Trade Flows and Trade Policy Analysis

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Partial-equilibrium (PE) trade policy analysis and simulation

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a. Market access analysis with PE modelling
b. Basic PE model for analyzing welfare changes
c. Empirical tool for trade policy simulations: SMART

a. Market access analysis with PE modelling

- Rationale for market access analysis
- Rationale for PE modelling
  - Advantages
  - Disadvantages

b. Basic PE model for analyzing welfare changes

- Derivation of social welfare function
- Perfect competition
  - Small open economy (SOE)
  - Large country

Social welfare

- Each consumer h has quasi-linear utility function $c_0^h + U^h(c^h)$
- Budget constraint: $c_0^h + p'c^h \leq I^h$
- FOC: $1 = \lambda$ and $U' = \lambda p = p$ (demand for non-numeraire goods is independent of income)
- Demand functions are $c^h = d^h(p)$ and $c_0^h = I^h - p'd^h(p)$

- Welfare is defined as the sum of individual indirect utilities V^h:

$$W(p, I) \equiv \sum_{h=1}^{H} V^h = \sum_{h=1}^{H} \{I^h - p'd^h(p) + U^h[d^h(p)]\}$$

- Notice that:
  - $\sum_{h=1}^{H} I^h = I$ (total income)
  - $\frac{\partial W}{\partial I} = 1$ and (by envelope theorem) $\frac{\partial W}{\partial p} = \sum_{h=1}^{H} -d^h(p) \equiv -d(p)$
  - $\sum_{h=1}^{H} \{-p'd^h(p) + U^h[d^h(p)]\} = CS$ (consumer surplus)

Social welfare (ct'd)

- To simplify, let there be only one good subject to specific tariff t
- World price is p^* and $p = p^* + t$
- Numeraire good is freely traded at fixed world price of unity
- Labor is the only factor of production. Each unit of numeraire requires one unit of labor
  - Therefore, $w = 1$ and $WL = L$
- Output of the good subject to the tariff is y. Produced by firms with cost function $C(y)$ and marginal costs $C'(y)$
- Imports $m = d(p) - y$, with $d'(p) < 0$
- Tariff revenue tm is redistributed to consumers
- Consumers are also entitled to profits from import-competing industry
  - Under perfect competition, $py - C(y) = PS$ (producer surplus)
  - Under imperfect competition, $py - C(y) = \pi$ (industry profits)
- Social welfare is then:

$$W(p, I) = W[p, L + tm + py - C(y)] \equiv W(t)$$

Social welfare (ct'd)

- How does social welfare vary with the tariff?

$$dW = \underbrace{\frac{\partial W}{\partial p}}_{-d(p)} dp + \underbrace{\frac{\partial W}{\partial I}}_{=1} dI$$

$$dW = -d(p)dp + d[L + tm + py - C(y)]$$

$$dW = -d(p)dp + mdt + tdm + pdy + ydp - C'(y)dy$$

$$\frac{dW}{dt} = -d(p)\frac{dp}{dt} + m + t\frac{dm}{dp}\frac{dp}{dt} + y\frac{dp}{dt} + [p - C'(y)]\frac{dy}{dt}$$

$$\frac{dW}{dt} = t\frac{dm}{dp}\frac{dp}{dt} - m\frac{dp^*}{dt} + [p - C'(y)]\frac{dy}{dt} \qquad (1)$$

Perfect competition, SOE

- Perfect competition implies that $p = C'(y)$
- SOE assumption implies that $dp^*/dt = 0$, therefore $dp = dt$ (there is full pass-through of the tariff to domestic price)
- Equation (1) simplifies to:

$$\frac{dW}{dt} = t\frac{dm}{dp}$$

- Since $\left.\frac{dw}{dt}\right|_{t=0} = 0$, the optimal tariff for a SOE is zero

Welfare loss from a tariff (SOE)

- Taking a second-order Taylor series approximation of welfare:

$$W(t) \approx W(0) + t\left.\frac{dw}{dt}\right|_{t=0} + \frac{1}{2}t^2\left.\frac{d^2W}{dt^2}\right|_{t=0}$$

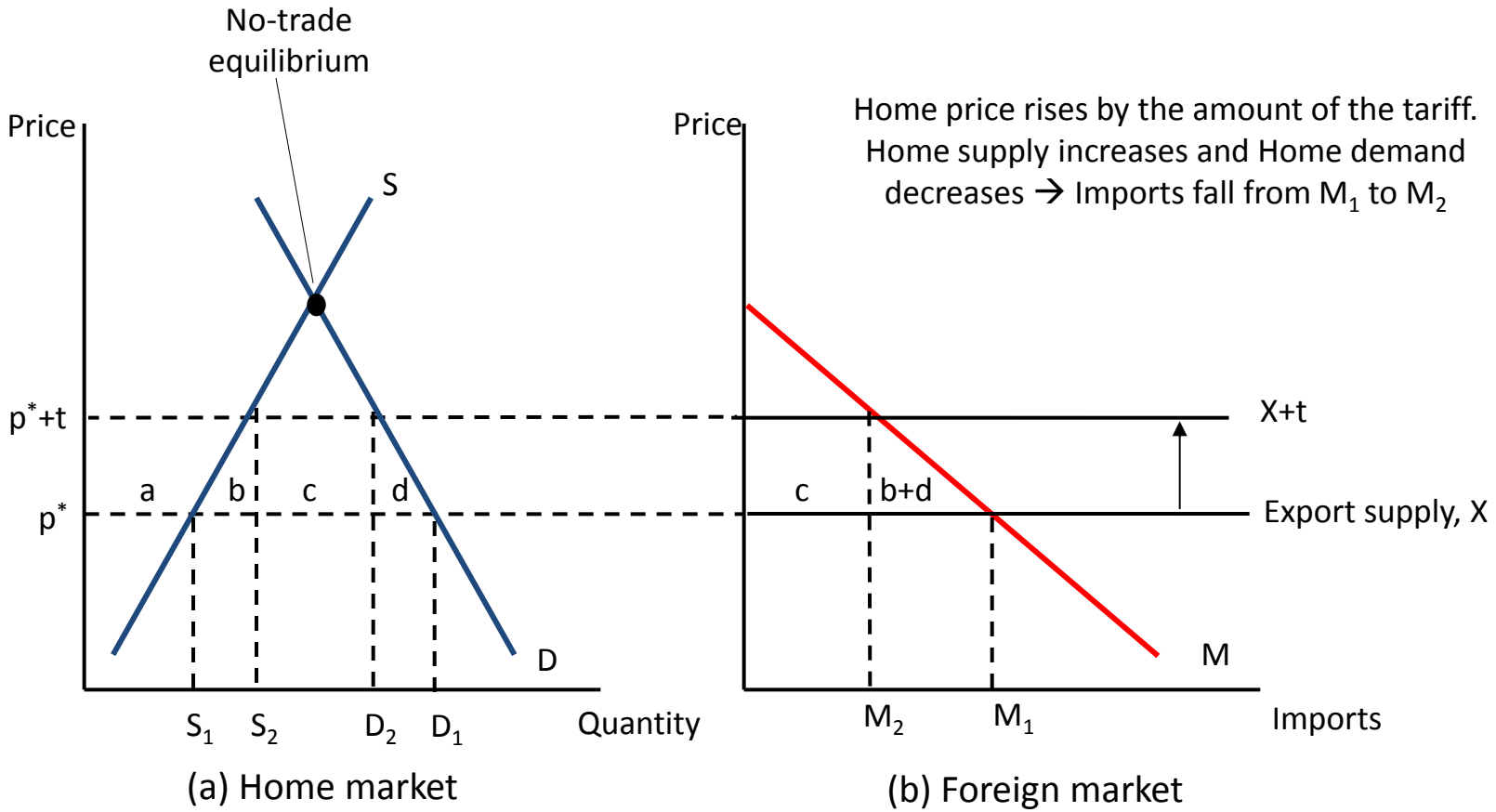
$$W(t) - W(0) \approx 0 + \frac{1}{2}t^2\frac{dm}{dp} < 0$$

- This is the deadweight loss (DWL). It can also be expressed as fraction of import expenditure pm:

$$\frac{W(t) - W(0)}{pm} \approx \frac{1}{2}\left(\frac{t}{p}\right)^2\left(\underbrace{\frac{dm}{dp}\frac{p}{m}}_{IDE}\right)$$

- E.g. with a 10% tariff and import demand elasticity (IDE) of 2, DWL (relative to import expenditure) is 1%

Perfect competition, SOE: graphical representation



- CS loss = -(a+b+c+d)
- PS gain = +a
- Tariff revenues = c
- DWL = b+d (also shown as triangle under import demand curve)

Perfect competition, large country

- Large country assumption implies that $dp^*/dt \neq 0$, therefore $dp/dt \neq 1$
  - $dp^*/dt < 0$ (intuitively, if a large country imposes a tariff it reduces its imports sufficiently to drive down the world price
  - $dp/dt < 1$ (intuitively, the pass-through of the tariff is not full, and foreign exporters absorb part of the tariff in the form of lower world price ($dp^*/dt < 0$)

- Equation (1) becomes:

$$\frac{dW}{dt} = t\frac{dm}{dp}\frac{dp}{dt} = -m\frac{dp^*}{dt} \qquad (2)$$

- Therefore:

$$\left.\frac{dw}{dt}\right|_{t=0} = -m\frac{dp^*}{dt} > 0$$

- A small enough tariff will necessarily raise welfare for a large country
- What does “large” mean?

Optimal tariff for large country

- "Large "means that the export supply is upward sloping (i.e. elasticity of export supply is finite – vs. SOE case in which export supply is horizontal, i.e. infinitely elastic)

- Optimal tariff t^{opt} for such large country is computed where (2) equals 0:

$$\frac{dW}{dt} = 0 \Rightarrow \frac{t^{opt}}{p^*} = \left(m\frac{dp^*}{dt}\right)\left(\frac{dm}{dp}\frac{dp}{dt}\right)^{-1} \qquad (3)$$

- Since domestic imports m = foreign exports x, $\frac{dm}{dp}\frac{dp}{dt} = \frac{dx}{dt}$. Therefore:

$$\frac{t^{opt}}{p^*} = \left(\underbrace{\frac{dx}{dp^*}\frac{p^*}{x}}_{XSE}\right)^{-1} \qquad (4)$$

- Optimal % tariff is equal to the inverse of the export supply elasticity (XSE)

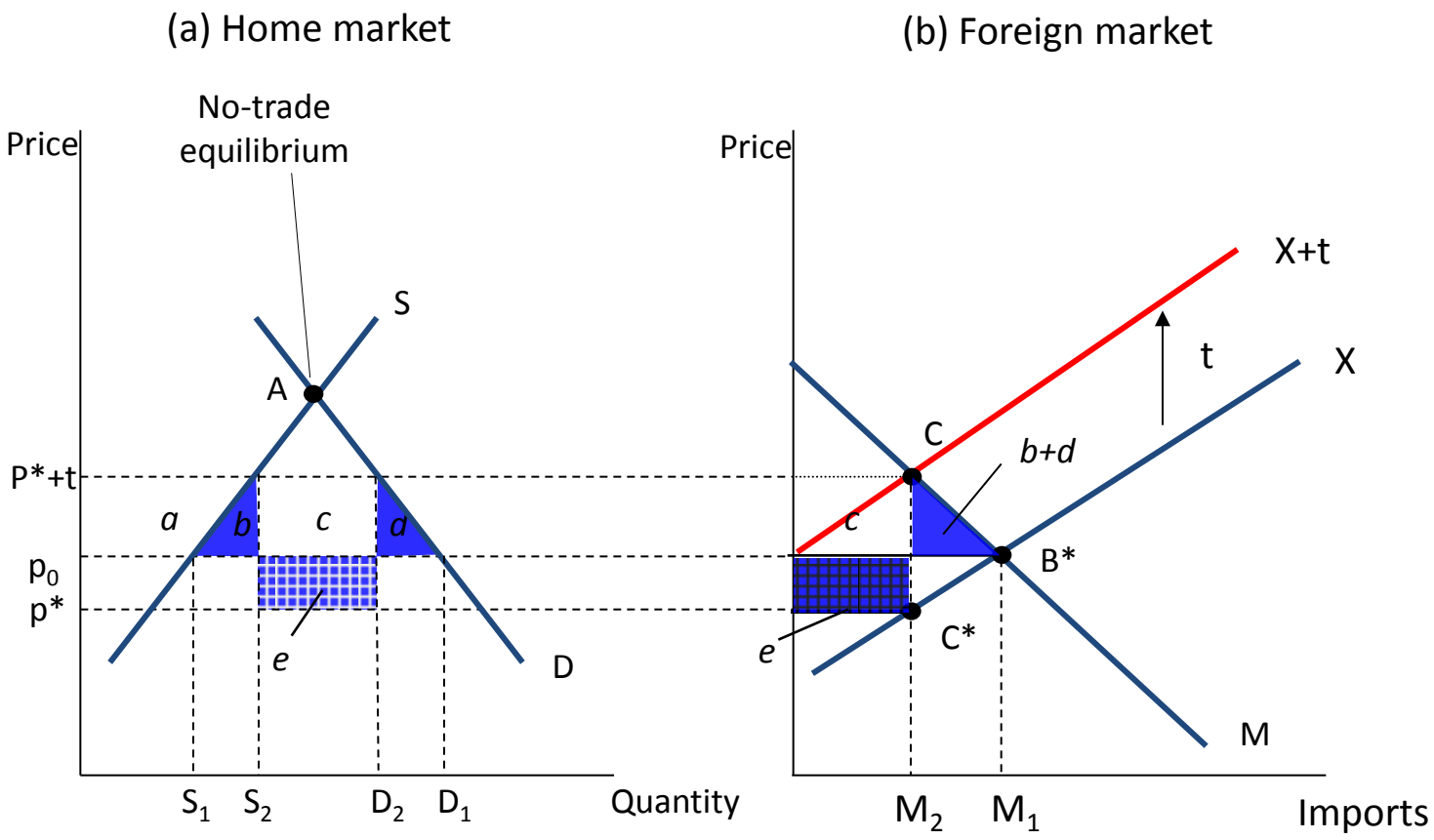
Optimal tariff for large country (ct'd)

- Alternatively, equation (4) can be re-arranged to yield:

$$\frac{t^{opt}}{p} = \left(\underbrace{\frac{dm}{dp}\frac{p}{m}}_{IDE} \right)^{-1} \left(\frac{dp^*/dt}{dp/dt} \right)$$

- Optimal % tariff is larger:
  - the smaller the pass-through dp/dt
  - $(\Leftrightarrow)$ the larger the terms-of-trade (TOT) gain dp^*/dt

Optimal tariff for large country: graphical representation



- The increase in the domestic price is less than the tariff ($dp/dt < 1$)
- Foreign exporters absorb part of the tariff ($dp^*/dt < 0$): area "e" = TOT gain
- If the gain of e is greater than the DWL loss (b+d), Home gains

Empirical evidence

- Broda et al. (2008) find that prior to WTO membership, countries set import tariffs 9 percentage points higher on inelastically supplied imports relative to those supplied elastically
- See bonus exercise for a replication of their results

- See also the R. Feenstra, "Advanced International Trade" (Princeton, 2004), Chapter 7, Section "Tariffs on Japanese Trucks and Motorcycles" (pp. 233-240).

c. Empirical tool for trade policy simulations: SMART

- Chapter 4 of the Practical Guide to TPA discusses various empirical tools
- Here we use SMART (built-in in WITS)

SMART

- Overview
- Theoretical underpinnings
  - Export supply side
  - Demand side
- Effects of policy changes
  - Trade effects
  - Effects on Tariff Revenue, Consumer Surplus and Welfare

- More details and formulas in Jammes and Olarreaga (2005)

SMART example: Albania's unilateral trade liberalization with the EU

- In 2007, Albania sourced buses (HS 870210) from 19 trading partners, of which 11 were European Union countries
- Albania levied tariffs from all sources, including the EU
- Using SMART, the user can simulate the effect of a full trade liberalization towards the EU, but not to the rest of the world
- SMART yields the results that all 11 EU countries would be able to increase their exports to Albania, for example Germany, the biggest exporter, by almost 1 million USD
- Non-EU countries, by contrast, would see their shares shrink, in particular the US, by about 0.3 million USD
- SMART results indicate that the tariff liberalization would:
  - Increase imports
  - Lower tariff revenues
  - Raise consumer surplus (Albania is a SOE)
- Results in this folder