Taxes and Efficiency Losses

\[ EL = \tau^2 \]

Taxes Cause Efficiency Losses

- Your benefits from widgets
  - $30 benefits on first
  - $25 on second
- My cost is $15

We will agree to build both. Your benefits are $55 and my costs are $30.

How we split the $25 net gain is negotiable.

Now the government imposes a $12 tax on widgets.

We will still build the first one, but not the second.

The consequence is $10 in benefits foregone.

Efficiency Losses

\[ \text{Efficiency Losses} \]

\[ P_o \quad S \]

\[ Q_o \quad D \]

$1 Tax

\[ \text{Efficiency Losses} \]
The shaded area shows the efficiency loss; the value of mutually advantageous trades forgone by suppliers and customers.

A Theorem
- Efficiency loss is proportional to square of tax rate.
- If a 1% tax costs $100 in EL, a 2% tax costs $400, a 3% tax costs $900, etc.

Can the efficiency loss be avoided?
- In General, No
- There are some special cases.

Can the efficiency loss be avoided?
- In General, No
- Generally, if you want government, you must tax and that means efficiency losses.
- But there are steps you can take to minimize the efficiency loss.
### Broad Taxes vs. Narrow Taxes

<table>
<thead>
<tr>
<th>Tax Rate on Apples</th>
<th>Tax Rate on Bananas</th>
<th>Efficiency Loss from Forgoing Mutually Beneficial Purchases and Sales of Apples</th>
<th>Efficiency Loss from Forgoing Mutually Beneficial Purchases and Sales of Bananas</th>
</tr>
</thead>
<tbody>
<tr>
<td>1%</td>
<td>0%</td>
<td>$100</td>
<td>0</td>
</tr>
<tr>
<td>0%</td>
<td>1%</td>
<td>0</td>
<td>$100</td>
</tr>
</tbody>
</table>

### Taxes and Efficiency Losses

### Some Applications

- Apples or Bananas
- Excise Taxes
- “Sin” Taxes
Some Applications

- Apples or Bananas
- Excise Taxes
- “Sin” Taxes
- The Ohio Lottery

A Qualification

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</tr>
<tr>
<td>0%</td>
<td>1%</td>
<td>0</td>
<td>$50</td>
</tr>
<tr>
<td>2%</td>
<td>0%</td>
<td>$400</td>
<td>0</td>
</tr>
<tr>
<td>0%</td>
<td>2%</td>
<td>0</td>
<td>$200</td>
</tr>
<tr>
<td>1%</td>
<td>1%</td>
<td>$100</td>
<td>$50</td>
</tr>
</tbody>
</table>

\[
\text{EL}_A = \frac{R}{\tau_a} = \frac{R}{0.01} = 100 \\
\text{EL}_B = \frac{R}{\tau_b} = \frac{R}{0.02} = 50 \\
\text{EL}_A = \frac{R}{\tau_a} = \frac{R}{0.01} = 100 \\
\text{EL}_B = \frac{R}{\tau_b} = \frac{R}{0.02} = 50 \\
\]

\[
\tau_B = 1.333\% \\
\tau_A = 0.666\%
\]
Taxes and Efficiency Losses

A Qualification

Tax Rate on Apples

Tax Rate on Bananas

Efficiency Loss from Forgoing Mutually Beneficial Purchases and Sales of Apples

Efficiency Loss from Forgoing Mutually Beneficial Purchases and Sales of Bananas

\[ \frac{\tau_B}{\tau_A} = \frac{R_{\tau_B=1\%} \cdot R_{\tau_A=1\%}}{EL_{\tau_B=1\%} \cdot EL_{\tau_A=1\%}} \]

\[ \begin{array}{c|c|c|c}
\tau_B & \tau_A & R_{\tau_B=1\%} & R_{\tau_A=1\%} \\
\hline
1\% & 0\% & $100 & 0 \\
0\% & 1\% & 0 & $50 \\
2\% & 0\% & $400 & 0 \\
0\% & 2\% & 0 & $200 \\
1\% & 1\% & $100 & $50 \\
1\% & 1\% & $100 & $50 \\
\end{array} \]

\[ \begin{array}{c|c|c|c}
\tau_B & \tau_A & EL_{\tau_B=1\%} & EL_{\tau_A=1\%} \\
\hline
1\% & 0\% & 50 & 100 \\
0\% & 1\% & 50 & 100 \\
2\% & 0\% & 0 & 0 \\
0\% & 2\% & 0 & 0 \\
1\% & 1\% & 0 & 0 \\
1\% & 1\% & 0 & 0 \\
\end{array} \]

\[ \frac{\tau_B}{\tau_A} = \frac{1.333\%}{0.666\%} \]

\[ \frac{1.333\%}{0.666\%} = 2 \]

\[ \begin{array}{c|c|c|c}
\tau_B & \tau_A & R_{\tau_B=1\%} & R_{\tau_A=1\%} \\
\hline
1\% & 0\% & $100 & 0 \\
0\% & 1\% & 0 & $50 \\
2\% & 0\% & $400 & 0 \\
0\% & 2\% & 0 & $200 \\
1\% & 1\% & $100 & $50 \\
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\end{array} \]

\[ \begin{array}{c|c|c|c}
\tau_B & \tau_A & EL_{\tau_B=1\%} & EL_{\tau_A=1\%} \\
\hline
1\% & 0\% & 50 & 100 \\
0\% & 1\% & 50 & 100 \\
2\% & 0\% & 0 & 0 \\
0\% & 2\% & 0 & 0 \\
1\% & 1\% & 0 & 0 \\
1\% & 1\% & 0 & 0 \\
\end{array} \]

Is there a proof?

Yes, but I put it in a separate lecture

End

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