EC931 – International Trade (MSc option)

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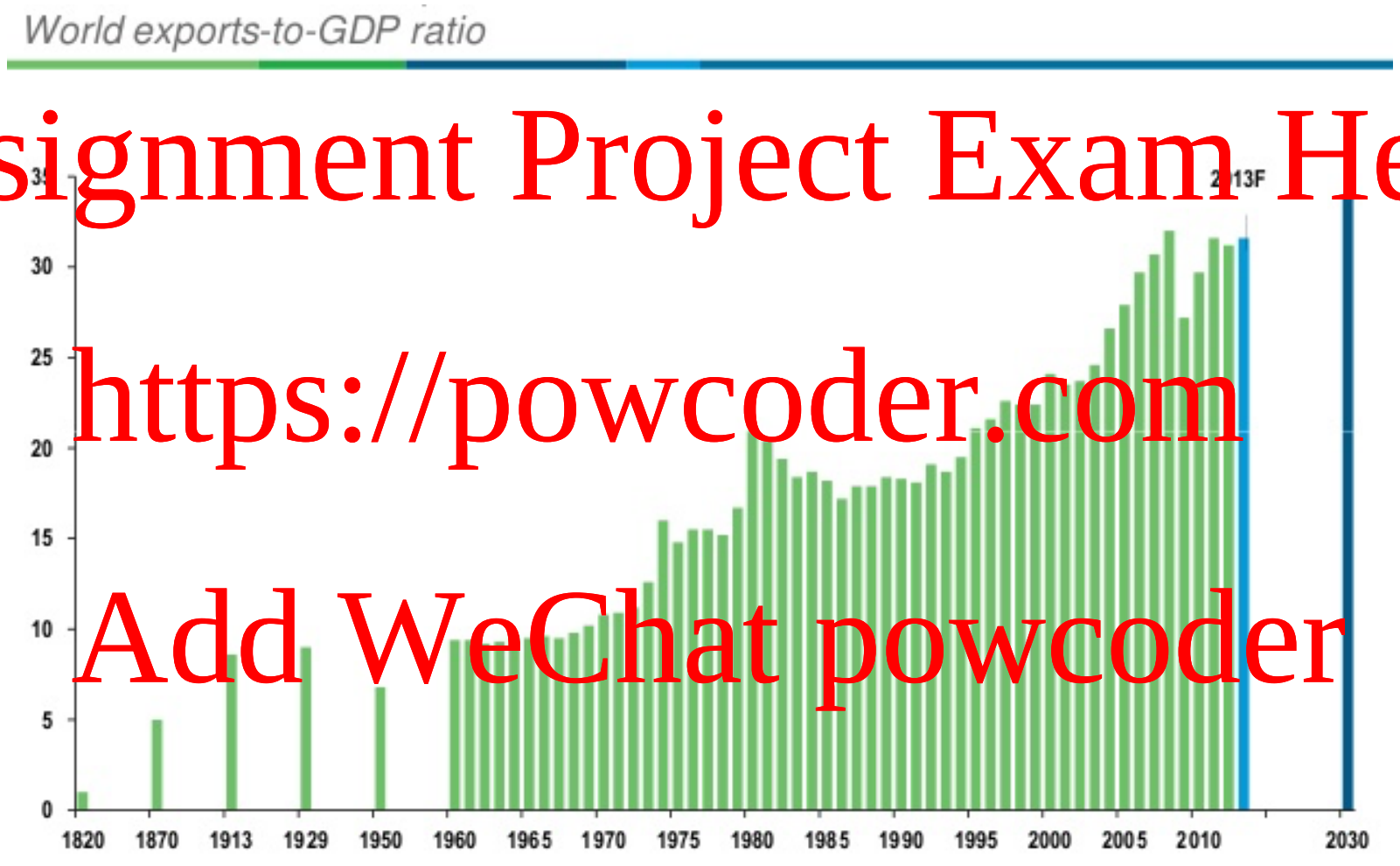
Outline

Trade and economic globalization trends



Source: IMF

Trade and economic globalization trends

Globalization waves

in the 19th and 20th centuries

(% changes unless indicated otherwise)

World	1850-1913	1950-2007
Population growth	0.8 [a]	1.7
GDP growth (real)	2.1 [a]	3.8
Per capita	1.3 [a]	2.0
Trade growth (real)	3.8	6.2
Migration (net) Million		
US, Canada, Australia, NZ (cumulative)	17.9 [a]	50.1
US, Canada, Australia, NZ (annual)	0.42 [a]	0.90
Industrial countries (less Japan) (cumulative)	...	...
Global FDI outward stock, year		
FDI as % of GDP (world)	...	...

a Refers to period 1870-1913.

Source: Maddison (2001), Lewis (1981), UNCTAD (2007), WTO (2007a).

Outline

The positive theory of international trade

Questions:

1) What are the causes of trade?
2) How are the patterns of trade determined?
3) Are there "gains" from trade?
4) What are the implications of trade for the organization and location of production?
5) What are the implications of trade for income distribution?

We focus on 1-3 first, leaving 4 and 5 aside for the time being (we'll address 4 and 5 later – 4 when discussing 'new' trade theories, 5 when discussing the political economy of trade policy formation)

Outline

Pure exchange economy: two countries and two goods

Two individuals/countries: A and B (one individual per country)

Two goods: 1 and 2

Consumption allocation: $x^A = (x_1^A, x_2^A)$, $x^B = (x_1^B, x_2^B)$

Well-behaved preferences (continuous, monotonic, convex)

represented by utility functions $U^j(x^j)$, $j = A, B$

Initial endowments: $y^A = (y_1^A, y_2^A)$, $y^B = (y_1^B, y_2^B)$

Autarky

$\widehat{x}^A = y^A$
$\widehat{x}^B = y^B$
"$\widehat{\ }$" refers to autarky

Utility maximization subject to budget constraint, $\widehat{p}^j\left(\widehat{x}^j - y^j\right) \leq 0$, requires

$$\frac{\partial U^j(\widehat{x}^j)/\partial \widehat{x}_1^j}{\partial U^j(\widehat{x}^j)/\partial \widehat{x}_2^j} = \text{MRS}_{12}^j(\widehat{x}^j) = \left(\frac{\widehat{p}_1}{\widehat{p}_2}\right)^j, \quad j = A, B$$

Autarky prices?

- In A: $\widehat{p}^A = (\widehat{p}_1^A, \widehat{p}_2^A)$ s.t. $\left(\frac{\widehat{p}_1}{\widehat{p}_2}\right)^A = \text{MRS}_{12}^A(y^A)$
- In B: $\widehat{p}^B = (\widehat{p}_1^B, \widehat{p}_2^B)$ s.t. $\left(\frac{\widehat{p}_1}{\widehat{p}_2}\right)^B = \text{MRS}_{12}^B(y^B)$

Free trade

- Common prices (world prices): $p = (p_1, p_2)$

  Terms of trade: p_1/p_2

  External trade for A:

  $m^A = x^A - y^A = (x_1^A - y_1^A,\ x_2^A - y_2^A) = (m_1^A, m_2^A)$

  External trade for B:

  $m^B = x^B - y^B = (x_1^B - y_1^B,\ x_2^B - y_2^B) = (m_1^B, m_2^B)$

- Budget constraint for A:

  $$p_1 x_1^A + p_2 x_2^A = p_1 y_1^A + p_2 y_2^A$$

  In vector notation:

  $$p\, x^A = p\, y^A$$

  or

  $$p\, m^A = 0 \quad \text{(trade balance)}$$

- Trade balance (budget constraint) for B:

  $$p\, m^B = 0$$

Trade equilibrium

- Trade equilibrium (in vector notation):

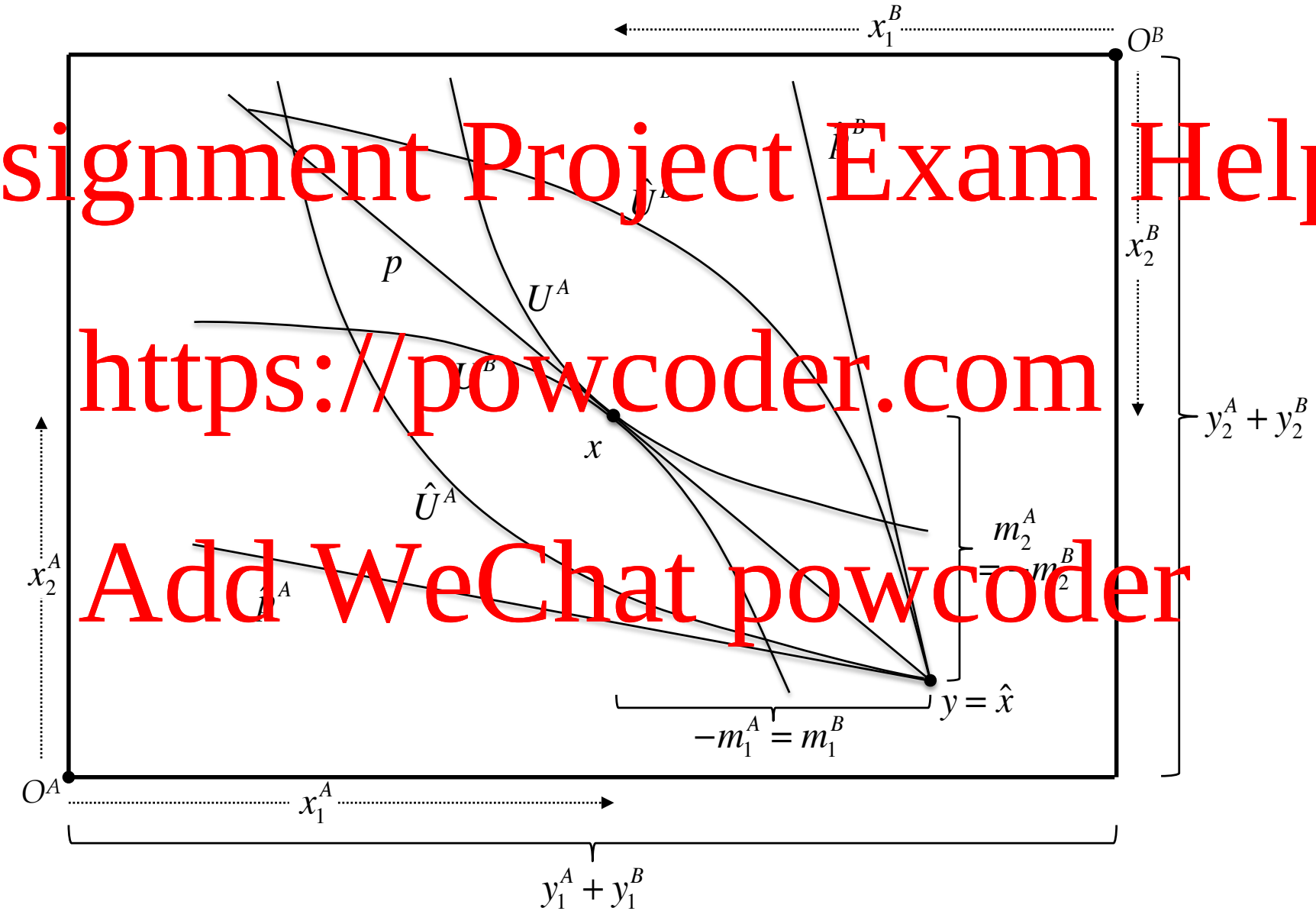
$$x^A + x^B = y^A + y^B$$

or

$$m^A + m^B = 0$$
$$\Rightarrow m^A = -m^B$$

- In equilibrium:

$$\frac{p_1}{p_2} = \text{MRS}_{12}^A(x^A) = \text{MRS}_{12}^B(x^B)$$



Are there gains from trade?

Yes:

$\widehat{x}^j$, $j = A, B$, always attainable ($p\widehat{x}^j = py^j$ for any p); choice of x^j over $\widehat{x}^j$ when both are feasible *reveals* that $x^j \succ \widehat{x}^j$, i.e. trade is mutually beneficial ("principle of voluntary exchange")

Trade patterns and autarky prices

- Revealed preference implies $\widehat{p}^j(x^j - y^j) = \widehat{p}^j m^j > 0,\ j = A, B$
  (or else $x^j \succ \widehat{x}^j$ would be chosen in autarky) $\Rightarrow$

  $\widehat{p}_1^A m_1^A + \widehat{p}_2^A m_2^A > 0$ and $\widehat{p}_1^B m_1^B + \widehat{p}_2^B m_2^B > 0 \Rightarrow \widehat{p}_1^B m_1^A + \widehat{p}_2^B m_2^A < 0$
  (since $m_i^A = -m_i^B,\ i = 1, 2$)

- Dividing through by $\widehat{p}_2^j m_1^A$ gives

$$\frac{\widehat{p}_1^A}{\widehat{p}_2^A} > -\frac{m_2^A}{m_1^A} = \left|\frac{m_2^A}{m_1^A}\right| \text{ and } \frac{\widehat{p}_1^B}{\widehat{p}_2^B} < -\frac{m_2^A}{m_1^A} = \left|\frac{m_2^A}{m_1^A}\right| \quad \text{if } m_1^A > 0$$

$$\text{or } \frac{\widehat{p}_1^A}{\widehat{p}_2^A} < -\frac{m_2^A}{m_1^A} = \left|\frac{m_2^A}{m_1^A}\right| \text{ and } \frac{\widehat{p}_1^B}{\widehat{p}_2^B} > -\frac{m_2^A}{m_1^A} = \left|\frac{m_2^A}{m_1^A}\right| \quad \text{if } m_1^A < 0$$

- Thus,

$$\left(\frac{\widehat{p}_1}{\widehat{p}_2}\right)^A > \left(\frac{\widehat{p}_1}{\widehat{p}_2}\right)^B \Leftrightarrow m_1^A > 0,\ m_2^A < 0 \quad \text{and}$$

$$\left(\frac{\widehat{p}_1}{\widehat{p}_2}\right)^A < \left(\frac{\widehat{p}_1}{\widehat{p}_2}\right)^B \Leftrightarrow m_1^A < 0,\ m_2^A > 0$$

  i.e. under free trade each country imports the good that has a comparatively higher autarky price and exports the good that has a comparatively lower autarky price

Trade prices

- Suppose $\left(\frac{\widehat{p}_1}{\widehat{p}_2}\right)^A > \left|\frac{m_2^A}{m_1^A}\right| > \left(\frac{\widehat{p}_1}{\widehat{p}_2}\right)^B \Rightarrow m_1^A > 0, \; m_2^A < 0$

  Trade balance implies $p\, m^A = 0 \Rightarrow \frac{p_1}{p_2} = \left|\frac{m_2^A}{m_1^A}\right|$

  hence $\left(\frac{\widehat{p}_1}{\widehat{p}_2}\right)^A > \frac{p_1}{p_2} > \left(\frac{\widehat{p}_1}{\widehat{p}_2}\right)^B$

- Same conclusion with inequality signs reversed if $\left(\frac{\widehat{p}_1}{\widehat{p}_2}\right)^A < \left(\frac{\widehat{p}_1}{\widehat{p}_2}\right)^B$

- Free-trade prices lie "between" the two countries' autarky prices

Determinants of trade

- Suppose A and B have the same preferences, the same endowment point (centre point in Edgeworth Box), and that there are no trade subsidies

  Then for trade to occur, at least one of the following must apply: (i) tastes differ; (ii) endowments differ

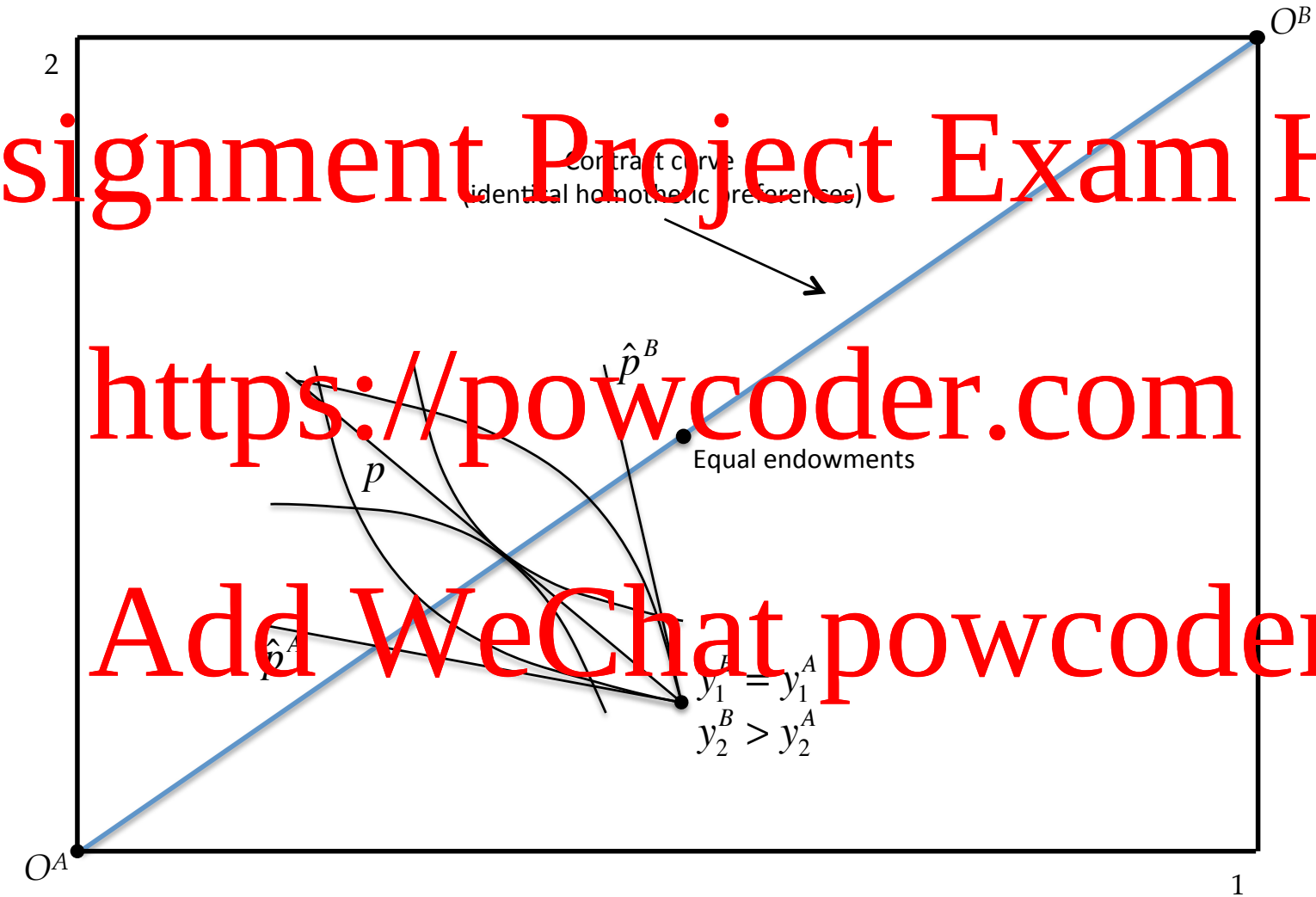
- Neoclassical trade theorists have focused mainly on (ii), which leads to the idea of *comparative advantage*

Endowment differentials: absolute advantage

- Suppose A and B have identical, homothetic preferences (income elasticity of demand equal to unity for all goods), implying that the contract curve coincides with the diagonal of the Edgeworth Box
- Also suppose that the two countries have the same level of endowment of good 1 but B has more of good 2 than A does, i.e. B has an *absolute advantage* with respect to good 2
- Then the endowment point is below the diagonal

$$\Rightarrow \left(\frac{\widehat{p}_1}{\widehat{p}_2}\right)^B > \left(\frac{\widehat{p}_1}{\widehat{p}_2}\right)^A$$

and so B will end up exporting good 2 (the good in which it has an absolute advantage)



Endowment differentials: comparative advantage

- What if B has less of both goods than A does but it has *comparatively* more of good 2 than A does? I.e.

$$\frac{y_2^B}{y_1^B} > \frac{y_2^A}{y_1^A}$$

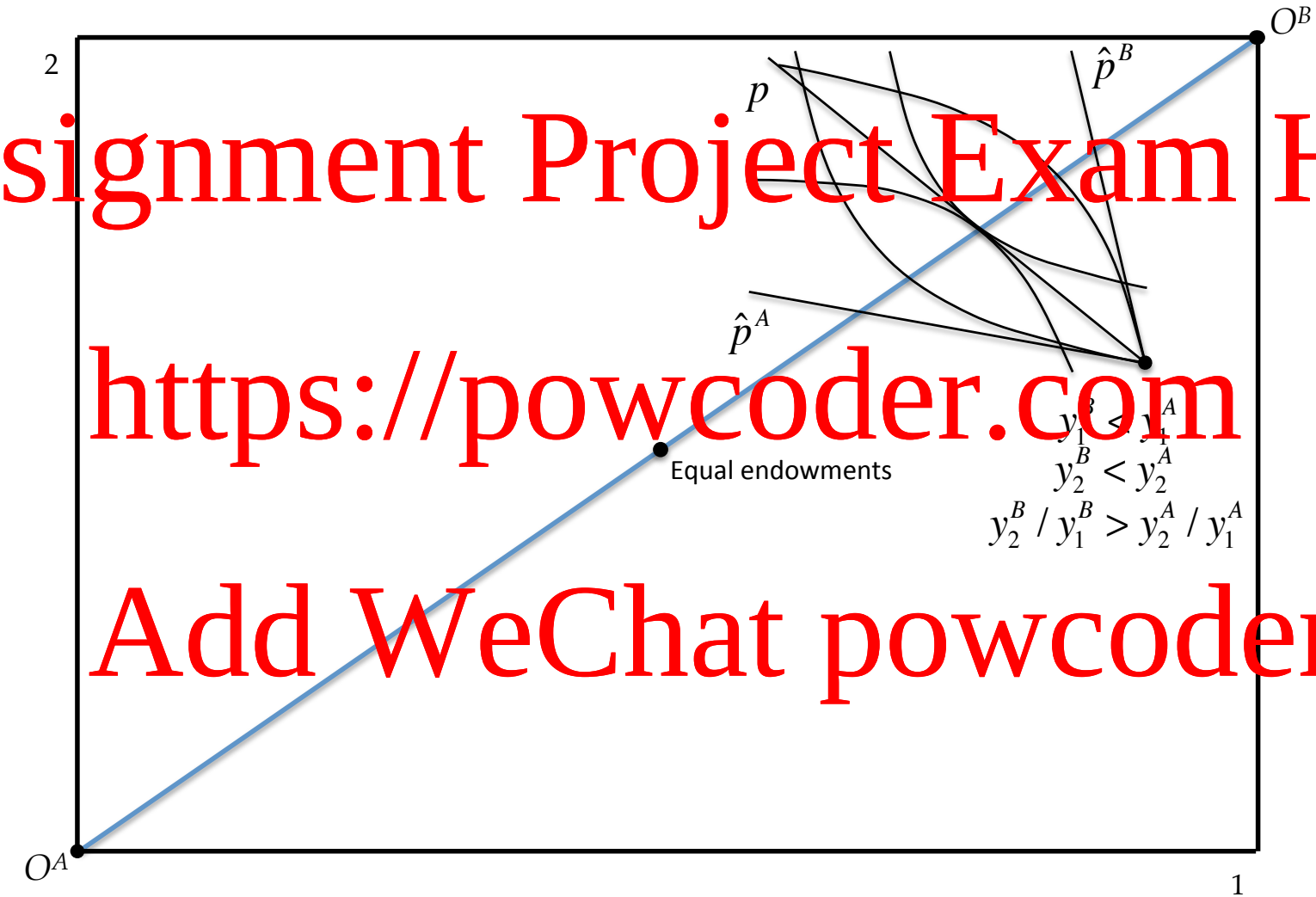
In this case we say that B has a *comparative advantage* with respect to good 2

- Then, also in this case, the endowment point is below the diagonal

$$\Rightarrow \left(\frac{\widehat{p}_1}{\widehat{p}_2}\right)^B > \left(\frac{\widehat{p}_1}{\widehat{p}_2}\right)^A$$

and so B will end up exporting good 2 (the good in which it has a comparative advantage)

- (Can you find a counterexample for a scenario with identical non-homothetic preferences?)



General two-country, N-goods case

- Expenditure functions (dual representation of preferences):

$$E^j(p, U^j) \equiv \min_{x^j} \left\{ p\, x^j \mid U^j(x^j) \geq U^j \right\}, \quad j = A, B$$

where $U^j(x^j)$ denotes a utility function (primal representation)

- Shephard's lemma:

$$\frac{\partial E^j(p, U^j)}{\partial p_i} = x_i^j(p, U^j), \ \forall i \quad \text{(compensated demand)}$$

In vector notation:

$$x^j(p, U^j) = E_p^j(p, U^j)$$

Autarky equilibrium

- "^" refers to autarky

$$E_p^j(\widehat{p}^j, \widehat{U}^j) = y^j \qquad \text{(market clearing, } N \text{ equations)}$$

$$E^j(\widehat{p}^j, \widehat{U}^j) = \widehat{p}^j y^j \qquad \text{(budget constraint, one equation)}$$

$N+1$ equations
$N+1$ variables $(\widehat{p}^j, \widehat{U}^j)$

- Homogeneity of degree zero in prices implies only $N-1$ independent prices; Walras' law implies only $N-1$ independent market clearing conditions

$$E_p^A(p, U^A) + E_p^B(p, U^B) = y^A + y^B \quad \text{(market clearing)}$$

$$E^A(p, U^A) = p\,y^A \quad \text{(budget constraint for } A\text{)}$$

$$E^B(p, U^B) = p\,y^B \quad \text{(budget constraint for } B\text{)}$$

$$E^j(p, \widehat{U}^j) \leq p\widehat{x}^j = py^j = E^j(p, U^j)$$

- The first inequality follows from the definition of $E^j(p, U^j)$: $\widehat{x}^j$ yields utility $\widehat{U}^j$ and is the least cost way of attaining $\widehat{U}^j$ at prices $\widehat{p}^j$, but it is not the least cost way of attaining $\widehat{U}^j$ at prices p
- The following equality follows from the fact that $\widehat{x}^j = y^j$
- The last equality follows from the budget constraint

Since $E^j(p, U^j)$ is increasing in U^j, we conclude that $U^j \geq \widehat{U}^j$

Welfare comparison across different trade equilibria

- Consider two alternative trade equilibria from the point of view of a certain country (country index omitted) – equilibrium 0 and equilibrium 1 – and suppose that
  $$p^1 x^1 > p^1 x^0 \quad (p^1 x^1 - p^1 x^0 > 0)$$
  Then x^1 is revealed preferred to x^0 (x^1 is chosen when x^0 could be)
- We can write:
  $$p^1 x^1 - p^1 x^0 = p^1 y - p^1 (y + m^0) + p^0 m^0$$
  (the term $p^1 y$ equals $p^1 x^1$ by the budget constraint; $y + m^0$ equals x^0; $p^0 m^0$ equals zero)
- Hence:
  $$p^1 x^1 - p^1 x^0 = (p^0 - p^1) m^0$$
  If this is positive then x^1 is preferred to x^0
- *Improvement in the terms of trade*:
  vector of old net trades is "cheaper" at new prices
  $$(p^0 - p^1) m^0 > 0 \quad \Rightarrow \quad p^1 m^0 < p^0 m^0$$

Vectors and angles

Given two vectors v' and v'' in vector space, forming an angle $\theta(v', v'')$ between them, we have

$$\cos\theta(v', v'') = \frac{v'\, v''}{|v'||v''|}$$

Thus a product $v'\, v'' = 0$ means that the two vectors are orthogonal (90^0 angle); a product $v'\, v'' > 0$ means that they form an angle that is less than 90^0; a product $v'\, v'' < 0$ means that they form an angle that is more than 90^0.

Autarky prices and trade prices

- By revealed preference:

  $\widehat{p}^A\, m^A > 0$ and $\widehat{p}^B\, m^B > 0$ (and so $\widehat{p}^B\, m^A < 0$)

- Trade balance implies:

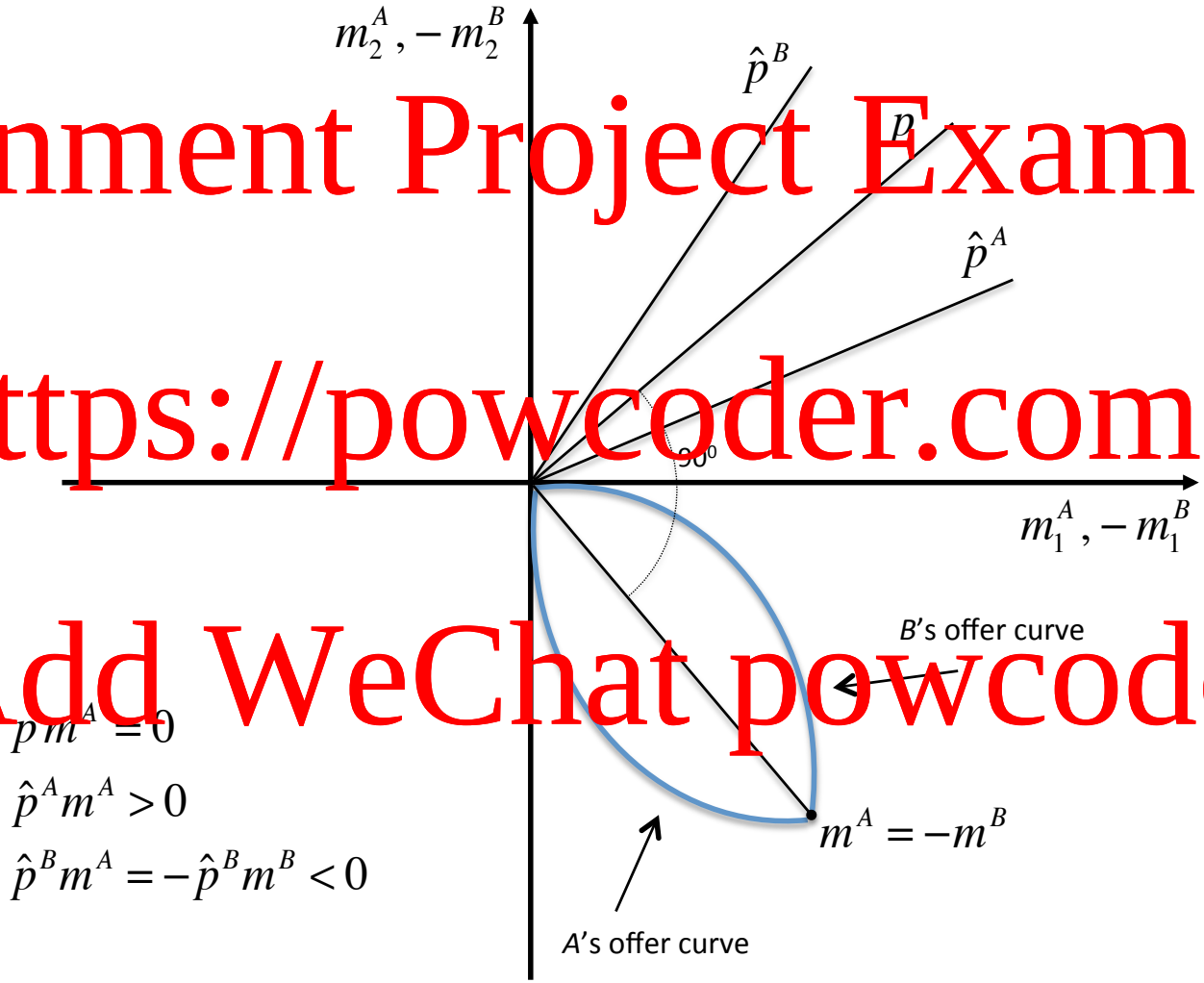
  $p\, m^A = 0$

- Hence:

  $\widehat{p}^A\, m^A > p\, m^A > \widehat{p}^B\, m^A$

  i.e. the vectors p and m^A form a 90^0 angle, the vectors $\widehat{p}^A$ and m^A form a narrower angle, the vectors $\widehat{p}^B$ and m^A form a wider angle

- Free-trade prices lie between autarky prices



Trade patterns and autarky prices

- Since, by revealed preference,
$$\widehat{p}^A m^A > 0 \text{ and } \widehat{p}^B m^A < 0 \Rightarrow -\widehat{p}^B m^A > 0$$
we can write
$$(\widehat{p}^A - \widehat{p}^B) m^A > 0$$
i.e. the vectors $(\widehat{p}^A - \widehat{p}^B)$ and m^A form an angle that is less than 90^0 (they "point in the same direction")
- The trade vector is positively correlated with the vector of autarky price differentials

Outline

Production possibilities

- Consider a scenario with two goods and two countries (as before), but where y^j is not exogenously given but is endogenously selected from a set Y^j
- Y^j: production possibilities set
  - represented by $\Phi^j(y^j) \geq 0$, $y^j \geq 0$ i.e. $Y^j \equiv \{y^j \mid \Phi^j(y^j) \geq 0\}$
- Set $\{y^j \mid \Phi^j(y^j) = 0\}$: *production possibilities frontier* (PPF)
- The endogenously selected output mix, y^j, maximizes revenue, py^j (and thus profits)

Autarky

$$\widehat{x}^A = \widehat{y}^A$$

$$\widehat{x}^B = \widehat{y}^B$$

Utility maximization subject to budget constraint requires

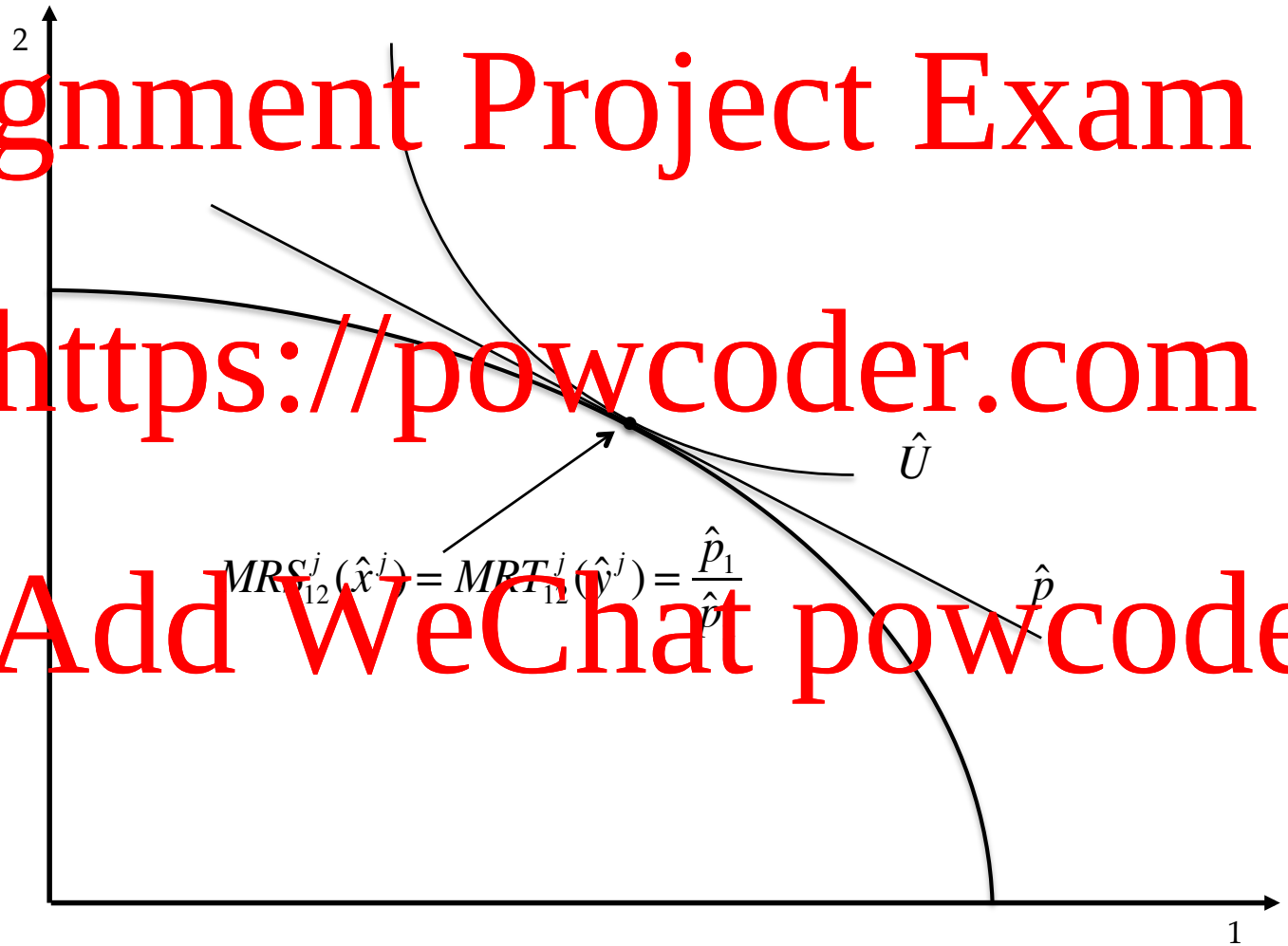
$$\frac{\partial U^j(\widehat{x}^j)/\partial \widehat{x}_1^j}{\partial U^j(\widehat{x}^j)/\partial \widehat{x}_2^j} \equiv \mathrm{MRS}_{12}^j(\widehat{x}^j) = \left(\frac{\widehat{p}_1}{\widehat{p}_2}\right)^j, \quad j = A, B$$

Revenue maximization subject to $\Phi^j(y^j) \geq 0$ requires

$$\frac{\partial \Phi^j(\widehat{y}^j)/\partial \widehat{y}_1^j}{\partial \Phi^j(\widehat{y}^j)/\partial \widehat{y}_2^j} \equiv \mathrm{MRT}_{12}^j(\widehat{y}^j) = \left(\frac{\widehat{p}_1}{\widehat{p}_2}\right)^j, \quad j = A, B$$

Autarky prices and autarky output mix?

- In A: $\widehat{p}^A$, $\widehat{y}^A$, s.t. $\left(\frac{\widehat{p}_1}{\widehat{p}_2}\right)^A = \mathrm{MRS}_{12}^A(\widehat{y}^A) = \mathrm{MRT}_{12}^A(\widehat{y}^A)$
- In B: $\widehat{p}^B$, $\widehat{y}^B$, s.t. $\left(\frac{\widehat{p}_1}{\widehat{p}_2}\right)^B = \mathrm{MRS}_{12}^B(\widehat{y}^B) = \mathrm{MRT}_{12}^B(\widehat{y}^B)$



- Trade equilibrium
  - Trade equilibrium:

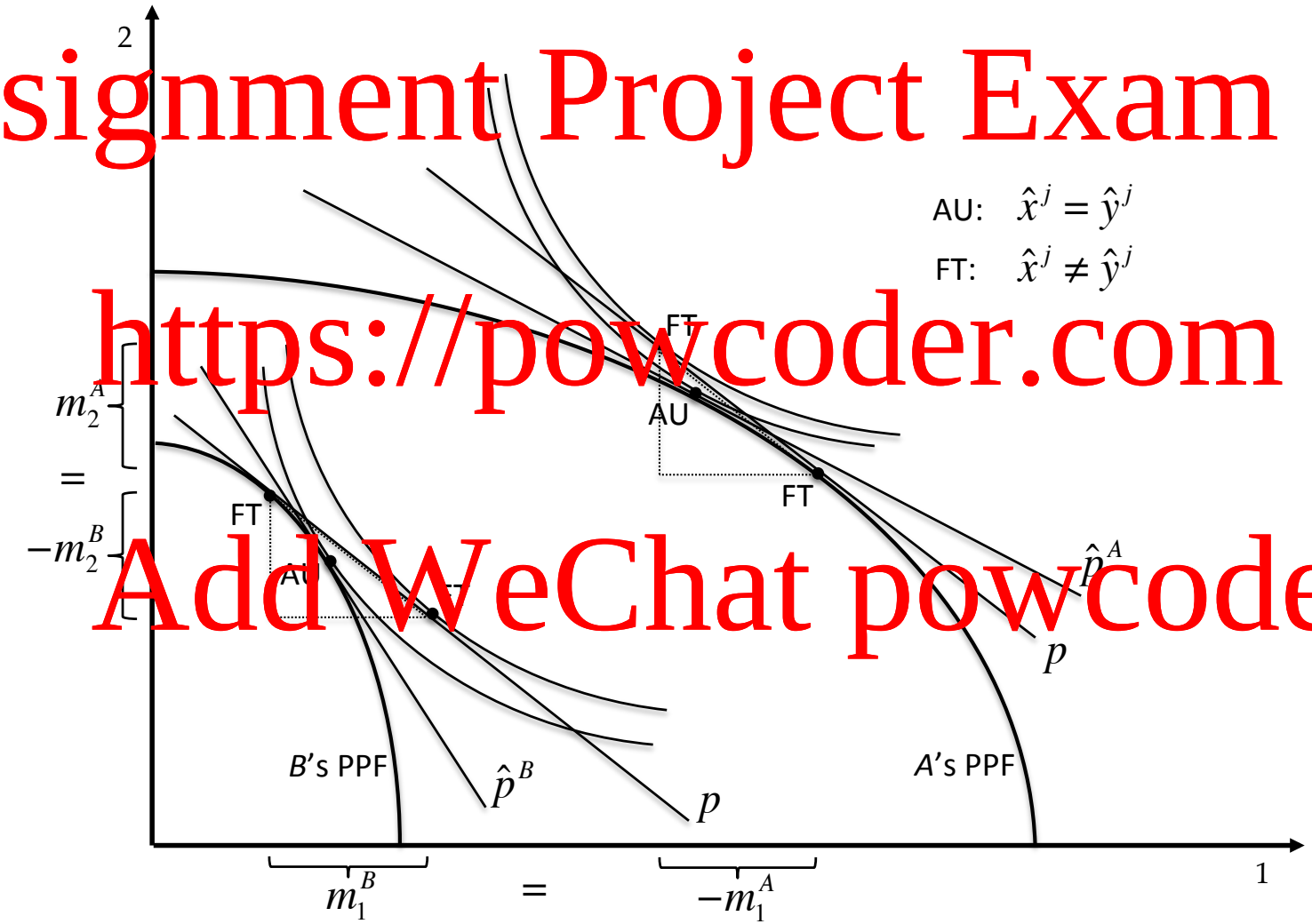
$$x^A + x^B = y^A + y^B$$

or

$$m^A + m^B = 0$$

  - In equilibrium:

$$\frac{p_1}{p_2} = \mathrm{MRS}_{12}^A(x^A) = \mathrm{MRT}_{12}^A(y^A) = \mathrm{MRS}_{12}^B(x^B) = \mathrm{MRT}_{12}^B(y^B)$$



Are there gains from trade?

Yes:

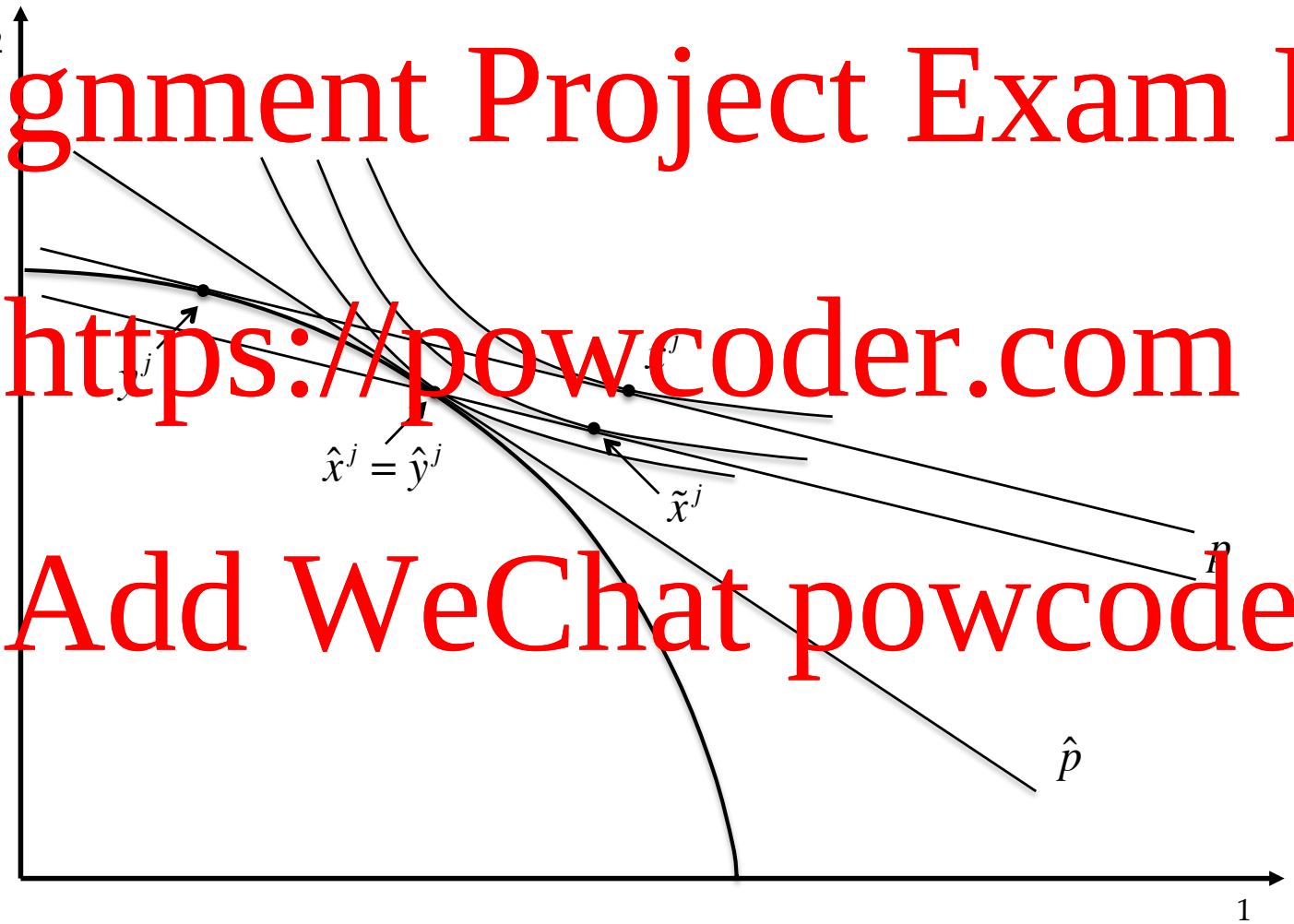
(i) Let $\widetilde{x}^j$ be the utility maximizing bundle for prices p and for the autarky output mix $\widehat{y}^j$; since a choice of $\widehat{x}^j = \widehat{y}^j$ would be attainable, $\widetilde{x}^j$ is revealed preferred to $\widehat{x}^j$, i.e. $\widetilde{x}^j \succ \widehat{x}^j$

(ii) Also, $\widehat{y}^j$ is always attainable for producers, and so a choice of y^j over $\widehat{y}^j$ implies $p\,y^j > p\,\widehat{y}^j = p\,\widetilde{x}^j$, i.e. $\widetilde{x}^j$ is a feasible choice from y^j; since x^j is chosen over $\widetilde{x}^j$ when both are feasible $(p\,x^j = p\,y^j)$, x^j is revealed preferred to $\widetilde{x}^j$, i.e. $x^j \succ \widetilde{x}^j$

Putting it all together, we conclude that

$$x^j \succ \widetilde{x}^j \succ \widehat{x}^j$$

(i) can be thought of as reflecting re-optimization on the consumption side (consumption gains); (ii) can be thought of as reflecting re-optimization on the production side (production gains)



Determinants of trade

- Given equal tastes (and absent trade subsidies), differences in production possibilities cause trade
- Where do production possibilities come from? Let v^j, $j = A, B$, be a vector of factor endowments, and let $\Omega^j(y^j, v^j) \geq 0$ represent technologies, i.e. y^j is technologically feasible from v^j if and only if $\Omega^j(y^j, v^j) \geq 0$. In formal terms,

$$\Phi^j(y^j) \geq 0 \quad \Leftrightarrow \quad \Omega^j(y^j, v^j) \geq 0$$

- Thus, differences in production possibilities can arise because of
  (i) Differences in technologies (different Ω^j's)
  (ii) Differences in factor endowments (different v^j's)

Trade and technology differentials: the Ricardo model

- Two goods, 1 and 2

  One production input (labour), nontraded, priced at w^j, $j = A, B$

- Technologies differ across countries

  Single-output, constant-returns-to-scale production

  $\Rightarrow$ marginal costs, $c_1^j(w^j)$, $c_2^j(w^j)$, independent of output levels and equal to unit costs:

$$c_1^j(w^j) = \alpha_1^j w^j$$
$$c_2^j(w^j) = \alpha_2^j w^j$$

  with $\alpha_i^j > 0$, $i = 1, 2$ (unit input requirements)

  $\Rightarrow$ marginal product of labour equals $1/\alpha_i^j$, $i = 1, 2$

- PPFs are linear and have constant slopes equal (in absolute value) to

$$\text{MRT}_{12}^j = \frac{c_1^j(w^j)}{c_2^j(w^j)} = \frac{\alpha_1^j}{\alpha_2^j}$$

Trade in the Ricardo model

- In autarky, $\widehat{p}_1^j = c_1^j(w^j)$, $\widehat{p}_2^j = c_2^j(w^j) \quad \Rightarrow \quad \left(\frac{\widehat{p}_1}{\widehat{p}_2}\right)^j = \frac{\alpha_1^j}{\alpha_2^j}$

  $\Rightarrow$ autarky price differentials are solely determined by technology

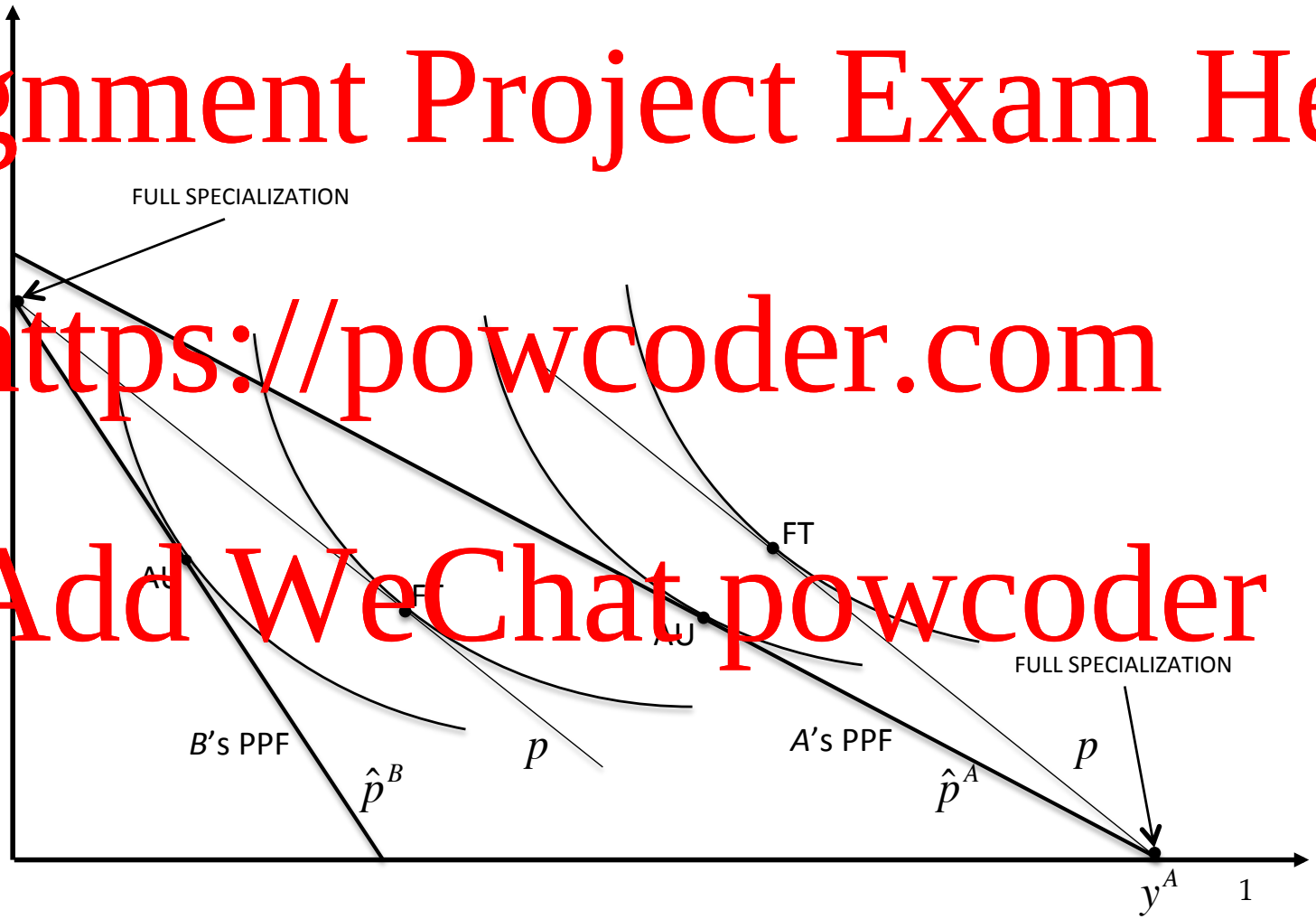
  i.e. comparative advantage is determined by *comparative* technology differentials (productivity *ratios* rather than levels)

- Under free trade, trade prices will lie between the two countries' autarky prices

- For any prices other than autarky prices, the revenue maximizing output mix is at a corner: full specialization under free trade

- Each country will fully specialize in the production of the good for which it has a comparatively lower autarky price and export some of its production, and will import the good for which it has a comparatively higher autarky price

  (If one country is much "smaller" than the other, then only the smaller country will fully specialize)



Trade and endowment differentials: the Heckscher-Ohlin model

- Two goods, 1 and 2
- Two production inputs, L and K (labour and capital), nontraded, respectively priced at $w_L^j,\ w_K^j,\ j = A, B$
- Identical homothetic preferences in the two countries
- Single-output, constant-returns-to-scale technologies, different across sectors but identical across countries
  $\Rightarrow$ marginal costs, $c_1(w_L^j,\ w_K^j)$, $c_2(w_L^j,\ w_K^j)$, independent of output levels and equal to unit costs
  Different technologies across sectors implies that production possibilities are strictly convex

The Heckscher-Ohlin model (continued)

- Factor input ratios only depend on factor prices:

$$\frac{L_i^j}{K_i^j} = \frac{y_i^j}{y_i^j}\frac{\partial c_i/\partial w_L^j}{\partial c_i/\partial w_K^j} = \frac{\partial c_i/\partial w_L^j}{\partial c_i/\partial w_K^j}, \quad i = 1,2 \quad j = A,B$$

- Factor ratios are assumed to differ across sectors, e.g.:

$$\frac{L_1^j}{K_1^j} > \frac{L_2^j}{K_2^j}, \quad j = A,B$$

i.e. sector 1 is *labour intensive* and sector 2 is *capital intensive* (comparatively speaking)

- Assumption: No factor intensity reversals:

$$\frac{\partial c_1/\partial w_L^j}{\partial c_1/\partial w_K^j} = \frac{L_1^j}{K_1^j} > \frac{\partial c_2/\partial w_L^j}{\partial c_2/\partial w_K^j} = \frac{L_2^j}{K_2^j}, \quad \forall (w_L^j, w_K^j)$$

i.e. one sector (sector 1 in this case) is *always* labour intensive and the other sector is *always* capital intensive for all factor prices

Autarky prices in the Heckscher-Ohlin model

- Assume different factor endowments across countries, e.g. (bars denote endowments):

$$\frac{\overline{L}^A}{\overline{K}^A} > \frac{\overline{L}^B}{\overline{K}^B}$$

i.e. A is comparatively labour rich and B is comparatively capital rich

- Then the autarky price of the labour intensive good will be comparatively lower in A than in B

Sketch of proof: (i) if 1 is comparatively labour intensive, then, for given prices p_1/p_2, the ratio y_1/y_2 will be higher in the country that is comparatively labour rich (Rybczynski Theorem, next slide); (ii) the absolute value of the slope of a concave PPF (which must equal p_1/p_2) is increasing in the ratio y_1/y_2; (iii) results (i) and (ii) together imply that if sector 1 is the labour intensive sector and country A is comparatively labour rich, then, for any given common ratio y_1/y_2, A's PPF will be flatter than B's PPF; (iv) given common homothetic preferences, (iii) implies that the autarky price ratio $\widehat{p}_1/\widehat{p}_2$ will be higher in B than in A

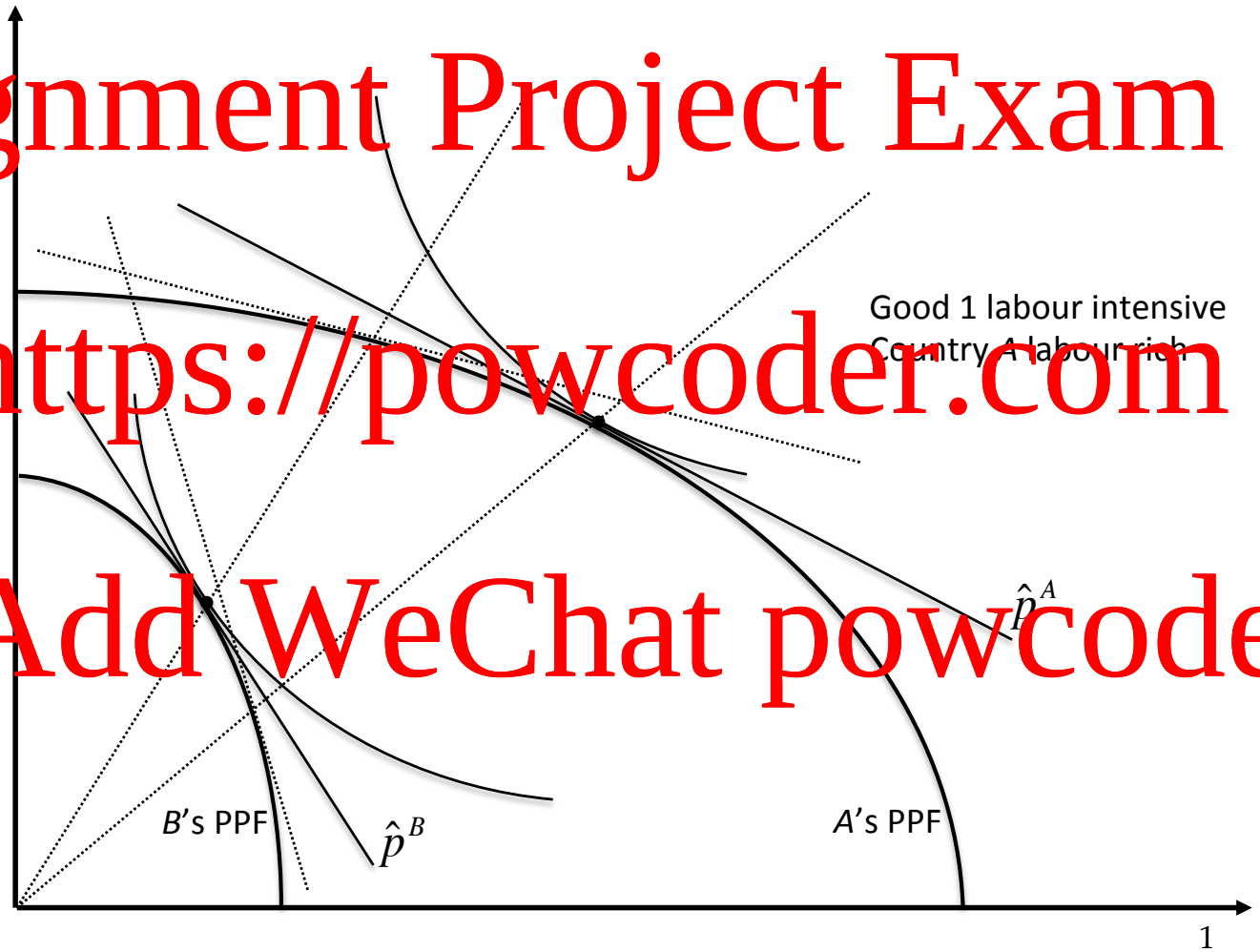
Rybczynski Theorem

- If sector 1 is labour intensive, a higher $\overline{L}$, for a given $\overline{K}$, raises y_1 and lowers y_2

  $\Rightarrow$ a higher labour to capital endowment ratio translates into a higher y_1/y_2 output ratio

Rybczynski Theorem: proof

- One-to-one mapping between output price ratio
$$p_1/p_2 = c_1(w_L, w_K)/c_2(w_L, w_K) = c_1(w_L/w_K, 1)/c_2(w_L/w_K, 1)$$
and w_L/w_K: both the numerator and the denominator are concave in w_L/w_K but they have different slope and curvature, and so (assuming no factor intensity reversals) there is a unique level of w_L/w_K for which $c_1(w_L/w_K, 1)/c_2(w_L/w_K, 1)$ equals a given p_1/p_2
- So, for a given p_1/p_2, the ratio w_L/w_K is given, and so are unit compensated demands $\partial c_i/\partial w_L \equiv \alpha_{iL}$, $\partial c_i/\partial w_K \equiv \alpha_{iK}$, $i = 1, 2$
- Solving the system of linear equations (factor markets clearing)
$$y_1\alpha_{1L} + y_2\alpha_{2L} = \bar{L}$$
$$y_1\alpha_{1K} + y_2\alpha_{2K} = \bar{K}$$
we obtain
$$y_1 = \frac{\bar{K}}{\alpha_{1K}} \frac{\bar{L}/\bar{K} - \alpha_{2L}/\alpha_{2K}}{\alpha_{1L}/\alpha_{1K} - \alpha_{2L}/\alpha_{2K}}$$
$$y_2 = \frac{\bar{K}}{\alpha_{2K}} \frac{\alpha_{1L}/\alpha_{1K} - \bar{L}/\bar{K}}{\alpha_{1L}/\alpha_{1K} - \alpha_{2L}/\alpha_{2K}}$$



Trade in the Heckscher-Ohlin model

- Heckscher-Ohlin Theorem: A country will export the good whose production uses its comparatively abundant factor more intensively
  - Sketch of proof: Suppose A is labour rich and the production of good 1 is labour intensive; (i) with common homothetic preferences and with common prices p_1/p_2, the free-trade ratio x_1/x_2 will be the same in the two countries; (ii) by the Rybczynski Theorem, y_1/y_2 will be higher in A than in B; (iii) it must then be the case that A exports good 1 and imports good 2 and B does the reverse
  - Factor abundance based explanation of comparative advantage

Heckscher-Ohlin Theorem: proof

– In a free-trade equilibrium where the ratio x_1/x_2 is the same in both countries (because of common prices and common preferences), consumption of each good must be proportional to income, i.e.

$$x_i^j = \frac{\sum_{i'} p_{i'} y_{i'}^j}{\sum_{i'} p_{i'} y_{i'}} \, y_i, \quad i = 1,2, \quad j = A,B$$

where $y_i = y_i^A + y_i^B$ is total output of good i, $i = 1,2$; now expand the expression $m_1^A = x_1^A - y_1^A$, using the above expression for x_1^A and manipulate it to obtain $m_1^A = \left(y_1^B/y_2^B - y_1^A/y_2^A\right) \dfrac{p_2 y_2^A y_2^B}{\sum_i p_i y_i}$

If A is labour rich, then $y_1^A/y_2^A > y_1^B/y_2^B$ (Rybczynski Theorem)

$\Rightarrow \; m_1^A < 0$, i.e. country A exports good 1 (and imports good 2);

if A is capital rich, then $y_1^A/y_2^A < y_1^B/y_2^B$

$\Rightarrow \quad m_1^A > 0$, i.e. country A imports good 1 (and exports good 2)

Factor price equalization and trade in the Heckscher-Ohlin model

- In a free-trade equilibrium where both goods are produced in the two countries (incomplete specialization), we must have

$$p_1/p_2 = c_1(w_L^A, w_K^A)/c_2(w_L^A, w_K^A) = c_1(w_L^B, w_K^B)/c_2(w_L^B, w_K^B)$$

- With different factor intensities across sectors, the ratio $c_1(w_L^j, w_K^j)/c_2(w_L^j, w_K^j)$ depends uniquely on the ratio w_L^j/w_K^j (note: $c_i(.)$ is homogeneous of degree one in factor prices)
- Then, in a free-trade equilibrium where both goods are produced in the two countries, w_L/w_K will be the same in the two countries
- Implication: factors trade is redundant
- It generalizes to a case with N goods and $M = N$ factors, but not readily to scenarios where $M \neq N$

General analysis of two-country, N-good, M-factor case

v: vector of factor endowments (M-dimensional)

Revenue functions (dual representation of production possibilities):

$$R^j(p, v^j) \equiv \max_{y^j} \left\{ p\, y^j \mid \Omega^j(y^j, v^j) \geq 0 \right\}, \quad j = A, B$$

– Properties of revenue function:

$$R^j_p(p, v^j) = y^j(p, v^j) \quad \text{(revenue maximizing output vector)}$$

$$R^j_v(p, v^j) = w^j \quad \text{(vector of factor prices)}$$

$$E_p^j(\widehat{p}^j, \widehat{U}^j) = R_p^j(\widehat{p}^j, v^j) \qquad \text{(market clearing, } N \text{ equations)}$$

$$E^j(\widehat{p}^j, \widehat{U}^j) = R^j(\widehat{p}^j, v^j) \qquad \text{(budget constraint, one equation)}$$

$N+1$ equations
$N+1$ variables $(\widehat{p}^j, \widehat{U}^j)$

- Homogeneity of degree zero in prices implies only $N-1$ independent prices; Walras' law implies only $N-1$ independent market clearing conditions

$$E_p^A(p, U^A) + E_p^B(p, U^B) = R_p^A(p, v^A) + R_p^B(p, v^B)$$

(market clearing)

$$E^A(p, U^A) = R^A(p, v^A) \qquad \text{(budget constraint for } A\text{)}$$

$$E^B(p, U^B) = R^B(p, v^B) \qquad \text{(budget constraint for } B\text{)}$$

Gains from trade

$$E^j(p, \widehat{U}^j) \leq p\,\widehat{x}^j = p\,y^j(\widehat{p}^j, v^j) \leq R^j(p, v^j) = E^j(p, U^j)$$

- The first inequality follows from the definition of $E^j(p, U^j)$
- The following equality follows from the fact that $\widehat{x}^j = y^j(\widehat{p}^j, v^j)$
- The second inequality follows from the definition of $R^j(p, v^j)$: $y^j(\widehat{p}^j, v^j)$ is not the revenue-maximizing output mix at prices p
- The last equality follows from the budget constraint

Since $E^j(p, U^j)$ is increasing in U^j, we conclude that $U^j \geq \widehat{U}^j$

The first inequality reflects "consumption gains" (resulting from re-optimization of consumption plans); the second inequality reflects "production gains" (resulting from re-optimization of production plans)

Outline

Comparative advantage: predictions vs. stylized facts

- Factor abundance driven comparative advantage implies that a country should be exporting those goods that are produced using its comparatively abundant factors
- Not clearly matching empirical facts: U.S. exports in the late 1940s were more labour-intensive than its imports, despite the fact that the U.S. was comparatively capital rich ("Leontief paradox")
- More generally:
  - Comparative advantage predicts that we should observe comparatively larger trade flows between countries that have comparatively more different production possibilities, i.e. different factor endowments (if we accept that technology itself is transferable)
  - It also predicts that countries' imports should not have the same factor content as their exports, i.e. countries should not be importing goods that are similar to those they are exporting

Comparative advantage: predictions vs. facts (continued)

- This is inconsistent with observed trade patterns: in 2011 almost 70% of OECD countries' merchandise trade consisted of trade with other OECD countries ("North-North trade"), and in the 2000s, about a third of trade between NAFTA countries – U.S., Canada and Mexico – consisted of trade in similar goods ("intra-industry trade", as opposed to "inter-industry trade")
- Comparative advantage is unable to account for North-North and intra-industry trade

Is there scope for trade between similar countries?

- "New" trade theories (1970s onwards) looking for explanations other than comparative advantage
- Trade between similar countries and in similar goods makes sense if there are scale economies in production
- We sketch the main idea below; we'll come back to it later

Scale economies and trade between central planners of identical countries

- Two economies, A and B, with a single consumer in each
- Two tradeable goods, 1 and 2
- One input, labour (L); equal endowments $\bar{L}^A = \bar{L}^B = \bar{L}$
- Technologies identical across goods and across countries
- Identical preferences in A and B, symmetric across the two goods, i.e. $U^j(q_1^j, q_2^j) = U^j(q_2^j, q_1^j)$
- Allocation choices made by a central planner – unrealistic, but useful to illustrate the main idea
- Scale economies in production (non-convex production possibilities):

$$y_i^j(L_i^j) = (L_i^j - F)/\alpha, \quad i = 1,2, \quad j = A,B$$

F: fixed cost

L_i^j: labour input in the production of good i in country j

Autarky

Two possible outcomes:

(i) If domestic welfare is higher when both goods are produced, i.e. if $U\big((\bar{L}/2-F)/\alpha,(\bar{L}/2-F)/\alpha\big) > U\big((\bar{L}-F)/\alpha,0\big)$, then the planner will choose to have both goods produced and consumed

(ii) If domestic welfare is higher when only one good is produced, i.e. if $U\big((\bar{L}/2-F)/\alpha,(\bar{L}/2-F)/\alpha\big) < U\big((\bar{L}-F)/\alpha,0\big)$, then the planner will choose to have only one good produced and consumed

Trade

Now suppose the two planners can agree to trade with one another, and that if they do so, trade will take place at a one-to-one ratio (one unit of good 1 in exchange for one unit of good 2). Two possible outcomes:

(i) if (i) under autarky, then with trade country A can specialize in the production of good 1 and country B can specialize in the production of good 2. Total production of each good is then $(\bar{L}-F)/\alpha$ and through trade each country can attain

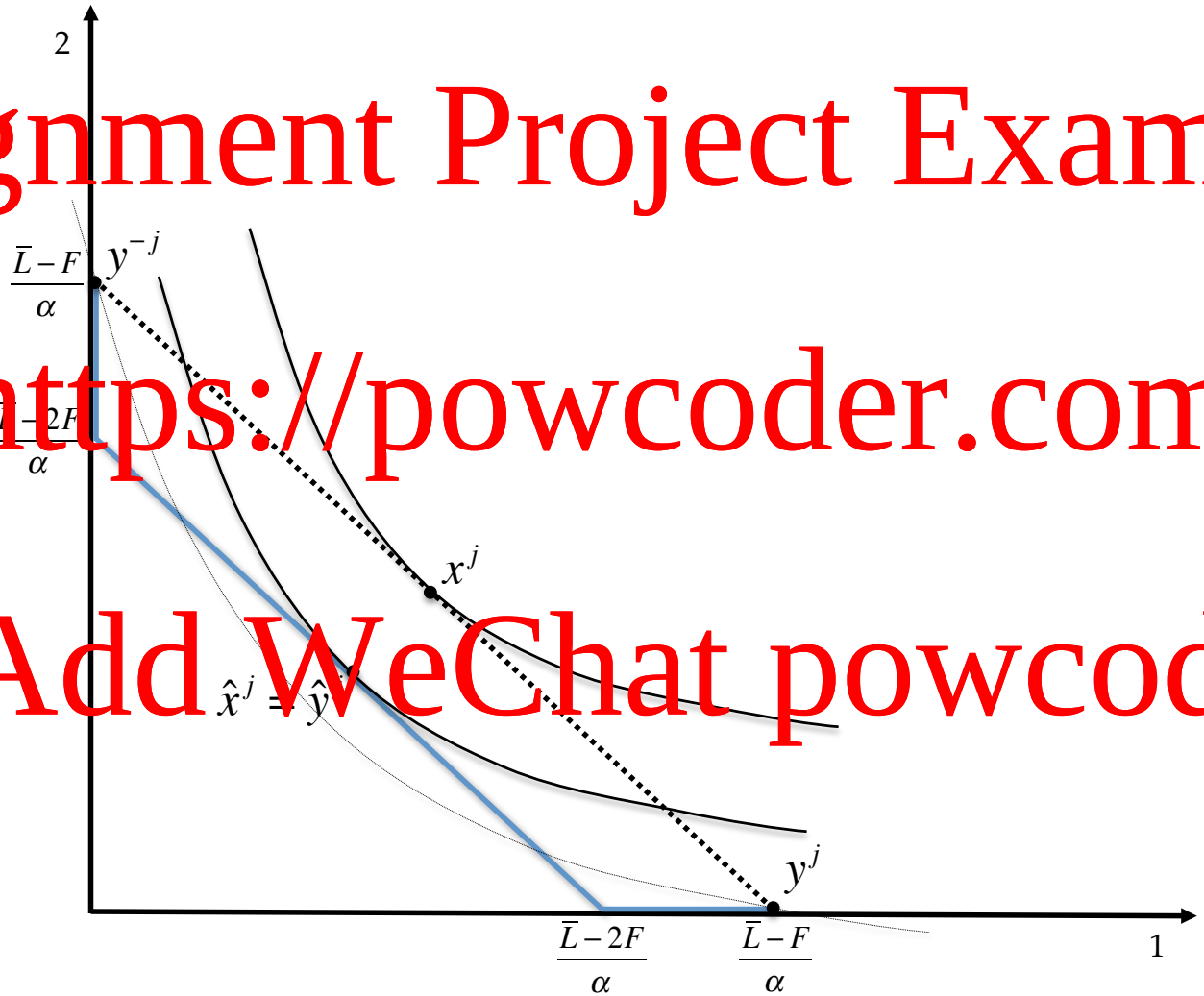
$$U\big((\bar{L}-F)/(2\alpha),(\bar{L}-F)/(2\alpha)\big) > U\big((\bar{L}-F)/\alpha,(\bar{L}-F)/\alpha\big)$$

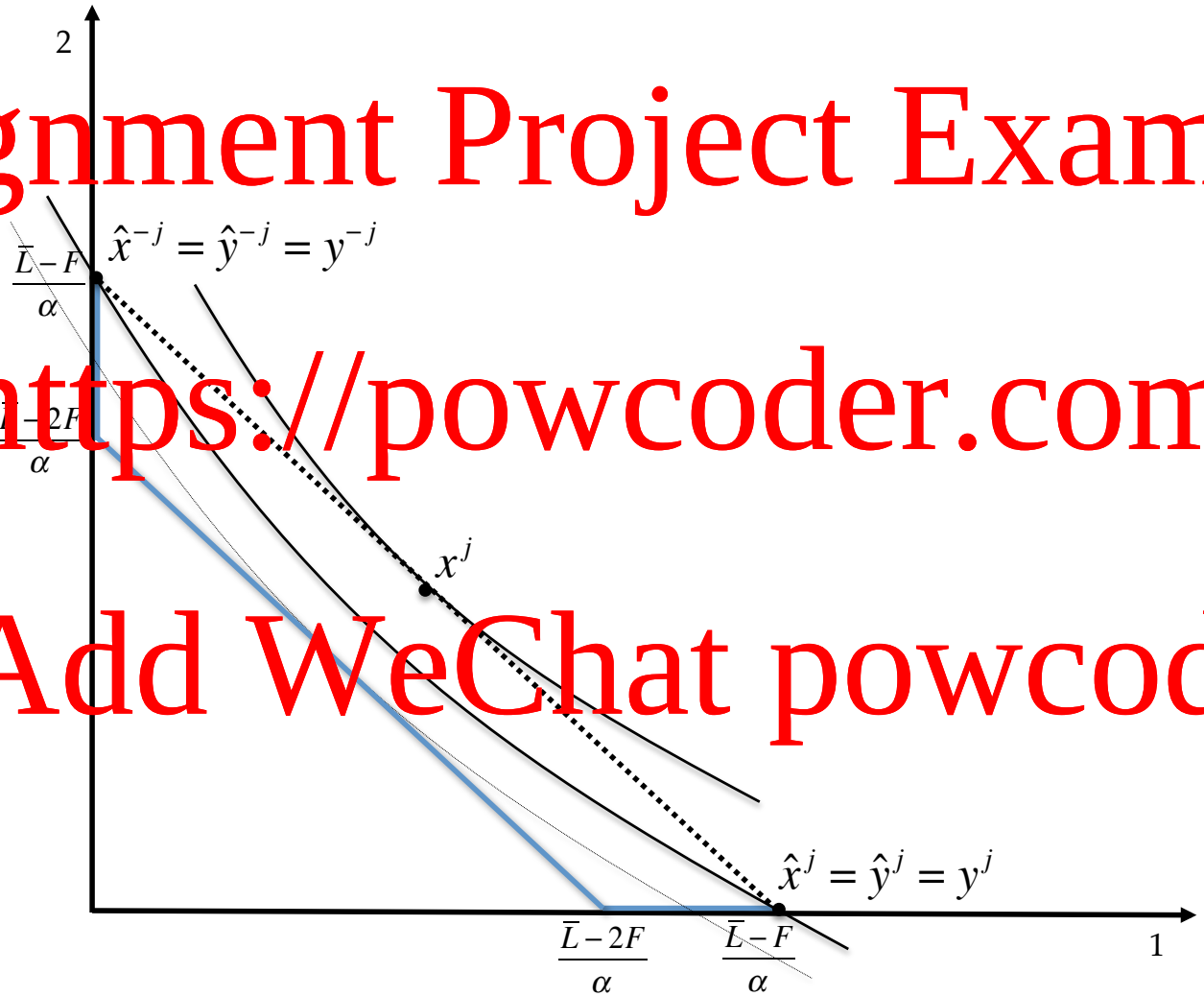
"production rationalization gains" (consumers are better off because goods can be produced more cheaply)

(ii) If (ii) under autarky, then with trade country A can specialize in the production of good 1 and country B can specialize in the production of good 2. Total production of each good is then $(\bar{L}-F)/\alpha$ and through trade each country can attain

$$U\big((\bar{L}-F)/(2\alpha),(\bar{L}-F)/(2\alpha)\big) > U\big((\bar{L}-F)/\alpha,0\big)$$

"consumption diversification gains" (consumers are better off because they can now consume both goods)





Scale economies, trade between similar countries, intra-industry trade

- Scale economies in production can account for trade between similar countries
- Can they account for trade in similar goods? Yes, if goods 1 and 2 are interpreted as different *varieties* of the same good. Then the "consumption diversification gains" can be thought of as "variety gains"
- Problem with above story: economies are not centrally planned. Need for theoretical constructs that can reconcile scale economies with decentralized decision making. Neoclassical trade model cannot do that $\Rightarrow$ need to look elsewhere – e.g. models of trade and production with imperfect competition or with production externalities

Outline

Trade policy instruments in the neoclassical model of trade

- What are the effects on trade and welfare of countries using policy instruments to restrict or influence trade? What trade policies should countries adopt? (Normative as opposed to positive analysis)
- Focus first on neoclassical environment; we will return to the discussion of trade policies later when looking at "new" trade models

Outline

Trade barriers under perfect competition – small open-economy case

- Small single-consumer economy (D) trading with the rest of the world (ROW) at given terms of trade p_1/p_2
- Convex production possibilities
- What is the welfare maximizing choice of y and x (and thus $m = x - y$) for a domestic planner? Maximization of $\mathcal{U}(x)$ s.t. $p\,x = p\,y$ and $\Phi(y) \equiv 0$ requires

$$\text{MRT}_{12} = p_1/p_2 = \text{MRS}_{12}$$
$$p_1 m_1 + p_2 m_2 = 0$$

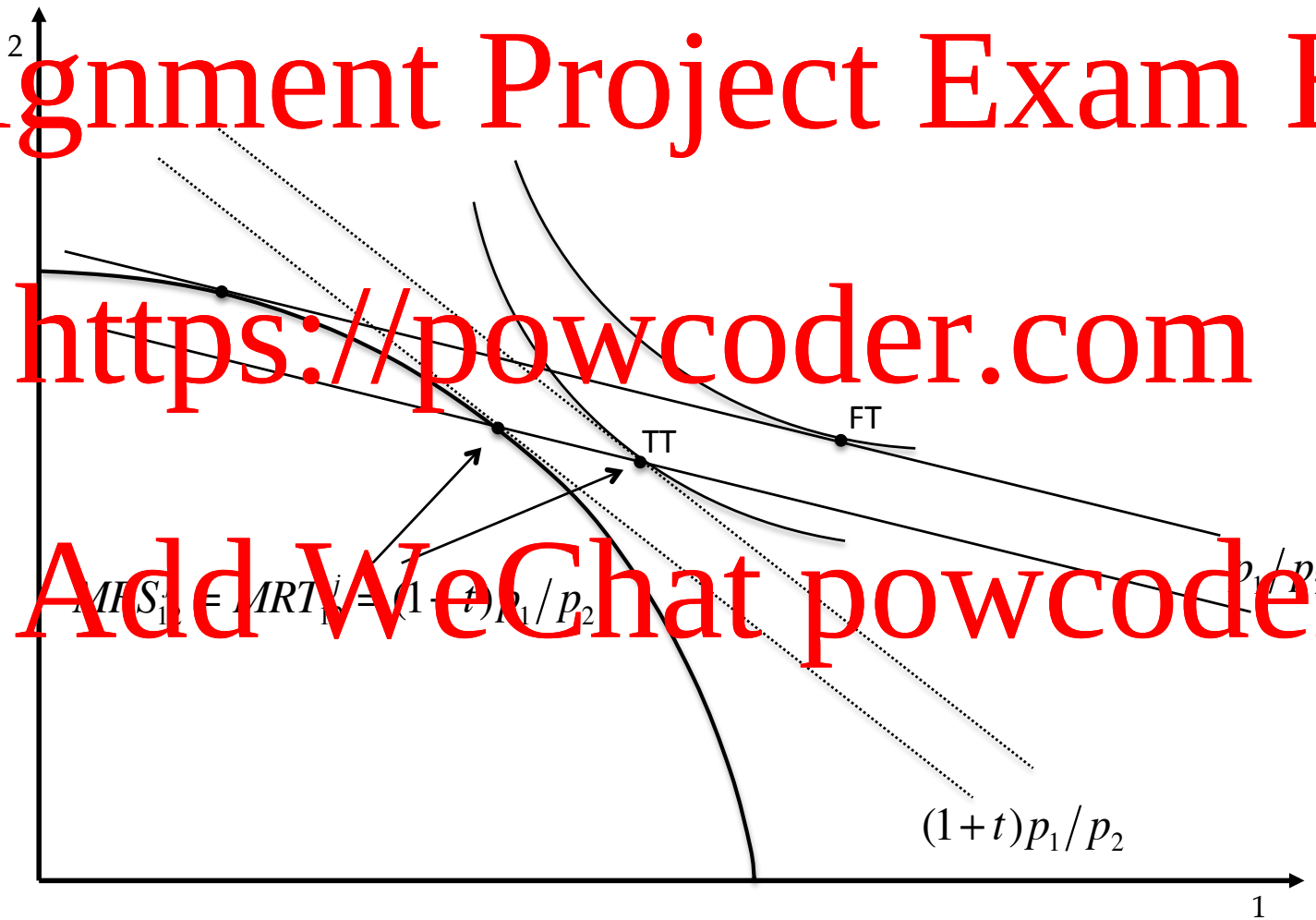
- We will assume $\hat{p}_1^D/\hat{p}_2^D > p_1/p_2 \Rightarrow$ under free trade the domestic economy imports good 1 and exports good 2

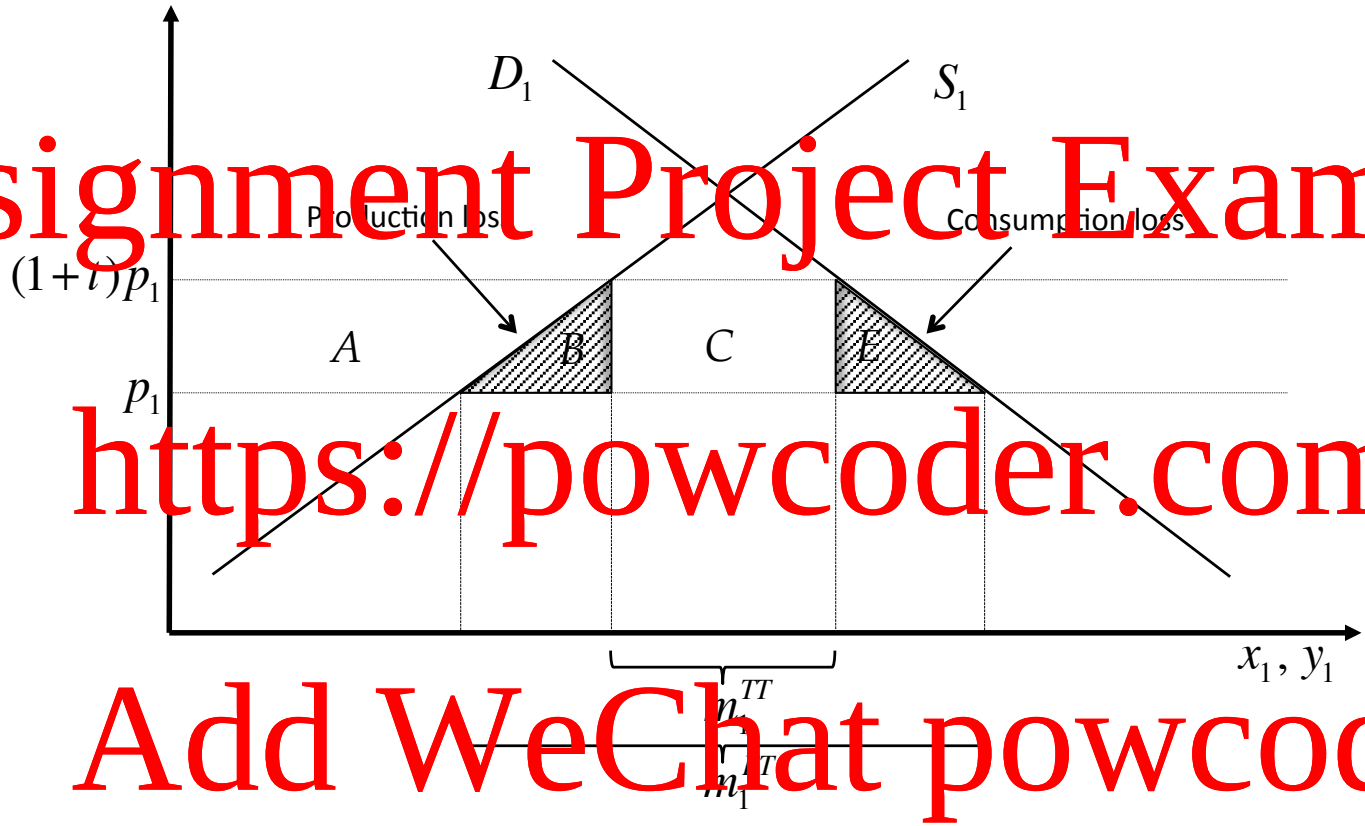
An import tax (a.k.a. tariff)

- Now suppose the domestic government levies an ad valorem import tax (a tax that is proportional to the value of imports) at rate t, whose revenue, $R = t\,p_1 m_1$, is returned to domestic consumers in a lump-sum fashion (i.e. consumers view this as exogenously given when making their choices)
- As long as there is some trade, by market arbitraging (law of one price) domestic prices must equal $p_1^D = (1+t)p_1,\ p_2^D = p_2$
- The consumer's budget constraint is now $p^D x = p^D y + R$

An import tax (continued)

- In a decentralized equilibrium, utility maximization and profit maximization imply
$$MRS_{12} = MRT_{12} = p_1^D / p_2^D = (1+t)p_1 / p_2 > p_1 / p_2$$
$$p_1 m_1 + p_2 m_2 = 0$$
- Since MRT_{12} is greater with the tariff than under free trade, the ratio y_1/y_2 will also be greater, i.e. output will expand in the *import-competing* sector (causing imports to fall) and will contract in the other (causing exports to fall)
- For $(1+t)p_1/p_2 \geq \widehat{p}_1/\widehat{p}_2$, i.e. $t \geq \bar{t} \equiv (\widehat{p}_1 p_2)/(\widehat{p}_2 p_1) - 1$, trade shuts down (*prohibitive tariff*)
- Since the decentralized outcome with tariffs does not correspond to the welfare maximizing outcome, the tariff causes a "deadweight loss" for the domestic economy





$\Delta CS = -(A + B + C + E)$

$\Delta PS = +A$ (value of protection to import-competing producers)

Tariff revenue $= +C = t\, p_1 m_1^{TT}$

Total $= -(B + E)$ DEADWEIGHT LOSS

Why would a small open economy levy an import tax?

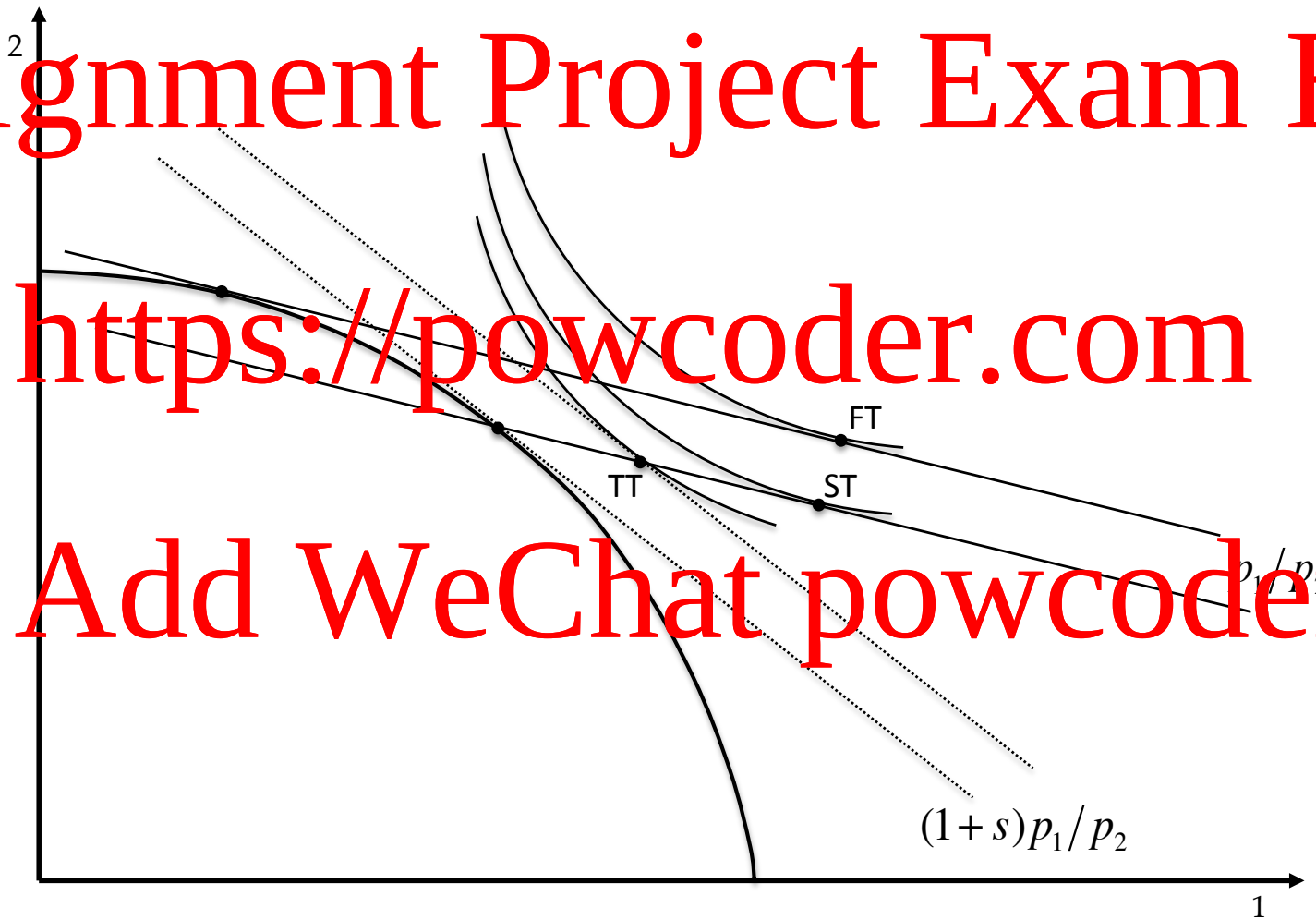
- Import tax is welfare worsening. Two possible reasons for why a small open economy would levy an import tax:

  (i) Distributional reasons: an import tax raises producer surplus/rents/factor income in the import-competing sector ("protection")

  However, this can be accomplished at a lower welfare cost by giving an output subsidy to sector 1 at rate $s = t$. This makes the ratio of producer prices equal to

  $$p_1(1+s)/p_2 = p_1(1+t)/p_2$$

  and so has the same effect on producers as an import tax t; but it can be shown that consumer welfare is higher in this case: taking the output mix y_1/y_2 (corresponding to an import tax t or a subsidy at the same rate $s = t$) as given, the welfare maximizing consumption choice requires $\text{MRS}_{12} = p_1/p_2$; this is achieved under a production subsidy (which does not affect consumer prices) but not under an import tax



Effective protection

- The level of "protection" an import-competing sector receives from trade taxes generally depends both on the tariffs levied on imports of the good it produces (its output) and on the tariffs levied on its inputs
- Per unit value added in sector i:

$$\text{va}_i = p_i^D - \sum_j \alpha_{ji} p_j^D$$

where α_{ji} is requirement of input j per unit of output i

- With no tariffs:

$$\text{va}_i = p_i - \sum_j \alpha_{ji} p_j$$

- With tariffs:

$$\text{va}_i' = (1 + t_i)p_i - \sum_j \alpha_{ji}(1 + t_j)p_j$$

Effective protection (continued)

- Relative gap (*rate of effective protection*):

$$\frac{\mathrm{va}_i' - \mathrm{va}_i}{\mathrm{va}_i} = \frac{t_i - \sum_j t_j \theta_{ji}}{1 - \sum_j \theta_{ji}} \equiv t_i^E$$

  where $\theta_{ji} = p_j \alpha_{ji} / p_i$ is j's input value share in i's production (note: this is independent of prices only when technologies are Cobb-Douglas)

- Effective protection depends positively on the tariff levied on imports of good produced by sector i and negatively on tariffs levied on imports of goods that are used as production inputs in sector i
- "Tariff escalation": the practice of levying higher tariffs on manufactured goods and lower tariffs on raw materials

Why would a small open economy levy an import tax? (continued)

...

(ii) Revenue raising reasons: governments need revenue to finance expenditures; raising revenue is costly/difficult; trade taxes may be a comparatively low cost way of doing so, especially for less developed countries (in formal terms, the planning problem in this case involves revenues being used to fund public good provision, which enters consumer's utility, and an opportunity cost in excess of unity for public funds obtained elsewhere)

- Revenue raising constraints can also account for why an import tax may be preferred to a production subsidy when the government pursues distributional objectives (a production subsidy must be funded by revenues raised elsewhere in the economy)

An export tax

- Now suppose the domestic government levies an ad valorem export tax at rate t with revenue $R = -tp_2^D m_2$ being returned to consumers in a lump-sum fashion
- As long as there is some trade, we must have $p_2 = (1+t)p_2^D$, and so domestic prices must equal $p_1^D = p_1$, $p_2^D = p_2/(1+t)$
- In a decentralized equilibrium, utility maximization and profit maximization then imply

$$\text{MRS}_{12} = \text{MRT}_{12} = p_1^D/p_2^D = (1+t)p_1/p_2 \neq p_1/p_2$$
$$p_1 m_1 + p_2 m_2 = 0$$

$\Rightarrow$ an export tax at rate t is fully equivalent to an import tax at the same rate t (Lerner symmetry)

Trade subsidies

- An import subsidy at rate s causes domestic prices to become $p_1^D = p_1(1-s)$, $p_2^D = p_2$
- This is equivalent to an export subsidy at rate s, whereby $p_1^D \equiv p_1$, $p_2 = (1-s)p_2^D \;\Rightarrow\; p_2^D = p_2/(1-s)$ (Lerner symmetry)

  In both cases, the outcome involves $\text{MRS}_{12} = \text{MRT}_{12} = p_1^D/p_2^D = (1-s)p_1/p_2 \neq p_1/p_2$ and is therefore inefficient
- With trade taxes, welfare cannot be below the level of autarky welfare, $\widehat{U}$ (attained with trade taxes at or above their trade prohibitive level); in contrast, trade subsidies can cause welfare to fall *below* the autarky level of welfare; e.g. if, without subsidies, it happens to be the case that $\widehat{p}_1^D/\widehat{p}_2^D = p_1/p_2$, implying $m = 0$ under free trade, then any trade subsidy will always lower welfare below $\widehat{U}$

Import quotas

- Suppose that the domestic country introduces a quantitative ceiling, $\overline{m}_1$ for imports: quantity based rather than price based instrument
- This is done through a licensing system granting some domestic agents (importers) the right to import a certain amount of good 1, with the licenses totalling $\overline{m}_1$
- Market arbitraging implies that imported goods will sell domestically at $p_1^D \Rightarrow$ a licensed importer purchasing one unit of good 1 at $p_1 < p_1^D$ in the world market and selling it at p_1^D domestically will obtain a per-unit quota rent equal to $p_1^D - p_1$ corresponding to a fraction $r = (p_1^D - p_1)/p_1$ of the import price, and domestic importers will receive total quota rents $R = r\, p_1 \overline{m}_1$

Import quotas (continued)

- We can then write

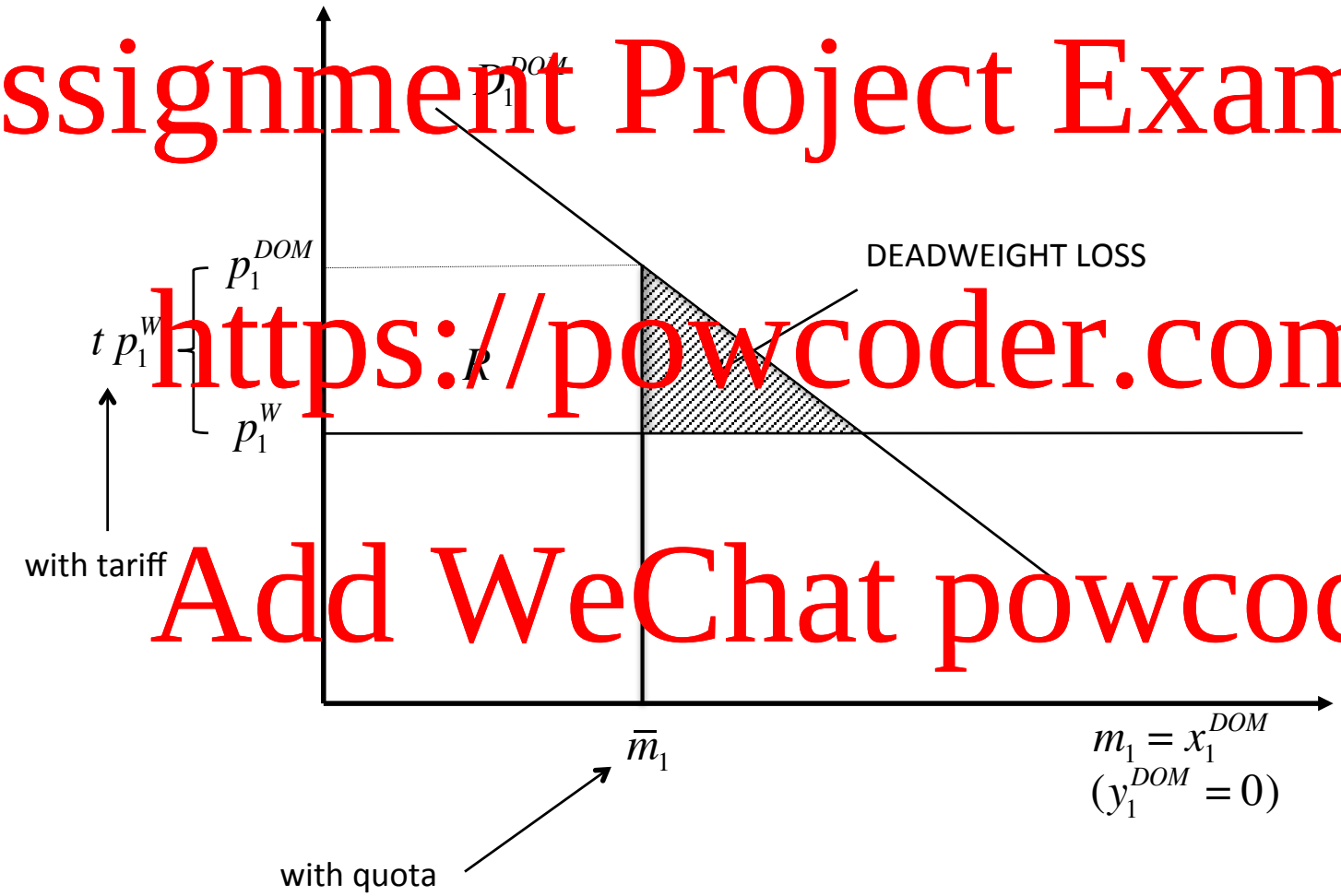
$$p_1^D = (1+r)p_1$$

and so, in equilibrium,

$$MRS_{12} = MRT_{12} \Rightarrow p_1^D / p_2^D = (1+r)p_1/p_2 \neq p_1/p_2$$

i.e. an outcome that is fully equivalent to that under an import tariff at rate $t = r$ (inducing the same deadweight loss)

- If the government sells the licenses (by auction), then quota rents will accrue to the public treasury just as tariff revenues do



Differences between tariffs and quotas

- Differences arise if p_1/p_2 changes: with a given t, p_1^D/p_2^D changes and so do trade flows; with a given $\overline{m}_1$ trade flows do not change
- Other difference: incentives for "quality upgrading" under quotas (rents to importers maximized by filling the quotas with higher-quality, higher-priced imports)
- Also, with competitive allocation of quota rights, individuals will devote real resources to obtaining the licenses (*rent seeking*), and will do so up to the point where the (marginal) cost of rent seeking equals the value of the license, i.e. importers will be willing to expend up to $r\,p_1$ in real resources (e.g. time spent in a queue) in order to obtain a license worth $r\,p_1$. Thus, in principle, the full value of quota rights, $R = r\,p_1\overline{m}_1$, could be dissipated through rent seeking efforts, resulting in a much higher welfare cost for the domestic economy in comparison with an import tariff

Other quantity based instruments

- Export quotas, equivalent to import quotas (Lerner symmetry)
- In principle, mandated minimum import and export levels are possible – equivalent to each other and equivalent to trade subsidies
- Voluntary export restraints (VERs): trade quotas negotiated with exporting countries; key difference is that quota rents accrue to exporters in ROW rather than to importers in the domestic economy

  $\Rightarrow$ more costly to domestic economy than an import tariff or an import quota; more attractive to ROW exporters

Other non-tariff trade barriers

- Product standards, customs requirements
- Hard to quantify
- Hard to distinguish trade-restriction objectives from other objectives (e.g. consumer protection, environmental objectives)

The marginal deadweight loss of trade barriers

- Good 1 imported, good 2 exported
  - No trade taxes on good 2, implying $p_2^D = p_2$
  - Normalize $p_2^D = p_2 = 1$ (implying $p_1^D / p_2^D = p_1^D$ and $p_1 / p_2 = p_1$)
  - Assume quasilinear preferences:

    $$U(x_1, x_2) = H(x_1) + x_2$$

    with $H(.)$ increasing and concave ($H'(.) > 0$, $H''(.) < 0$)
  - No domestic import-competing production

    $\Rightarrow \quad x_1^D = m_1, \quad x_2^D = y_2 = p_1 m_1$

The marginal deadweight loss of trade barriers (continued)

- Let $\check{m}_1$ be the level of imports with no trade barriers; we can write

$$m_1 = \check{m}_1 - (\check{m}_1 - m_1) = \check{m}_1 - \omega_1$$

where $\omega_1 = \check{m}_1 - m_1$ is the import reduction, relative to free trade, brought about by the use of trade barriers

- Domestic welfare is

$$H(m_1) + \bar{y}_2 - p_1 m_1 = H(\check{m}_1 - \omega_1) + \bar{y}_2 - p_1(\check{m}_1 - \omega_1)$$

The marginal effect on domestic welfare of a higher ω_1 (a trade reduction arising from more stringent trade restrictions) is

$$-H'(\check{m}_1 - \omega_1) + p_1 < 0$$

which is increasing in ω_1 (in absolute value) since

$$H''(\check{m}_1 - \omega_1) < 0$$

$\Rightarrow$ the marginal welfare cost of trade restrictions becomes progressively higher as restrictions get tighter (and so the marginal welfare gain from trade liberalization becomes progressively smaller as trade restrictions are relaxed)

Arguments for trade protection by a small open economy in a neoclassical environment

- Protection objective and revenue raising objective have already been covered
- Other arguments: "second-best" arguments, based on the recognition of other distortions being present
- Examples:
  - Environmental externalities (negative externality): suppose that the production of exported goods causes negative, uninternalized, domestic environmental externalities (e.g. logging in tropical forests causing loss of biodiversity); then restricting trade with trade taxes may push the outcome closer to efficiency
  - Learning-by-doing externalities (positive externality): suppose that the production of import-competing goods causes positive, uninternalized, domestic production externalities (e.g. production of high-tech goods causing skill upgrading in the labour force); then restricting trade with trade taxes may push the outcome closer to efficiency ("infant industry argument")

Counterargument to second-best arguments for trade protection

- Targeting principle: distortions are best addressed by policies that are directly targeted to the distortion
- If the cause of inefficiency is an uninternalized externality from production (involving both traded goods and goods that are consumed domestically) then the first-best way of offsetting the externality is by a domestic production tax or subsidy – or, even better, a tax or subsidy on the external effect itself if this can be more directly targeted
- Trade policy instruments in this case are imperfectly targeted instruments; e.g. a trade tax targets timber exports but fails to target domestic uses of domestically harvested timber, which also induce uninternalized externalities

Outline

Large country tariff

- A large economy can influence world prices by its trade flows
  - Assume good 1 imported, good 2 exported
  - As in the small open economy case, in a decentralized equilibrium we have

$$MRS_{12} = MRT_{12} \Rightarrow p_1^D / p_2^D = (1+t)p_1/p_2 > p_1/p_2$$

$$p_1 m_1 + p_2 m_2 = 0$$

  - However p_1/p_2 is no longer given; thus, it is possible for a tariff that lowers p_1/p_2 – improving the large country's terms of trade – to raise welfare for the large country relative to free trade

Optimal tariff: partial equilibrium analysis

- No trade taxes on good 2; price normalization: $p_2^D = p_2 = 1$
- Assume quasilinear preferences in the large country:
  $U(x_1, x_2) = H(x_1) + x_2$
  with $H(.)$ increasing and concave
- No domestic import-competing production
  $\Rightarrow x_1^D \equiv m_1$, $x_2^D = \bar{y}_2 - p_1 m_1$
- Net supply of good 1 by ROW, $-m_1^{ROW} = m_1$, is an increasing function of $p_1/p_2 = p_1$, i.e. $S(p_1)$, $S'(.) > 0$
- Foreign supply elasticity: $p_1 S'(p_1)/S(p_1) \equiv \eta$
- Inverse supply function, giving supply price p_1 as a function of m_1:
  $p_1 = S^{-1}(m_1)$
- Domestic demand for imports identified by the condition
  $H'(m_1) = p_1^D = (1+t)p_1$

Optimal tariff: partial equilibrium analysis (continued)

– What is the welfare maximizing level of m_1 for the large country? Maximization of objective $H(m_1) + \bar{y}_2 - p_1 m_1$ requires

$$H'(m_1) - p_1 - m_1 \, dS^{-1}(m_1)/dm_1 = 0$$

$$(p_1^D - p_1) - m_1 \frac{1}{dS(p_1)/dp_1} = 0$$

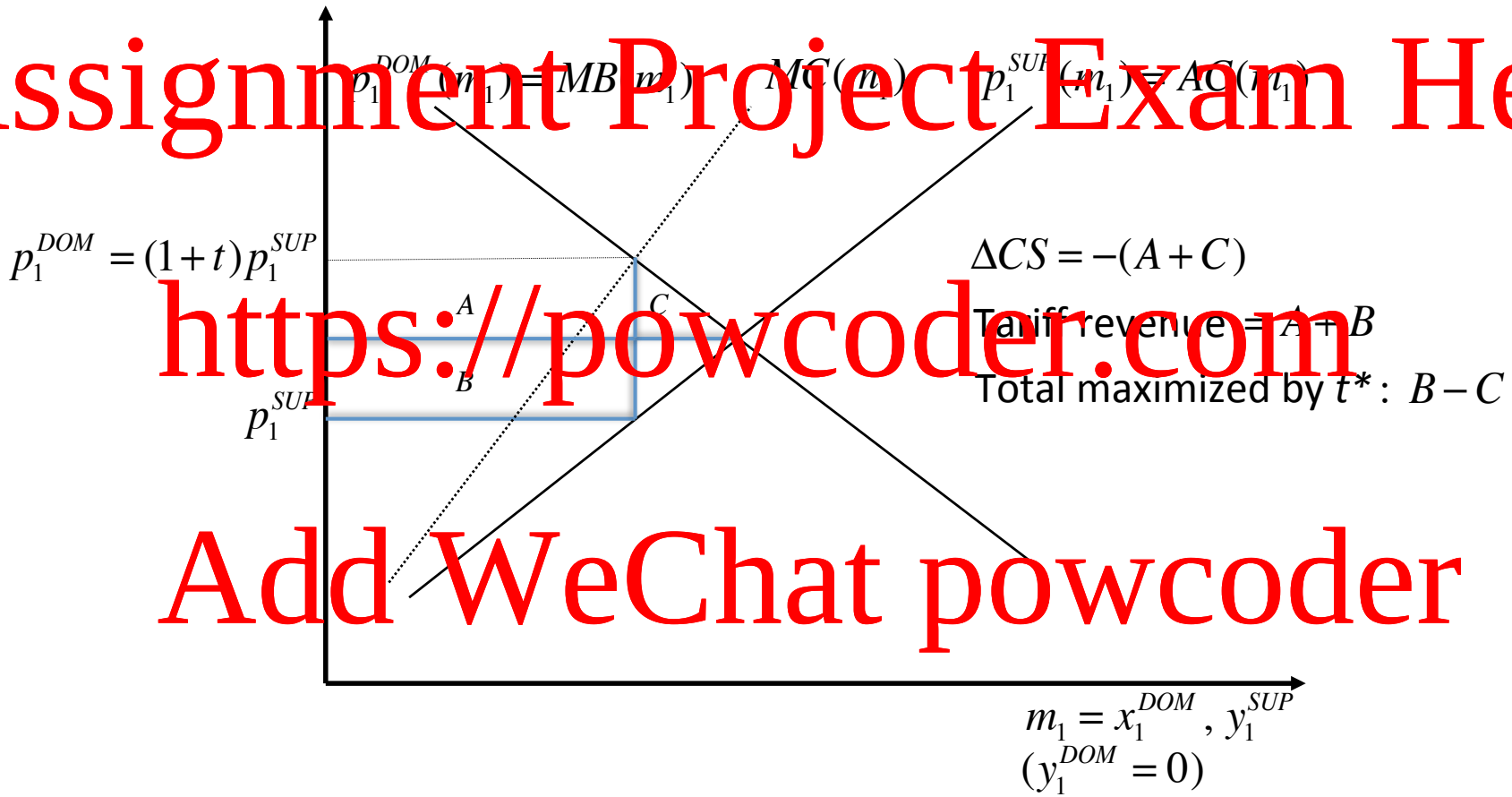
$$\frac{p_1^D - p_1}{p_1} - \frac{m_1}{p_1} \frac{1}{S'(p_1)} = 0$$

$$\frac{tp_1}{p_1} = \frac{1}{p_1 S'(p_1)/S(p_1)}$$

$t = t^* = \frac{1}{\eta}$ inverse elasticity rule (Lerner)

Optimal tariff, t^*, is inversely related to the elasticity of foreign supply

– For a small open economy, $\eta \to \infty \quad \Rightarrow \quad t^* \to 0$ (as previously established)



Optimal trade policies for a large economy

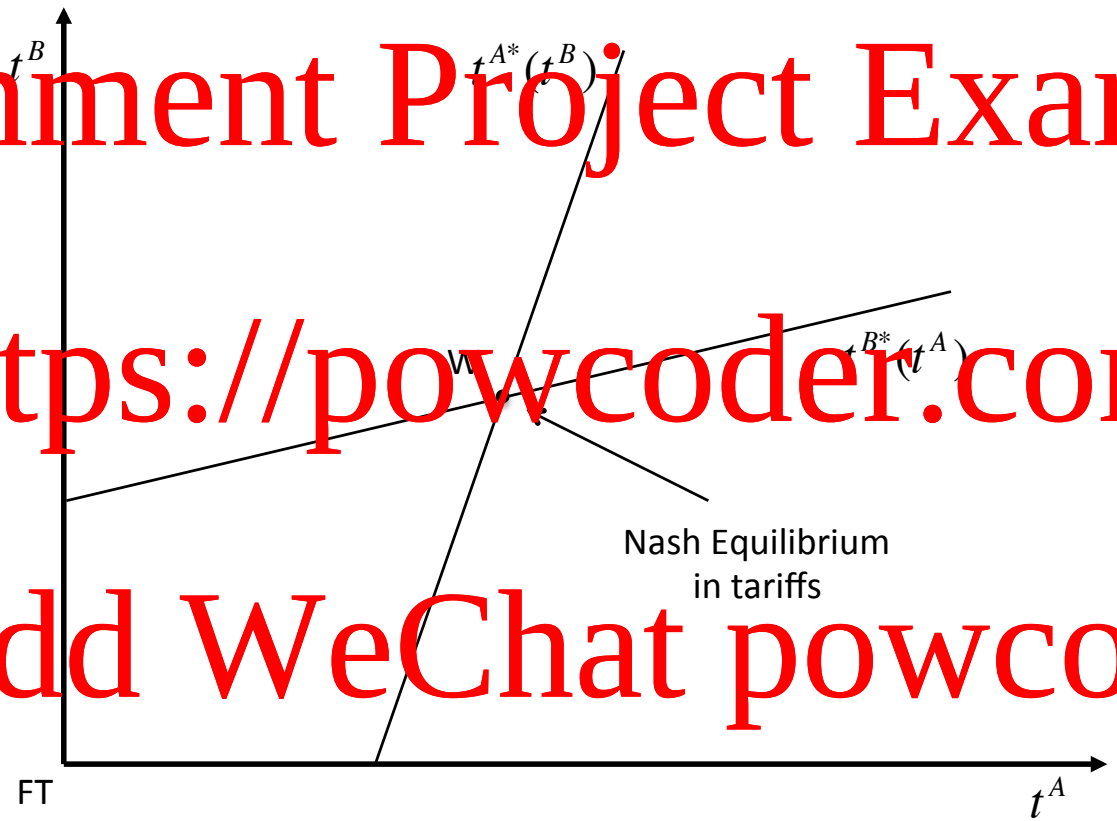
- Trade taxes are welfare worsening for a small open economy, but terms of trade gains can motivate a large country to levy trade taxes (or use trade quotas)
- What about trade subsidies? Trade subsidies can never be welfare maximizing in a neoclassical framework, even for a large country

Outline

Tariff retaliation

- Suppose now there are two countries trading two goods with one another and both are "large" (i.e. neither is negligibly small compared to the other)
- Given a choice of tariff t^A by A (levied on its imports), the optimal choice of import tariff, t^B, by B is found by maximizing B's welfare subject to trade equilibrium constraints (analogously to the optimal tariff problem for a single large country); this gives an optimal choice $t^{B*}(t^A)$ (best-response mapping for B)
- Analogously, we can derive a best-response mapping for A, $t^{A*}(t^B)$
- The best-response mappings can be increasing (t^A and t^B are *strategic complements*), decreasing (t^A and t^B are *strategic substitutes*), or constant
- A noncooperative Nash equilibrium in tariffs, (t^{AN}, t^{BN}), is identified by

$$t^{AN} = t^{A*}(t^{BN})$$
$$t^{BN} = t^{B*}(t^{AN})$$



Consequences of tariff retaliation

- Let Π_F^j identify the free-trade level of utility for $j = A, B$ at $t^j = 0,\ j = A, B$ (free trade)
- Let Π_W^j identify the trade retaliation level of utility for $j = A, B$ at $t^j = t^{jN},\ j = A, B$ (trade war)
- Let Π_D^j identify the level of utility for $j = A, B$, if the other country levies no tariffs and j levies its optimal tariff against the other country, i.e. if $t^j = t^{j*}(0),\ t^{-j} = 0$ (j unilaterally defects from free trade)
- Let Π_V^j identify the level of utility for $j = A, B$, if j levies no tariffs and the other country levies its optimal tariff, i.e. if $t^j = 0$, $t^{-j} = t^{-j*}(0)$ (j is a "victim" of defection)
- By the definition of a best-response mapping, we have:

$$\Pi_D^j > \Pi_F^j$$

$$\Pi_W^j > \Pi_V^j$$

Consequences of tariff retaliation (continued)

- What about the comparison between Π_W^j and Π_F^j?
- Pareto efficiency of a free-trade equilibrium implies that $\Pi_W^j < \Pi_F^j$ for at least one of A and B
- If one country is sufficiently larger than the other then it is possible that $\Pi_W^j > \Pi_F^j$ for that country (j wins the trade war and the other country loses)
- If the countries are similar (e.g. symmetric case), then $\Pi_W^j < \Pi_F^j$ for both; in this case the corresponding strategic game has a prisoners' dilemma structure, whereby the Nash equilibrium outcome $(\Pi_W^A,\ \Pi_W^B)$ is Pareto dominated by the free-trade outcome $(\Pi_F^A,\ \Pi_F^B)$
- Both countries would be better off under free trade, yet free trade cannot be sustained by decentralized tariff choices

Sustaining free trade

- The two countries could solve the problem through a binding agreement but this requires outside enforcement, and there is no outside mechanism (a supranational authority with autonomous powers) that can induce sovereign countries to abide by their commitments

  $\Rightarrow$ international agreements must be self-enforcing, i.e. they must correspond to equilibria of a sequential game where incentives to renege on the agreement at any point in time are kept in check by the cost of the future consequences of doing so
- Folk theorem: implies that, under certain conditions, repetition can make it possible to improve on the one-shot payoff combination

Sustaining free trade (continued)

- One way of doing so is by the use of "Nash-reversion strategies": player j selects $t^j = 0$ as long as the other player does the same; if the other player selects $t^{-j} > 0$ in a certain round, then from the next round onwards, j selects $t^j = t^{jN}$, indefinitely – to which the other player will respond by selecting $t^{-j} = t^{-jN}$, indefinitely

  - If both players adopt this strategy, then there will be free trade, indefinitely
  - Condition for this to be an equilibrium strategy is that sticking to it when the other player does is an optimal choice for j

Sustaining free trade (continued, 2)

- If j deviates from the stated strategy, assuming the other player sticks to it, then the highest payoff that j can obtain is by selecting $t^{j*}(0)$ in the first round of deviation and then $t^{jN} = t^{j*}(t^{-jN})$ in all subsequent rounds; thus the discounted payoff change to j from deviating from the stated strategy is

$$(\Pi_D^j - \Pi_F^j) + \frac{\delta^j}{1-\delta^j}(\Pi_W^j - \Pi_F^j) \equiv \Lambda^j$$

where $\delta^j \in (0,1)$ is a discount factor

- The stated strategy will be a Nash equilibrium (and so free trade will be sustainable) if

$$\Lambda^j \leq 0, \quad j = A, B$$

i.e. if

$$\delta^j \geq \frac{\Pi_D^j - \Pi_F^j}{\Pi_D^j - \Pi_W^j}, \quad j = A, B$$

- The policymakers in the two countries must be sufficiently "patient" (they must put enough weight on future payoffs)

Sustaining free trade – remarks

- Note: the above equilibrium is subgame perfect
- Limited predictive power (indeterminacy): this only says that free trade can be sustained, not that it will be; i.e. there are many other equilibria
- Cooperative outcome, if sustainable, does not require a formalized agreement; then what is the role of the formal agreements we observe?

Outline

Trade with scale economies and imperfect competition

- Comparative advantage cannot account for intra-industry trade and trade between similar countries
- The idea that similar countries may trade more with one another is an old conjecture due to Linder ("Linder hypothesis"), who based it on the notion that similar countries may have comparatively more similar tastes
- As anticipated earlier, scale economies in production can account for intra-industry trade and for trade between similar countries even when tastes are all the same: "new" trade theories
- Scale economies imply non-convex production sets, which cannot be handled by neoclassical competitive (Arrow-Debreu) framework

  $\Rightarrow$ need to go beyond the general neoclassical trade model

  The literature relies on a variety of specialized models to develop specific points

Scale economies and firms' decisions

- Economies of scale can be *internal* to firms (accounted for by firms in their production choices) or *external* to firms (i.e. arising from inter-firms externalities)
- Economies of scale that are external to firms can be compatible with competitive behaviour by firms, but typically give rise to multiple equilibria
- Economies of scale that are internal to firms are incompatible with competitive (price taking) behaviour by firms $\Rightarrow$ need to incorporate imperfectly competitive behaviour into the theories (though imperfect competition is relevant in its own right)
- We will start by looking at the case where scale economies are internal to firms
- To develop arguments, it is convenient to start by looking at situations where there is imperfect competition but no economies of scale

Outline

No scale economies: domestic monopoly

- Small open economy
- Two goods, 1 and 2
- Single input, labour, with total endowment $\bar{L}$ and price $w = 1$
- Good 2 produced from labour with CRS technology and $\alpha_2 = 1 \Rightarrow c_2 = w = 1$, i.e. marginal cost and price equal to unity (without loss of generality)
- Good 1 produced from labour with single-output production technologies featuring constant marginal labour cost, $\alpha_1 = c$
- We abstract from comparative advantage, i.e. focus on a scenario where $c = \alpha_1/\alpha_2$ equals the ratio of world prices p_1/p_2
  $\Rightarrow$ under perfect competition and free trade, there would be no trade

Domestic monopoly (continued)

- Preferences are quasilinear, and have the form

$$U(x_1, x_2) = (\phi/\gamma)(x_1)^{\gamma} + x_2, \quad \gamma \in (0,1)$$

- From utility maximization, demand for good 1 is

$$x_1(p_1) = (p_1/\phi)^{\epsilon},$$
$$\epsilon \equiv 1/(\gamma - 1) = (dx_1/dp_1)(p_1/x_1) < -1$$

$\Rightarrow$ constant elasticity (ϵ) demand; inverse demand is

$$p_1(x_1) = \phi(x_1)^{\frac{1}{\epsilon}}$$

and the inverse elasticity of demand is $1/\epsilon$

Domestic monopoly: autarky

- Single producer in sector 1 (monopolist)
- Optimal monopoly pricing: single producer in sector 1 (monopolist) producing $y_1 = x_1$
- Condition for maximization of profits, $p_1(x_1)\,x_1 - cx_1$:

  $\mathrm{MR}(x_1) = \mathrm{MC}(x_1)$, i.e.

  $p_1(x_1) + x_1\, dp_1/dx_1 = c \;\Rightarrow\; p_1(x_1)\big(1 + (x_1/p_1)(dp_1/dx_1)\big) = c$

  $\Rightarrow p_1(1 - 1/\epsilon) = c$
- Monopolistic mark-up over marginal cost, c, as a proportion of c:

  $\widehat{\mu}_1 = \widehat{p}_1/c - 1 = 1/(|\epsilon| - 1)$
- In an autarky equilibrium:

  $\mathrm{MRS}_{12} = \widehat{p}_1/\widehat{p}_2 = (1 + \widehat{\mu}_1)c \neq c = \mathrm{MRT}_{12}$

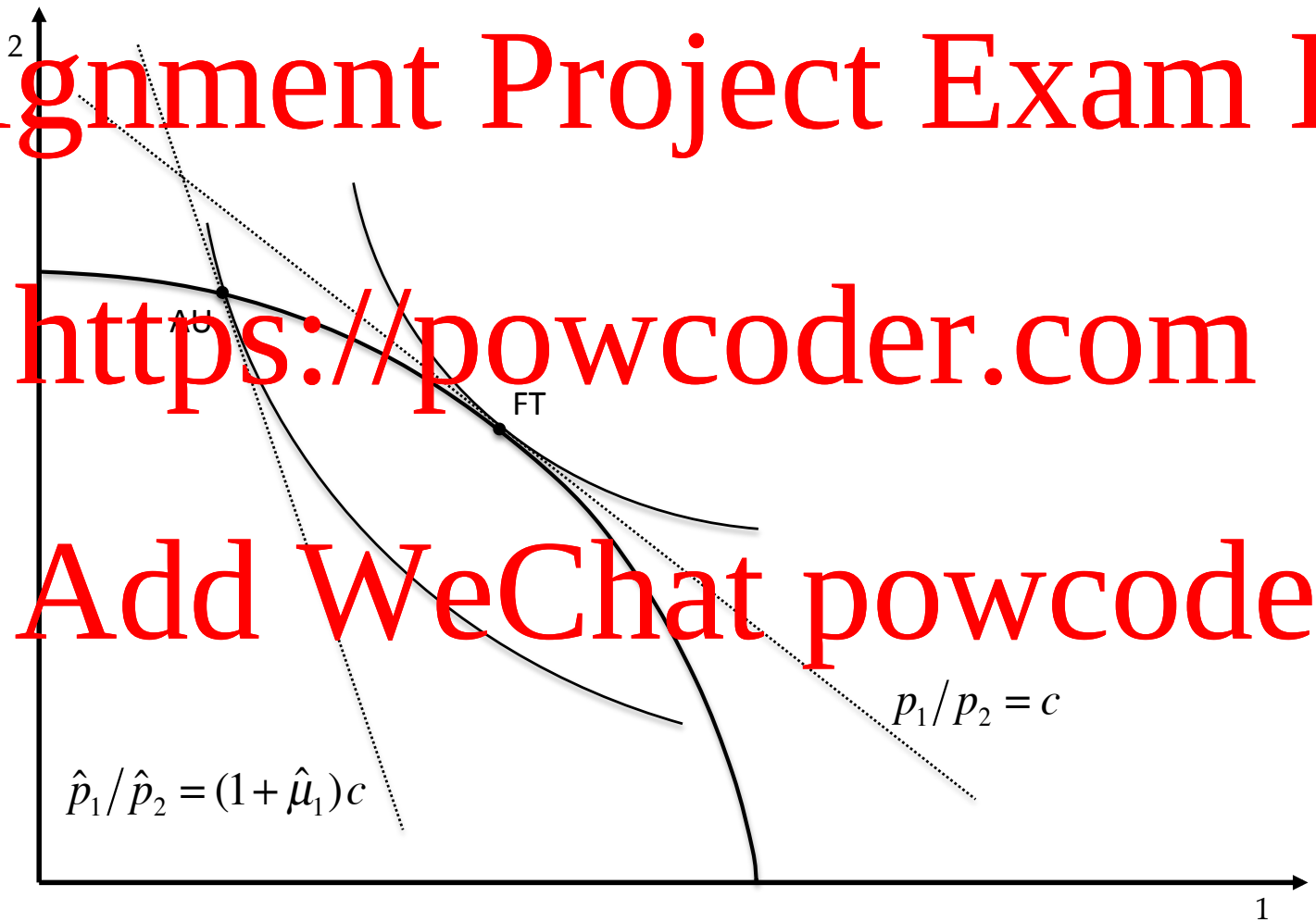
  $\Rightarrow$ monopolistic distortion (deadweight loss of monopoly, price too high, output too low)

Domestic monopoly: free trade

- Trade liberalization: domestic price ratio must equal world price ratio, $p_1/p_2 = c$:

$$\text{MRS}_{12} = c = \text{MRT}_{12}$$

- No trade (by assumption, domestic MRT equals ROW's MRT); the only effect is that the monopolistic distortion is eliminated, producing a welfare gain
- Opening of trade causes monopolist to lose its monopoly position even if trade liberalization does not induce trade
- Pure *pro-competitive effect* of trade liberalization (removal of deadweight loss from monopoly)



Cournot competition, no entry

- Two identical countries, A and B
- Good 1 produced by $\widehat{N}$ identical firms in each country
- Total output of good 1 is $y_1^j = \sum_i y_{1i}^j$, $i = 1, \ldots, \widehat{N}$, $j = A, B$
- Preferences are quasilinear as before:

$$U(x_1, x_2) = (\phi/\gamma)(x_1)^\gamma + x_2, \quad \gamma \in (0, 1)$$

- If a firm has market share s_i, its output is $y_{1i} = s_i x_1$, and so

$$\frac{dp_1(x_1)}{dy_1}\frac{y_{1i}}{p_1} = \frac{dp_1(x_1)}{dx_1}\frac{s_i x_1}{p_1} = \frac{1}{\epsilon/s_i} = \frac{1}{\epsilon_i}$$

where $\epsilon_i = \epsilon/s_i$ is the firm-specific demand elasticity

Cournot competition: autarky

- Cournot conjectures (firms choose quantities)
- Profit maximization condition:

$$\mathrm{MR}^i(y_{1i}) = \mathrm{MC}^i(y_{1i}), \text{ i.e.}$$

$$p_1(x_1) + y_{1i}\, dp_1/dy_{1i} = c$$

$$\Rightarrow \widehat{p}_1(1 + 1/\epsilon_i) = c$$

- In a symmetric equilibrium: $s_i = s = 1/\widehat{N}$, and $\epsilon_i = \widehat{N}\epsilon$, $i = 1, \ldots, \widehat{N}$, and so

$$\widehat{p}_1(1 + 1/(\widehat{N}\epsilon)) = c$$

Markup: $\widehat{\mu}_1 = 1/(\widehat{N}|\epsilon| - 1)$

Cournot competition: free trade

- In an integrated market with two identical countries, total number of firms is $N = 2\widehat{N}$ and so markup is

  $$\mu_1 = 1/(2\widehat{N}|\epsilon| - 1) < \widehat{\mu}_1$$

  $\Rightarrow$ lower monopolistic distortion: pure pro-competitive effect

  No trade actually needs to take place

- If transportation costs are higher for consumers than for producers, then markets are segmented (rather than integrated) and producers will compete in each market, giving rise to two-way trade

  For example, if transportation costs are zero for producers and prohibitively high for consumers, then competition in segmented markets will give rise to the same price outcome, but half of the output of sector 1 in each of the countries will be exported and a corresponding amount will be imported

  $\Rightarrow$ two-way trade under market segmentation and imperfect competition can account for intra-industry trade

Cournot competition: free trade (continued)

- If there are non-zero (but non-prohibitive) transportation costs, then two-way trade occurs and the consumer price for domestically produced goods is the same as the price (gross of transportation costs) of the imported goods.

This means that goods exported are sold by producers at a price, net-of-transportation costs, that is less than the price at which goods are sold by producers domestically

$\Rightarrow$ *'reciprocal dumping'*

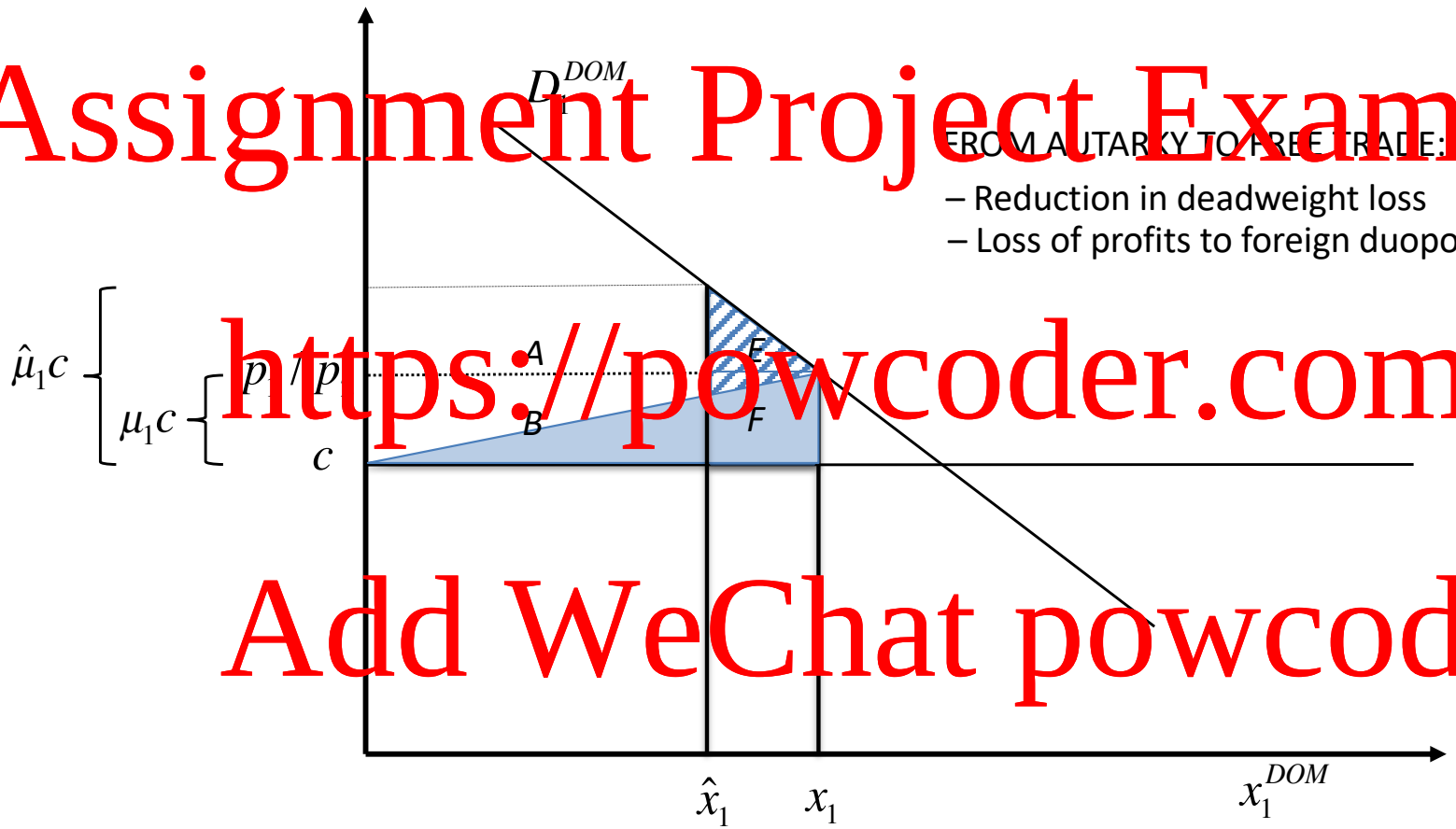
Imperfect competition: tariffs vs. quotas

- Under imperfect competition tariffs and quotas have different implications
- Consider first a scenario with a domestic monopolist (as discussed earlier), and suppose that we move from autarky to a situation where there is some trade but there are still some barriers to trade
- A tariff, t, then raises the domestic price of imports (relative to free trade), but the domestic producer can no longer behave as a monopolist (relative to autarky), i.e. the domestic price will be $p_1^D = (1+t)c$, just as with a tariff under perfect competition
- A quota $\overline{m}_1$ on the other hand, reduces the "residual demand" faced by the domestic producer from $x_1(p)$ to $x_1(p) - \overline{m}_1$, but within this given residual demand, the domestic producer can still behave as a monopolist
- Similarly, under oligopoly, a quota can sustain an oligopolistic outcome in the domestic market, whereas a tariff does not

Profit shifting

- Go back to a small open economy, domestic monopoly scenario
- Suppose that opening trade results in a single foreign firm entering the domestic market for good 1 alongside the domestic producer
  Trade liberalization then causes the monopoly to become a duopoly
  $\Rightarrow$ lower monopolistic mark-up – from $\widehat{\mu}_1 = 1/(|\epsilon| - 1)$ to $\mu_1 = 1/(2|\epsilon| - 1)$
- However, under autarky all the monopoly profits accrue to the domestic producer, whereas with free trade half of the (lower) duopoly profits accrue to a foreign firm
- The net effect on domestic welfare is:
  $$H(x_1) - H(\widehat{x}_1) - (p_1 x_1 - \widehat{p}_1 \widehat{x}_1) - \mu_1 c x_1/2$$
  which can be positive or negative

  The last term represents a negative welfare effect associated with extraction of domestic consumer surplus by foreign monopolistic producers



FROM AUTARKY TO FREE TRADE:

– Reduction in deadweight loss = + E + F

– Loss of profits to foreign duopolist = - (B + F)/2

Profit shifting (continued)

- Trade protection causes a positive profit shifting ("profit repatriation") effect: possible justification for protection by a small open economy
- Zero profit shifting effects (in net terms) when countries are symmetrical, e.g. the two-country oligopoly model discussed earlier

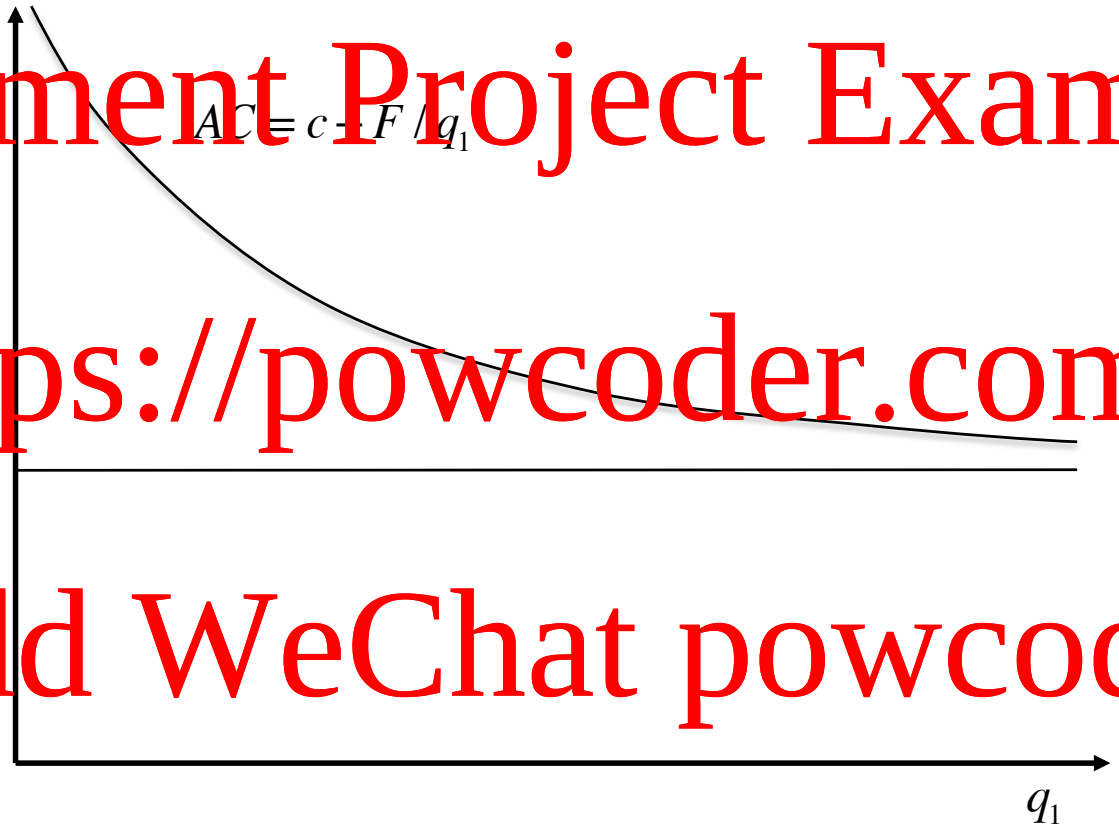
Outline

Internal scale economies

- Good 1 produced by N firms from labour with single-output production technologies, same for all firms, featuring constant marginal labour cost, c and fixed labour cost, F
- Average cost for firm $i = 1, \ldots, N$, producing an amount y_{1i} is

$$\mathrm{AC}^i(y_{1i}) = c + F/y_{1i}$$

- Not compatible with marginal cost pricing



Natural monopoly

- When the goods produced by different firms are homogeneous, scale economies give rise to "natural monopoly" (single producer)
- With constant elasticity, autarky mark-up is $\widehat{\mu}_1 = 1/(|\epsilon| - 1)$ and quantity produced is $x_1(c(1+\widehat{\mu}_1)) \equiv \widehat{x}_1$
- Trade liberalization between two identical countries may then result in the exit of one of the two monopolists

The fixed cost F will be incurred only once rather than twice: *rationalization* of production (same amount produced at a lower total cost by one producer rather than two)

Mark-up, price and total quantity produced globally all remain the same as in autarky

Good 1 is produced at a lower average cost, but the distribution of welfare effects is uneven: net surplus extraction (profits) by the country whose monopolist survives

If monopoly in B exits, then country A obtains higher profits, some of which are transferred from consumers in country B (the aggregate welfare effect is $F > 0$)

Product differentiation: monopolistic competition

- Basic idea due to Chamberlin; applied to trade by Krugman
- Single good produced by N firms from labour with single-output production technologies, same for all firms, featuring constant marginal labour cost, c, and fixed labour cost, F
- Total labour endowment $\overline{L}$; assume $w = 1$ (wage)
- Consumers view output as being differentiated across producers: different varieties of the same good (good 1), imperfect substitutes for one another
- Preferences are represented by

  $$U(x_1, \ldots, x_N) = \sum_i u(x_i)$$

  with $u'(x) > 0$, $u''(x) < 0$

  Symmetric product differentiation and "love of variety", i.e. $d\big(N\,u(X/N)\big)/dN = u(X/N) - (X/N)\,u'(X/N) > 0$
- Elasticity of $u'(x)$ (absolute value): $-x\,u''(x)/u'(x) \equiv \rho(x)$
- It is assumed that $\rho'(x) \geq 0$

Monopolistic competition (continued)

- Marshallian demands obtained from utility maximization subject to budget constraint $\sum_i p_i x_i = \bar{I}$; necessary conditions:

$$u'(x_i) = \lambda p_i, \quad i = 1, \ldots, N$$

where λ is marginal utility of income ($(N+1)$th variable) identified by budget constraint ($(N+1)$th condition)

- If N is large, the effect of individual p_i on λ is negligible, i.e. individual producers view $u'(x_i) = \lambda p_i$ as identifying firm-specific demand

Firm-specific inverse demand is then $p_i(x_i) = u'(x_i)/\lambda$

Inverse elasticity of demand is $\dfrac{dp_i}{dx_i}\dfrac{x_i}{p_i} = \dfrac{x_i u''(x_i)}{u'(x_i)} = -\rho(x_i)$

Elasticity of demand is $\epsilon_i(x_i) = -1/\rho(x_i)$

Monopolistic competition (continued, 2)

- Free entry and exit, N endogenous
- In autarky ('^' omitted for the time being) supply equals domestic demand for each firm: $y_i = x_i$
- Profit maximization condition:

$$\mathrm{MR}^i(x_i) = \mathrm{MC}^i(x_i), \text{ i.e.}$$

$$p_i + x_i \, dp_i/dx_i = c \quad \Rightarrow \quad p_i\left(1 + 1/\epsilon_i(x_i)\right) = c$$

where $\epsilon_i(x_i)$ is the firm-specific elasticity of demand

$$\Rightarrow \quad p_i = c/\left(1 + 1/\epsilon_i(x_i)\right) = \left(1 + \mu(x_i)\right)c$$

$$\mu(x_i) = 1/\left(|\epsilon_i(x_i)| - 1\right) = \rho(x_i)/\left(1 - \rho(x_i)\right)$$

Assumption $\rho'(x_i) \geq 0$ implies $\mu'(x_i) \geq 0$

- Zero profit condition (free entry/exit):

$$\mathrm{AR}^i(x_i) = \mathrm{AC}^i(x_i), \text{ i.e.}$$

$$p_i = c + F/x_i$$

Monopolistic competition (continued, 3)

- Symmetric equilibrium, i.e. $p_i = p$, $x_i = y_i = x = y$, $i = 1, \ldots, N$
  - Profit maximization condition (MR = MC):

$$p/(1+\mu(x)) = c \quad \Rightarrow \quad p = (1+\mu(x))c$$

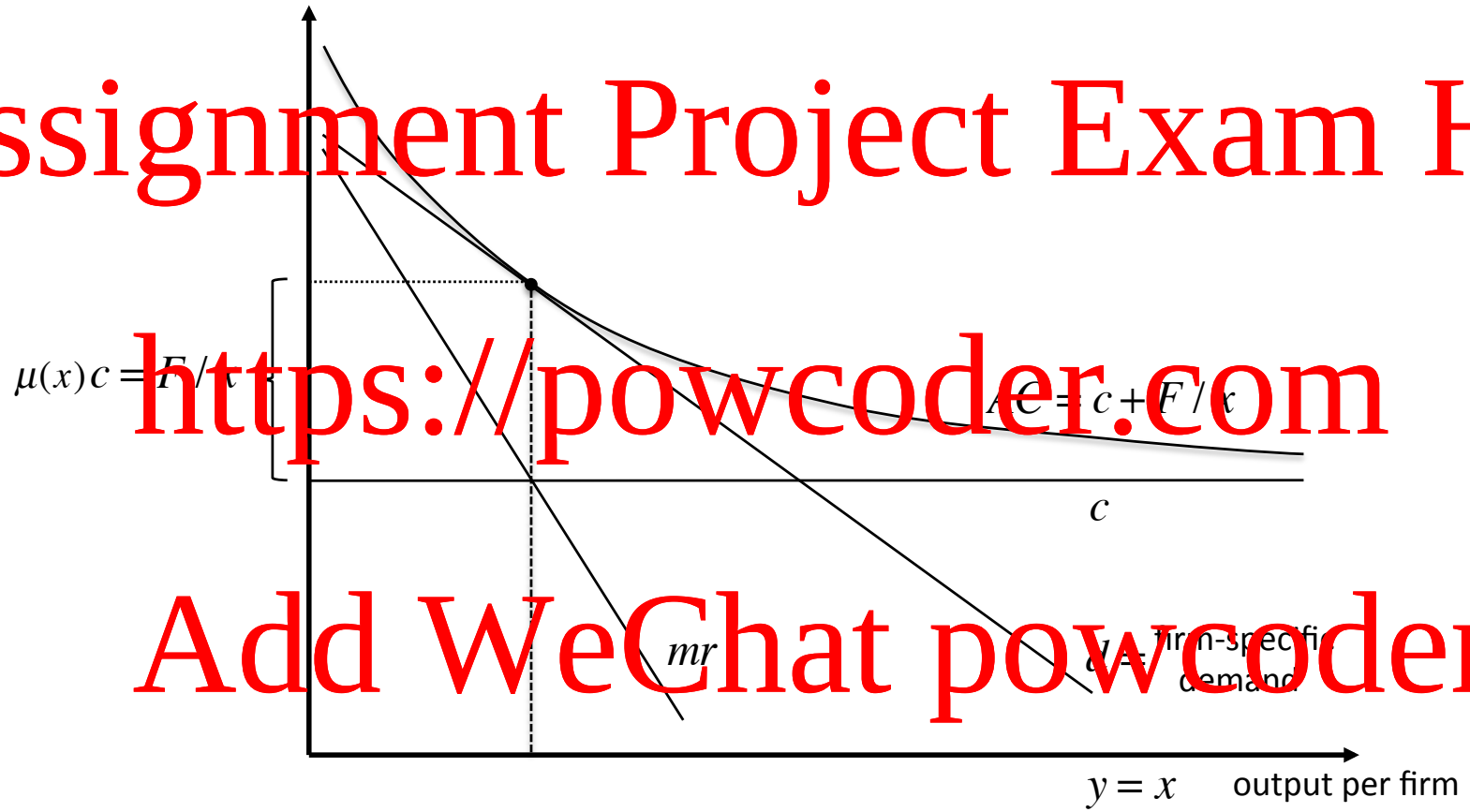
  - Zero profit condition (AR = AC):

$$p = c + F/x$$

  - Combining the above two conditions:

$$(1+\mu(x))c = c + F/x \quad \Rightarrow \quad (1+\mu(x))c - c - F/x = 0$$

$$\Rightarrow \quad \mu(x)\,c - F/x = 0$$



Monopolistic competition: trade liberalization

- Above condition identifies autarky levels of demand and supply for individual varieties, $\widehat{x} = \widehat{y}$, and autarky price, $\widehat{p}$
- Now suppose that liberalization with another identical $q - 1$ countries increases market size as well as total labour endowments by a factor q

Then, for a given price, total demand for a given variety is $y = q\,x(p)$, but demand elasticity remains unchanged, and so does the mark-up

Using $x = y/q$, the condition identifying y becomes

$$\mu(y/q)\,c - F\,y \equiv \Omega(y,q) \equiv 0$$

Monopolistic competition: trade liberalization (continued)

- Totally differentiating $\Omega(y,q)=0$ with respect to y and q:

$$\frac{\mathrm{d}y}{\mathrm{d}q}\frac{q}{y}=-\frac{\partial\Omega/\partial q}{\partial\Omega/\partial y}\frac{q}{y}=-\frac{F}{F+cyx\mu'(x)}\Rightarrow 0 \text{ and } <1$$

If $\rho'(x)$ is strictly positive (and so $\mu'(x)$ is strictly positive), output per variety, y, will rise – but will do so by less than a factor q

- Labour market clearing in each country requires:

$$N(cy+F)=\bar{L} \quad \Rightarrow \quad N=\bar{L}/(cy+F)$$

This is decreasing in y $\Rightarrow$ a higher y translates into a smaller number of firms in each country:

$$\frac{\mathrm{d}N}{\mathrm{d}q}\frac{q}{N}=-\frac{cy}{cy+F}\left(1-\frac{F}{F+cyx\mu'(x)}\right)<0 \quad \text{and} \quad >-1$$

i.e. N falls but by less than a factor q

Monopolistic competition: trade liberalization (continued, 2)

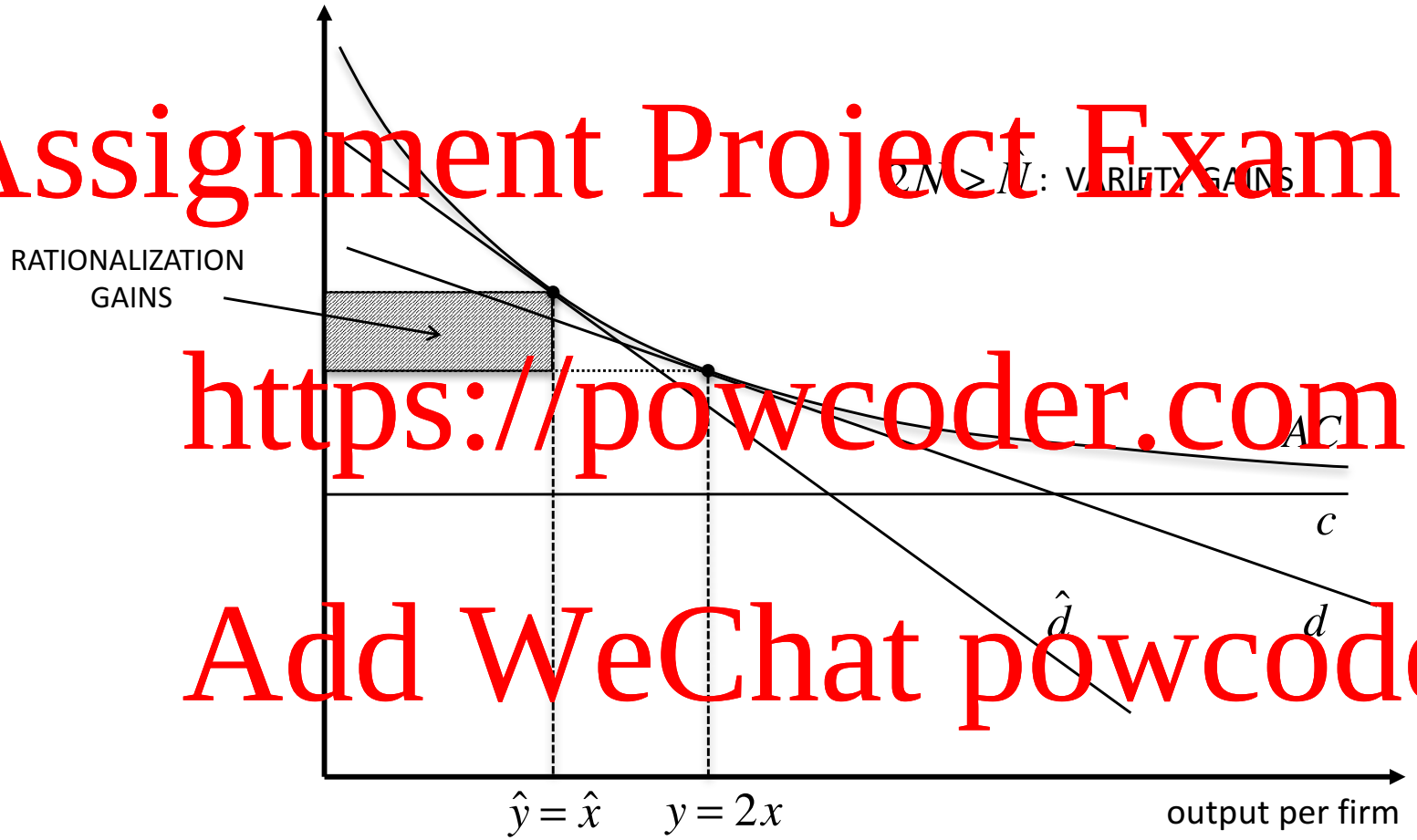
– Then, for $\rho(x)$ strictly increasing in x, if two identical countries liberalize trade with one another, and if the autarky number of firms in each country is $\widehat{N}$, the total number of firms (and varieties available to consumers) under free trade, $2N$, will be greater than $\widehat{N}$ but will be less than $2\widehat{N}$

$\Rightarrow$ the resulting scale of operation for each firm will be larger, and average cost and price will be smaller

Rationalization gains: trade raises competition and induces lower mark-ups $\Rightarrow$ some firms exit $\Rightarrow$ a smaller number of firms in each country each producing more output at a lower cost

as well as

Variety gains: trade increases the number of varieties each consumer has access to ($2N > \widehat{N}$)



Monopoly and oligopoly revisited: decreasing marginal cost, no entry

- If there are fixed costs but no free entry/exit:
  - Trade liberalization will reduce markup and hence raise output ("pure" pro-competitive effect)
  - Higher output also brings about a reduction in marginal (and average) cost (sometimes referred to as an additional component of pro-competitive effect)

Monopolistic competition: CES preferences

- Special case (homothetic, Dixit-Stiglitz):
  $u(x) = x^{\gamma}, \quad \gamma \in (0,1) \Rightarrow -xu''(x)/u'(x) \equiv \rho(x) = 1 - \gamma$
  $\Rightarrow \rho'(x) = 0$ and $\mu'(x) = 0$
- Then an increase in q (trade liberalization) will have no effect on y (the level of output per firm)
- The number of firms in each country is independent of q – i.e. there is no exit on the supply side – and the total number of varieties increases linearly with q
- No scale economy effects; the only effect of trade liberalization is a variety effect
- With heterogeneous firms (different technologies) scale effects can arise in conjunction with variety effects even for $\rho(x)$ constant

Where are differentiated goods produced?

(Informal discussion: statement of results and intuition)

- Consider trade between two countries each with a monopolistically competitive sector producing differentiated goods
- Suppose that country A is twice as large (more workers/consumers) than country B
- If a second *non-differentiated* good with marginal cost $c_2 = 1$ is produced and traded, and there are no trade costs, there will be a certain equilibrium number of varieties of the differentiated good, but the location of production of these varieties is indeterminate. Fixed costs mean that a variety will only produced in one location, but this location could equally be A or B

Where are differentiated goods produced? (continued)

- If, however, there are trade costs in good 1, then the total costs of producing and selling a certain amount of a certain variety will be lower if production takes place in A (the larger country): if the variety in question is produced in A then transportation is only required for one third of all consumers of that variety, whereas if it is produced in B transportation is only required for two thirds of all consumers
  $\Rightarrow$ cost of two-way trade in the differentiated good is lower if its production is located in A
- Thus location of production of the differentiated good will tend to be concentrated in the larger country (the country with the larger home market) more than proportionally to its size, and a comparatively larger fraction of the country's exports will consist of differentiated goods

  Home market effect (Krugman)

Heterogeneous firms

(Informal discussion: statement of results and intuition)

- If firms differ with respect to their marginal productivity, $\phi = 1/c$, then, given a certain distribution of productivity types, a free-entry equilibrium with product differentiation will be characterized by a cutoff type ϕ^* such that only firms with $\phi \geq \phi^*$ will be active

  In this equilibrium, firms with $\phi = \phi^*$ will earn zero profit and those with ϕ strictly greater than ϕ^* will earn positive profits

Heterogeneous firms (continued)

- Assume CES preferences and let $\widehat{\phi}^*$ be the cutoff productivity type under autarky
- Under free trade between symmetric economies, and assuming transportation costs and an additional fixed cost for exporting, entering the foreign market will only be worthwhile for the most productive firms, those with a level of productivity above ϕ^{**}
  By entering the foreign market, these firms will cause the least productive firms in the foreign market to exit

  Intuition: exporters (the more productive firms) increase their market share by entering the foreign market but lose some market share at home; firms that don't export (the less productive ones) only lose market share $\Rightarrow$ trade induced selection against less productive firms and in favour of more productive ones

Heterogeneous firms (continued, 2)

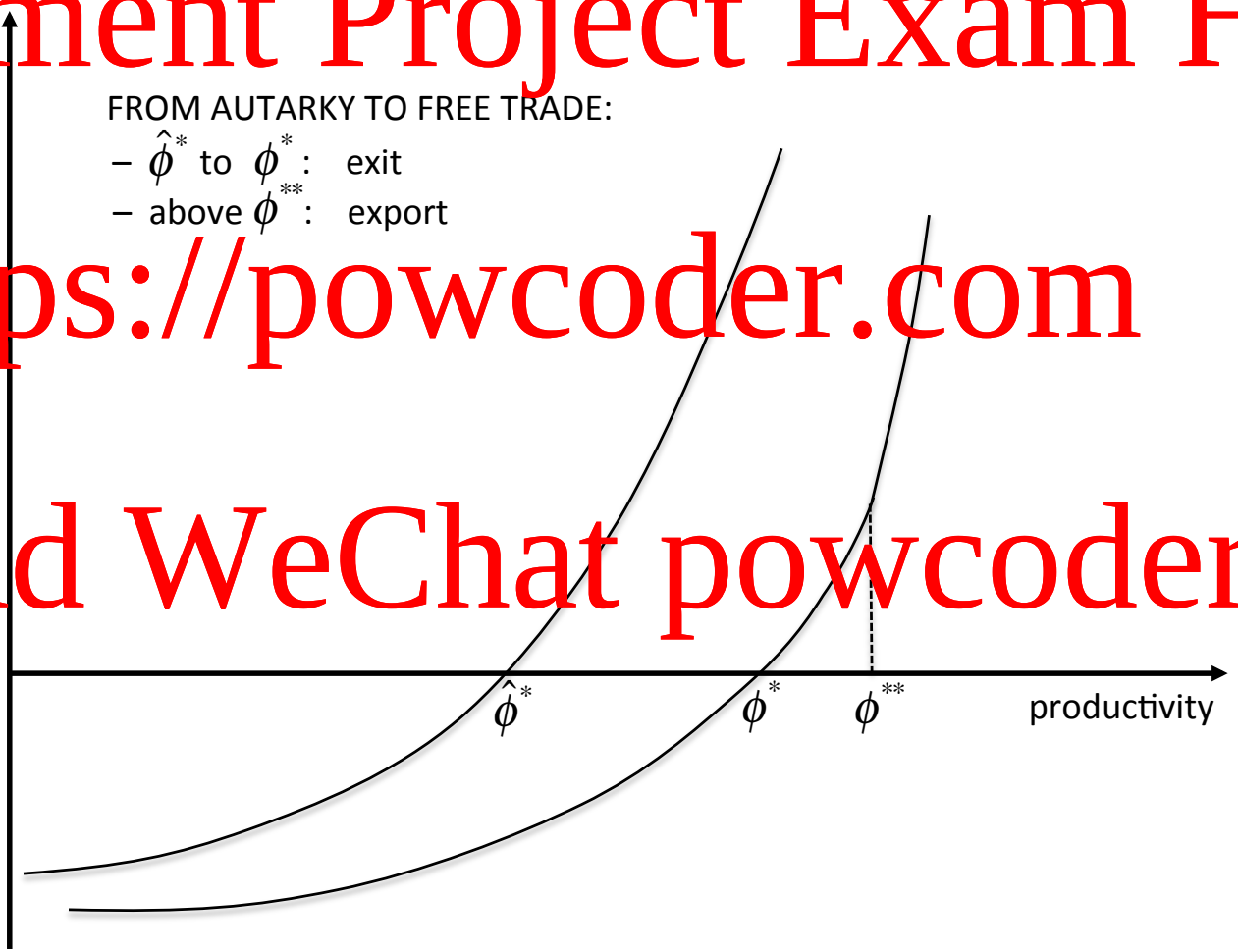
- Thus, with free trade, only firms above $\phi^* > \widehat{\phi}^*$ will be active – firms with productivity between ϕ^* and $\phi^{**} > \phi^*$ only in the domestic market, those with productivity above ϕ^{**} both in the domestic market and in the foreign market (Melitz)
- The exit of the least productive firms (those between $\widehat{\phi}^*$ and ϕ^*) is a further *rationalization* effect that is only present when firms are heterogeneous
- Predictions on the relationship between firm characteristics and export choices: exporting firms should have higher productivity than firms that only produce for the domestic market, and they should be comparatively larger

  Consistent with evidence

Net profits

FROM AUTARKY TO FREE TRADE:

- $\hat{\phi}^*$ to ϕ^*: exit
- above ϕ^{**}: export



Trade and the international organization of production

- We have discussed how trade affects the international organization of production through comparative advantage driven and scale economies driven specialization
- With scale economies, there are a number of other dimensions of production choices that can give rise to increased specialization and higher productivity under free trade:
  - Horizontal specialization within integrated organizations – whether a producer services a foreign market through a foreign subsidiary (FDI) or directly
  - Vertical specialization in the supply chain through offshoring (FDI) and outsourcing (no FDI)
  - Improved matching opportunities for firms (firm-to-firm matching in horizontal and vertical relationships)

Large and growing literature

Outline

Trade flows and country size: predictions from monopolistic competition model

- Assume a Dixit-Stiglitz (CES) world where all production consists of differentiated goods, all produced goods are traded and there are no trade barriers or transportation costs

Choose units for goods so that prices equal to unity, and so values equal quantities

$\Rightarrow$ the total quantity (and value), $y_i = y$, of each variety produced is the same for all varieties

$\Rightarrow$ country j's GDP equals y times the number, N^j, of varieties produced by j

$\Rightarrow$ the number of varieties produced by each country is proportional to country size, i.e.

$$N^j / N^{\text{WORLD}} = \text{GDP}^j / \text{GDP}^{\text{WORLD}} \equiv s^j$$

Trade flows and country size (continued)

- All consumers in all countries consume all varieties in equal proportions

  $\Rightarrow$ the amount of variety i from country j consumed by consumers in country k is proportional to country size, i.e., $x_i^k = s^k y$

  $\Rightarrow$ total exports, TF^{jk}, from j to k are then proportional to the number of varieties produced by j and to s^k, i.e.

$$\mathrm{TF}^{jk} = N^j s^k y = \mathrm{GDP}^j s^k = \frac{\mathrm{GDP}^j \mathrm{GDP}^k}{\mathrm{GDP}^{\mathbf{WORLD}}}$$

- Note that this means that the ratio of total exports or imports to GDP should be higher for smaller countries:

$$\sum_{k \neq j} \mathrm{TF}^{jk} / \mathrm{GDP}^j = \sum_{k \neq j} \mathrm{GDP}^k / \mathrm{GDP}^{\mathbf{WORLD}} = 1 - s^j$$

(exports to GDP ratio for country j)

$$\sum_{j \neq k} \mathrm{TF}^{jk} / \mathrm{GDP}^k = \sum_{j \neq k} \mathrm{GDP}^j / \mathrm{GDP}^{\mathbf{WORLD}} = 1 - s^k$$

(imports to GDP ratio for country k)

Deriving the gravity equation

- Idea of gravity first proposed by Tinbergen in the 1960s
  - Later derivations (Anderson and van Wincoop) derive role of distance from monopolistically competitive model with symmetric product differentiation, trade, and transportation costs
  - Previous equality says that trade flows from j to k are proportional to the sizes of the two countries – just as the gravitational force between two bodies with positive mass is proportional to the product of their masses; full analogy with Newtonian gravity can be derived as follows:

Deriving the gravity equation (continued)

- Assume symmetric, "iceberg" transportation costs $\tau^{jk} = \tau^{kj}$ and CES (Dixit-Stiglitz) preferences with elasticity of substitution $\sigma = 1/(1-\gamma) > 1$ (with γ defined as in an earlier slide on the CES/Dixit-Stiglitz formulation)
- With no trade barriers, the value of Marshallian demand can be derived as (derivation omitted)

$$x^{jk} = \frac{\text{GDP}^j \text{GDP}^k}{\text{GDP}^{\text{WORLD}}} \left(\frac{\tau^{jk}}{E^j E^k} \right)^{1-\sigma} \tag{G.0}$$

where E^j is a CES utility price index for j, i.e.

$$E^j \equiv \left(\sum_h s^h (p_h (1 + t^{hj}))^{1-\sigma} \right)^{1/(1-\sigma)}$$

with p_h representing the equilibrium price of goods produced by country h

The literature refers to E^j as "outward multilateral resistance" and to E^k as "inward multilateral resistance"

Deriving the gravity equation (continued, 2)

- Further, suppose that $1+\tau^{jk}$ increases quadratically with distance D^{jk}, i.e. $1+\tau^{jk}=\delta\left(D^{jk}\right)^2$ and that $\sigma=2$

If we could take the product E^jE^k to be the same for all countries (which we can only legitimately do if τ^{jk} is the same for all countries), then

$$x^{jk}=\text{CONSTANT}\times\frac{\text{GDP}^j\,\text{GDP}^k}{\left(D^{jk}\right)^2}$$

(just as in Newton's law of gravitation)

Empirical specification of the gravity equation

- Taking logs in (G.0), this gives rise to a (cross-section) empirical specification with a structure such as the following:

$$\ln x^{jk} = \beta_0 + \beta_{\text{DIS}} \ln D^{jk} + \eta_j + \eta_k + \vec{\gamma} \vec{Z}^{jk} + \varepsilon^{jk} \quad \text{(G.1)}$$

  where η_j and η_k are dummy variables that encompass respectively GDP^j and GDP^k as well as the (unobservable) variables E^j and E^k, and $\vec{Z}^{jk}$ is a vector of additional variables relating to j and k (e.g. shared language, common border, currency union, etc.)

  (Anderson and van Wincoop use a simultaneous equation specification that also indirectly estimates E^j and E^k)

- Gravity does a much better job at predicting basic trade patterns than comparative advantage does

- Connected with, and derived from, "new" trade theories that account for trade between similar countries and in similar goods; it is *not* a separate idea (the term "gravity" may be misleading in this respect)

Empirical specification of the gravity equation (continued)

- In empirical studies, gravity is typically not in and of itself the focus of the analysis; rather it is a "benchmark" specification for picking up empirical departures from baseline patterns and for investigating possible explanations for such departures (by testing predictions of model variants that incorporate additional mechanisms, such as comparative advantage)

  Example: *border effects* – after controlling for trade barriers, distance, transportation costs, common language etc., we should expect national borders not to matter for trade; i.e. once we take into account formal trade barriers, transportation costs, etc., internal trade between different regions of a given country should "look like" trade between countries; however, gravity regressions show that national borders still matter

Outline

Economies of agglomeration

- Consider a large number of small firms producing a homogeneous good and operating at a given location, and suppose that production costs are decreasing with the *aggregate* scale of production at that location (*economies of agglomeration*)
- Because scale economies are external to the firm, individual firms will take technological conditions as independent of their own individual choices $\Rightarrow$ external scale economies can be compatible with competitive behaviour
  - E.g., if cost at the firm level is $C^i(y_i) = \Lambda(Y - y_i)\, y_i$, where Y is aggregate supply, $Y = y_{-i} + y_i$, and $\Lambda'(.) < 0$, then marginal cost for firm i is constant and equal to $\Lambda(y_{-i})$
  - With a large number of firms, marginal revenue approaches the price, $p(Y)$, and so profit maximization ($\text{MR}^i = \text{MC}^i$) gives $p(Y) = \Lambda\big((1 - 1/N)Y\big)$, i.e. MC pricing from the point of view of individual firms (= average cost pricing economywise)
- Multiple equilibria can arise with trade; which and how many equilibria are possible in a given scenario depends on the size of transportation costs and trade barriers

External economies of scale (continued)

(Stylized treatment follows)

- Two locations, A, B, with given labour endowments at each location
- Labour is the only input into production and has price $w = 1$
- Two goods, good 1 (scale economies in production), good 2 (no scale economies in production, marginal labour cost $\alpha_2 = 1$ $\Rightarrow p_2 = w = 1$)

No product differentiation (good 1 is homogeneous); consumer preferences given by:

$$U(x_1, x_2) = \beta \min\{\bar{x}_1, x_1\} + x_2, \quad \beta > 1$$

i.e. for $p_1 \leq \beta$ consumers demand an amount $\bar{x}_1$ of good 1 (any amount above $\bar{x}_1$ does not raise utility), i.e. they are willing to pay $\beta > 1$ for each unit of good 1 up to $\bar{x}_1$

Total demand across the two locations is $2\bar{x}_1$

External economies of scale (continued 2)

- Fixed output level per firm $\bar{y}_1 = q\bar{x}_1$, with q much smaller than unity

  Unit cost, c_1^j, of producing $\bar{y}_1$ for a firm at location $j = A, B$, depends on N^j, the total number of firms producing good 1:

  $$c_1^j(N^j) = 1 - g(N^j), \quad g'(.) > 0, \quad g(.) < 1$$

- Unit transportation cost, τ
- Without loss of generality, assume $\bar{x}_1 = 1$

Location of production and costs

(1) If all production of good 1 takes place at A, then

$N^A = 2q = \overline{N}$ and $N^B = 0$

Then goods sold in A incur a unit cost $1 - g(\overline{N})$ and goods sold in B incur a unit cost $1 - g(\overline{N}) + \tau$

If $\tau \leq \beta - 1$, then cost to consumers in B is still less than β

(2) If half of the production of good 1 takes place in A and half of it in B, then unit cost is $1 - g(\overline{N}/2)$ at both locations

- Which one is more efficient? If $1 - g(\overline{N}) + \tau/2 < 1 - g(\overline{N}/2)$, i.e., if:

  (C) $\tau < 2\big(g(\overline{N}) - g(\overline{N}/2)\big)$

  then (1) is; otherwise (2) is

Agglomeration equilibria

- Non-cooperative firm location choices

(1) Starting from (1), no firm will individually choose to relocate to B if:

$$1 - g(1) > 1 - g(\overline{N}) + \tau \quad \text{(E1)}$$

(2) Starting from (2), no firm from one location will individually choose to relocate to the other location if:

$$1 - g(\overline{N}/2 + 1) - \tau > 1 - g(\overline{N}/2) \quad \text{(E2)}$$

- It is possible for the two equilibria to co-exist
- It is possible for (E2) to be met (production at two locations is an equilibrium) even when (C) is met (production at a single location is efficient)
- It is possible for (E1) to be met (production at a single location is an equilibrium) even when (C) is not met (production at two locations is efficient)

Agglomeration effects and trade policy

- if both countries levy a tariff t, and all production takes place in A, then goods sold in B incur a unit cost $1 - g(\overline{N}) + \tau + t$, and so condition (E1) becomes

  (E1.t) $\quad 1 - g(1) > 1 - g(\overline{N}) + \tau + t$

  If (E1) and (C) are met but (E1.t) is violated, then the tariff will induce inefficient relocation for "tariff jumping" reasons

- Then trade liberalization can lead to rationalization gains from increased agglomeration (a move back to (1))

- On the other hand, if (2) is efficient but (1) is an equilibrium, a tariff or a relocation subsidy may help restore efficiency

Outline

Effects of trade liberalization with scale economies and imperfect competition – summary

(i) Pure pro-competitive gains from reduction of monopolistic distortions

(ii) Profit shifting effects

(iii) Rationalization gains from: (a) an increase in the scale of production and a reduction in average costs; (b) exit of the less productive firms; (c) increased agglomeration

(iv) Variety gains from an increase in the number of varieties available to consumers

These are in addition to

(v) Gains from comparative advantage

(vi) Terms of trade loss for a large countries from reducing its tariff below its unilaterally optimal level

Trade liberalization with scale economies and imperfect competition (continued)

- Note: for a given trade induced fall in domestic price, rationalization gains will be larger than comparative advantage driven gains: "rectangles are bigger than triangles"
  - (i), (iii), (iv) and (v) all point in the same direction: trade liberalization improves domestic welfare and trade barriers reduce domestic welfare; (vi) only applies to large countries

    (ii), on the other hand, may provide a trade-based rationale for protection by a small open economy
  - In the following, we show that (ii) can also rationalize the use of export subsidies – which are otherwise difficult to explain

"Strategic" export subsidies

- We observe countries engaging in export promotion; yet, with the exception of certain scenarios where there are external economies of scale, none of the arguments presented so far can help rationalize the use of export subsidies
- With imperfect competition, export subsidies can be justified by profit shifting motives

Argument due to Brander and Spencer

Often referred to in the literature as "strategic trade policy" (note: potentially misleading label)

Duopolistic competition in a third country market

- Consider two countries, A and B, each with a producer of a homogeneous good engaging in Cournot duopolistic competition in the market of a third country (C), which is fully segmented in relation to the rest of the world market
- No effects on domestic consumers of countries A and B; the only welfare effects flow through the profits that accrue to domestic firms (isolating the profit shifting motive)
- Linear (inverse) demand in country C for the good in question:

$$p(x) = p(y^A + y^B) = \omega - \theta(y^A + y^B)$$

- Marginal production cost, c
- Profits of producer $j = A, B$, are $\Pi^j = \big(p(y^j + y^{-j}) - c\big)y^j$, maximized for $y^{j*}(y^{-j}) = (1/2)\big((\omega - c)/\theta - y^{-j}\big)$
- Symmetric duopoly outcome: $y^A = y^B = (1/3)(\omega - c)/\theta$ and profits $\Pi^A = \Pi^B = (1/9)(\omega - c)^2/\theta$

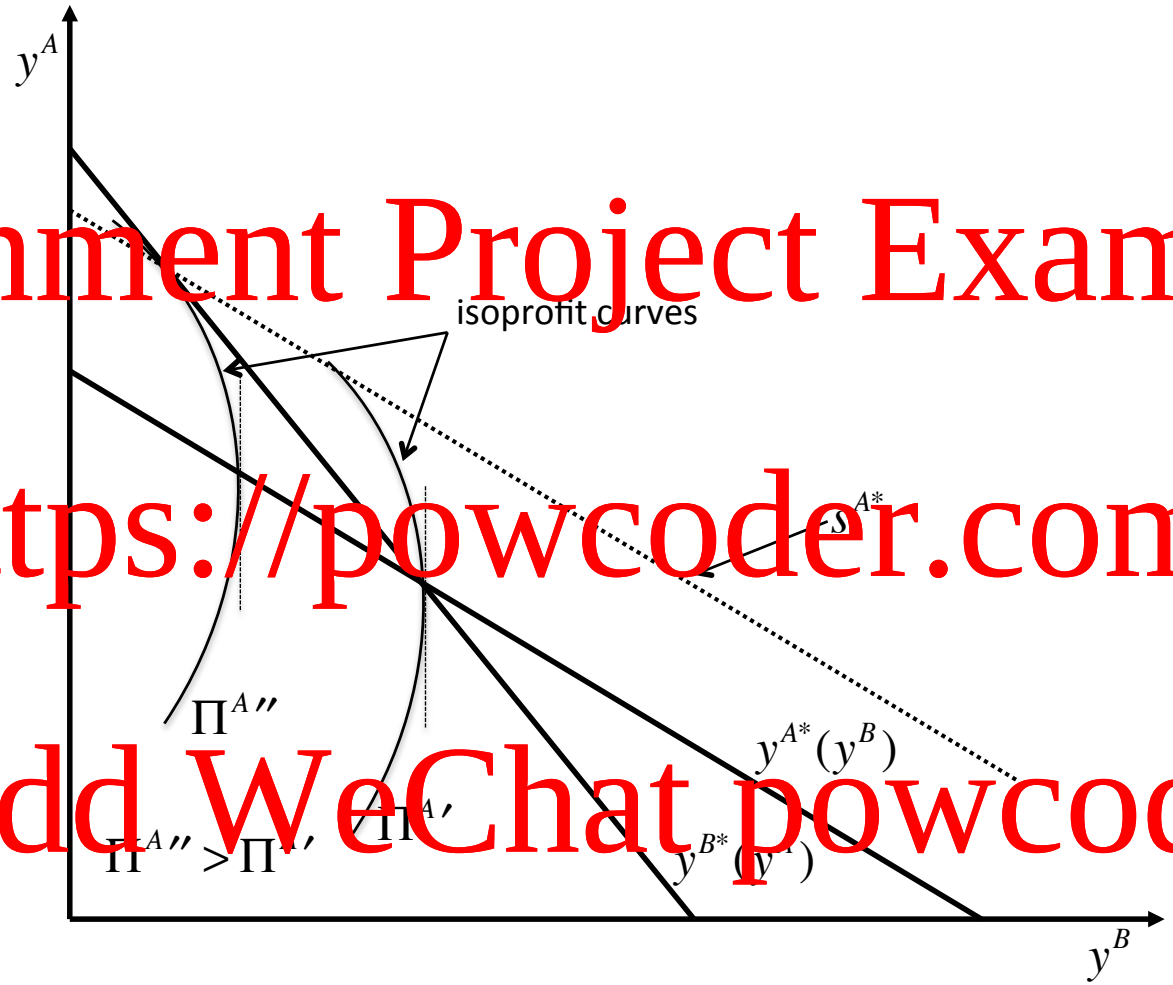
An export subsidy

- How can country A improve the outcome for its producer? The best the producer from A can do would be by "leading", i.e. choosing its quantity before the other producer does (acting as a Stackelberg leader)
- This can be replicated by the use of an export subsidy, s^A, which lowers marginal cost to $c - s^A$ and makes the optimal choice by the producer from A equal to $y^{A*}(y^B) = (1/2)\big((\omega - c + s^A)/\theta - y^B\big)$

  In the resulting duopoly equilibrium, output by the producer from A is $y^A = (1/3)(\omega - c + 2s^A)/\theta$ and the associated profits, *net of export subsidy*, are $\Pi^A = (1/3)(\omega - c - s^A)(\omega - c + 2s^A)/\theta$

  In turn, this is maximized by a choice $s^{A*} = (\omega - c)/4$, which gives $\Pi^A = (1/8)(\omega - c)^2/\theta$ – the same level as the leader's profits under Stackelberg competition

  Higher profits than under the Cournot outcome: by subsidizing its exporter, country A makes its exporter a less accommodating competitor, helping it obtain a larger market share and a larger share of the profits



Export subsidy retaliation

- If country B responds in the same way, then the non-cooperative subsidy outcome involves $s^A = s^B = (\omega - c)/5$, resulting in profits (net of subsidy) equal to $\Pi^A = \Pi^B = (2/25)(\omega - c)^2/\theta$ – which is less than the corresponding level without subsidies

$\Rightarrow$ non-cooperative subsidy setting leads to joint oversubsidization of exports $\Rightarrow$ need for a cooperative agreement restricting the use of export subsidies

Bertrand competition

- Conclusions can be reversed under Bertrand (price) competition: optimal for countries to tax exports, non-cooperative export tax too low

Outline

Outline

Do all domestic agents gain from trade?

(1) "Technical" question: under which conditions do the results from representative-consumer analyses generalize exactly to a case with multiple individuals in each country? I.e. under which conditions can we represent domestic welfare in terms of an "aggregate" ordering over aggregate domestic consumption bundles, and represent this ordering in terms of *community indifference curves*?

Very restrictive conditions: preferences must be identical across individuals *and* quasi-homothetic

No reasons to expect these conditions to apply

Do all domestic agents gain from trade? (continued)

(2) Even if the above conditions are not met, can we still conclude that trade raises welfare for everyone? Not necessarily

Trivial example: take a pure-exchange economy with two goods and two domestic individuals, $D1$ and $D2$, and assume that $D1$ owns all the domestic endowment of good 1 and $D2$ owns all the domestic endowment of good 2

If autarky prices $\widehat{p}_1/\widehat{p}_2$ differ from world prices p_1/p_2 and the country starts trading, then the domestic price ratio will move towards the world price ratio; this will by necessity worsen terms of trade for one of the two individuals, who will then be worse off as a consequence of free trade

$\Rightarrow$ international trade can produce winners and losers

Can the winners compensate the losers?

- It can be shown that, in principle, the winners can compensate the losers in such a way that free trade makes everyone better off in comparison with autarky
- We will show this with reference to an N-good, H-individual pure exchange economy in which the endowment vector of each domestic individual is y^h (it can be extended to a scenario with CRS production)
- Consider a set of lump-sum transfers that, at free trade prices, compensate losers and winners so as to restore them to the autarky level of utility

  The required transfer (positive or negative) for individual h is:

  $$E^h(p, \hat{u}^h) - p\,y^h \equiv T^h, \quad h = 1, \ldots, H$$

  A positive T^h means that h must receive a transfer; a negative T^h means that h can make a transfer

  $\Rightarrow$ the combination of transfers $T^1, \ldots, T^H$ is feasible if

  $$\sum_h T^h < 0$$

Can the winners compensate the losers? (continued)

- By the definition of $E^h(.)$: $E^h(p, \widehat{U}^h) \leq p\,\widehat{x}^h$, and so

$$\sum_h T^h = \sum_h E^h(p, \widehat{U}^h) - \sum_h p\,y^h$$
$$\leq \sum_h p\,\widehat{x}^h - \sum_h p\,y^h = p\left(\sum_h \widehat{x}^h - \sum_h y^h\right) = 0$$

(the last equality must hold in autarky)

- In principle, the winners could compensate the losers
  Same result can be accomplished by domestic commodity taxes
- In practice, informational constraints prevent implementation of first-best redistributive policies (T^h depends on h's preference type and on h's endowments, which are typically private information to h); moreover, we just do not observe countries introducing (permanent) redistributive policies to accompany permanent trade policy reform
- So, trade reform typically produces winners and losers; two channels:
  (i) Differences in tastes (preferences are different or they are identical but non-homothetic)
  (ii) Differences in endowments (factor endowments)

  Trade economists have traditionally focused on (ii), i.e. trade-induced income redistribution

Trade and factor prices in the Heckscher-Ohlin model

- Assume identical consumers with homothetic preferences

  $\Rightarrow$ good prices affect everyone's consumption in the same way

  The only differential effects flow through endowment differences: focus on the "functional distribution of income" (effects on factor prices)

- Suppose that sector 1 is labour intensive and that p_1 rises – while p_2 stays constant). Stolper-Samuelson Theorem:

  $$\frac{dw_K}{dp_1} < 0$$

  i.e. w_K falls relative to p_2 – which stays constant – and to p_1 – which rises $\Rightarrow$ capital owners are worse off *in real terms* no matter what the proportions of goods 1 and 2 are in consumption; and

  $$\frac{dw_L}{dp_1}\frac{p_1}{w_L} > 1$$

  i.e. w_L rises relative to p_2 – which stays constant – and rises more than proportionally with p_1 ("magnification effect") $\Rightarrow$ labour owners are better off *in real terms*

Trade and factor prices in the Heckscher-Ohlin model (continued)

– Proof of Stolper-Samuelson Theorem: Let $\alpha_{ih} \equiv \partial c_i / \partial w_h$, $i = 1, 2$, $h = L, K$; totally differentiating the zero profit conditions $c_1(w_L, w_K) = p_1$, $c_2(w_L, w_K) = p_2$ re. p_1, w_L and w_K gives

$$\begin{cases} \alpha_{1L}\, dw_L + \alpha_{1K}\, dw_K = dp_1 \\ \alpha_{2L}\, dw_L + \alpha_{2K}\, dw_K = 0 \end{cases}$$

For $\alpha_{1L}/\alpha_{1K} > \alpha_{2L}/\alpha_{2K}$, solving for $\mathrm{d}w_K/\mathrm{d}p_1$ and $\mathrm{d}w_L/\mathrm{d}p_1$:

$$\frac{\mathrm{d}w_K}{\mathrm{d}p_1} = -(\alpha_{2L}/\alpha_{2K}) \frac{1/\alpha_{1K}}{\alpha_{1L}/\alpha_{1K} - \alpha_{2L}/\alpha_{2K}} < 0$$

$$\frac{\mathrm{d}w_L}{\mathrm{d}p_1} = \frac{1/\alpha_{1K}}{\alpha_{1L}/\alpha_{1K} - \alpha_{2L}/\alpha_{2K}} > 0$$

We can also write

$$\frac{p_1}{w_L} = \frac{w_L\, \alpha_{1L} + w_K\, \alpha_{1K}}{w_L} > \alpha_{1L}$$

Combining the last two conditions gives

$$\frac{\mathrm{d}w_L}{\mathrm{d}p_1} \frac{p_1}{w_L} > \frac{\alpha_{1L}/\alpha_{1K}}{\alpha_{1L}/\alpha_{1K} - \alpha_{2L}/\alpha_{2K}} = \frac{1}{1 - (\alpha_{2L}/\alpha_{2K})/(\alpha_{1L}/\alpha_{1K})} > 1$$

Trade and factor prices in the Heckscher-Ohlin model (continued, 2)

- Suppose next that the domestic economy moves to free trade starting from an autarky equilibrium where $\widehat{p}_1^D / \widehat{p}_2^D$ is less than the corresponding world price ratio (or the autarky price ratio of other trading partners), i.e. the domestic economy has a comparative advantage in good 1; and suppose that, in a free trade equilibrium, both goods are produced
  $\Rightarrow$ free trade will cause p_1^D / p_2^D to rise and so labour owners will be better off and capital owners will be worse off
- Application to trade and wages debate: Think of the two primary inputs as being skilled (high-wage) and unskilled (low-wage) labour – rather than labour and capital. If a country (e.g. the U.S.) starts trading with another country that has a comparatively lower endowment of skilled labour (e.g. China), then trade should widen the distribution of wages in the former and narrow it in the latter

Trade and factor prices: intersectorally immobile capital

- Suppose capital is not sectorally mobile – plausible if thinking about the short run: "specific-factors model" (Ricardo-Viner model)

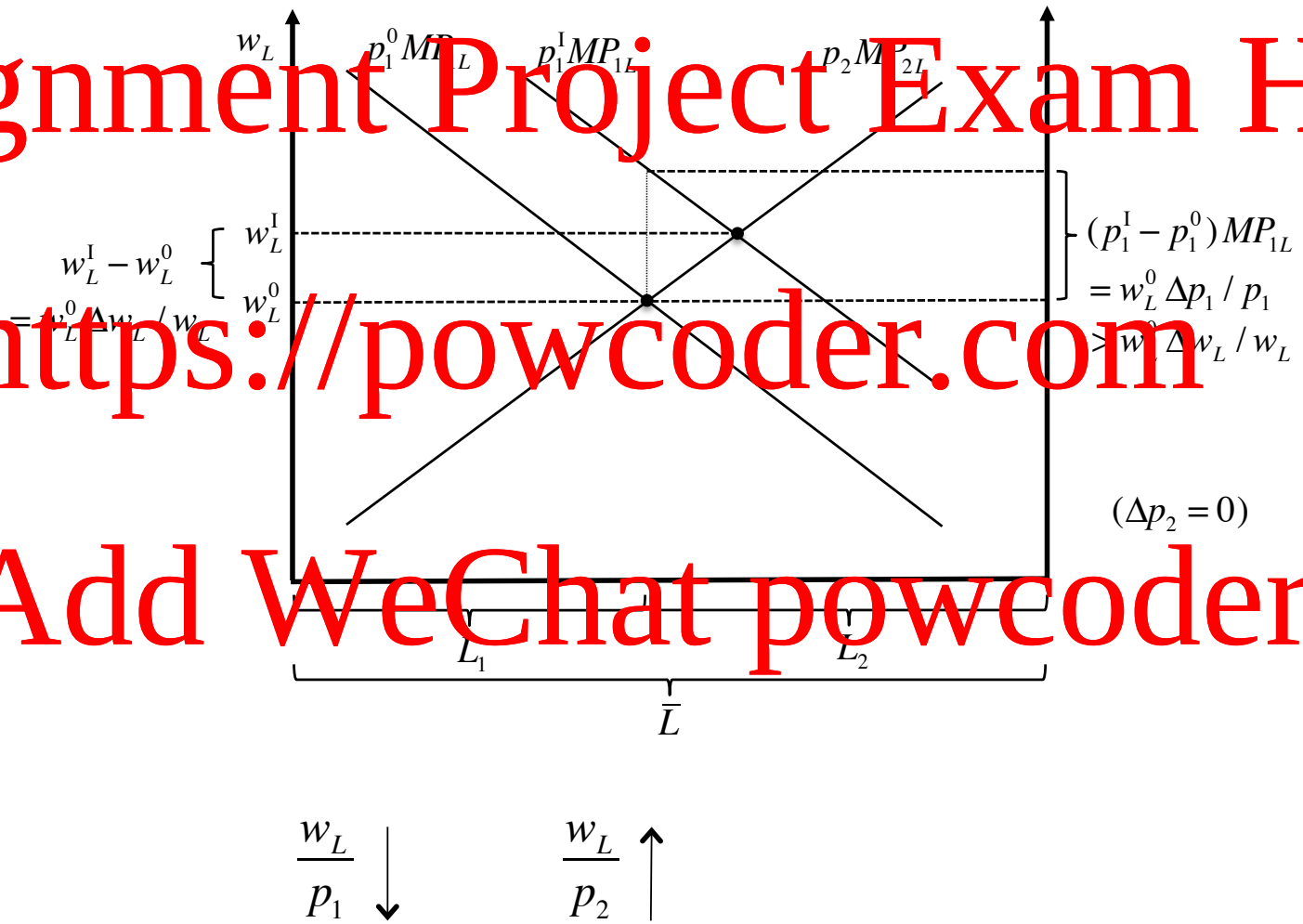
  Then an increase in p_1 will cause the wage to rise relative to p_2 (which stays constant) but to *fall* relative to p_1: "neoclassical ambiguity"

- Proof: Denoting with $f_{iL} = f_{iL}(L_i, \overline{K}_i)$ the marginal product of labour in sector $i = 1, 2$, and with $f_{iLL} < 0$ the derivative of f_{iL} with respect to L_i, and totally differentiating the profit maximization conditions (marginal revenue product = input price) $p_1 f_{1L} = w_L$, $p_2 f_{2L} = w_L$, and the labour market clearing condition, $L_1 + L_2 = \overline{L}$, with respect to w_L, L_1, L_2, and p_1, we get

$$\begin{cases} f_{1L}\, dp_1 + f_{1LL}\, dL_1 = dw_L \\ f_{2LL}\, dL_2 = dw_L \\ dL_1 + dL_2 = 0 \end{cases}$$

Solving for $\mathrm{d}w_L / \mathrm{d}p_1$, and using the conditions $w_L = p_1 f_{L1}$ and $w_L = p_2 f_{L2}$ to simplify the solution:

$$\frac{\mathrm{d}w_L}{\mathrm{d}p_1}\frac{p_1}{w_L} = \frac{1}{1 + (f_{2L}\, f_{1LL})/(f_{1L}\, f_{2LL})} \qquad > 0 \text{ but } < 1$$



Trade and factor prices: general N-good, M-factor case

- Recall that $w = R_v(p, v)$ (vector notation)
- Then the effects on factor prices of changes in good prices are given by:

$$\frac{\mathrm{d}w}{\mathrm{d}p} = \left[\mathrm{d}w_j / \mathrm{d}p_i\right] = R_{vp}(p, v)$$

"Stolper-Samuelson derivatives"

- What can we say about them that is general?

  Not much

  $\Rightarrow$ Stolper Samuelson Theorem is useful as a benchmark around which the debate on trade and income distribution can be organized, but it should not be taken too seriously as a prediction (e.g., the result does not carry over to scenarios where some of the goods produced domestically are non-traded goods)

Outline

How are the interests of winners and losers mediated?

- If trade policy reform produces winners and losers, and if there is no compensation, then how are the interests of the winners and losers mediated to arrive at a policy decision?

  Collective choice problem

- In the real world collective choice problems are handled by some form of collective institution, such as a dictatorship, oligarchic rule, direct democracy, or representative democracy.

Voting over a tariff

- Direct majority voting over a tariff (Mayer)
- H-O framework; assume imports are capital intensive; tariff revenues returned to consumers through a uniform lump-sum transfer

A continuum of individuals, $h \in [0,1]$, each endowed with the same amount of labour

Individuals $h \in [\underline{h},1] \equiv \mathcal{K}$, $\underline{h} > 0$, are also endowed with capital, each for the same amount

Same preferences for all, and so re-distributional effects flow only through factor prices; also assume a linearly homogeneous utility representation (which makes utility changes comparable across individuals with the same preferences but different incomes)

Small tariff $\Rightarrow$ the main effect are re-distributional (deadweight loss of tariff is neglible), i.e., denoting respectively with $\Delta U^{\mathcal{K}}$ and $\Delta U^{\mathcal{L}}$ the welfare change experienced by individuals in $\mathcal{K}$ and in $\mathcal{L} \equiv [0,\underline{h}]$:

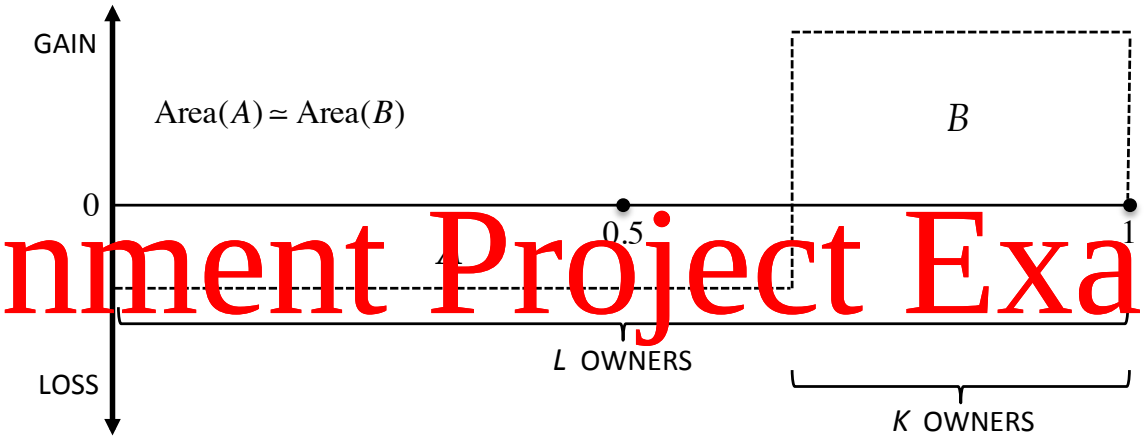
$$\underline{h}\,\Delta U^{\mathcal{L}} + (1-\underline{h})\Delta U^{\mathcal{K}} \approx 0 \quad \text{(Z)}$$

Voting over a tariff (continued)

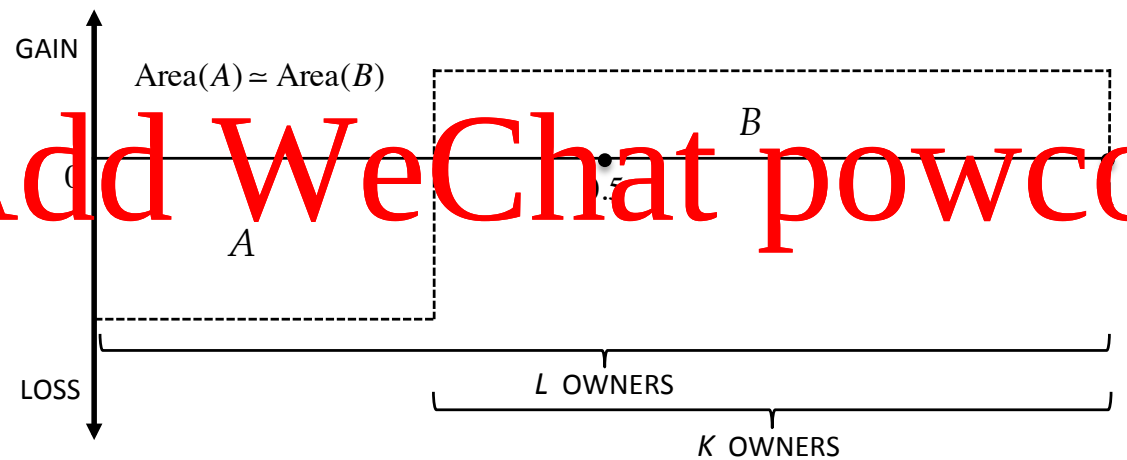
- The Stolper-Samuelson Theorem implies that a tariff will cause w_K to increase in real terms and w_L to fall in real terms
  $\Rightarrow$ individuals in $\mathcal{L}$ (who own only labour) will be worse off, i.e. $\Delta U^{\mathcal{L}} < 0$
  $\Rightarrow$ because of (Z), individuals in $\mathcal{K}$ will be better off, i.e. $\Delta U^{\mathcal{K}} \approx -\Delta U^{\mathcal{L}}\ \underline{h}/(1-\underline{h}) > 0$
- With direct majority voting over the tariff:
  - A majority will support the tariff if $\underline{h} \leq 1/2$ ("diffuse" capital ownership)
  - A majority will reject the tariff if $\underline{h} > 1/2$ ("concentrated" capital ownership)
- Conclusions can be overturned if individuals incur a (utility) cost, q, for participating (assuming they can coordinate their participation choices); e.g., if $q = \left(\Delta U^{\mathcal{K}}\right)_{\underline{h}=1/2}$ then:

  $\underline{h} \leq 1/2 \ \Rightarrow\ \Delta U^{\mathcal{K}} \leq q < \Delta U^{\mathcal{L}}\ \Rightarrow$ individuals in $\mathcal{K}$ don't participate and the tariff is rejected

  $\underline{h} > 1/2 \ \Rightarrow\ \Delta U^{\mathcal{L}} < q < \Delta U^{\mathcal{K}}\ \Rightarrow$ individuals in $\mathcal{L}$ don't participate and the tariff is supported



Majority voting => tariff option defeated



Majority voting => tariff option passed

Representative democracy and interest groups

- Most trade policy decisions are taken by elected representatives (representative democracy), rather than by direct voting
- Elected representatives aim at (re-)election, which, under certain conditions, means that they will do what the majority of voters want them to do; but they will also respond to organized pressure groups, because pressure groups can influence (re-)election through additional channels – e.g. through campaign contributions, media campaigns, public protests, etc.
- Our preceding discussion of the role of participation costs in a majority voting scenario also points to a relationship between the degree of concentration of trade-related interests on the one hand and how much they can weigh on trade policy formation in a representative democracy on the other

Representative democracy and interests groups (continued)

- Diffuse interests find it difficult to give rise to pressure groups that can influence election outcomes; this is for two related reasons: (i) the stakes for individual stake-holders are smaller the more diffuse a special interest is, lowering individual incentives to engage; (ii) the number of stake-holders is larger the more diffuse a special interest is, raising free riding incentives in efforts to exert pressure
- Unlike other policies – such as, for example, domestic taxation – by their very nature trade policies tend to produce effects that are concentrated for some agents and diffuse for others; e.g. a tariff on imported cheese will produce a comparatively small effect on individual consumers (of whom there are many) but a comparatively large effect on individual domestic cheese producers (of whom there are few)

  $\Rightarrow$ trade policy formation tends to be driven by pressure groups – producer lobbies, environmental lobbies, workers' unions, etc.

Trade lobbies and import protection

- In representative democracies, organized interests lobby policymakers for policies they favour
- Lobbying can be represented as an offer of conditional contributions to policymakers – who in turn depend on them for re-election ("protection for sale" model, Grossman and Helpman)
- Equivalent to the policymaker pursuing an aggregate domestic welfare objective where the welfare of the organized lobbies carries a higher weight than that of non-organized interests. Key implications:

  In a small open economy, if the weight on the producer surplus of import-competing lobbies in an industry is the same as that on consumer surplus and tariff revenues, the optimal import tariff for the good produced by that industry is zero but if the policymaker attaches a higher weight on the former than on the latter, then the optimal import tariff is positive

  Since the marginal deadweight loss of the tariff (net loss of consumer surplus) is greater the larger is the volume of imports relative to domestic production, protection will be lower for those industries where import penetration is greater

Trade lobbies and import protection (continued)

- Sketch of argument: good 1 imported, good 2 exported; assume $p_2^D = p_2 = p_1 = w \equiv 1$; tariff $t \Rightarrow p_1^D = (1+t)p_1 = 1+t$; quasilinear preferences, $U(x_1, x_2) = H(x_1) + x_2$; domestic import-competing production of good 1, y_1^D, uses labour and a sector-specific factor through a production function $f(L_1, \overline{K}_1) \equiv \tilde{f}(L_1)$; labour costs are then $\tilde{f}^{-1}(y_1^D) \equiv C(y_1^D)$
  Specific-factor rents (producer surplus or profits) equal

$$p_1^D y_1^D - C(y_1^D) = (1+t)y_1^D - C(y_1^D) \equiv \text{PS}$$

  Consumer surplus plus tariff revenues equal

$$H(x_1^D) - p_1^D x_1^D + t(x_1^D - y_1^D) = H(x_1^D) - x_1^D - ty_1^D \equiv \text{CS} + \text{R}$$

  The policymaker's objective is

$$W(t) \equiv \text{CS} + \text{R} + (1+\lambda)\text{PS}, \quad \lambda > 0$$

Trade lobbies and import protection (continued, 2)

– The effect of a change in t on $W(t)$ is

$$W' = (H' - 1)dx_1^D/dp_1^D + ((1+\lambda)((1+t) - C') - t)dy_1^D/dp_1^D + \lambda y_1^D$$

Using $H' \equiv p_1^D = 1 + t$ (utility maximization) and $C' \equiv p_1^D = 1 + t$ (profit maximization):

$$W' = t\left(dx_1^D/dp_1^D - dy_1^D/dp_1^D\right) + \lambda y_1^D$$

For $\lambda = 0$ this is negative $\Rightarrow$ the optimal t is zero.

For $\lambda > 0$, dividing W' by y_1^D, and expressing x_1^D as $y_1^D + m_1$, the FONC for an interior optimum can be written as

$$\frac{t}{1+t}\left(\frac{1+t}{x_1^D}\frac{dx_1^D}{dp_1^D}(1 + m_1/y_1^D) - \frac{1+t}{y_1^D}\frac{dy_1^D}{dp_1^D}\right) + \lambda = 0$$

$$\frac{t}{1+t}\left((1 + m_1/y_1^D)\epsilon - \eta\right) + \lambda = 0$$

where $\epsilon < 0$ and $\eta > 0$ are respectively the elasticity of domestic demand and the elasticity of import-competing supply

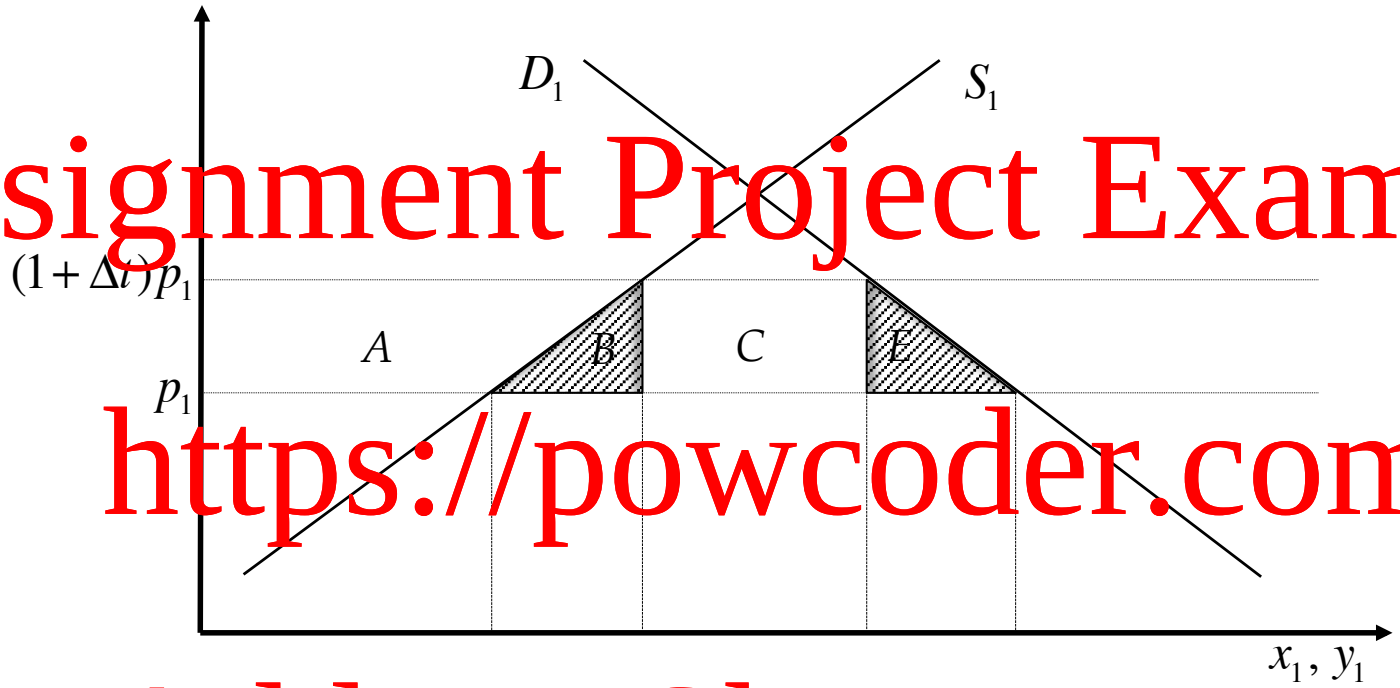
Trade lobbies and import protection (continued, 3)

Solving for $t/(1+t)$ (increasing in t) we obtain

$$\frac{t^*}{1+t^*} = \frac{\lambda}{\lambda + (1-\lambda)\, m_1/y_1^D)\,|\varepsilon|} = \frac{\lambda}{|\varepsilon|}\,\frac{y_1^D}{m_1^D} \quad (\varepsilon = \text{import elasticity})$$

i.e., a positive weight λ (an organized lobby) results in positive protection, but the less so the greater is import penetration, m_1/y_1^D

- If there are multiple industries, and preferences are additively separable across goods, then politically organized industries are predicted to get more protection, but less so if import penetration is high
- An analogous argument leads to the conclusion that politically organized export industries are predicted to receive export subsidies, but less so if export penetration is high
- Empirical evidence is consistent with these predictions; however, other predictions of the protection for sale model (import subsidies and export taxes in politically unorganized industries) are counterfactual



$\Delta(CS+R) = -(A+B+E)$

$\Delta PS = +A$

$\Delta\big((1+\lambda)PS + CS + R\big)/\Delta t$ at $t_1 = 0$ is $\lambda A - (B+E)$

$\dfrac{A}{B+E}$ increasing in $\dfrac{y_1}{x_1}$ i.e. decreasing in $\dfrac{x_1 - y_1}{x_1} = \dfrac{m_1}{x_1}$

Outline

International economic integration

Focus so far on trade liberalization by small open economies or simultaneous trade liberalization between two countries (or more than two identical countries); but world trade involves more than two countries and trade liberalization is often restricted to subsets of countries

- Multilateral trade liberalization (e.g. WTO)
- Preferential liberalization (PTAs) (trade clubs):

(i) Free trade areas (FTAs)
  - Zero bilateral tariffs
  - Independent tariff setting with respect to third countries

  $\Rightarrow$ need for "rules of origin" to restrict tariff-jumping via the zero-tariff FTA route

(ii) Customs unions (CUs)
  - Zero bilateral tariffs
  - Common external tariff (delegation to tariff setting authority)

(iii) Common markets
  - CU + free movement of factors

Outline

Customs unions: trade creation and trade diversion

- Until the 1950s trade economists took for granted that, in a neoclassical environment, more trade liberalization must always be better for a country, and so a country forming a customs union with another country must always gain
- The above conclusion is incorrect (Viner): a country will gain because the expansion of trade with the CU partner allows it to make more imports available to domestic consumers at a lower price (trade creation); but it will lose from it if the expansion of trade with the CU partner comes at the expense of lower-cost imports from a third country (trade diversion); the net effect can be positive or negative

Customs unions: trade creation and trade diversion (continued)

- Three countries, A, B and C, starting from non-prohibitive tariffs, t^A, t^B, t^C (i.e. not from autarky)
- Two goods, one input (labour); good 2 produced in all countries at a constant marginal labour costs $\alpha_2^j = 1, \ j = A, B, C$; good 1 produced in B and C only ($\Rightarrow A$ imports good 1 and there is no import-competing production in A) at constant marginal cost

$$\alpha_1^B = c^B > \alpha_1^C = c^C$$

$\Rightarrow$ since $(1 + t^A)c^C < (1 + t^A)c^B$, country A will be importing x_1^{NCU} from C

- Quasilinear preferences in A:

$$U(x_1, x_2) = H(x_1) + x_2$$

with $H(.)$ increasing and concave ($H'(.) > 0$, $H''(.) < 0$)

Customs unions: trade creation and trade diversion (continued, 2)

- Suppose $t^A < t^B$ (common tariff after CU is t^A) and $(1+t^A)c^C > c^B$
- A and B form a customs union, setting $t^{AB} = t^{BA} = 0$ and a common external tariff $t^{CA} = t^{CB} = t^A$

  $\Rightarrow$ all imports in A will now be originating from B

  The domestic price in A falls from $(1+t^A)c^C$ to c^B, and so imports increase from x_1^{NCU} to x_1^{CU}; tariff revenue falls from $t^A c^C x_1^{NCU}$ to zero; the total effect on A's welfare is

  $$H(x_1^{CU}) - H(x_1^{NCU}) - \left(c^B x_1^{CU} - c^C x_1^{NCU}\right)$$

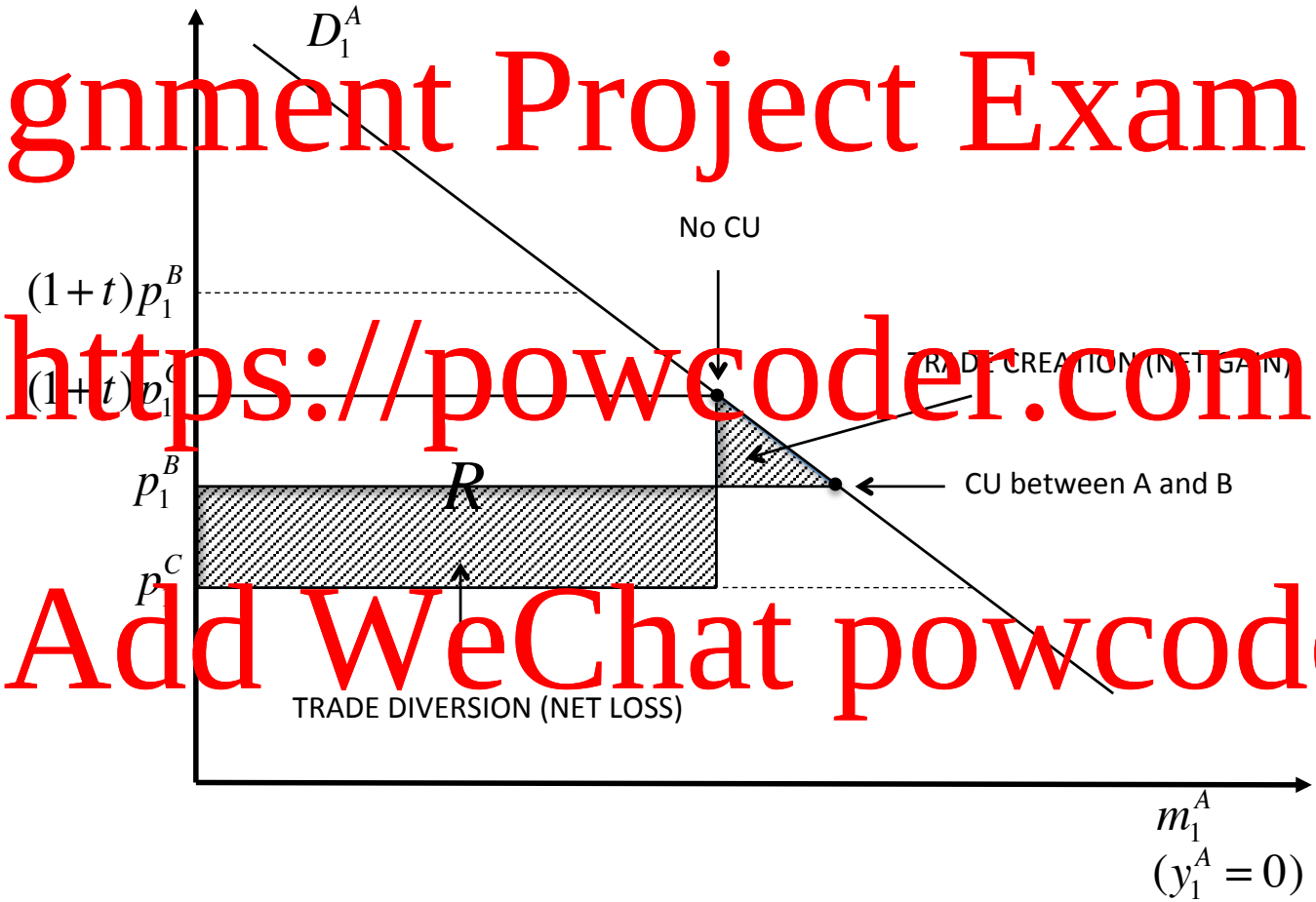
  This can be decomposed into a gain

  $$H(x_1^{CU}) - H(x_1^{NCU}) - c^B\left(x_1^{CU} - x_1^{NCU}\right) \quad (\textit{trade creation} \text{ effect})$$

  and a loss

  $$(c^C - c^B)x_1^{NCU} \quad (\textit{trade diversion} \text{ effect})$$

- The net welfare effect for A can be positive or negative



Customs unions: trade creation and trade diversion (continued, 3)

- In principle, it is always possible to achieve a Pareto improvement for A and B if the formation of the CU is accompanied by a suitable combination of other policies

  Intuition: with the CU, one could always adjust external tariffs so as to leave world prices unchanged at the pre-CU level, implying that the initial trade vectors are attainable for the two countries in the CU; the additional flexibility in the allocation of resources between A and B made possible by the CU and the transfers, however, can be exploited to achieve a Pareto improvement (Kemp and Wan)

- In practice, we don't observe lump-sum transfers between FTA and CU partners, but arguably side payments in kind do take place

Customs unions: endogenous protection and endogenous coalition formation

- External trade barriers are not exogenous for a CU
- The formation of a CU changes incentives for a (large) CU to use tariffs for terms-of-trade manipulation

An enlarged trading bloc (CU) yields more market power in the world market $\Rightarrow$ optimal external tariff is higher

An enlarged trading bloc (CU) can thus "win" a trade war against a third country, which in turn lowers incentives for the CU to engage in further liberalization with outsiders

$\Rightarrow$ regional agreements can be a "stumbling block" to multilateral liberalization rather than a "building block" (or "stepping stone") towards it

Customs unions and the Core

- Three symmetric countries, A, B and C, which can form coalitions (CUs) ; the set of possible coalitional configurations is:

$$\Big\{\{\{A\},\{B\},\{C\}\},\ \{\{A,B\},\{C\}\},\ \{\{A,C\},\{B\}\},\ \{\{A\},\{B,C\}\},\ \{\{A,B,C\}\}\Big\}$$

the last one is the "grand coalition"

Countries within a coalition co-ordinate their choices, outside a coalition choices occur non-cooperatively, resulting in a non-cooperative tariff equilibrium; so, if each country is on its own, the outcome is a standard Nash tariff equilibrium; if A and B form a coalition they choose their common external tariff, t^{A+B}, as an optimal joint response to t^C, and C sets t^C optimally in response to t^{A+B}; if A, B and C all form a joint coalition (grand coalition) the jointly optimal tariff is $t = 0$ (multilateral free trade)

- Coalition formation is endogenous: equilibrium configurations are those that are robust to "objections" by coalition members – i.e. coalitional configurations that are in the *core*

Customs unions and the Core (continued)

- It is possible for the grand coalition not to be in the core, i.e. starting from the grand coalition (free trade), two countries can end up better off if they form a CU and play non-cooperatively against the third country (Riezman)

  $\Rightarrow$ regional trade agreements can undermine multilateral liberalization
- Conclusions are different for FTAs: countries in an FTA still choose their external tariffs independently, so an FTA does not raise market power for FTA members

Simultaneous bloc enlargement

- Starting point: M symmetric countries setting tariffs non-cooperatively against each other
- Outcome: symmetric non-cooperative tariff, $t^N(M)$
- Simultaneous bloc enlargement: move to $M/2$ blocs each including two countries (a smaller number of larger players), with blocs setting tariffs non-cooperatively against each other
- Outcome: symmetric non-cooperative tariff, $t^N(M/2) > t^N(M)$
  Intuition: larger blocs have comparatively more market power and so their optimal tariff is higher
- Thus, simultaneous bloc enlargement can lead to a less cooperative trade environment, which can make all countries worse off (Krugman)
- Counterargument: by making the consequences of a trade war more severe, simultaneous bloc enlargement can raise incentive for multilateral cooperation – e.g. through a self-enforcing multilateral agreement

Outline

Pareto improving multilateral trade reform

- Result: Consider a scenario with M countries starting from positive, non-prohibitive tariffs, and where all goods are traded

  Then an equiproportional reduction in trade taxes from t^j to $\zeta\, t^j$, $j = 1, \ldots, M$, $\zeta < 1$, is Pareto improving (Dixit)

- This is in line with the practice of adopting tariff cutting formulas in multilateral negotiations

Multilateral agreements and trade policy cooperation

- Coordinated enforcement under a multilateral agreement can dominate bilateral enforcement (Maggi); two reasons:
  - Information pooling under imperfect monitoring of violations
  - Stronger punishment for deviators if all trading partners are involved
    (Counterargument: if PTAs can make selective cooperation easier to sustain, then punishment is even stronger with PTAs alongside a multilateral agreement)

- Multilateral liberalization can also help dilute the influence of individual protectionist lobbies

Multilateral trade institutions

- History: Bretton Woods system was meant to include ITO alongside IMF and IBRD; ITO did not materialize

  Interim regime: GATT, initially restricted to a small set of countries and led by the US

  GATT legal principles fashioned after US trade law (mercantilistic logic and language)

- Several "rounds" of negotiations, progressively lowering trade barriers, involving progressively more countries, becoming increasingly more complex, and taking increasingly longer to complete
  - Average tariff level was >15%; it is now <5%
  - Average yearly growth in merchandise trade, 1960-1990: $\approx$ 9%
  - First GATT round (Geneva, 1956) involved 22 countries; as of mid 2012, out of 193 UN members 157 were WTO members
  - First GATT round took less than a year; the last successful round (Uruguay Round, completed in 1994) took close to ten years
- The 1994 Uruguay Round Final Act instituted the WTO, which incorporates GATT articles as its own

Multilateral trade institutions (continued)

- The WTO has two main elements:
  - Framework for negotiating multilateral and *reciprocal* reductions in trade barriers (tariff bindings)
  - Rules governing trade relations between members and the resolution of trade-related disputes

WTO principles and rules

- National Treatment: nondiscrimination for imported goods past customs
- Most Favoured Nation (MFN) principle: nondiscrimination across trading partners (a country may have different tariffs for different goods, and these may be different from those of another country, but a country must apply same tariff on imports originating from all WTO members)

Exceptions:

(i) CUs and FTAs allowed as long as they are formed for trade creation purposes (i.e. not restricting trade with non-members)

(ii) Special and differential (S&D) rules for less developed countries, which include a preferential market-access component for LDCs' exports to developed countries

Example: US Generalized System of Preferences (GSP). LDCs granted GSP status by the US face below-MFN tariffs for their exports to the US; GSP status can be unilaterally revoked by the US (GSP "graduation") on the basis of certain "tests"

WTO principles and rules (continued)

- Transparency: policies and practices relating to trade between members must be clearly visible and quantifiable; e.g. all non-tariff barriers (quotas and other NTBs) should be converted to tariffs ("tariffication") and then countries should be negotiating on those; ban on VERs (used for circumventing MFN)
- Contingent protection: member countries are allowed to use temporary trade-restricting measures in situations where trade can cause "injury" to the domestic economy ("safety valves"). A legacy of US trade law. Two main types of instruments:
  (i) *safeguards*, for health and safety reasons, or to protect against "excessive" competition
  (ii) *countervailing duties* against "unfair" competition in the form of "dumping" by exporters or export subsidization by other countries

  WTO rules prescribe minimum requirements for "injury tests" (for safeguards) and "specificity tests" (for AD/CVD) used by a country for granting contingent protection to a domestic firm or industry
- Dispute settlement rules: rules governing the formation and operation of WTO panels ruling on trade disputes between members