

# Gasoline Taxes and Consumer Behavior

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# Overview

Central question: Do consumers respond differently to tax component of gasoline prices than to non-tax components?

Measured responses:

- Gas consumption (state level)
- VMT (state and household level)
- MPG of purchased autos (household level)
- Market share of purchased autos (MSA level)

Main result: consumers appear considerably more responsive to tax movements than changes in tax-exclusive prices, except in VMT

Authors' proposed explanation: consumers perceive tax changes as more persistent than changes in tax-exclusive prices

## *Summary of Discussion*

Paper uncovers a very interesting empirical pattern in asymmetric response to price components

- Probably robust, but a few concerns remain

I'm more skeptical about the offered interpretation of the result

- Though I cannot offer an obvious alternative

## *Comment: State-Level Panel Regressions*

State-level data on just about everything is nonstationary—run everything controlling for trends (or first-difference)

- State FEs won't fix this (that's why OLS estimates are so large)
- AR(1) specifications probably won't fix this
- Authors do first difference in auxiliary monthly specification

## *Comment: Demand Estimation Particulars*

Empirical exercises are all forms of demand estimation

Faces classic problem: prices are not exogenous

- Observed P-Q covariance not just along demand curve, but also reflects shifts in it

First: Are taxes exogenous?

Second (and probably more important): standard price endogeneity problem is especially dangerous for the key result

- Prices rise when demand shifts out, imparting positive bias to demand elasticity estimates (i.e., tending to make them too small in magnitude)
- If tax-exclusive prices are more responsive to demand shifts than taxes, response to tax-exclusive price will be underestimated
- Authors aware of general problem, but this is so key, I think all reported specifications should be IV

## *Comment: Demand Estimation Particulars, Ctd.*

Authors' solution: use crude oil price as IV for tax-exclusive gas price

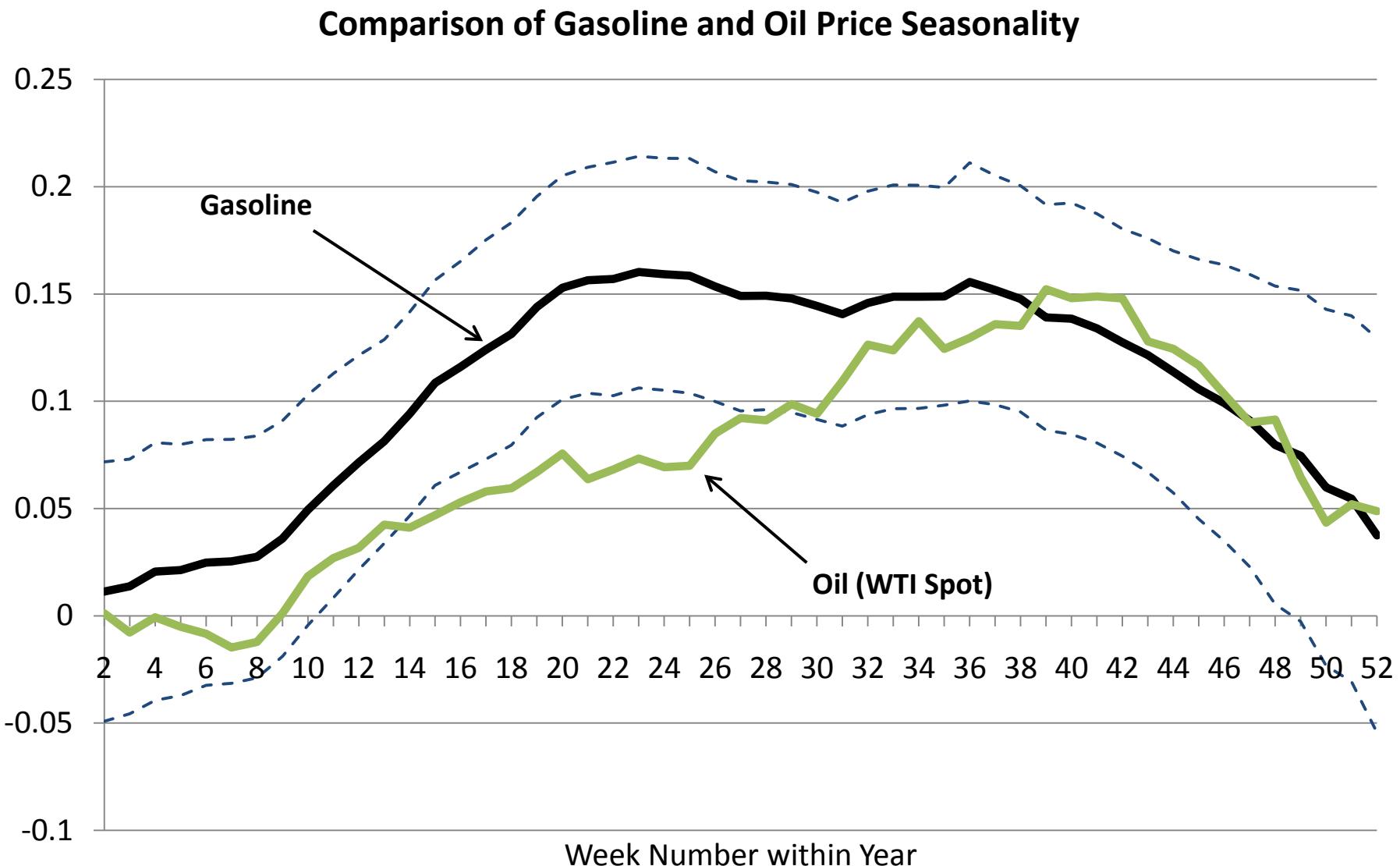
- This is a classic approach...instrument for price using supply-side shifters (input price here) to obtain price movements that are orthogonal to demand shifts
- But...supply of inputs needs to be perfectly elastic to price setter's factor demand
- Otherwise, demand shift for good of interest (gasoline here) drives up price of both the good *and* the input (crude oil here)
  - I.e., increases in oil price may reflect shifts in gas demand rather than shifts in supply

## *Comment: Demand Estimation Particulars, Ctd.*

Is it plausible that this instrument is itself endogenous?

- Input-output tables—crude oil-to-refining one of heaviest vertical connections between industries
- IV should have one of three theoretical effects
  1. OLS is already unbiased—no change in coefficient
  2. OLS was positively biased, IV solves problem—coefficient becomes more negative
  3. Price was measured with error, IV solves this problem—coefficient becomes more negative (moves away from zero)
    - But actual effect on estimate was to make coefficient more positive
- Both gasoline and crude oil prices follow seasonal pattern (see below)
  - Not a direct problem here (annual variation), but suggests gas demand movements can shift oil prices, in at least one dimension

## *Comment: Demand Estimation Particulars, Ctd.*



## *Comment: Interpretation of Result*

Is the differential response driven by consumers' beliefs about relative persistence of gas tax changes vs. tax-exclusive price changes?

### 1. What do consumers know about gas taxes?

- While tax-inclusive prices might be one of the most followed prices by consumers, taxes are rarely broken out
- In a 2009 poll of 800 adults (by Building America's Future, Public Opinion Strategies, and Greenberg Quinlan Rosner Research):
  - 60% of respondents believe the federal gas tax is raised annually
    - Similar responses from Republicans and Democrats
    - Similar responses across geographic regions
  - (Federal gas tax hasn't changed since 1993)

## *Comment: Interpretation of Result, Ctd.*

2. Do the two time series actually exhibit differential persistence?

- Paper does not present formal tests
- Does mention that state-level data for both have unit roots, so if anything, persistence appears similar

## *Comment: Interpretation of Result, Ctd.*

3. What does behavioral response imply about consumers' perceptions?

- Suppose all of differential response a result of differential persistence
- PDV of fully persistent 1¢ tax increase ( $\beta$  = discount factor):  $1/(1 - \beta)$ ,
- PDV of 1¢ tax-exclusive price increase with AR(1) coeff.  $\rho$ :  $1/(1 - \beta\rho)$
- Ratio of tax to tax-exclusive responses:  $\frac{1-\beta\rho}{1-\beta}$
- Difference in tax and tax-exclusive responses:  $\frac{\beta(1-\rho)}{(1-\beta)(1-\beta\rho)}$
- Both of these can be matched to behavioral estimates and guesses or estimates of  $\beta$  to compute implied  $\rho$

## *Comment: Interpretation of Result, Ctd.*

### 3. Behavioral response and consumers' perceptions, ctd.

- Table 2: Ratio of tax to tax-exclusive responses  $\approx 3$
- Table 2: Difference between tax and tax-exclusive responses  $\approx 0.2$
- Table 14: Implied  $\beta \approx 0.2$
- Implied  $\rho$  from ratio formula  $\frac{1-\beta\rho}{1-\beta} \rightarrow$  no solution in  $[0,1]$
- Implied  $\rho$  from difference formula  $\frac{\beta(1-\rho)}{(1-\beta)(1-\beta\rho)} \rightarrow \rho = 0.24$
- As  $\beta$  grows, so does implied  $\rho$ 
  - For  $\beta \approx 0.9$ , implied  $\rho = 0.78$  from ratio and  $\rho = 0.99$  from difference