a STH may lead to either an increase or a decrease in spending in the pre- and post-period.

TABLE 9A—SPENDING RESPONSE BEFORE, DURING, AND AFTER SALES TAX HOLIDAYS
CHILDREN'S APPAREL ITEMS (*CEX*)

	1 week (1)	2 weeks (2)	1 month (3)	1 week (4)
1 month before			−0.301	
			(0.187)	
2 weeks before		0.174		
		(0.230)		
1 week before	0.042			−0.311
	(0.281)			(0.633)
STH	1.520	1.628	1.391	1.136
	(0.507)	(0.510)	(0.513)	(0.465)
1 week after	0.248			0.211
	(0.361)			(0.562)
2 weeks after		0.465		
		(0.272)		
1 month after			0.044	
			(0.184)	
Fixed effects:				
State × month	X	X	X	
Household				X
Observations	784,993	784,993	784,993	784,993
Adjusted R^2	0.013	0.013	0.013	0.013

Notes: Each column represents a separate regression where the dependent variable is spending on children's apparel. Regressions (1) to (3) include controls for age, sex, and race of household head, household composition, and income category. All regressions include date fixed effects. Standard errors are clustered by state.

Source: Authors' tabulations from Consumer Expenditure Survey Diary, 1997–2011

instead of focusing on STH dates, we now extend our analysis to dates before and after the STH.

For household i in state s, STH_Pre_{istr} is equal to 1 if our household date includes expenditures in a week or month r prior to the STH at date t; STH_Post_{istr} is defined in an analogous manner, only for periods after the STH. Note that the same households are unlikely to be observed before, during, and after an STH in the Diary sample because households are only in the sample for a maximum of two weeks.

Table 9A presents the findings from applying equation (2) to the CEX data. We consider three different windows to explore shifting behavior: one week before and after (columns 1 and 4), two weeks before and after (column 2), and one month before and after (column 3). Children's apparel expenditure is the dependent variable in each regression, and regressions 1–3 include state-month fixed effects, while regression 4 has household fixed effects. Across all four regressions, we observe the same general pattern of results. First, the estimated consumption increases during the STH are of a similar magnitude and are statistically significant. Second, we find little evidence of consumption increasing or decreasing in the periods before or after the STH. In almost every instance, the coefficients on the pre- and post-periods are statistically insignificant. The one exception is the second regression, where we find an increase in the period two weeks after, which is significant at the 10 percent level.

TABLE 9B—SPENDING RESPONSE BEFORE, DURING, AND AFTER SALES TAX HOLIDAYS APPAREL MERCHANTS
(*credit card*)

	1 week (1)	2 weeks (2)	1 month (3)	1 week (4)	1 week (5)
1 month before			0.122		
			(0.059)		
2 weeks before		0.167			
		(0.125)			
1 week before	0.089			0.030	0.048
	(0.079)			(0.075)	(0.119)
STH	0.778	0.796	0.802	0.721	0.809
	(0.127)	(0.129)	(0.130)	(0.135)	(0.272)
1 week after	0.110			0.050	−0.004
	(0.071)			(0.083)	(0.120)
2 weeks after		0.115			
		(0.055)			
1 month after			0.028		
			(0.061)		
Fixed effects					
Date × temp				X	
Date × school start					X
Observations	5,414,254	5,414,254	5,414,254	5,386,645	3,807,874
Adjusted R^2	0.001	0.001	0.001	0.001	0.001

Notes: Data cover the time period from May–September 2003. Each column represents a separate regression where the dependent variable is spending at apparel merchants. All regressions include controls for age, age squared, income, income squared, FICO score, a co-applicant flag and state fixed effects. Regressions (1)–(3) include transaction date fixed effects. Standard errors are clustered by state.

Source: Authors' tabulations from proprietary credit card data

Table 9B reports similar regressions for the credit card sample. Here, the dependent variable is spending at apparel merchants. All regressions include state fixed effects. Columns 1–3 include transaction date fixed effects, while column 4 includes temperature group-date fixed effects and column 5 includes school start group-date fixed effects. The results from the credit card data broadly mirror those we find in the CEX regressions. The coefficient on the STH remains positive and statistically significant, and we find no evidence of consumption decreasing before or after the STH. One point of departure, though, is we observe a positive and statistically significant *increase* in consumption in the period before the STH for the one month window and after the STH for the two week window.[17] While these coefficients are statistically significant, the effects are far smaller than the increases we observe during the STH.[18] In Table 9C, we perform similar regressions for the set of merchants that sell children's clothing. We observe a similar pattern of results.

[17] The increase in spending one week before the STH should not be driven by the misalignment of the dates of the STH. Though it is possible that some merchants apply the STH a week before. Nevertheless, it is a puzzle that people increase spending in anticipation of the STH while not getting the reduction in sales tax.

[18] Replacing the state fixed effects with zip code or account fixed effects or omitting panel-based fixed effects, leads to a similar pattern of results with substantial increases during the holiday and no significant declines in the period before or after. Results using date-temperature or date-school start in the two week or one month window are comparable to the results presented.

TABLE 9C—SPENDING RESPONSE BEFORE, DURING, AND AFTER SALES TAX HOLIDAYS
CHILDREN'S APPAREL MERCHANTS (*credit card*)

	1 week (1)	2 weeks (2)	1 month (3)	1 week (4)	1 week (5)
1 month before			0.002		
			(0.006)		
2 weeks before		0.020			
		(0.011)			
1 week before	−0.004			−0.010	0.002
	(0.014)			(0.015)	(0.016)
STH	0.118	0.121	0.117	0.105	0.117
	(0.016)	(0.017)	(0.018)	(0.018)	(0.028)
1 week after	−0.005			−0.012	0.004
	(0.013)			(0.013)	(0.019)
2 weeks after		0.005			
		(0.014)			
1 month after			−0.005		
			(0.010)		
Fixed effects					
Date × temp				X	
Date × school start					X
Observations	5,414,254	5,414,254	5,414,254	5,386,645	3,807,874
Adjusted R^2	0.000	0.000	0.000	0.000	0.000

Notes: Data cover the time period from May–September 2003. Each column represents a separate regression where the dependent variable is spending at children's apparel merchants. All regressions include controls for age, age squared, income, income squared, FICO score, a co-applicant flag and state fixed effects. Regressions (1)–(3) include transaction date fixed effects. Standard errors are clustered by state.

Source: Authors' tabulations from proprietary credit card data

Combining the results in Table 9, we find substantial increases in spending during the STH that are not offset by declines in spending before or after the holiday and may be accompanied by increases in spending in the periods surrounding the STH. This is broadly consistent with Cole (2009a), who finds that the total increase in the number of computers purchased during the 30 weeks surrounding a STH (summed across the states he studies) is larger than the increase during the two weeks containing the holidays.[19]

D. *Aggregate Effects*

In Table 10, we present the results of back of the envelope calculations that compare the revenue lost by state governments to the increase in spending both per household and in total for 2003. The amount of additional spending caused by the STH for each household-date is the coefficient on the STH indicator variable from our baseline regression using all apparel as the dependent variable.[20] The amount

[19] According to his table 3.7, in the two weeks including the holidays, extra computer purchases were 84,105 in STH states, while in the 30 weeks surrounding the STHs, extra computer purchases were 87,812.

[20] The coefficient differs slightly from the one shown in Table 5A because we use our preferred specification that includes state-month fixed effects.

TABLE 10—AGGREGATE SPENDING AND REVENUE RESPONSES TO SALES TAX HOLIDAY ON APPAREL PURCHASES

	CEX	Credit card
Increased spending		
Per household-date	1.85	0.77
Aggregate effect (millions)	219	177
Lost revenue		
Per household-date	0.28	0.07
Aggregate effect (millions)	33.6	17.2

Notes: This table provides a back of the envelope estimate of the aggregate effects of the Sales Tax Holiday. Increased spending per household-date for the CEX is the STH-coefficient from a baseline regression that includes state-month fixed effects. For the credit card data, it is the estimate in Table 5B, column 2. Lost revenue per household date contains the average spending on STH dates in non-STH states multiplied by the average tax rate. The aggregate effects are computed by taking the preceding two effects and multiplying by the appropriate household (CEX) or individual (credit card) populations and the average STH length.

of revenue lost by state governments for each household-date is computed by multiplying the average prevailing tax rate by the amount of spending that would have taken place absent the STH. To compute this value, we take the average spending on apparel that occurs on STH dates but in states that do not hold an STH.

We then estimate total increased spending and total lost revenue due to all of the STHs in 2003 (the sample year of the credit card data). To do this, we calculate the population in the nine sales tax states and assume that all STHs lasted 4.36 days (the population weighted average length of a STH in 2003). This results in total of 230.1 million potential individual-shopping days and 118.1 million potential household-shopping days.[21] With this base, we then estimate that the total additional spending for one year of a STH to be $219 million and $177 million for the CEX and credit card sample, respectively. Using the same type of calculation, we compute that the amount of revenue lost to be $33.6 million and $17.2 million for the CEX and credit card sample, respectively. Hence, for every one dollar of lost tax revenue, the STH appears to generate between $6.5 and $10 in additional spending.

IV. Discussion and Conclusion

Our main findings are that households increase spending on apparel items during STHs, and that this increase is not offset in the periods before or after. In fact, we appear to find a slight *increase* in spending in the period preceding the STH when using the credit card data.

This suggests that STHs provide a net stimulus to the consumption of covered items over the fairly long window covered in our analysis. This finding is consistent

[21] In 2003, there were 290 million individuals (74 percent of which are over eighteen) and 111 million households. Limiting both samples to the 24 percent of which live in a state exposed to a STH yields the total number of individuals and households exposed to a STH.

across our two independent data sources. The temporary lowering of after-tax prices temporarily serves to increase consumption.

What could account for the increase in consumption prior to the holiday? We can write down a simple model of intertemporal substitution (see online Appendix section 1) where consumption may increase in the periods surrounding a price drop. This can occur if the wealth effect from the reduced cost during the period of reduced prices dominates the substitution effect that pushes consumption into the period of lower prices. According to our model, this could occur if the Intertemporal Elasticity of Substitution (IES) is low and the good in question depreciates slowly because it is durable or storable. Recent research supports the conjecture that the IES is low. In Cashin and Unayama (2016), the authors use a permanent increase in the VAT in Japan to provide a new estimate for the IES, and find a value of 0.21. While clothing depreciates more quickly than many durable items, depreciation over the few weeks surrounding the STHs is likely to be small.

However, while the model can justify an increase in consumption and spending prior to the tax holiday, it cannot explain this increase being accompanied by an increase in spending (defined as consumption times price) during the holiday in the presence of a binding intertemporal budget constraint. Put differently, a household that saves less in the first period cannot spend more in the subsequent periods.

There are a few potential explanations for our combination of results. First, households may decrease spending on the exempt goods outside the holiday, but do so in a wider window than we capture with our data. In other words, the budget constraint does bind, but not in our estimation window. If we look at a wider window, we cannot reject that total children's apparel spending is unchanged over the holiday and two months surrounding in the Diary data or that spending at apparel merchants is unchanged over the holiday and surrounding three months in the credit card data. However, our inability to reject is driven by increasing standard errors rather than by declining estimated effects.

Additional explanations rely on STHs leading to increases in overall spending on the exempt goods. This result would require a model where households save less overall or switch in aggregate from other goods to the exempt goods in response to the change in price or to the holiday more broadly. An expanding budget on exempt items could arise due to either a high price elasticity for these items or because households are responding to something in addition to the price drop. Given the small changes in price arising from the removal of tax and the large changes in spending, our results imply large price elasticities (on the order of -10). This is a substantially larger elasticity than most conventional estimates, but more in line with (although still larger than) estimates measuring the responsiveness of internet spending to sales taxes rate (Goolsbee 2000, Einav et al. 2014). Such a large change in consumption relative to the price could occur if the price change was also accompanied by other factors that served to increase consumption of the covered goods. For example, households could be responding to considerable media attention and promotional advertising that accompanied STHs. Alternatively, households could receive a psychic benefit from avoiding tax, which made them consume more than would be dictated by the drop in price.

Our results are relevant for those debating the merits of the STH policy. We find strong evidence to suggest that consumption responses are largest for apparel items purchased for children and at children's apparel merchants and indicate that the holiday is successful in inducing additional consumption of children's apparel. According to policymakers, children are the intended beneficiaries of the tax suspension. However, these holidays also advantage individuals other than the intended beneficiaries and may be a costly way to subsidize and stimulate the demand of specific beneficiaries. We do not find evidence that low income or liquidity constrained individuals disproportionately benefit from these holidays. In fact, we find that higher income households and those with more access to credit gain more from the tax break. In addition, while critics of STHs have suggested that the holidays might serve to alter the timing of purchases rather than the total amount purchased, we do not find evidence of this in our data. This implies that retailers benefit from the holiday via increased sales. Related, the finding that spending during a STH is not offset by decreases in spending in the periods before or after the change suggest STHs may be an effective tool for stimulating demand. This suggests that policies that temporarily decrease taxes on other items may also be successful in increasing demand for those items.

Appendix 1: Transaction Data Appendix

Any user initiated credit card activity is referred to as a transaction. Transaction data is transmitted from the point of purchase to a central clearinghouse. There are several clearinghouses throughout the United States. The major clearinghouse is First Data Resources or FDR. FDR provides monthly summaries of transaction data to the credit card issuers.

The transaction data file includes many fields (such as exact time of transaction) but the ones used for this study are transaction amount, card account number, and Merchant Category Code or MCC. Merchant Category Codes (MCCs) are codes established by bankcard associations to identify different types of businesses. The MCC is a four-digit code that corresponds to the merchant's main business.

In this study, the only information available for identifying the items purchased in a transaction is the MCC. As a result, we employ the following mapping from MCCs to STH exempt status. For STHs that exempt clothing and shoes, we look at spending at clothing stores, apparel stores, shoe stores, and department stores.[22] For sales tax holidays that exempt school supplies, we look at spending at book stores, office supply stores, religious goods stores, and newsstands. For sales tax holidays on computers, we look at spending at computer stores and software stores. In the online Appendix, we investigate spending at big box retailers, which includes general merchandise stores, discount stores, and wholesale clubs.

[22] We do not separate clothing and shoe holidays because all of the holidays in 2003 that exempt clothing also exempt footwear.

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