Specific Factors Model (2/1/2012)   Econ 390-001

Equations

- production functions
  - $Q_C = Q_C(K, L_C)$ production function for cloth
  - $Q_F = Q_F(T, L_F)$ production function for food
- factor price
  - $w = P_C MPL_C = P_F MPL_F$ equilibrium wage
  - $r_K = P_C MPK$ equilibrium rental rate of capital
  - $r_T = P_F MPT$ equilibrium rental rate of land
- budget contraints
  - $P_C D_C + P_F D_F = P_C Q_C + P_F Q_F$ budget constraint (consumption = production)
  - $(D_F - Q_F) = (P_C/P_F)(Q_C - D_C)$ budget constraint (imports value = exports value)
- miscellaneous
  - $-P_C/P_F = -MPL_F/MPL_C$ relative price = opportunity cost
  - $L_C + L_F = L$ allocation of labor between cloth and food
  - $Q_C P_C = Kr_K + L_C w$ cloth revenue = capital costs + labor costs
  - $Q_F P_F = Tr_T + L_F w$ food revenue = land costs + labor costs

Variable definitions

- production/consumption
  - $Q_C \equiv$ cloth production
  - $Q_F \equiv$ food production
  - $D_C \equiv$ cloth consumed
  - $D_F \equiv$ food consumed
- marginal product (*high MPL means high productivity*)
  - $MPL_C \equiv$ marginal product of labor for cloth
  - $MPL_F \equiv$ marginal product of labor for food
  - $MPK \equiv$ marginal product of capital for cloth
  - $MPT \equiv$ marginal product of land for food
- factors of production
  - $L \equiv$ total supply of labor
  - $K \equiv$ supply of capital (capital stock)
  - $T \equiv$ supply of land
- prices
  - $P_C \equiv$ unit price of cloth
  - $P_F \equiv$ unit price of food
  - $w \equiv$ wage rate
  - $r_K \equiv$ rental rate of capital
  - $r_T \equiv$ rental rate of land
- income distribution
  - $w/P_C \equiv$ real wage in terms of cloth
  - $Kr_K/P_C \equiv$ real income of capital owners in cloth
  - $Tr_T/P_F \equiv$ real income of landowners in food
- miscellaneous
  - $(D_F - Q_F) \equiv$ imports of food
  - $(Q_C - D_C) \equiv$ exports of cloth
  - $(P_C/P_F) \equiv$ relative price of cloth
  - $(MPL_F/MPL_C) \equiv$ opportunity cost of cloth

Definitions
- ***specific factor*** - factor that can only be used in the production of a particular good
- ***mobile factor*** - factor that can move between sectors
- ***production function*** - relates output of a good to amount of inputs (factors)
- ***marginal product of labor*** - addition to output generated by adding 1 person hour
- ***diminishing marginal returns*** - decrease in marginal (per unit) output as the amount of a single factor of production is increased while other factors of production stay constant
- ***budget constraint*** - combinations of goods available for consumption given an income
- ***income distribution*** – division of revenues among factors of production

Principles
- The Specific Factors Model aims to explore how trade affects income distribution.
- Specific Factors Model assumptions
    1) 2 goods: cloth & food.
    2) 3 factors of production: labor (L), capital (K), & land (T).
    3) Perfect competition in all markets.
    4) Cloth produced using capital and labor (not land).
    5) Food produced using land and labor (not capital).
    6) Labor is a mobile factor.
        - can move between sectors
    7) Land and capital are both specific factors.
        - used only in the production of one good
- Reasons for income distribution effects
    o resources can't move instantly/costlessly between industries
    o industries use different mixes of factors of production they demand.
- Why do economists favor free trade despite distribution effects?
    o distribution effects are not specific to international trade
        - Winners and losers in all trade – not just international trade.
        - Shifting consumer preferences and technology advances, helps some and hurts others.
    o allowing trade and compensating losers better than blocking trade
        - Preserves more of the gains for society than blocking trade.
    o winners from trade are less politically organized than losers
        - Gainers are typically less concentrated, informed, and organized than losers.
        - Losers can convince politicians to block trade with tariffs and quotas.
        - As a counterweight, should favor free trade in general.
- Factors of production
    o Capital is a specific factor.
    o Land is a specific factor.
    o Labor is a mobile factor.
- Trade shifts jobs from the import sector to the export sector (labor is a mobile factor).
    o Not instantaneous … there can be temporary unemployment.
- No obvious correlation between imports (trade) and unemployment in the U.S.
- Only 2.5% of involuntary displacements stemmed from plants moved overseas / import competition.
- Empirically there has been real wage convergence due to international migration.
    o Wages don't actually equalize because of immigration restrictions.
- Real wages start out higher in destination countries than in origin countries.
- Real wages rose faster in origin countries than in destination countries.

Model functions/graphs

- Production function
    - When labor moves from food to cloth, output of food falls while output of cloth rises.
    - Shape reflects the law of diminishing marginal returns.
        - Each unit of labor adds less output than the last.
        - Each worker has less capital with which to work.
    - Marginal product of labor is the first partial derivative for labor of the production function.
        - MPL_C is downward sloping because of diminishing marginal returns to labor.
- Production Possibilities Frontier
    - Diminishing marginal returns to labor leads to a curved PPF.
        - See 4 quadrant diagram:
            - lower left quadrant: allocation of labor
            - lower right quadrant: cloth production function
            - upper left quadrant: food production function
            - upper right quadrant: PPF for cloth and food
    - At the production point PPF must be tangent to budget constraint
        - PPF slope is opportunity cost of cloth in terms of food ($-MPL_F/MPL_C$).
            - The slope of the PPF is steeper with more cloth.
        - Budget constraint slope is relative price of cloth to food ($-P_C/P_F$).
- Allocation of labor
    - The wage equals the value of the marginal product of labor in manufacturing and food sectors.
        - Employers maximize profits by demanding labor up to the point where the value produced by additional hour equals the marginal cost of employing worker that hour.
    - Demand for labor in the cloth sector is $MPL_C P_C$. (measured left to right)
    - Demand for labor in the food sector is $MPL_F P_F$. (measured right to left)
    - Demand curves intersect at w and the allocation of labor between sectors.
    - The two sectors must pay the same wage because labor can move between sectors.
- Income distribution
    - Equal (proportional) change (P_C up 10% & P_F up 10%)
        - $\Delta P_C/P_C = \Delta w/w = \Delta P_F/P_F$
            - 10% = 10% = 10%
        - No real changes.
            - Output of cloth and food don't change.
            - Labor in cloth and food don't change.
            - Real wages (w/P_C & w/P_F) don't change.
            - Real incomes of capital owners (Kr_K/P_C, Kr_K/P_F) don't change.
            - Real incomes of landowners (Tr_T/P_C, Tr_T/P_F) don't change.
    - Change in relative prices (P_C up 10%, P_F constant)
        - $\Delta P_C/P_C > \Delta w/w > \Delta P_F/P_F$
            - 7% > ~2.5% > 0%
        - Real changes.
            - Output of cloth rises; output of food falls.
            - Labor in cloth rises; labor in food falls.
            - Real wages in terms of cloth (w/P_C) fall; real wages in terms of food (w/P_F) rise.
            - The welfare change for workers is ambiguous.
            - Real incomes of capital owners (Kr_K/P_C, Kr_K/P_F) rise.
   - Real incomes of landowners (Tr_T/P_C, Tr_T/P_F) fall.

- Relative supply/demand
  - Assume preferences are the same across countries, so relative demand is RD^W.
  - Before trade P_C/P_F is at the intersection of a RS & RD^W.
    - Without trade, consumption must equal production.
  - After trade P_C/P_F is the intersection of RS^W & RD^W.
    - Trade allows consumption to differ from production.
    - Import/export for the differences.
  - International trade shifts P_C/P_F, so factor prices change.
  - Income distribution effects
    - Trade benefits the factor specific to the export sector in both countries.
    - Trade hurts the factor specific to the import sector in both countries.
    - Trade has ambiguous effects on mobile factors.
    - It is possible to redistribute income so that everyone gains.
      - But doesn't necessarily happen.
- Budget constraint for trading economy
  - Budget constraint with trade lies above the PPF.
- International labor mobility
  - Workers migrate to where wages are highest.
  - Without migration:
    - Workers in the Home country earn a low real wage (point C).
    - Low MPL (productivity) due to less land per worker.
    - Workers in the Foreign country earn a high real wage (point B).
    - High MPL (productivity) due to more land per worker.
  - With migration:
    - Real wages in Home and Foreign reach equilibrium (point A).
    - Emmigration from Home reduces L and raises Home real wages.
    - Immigration to Foreign increases L* and lowers Foreign real wages.
    - World output rises: labor moves to where it is more productive.
  - Income distribution effects
    - Workers initially in Home benefit (real wages rise)
    - Workers initially in Foreign lose (real wages decline).
    - Landowners in Foreign gain from the inflow of workers.
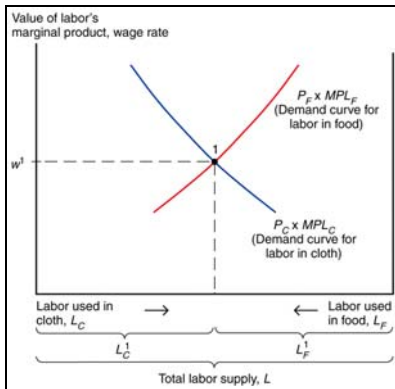   - Landowners in Home lose from the outflow of workers.
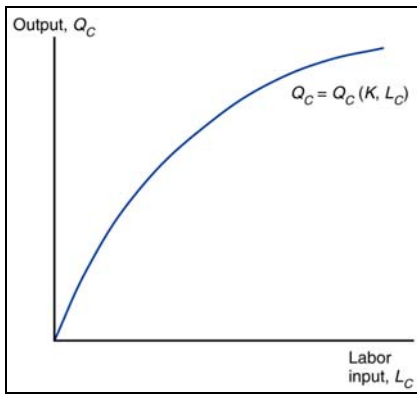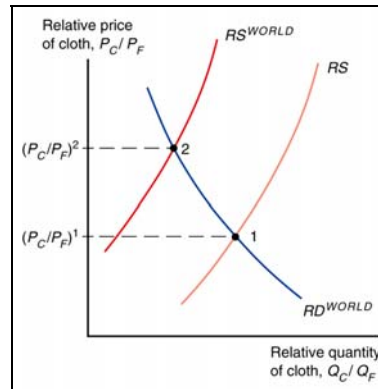
Production Function
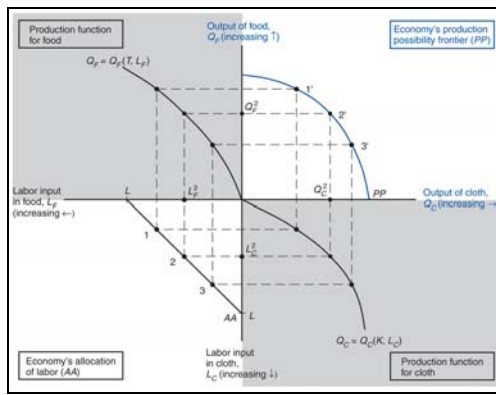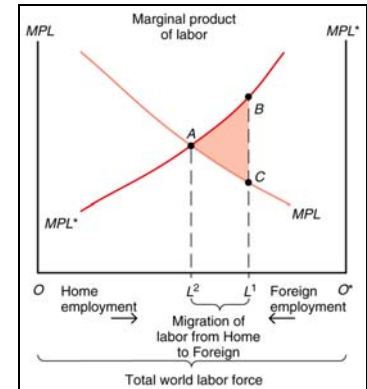

Production Possibilities Frontier (derive)
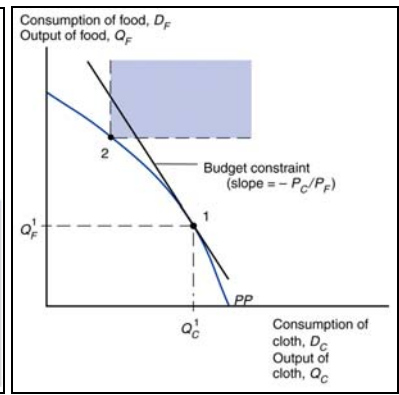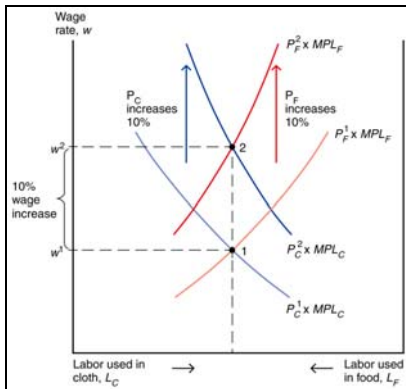

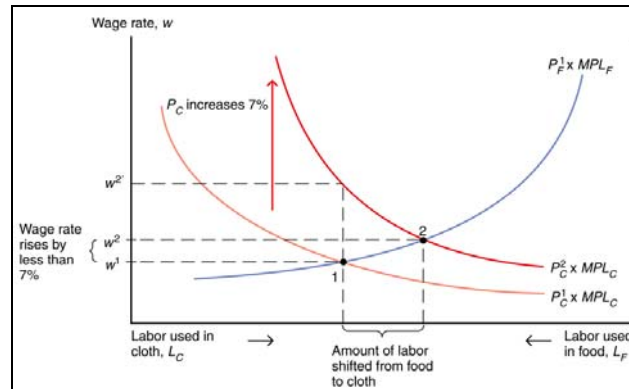Production Possibilities Frontier

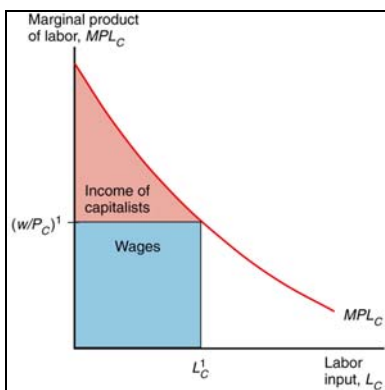Allocation of Labor

Trade and Relative Prices
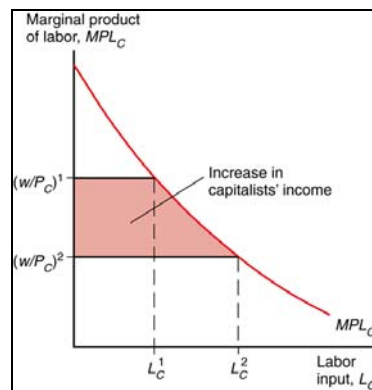

International Labor Mobility

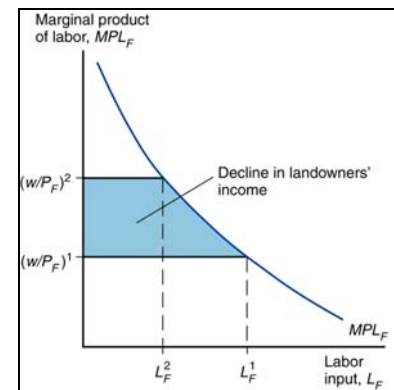Income distribution: proportional rise

Income distribution: relative rise in prices

Income Distribution

Rise in Capitalist Income

Decline in Landowner Income