Perceptions of Ad-Valorem Consumption Taxes

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There are many instances when consumer prices are quoted without a mandatory ad-valorem (VAT or sales) tax.
Motivation (1)

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1. hidden consumption taxes may be preferable to the explicit ones because they generate a lower deadweight loss.
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- There is some empirical evidence (Chetty et al. 2009) that consumers tend to (at least partially) ignore such taxes.
- If this is really so, there are fundamental implications for tax design:
  1. hidden consumption taxes may be preferable to the explicit ones because they generate a lower deadweight loss.
  2. the mix of various taxes should move toward hidden consumption taxes.
  3. in terms of the revenue-efficiency trade-off, it may be optimal to increase small hidden consumption taxes.
Excluding a consumption tax from the quoted price is a special case of "price partitioning" (Morwitz et al. 2009). Under this practice, the overall price for the product is divided into:

1. base price, charged for the product itself,
2. mandatory (and often hidden, or "shrouded") surcharge(s) for services, fees, or taxes associated with purchasing or using the product.

Overall, the marketing literature (Morwitz et al. 2009) concludes that for relatively small surcharges (10 to 20 percent of the base price), price partitioning leads to higher demand/lower price recall compared to all-inclusive pricing. For higher surcharges, however, price partitioning might have no effect or even the opposite effect (Sheng et al. 2007).
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1. Scarce cognitive effort; it may be optimal to entirely ignore the tax

2. Separate mental accounts of the base price and the surcharges; they are treated as separate attributes of the product; finite MRS

3. Special cases proposed in the literature: “anchoring and adjustment” heuristic (Morwitz et al. 1998) low salience of hidden taxes (Chetty et al. 2009)

4. Consumers are not aware of the tax or its rate (Chetty et al. 2009) provide evidence to the contrary, however.
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Chetty et al. (2009):

- Tax rate of 8 percent; What happens for higher tax rates?
- Set of goods relatively homogeneous in terms of pre-tax prices (personal care products, alcoholic beverages). What happens if consumers face a broader domain of goods?
- What does the treatment effect from the field experiment identify? A long-run response, a short-run response, or consumer confusion upon seeing a tax-inclusive price sticker?
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- How important are the welfare consequences?
In a controlled laboratory environment, with subjects that are used to seeing prices quoted both with and without a consumption tax, with full incentivization, do the results of Chetty et al. (2009) extend to various ad-valorem tax rates (ranging from 5 to 23 percent)?
Research Questions

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- How do consumers allocate their cognitive effort when purchasing goods in several tax rate categories and face purchase tasks with different amounts of available consumer surplus?
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- How do consumers allocate their cognitive effort when purchasing goods in several tax rate categories and face purchase tasks with different amounts of available consumer surplus?

- If consumers estimate the after-tax price incorrectly, what are the resulting welfare consequences?
Experimental Design (1)

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- In each purchase task:
  - a subject is given his downward-sloping induced demand schedule, the pre-tax price and the ad-valorem consumption tax rate
  - decides on the quantity $q \in \{0, \ldots, 10\}$ of the good to buy; the default quantity is 0; the purchase quantity identifies a range for the effective after-tax price, and hence also the tax rate, used by the subject
  - In each round, a subject is given 120 seconds to make his decisions on 6 purchase tasks. He is paid a bonus of 1 experimental currency unit (ECU) for each second of saved time if he finishes earlier.
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- Among the 3 tasks, there is:
  1. a low-surplus task with an achievable consumer surplus of 15
  2. a medium-surplus task with an achievable consumer surplus of 60
  3. a high-surplus task with an achievable consumer surplus of 150
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  3. a high-surplus task with an achievable consumer surplus of 150

- Treatments and the number of subjects in each treatment:

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<th>23</th>
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The tax rates for the next several rounds will be 6.6 and 23.0 percent. You will be informed of the tax rate applied to each purchase.
### Experimental Design: Task Selection Menu (1)

#### Round 1

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#### Task rate 6.5%

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#### Task rate 25.5%

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#### Continue to Task 2

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**Experimental Design: Task**

### Purchase Task #1 (Round 1)

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**Per unit price of the good: 184.87**

**Tax rate on the good: 5.5 percent**

Please make your quantity selection by clicking the appropriate quantity button.
### Experimental Design: Task Selection Menu (2)

#### Round 1

<table>
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#### Round 2

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<tr>
<th>Tax Rate: 23.5%</th>
<th>Quantity</th>
<th>Marginal Valuation</th>
<th>Cumulative Valuation</th>
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*Stop Deciding Now ( Irreversible)*
**Experimental Design: Round Feedback**

<table>
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<tr>
<th>Task</th>
<th>Quantity choice</th>
<th>Net price</th>
<th>Tax-inclusive price</th>
<th>Payment</th>
<th>Gross surplus</th>
<th>Net surplus</th>
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<td>181.00</td>
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<td>90.62</td>
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<td><strong>TOTAL</strong></td>
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<td>1322.23</td>
<td>1847.37</td>
<td>603.85</td>
<td>603.85</td>
<td>447.74</td>
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Time bonus: 13
Total net earnings for the round: 603.85
Experimental Design (3)

- A subject first goes through 8 rounds of tasks at his/her assigned pair of low and high tax rates (base block).
Experimental Design (3)

- A subject first goes through 8 rounds of tasks at his/her assigned pair of low and high tax rates (base block).
- This is followed by four blocks of rounds (in a randomized order) in which one of the two tax rates is changed to a round number:
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This is followed by four blocks of rounds (in a randomized order) in which one of the two tax rates is changed to a round number:

1. the low tax rate changed to 0%, the high tax rate unchanged
2. the low tax rate changed to 10%, the high tax rate unchanged
3. the low tax rate unchanged, the high tax rate changed to 10% (20%)
4. the low tax rate unchanged, the high tax rate changed to 20% (25%)

In all other aspects (purchase tasks, pre-tax prices), a round in one of these blocks is identical to a round in the base block (except that the ordering of purchase tasks is re-randomized within each tax rate to prevent memory effects).

The objective is to evaluate the change in consumer surplus, tax revenue and welfare from such tax rate change.
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EXTERNAL VALIDITY OF THE EXPERIMENTAL TASK

Tax Rate = 0%

Percentile vs. Tax Rate
Idea: we want to focus only on the additional price misperception introduced by hidden ad-valorem taxes, we want to control for “baseline” price misperception.
Selection of Subjects

- Idea: we want to focus only on the additional price misperception introduced by hidden ad-valorem taxes, we want to control for “baseline” price misperception.

- Out of 95 subjects, there are 41 subjects that always buy the optimal quantity when the tax rate $= 0\%$. 

There are additional 19 subjects for whom the correlation between actual and optimal quantity when the tax rate $= 0\%$ is over 0.9 and the average deviation from the optimal quantity is less than 1. In what follows, we only use data from the 41 subjects. Selection pattern: men and econ majors are more likely to be among the 41 subjects.
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Effective Tax Rates For Low Nominal Rates

Low Tax Rates

Tax Rate = 5%

Tax Rate = 6.5%

Tax Rate = 8%

Tax Rate = 10%
Effective Tax Rates for High Nominal Rates

High Tax Rates

- Tax Rate = 14%
- Tax Rate = 16%
- Tax Rate = 20%
- Tax Rate = 23%

Percentile vs. Tax Rate plots for different tax rates.
For round tax rates (5%, 10%, 20%), subjects correctly impute the tax in more than 70 percent of cases.
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Among the remaining cases, underestimation of the tax rate is slightly more prevalent than overestimation.
Observations

- For round tax rates (5%, 10%, 20%), subjects correctly impute the tax in more than 70 percent of cases.

- Among the remaining cases, underestimation of the tax rate is slightly more prevalent than overestimation.

- For non-round tax rates (6.5%, 8%, 14%, 16%), subjects correctly impute the tax in about 50 to 65 percent of cases.
For round tax rates (5%, 10%, 20%), subjects correctly impute the tax in more than 70 percent of cases.

Among the remaining cases, underestimation of the tax rate is slightly more prevalent than overestimation.

For non-round tax rates (6.5%, 8%, 14%, 16%), subjects correctly impute the tax in about 50 to 65 percent of cases.

Again, among the remaining cases, underestimation of the tax rate is more prevalent than overestimation.
Within subject, we difference consumer surplus, tax revenue and overall welfare (sum of the two) when one of the two tax rates is changed to a round number (0%, 10%, 20%, 25%).
## Going from 8% to 10% Tax Rate

<table>
<thead>
<tr>
<th></th>
<th>Consumer surplus</th>
<th>Tax revenue</th>
<th>Overall welfare</th>
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<tbody>
<tr>
<td>Absolute change</td>
<td>-21.7 (3.33)***</td>
<td>8.49 (2.84)***</td>
<td>-13.21 (4.51)***</td>
</tr>
<tr>
<td>Change relative to theory</td>
<td>1.91 (3.44)***</td>
<td>11.0 (2.46)***</td>
<td>12.9 (4.20)***</td>
</tr>
</tbody>
</table>
Welfare Analysis (2)

- We obtain qualitatively similar results for tax shifts.
Welfare Analysis (2)

- We obtain qualitatively similar results for tax shifts
  - from 16% to 20%

Message: because of potential “nearby” upward rounding of non-round tax rates by consumers, the overall welfare may be improved by increasing the tax rate to a “nearby higher round number.” Results for other tax shifts are more in line with traditional theory.
Welfare Analysis (2)

- We obtain qualitatively similar results for tax shifts
  - from 16% to 20%
  - from 23% to 25%

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- from 16% to 20%
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- We obtain qualitatively similar results for tax shifts
  - from 16% to 20%
  - from 23% to 25%

- Message: because of potential “nearby” upward rounding of non-round tax rates by consumers, the overall welfare may be improved by increasing the tax rate to a “nearby higher round number.”

- Results for other tax shifts are more in line with traditional theory.
Subjects who only make optimal purchasing decisions under the zero tax rate sometimes incorrectly impute non-zero tax rates.
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This finding is less prevalent (30 percent of purchasing decisions or less) under round tax rates (5%, 10%, 20%), and more prevalent (up to 45 percent of purchasing decisions) under non-round tax rates (6.5%, 8%, 14%, 16%).
Conclusion

Subjects who only make optimal purchasing decisions under the zero tax rate sometimes incorrectly impute non-zero tax rates.

This finding is less prevalent (30 percent of purchasing decisions or less) under round tax rates (5%, 10%, 20%), and more prevalent (up to 45 percent of purchasing decisions) under non-round tax rates (6.5%, 8%, 14%, 16%).

In case a tax rate is “nearby” a “higher round” number, welfare losses from the potential tax increase are smaller than suggested by traditional theory. This suggests that many subjects may already be using the higher tax rate in their imputations and so it may be desirable from a policy perspective to increase the tax rate to the round number.