The Effect of Sales Tax on Retail Prices and Employment
Evidence from Exemptions on Apparel

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Motivation

Sales tax

▸ 30% of state revenues (Census)

Two policy dimensions:

1. changing a general tax rate
   ▸ small and rare

2. setting selective rates
   ▸ 2-3 changes per state-year
   ▸ substantial
      ▸ exemptions (food, apparel)
      ▸ additional rates (alcohol, tobacco, car rentals)

Is it efficient to apply good-specific sales tax on apparel?
Motivation

Is it efficient to tax apparel?
- a policy debate
  - constant revisions of permanent exemptions
  - tax holidays in 23 states
- 36 states tax apparel
  - likely elastic demand

Apparel industry:
- $245 billion (3.5% of total HH expenditures)
- 1.2 million employees
Who bears the incidence of the tax?
  ▶ consumers vs. retailers

Does the tax affect the usage of inputs?
  ▶ labor vs. capital

Tax Exemption - policy that (partially) exempts certain items from taxation.
  ▶ New York: no tax on clothing priced below $110
  ▶ Long-term exemption - intended to last forever
  ▶ Tax holiday - lasts for 1-10 days
Using

- changes in **long-term** exemptions in 3 states

I find that 1 p.p increase in sales tax leads to:

1. no change in retail prices (Price effect)
   - consumers pay the sales tax

2. 0.33% decrease in apparel retail employment (Quantity effect)
Contributions

Tax Incidence Estimation

1. first to use Consumer Price Index data, restricted access
   - item characteristics
   - store location
   - date of a price quote
   - reason for item disappearance

2. clean identification strategy

Effect on inputs:
   - first to establish robust link between sales tax and employment
Outline

Literature

Theory

Tax Data

Tax Incidence

Employment

Deadweight Loss
Literature

- Tax incidence (Empirics)
  - Apparel market: Besley and Rosen, 1999; Poterba, 1996
  - Other markets: Carbonnier, 2014; DeCicca et al., 2013; Kopczuk et al., 2013; Harding et al., 2012; Doyle and Samphantharak, 2008

- Tax incidence (Theory)
  - Fabinger and Weyl, 2014; Anderson et al., 2001

- Elasticity of apparel expenditures:
  - Einav et al., 2014; Hu and Tang, 2014; Agarwal et al., 2013

- Sales tax and employment:
  - Burnes et al., 2013; Rohlin and Thompson, 2012; Billings, 2009; O’Keefe, 2004
Theory - Plan

Given

1. elastic demand
2. increase in sales tax rate

retailers drop

1. prices (Price effect)
2. quantity (Quantity effect)

▶ use less inputs

presented under the assumption of perfect competition
Theory - Price Effect

\[ \rho = \frac{1}{1 + \epsilon_S |\epsilon_D|} \]

\[ P = P_d, P = P_\theta, P = P_s, P = 0 \]

\[ Q_T, Q_0 \]

\[ D_T^{\neq 0}, S \]

\[ Q \rightarrow P \]
Proposition 1

Under perfect competition tax incidence \( \rho = -\frac{1}{1 + \frac{\epsilon_s}{|\epsilon_D|}} \). The more elastic is supply (demand), the less (more) incidence is shifted onto retailers. By construction: \(-1 < \rho < 0\).

> for imperfect competition:
  > \( \rho \) can be positive
  > same comparative statics for both elasticities
Theory - Quantity Effect

\[ Q_{\text{elas}} \]
 Proposition 2

↑ Tax rate → ↓ equilibrium quantity → employees hired ↓. 
The effect increases with an increase in the elasticity of supply $\epsilon_S$ or demand $\epsilon_D$.

Same result holds for imperfect competition
Data

1. Data sets:
   - Self-compiled data, tax rates and tax exemptions
   - Consumer Price Index micro data, restricted access
     - allows to control for item disappearance
   - Quarterly Census of Wages and Employment
   - Consumer Expenditure Survey

2. Geographical and Time Span:
   - Northeast and Midwest states;
   - January 1997 to December 2012
Tax Exemptions in three Northeast states:

1. Connecticut (2 changes):
   - 1997: 6% sales tax rate on items priced above $75
   - 2003 revision: 6.35% sales tax rate on items priced above $50
   - 2011 repeal: 6.5% sales tax rate on all items

2. Vermont (2):
   - 1997: 5% sales tax rate for all items
   - 1999 intro: 5% sales tax rate on clothing items priced above $110
   - 2007 revision: no sales tax rate on clothing items

3. New York (6 changes):
   - First change in 2000, last in 2012
   - cities and counties can introduce/repeal
New York City Tax Rate

- **Red line** — items priced above $110
- **Black line** — items priced below $110
## Tax Rates

**Table:** Population Weighted Average Cumulative Sales Tax Rate in other Northeast and Midwest States

<table>
<thead>
<tr>
<th>Year</th>
<th>Treatment State</th>
<th>Control States</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>New York</td>
<td>Illinois</td>
<td>Other Midwest</td>
</tr>
<tr>
<td></td>
<td>( \leq $110 )</td>
<td>Any</td>
<td>Any</td>
</tr>
<tr>
<td>1998</td>
<td>7.91</td>
<td>7.48</td>
<td>5.32</td>
</tr>
<tr>
<td>2001</td>
<td>1.74</td>
<td>7.55</td>
<td>5.36</td>
</tr>
<tr>
<td>2004</td>
<td>8.40</td>
<td>7.63</td>
<td>5.63</td>
</tr>
<tr>
<td>2007</td>
<td>2.34</td>
<td>7.68</td>
<td>5.67</td>
</tr>
<tr>
<td>2010</td>
<td>6.60</td>
<td>8.02</td>
<td>5.72</td>
</tr>
<tr>
<td>2012</td>
<td>2.44</td>
<td>7.60</td>
<td>5.77</td>
</tr>
</tbody>
</table>

The other control states (ME, MA, NH, NJ, PA, RI) have constant tax rate.
Consumer Price Index Micro Data

CPI data consists of quotes:

<table>
<thead>
<tr>
<th>Month</th>
<th>Apr</th>
<th>May</th>
<th>Jun</th>
<th>Jul</th>
<th>Aug</th>
<th>Sep</th>
<th>Oct</th>
<th>Nov</th>
<th>Dec</th>
</tr>
</thead>
<tbody>
<tr>
<td>Item 1:</td>
<td>…</td>
<td>•</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Item 2:</td>
<td>$65</td>
<td>$65</td>
<td>$60</td>
<td>•</td>
<td>$65</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
</tr>
<tr>
<td>Item 3:</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>$65</td>
</tr>
</tbody>
</table>

- Item example: mid-size blue T-shirt sold at “Gap” store located in Poughkeepsie, NY
- Yellow: temporary missing observations (stockouts)
- Red: permanently missing observations (cancellations)
- Item - unit of observation
Empirical Strategy
Triple-Difference Model

\[ \log(price_{it}) = \alpha + \beta_1 \times \text{tax rate}_{it} + Controls_{it} + \nu_i + \mu_m(t) + \epsilon_{it} \]

- \( \beta_1 \in [-1, 0] \) is tax incidence on retailers
  - price is pre-tax
- I control for:
  - permanent item characteristics \( \nu_i \)
  - month-year fixed effects \( \mu_m(t) \)
  - sales tax holidays
  - month in the season
- Triple-difference:
  - observe non-treated items (priced above thresholds) in treated states
Empirical Strategy

Accounts for 1\textsuperscript{st} endogeneity concern:

- State tax policy responds to price levels

but creates another one:

- Incentives for bunching:
  - Example: NYC exemption
  - Retail price: $110 \rightarrow consumer price: $119
  - Solution — instrument from taxable income elasticity literature
Tax Incidence

Empirical Strategy - Instrument

Instrument: would-be tax rate applied to predicted item price

\[ p_{im} = \alpha + \gamma_{\text{category}} + \gamma_{\text{region}} + \mu_m + \text{season}_{im} + \epsilon_{im} \]

- Prediction sample: treatment states before 2000 and control states

- Category example: men’s sweaters and vests
### Tax Incidence

**Regression Analysis**

−0.06 implies that retailers pay 6% of the sales tax:

<table>
<thead>
<tr>
<th>VARIABLES</th>
<th>(1) All states</th>
<th>(2) NE</th>
<th>(3) NY</th>
<th>(4) CT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tax Rate</td>
<td>−0.062 (0.055)</td>
<td>0.054 (0.042)</td>
<td>−0.005 (0.041)</td>
<td>−0.152** (0.070)</td>
</tr>
<tr>
<td>F-statistic</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sales Tax</td>
<td>−0.27 (0.90)</td>
<td>−0.90 (0.83)</td>
<td>1.61** (0.65)</td>
<td>−0.88 (2.23)</td>
</tr>
<tr>
<td>Holiday</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Item and month fixed effects are in all columns

<table>
<thead>
<tr>
<th></th>
<th>516,710</th>
<th>267,042</th>
<th>474,989</th>
<th>403,753</th>
</tr>
</thead>
<tbody>
<tr>
<td>No. of Obs.</td>
<td>0.056</td>
<td>0.054</td>
<td>0.063</td>
<td>0.067</td>
</tr>
<tr>
<td>$R^2$</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No. of Items</td>
<td>62,018</td>
<td>31,127</td>
<td>59,471</td>
<td>52,322</td>
</tr>
</tbody>
</table>

*** p<0.01, ** p<0.05, * p<0.1
### Tax Incidence

**Robustness Checks**

This result is true for most subsamples:

<table>
<thead>
<tr>
<th>Dependent Variable: Logarithm of Pre-tax Price</th>
<th>(1) &lt; 2008</th>
<th>(2) &gt; 2008</th>
<th>(3) Tax↓</th>
<th>(4) Tax↑</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tax Rate</td>
<td><strong>-0.070</strong>*</td>
<td><strong>0.060</strong></td>
<td><strong>-0.003</strong></td>
<td><strong>0.074</strong></td>
</tr>
<tr>
<td></td>
<td>(0.037)</td>
<td>(0.167)</td>
<td>(0.086)</td>
<td>(0.057)</td>
</tr>
<tr>
<td>F-statistic</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sales Tax</td>
<td>0.634</td>
<td>0.467</td>
<td>0.366</td>
<td>0.571</td>
</tr>
<tr>
<td>Holiday</td>
<td>(0.630)</td>
<td>(3.18)</td>
<td>(0.967)</td>
<td>(0.293)</td>
</tr>
</tbody>
</table>

Item and month fixed effects are in all columns

<table>
<thead>
<tr>
<th></th>
<th>(1)</th>
<th>(2)</th>
<th>(3)</th>
<th>(4)</th>
</tr>
</thead>
<tbody>
<tr>
<td>No. of Obs.</td>
<td>367,192</td>
<td>122,487</td>
<td>188,051</td>
<td>88,936</td>
</tr>
<tr>
<td>(R^2)</td>
<td>0.067</td>
<td>0.057</td>
<td>0.069</td>
<td>0.082</td>
</tr>
<tr>
<td>No. of Items</td>
<td>63,995</td>
<td>24,350</td>
<td>34,466</td>
<td>16,916</td>
</tr>
</tbody>
</table>

*** p&lt;0.01, ** p&lt;0.05, * p&lt;0.1
## Tax Incidence

### Robustness Checks 2

Except for some apparel groups for which demand is presumably more elastic:

| Dependent Variable: Logarithm of Pre-tax Price |
|---|---|---|---|
| (1) Men | (2) Women | (3) Non-Seasonal | (4) Seasonal |
| Tax Rate | $-0.04^{***}$ | $0.01^{***}$ | $-0.21^{***}$ | $0.00$ |
| | $(0.077)$ | $(0.124)$ | $(0.050)$ | $(0.077)$ |

F-statistic

| Sales Tax | -0.729 | -0.36 | $-0.302$ | $-0.254$ |
| Holiday | $(1.92)$ | $(0.551)$ | $(0.891)$ | $(1.10)$ |

Item and month fixed effects are in all columns

| No. of Obs. | 141,911 | 164,016 | 184,579 | 324,193 |
| $R^2$ | 0.036 | 0.121 | 0.010 | 0.075 |
| No. of Items | 11,780 | 27,306 | 15,466 | 7,651 |

*** $p<0.01$, ** $p<0.05$, * $p<0.1$
Tax Incidence

No Bunching at Exemption Threshold in New York State

![Graph showing density distribution for Price with and without exemption.](Graphs by kink)
Tax Incidence

Findings

- tax incidence is close to zero
- sign is negative: retailers share a small burden of the sales tax
- different from Besley and Rosen (1998):
  - positive incidence
- interesting given elastic demand for apparel (Agrawal et al., 2014)
Theory

Price effect is zero
Quantity effect is large

$P_0, P_s$

$Q_{elas}$

$Q_T$

$Q_0$

$D_e^e$

$D_{T>0}$
Employment

1. Quarterly Survey on Employment and Wages
   - County-level panel data for every county
   - Every month for employment
   - Every quarter for wages and establishment number

2. My sample covers:
   - Northeast states
   - January 1997 - December 2012
   - Data for apparel and entertainment retailers
Empirical Strategy
Difference-in-Difference

\[ \log(labor_{cm}) = \alpha + \beta_1 \times \text{tax rate}_{cm} + Controls_{cm} + \nu_c + \mu_m + \epsilon_{cm} \]

- \( \beta_1 \) is the effect of sales tax on employment
- Ignore exemption thresholds
- I control for:
  - permanent county characteristics \( \nu_c \)
  - month specific shocks \( \mu_m \)
  - population
  - state trends
- Perform robustness check
## Employment

1 p.p. ↑ sales tax → 0.4% decrease in employment

<table>
<thead>
<tr>
<th>Dependent Variable: $\log(\text{Employment+10})$</th>
<th>Employment</th>
<th>Apparel</th>
<th>Taxed Stores</th>
<th>Payroll</th>
</tr>
</thead>
<tbody>
<tr>
<td>(1)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(2)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(3)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(4)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(5)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Tax Rate</th>
<th>$-0.25^{***}$</th>
<th>$-0.39^{***}$</th>
<th>$0.09$</th>
<th>$-0.59^{***}$</th>
<th>$-0.16$</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(0.053)</td>
<td>(0.077)</td>
<td>(0.077)</td>
<td>(0.15)</td>
<td>(0.22)</td>
</tr>
</tbody>
</table>

State Trends | X | X | X | X | X | X
Large Counties | X | X | X | X | X | X

Item and month fixed effects are in all columns

<table>
<thead>
<tr>
<th>No. of Obs.</th>
<th>34,558</th>
<th>29,501</th>
<th>29,887</th>
<th>8,292</th>
<th>11,835</th>
</tr>
</thead>
<tbody>
<tr>
<td>$R^2$</td>
<td>0.154</td>
<td>0.179</td>
<td>0.162</td>
<td>0.690</td>
<td>0.289</td>
</tr>
<tr>
<td>No. of Counties</td>
<td>206</td>
<td>163</td>
<td>201</td>
<td>163</td>
<td>163</td>
</tr>
</tbody>
</table>

*** p<0.01
Employment

Graphical Results

Apparel retail employment NY vs. MA-NJ-PA

No  Exempt  No  Exempt

Apparel employment - Hobby employment, %


New York  MA-NJ-PA
Employment

Summary of Findings

1 p.p. ↑ sales tax →

- 0.4% decrease in employment
- 0.6% decrease in taxed payroll
- zero effect on the number of establishments
Deadweight Loss

What is the deadweight loss of a sales tax?

- Need to recover elasticities of demand and supply
  1. From Consumer Expenditure Survey: $\epsilon_D = -1.8$
  2. Plugging into tax incidence: $\epsilon_S = 40$

DWL is 13 cents from $1$ collected in tax revenue ($1.3$ billion)

- using Goulder and Williams (2003) methodology
- comparable with DWL from cigarette taxes
- lower bound
Deadweight Loss

average \( DWL = -\frac{\tau_a \epsilon_D}{2} + \tau_L \epsilon_L \)
Conclusion

Using
- changes in sales tax exemptions
- three different data sets

I show that good-specific sales tax on clothing
- fully shifts on consumers
  - despite elastic demand for it ($\epsilon_D = -1.8$)
- decreases apparel retail employment
  - 1 p.p sales tax increase $\rightarrow$ 0.33% decrease
- generates an average DWL of 13 cents per $1$ tax revenue
Tax Incidence - Symmetric Imperfect Competition

\[ \rho = \frac{1 - \frac{\theta}{\epsilon_D}}{1 + \frac{\theta}{\epsilon_{\theta}} + \frac{\theta}{\epsilon_{ms}} + \frac{\epsilon_D - \theta}{\epsilon_S}} - 1. \] The comparative statistics for both elasticities hold.

- \( \theta \) is Bresnahan(1989) parameter of conduct
- \( \epsilon_{\theta} \) - inverse elasticity of conduct parameter with respect to quantity produced
- \( \epsilon_{ms} \) - inverse elasticity of marginal surplus with respect to quantity produced

Back to return.
## Summary Statistics for Price Regressions

<table>
<thead>
<tr>
<th></th>
<th>NY</th>
<th>CT</th>
<th>Other NE</th>
<th>IL</th>
<th>Other MW</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Price, $</strong></td>
<td>86.4</td>
<td>88.8</td>
<td>58.7</td>
<td>67.2</td>
<td>56.0</td>
</tr>
<tr>
<td></td>
<td>(156)</td>
<td>(174)</td>
<td>(94)</td>
<td>(112)</td>
<td>(89)</td>
</tr>
<tr>
<td><strong>Sale, %</strong></td>
<td>35.2</td>
<td>44.1</td>
<td>41.6</td>
<td>38.1</td>
<td>40.6</td>
</tr>
<tr>
<td></td>
<td>(47.7)</td>
<td>(49.7)</td>
<td>(49.3)</td>
<td>(48.6)</td>
<td>(49.1)</td>
</tr>
<tr>
<td><strong>Tax Holiday, %</strong></td>
<td>1.163</td>
<td>1.962</td>
<td>0.005</td>
<td>0.150</td>
<td>0.030</td>
</tr>
<tr>
<td></td>
<td>(10.719)</td>
<td>(13.870)</td>
<td>(0.712)</td>
<td>(3.865)</td>
<td>(1.726)</td>
</tr>
<tr>
<td><strong>Monthly Quotes</strong></td>
<td>0.828</td>
<td>0.556</td>
<td>0.289</td>
<td>0.756</td>
<td>0.050</td>
</tr>
<tr>
<td></td>
<td>(0.377)</td>
<td>(0.497)</td>
<td>(0.453)</td>
<td>(0.429)</td>
<td>(0.219)</td>
</tr>
<tr>
<td><strong>Nonseasonal Goods</strong></td>
<td>0.307</td>
<td>0.267</td>
<td>0.296</td>
<td>0.309</td>
<td>0.310</td>
</tr>
<tr>
<td></td>
<td>(0.461)</td>
<td>(0.442)</td>
<td>(0.456)</td>
<td>(0.462)</td>
<td>(0.462)</td>
</tr>
<tr>
<td><strong>Fall Seasonal Goods</strong></td>
<td>0.132</td>
<td>0.095</td>
<td>0.118</td>
<td>0.111</td>
<td>0.111</td>
</tr>
<tr>
<td></td>
<td>(0.339)</td>
<td>(0.294)</td>
<td>(0.323)</td>
<td>(0.314)</td>
<td>(0.315)</td>
</tr>
<tr>
<td><strong>Spring Seasonal Goods</strong></td>
<td>0.131</td>
<td>0.099</td>
<td>0.113</td>
<td>0.099</td>
<td>0.109</td>
</tr>
<tr>
<td></td>
<td>(0.337)</td>
<td>(0.299)</td>
<td>(0.317)</td>
<td>(0.299)</td>
<td>(0.312)</td>
</tr>
</tbody>
</table>

Back to [return](#).
More
Quality

Biased estimates if tax rate $\rightarrow \uparrow Pr(\text{missings})$

- Divide sample into seasonal and non-seasonal items
- Consider separately: stockouts and cancellations
- Stockouts describe store quality. Data Refinements:
  1. Drop the last three months before cancellation (nonseasonal items)
  2. Use observations between first and last non-missing price
- Cancellations - store product variety
  1. Valid cancellation if it is right after non-missing price
## Results

### Quality

Supermarket quality does not change:

<table>
<thead>
<tr>
<th></th>
<th>(1)</th>
<th>(2)</th>
<th>(3)</th>
<th>(4)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Non-seasonal</td>
<td></td>
<td>Seasonal</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Stockout</td>
<td>Cancel.</td>
<td>Stockout</td>
<td>Cancel.</td>
</tr>
<tr>
<td>Tax Rate</td>
<td>$-0.092$</td>
<td>$-0.009$</td>
<td>$0.062$</td>
<td>$0.097$</td>
</tr>
<tr>
<td></td>
<td>(0.059)</td>
<td>(0.036)</td>
<td>(0.195)</td>
<td>(0.0507)</td>
</tr>
<tr>
<td>Sales Tax</td>
<td>$-1.43$</td>
<td>0.028</td>
<td>0.968</td>
<td>$-1.66^{* *}$</td>
</tr>
<tr>
<td></td>
<td>(1.24)</td>
<td>(0.71)</td>
<td>(1.124)</td>
<td>(0.814)</td>
</tr>
<tr>
<td>No. of Obs.</td>
<td>137,253</td>
<td>202,284</td>
<td>265,477</td>
<td>518,939</td>
</tr>
<tr>
<td>$R^2$</td>
<td>0.003</td>
<td>0.002</td>
<td>0.021</td>
<td>0.072</td>
</tr>
<tr>
<td>No. of Items</td>
<td>7,313</td>
<td>8,560</td>
<td>22,046</td>
<td>20,730</td>
</tr>
</tbody>
</table>

*** p < 0.01, ** p < 0.05, * p < 0.1
More

Graphical Results

Figure: Employment in Chittenden County, Vermont