INCREASING RETURNS AND TRADE

- **Long recognized that scale economies can provide an opportunity for trade; however, difficult to incorporate into general equilibrium models, as scale economies are inconsistent with perfect competition**

- **Generally two types of scale economies:**

  - *external economies*, economies external to the firm occurring at industry level, competitive equilibrium being preserved

  - *internal economies*, internal to the firm, generating large-scale production, inconsistent with perfect competition

- **Consider Figure 1, where a firm must incur a large fixed cost to start production, but then produces with constant marginal costs**

- **Total cost is given by:**

$$TC_x = F + (MC_x)X \qquad (1)$$

$$AC_x = F/X + MC_x \qquad (2)$$

where **F** = fixed cost, MC_x = constant marginal cost, **X** = output; average cost is **TC/X**, so AC_x is given in **(2)**

■ In Figure 1, MC_x is a constant, while AC_x falls as fixed costs **F** are spread over a larger output **X**, AC_x never actually touching MC_x

■ Is it possible to have a competitive equilibrium? No. If price $p = p_c = MC_x$, each firm loses money as $AC_x > MC_x$ (losses = area $\{p_c - AC_c\}X_c$)

■ If $p > MC_x$, each firm attempts to produce an infinite amount, which is not a stable equilibrium

■ One solution is to have *monopoly* with *entry barriers*, in Figure 1 this where **MR=MC**, at the equilibrium p_m, X_m (profits = area $\{p_m - AC_m\}X_m$)

■ A second solution is to have free entry of firms selling differentiated goods until the demand curve is driven down to tangency with the AC curve, so that while firms cover average cost, they price above marginal cost in equilibrium (*monopolistic competition*)

FIGURE 1: MONOPOLY AND INCREASING RETURNS
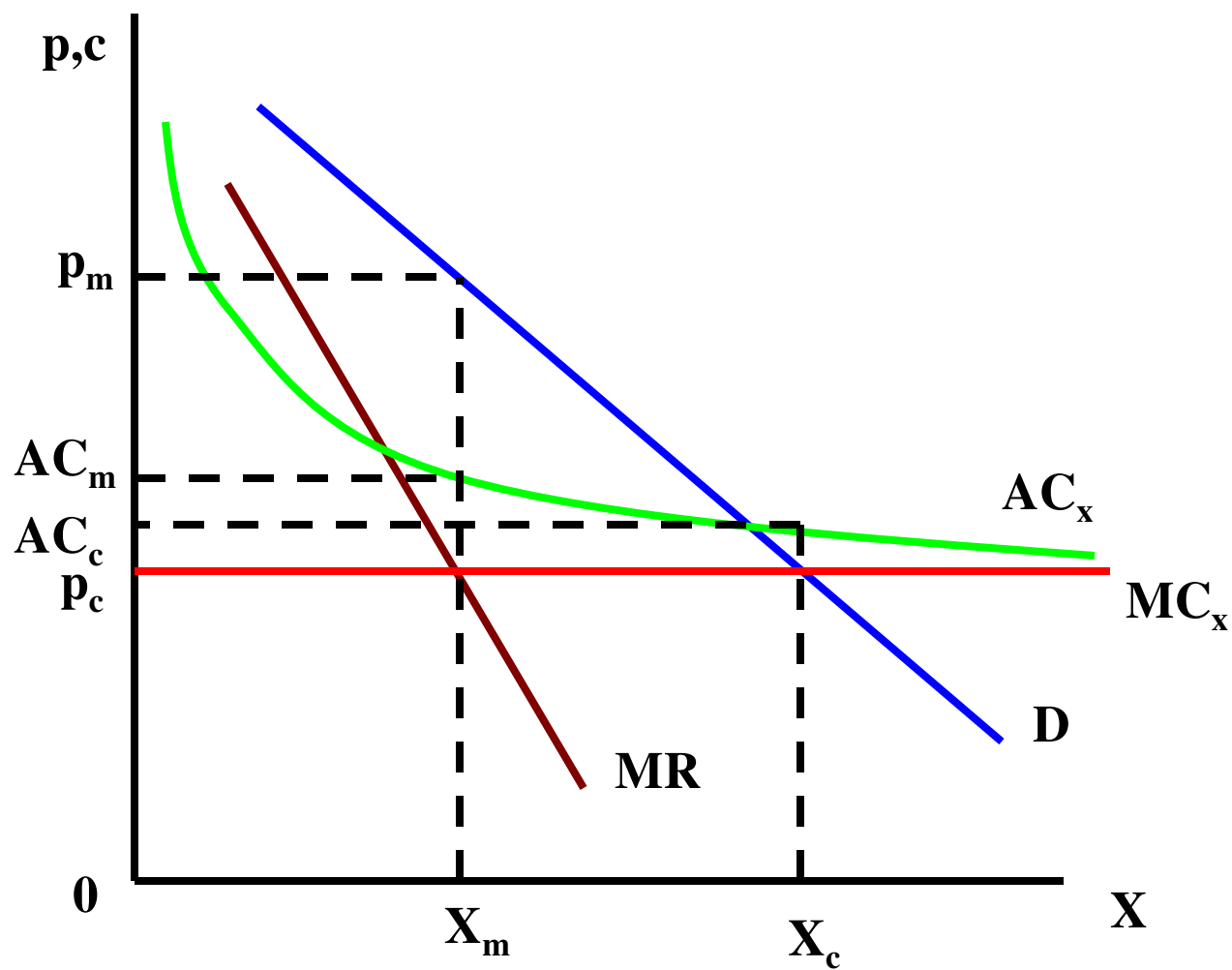
- **Figure 2 gives a general equilibrium representation of this technology; suppose X and Y are each produced with one factor L, where total $L = L_x + L_y$. Assume Y is produced under constant returns by a competitive industry, such that $Y = L_y$**

- **If Y is the *numeraire*, $p_y = 1$, and wage rate in terms of Y is also 1; p is the price of X in terms of Y, the cost of producing X being L_x**

- **With X produced under increasing returns:**

  $$L_x = F + (MC_x)X \qquad (3)$$

  The production frontier is given as TFT$'$, T=L is maximum output of Y when X=0; to begin producing X, the fixed cost TF must be incurred, thereafter, constant MC_x gives the linear segment FT$'$, which has a slope equal to MC_x

- **Average costs of X are:**

  $$AC_x = L_x/X = (L - L_y)/X = (T - Y)/X \qquad (4)$$

  (4) shows that at A, average costs of producing X is the slope of a line passing through T and A; as one moves along FT$'$, average costs are falling

■ **Equilibrium price ratio must cut production frontier if positive X is produced at non-negative profits - in Figure 2, slope of price ratio exceeds FT′ (MC$_x$)**

■ **In Figure 2, autarky equilibrium is given; price ratio p^a through A steeper than average cost TA; point G gives GNP in terms of good Y**

   - labor paid a wage of 1 in terms of good Y, so total wage income is given by L=Y, or 0T; profits in terms of Y are given by TG

   - budget line of wage earners is given by a line with slope p^a through T=L; point B on the wage earner's budget line is consumption of wage labor; difference between A and B is consumption out of profit income

   - as wage income is fixed at T=L in terms of Y, a decrease in p always raises real wage income, the budget line rotating around point T

   - wage income equals GNP if profits are zero, i.e. the price line is TA; so trade changes GNP via real incomes and /or changes in monopoly profits
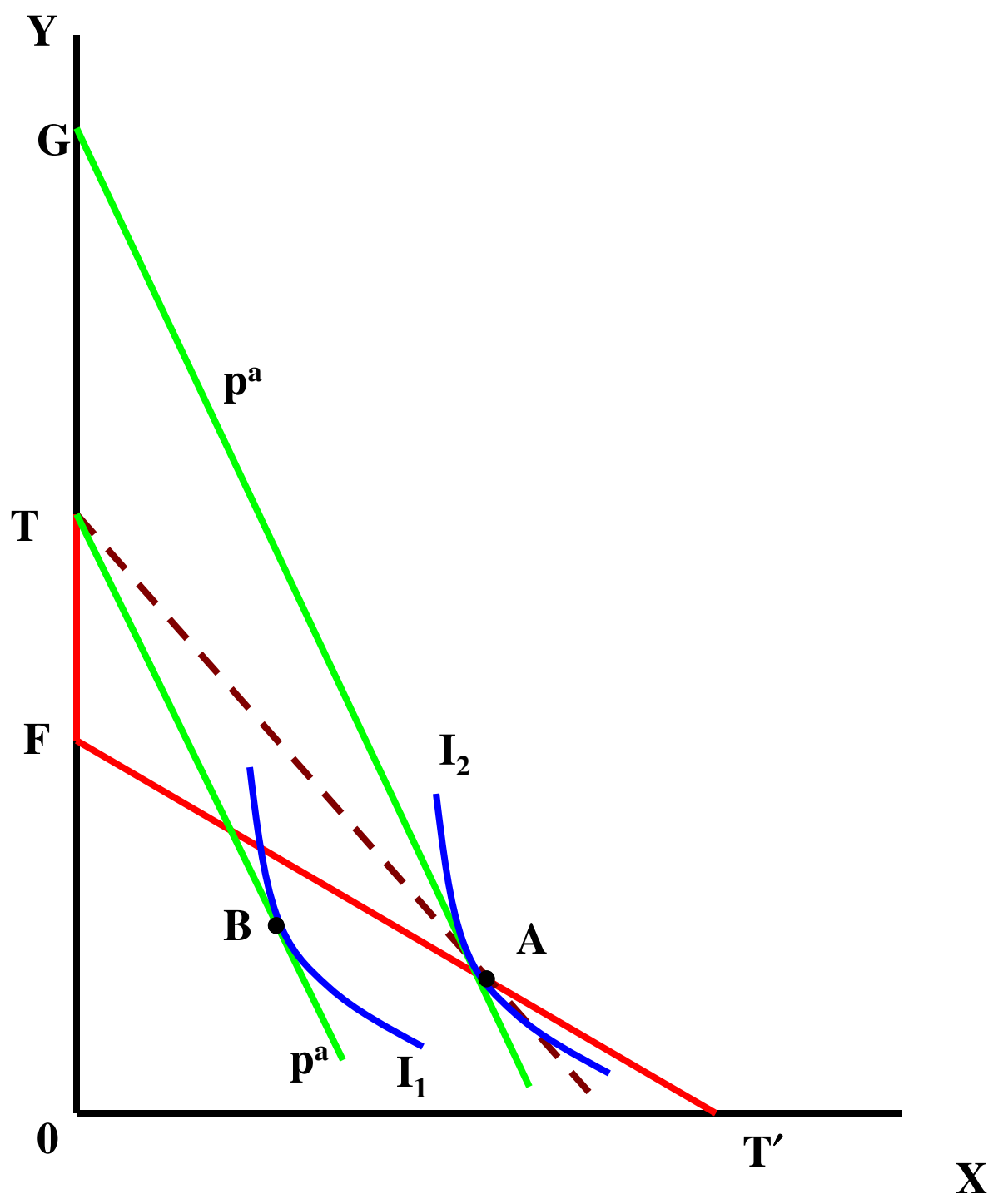
■ **There are several conceptually different sources of gains from trade in presence of increasing returns**

■ <u>**Pro-Competitive Gains**</u>

As with monopoly there will be pro-competitive effects that can be broken down into two components, a *profit effect* and an *average-cost effect*

- Welfare under monopoly is affected by a change in output of X when X is priced in excess of marginal cost:

$$(p - MC_x)dX \qquad (5)$$

Increasing X benefits the economy because it captures excess of price over marginal cost

- Write down total cost of X, TC_x, as average cost multiplied by output:

$$TC_x = X(AC_x), \quad dTC_x = dX(AC_x) + X(dAC_x) \qquad (6)$$

Divide (4) through by dX to get marginal cost:

$$MC_x = dTC_x/dX = AC_x + X(dAC_x/dX) \qquad (7)$$

- Substitute the right-hand side of (7) into (5):

$$(p - MC_x)dX = (p - AC_x)dX - X(dAC_x/dX)dX \quad (8)$$

Decompose production expansion effect into two separate effects:

(i) First-term of (8) is the *profit effect*, if $p > AC_x$, an increase in output generates a surplus of price over average cost on the extra output

(ii) Second-term of (8) is the *decreasing average cost effect*; with increasing returns, $dAC_x/dX < 0$, so an increase in output increases welfare

- In moving from autarky to free trade, even though price is driven to average cost in equilibrium, economy captures excess of price over average cost, saves on real resources from falling average costs

- Two effects captured in Figure (3); A is initial equilibrium at price ratio p, and suppose this stays the same with trade, but output of X expands to Q

Country is on a higher budget line, A to Q being made up of two components, A to B, and B to Q:

- Output expands from X_a to X_f, but hold average cost fixed at initial level of AC_{x0}, i.e. slope of the line through points T and A; therefore, A to B is the profit effect

- B to Q is the scale economies effect; more Y can be produced at Q than B, as the average cost of producing X has fallen from AC_{x0} to AC_{xf}

■ **Firm Exit Effect**

Scale economies pose a dilemma with respect to numbers of firms in an industry; on one hand, desirable to have few firms for technical efficiency, but on the other hand, few firms implies market power

Trade-off gives rise to a further gain from trade - the total number of firms in competition increases, but the number of firms in each country is reduced

■ **Increased Product Diversity**

Recent literature has focused on product diversity as a gain from trade, where monopolistic competition is the usual market structure

FIGURE 3: GAINS UNDER INCREASING RETURNS
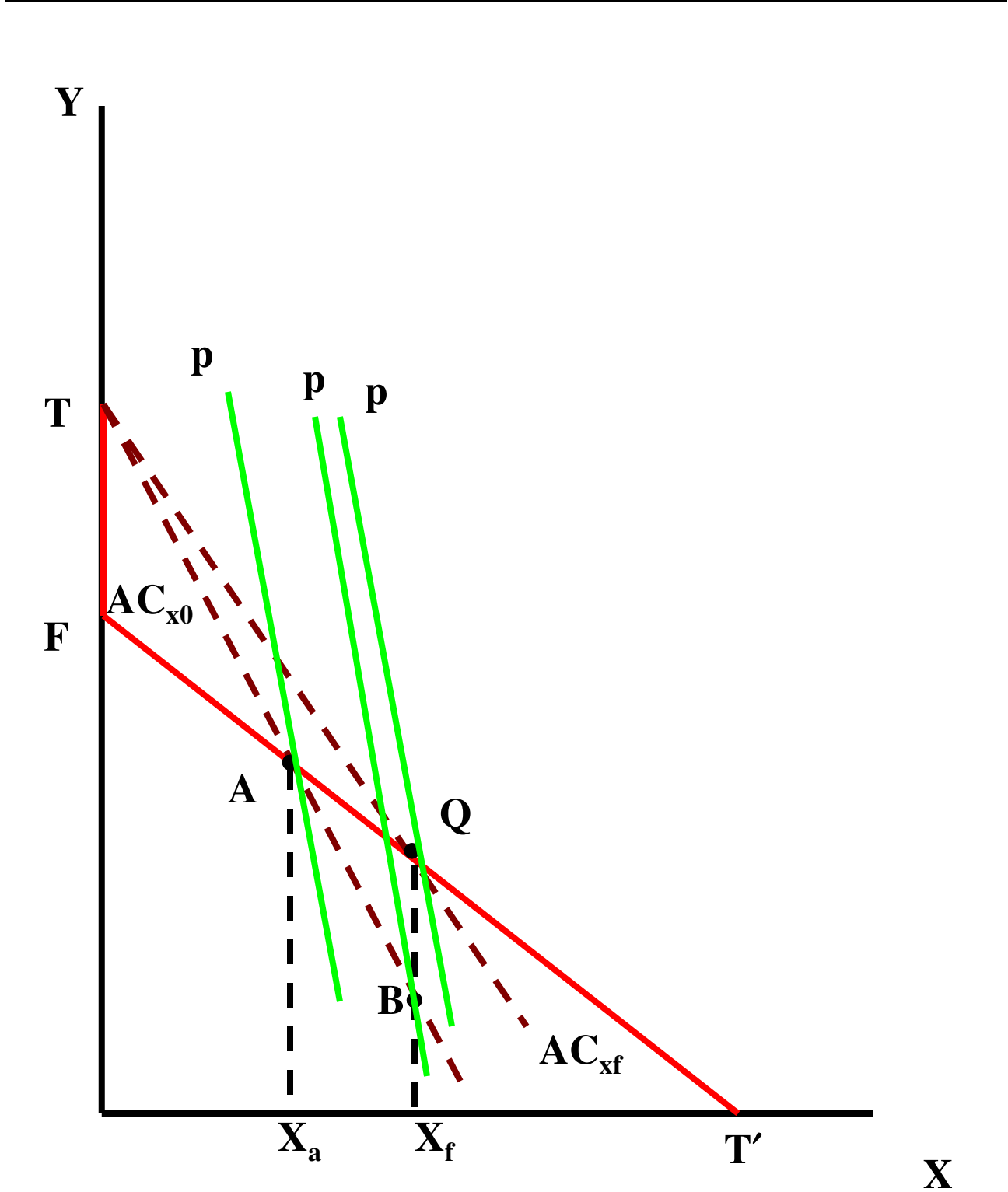
- **In Figure 4, assume both goods X and Y are produced with increasing returns, production functions for X and Y being identical, and goods are symmetric but imperfect substitutes**

- **Consumers are indifferent between a unit of X and a unit of Y, but they prefer to have some of both rather than just one, *love of variety approach* to consumer preferences**

- **In autarky, each country can attain consumption point A, but not best choice given scale economies in X and Y; due to fixed costs best to produce Y at T or X at T′, putting country on an indifference curve through T and T′, higher than A**

- **Under trade, each country can specialize in one of the goods, X or Y, and trade half its output for half that from the other country, attaining consumption level C**

- **There are no changes in average cost, and no pro-competitive gains from trade, the gains are entirely from an increase in product diversity due to *intra-industry* trade**

FIGURE 4: PRODUCT DIVERSITY AND TRADE