TAX INCIDENCE AND DEAD-WEIGHT LOSSES

Effect of a tax or a subsidy

Tax: Quantity reduced from $Q_E$ to $Q_T$
- Consumers pay $C_T - P_E$ more per unit;
  - Consumer surplus down by $C_T D_T E P_E$
- Firms receive $P_E - F_T$ less per unit;
  - Producer surplus down by $F_T S_T E P_E$
- $C_T - F_T = $ amount of tax per unit of good

Government revenue rectangle $C_T D_T E F_T$
Dead-weight loss: triangle $ED_T S_T$

Subsidy: Quantity increased from $Q_E$ to $Q_S$
- Consumers pay $P_E - C_S$ less per unit;
  - Consumer surplus up by $C_S D_S E P_E$
- Firms receive $F_S - P_E$ more per unit;
  - Producer surplus up by $F_S S_S E P_E$
- $F_S - C_S = $ amount of subsidy per unit of good

Government pays out rectangle $C_S D_S S_S F_S$
Dead-weight loss: triangle $ED_S S_S$
APPLICATION – EU’S COMMON AGRICULTURAL POLICY

Note - numbers are schematic; actual depend on commodity, year, special rates used for exchange ...

Under free trade: \( P = 60 \)
- \( \text{EU cons.} = 120, \text{prod.} = 40 \)

With price support at 130
- \( \text{EU cons.} = 85, \text{prod.} = 145 \)

Surplus 145 - 85 = 60 is sold on world market (or given away) (with reimports prohibited)

\[
\text{EU consumer surplus loss} = \frac{1}{2} (85+120) \times (130-60) = 7175
\]
\[
\text{EU producer surplus gain} = \frac{1}{2} (145+40) \times (130-60) = 6475
\]

Note conflicting interests, typical in most international trade policy issues

\[
\text{EU government revenue loss} = (145-85) \times (130-60) = 4200
\]

Total EU loss = 7175 - 6475 + 4200 = 4900

This can be seen as the sum of two dead-weight loss triangles:
\[
\frac{1}{2} (120-85)(130-60) + \frac{1}{2} (145-40)(130-60) = \frac{1}{2} 35 \times 70 + \frac{1}{2} 105 \times 70 = \frac{1}{2} 140 \times 70
\]

In politics, concentrated and organized special interests can win, even if aggregate loss

In reality, ROW supply curve is not perfectly elastic. The EU’s dumping of its surplus on the world market lowers the world price and inflicts further loss of ROW surplus, usually harming producers in less-developed countries.
APPLICATION – U.S. PETROLEUM SELF-SUFFICIENCY?

Quantities in millions of barrels per day, prices in dollars per barrel
Approximate data for 2003: Price = 30, World production = consumption = 80,
Assumptions: All supply and demand curves straight lines, with point elasticities at the data point
US demand elasticity = 0.3 (rough estimate for medium-run adjustment)
US supply elasticity = 1 (probably too high)
Elasticity of ROW export supply to the US ≈ 3 (exactly 30/11) (probably far too low)
These imply equations for: US demand $Q = 26 - 0.2 P$ . US inverse demand $P = 130 - 5 Q$
US supply $Q = 0.3 P$ , its inverse $P = 3.33 Q$
US import demand $Q = 26 - 0.5 P$ , its inverse $P = 52 - 2 Q$
ROW’s supply to the US $Q = P - 19$ , its inverse $P = Q + 19$
In isolation (“autarky”), US price would be 52, quantity 15.6
In free trade, $P = 30$, US consumption = 20, US production = 9, imports = 11
Now suppose the US imposes an import tariff (tax) of $15 per barrel.
Equilibrium: US imports = ROW exports = Q must be such that:

\[ \text{Price in the US} = \text{Price in ROW} + 15, \quad \text{or} \quad 52 - 2Q = Q + 19 + 15 \]

\[ 3Q = 18, \quad \text{or} \quad Q = 6 : \text{US “dependence on foreign oil” has been cut nearly by half} \]


\[ \text{US consumer surplus loss} = \frac{1}{2} (18+20) * (40-30) = 190 \text{ (million dollars / day)} \]

\[ \text{US producer surplus gain} = \frac{1}{2} (12+9) * (40-30) = 105 \]

(So guess which interest group advocates and supports “energy independence” !)

US government’s revenue from tariff = (40-25) * 6 = 90. So US net gain = 105 + 90 - 190 = 5

ROW loss = \( \frac{1}{2} (11+6) * (30 - 25) = 42.5 \)

World-wide net loss = 42.5 - 5 = 37.5, equals dead-weight loss triangle \( \frac{1}{2} (40-25) * (11-6) \)

Reason for gain: reduction in our purchase lowers the price at which ROW receives.

(Our consumers pay more, but our own government gets the difference)

So the tariff is helping the US exercise “monopsony power” in world trade.

To see this, redo the problem when ROW supply curve is flat at \( P = 30 \); then US loses...