This is the first of two sets of notes on increasing returns to scale and imperfect competition as a source of trade and gains from trade.

This set focuses on *homogeneous goods* (firms produce identical products).

The principal ideas are:

(1) trade can offer opportunities and gains even for identical countries: a pattern of comparative advantage need not exist.

(2) *efficiency gains*: by specializing in producing only one good for the whole world, each country becomes more *productive*.

(3) scale economies are associated with imperfect competition, and hence trade allows for *pro-competitive gains from trade*.

General idea behind production efficiency (productivity) gains:

In autarky, each country divides is resources between both goods, and hence the average cost of production is high (productivity is low).

With trade, each country can focus on a single good, and hence the average cost of each good falls, more is produced from a given among of factors, and a surplus is created.

Figure 1

General idea behind pro-competitive gains:

As we will see, increasing returns is inevitably associated with imperfect competition and prices above marginal cost. Trade induces more competition and hence more output and lower prices.

Figure 2

Another way to think about this is as a classic Prisoners' Dilemma game.

Suppose that each firm makes profits of 10 in autarky. When trade is opened up, each firm has the choice between holding it quantity at the autarky level or increasing quantity.

This game has the following payoff matrix, where the first number is the profits of the home firm, and the second number is the profits of the foreign firm.

		Foreign Firm: Hold quantity	Foreign Firm: Increase quantity
Home Firm	Hold quantity	(10, 10)	(5, 12)
	Increase quantity	(12, 5)	(7, 7)

In this case the Nash equilibrium is a situation is which each firm is making a best response to the decision of its rival.

The Nash equilibrium in this case is that both firms raise their quantities, resulting in the fact that both firms are worse off relative to autarky. Profits falls from (10, 10) to (7, 7).

However, the increase in their quantities must mean that consumers are better off.

Firms costs: fixed cost plus constant marginal cost.

"Real" (in units of labor) cost function for a firm in the X industry

$L_x = F + cX$

F - fixed cost to begin production
c - constant marginal cost
X - output

$ac_x = F/X + c$

Average cost function
Average cost is decreasing in X
Average cost always > marginal cost

Figure 3

Because average cost is always greater than marginal cost, it is not possible to have a perfectly competitive equilibrium ($p = c$).

This would imply that firms are losing money.

And if firms are assumed to be price takers, any price $p > c$ would induce firms to expand output to infinity.

Therefore, the assumption of price-taking behavior is inconsistent.

Equilibrium must involve large firms with market power.

Assume $Y = L_y$, $L_x = F + cX$ and that $L = L_x + L_y$

Figure 4

For a given amount of X output, the minimum price which allows a monopoly producer to break even is average cost, ac.

$$ac_x = \frac{L_x}{X} = \frac{(\bar{L} - L_y)}{X} = \frac{(\bar{Y} - Y)}{X}$$

This is shown in Figure 4 by a cord connecting the production point Q to the Y intercept of the production frontier.

Income distribution between profits and factor income (payments to labor)

Measure income in terms of good Y (e.g., 25000 hamburgers a year).

Figure 5

Suppose that the equilibrium production is point Q and equilibrium price p > ac in Figure 5, so profits are positive.

Run a line up from the production point Q in Figure 5 to the Y axis. The point T represents total income in terms of Y.

But factors (labor) are paid average cost, so labor's total income in terms of Y is point Y*. Labor's budget line is a line through Y* with slope p.

So total consumption is C_t, labor's consumption is C_f, and the difference is monopoly profit's share of total income.

1. Derive the marginal revenue function for a monopolist

2. Show the relationship between the monopoly equilibrium and a production tax for a closed economy.

Marginal Revenue: The revenue derived from selling one more unit. For a perfectly competitive firm, marginal revenue = price (since price is fixed from the firm's point of view).

For a monopolist, price must be lowered on <u>all units</u> in order to sell more. So marginal revenue is less than price: price - loss of revenue on other sales.

(1) $R = p_x X \qquad \Delta R = p_x \Delta X + X \Delta p_x$

(2) $$MR \equiv \frac{\Delta R}{\Delta X} = p_x + X\frac{\Delta p_x}{\Delta X} = p_x + p_x\frac{X}{p_x}\frac{\Delta p_x}{\Delta X}$$

(3) $$MR = p_x\left[1 + \frac{X}{p_x}\frac{\Delta p_x}{\Delta X}\right] \qquad let \quad e_x \equiv -\frac{\Delta X/X}{\Delta p_x/p_x}$$

e_x is (minus) the price elasticity of demand for X, $e_x > 0$.

(4) $$MR = p_x(1 - 1/e_x) < p_x$$

In equilibrium, producers in both sectors equate marginal revenue to marginal cost (marginal cost in Y equals price).

(5) $$\frac{p_x(1 - 1/e_x)}{p_y} = \frac{MC_x}{MC_y} = MRT < p_x$$

This looks very much like a production tax on X. Closed economy equilibrium with the X sector monopolized.

Figure 6

Pro-Competitive Gains from Trade:

Suppose that a firm does not have the whole market. Assume that the firm behaves as a "Cournot competitor". That is, the firm views the outputs of the other firms as fixed.

(1) $$R_h = p_x(X_h + \bar{X}_f)X_h \qquad \Delta R_h = p_x \Delta X_h + X_h \Delta p_x$$

(2) $$MR_h \equiv \frac{\Delta R_h}{\Delta X_h} = p_x + X_h \frac{\Delta p_x}{\Delta X_h}$$

(3)

$$MR_{xh} = p_x + X_h \frac{\Delta p_x}{\Delta X} \frac{\Delta X}{\Delta X_h} = p_x + X_h \frac{\Delta p_x}{\Delta X} \qquad \frac{\Delta X}{\Delta X_h} = 1 \quad (Cournot)$$

(4) $$MR_{xh} = p_x + \frac{X_h}{X}\left[X \frac{\Delta p_x}{\Delta X}\right] = p_x + p_x \frac{X_h}{X}\left[\frac{\Delta p_x / p_x}{\Delta X / X}\right]$$

The expression in (1) is similar to the monopoly formula expect for the term X_h/X, which is the share of the home firm in total sales.

We will denote this share as $s_h = X_h/X$.

Continuing to denote the market price elasticity of demand for X as e_x, (1) can then be written in a form comparable to the monopoly (autarky) formula in).

(5) $$MR_{xh} = p_x\left[1 - \frac{s_h}{e_x}\right] = MC_{xh} \qquad s_h = \frac{X_h}{X}$$

A firm's optimal market is decreasing in its market share. This markup goes from $1/e_x$ for a monopolist (s = 1), to zero for a perfect competitor (s = 0).

Now assume that there are two *identical countries*, each with a monopoly producer of X in autarky.

Now open trade. The market share of each firm falls from 1 to 1/2. Thus markups must fall. Equilibrium price will be closer to marginal cost.

Point A in Figure 6 is autarky, point T is free trade.

The intuition is that after opening trade, there are twice as many consumers. If a firm views its rival's output as fixed, any increase in supply will be spread across twice as many consumers as it was in autarky.

Therefore, the price fall will be only half as much.

In other words, Cournot firms perceive demand as more elastic in the open economy.

Two identical economies each with one X firm:

Autarky markups: 1/e

Free-trade markups: 1/(2e)

Free trade may results in no *net* trade, but there may be considerable *gross* trade as firms invade one another's markets.

Free trade results in:

(1) higher outputs per firm and lower average cost

(2) lower consumer price

(3) welfare gain

1. Suppose that there is free entry an exit of firms, so that the number of firms adjusts so that there are zero pure profits in equilibrium.

2. Put two identical countries together as before. All firms will have an incentive to expand as earlier, but now the "prisoners' dilemma will mean that all firms now make losses.

2. Trade will have the "rationalizing" effect of reducing the number of firms in each country individually, but leaving the world economy with more firms in the end (more competition for the consumers).

   Example: each country has 10 firms in autarky.

   competition due to trade forced out 3 firms in each country.

Figure 7

   each country has 7 firm in free trade, but there are now 14 firms in competition with each other.

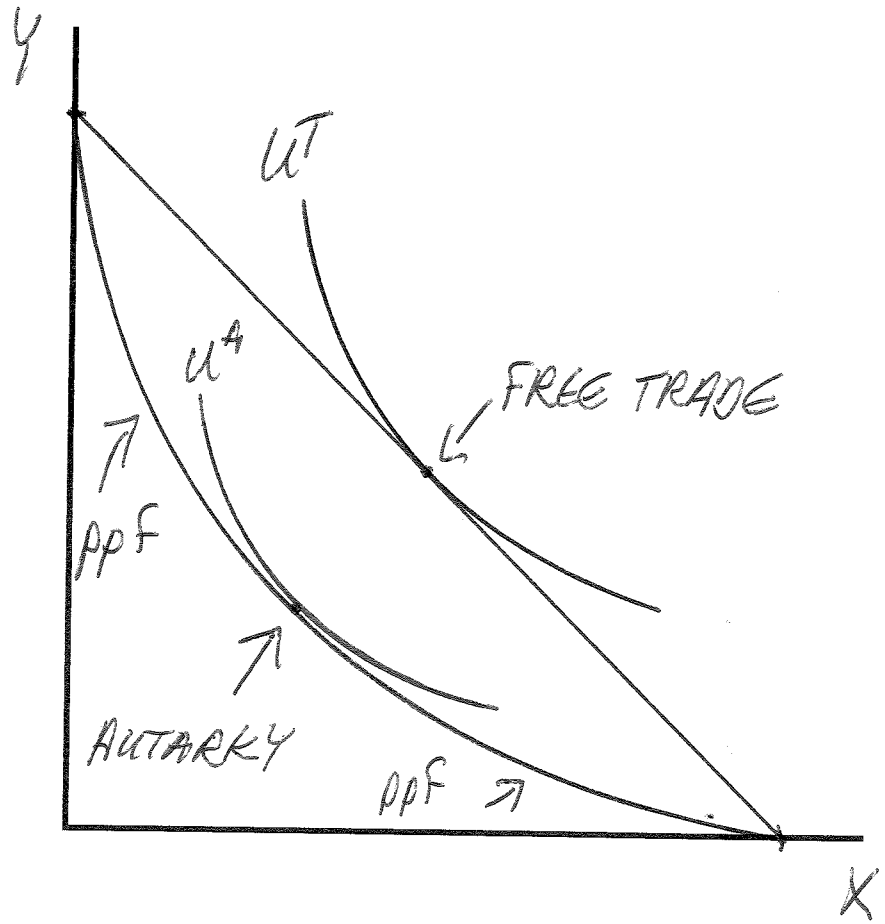
1. With increasing-returns-to-scale technologies, trade and gains from trade can arise even between two identical economies. We could refer to this as "non-comparative-advantage trade".

2. There are several sources of gains from trade in the presence of scale economies and imperfect competition (initially distorted economies).

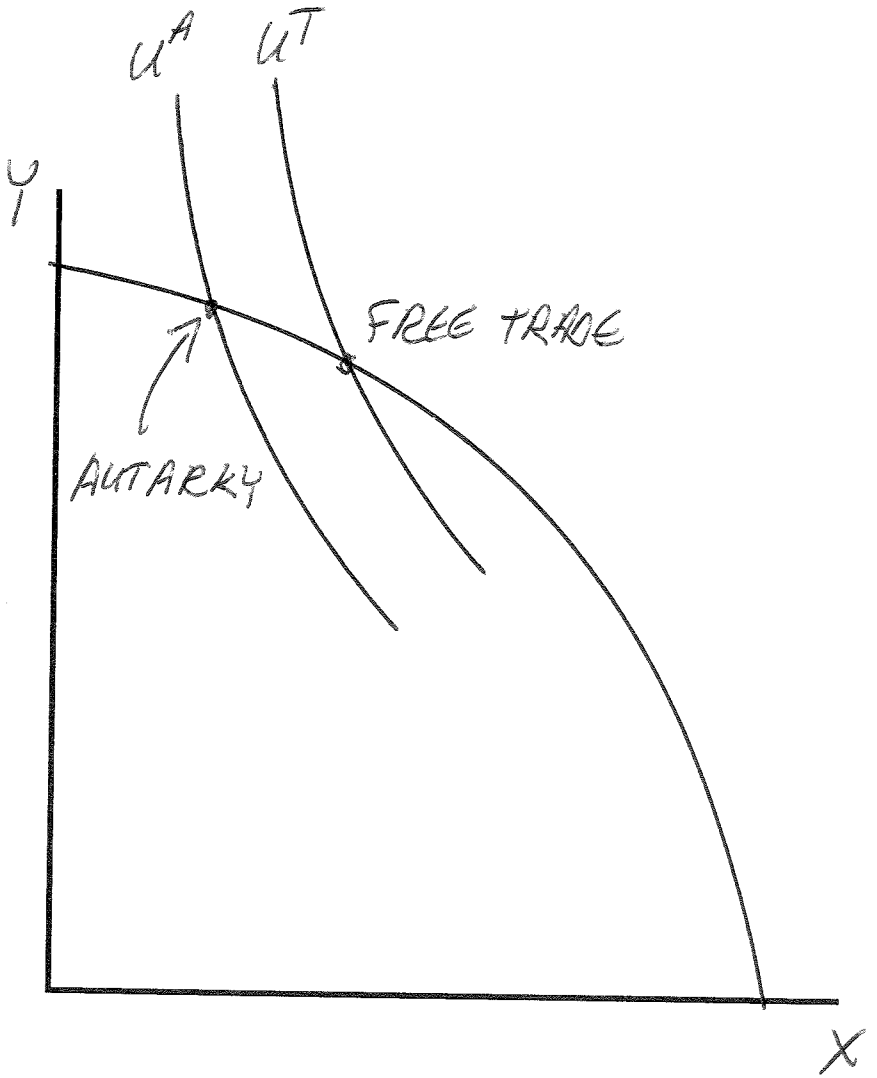
(1) Pro-competitive effects lead firm to expand output toward a first-best when the market expands through trade, reducing the distortion between price and marginal cost.

(2) Individual firms move down their average cost curves, leading to an efficiency (productivity) effect.

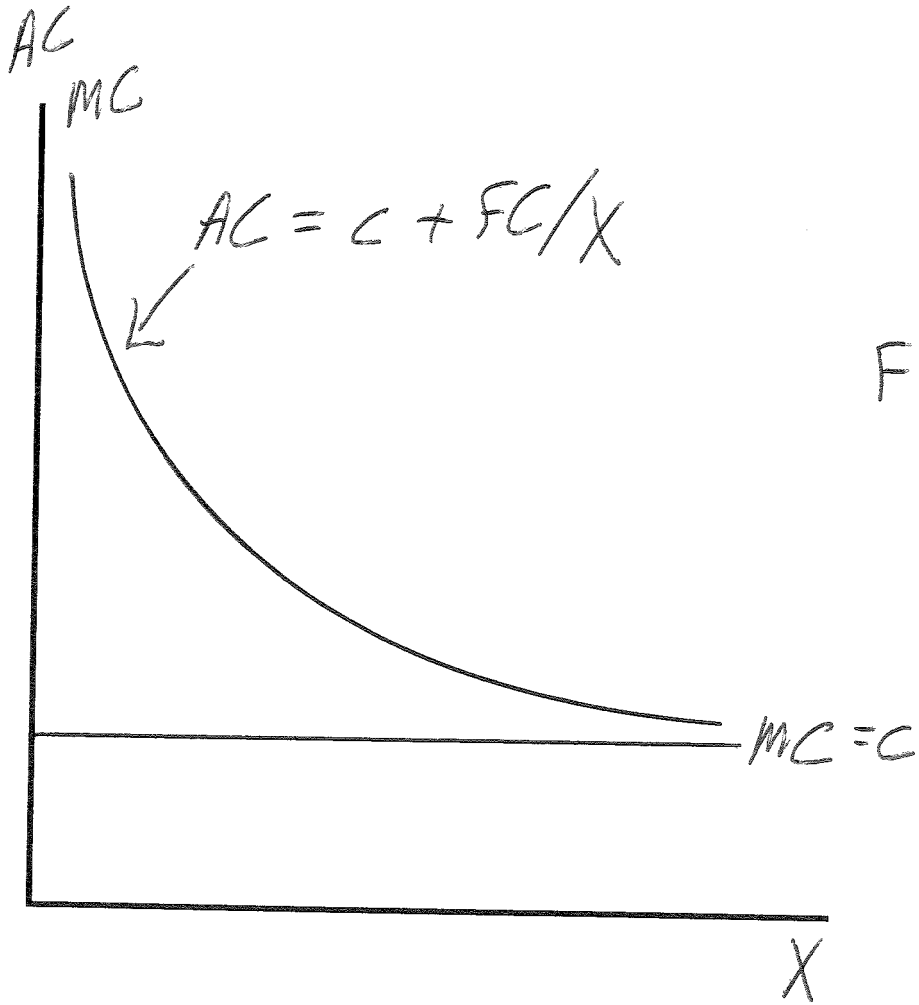
(3) Gains may also be captured in the form of the exit of some firms, therefore freeing up the resources that were used in fixed costs.



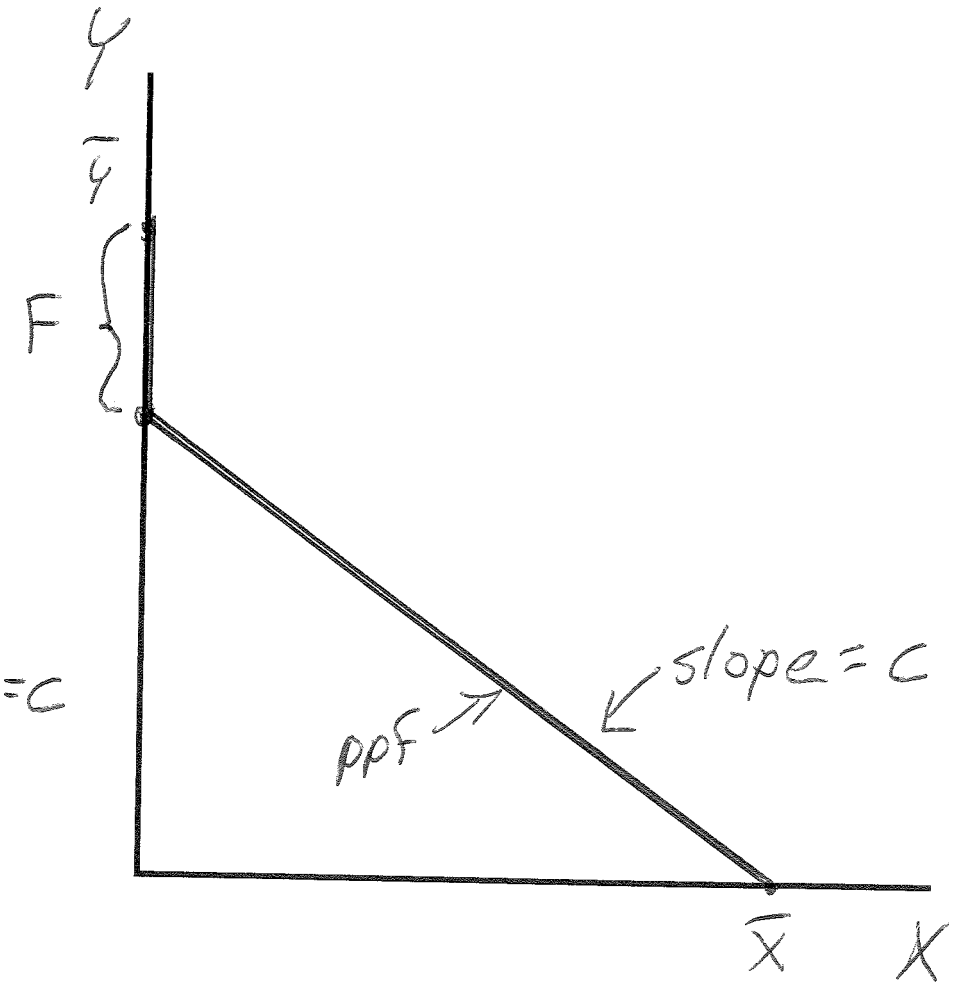
Unotes 7 Figure 1



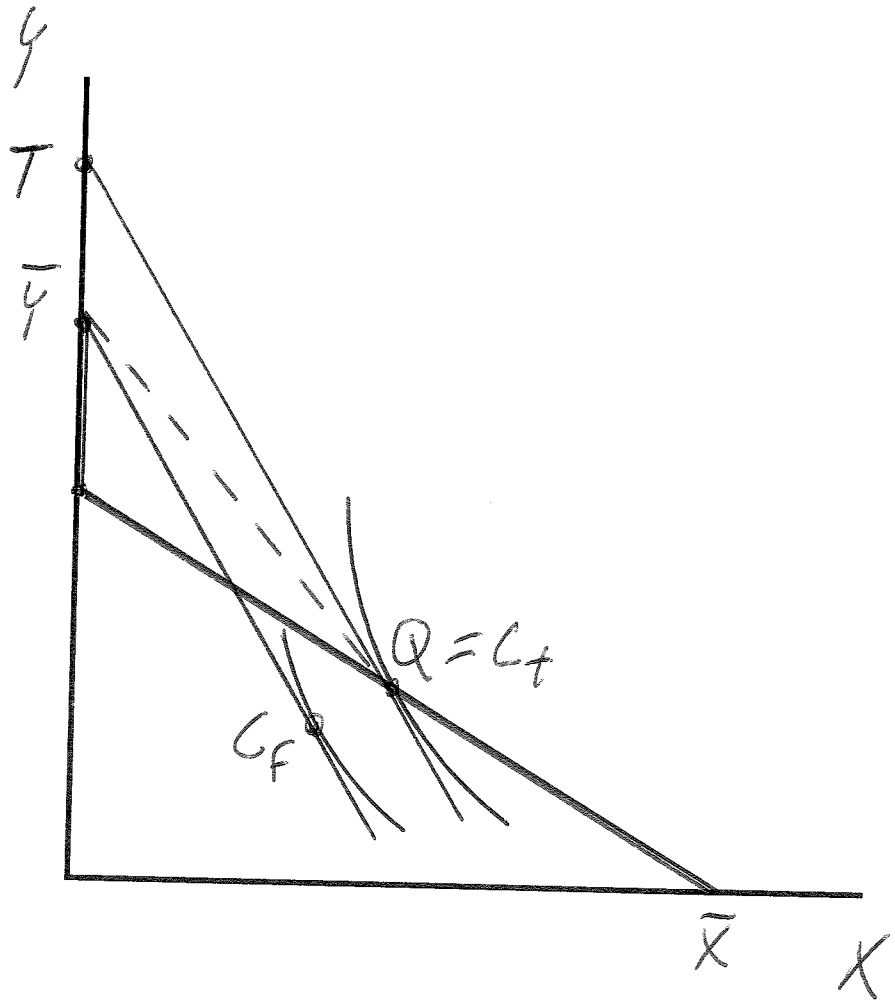
Unotes 7 Figure 2



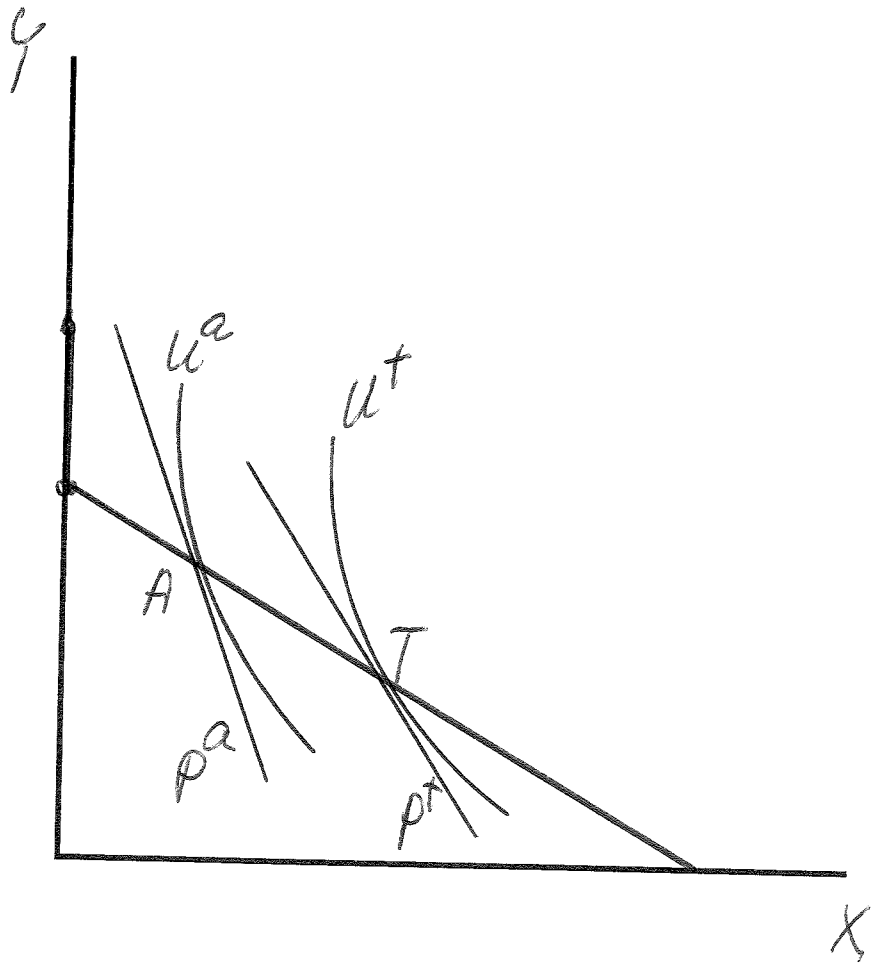
Unotes 7 Figure 3



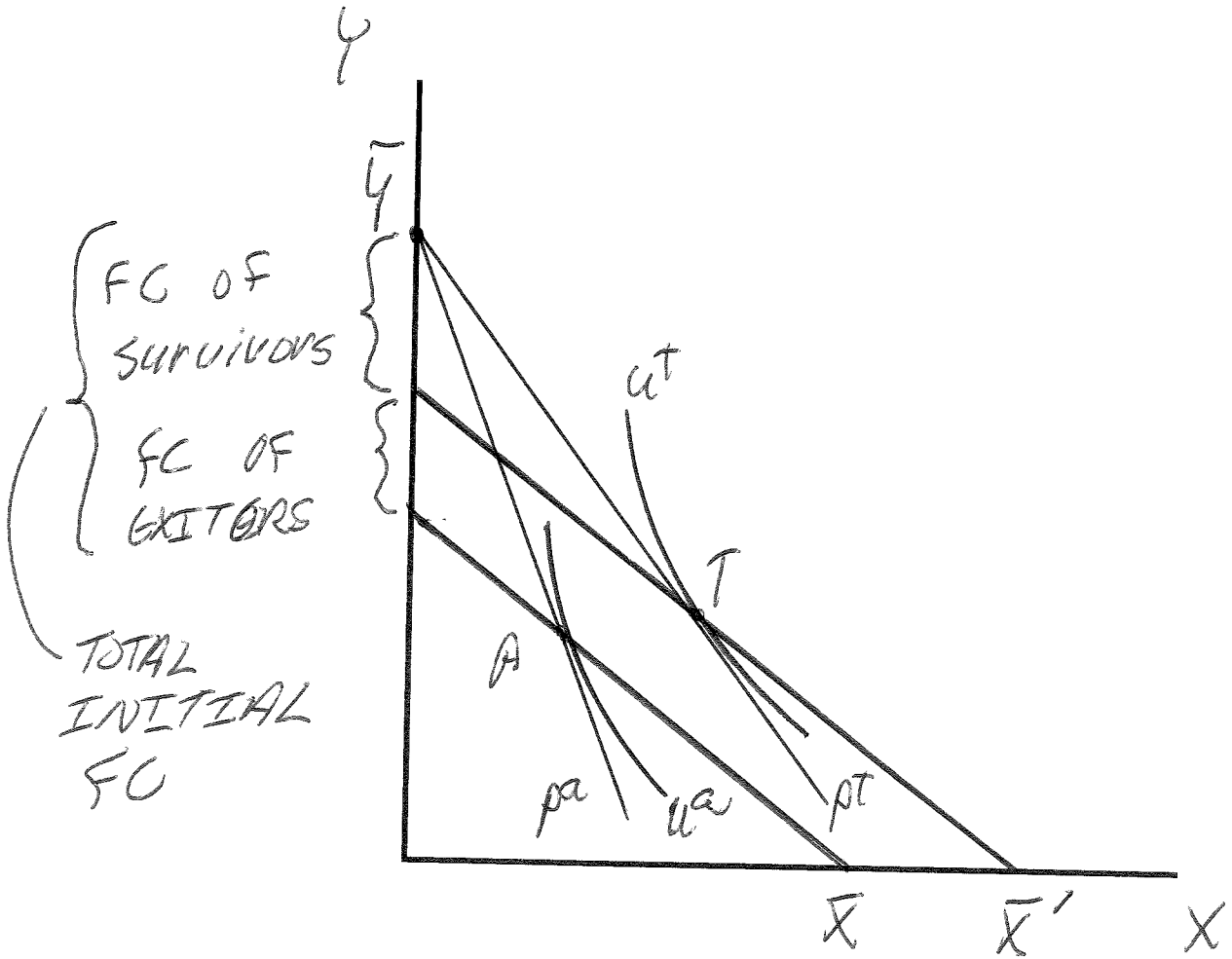
Unotes 7 Figure 4



Unotes 7 Figure 4



Unotes 7 Figure 5



Unotes 7 Figure 7