Pyramiding, Productive Efficiency, and Revenue under a Gross Receipts Tax

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Outline

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Gross receipts tax

- A gross receipts tax (GRT) is a tax on the gross receipts (total revenue) of firms
- Also known as a turnover tax
- Equivalent to a tax on sales to other firms (intermediate goods) or consumers (final goods)

Retail sales tax (RST), in principle, only taxes sales to consumers (final goods)
History of Gross Receipts Taxes

1200s: First gross receipts taxes in Europe

1800s: Pennsylvania, Virginia, Connecticut, and Delaware implement small gross receipts taxes

1921s: West Virginia is first state to implement a fiscally significant gross receipts tax

1960-1980: European countries replace gross receipts taxes with national value added taxes
Statutory Gross Receipt Taxes in 2002-2007
Tax Pyramiding

Tax pyramiding is the taxation of a good multiple times as it moves through the supply chain before finally reaching consumers. Also known as tax cascading.

Caused by taxation of intermediate goods:
- Gross receipts tax: if no deduction for intermediate good purchases
- Sales tax: if taxes sales of intermediate goods
Pyramiding Example

Effect of a 10% GRT on the price of a good initially costing $1

Perfectly competitive market

Supply Chain with No Pyramiding:

\[
\text{Firm 1} \rightarrow \text{Consumer}
\]

Price: $1.10

Tax increases price of first good by 10%

Supply Chain with Pyramiding:

Firm value added equals 0 for simplicity

\[
\text{Firm 2} \rightarrow \text{Firm 3} \rightarrow \text{Consumer}
\]

Price: $1.10 $1.21

Tax increases price of second good by 21% when statutory rate is only 10%
Pyramiding Consequences I

Literature is very negative towards GRT because of problems caused by tax pyramiding

Arbitrary Rates

- As seen in example
- Higher effective rates for goods with high value added early in production and many firms in supply chain
- Rates are not based on economic criteria such as firms’ ability to pay
Pyramiding Consequences II

Productive Inefficiency
- Diamond and Mirrlees (1971)
- Taxes on intermediate goods are inefficient
- The tax on intermediate goods is still reflected in the price of final goods
- Firms substitute away from more heavily taxed intermediate goods to more lightly taxed goods
- This substitution minimized the post-tax cost of inputs, not the pre-tax cost of inputs

Transparency
- Consumers do not know how much tax will pyramid and thus how much prices will be increased
Previous Work

Little quantitative analysis

New Mexico GRT
- del Valle (2005)
  - 5% statutory rate. 6.35% effective rate
  - 27% increase in tax due to pyramiding

Washington GRT
  - 0.6% statutory rate. 1.5% effective rate
  - 150% increase in tax due to pyramiding
Limitations of Previous Work

Do not account for productive inefficiency
- Producer substitution is not allowed
- Productive inefficiency is zero by assumption

External validity
- Tax features and economy parameters are state specific

Modeling issues
- Consumer substitution
- Labor supply

Compare GRT to no tax state instead of an alternative method of raising the tax revenue such as a sales tax
Our Contribution

Compare efficiency of GRT to retail sales tax

Model Features
- Allow for producer substitution to include technical inefficiency
- Allow for consumer substitution
- Model labor supply

Parameter Features
- Estimate using data from many years instead of calibrating to a specific year
- National data
Overall Methodology I

Create general equilibrium model of representative US state economy

Production:

- 21 industries, one for each 2-digit NAICS sector
- All industries perfectly competitive
- Each industry has a cost function for producing output using capital, labor, and the outputs of the 21 industries as inputs
- Labor supply is fixed but capital is mobile
- Imports and exports held constant
Consumers:
- Expenditure function for one representative consumer
- Consumers receive income from labor and capital

Calculate the effect of replacing an existing sales tax with a gross receipts tax

- Use a 1% GRT and a revenue neutral sales tax
- Sales tax applies to all final good sales to consumers
- Gross receipts tax applies to all revenue of all firms
Methodology

Share Equation

Standard translog cost and expenditure functions

Share of industry $x$ costs spent on input $i$:

\[ s_i = \sum_{j=1}^{N} \beta_{ij}^{\text{substitution}} \ln(p_j) + \beta_{i}^{\text{shareyear}} t + \beta_{i}^{\text{shareconstant}} \]  

(1)

$N$ is the total number of inputs, $t$ is the year, and $p_j$ is the price of input $j$ to industry $x$

Share spent on input $i$ depends on price of all inputs, substitutability of those inputs and $i$, the year, and a constant term
Log cost function for industry x output:

\[
\ln(c_x) = \frac{1}{2} \sum_{i=1}^{N} \sum_{j=1}^{N} \beta_{ij} \ln(p_i) \ln(p_j) + \sum_{i=1}^{N} \beta_{i}^{\text{shareyear}} \ln(p_i) t + \\
\sum_{i=1}^{N} \beta_{i}^{\text{shareconstant}} \ln(p_i) + \beta_{x}^{\text{costyear}} t + \beta_{x}^{\text{costconstant}}
\]

(2)

\(N\) is the total number of inputs, \(t\) is the year, \(p_i\) is the price of input \(i\), and variables \(i\) and \(j\) index inputs.

Then add taxes to get final price of output.

For GRT: \(p_x = 1.01 c_x\)
Parameter Estimation

Data Sources:
- 1997 Economic Census Bridge between NAICS and SIC
- BEA Tables of the Use of Commodities by Industries 1997-2010
- BEA Gross Output Price Index 1987-2010

Regressions run using iterated 3-stage least squares
Overall Results

Revenue neutral sales tax rate is 1.78%

Impact of the GRT is negative
- Increases average prices by 0.50%
- Decrease in average quantity demanded of 1.29%
- Increases excess burden by 6.0% of revenue

Large variation in price and demand changes by sector
Increase in Prices

- Finance and Insurance: 0.027
- Management: 0.06
- Real Estate: 0.23
- Average: 0.5
- Transportation: 0.83
- Manufacturing: 0.95
- Construction: 0.98
Increase in Prices and Intermediate Inputs
Decrease in Demand

Results

- Real Estate: 0.12
- Educational Services: 0.31
- Retail Trade: 0.4
- Average: 1.3
- Mining - Except Oil and Gas: 2.2
- Waste Disposal: 2.6
- Agriculture: 2.6

Percent

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### Sensitivity of Revenue Estimates

<table>
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<tr>
<th>Specification</th>
<th>Baseline</th>
<th>1</th>
<th>2</th>
<th>3</th>
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<tbody>
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<td>yes</td>
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</tr>
<tr>
<td>Consumer Substitution</td>
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<td>yes</td>
<td>no</td>
<td>no</td>
</tr>
<tr>
<td>Price of Labor Constant</td>
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<tr>
<td>Quantity of Labor Constant</td>
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<td>no</td>
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<tr>
<td>Increase in GRT Revenue (%)</td>
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<td>0</td>
<td>3.5</td>
<td>4.5</td>
</tr>
</tbody>
</table>

Modeling labor supply has a negligible effect on revenue.

Not allowing for substitution leads to higher revenue estimates.
Summary

Efficiency problems of gross receipts taxes are significant
Higher prices, higher excess burden, lower demand, lower utility

Future Work
- Interstate trade
- Less efficient retail sales tax
Thank You
Tier Structure of Production
Increase in Price by Sector, All Sectors

- Mining Support: 0.52
- Mining - Except Oil and Gas: 0.71
- Mining - Oil and Gas: 0.34
- Other Services: 0.4
- Accommodation and Food Services: 0.43
- Arts, Entertainment, and Recreation: 0.4
- Health Care and Social Assistance: 0.33
- Educational Services: 0.34
- Waste Disposal: 0.52
- Management: 0.06
- Technical Services: 0.39
- Real Estate: 0.23
- Finance and Insurance: 0.027
- Information: 0.47
- Transportation: 0.83
- Retail Trade: 0.54
- Wholesale Trade: 0.52
- Manufacturing: 0.95
- Construction: 0.98
- Utilities: 0.69
- Agriculture: 0.82

Percent Range: 0.0 to 1.0
Decrease in Demand and Intermediate Inputs

- Waste Disposal
- Agriculture
- Mining - Except Oil and Gas
- Mining - Oil and Gas
- Manufacturing
- Transportation
- Technical Services
- Information
- Wholesale Trade
- Management
- Accommodation and Food Services
- Health Care and Social Assistance
- Retail Trade
- Education Services
- Real Estate
- Finance and Insurance
- Arts, Entertainment, and Recreation
- Other Services
- Mining Support
- Construction
- Utilities

Gross Receipts Taxes
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Decrease in Demand and Price

- Waste Disposal
- Agriculture
- Mining - Except Oil and Gas
- Mining - Oil and Gas
- Manufacturing
- Transportation
- Technical Services
- Information
- Mining Support
- Wholesale Trade
- Utilities
- Arts, Entertainment, and Recreation
- Health Care and Social Assistance
- Accommodation and Food Services
- Other Services
- Retail Trade
- Educational Services
- Real Estate