14.54 International Trade
— Lecture 6: "Standard" Trade Models —

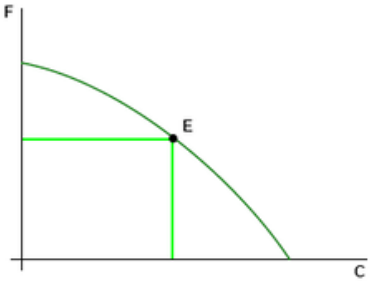
Today's Plan

1. Production Possibility Frontier
2. Constructing Relative Supply Curves
3. Putting Things Together: Relative Supply and Demand

Small graphs on slides 3-5, 7, 13-34, 36, 38, and 39
were created by Marc Melitz and used with permission.

Production Possibility Frontier

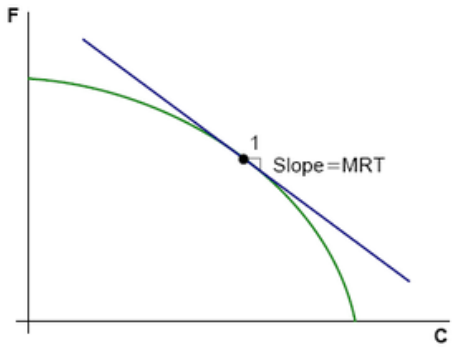
- Now introduce responses in production to trade in longer run
- Recall definition of PPF: set of goods that can be produced
  - Given technology and factor endowments



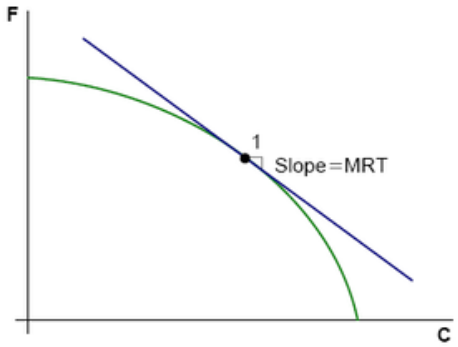
- Production can now respond to changes in relative prices (just like consumer demand)
- Movements along PPF represent a reallocation of the factors of production across sectors (C and F)

Production Possibility Frontier (Cont.)

- The PPF must be downward sloping (Why?)
- The slope of the tangent to the PPF represents the marginal rate of transformation (MRT) between C and F
  - It is also the opportunity cost of C (measured in units of F)
  - .. and hence the relative marginal cost of C



Production Possibility Frontier (Cont.)



- We will almost always assume that the PPF is bowed out to the origin
- This means that the relative MC of both C and F is increasing:
  - The more C is produced, the higher the cost in terms of foregone units of F

Increasing Relative Marginal Costs

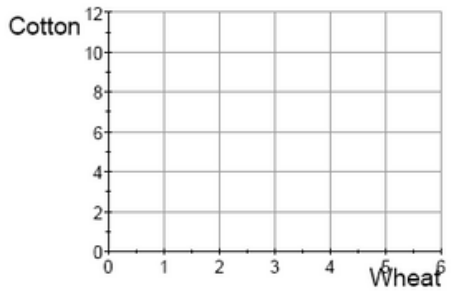
- Why is relative marginal cost typically increasing?
  - This is a natural consequence of differences in factors of productions (they are relatively more useful for producing some goods than others)
- Consider the following 2-crop farming example:
  A farmer can use 3 different fields to produce Wheat and Cotton

Case 1: No Differences

	Production	
Field	Wheat	Cotton
1	2	4
2	2	4
3	2	4

Case 2: Differences

	Production	
Field	Wheat	Cotton
1	2	2
2	2	4
3	2	6



Farm Example

Case 1: No Differences

	Production	
Field	Wheat	Cotton
1	2	4
2	2	4
3	2	4

Case 2: Differences

	Production	
Field	Wheat	Cotton
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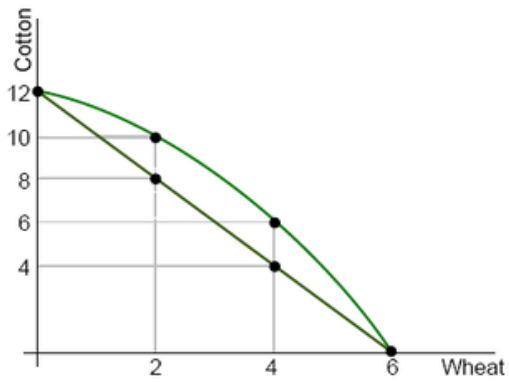
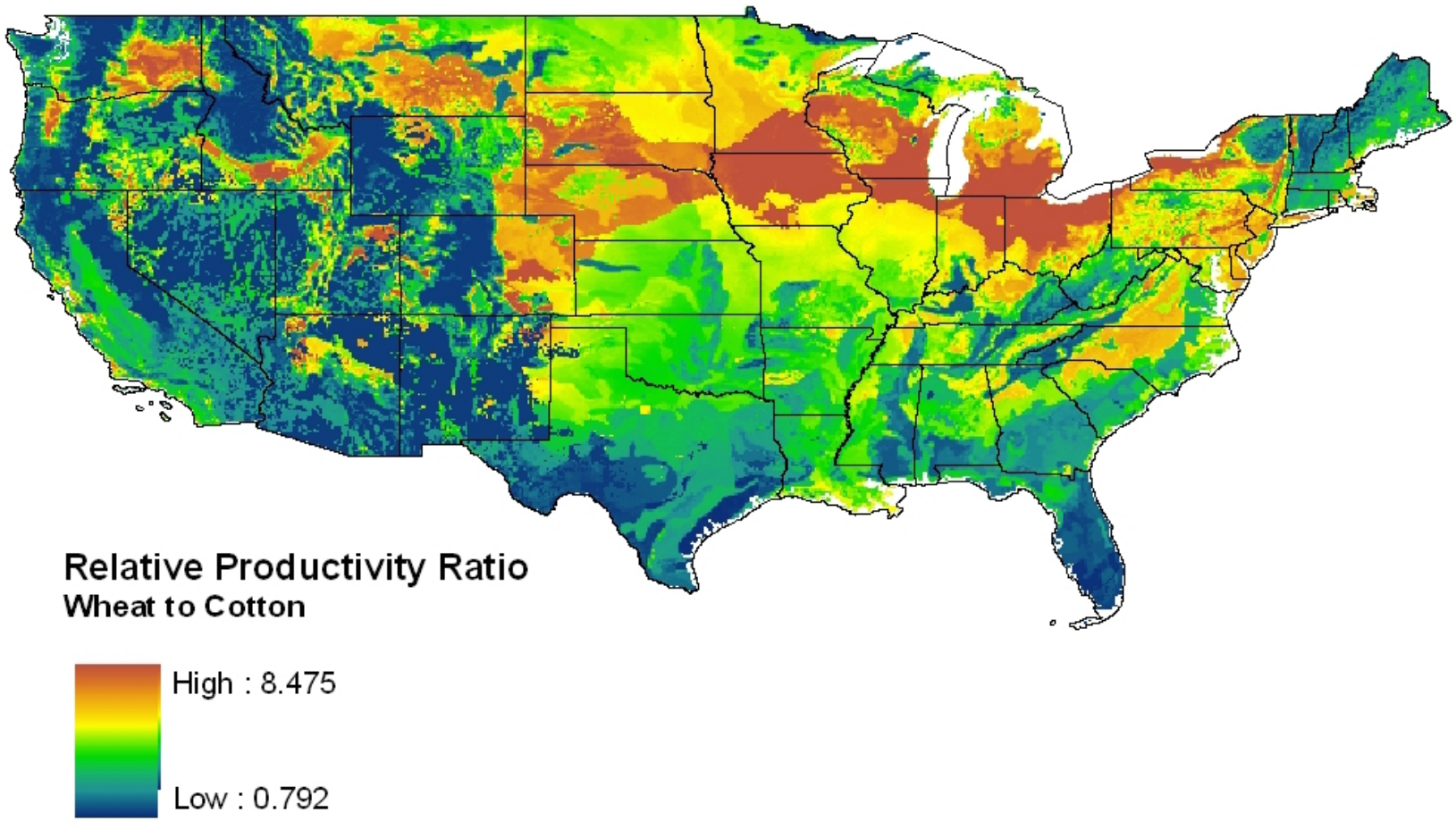


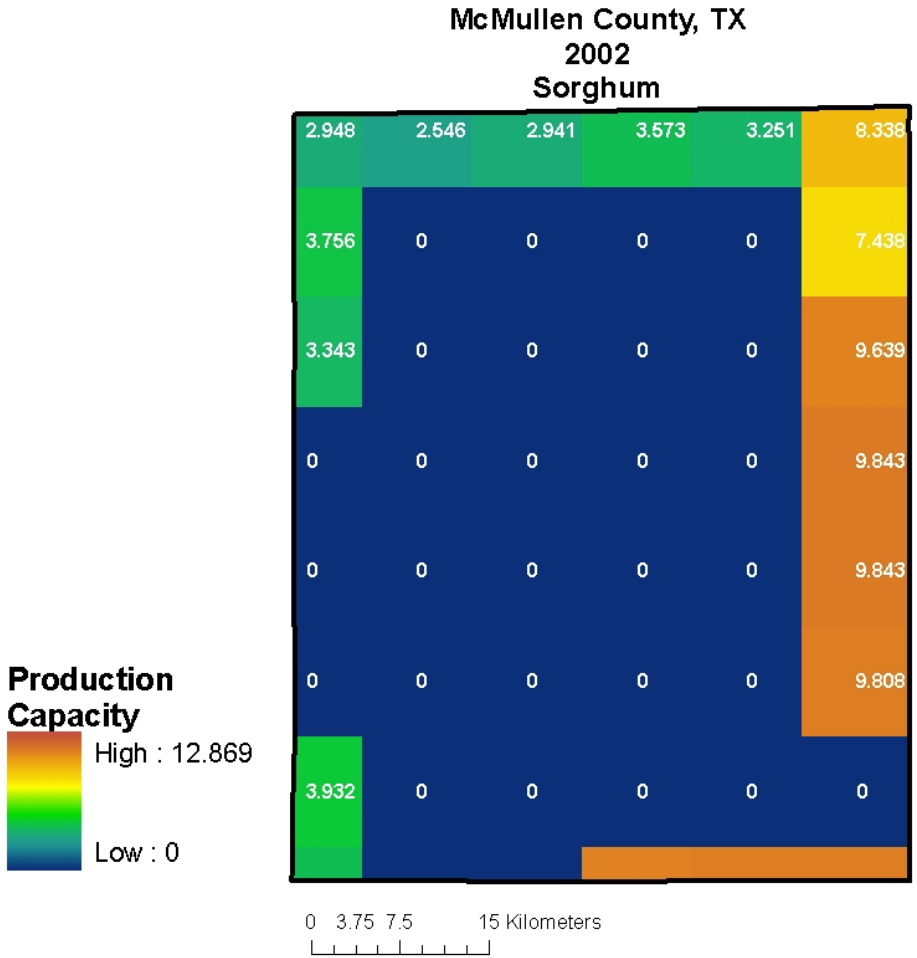
A Real World Example

Ratio of Wheat Yield to Cotton Yield (FAO, 2011)



A Real World Example

PPF for a county that can be illustrated in 2-dimensions



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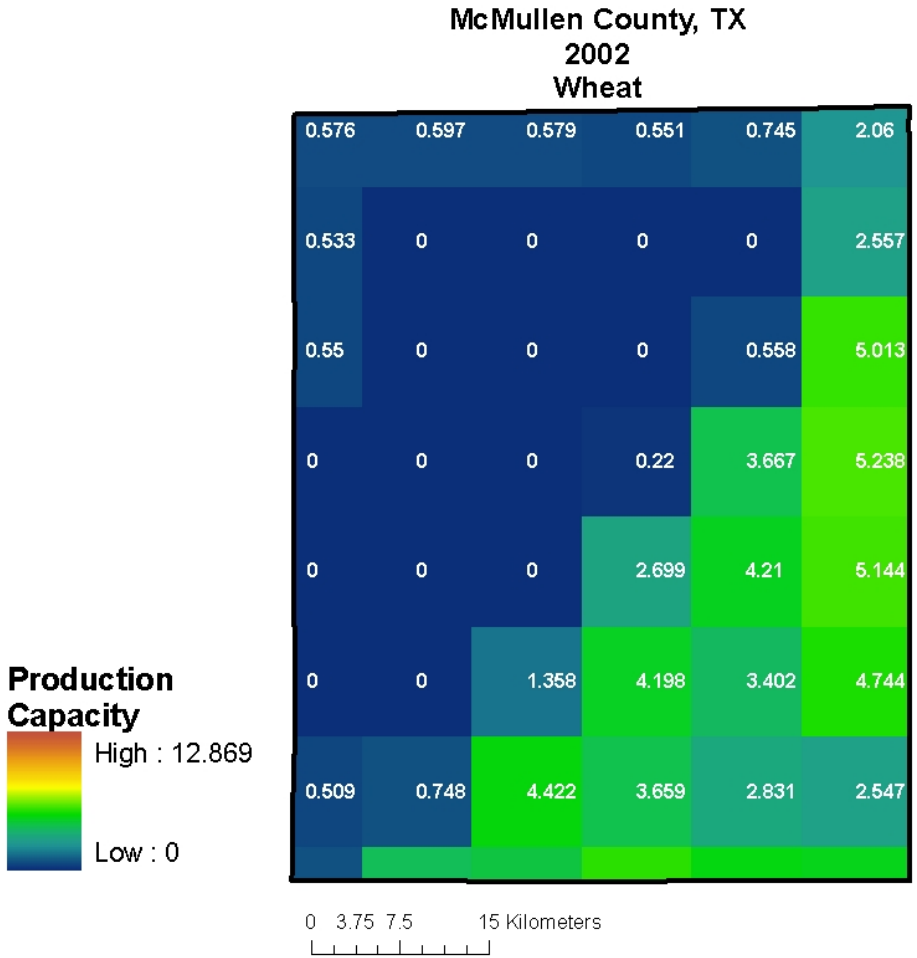

A Real World Example

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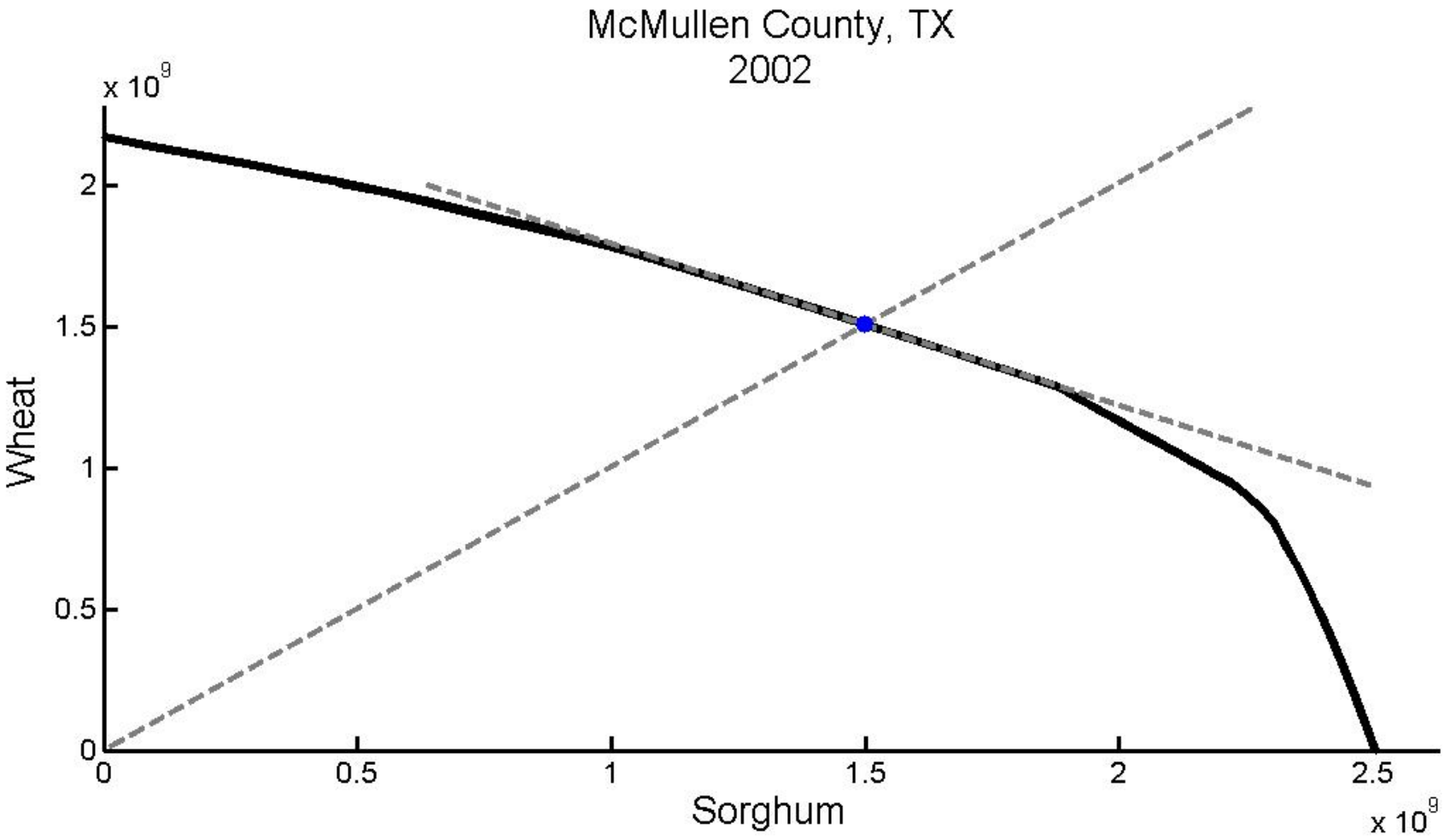
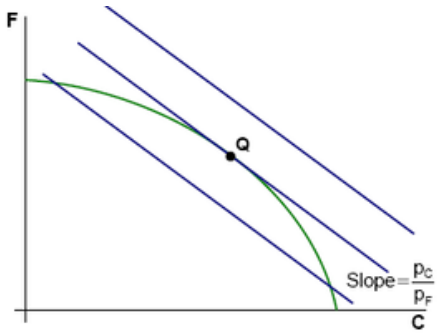


Shape of the Production Possibility Frontier

- A PPF will exhibit increasing relative marginal cost even when the factors of production are homogeneous
  - ... but are used in different proportion to produce the different goods
- Nevertheless, it is still possible for a PPF to exhibit decreasing relative marginal cost
- For example, the farmer could become more efficient, the more production is concentrated in a single crop
- However, even if this were true at the level of the farm, it may not hold at a more aggregated level

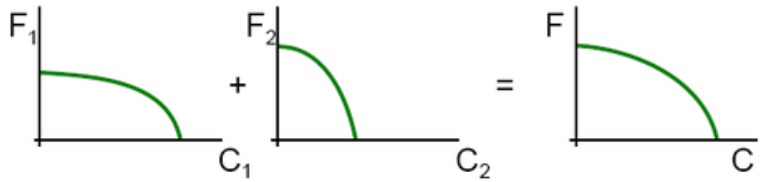
Producer Revenue Maximization

- If the PPF represents all the possible productive activities for the available factors of production
- ... then producer profit maximization is equivalent to revenue maximization
- Given prices p_C and p_F, a producer chooses the production point $\mathbf{Q} = (Q_C, Q_F)$ that maximizes revenue $p_C Q_C + p_F Q_F$



Aggregation

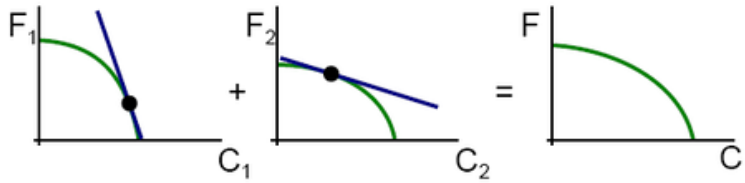
- Just like preferences, individual PPFs (or country PPFs) can be aggregated into an 'aggregate' (world) PPF:



- Do points on aggregate PPF represent all combinations of individual production points on PPF1 and PPF2?

Aggregation and Revenue Maximization

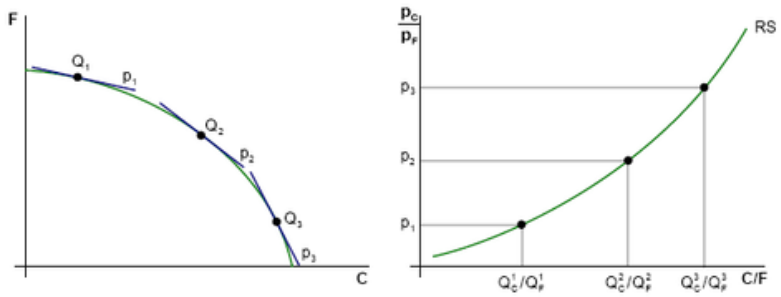
- Is this combination of production points on the aggregate PPF?



- No! $RMC^1 > RMC^2$ so if producer 1 produces less C and producer 2 produces more C (leaving aggregate C production unchanged) then aggregate production of F will increase
- When is a point on the aggregate PPF reached?
  - When $RMC^1 = RMC^2$ (and then $= RMC^{AGG}$)
  - This will always occur when all producers maximize revenues subject to the same relative price p_C / p_F
  - When this happens, revenue maximization subject to aggregate PPF yield same outcome as aggregating optimal production plans of all individual producers

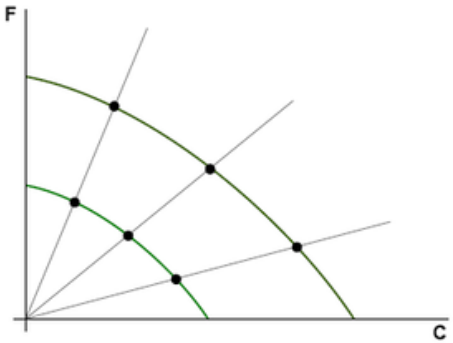
PPF and Relative Supply

- Producer optimization subject to a relative price p_C / p_F and a PPF yields a relative supply curve: $Q_C / Q_F = RS(p_C / p_F)$



Relative Supply Curve and Country Size

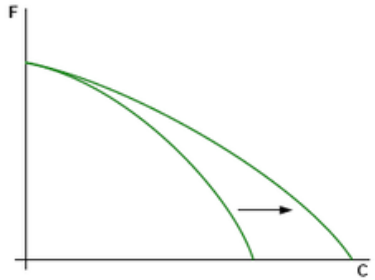
- The RS curve does not capture the 'size' of an economy
- The following 2 PPFs will share the same RS curve (so growth need not affect the RS)



- Rather, RS captures shape of PPF: ability to produce relatively more C or F

Relative Supply Curve and Growth

- Growth can be biased towards the production of a particular good:



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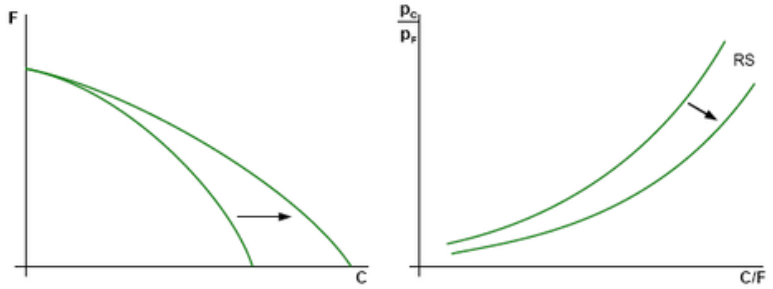

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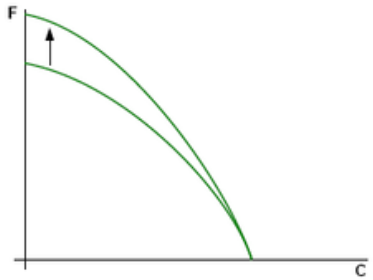

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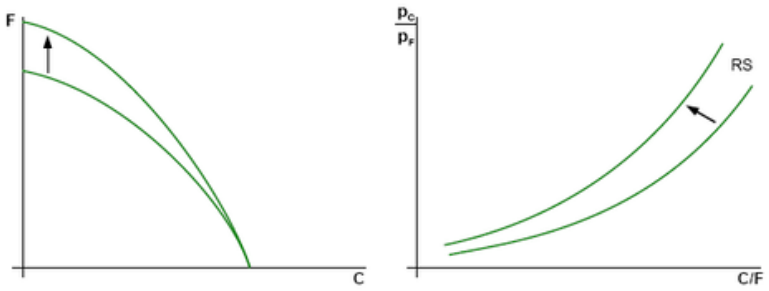
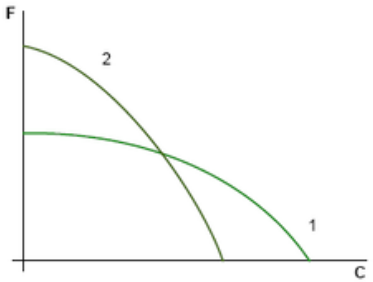


Different Country PPFs and Relative Supply Curves



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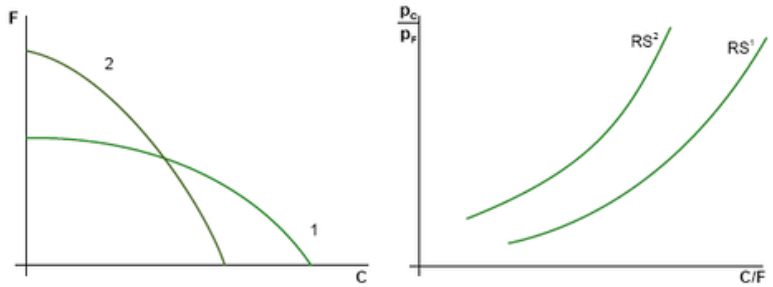
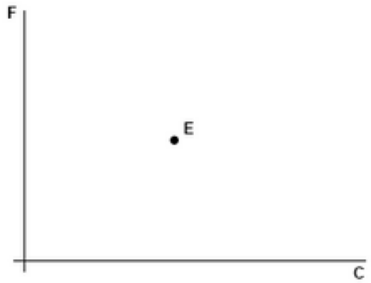
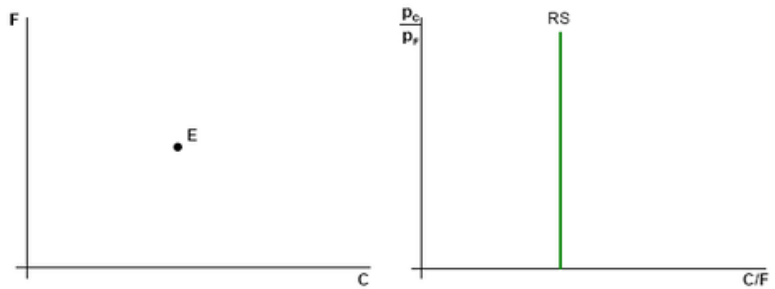


- Such differences in PPFs can be due to:
  - Differences in technology (countries are relatively better at producing some goods)
  - Differences in relative factor abundance (countries have access to factors that are relatively more useful in producing certain goods)

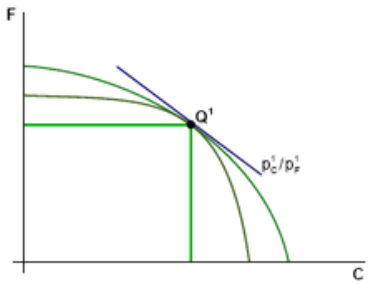
Endowment Economy and Relative Supply



Endowment Economy and Relative Supply



Elasticity of the Relative Supply Over Time



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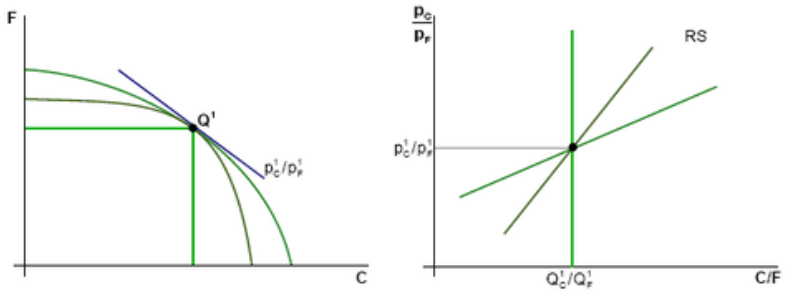
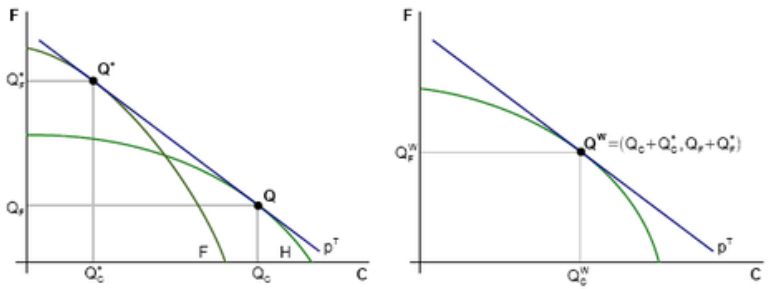


- The RS curve will become more elastic in the long run

Country Revenue Maximization and the World PPF

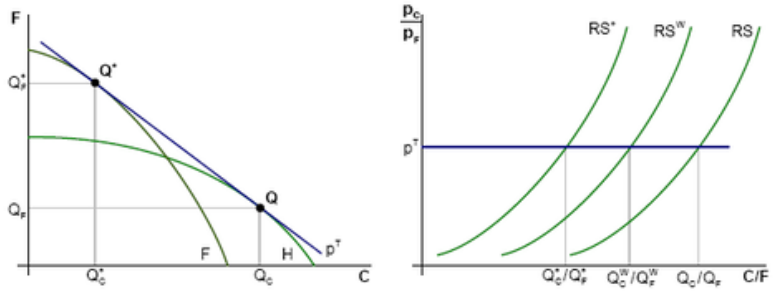
- Back to 2 countries, Home and Foreign
- Both face the same world relative trade price $p^T = p_C^T / p_F^T$



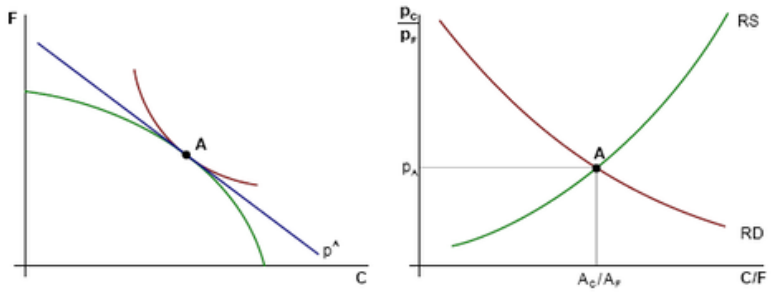
Country and World Relative Supply

- Just like the case of relative demand, the world relative supply curve must lie between the 2 country relative supply curves

$$\frac{Q_C^W}{Q_F^W} = \frac{Q_C + Q_C^*}{Q_F + Q_F^*} \text{ is a weighted average of } \frac{Q_C}{Q_F} \text{ and } \frac{Q_C^*}{Q_F^*}$$



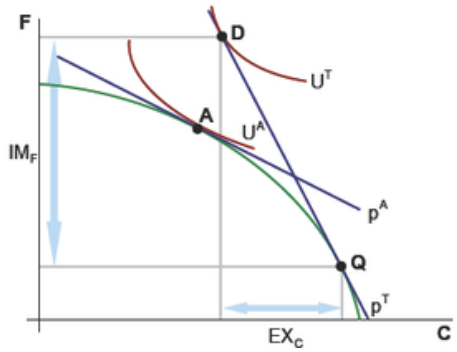
Supply and Demand: The Autarky Equilibrium



- As before, assume that all consumers share the same homothetic preferences (otherwise, RD curve would shift with changes in relative prices)
- The equilibrium p^A is such that $RS(p^A) = RD(p^A)$ and $p^A = MRS^A = MRT^A$
  - At p^A, the value of production is maximized and consumers maximize utility

Supply and Demand: Trade Equilibrium

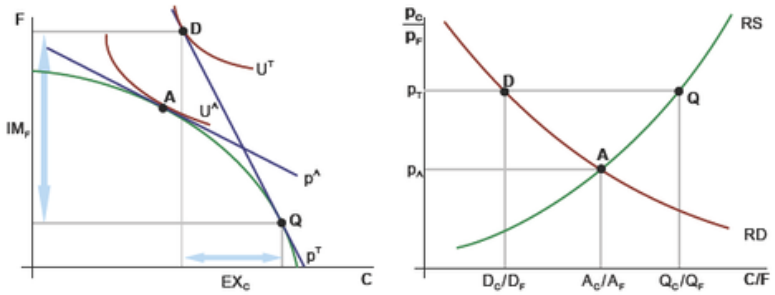
- Now assume that this country can trade at a world trade price $p^T = p_C^T / p_F^T$ (assume that $p^T > p^A$)



- Given p^T, the value of production is maximized at Q and the aggregate consumer maximizes utility at that relative price given an income $p_C^T Q_C + p_F^T Q_F$

- The country exports C and imports F
- Gains from trade: welfare rises from U^A to U^T

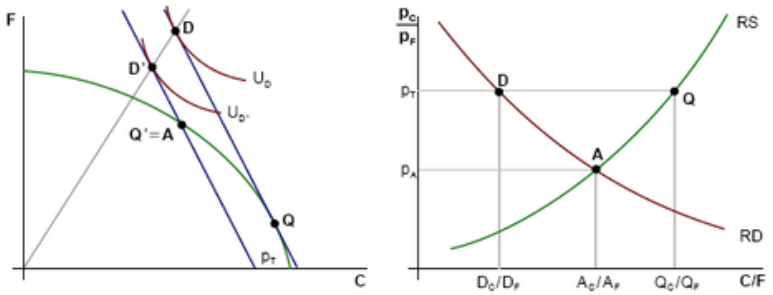
Supply and Demand: Trade Equilibrium (Cont.)



- An equilibrium p^T is such that export supply and import demand for both goods are equalized across countries

Decomposing Production and Demand Responses from Trade

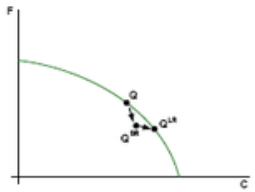
- Assume first that production cannot respond in the short run



- The production response increases the volume of trade and further raises the gains from trade

Production Response from Trade and Transition Costs

- Note that a movement along the PPF assumes the full employment of the factors of production (which is the long run response)
- However, the reallocation of the factors of production induces short run transition costs
  - Often manifested as unemployment or under-employment of some factors (workers and/or capital)
  - One can think of this as a transition point inside the long run aggregate PPF



  - As previously discussed, these short run transition costs should be weighed against the higher permanent aggregate welfare gains

U.S. Labor Reallocations Driven by Foreign Trade

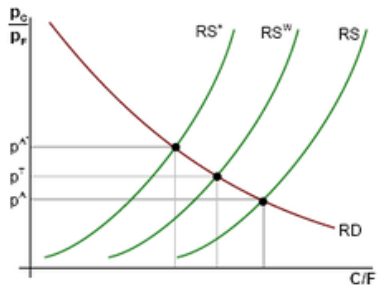
Percentage Change in Employment in U.S. Manufacturing Resulting from Foreign Trade

Industry	Percentage Change
Footwear	-15.9%
Motor vehicles and equipment	-11.1%
Electrical components and accessories	-7.8%
Leather products	-6.3%
Apparel	-6.3%
Radio and television equipment	-5.7%
Miscellaneous manufacturing	-5.0%
Funitures and fixtures	-4.5%
Service industry machines	5.7%
Miscellaneous electrical machinery	6.6%
Electrical and industrial equipment	7.1%
Miscellaneous machinery	8.0%
Aircrafts and parts	12.8%
Office, computing, and accounting machines	16.1%
Engines and turbines	17.8%
Construction and mining machinery	19.9%

Source: R.Z. Lawrence, *Can America Compete?*

Comparative Advantage

- Same definition: a country has a comparative advantage in the good whose autarky relative price is lower than the world relative price
- As with the endowment model of trade, when there are no differences in demand across countries, then the differences in relative supply across countries determine the pattern of trade:



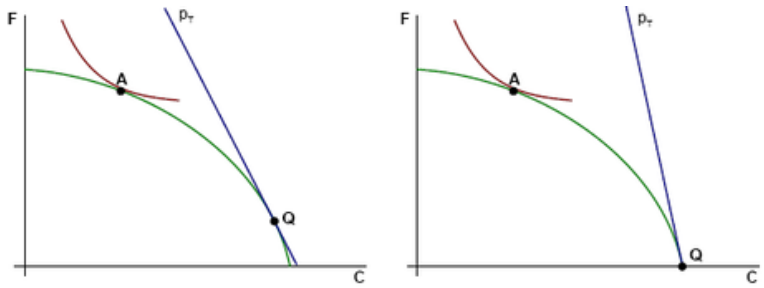
- Differences in *RS* are now based on differences in the shapes of the PPFs (and not a single endowment point)

Comparative Advantage (Cont.)

- A country that is relatively more efficient at producing a good will have a comparative advantage in that good
- This relative efficiency is not related to country size or overall productivity

Incomplete Versus Complete Specialization

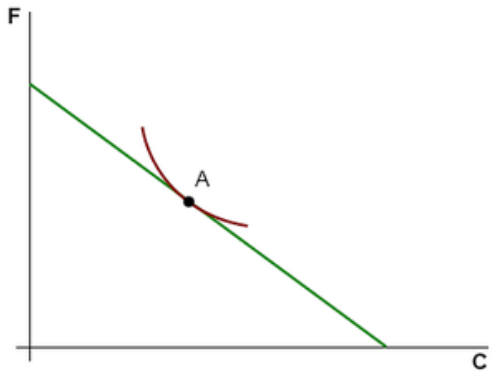
- As production responds to trade in the long run, it becomes possible for countries to completely specialize in the production of some goods
  - ... which means no longer producing some other goods (and consume them via imports)



  - Recall that p^T must be greater than MRT at $Q_F = 0$ for complete specialization

Complete Specialization with Flat PPF

- If the relative marginal costs of C and F are constant then any trade price $p^T \neq p^A$ will lead to complete specialization



- Autarky price p^A must be given by constant MRT of PPF (think of RS curve)
- If $p^T > p^A$, specialize in C. If $p^T < p^A$: specialize in F

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