Excess Burden

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A Congressional Request

- Imagine you get a call from Kirsten Gillibrand and Pat Ryan:
  Good news, we've ended global warming, all chance of war, and busted all inefficient monopolies. We just need to pay off the debt, and then we're done here. We're just going to tax one good. What do we pick?
- What do you pick?

Lecture goals: excess burden

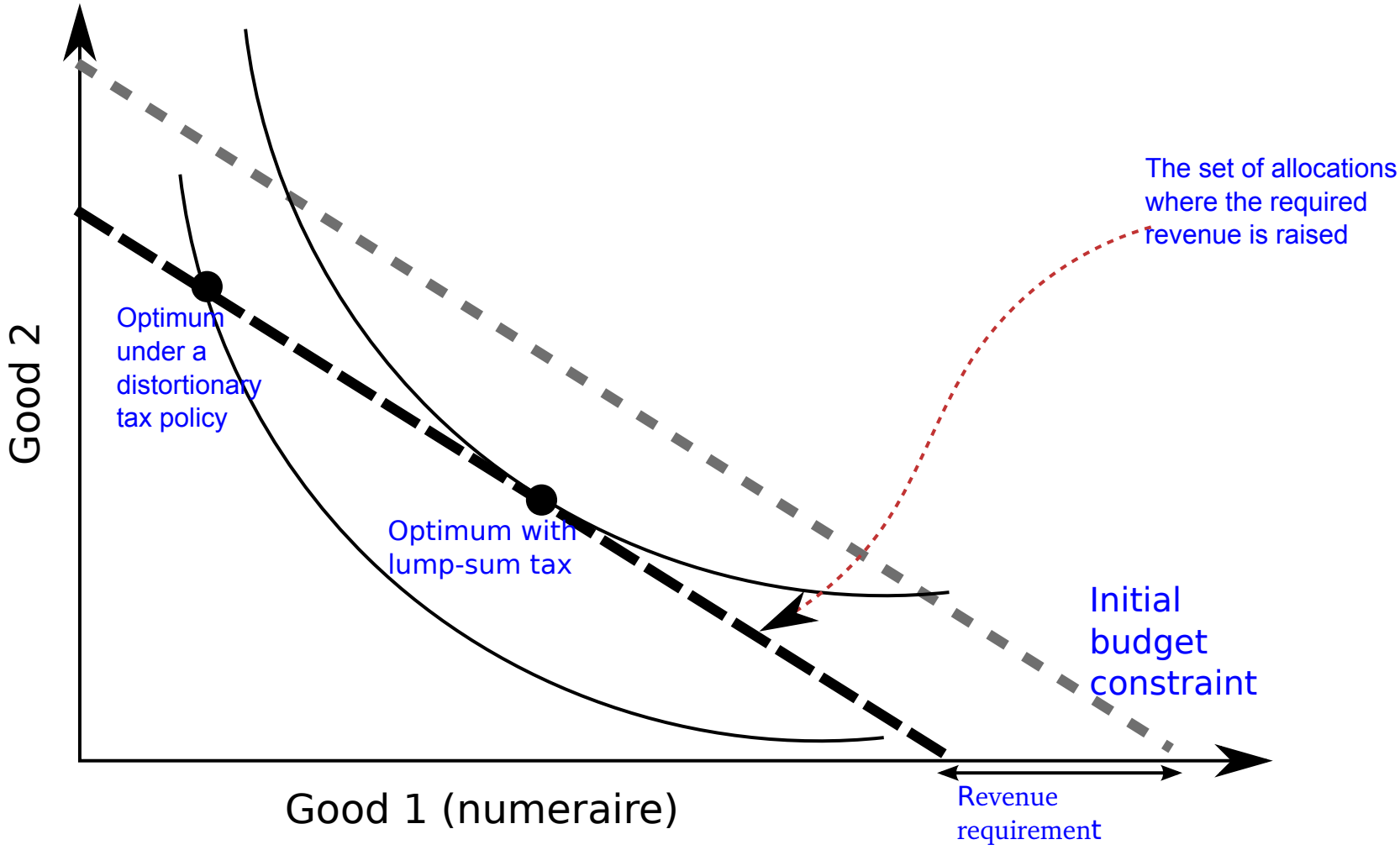
1. Define excess burden of taxation
2. Characterize how taxes create excess burden
3. Provide tools to measure excess burden
4. Contrast excess burden with and without pre-existing taxes

Excess burden of taxation

Deadweight loss: loss of welfare due to deviation from Pareto efficient allocation.
Excess burden: deviation from Pareto efficient allocation due to taxation reducing welfare.

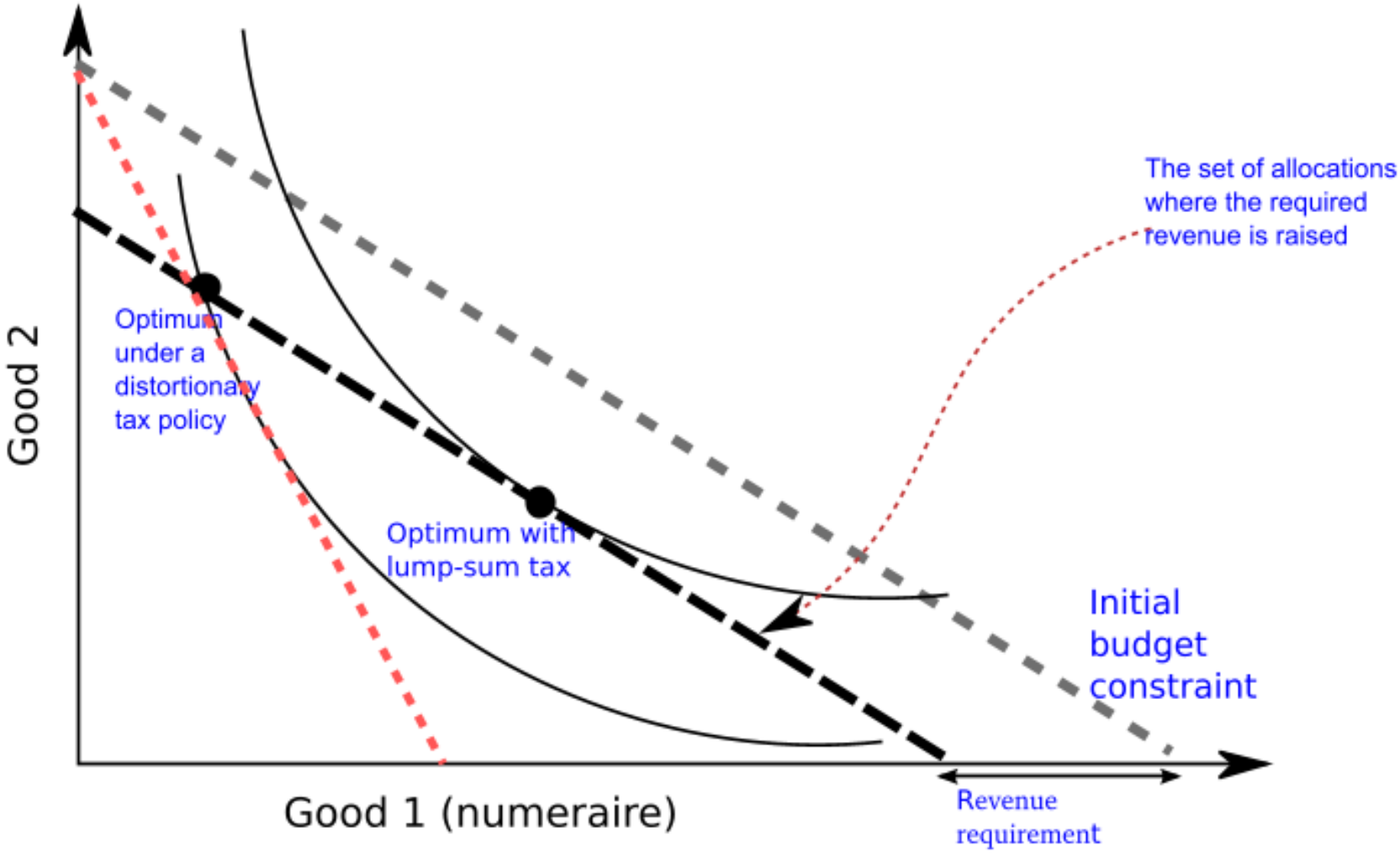
- Recall 2nd welfare theorem: Lump sum redistribution plus trade will achieve any Pareto efficient allocation
- Lump-sum taxation is one (theoretically?) possible way of raising revenue
- Marginal tax rates affect relative prices and skew choices
- Hence, holding revenue constant, welfare is reduced relative to the benchmark of lump-sum taxation (2WT)

Cost of taxation



Dashed constraint is budget frontier that meets revenue requirement

Cost of taxation



Red line shows a distortionary tax on the numeraire, which shifts relative prices

Can lump-sum taxes exist?

- Excess burden of a new tax is always (weakly) positive and depends on how responsive decisions are to the tax
- Uniform lump-sum taxes do not depend on the ability to pay
- Differentiated lump-sum taxation is difficult to implement
- In practice, taxes depend on individual characteristics that can be changed in response to taxation
- Examples:
  - income
  - marital status
  - windows (https://en.wikipedia.org/wiki/Window_tax)
  - floors of house (attics don't count)

Windows? Yes, windows

Figure: What happened to the number of windows? No sunlight for me, no taxes for the Crown.

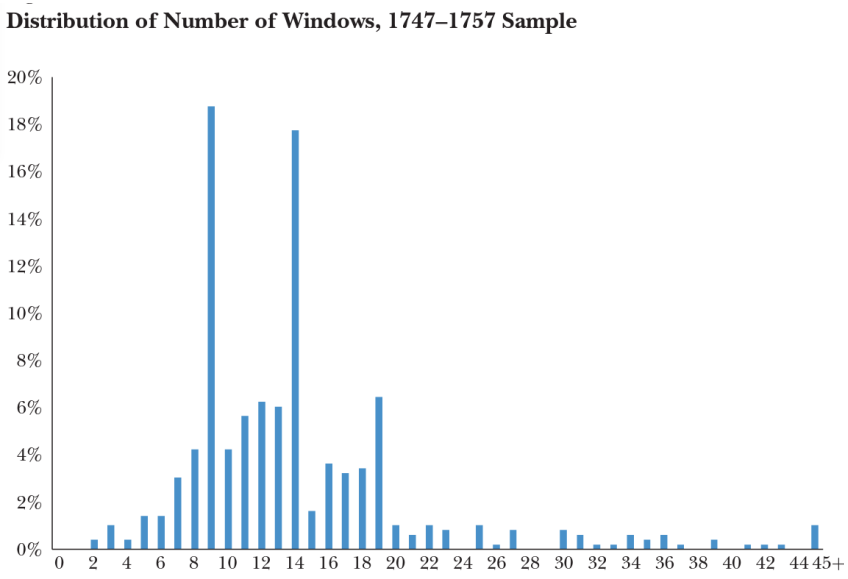
So about that British Window Tax

- The British government imposed a tax on windows in 1696
- Lasted until 1851!

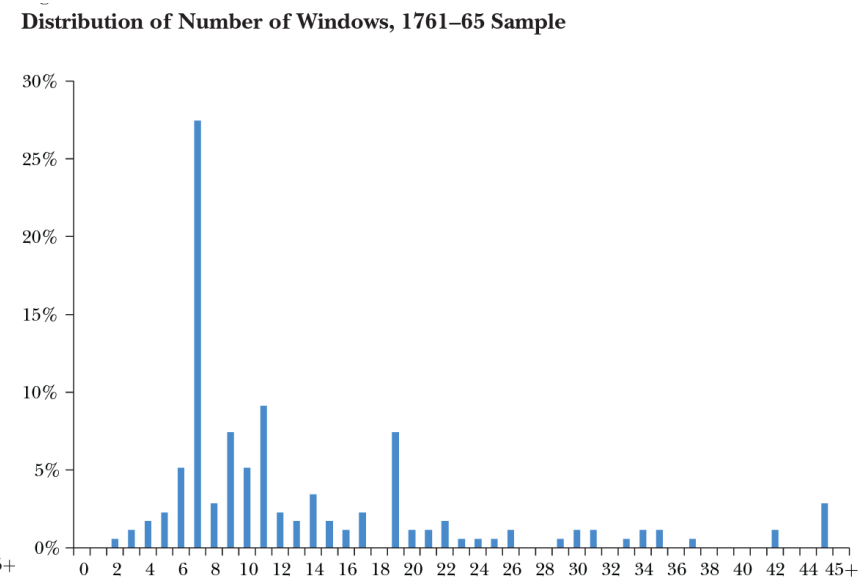
Threshold	1747-1757 tax	1761-1765 tax
< 8 windows	0	0
$8 - 9$ windows	0	1s
$10 - 14$ windows	6p	1s 6p
$15 - 19$ windows	9p	1s 9p
$20+$ windows	1s	2s

Table: Per window tax rates. 12p=1s

Did people really respond to this?



(a) 1747-1757



(b) 1761-1765

Figure: Consequences of window tax in England, 1747-1765. Source: Oates & Schwab JEP (2015)

Consequences?

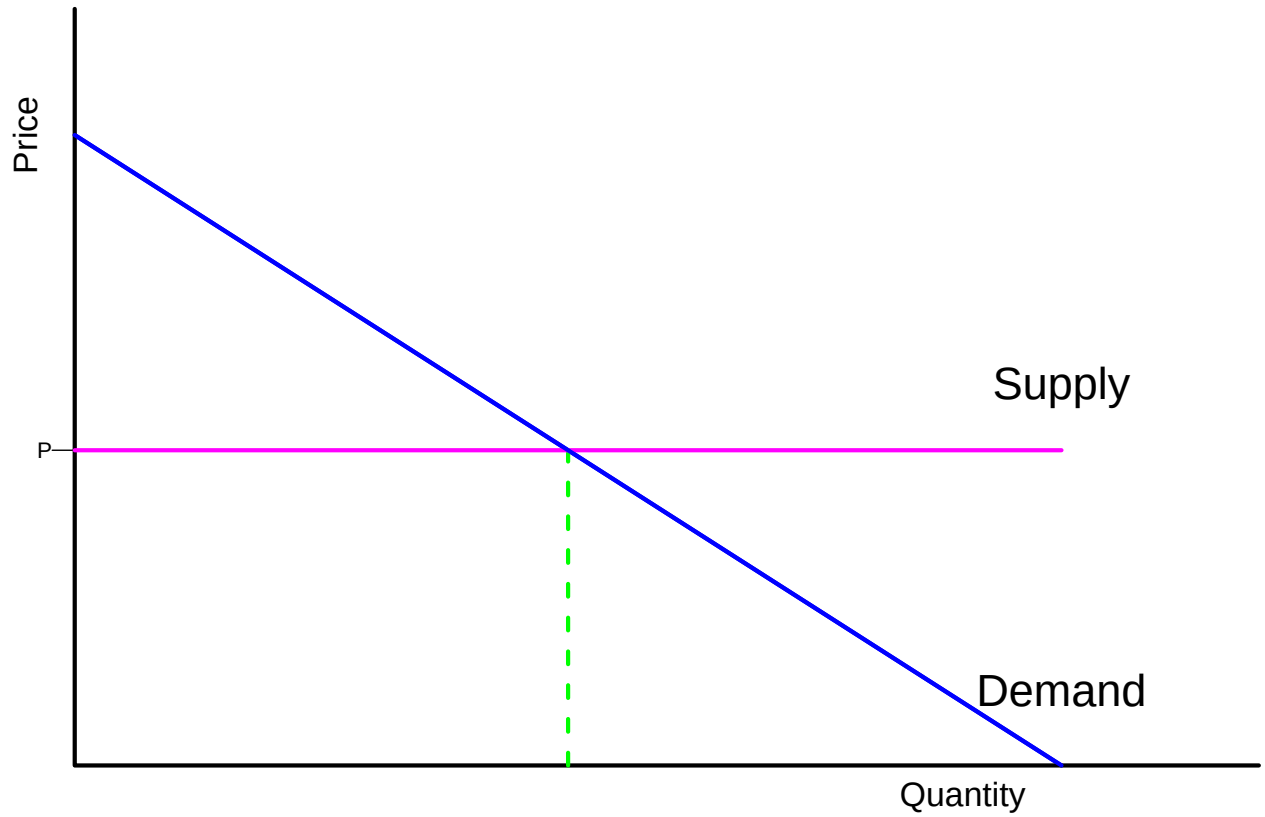
- Houses built with fewer windows
- Spending to block windows in existing houses
- No sunlight in homes
- Disease spread from poor ventilation (dysentery, gangrene, typhus)
- Study in 1848 led to repeal of tax in 1851
- Oates & Schwab (2015) estimate (lower bound) deadweight loss of 13.4% of tax revenues
- Marginal excess burden of \$0.23 per additional tax dollar

Tax distortions

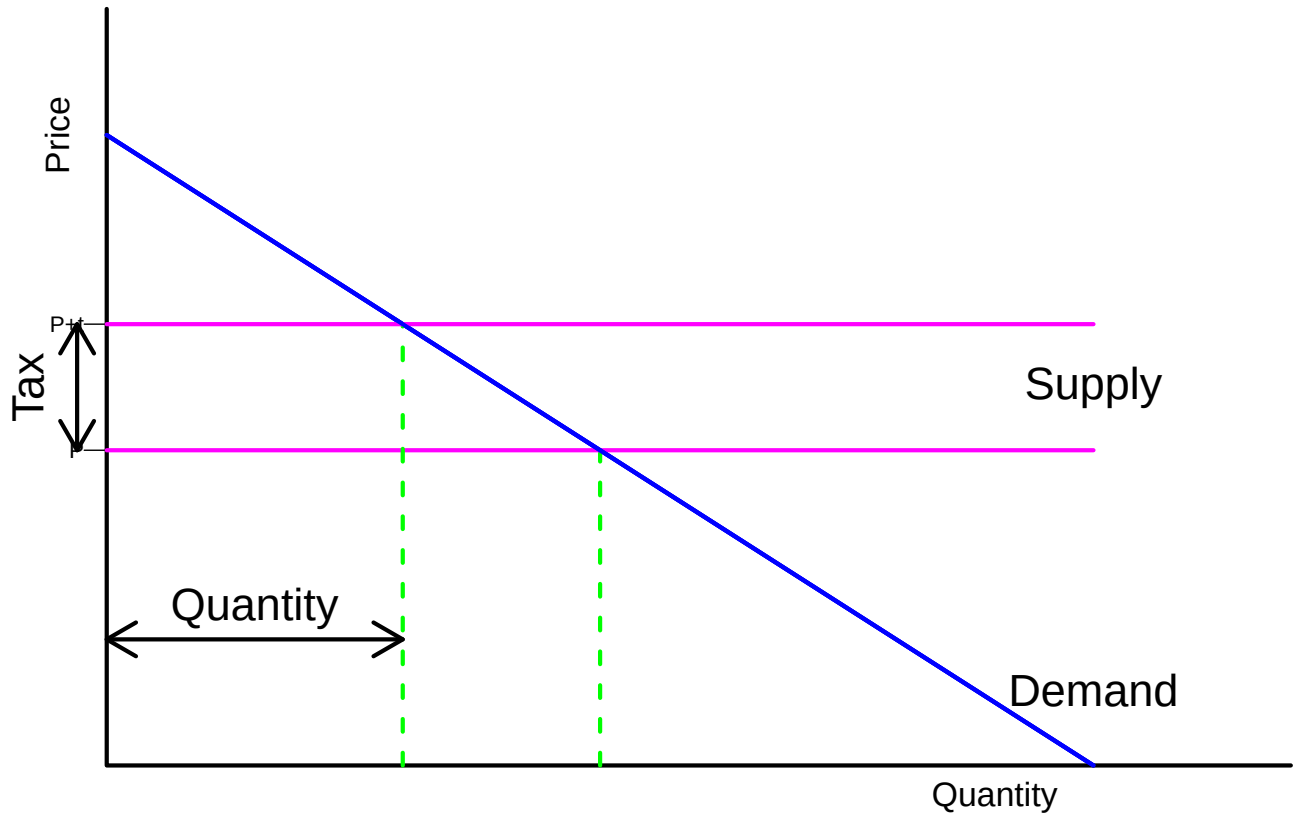
- Excess burden captured by the Harberger triangle
- The more elastic the tax base, the higher the cost of taxation
- In practice, excess burden depends on demand and supply

$$
\begin{aligned}
EB &= -\frac{1}{2}\partial Q \cdot \partial t \quad \{\text{area of Harberger triangle}\} \\
&= -\frac{1}{2} S'(p) \cdot \partial p \cdot \partial t \quad \{\partial Q = S'(p) \cdot \partial p\} \\
&= -\frac{1}{2} \frac{S'(p)p}{S(p)} \cdot \frac{Q}{p} \cdot \partial p \cdot \frac{\partial t}{\partial t} \cdot \partial t \quad \{Q = S(p) \text{ and } \frac{\partial t}{\partial t} = 1\} \\
&= -\frac{1}{2} \cdot \frac{\varepsilon_S \varepsilon_D}{\varepsilon_S - \varepsilon_D} \cdot \frac{Q}{p} \cdot (\partial t)^2 \quad \{\frac{\partial p}{\partial t} = \frac{\varepsilon_D}{\varepsilon_S - \varepsilon_D} \text{by tax incidence!}\}
\end{aligned}
$$

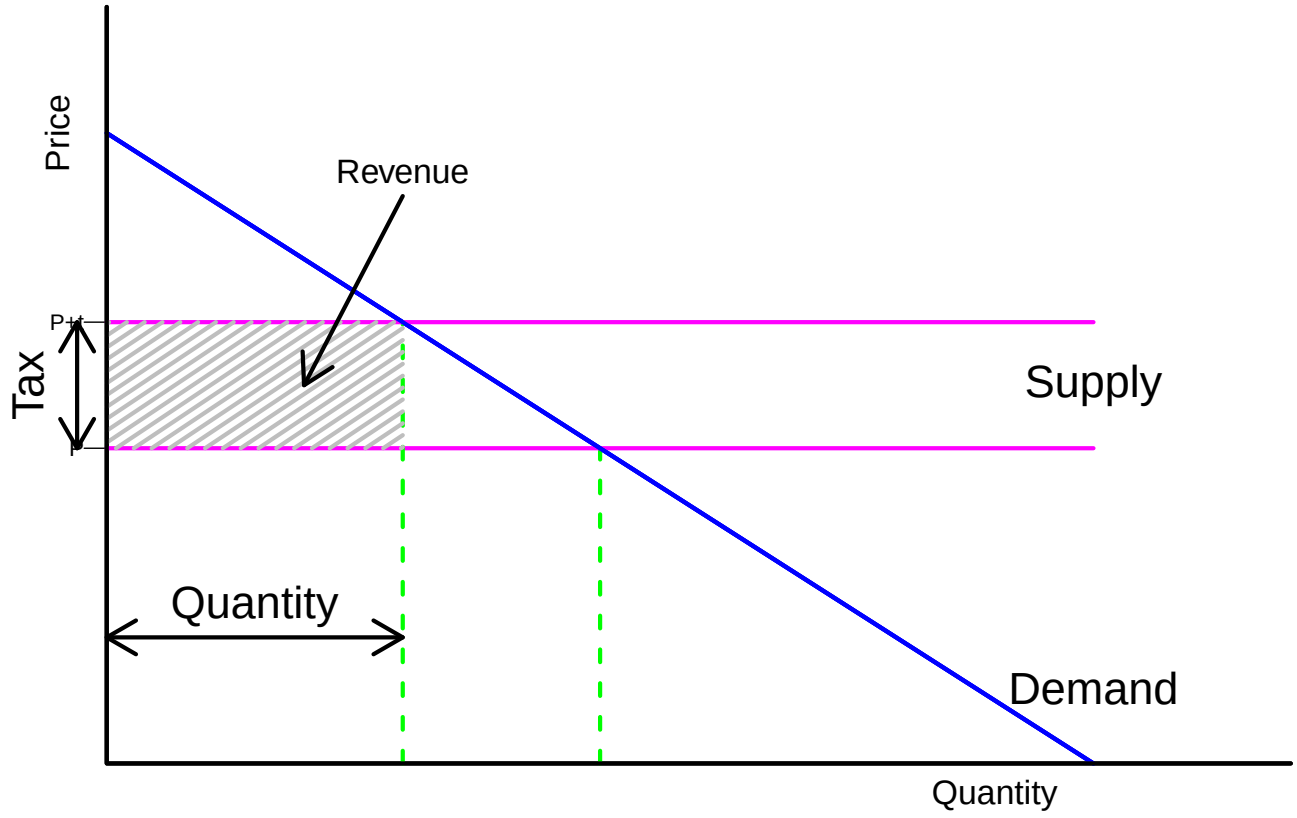
$\Rightarrow$ More efficient to tax inelastic goods



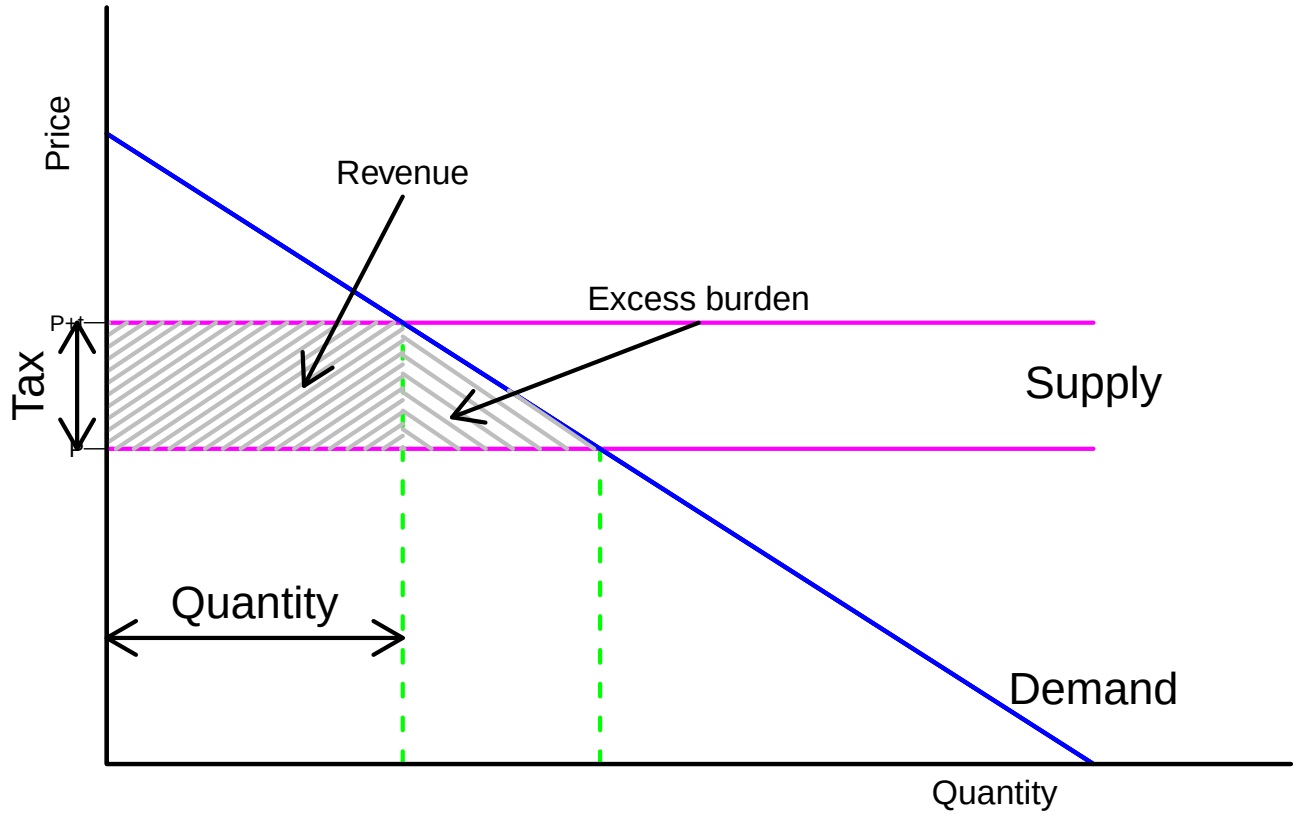
Let's assume a horizontal supply curve (perfectly elastic)



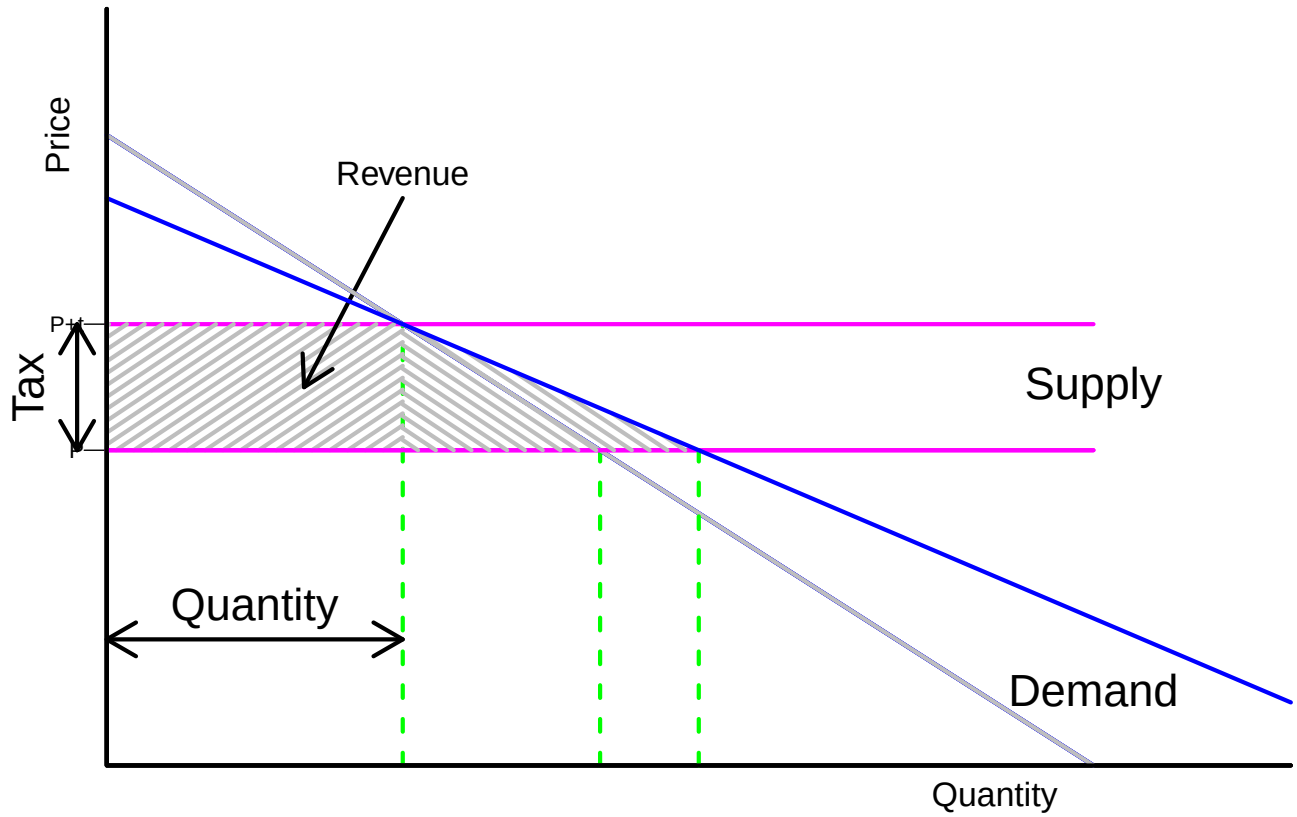
Introduce a tax – where is the tax revenue?



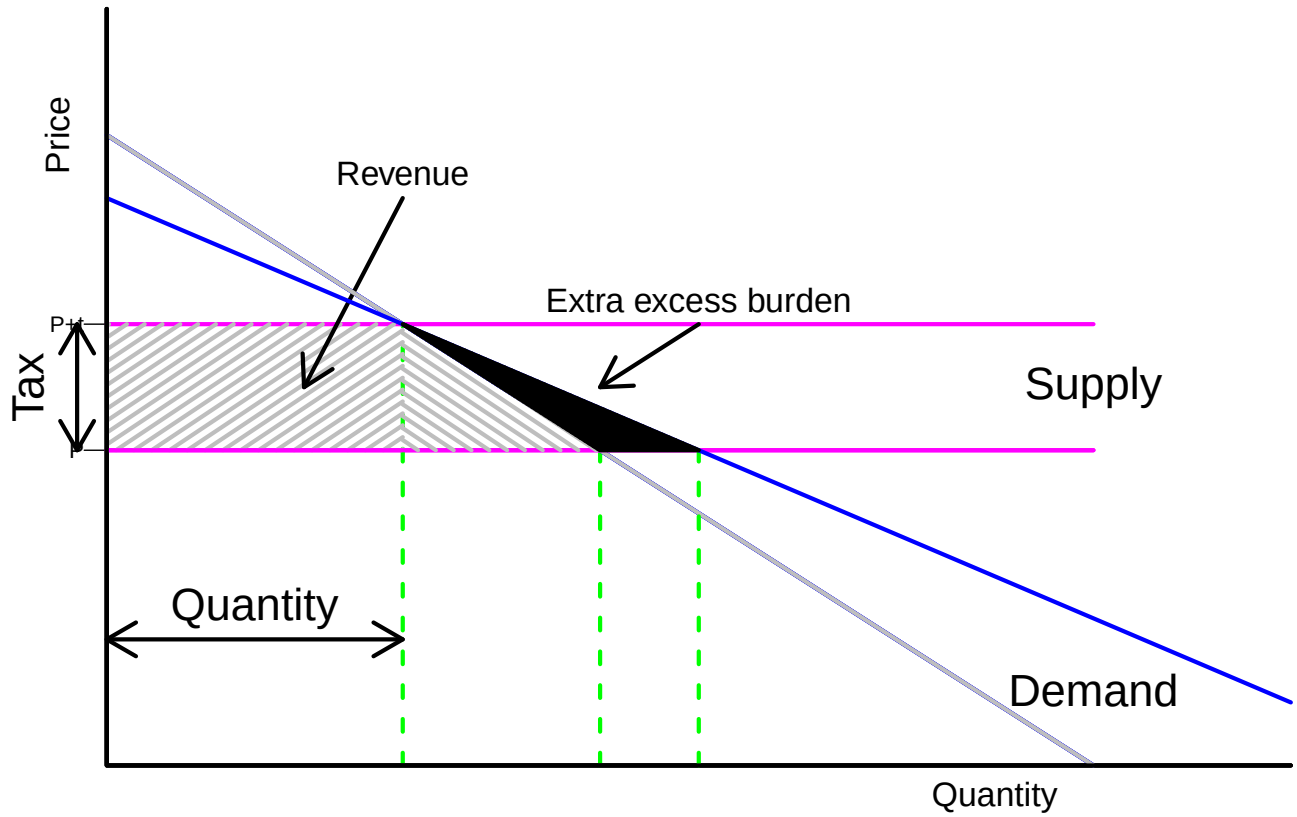
Where is the excess burden?



What happens to excess burden with a more elastic demand curve?



Make demand more elastic...



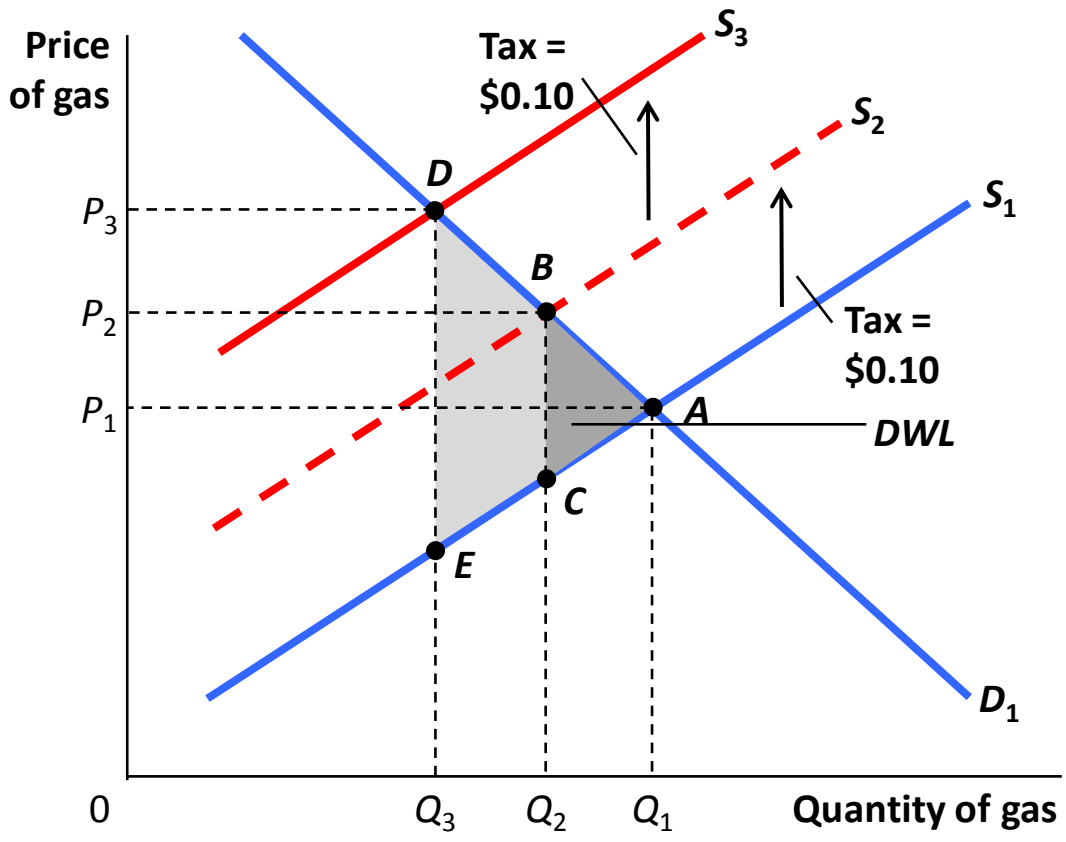
...and the Harberger triangle grows.

Remarks on excess burden formula

$$EB = -\frac{1}{2} \cdot \frac{\varepsilon_S \varepsilon_D}{\varepsilon_S - \varepsilon_D} = \frac{1}{2} \cdot \frac{1}{\frac{1}{\varepsilon_S} - \frac{1}{\varepsilon_D}} \cdot \frac{Q}{p} \cdot (\partial t)^2$$

1. EB $\uparrow$ with the absolute value of $\varepsilon_S > 0$ and $\varepsilon_D < 0 \Rightarrow$ more efficient to tax more inelastic goods
2. EB $\uparrow$ with the *square* of tax rate: a small tax has negligible excess burden, a large tax has a large excess burden
   - Better to spread taxes across many goods
   - Better to fund large *one-time* expenses with debt repaid over time instead of massive taxes today
3. Pre-existing taxes $\uparrow$ EB because the Harberger triangle increases in a trapezoid shape

Marginal excess burden with pre-existing taxes



Increasing an existing tax by ∂t (here \$0.10) creates a trapezoid instead of a triangle equal to the lost consumer surplus + lost producer surplus + "leakage" of tax revenue. Similar argument if other goods taxed. Image from "Public Finance and Public Policy" Gruber (2022).

Conclusion

- To raise revenue, the government must impose taxes
- In the absence of lump sum taxes, this creates market distortions, and thus excess burden
- As tax elasticity increases, excess burden increases
- Simple formula for excess burden from a no-tax equilibrium
- Small taxes have negligible excess burden, unless other taxes are present
- Does this change where you would recommend the government raise revenue?