LECTURE 1

I. GOALS OF PUBLIC FINANCE AND THIS COURSE
- A. Definition of Public Finance

II. HOW DOES THE GOVERNMENT SPEND THE MONEY IT RAISES?

III. REVIEW OF BASIC MICROECONOMICS
- A. Utility Function: Preferences over different goods
  1. Completeness
  2. Non-satiation Assumption
  3. Transitivity
  4. Revealed Preference
  5. Derive Indifference Curves
- B. Monotonic Transformations
  - how to convert equations, examples
- C. Marginal Rate of Substitution
  - definition and derivation
  - examples
- D. Key Utility Functions
  1. Perfect Complements
     - example
  2. Perfect Substitutes
     - example
  3. Cobb-Douglas Utility
     - example

Relevant readings: Rosen textbook, Chapter 1 and Appendix, "Some basic microeconomics," pp. 507-527.

I. GOALS OF PUBLIC FINANCE AND THIS COURSE

A. Public finance is knowing what activities the public sector engages in and how they are organized. A lot of people might have misconceptions about what the programs are out there and why they really are important. Some examples from back when I was a student:

1. "If I quit my job or get fired, I can just go onto welfare or collect unemployment insurance."
2. "Why is everyone so concerned about health care? I'm healthy, why should I care? What is an HMO and how do they control costs?"
3. "What is an IRA? Why do people seem to talk about them right a lot right around April 15th when taxes are due?"
4. "What is a marginal tax rate? I know that the tax system has different rates, i.e. 15%, 28%, etc. What does that mean for my take home pay?"
5. "The cost of welfare programs is driving the debate behind welfare reform."

B. Understanding and anticipating the full consequences of governmental activities.
   1. Who wins and loses, different behavioral responses.
   2. "Rent control benefits the poor."

C. Evaluating alternative policies.
   1. To get families off of welfare: cut back benefits vs. job training. Short vs. long run effects.

II. HOW DOES THE GOVERNMENT SPEND THE MONEY IT RAISES?

A. Some of the more important items include national defense, social security, public welfare, and interest on the debt.

B. Total expenditure in 1991 by government was 2.4 trillion. Who spends it?
   1. Federal government (defense, social security, other stuff): 55%
   2. States (welfare, education): 19%
   3. Localities (police, fire protection): 26%

III. REVIEW OF BASIC MICROECONOMICS

A. Utility Function: Preferences over different goods

For example, $U = u(F, C)$. This can be generalized to more than two goods, and in some case we will do that. Consider the following budget constraints in {F,C} space.

***** SEE FIGURE 1-1 *****

1. Non-satiation assumption: more is preferred to less; A provides more than C
2. Transitivity: if $A \succ B$ and $B \succ C$, then $A \succ C$.
3. Revealed Preference: If point B is chosen, it is (weakly) preferred to all other points on that budget line.
4. Derive Indifference Curves: all the {F,C} bundles that keep utility constant.

B. Monotonic Transformations

Consider the Cobb-Douglas utility function: $u = C^{\frac{1}{3}}F^{\frac{2}{3}}$.
Another utility function that preserves these preferences is:

$$\tilde{u} = \log u = \log\left(C^{\frac{1}{3}}F^{\frac{2}{3}}\right) = \frac{1}{3}\log C + \frac{2}{3}\log F$$

Yet another utility function that preserves these preferences is

$$\hat{u} = 20u = 20C^{\frac{1}{3}}F^{\frac{2}{3}}$$

Note: In all cases, the shape of the indifference curve remains the same, the only thing that changes is the utility associated with it. Why do this? In some cases, transforming the utility function makes the problem easier to solve when differentiating.

C. Marginal Rate of Substitution (MRS): The tradeoff between two goods, holding utility constant; the slope of the indifference curve.

You should know how to derive the MRS (and then demand curve):

Marginal rate of substitution for the utility function $u = C^{\frac{1}{3}}F^{\frac{2}{3}}$

In this case, the MRS equals the ratio of marginal utilities:

$$MRS = -\frac{dC}{dF} = \frac{MU_F}{MU_C} = \left(\frac{2}{3}C^{\frac{1}{3}}F^{-\frac{1}{3}} \Big/ \frac{1}{3}C^{-\frac{2}{3}}F^{\frac{2}{3}} \right) = 2\frac{C}{F}$$

Note: If took logarithms instead (monotonic transformation) would get:

$$\tilde{u} = \frac{1}{3}\log C + \frac{2}{3}\log F$$

$$MRS = \left(\frac{2}{3}\frac{1}{F} \Big/ \frac{1}{3}\frac{1}{C} \right) = 2\frac{C}{F}$$, as before.

Let P_F and P_C be the prices of food and clothing.
Then set MRS equal to the ratio of prices

$$2\frac{C}{F} = \frac{P_F}{P_C}$$

or $2P_C C = P_F F$.

And from the budget constraint, $P_C C + P_F F = I$

Substituting this in, we get $3P_C C = I$, or $C^* = \frac{1}{3}\frac{I}{P_C}$.
For the Cobb Douglas, we spend a constant share of our income on food, a constant share on clothing.

D. *When setting MRS equal to the ratio of prices, how do we know which of the prices is in the numerator?*

Go through the ”Bang per Buck” argument

$\frac{MU_F}{P_F} = \frac{MU_C}{P_C}$ when maximizing utility

Otherwise: if $\frac{MU_F}{P_F} > \frac{MU_C}{P_C}$, what should the consumer do?

Rearrange to get: $\frac{MU_F}{MU_C} = \frac{P_F}{P_C}$, or $MRS = \frac{P_F}{P_C}$

E. KEY UTILITY FUNCTIONS

1. Perfect complements:

$u(F,C) = \min\{\alpha F, \beta C\}$: choose {F,C} such that $\alpha F = \beta C$.

Leads to "L" shaped indifference curves.

For example, left-shoes and right-shoes.

$$P_C C + P_F F = I$$

$$\alpha F = \beta C \Rightarrow F = \frac{\beta}{\alpha} C$$

$$P_C C + P_F \frac{\beta}{\alpha} C = I$$

$$C^* = \frac{I}{P_C + P_F \frac{\beta}{\alpha}}$$

$$F^* = \frac{I}{P_F + P_C \frac{\alpha}{\beta}}$$

Note: Food and Clothing are not good examples of perfect complements.
Note 2: Can't take derivatives of min {...} function.

2. Perfect substitutes:

$u(F,C) = \alpha F + \beta C$: constant MRS $\frac{MU_F}{MU_C} = \frac{\alpha}{\beta}$

- The indifference curves are straight lines. Unless relative

prices are also equal to $\frac{\alpha}{\beta}$, will end up at a corner solution.

- To solve the demand curve, note that as long as MRS equal to the ratio of prices, all bundles on budget constraint give same utility.

3. Cobb-Douglas Utility:

Consider the utility function $u(F,C) = F^{\alpha}C^{\beta}$ which has equivalent preferences as $\tilde{u} = F^{\frac{\alpha}{\alpha+\beta}}C^{\frac{\beta}{\alpha+\beta}}$.

The way to see that these are the same is to note that $\tilde{u} = u^{\frac{1}{\alpha+\beta}}$, and that is a monotonic transformation.

-That is, $u = F^2C$ gives the same indifference curves as $\tilde{u} = F^{\frac{2}{3}}C^{\frac{1}{3}}$. Put differently, $\tilde{u} = u^{\frac{1}{3}}$.

-To solve, one could transform utility function by taking logs, e.g., by going back to the first expression,

$$\bar{u} = \log \tilde{u} = \log\left(F^{\frac{\alpha}{\alpha+\beta}}C^{\frac{\beta}{\alpha+\beta}}\right) = \log F^{\frac{\alpha}{\alpha+\beta}} + \log C^{\frac{\beta}{\alpha+\beta}} = \frac{\alpha}{\alpha+\beta}\log F + \frac{\beta}{\alpha+\beta}\log C$$

- Then set $\left(\frac{\partial \bar{u}}{\partial F}\Big/ P_F\right) = \left(\frac{\partial \bar{u}}{\partial C}\Big/ P_C\right)$, which is the expression for setting the marginal rate of substitution equal to the ratio of prices. This is the first condition we need for utility maximization. We first find the marginal utility of food:

$$\frac{\partial \bar{u}}{\partial F} = \frac{\partial\left(\frac{\alpha}{\alpha+\beta}\log F + \frac{\beta}{\alpha+\beta}\log C\right)}{\partial F} = \frac{\alpha}{\alpha+\beta}\frac{1}{F}$$, because if you recall from calculus, the partial derivative $\frac{\partial \log F}{\partial F} = \frac{1}{F}$, and the partial derivative of the

second part of the expression, $\left(\frac{\beta}{\alpha+\beta}\right)\log C$, with respect to F is zero because it is treated as a constant term. Then dividing the marginal utility of food by its price gives us $\left(\frac{\partial \bar{u}}{\partial F}\Big/ P_F\right) = \frac{\alpha}{\alpha+\beta}\frac{1}{F}\Big/ P_F = \frac{\alpha}{\alpha+\beta}\frac{1}{P_F F}$.

- If you did a similar exercise for clothing, you would get $\left(\frac{\partial \bar{u}}{\partial C}\Big/ P_C\right) = \frac{\beta}{\alpha+\beta}\frac{1}{C}\Big/ P_C = \frac{\beta}{\alpha+\beta}\frac{1}{P_C C}$.

- Therefore, setting the marginal utilities divided by their prices leads to: $\frac{\alpha}{\alpha+\beta}\frac{1}{P_F F} = \frac{\beta}{\alpha+\beta}\frac{1}{P_C C}$, which simplifies to $\alpha P_C C = \beta P_F F$ (once we multiply both sides of the equation by $(\alpha+\beta)$ and cross multiply).

- We can then express expenditure on food, $P_F F$, in terms of the other variables so that we can substitute this into the budget constraint. Rewriting the equation, expenditure on food is: $P_F F = \frac{\alpha}{\beta} P_C C$.

- We then substitute this into the budget constraint, which is given by $P_C C + P_F F = I$. Thus, $P_C C + \frac{\alpha}{\beta} P_C C = I$.

- This gives us an expression with one unknown variable, the quantity of clothing (C). We can rewrite this last equation as $\frac{\beta}{\beta} P_C C + \frac{\alpha}{\beta} P_C C = I$, which in turn can be expressed as $\frac{\beta+\alpha}{\beta} P_C C = I$, or $\frac{\beta+\alpha}{\beta} C = \frac{I}{P_C}$, or finally, $C^* = \frac{\beta}{\alpha+\beta}\frac{I}{P_C}$.

- Through similar steps, we would find that $F^* = \frac{\alpha}{\alpha+\beta}\frac{I}{P_F}$.

- We could also solve for the initial utility function $u(F,C) = F^{\alpha}C^{\beta}$. First set the MRS equal to the ratio of the prices. Computing the marginal utilities, we have $\frac{\partial u}{\partial F} = \alpha F^{\alpha-1}C^{\beta}$ and $\frac{\partial u}{\partial C} = \beta F^{\alpha}C^{\beta-1}$. Therefore, $\frac{MU_F}{MU_C} = \frac{\frac{\partial u}{\partial F}}{\frac{\partial u}{\partial C}} = \frac{\alpha F^{\alpha-1}C^{\beta}}{\beta F^{\alpha}C^{\beta-1}} = \frac{\alpha F^{\alpha-1}C^{\beta}}{\beta F^{\alpha}C^{\beta-1}}\left(\frac{F^{1-\alpha}}{F^{1-\alpha}}\frac{C^{1-\beta}}{C^{1-\beta}}\right) = \frac{\alpha C}{\beta F} = \frac{P_F}{P_C}$, which simplifies to $\alpha P_C C = \beta P_F F \Rightarrow P_F F = \frac{\alpha}{\beta}P_C C$. If we substitute into the budget constraint, given by $P_C C + P_F F = I$, for food expenditure ($P_F F$), we get $P_C C + \frac{\alpha}{\beta}P_C C = I$ which can be rewritten as $\frac{\beta}{\beta}P_C C + \frac{\alpha}{\beta}P_C C = I$, or $\frac{\alpha+\beta}{\beta}P_C C = I$, which then can be rewritten as the demand curve for clothing, $C^* = \frac{\beta}{\alpha+\beta}\frac{I}{P_C}$.

- Suppose you were given the following utility function: $\tilde{u} = F^{\frac{2}{3}}C^{\frac{1}{3}}$. Then $\alpha = \frac{2}{3}$ and $\beta = \frac{1}{3}$. If we substitute these into the demand equations for F^*, we would get $F^* = \left(\frac{\frac{2}{3}}{\frac{2}{3}+\frac{1}{3}}\right)\frac{I}{P_F}$, or $F^* = \frac{2}{3}\frac{I}{P_F}$. A similar calculation for C^* would give $C^* = \frac{1}{3}\frac{I}{P_C}$. If you were given prices and income, you could compute the exact amount of food and clothing that the consumer would choose.

- As an exercise, you should be able to derive the demand curves for the utility function $\tilde{u} = F^{\frac{4}{5}}C^{\frac{5}{4}}$. As a hint, the demand curve for food is

$F^* = \left(\frac{16}{41}\right)\frac{I}{P_F}$. Try to figure out the demand curve for clothing on your own.

LECTURE 2

I. INTRODUCTION
- should the government intervene?

II. COMPETITIVE ECONOMY AND EFFICIENCY
A. Edgeworth box, definition
- Example 1
- why is the "Edgeworth box" a box?
- terms of trade
B. The price line, definition
C. Equilibrium – when do consumers reach equilibrium?
- Example 2, edgeworth box
- Example 3, same as ex. 2, but with new utility function
D. Some Common Questions

III. THE FUNDAMENTAL WELFARE THEOREM
A. Definition
B. Market Failures
* Failure of Competition
* Public Goods
* Externalities
* Incomplete Markets
* Information failures
C. Market Failures, examples

IV. CONSUMER SURPLUS AND DEADWEIGHT LOSS
A. Consumer Surplus
B. DWL . . .when **MSB does not equal MSC**
Figure 2-2: Find DWL at Q* and Q**

Readings: Rosen, chapter 3 including appendix (skip pp. 40-44)

You may want to review the following problems:
Midterms: Winter 1996, Question 1

I. INTRODUCTION

A. In United States, private market produces most goods and services.

B. Generally, economics suggests free market is a good thing, will end up at an "efficient" solution.

C. Under what circumstances should the government intervene?

D. Welfare economics provides framework for thinking about the government intervention. Will intervention:

1. Have good distributional consequences; i.e. who wins, who loses
2. Increase efficiency,
3. Be too costly?

II. COMPETITIVE ECONOMY AND EFFICIENCY

A. Edgeworth box: exchange of 2 goods between 2 people, graphically. Throughout this discussion, the people will be Jerry and George, and the goods will be food and clothing.

Why is this a box ?

- Limited amount of each good. Each point in the box uses all the goods. Each point shows bundles for both consumers.
- Can draw indifference curves in the box.
- The corners of the box – who has what?

B. *Are there gains from trade at initial endowment?*
Yes, if MRS of Jerry and George are not equal.

C. *When will they stop trading?*

- When MRS are equal for Jerry and George. Many bundles satisfy this condition. Some of these bundles are outside of the "lens-shape" area. Since trade has to be voluntary and mutually beneficial, these will not be chosen given the initial endowments even though they are efficient.

D. *The price line* – tradeoff between two goods. Can think of as a barter economy where exchange goods. Thus the price of food is how much clothing a person must give up.

E. *Equilibrium*: Even though there are only 2 people, they act as price takers – e.g, they act as if they can buy or sell as much food or clothing as they want at given prices. Thus each sets $MRS = \frac{P_F}{P_C}$. If, prices are given, the individuals maximize utility and the point is feasible, we have found a competitive equilibrium.

Note: Given the prices, each person individually chooses bundles that maximize utility, and consume all goods in the economy.

Example 1
Consider Jerry and George, who consume two goods, food and clothing.

$$U_J = \min\left\{F, \frac{C}{2}\right\}$$
$$U_G = 4F + 3C$$

Total amount of food: $F = 100$
Total amount of clothes: $C = 200$

PART I: Draw the edgeworth box and some indifference curves.

Note: What are the special features of the utility functions?

***** SEE FIGURE 2-1 *****

PART II: Jerry's and George's endowments are given below, solve for the competitive equilibrium.
$F_J = 60, C_J = 80$
$F_G = 40, C_G = 120$

** What is the equilibrium allocation?*
Simple utility maximization. For Jerry to maximize utility:

(1) $F^* = \frac{C^*}{2}$

Any other allocation wastes resources. Food and clothing for Jerry are consumed in fixed proportions. MRS is not well defined for L-shaped indifference curves.

** How do we figure out the equilibrium price ratio, since prices are not given?*

In equilibrium, $MRS = \frac{MU_F}{MU_C} = \frac{P_F}{P_C}$. For George's utility function, the MRS is always equal to $\frac{4}{3}$. This sets the price ratio. When one of the utility functions is "perfect substitutes," it sets the price ratio.

Now we have the price ratio. Next, assume that Jerry sells his food and clothes, so that he has income. Since only relative prices matter, set $P_F = 4, P_C = 3$ (the combination of $P_F = 8, P_C = 6$ would give the same solution). Jerry's income is:

(2) $I = P_F F + P_C C = 4*60 + 3*80$

Thus, Jerry's budget constraint is:

(3) $I = P_F F^* + P_C C^* = 4F^* + 3C^* = 480$

If we then substitute equation (1) into (3) we get:

(4) $2C^* + 3C^* = 480$, so $C_J^* = 96$, and $F_J^* = 48$.

Thus, Jerry gives up some food and gets some clothing.

** How do we figure out George' allocation?*

George's whole indifference curve is tangent to the budget set. George is willing to move to any point on this price line.

$C_G^* = 104$, $F_G^* = 52$.

George has more food and less clothing.

Both have maximized utility, given the prices, and all of the food and clothing is consumed.

Example 2

Change Jerry's utility to $U_J = F^{\frac{3}{2}}C^{\frac{3}{2}}$.
Resolve PART II where $F_J = 40, C_J = 80, F_G = 60, C_G = 120$.

Jerry's income is $I_J = 400, P_F = 4, P_C = 3$. From Cobb-Douglas utility, $F_J^* = \frac{1}{2}\left(\frac{I}{P_F}\right) = \frac{1}{2}\left(\frac{400}{4}\right) = 50$ $C_J^* = \frac{1}{2}\left(\frac{I}{P_C}\right) = \frac{1}{2}\left(\frac{400}{3}\right) = \frac{200}{3}$. George gets the remainder: $F_G^* = 50$. $C_G^* = \frac{400}{3}$. George' utility is unchanged: 600 before, 600 after.

E. Define Pareto efficiency

- An allocation is <u>pareto efficient</u> if the only way to make one person better off is to make another person worse off.
- Pareto efficiency does not equal "fair" to everyone But efficiency will be the benchmark for "good economic outcome."

<u>Common questions on Edgeworth boxes</u>:

1) *Must prices be given?*
   * With perfect substitutes, no. The MRS is constant, which determines the price ratio.
   * With most utility functions, yes. As an exercise, draw a picture which shows that with "standard" indifference curves, two different price lines could lead to two different equilibria, even with the same initial endowments.

2) *What information do you need to solve the competitive equilibrium?*
   * Usually prices, endowments, and preferences.

3) *After we find the price ratio (from the perfect substitutes utility function), why do we first solve for the other utility function?*
   * Since the $MRS = \frac{P_F}{P_C}$ is constant for George, any bundle on the budget constraint gives him the same utility. The bundle is not unique.

4) *Why is it different for Jerry, who had a perfect complements utility function?*

* With the price ratio fixed, Jerry has one utility maximizing bundle.

5) *If George's utility is exactly the same before and after the trade, why does he trade?*

* You can imagine that Jerry offers a bundle that is very close to the utility maximizing bundle, except that it gives George slightly higher utility. In that case, George would definitely trade.

6) *What steps are needed to solve the competitive equilibrium?*

* If prices are not given, see if one of the utility functions is perfect substitutes.
* Assuming that one of the utility functions is perfect substitutes, find the market prices from the constant MRS.
* Compute the income for the other person, by hypothetically selling their endowment at market prices.
* From prices, income, and preferences, solve for the person's utility maximizing bundle.
* Then the person with perfect substitutes utility gets the rest of the goods.

7) *How do we find demand curves from Cobb Douglas utility?*

* See Lecture 1 for a derivation. You should be write down the demand curves without "reinventing the wheel."

III. THE FUNDAMENTAL WELFARE THEOREM

* *When do competitive markets lead to economic efficiency?*

A. <u>The Fundamental Welfare Theorem</u>:

Under certain assumptions, competitive markets lead to a pareto efficient allocation

- Edgeworth box illustrates set of pareto efficient points
- Implies that free markets are amazingly productive!

B. *What are the assumptions that violate the theorem?*

* **Failure of competition**: monopoly and oligopoly
  - Can occur with increasing returns to scale and fixed costs.
  - Or artificial barriers to entry.

* **Public goods**: national defense, renting a video movie a dorm lobby.
  - No additional cost for another individual to enjoy benefits of the good.
  -Hard to exclude individuals.
  - Incentive to hide valuations.

* **Externalities**: actions that impose cost (or benefit) on others without appropriate compensation.
  - Negative externalities: Examples of negative externalities are smoking cigarettes and "The Club" anti-theft device.
  - Positive externalities: include students who ask questions in class and the "LoJack" anti-theft device.

  Note: Essential problem is that the price system fails to provide the correct signals about the cost of a commodity.

* **Incomplete markets**: whenever private markets fails to provide a good or service, even though the cost of providing the good is less than what individuals are willing to pay.

  - Example: Until 1965, very difficult for students to get loans to finance their college education. Then government passed legislation providing government guarantees on student loans. Hard to borrow against "future income."

* **Information failures**: firms might lie about their product. Regulation, however, might be unnecessary, irrelevant and costly. Information provision is a public good, so private market will under supply info.

C. Market Failures: Yes or no? Is government intervention required?

- Mandatory seat belt laws
- Auto pollution: negative externality.

- Police protection: public good.
- Unemployment insurance: incomplete markets. An insurance firm on its own would be reluctant to provide unemployment insurance because of adverse selection. Who would be the most likely to take up the coverage?
- Health insurance for the elderly: again, adverse selection and incomplete markets.

IV. CONSUMER SURPLUS AND DEADWEIGHT LOSS

A. Pareto efficiency tells whether consumers better off, but not by *HOW MUCH?*

B. Consumer surplus puts a dollar figure on the improvement in a consumer's welfare.

C. Demand curve represents consumer's marginal willingness-to-pay. But consumer only pays market price. Consumer Surplus is the sum that individuals would have been willing to pay minus the sum that they actually pay.

D. If MSB does not equal MSC, then there is deadweight loss.
MSB: Marginal Social Benefit
MSC: Marginal Social Cost

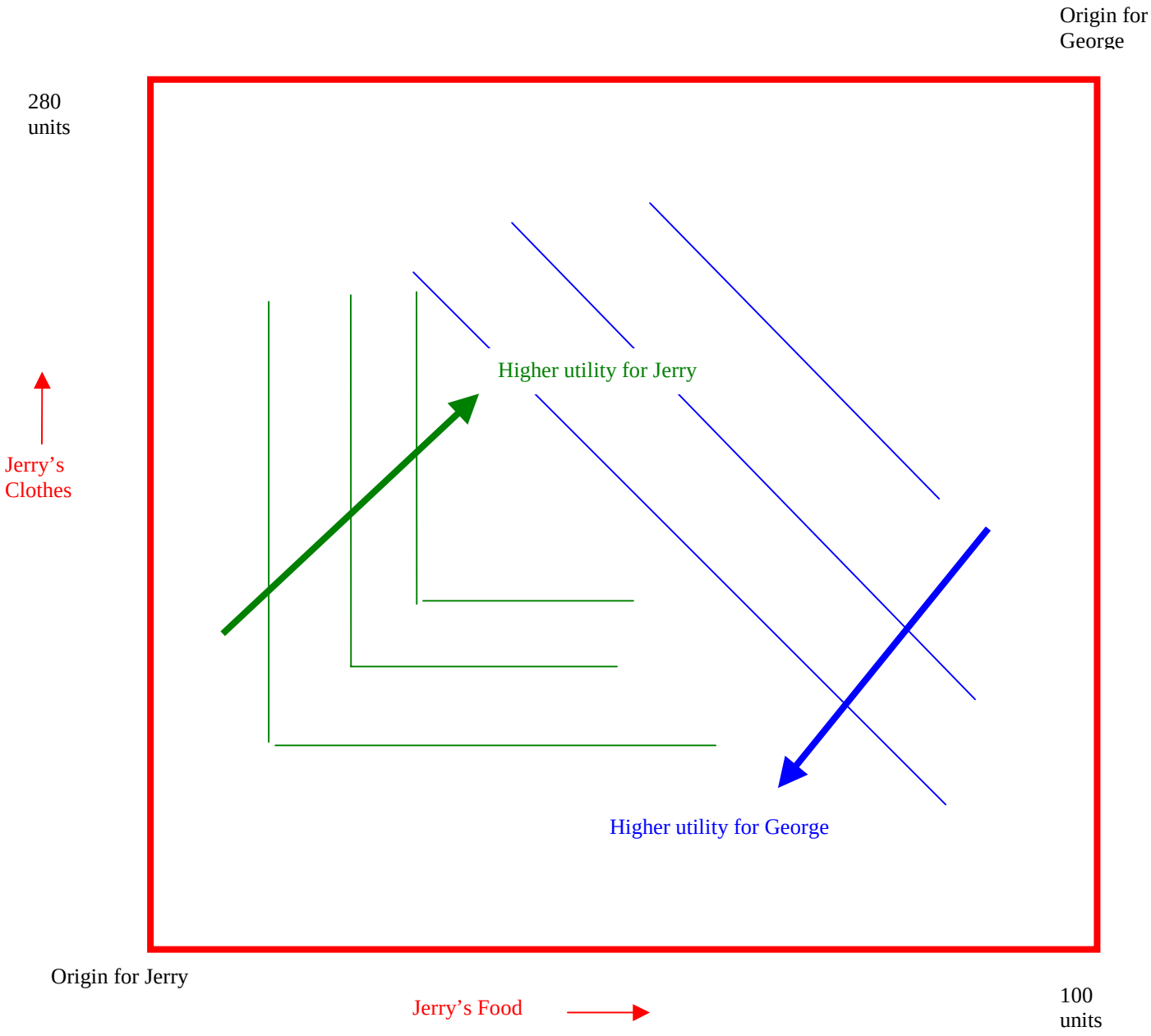
E. The most general formula for deadweight loss evaluated at the quantity Q_0 is: $DWL\big|_{Q_0} = \frac{1}{2}\left|\left(Q_{SOCIAL} - Q_0\right) * \left(MSB - MSC\right)\big|_{Q_0}\right|$

That is, the "base" is the difference between the socially optimal quantity and the quantity we are evaluating DWL at, and the height is the difference between the MSB and MSC evaluated at Q_0. We take the absolute value of this product, because DWL is a positive number.

***** SEE FIGURE 2-2 *****

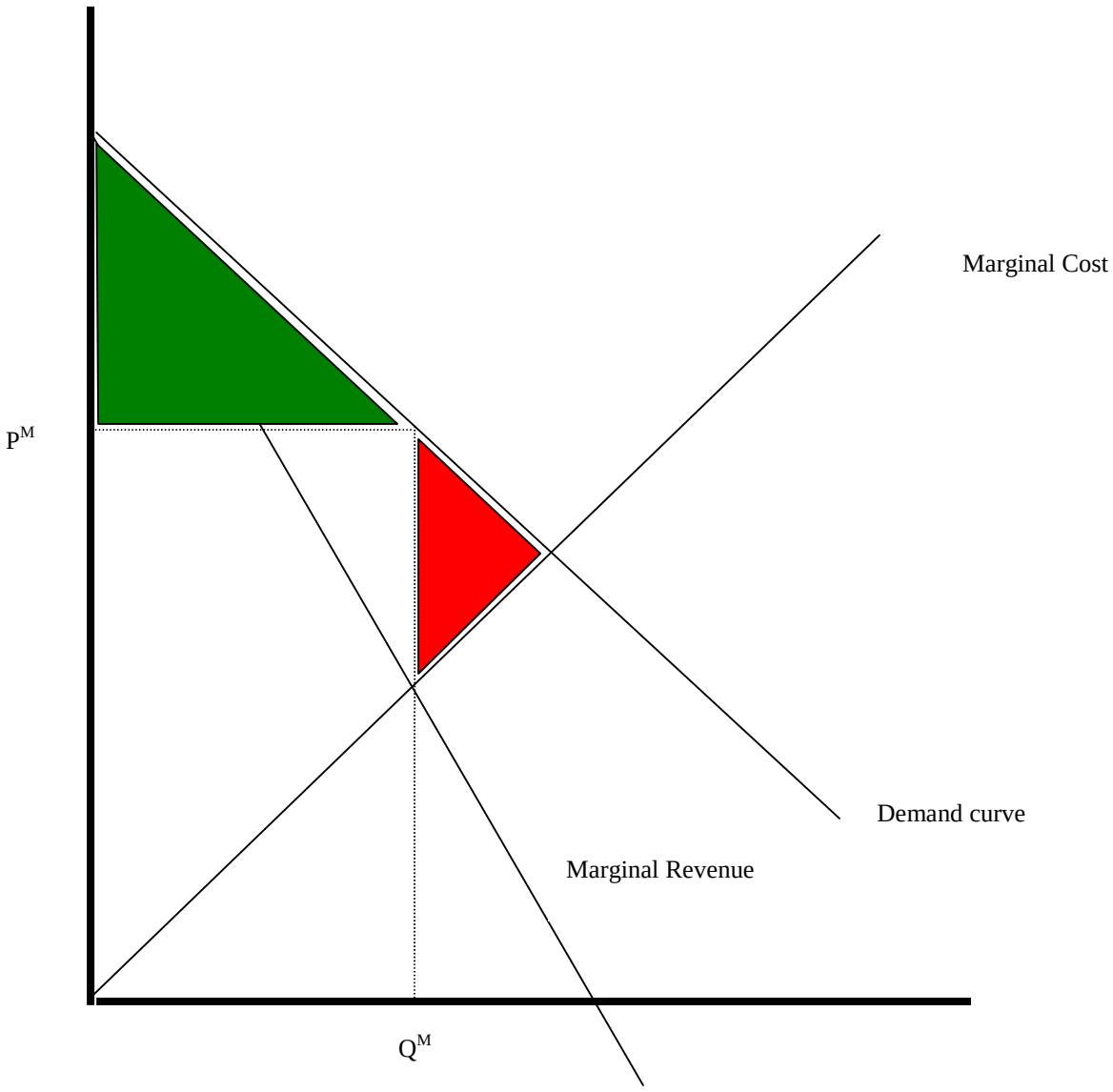
Where is DWL at Q^*? Where is DWL at Q^{**}?

Figure 2-1



Jerry's indifference curves in GREEN
George's indifference curves in BLUE

Figure 2-2 – Deadweight loss from a monopolist



Red triangle indicates deadweight loss (DWL)

Green triangle indicates consumer surplus

LECTURE 3

I. DEFINITION OF PUBLIC GOODS
- Property 1 - non-excludable
- Property 2 - non-rival
- examples

II. EFFICIENCY CONDITIONS FOR PUBLIC GOODS
- A. How much of a public good should be provided?
  - Add up MRS across people
- Example 1, public goods
- Example 2, public goods
- B. Why is government intervention needed?
  1. Free rider problem
  2. No "invisible hand"
  3. Since the good is non-rival, should allocate costs to ANYONE who benefits from it

Readings: Rosen, chapter 4

You may want to review the following problems for this section:
Midterms
Spring 1995, Question 1
Fall 1995, Question 2
Winter 1996, Question 4
Spring 1996, Question 2
Winter 1998, Question 2
Spring 1999-1, Question 1
Spring 1999-2, Question 1
Fall 1999-1, Question 1
Fall 1999-2, Question 1

Finals
Fall 1995, Question 1
Winter 1996, Question 1
Spring 1996, Question 1
Fall 1997, Question 3

Winter 1998, Question 2
Fall 1999-1, Question 2
Fall 1999-2, Question 2b

I. PUBLIC GOODS

Public goods have two important properties that differ them from private goods.

Property 1: public goods are <u>non-excludable</u>. If someone wants to consume the good, he or she may.

**Non-excludability means private provision may not reach a pareto efficient allocation. Why?*

1. People may hide their true valuation for the good, since they receive the benefit whether or not they contribute. This is known as the "<u>free rider</u>" problem – there is little incentive to pay for the good voluntarily.

2. Example: Some people may want to rent a movie to watch on the dorm's VCR, but it is hard to exclude people, and no one volunteers to pay for the movie.

3. How can the government do better? The government can use coercion. It can make people pay for a good.

Property 2: public goods are <u>non-rival</u> in consumption. Once the good is provided, the marginal cost of another person consuming it is zero.

Non-rivalness:

1. Undesirable to exclude anyone: an individual's consumption does not reduce the amount available for others.

2. MC of an additional person versus MC of another unit.

   $MC_{PERSON} = 0$

   $MC_{UNIT} > 0$ ... i.e. another police officer costs money.

3. Private good, such as clothing:

$MC_{PERSON} > 0$ ... i.e. to clothe two people costs more than one person.

4. Since public goods are non-rival, everyone consumes same Q. But consumption not valued equally by all (i.e. national defense). For private goods in competitive markets, everyone pays the same P, but consumes different Q.

Examples of public goods:
National defense for a nation, police protection for a community, a fireworks display, or house cleaning for a group of roommates.

II. EFFICIENCY CONDITIONS

A. How much of a public good should be provided?

For public goods, the sum of the MRS equal the marginal rate of transformation. The MRS is the slope of the indifference curves, and the MRT is the slope of the production possibilities curve (PPF). That is:

$$\sum_i MRS_i = \frac{P_{PUBLIC}}{P_{PRIVATE}} = MRT$$ for public goods.

The MRS of private goods for public goods tells us how much of the private good each individual is willing to give up to get one more unit of the public good. The sum tells us how much ALL members would be willing to give up to get another unit of the public good. This sum is relevant because public goods are non-rival.

Example
Jerry and George have identical utility functions. They derive utility from the <u>total</u> number of lava lamps in the house, V, and the amount of food that they eat alone, F. Lava lamps, V, are a local public good:

$$U_i(V, F_i) = V^{\frac{1}{3}} F_i^{\frac{2}{3}}$$ for i=Jerry or George

Note: We have changed to using lava lamps instead of clothing because lava lamps are non-rival and non-excludable. Therefore, this is a public goods example.

Note 2: Notice that the utility of each person depends on the total number of lava lamps and on the amount of food consumed individually.

Each has income of \$300, $P_V = 100, P_F = 0.20$. Given these prices, 500 units of food can implicitly be converted into 1 lava lamp. We shall therefore assume that the MRT is constant and equal to 500.

(a) *Calculate the optimal quantities if the person lived alone.*

From Cobb-Douglas preferences, this implies that $V = \frac{1}{3}\left(\frac{300}{100}\right) = 1$, $F = \frac{2}{3}\left(\frac{300}{0.20}\right) = 1000$.

(b) *Suppose that Jerry assumed that George would buy no lava lamps, and this turns out to be true. Calculate the quantities and utilities for each person.*

Jerry then acts as if he is the sole provider, and chooses the same allocation as in part (a). $U_J = 100$. George spends all his money on food, $U_G = 1^{\frac{1}{3}}1500^{\frac{2}{3}} = 131$. George has gained from his free rider position.

(c) *Is the allocation in (b) pareto efficient? What is the efficient amount of public goods?*

$$MRS_i = \left(\frac{\frac{\partial U_i}{\partial V}}{\frac{\partial U_i}{\partial F_i}}\right) = \frac{F_i}{2V}$$ where i=Jerry or George

For the allocation described in (b), $MRS_J = 500, MRS_G = 750$. Therefore, Jerry and George combined would sacrifice 1,250 units of food for another lava lamp, but from the prices given, it would only

cost them 500 units of food ($P_F F = 0.20 * 500 = 100 = P_V$). Therefore relying on the decentralized system is inefficient. Efficiency requires:

$$MRS_J + MRS_G = \frac{F_J}{2V} + \frac{F_G}{2V} = \frac{F_J + F_G}{2V} = \frac{P_V}{P_F} = \frac{100}{0.20}.$$

Therefore $F_J + F_G = 1000V$

Substitute this into a combined budget constraint for the household:
$0.20(F_J + F_G) + 100V = 600$

Which gives $V = 2, F_J + F_J = 2000$. Note that efficiency requires 2 lava lamps, but does not say how much food each would consume.

B. Demand curves for public goods

Efficient provision of a public good requires that the sum of each person's marginal valuation on the last unit just equal the marginal cost. To find the market demand curve for a public good, we add up individual demand curves vertically. This is in contrast to private goods, where we add up demand curves horizontally. Why? Because a public good must be consumed in equal amounts.

Example 2

Two people have the following individual demand curves for defense:

$Q_1 = 30 - P$
$Q_2 = 50 - 2P$

Rewrite with Q as independent variable:

$P_1 = 30 - Q_1$, thus P_1 is the "willingness to pay" of person 1 for defense

$P_2 = 25 - \frac{1}{2}Q_2$

Then, $P = P_1 + P_2$ is society's willingness to pay for defense.

$$P_1 + P_2 = 30 - Q_1 + 25 - \frac{1}{2}Q_2$$

Remember that $Q_1 = Q_2$ because both people consume equal amounts of the public good.

$$P = 55 - \frac{3}{2}Q \qquad \text{for } Q \le 30$$

$$P = P_2 = 25 - \frac{1}{2}Q \qquad \text{for } Q > 30$$

For example, suppose we want to provide two units of defense. Person 1 is willing to pay $28 for the last unit, and person 2 is willing to pay $24, so society is willing to pay $52 for the last unit.

Notice at 30 units, person 1's willingness to pay for additional units is zero. Society's demand is person 2's demand after that quantity.

After finding the demand curve, simply draw in the supply curve to find the equilibrium quantity.

***** SEE FIGURE 3-1, 3-2, 3-3, 3-4 *****

Figure 3-1 (Private Good example)

If this were a private good, how would you get aggregate demand?

Figure 3-3

Find DWL if person 2 provided the good.

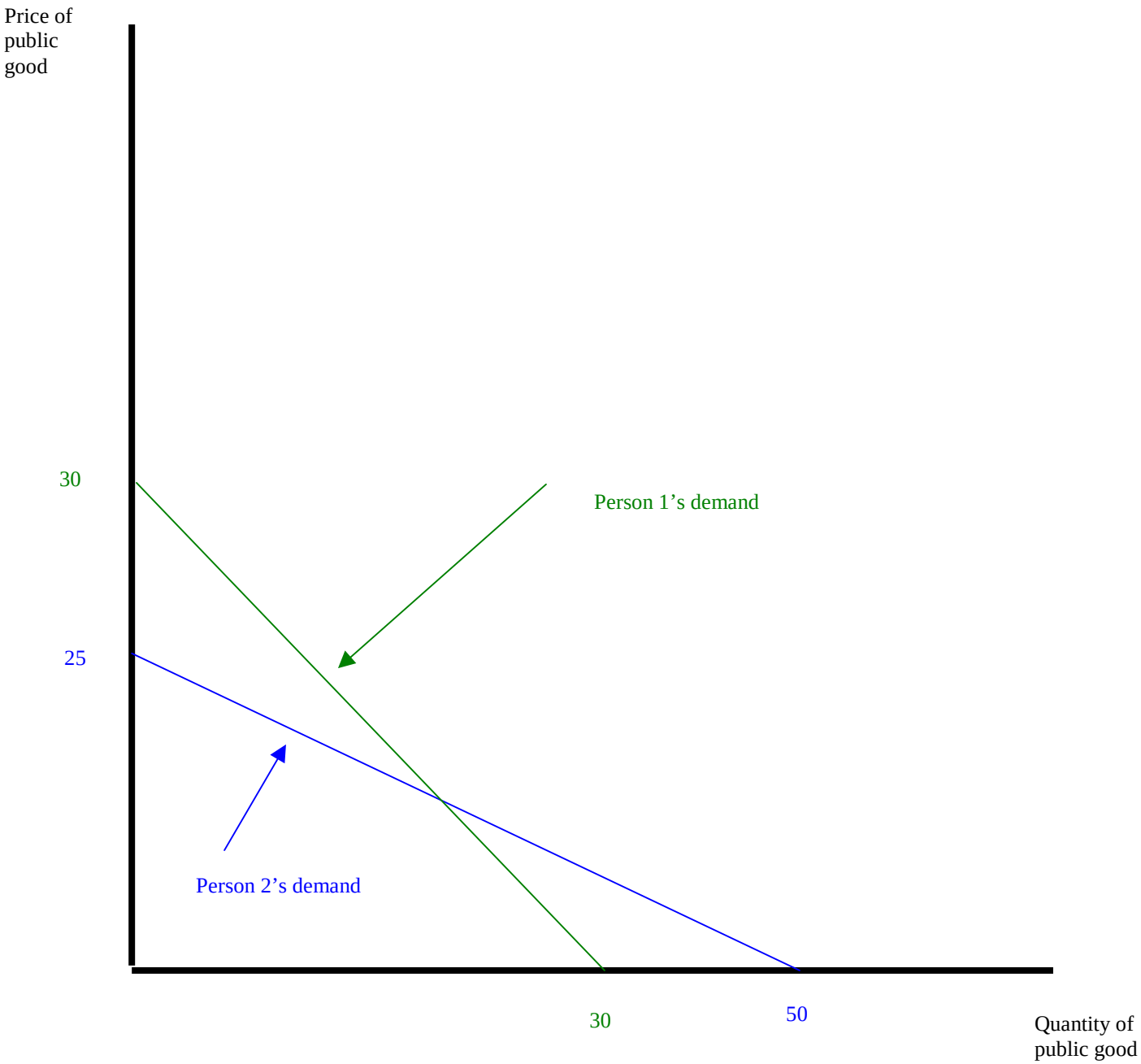
Figure 3-4

Find DWL if person 1 provided the good.

C. Why is government intervention needed?

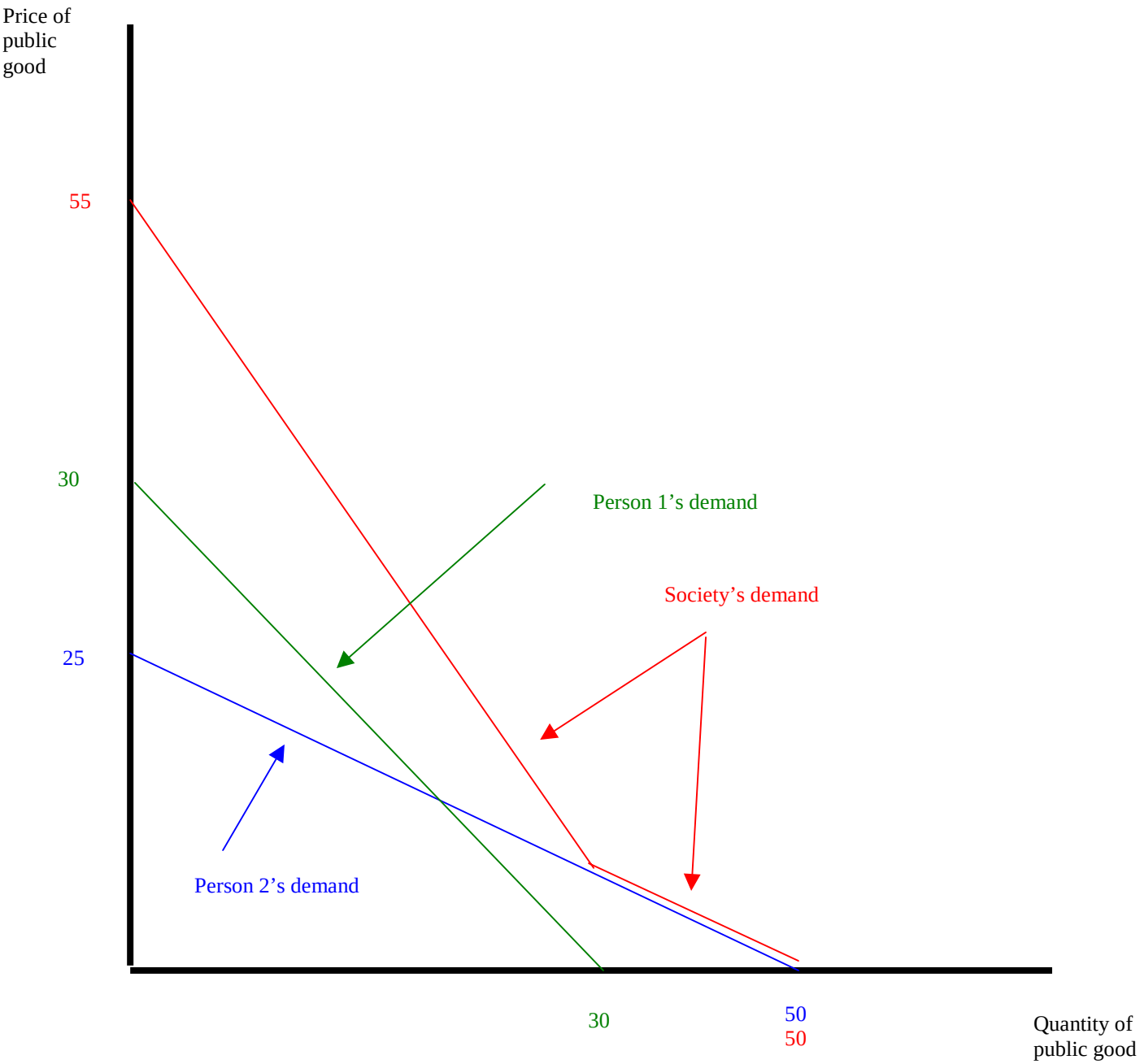
1. Free rider problem – consumers do not want to reveal high valuations for the public good if they will have to pay according to the valuations. This arises because of non-excludability.
2. No tendency for free markets to reach Pareto efficiency. No "invisible hand."
3. Even if excludable, provision still inefficient. Good is non-rival, so anyone who gets benefit from it should consume it.

Figure 3-1 – Individual demand curves for public goods



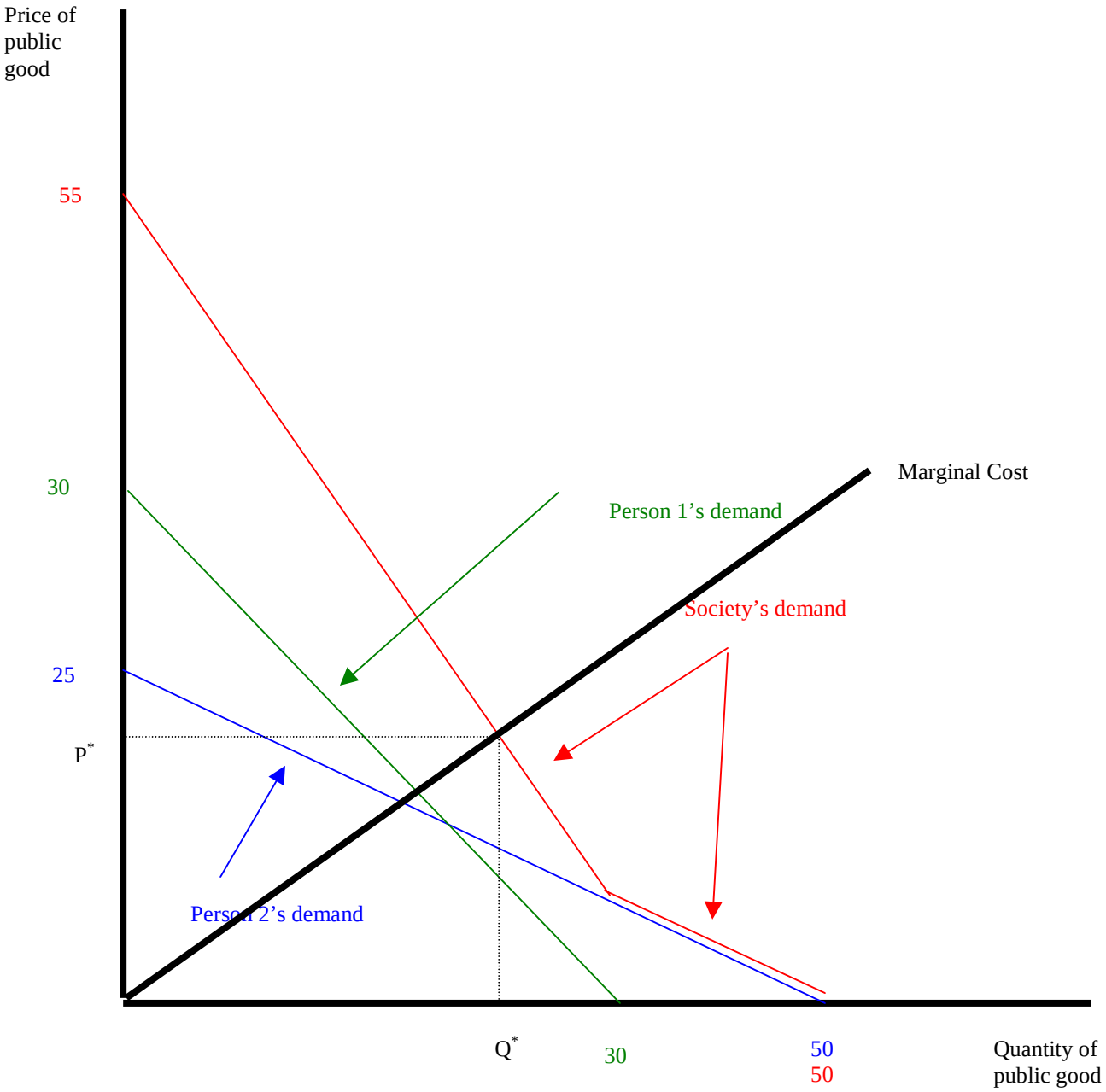
Two individual demand curves for a public good

Figure 3-2 – Deriving demand curves for public goods



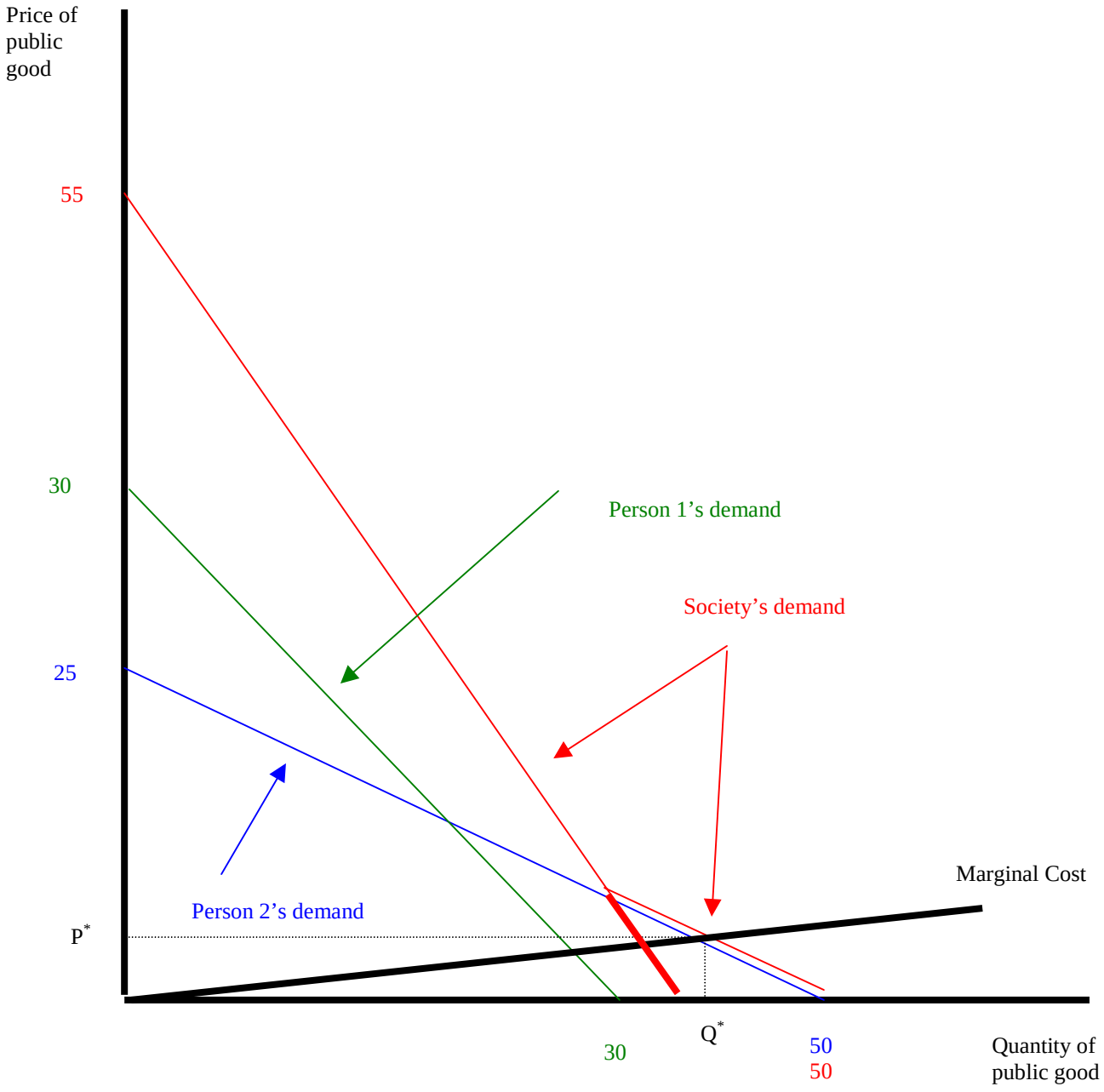
Add the individual demand curves vertically (look at the y-axis)

Figure 3-3 – P=MC along first segment (easy case)



Make sure you set P=MC along the correct segment

Figure 3-4 – P=MC along second segment (more difficult)



Don't set P=MC along first segment (the thick red line)

LECTURE 4

EXTERNALITIES

I. INTRODUCTION
- A. Negative Externalities, definition
- B. Positive Externalities, definition

II. THE CONSEQUENCES OF EXTERNALITIES

Negative externalities, graphically Figure 4-1, 4-2, 4-3
Positive externalities, graphically Figure 4-4, 4-5, 4-6

III. PRIVATE SOLUTIONS

IV. PUBLIC REMEDIES
- A. Pigouvian tax

Example 1, Example 2
- B. The Coase Theorem, definition
  - Property rights
  - Total Surplus=PS+CS+TEB-TEC
  - Bribes

Readings: Rosen, chapter 5

You may want to review the following problems:
Midterms
Winter 1995, Question 1
Fall 1995, Question 1
Winter 1996, Question 2
Spring 1996, Question 1
Fall 1997, Question 2
Winter 1998, Question 1
Spring 1999-1, Question 2
Spring 1999-2, Question 2
Fall 1999-1, Question 2
Fall 1999-2, Question 2

Finals
Winter 1995, Question 1
Spring 1995, Question 2
Spring 1996, Question 2
Fall 1997, Question 1
Winter 1998, Question 1
Spring 1999-1, Question 1
Spring 1999-2, Question 1
Fall 1999-2, Question 2

I. EXTERNALITIES: SOME EXAMPLES

A. **Negative externalities** – actions that impose <u>costs</u> on others without paying appropriate compensation – for instance, a steel firm dumping pollution into a river which hurts a fishery downstream, cigarette smokers in public places, students who walk into class late or let their cell phones ring, or the "The Club" anti-theft device.

B. **Positive externalities** – actions that impose <u>benefits</u> on others without receiving appropriate compensation – for instance, research and development by one firm which benefits another firm, a smart student who asks good clarifying questions during class, the "LoJack" anti-theft device.

II. THE CONSEQUENCES OF EXTERNALITIES

A. Private market quantity will be inefficient

B. Negative externalities, graphically.

Consider a steel firm that dumps pollution into the river and harms a fishery downstream. Assuming the market is perfectly competitive, the key difference between the example with negative externalities and the one without is the <u>marginal external cost</u>, or MEC. The MEC is the additional cost to others from the steel firm producing one more unit of steel. The sum of the MC (to the steel firm) and the MEC (to the fishery) is equal to the marginal social cost, MSC. Graphically:

***** SEE FIGURES 4-1, 4-2, 4-3 *****

Figure 4-1: D=MB=MSB since MEB=0

Figure 4-2: Where is DWL?

Figure 4-3: Compare MSC and MSB

C. From this picture:

1. The steel firm maximizes profits at P=MC, so it chooses Q_P.
2. At Q_P there is DWL. Consider cutting steel production back by one unit. What happens to the MSC? To MSB?
3. In the picture, how much DWL is there at Q_P?
4. $Q_P > Q_S$. The steel firm produces too much steel.
5. From the fishery's standpoint, what quantity of steel would it want

produced?
6. At Q_S, is the fishery being harmed?

Note: The firm's privately optimal point is where P=MC. The socially optimal point is where MSB=MSC. When you are calculating DWL you need to look at the difference between MSB and MSC.

D. Positive Externalities, graphically

For positive externalities, the key difference is the marginal external benefit (MEB). Just as we can think about adding the MEC and MC curves together to get the MSC, we can add the MEB and MB curves together to get MSB. Note that the demand curve represents the private MB to the firm.

***** SEE FIGURE 4-4, 4-5, 4-6 *****

Figure 4-5: Find Q_P,Q_S, and DWL

Figure 4-6: $DWL = \frac{1}{2}(base)(height)$

$$base = Q_S - Q_P\,,\ height = MEB\Big|_{Q_P}$$

1. The R&D firm maximizes profits at P=MC, so it chooses Q_P.
2. At Q_P there is deadweight loss. Consider increasing R&D by one unit. What happens to the costs and benefits for society?
3. In the picture, how much deadweight loss is there at Q_P?
4. $Q_P < Q_S$. The R&D firm produces too little R&D.
5. From the other firm's standpoint, what quantity of R&D would it want produced?
6. At Q_P, does the other firm benefit? If so, how much?

Note: There is no reason to expect private market to produce the socially efficient level. Negative externalities lead to overproduction (relative to the socially efficient level) and positive externalities lead to underproduction.

III. PRIVATE SOLUTIONS

A. A merger would internalize the externality. The steel firm and fishery could merge together, and then would take actions that are best for the firm as a whole to maximize profits.

B. Social conventions, pressure, and sanctions

- Examples: driving on the right-hand side of the road, stopping at red lights, going at green lights.

C. Failures of Private Solutions

1. Getting rid of some externalities has a "public good" characteristic: for example, clean air is non-excludable, so run into a free-rider problem in clean-up.
2. Transaction costs of organizing: usually far from zero.

IV. PUBLIC REMEDIES

Should the government ever allow activities that generate externalities to occur? Yes, for example, the optimal amount of pollution is not zero. The key point is to make sure the polluter incurs full MC of producing another unit.

A. Pigouvian tax

A pigouvian tax is a tax levied on each unit of a polluter's output in an amount just equal to the MEC at the efficient level of output. Such a tax shifts the MC for the firm.

Some comments:

- A tax on pollution creation, raises revenue.
- The correct tax: $\tau = MEC\Big|_{Q_S}$
- Unnecessary to compensate the fishery with the money that is raised.
- Central issue for regulators is obtaining sufficient information so that the correct tax can be imposed directly on the polluting firm.

Note: Without a tax on pollution, firms will set P=MC. There will be excessive production at $Q_{PRIVATE}$. By setting $\tau = MEC\Big|_{Q_S}$, the MC curve is shifted upward

to MC+J.

***** SEE FIGURE 4-7 *****

1. Geometry with negative or positive externalities. (i.e. Trapezoid under MED equals DWL + forgone profit).
2. Total Surplus = PS + CS+ TEB-TEC
3. Steel Firm = Firm + its consumers. Firm 1 vs. Firm 2
4. Pigouvian taxes: easier to think of as MC + J (instead of shifting MSB or MSC).

Example 1

A construction company is remodeling the business school. The company is in a perfectly competitive market and faces the following demand and total cost curves for its services.

$P = 300 - Q$

$TC = 20Q + \frac{1}{2}Q^2$

Q=quantity of remodeling in hours, TC=total cost

P=price

The construction company is very noisy, however. This noise distracts the professors from doing their research. The total external cost (TEC) is given by: $TEC = 40Q + Q^2$

Note: In this example, the noise is an external cost to the professors.

1. *How many hours of remodeling would the construction firm privately choose to produce? How many hours are socially desirable?*

Privately optimal: $P = MC \Rightarrow 300 - Q = 20 + Q \Rightarrow Q = 140$

Socially optimal: $P = MSC \Rightarrow 300 - Q = 20 + Q + 40 + 2Q \Rightarrow Q = 60$

2. Calculate the per-unit pigouvian tax that would achieve the socially optimal level of remodeling.

$300 - Q = 20 + Q + \tau$

$280 = 2Q + \tau$

$$\frac{1}{2}(280 - \tau) = Q$$

$$\left(140 - \frac{\tau}{2}\right) = 60$$

$$\frac{\tau}{2} = 80$$

$$\tau = 160$$

Optimal tax: $\tau = MEC\big|_{Q=60}$, or $\tau = 160$

**Why at $Q = 60$?*

3. *Calculate the DWL from the construction firm choosing its privately optimal level.*

$$DWL = \frac{1}{2}(140 - 60)(320) = 12800$$

***** SEE FIGURE 4-8 *****

Figure 4-8: MEC>MC in this example...Can you think of a "real-life" example?

4. *Evaluate the following statement: "The professors' most preferred level of remodeling is the socially optimal amount."*

False. Even at $Q = 60$, MEC>0. The professors would prefer $Q = 0$.

*Property rights are not well-defined

*Right to make noise vs. right to silence

Example 2

Jane bakes blueberry pies which she sells in a perfectly competitive market, facing an inverse demand curve of $P = 28 - Q$. Her total costs of producing pies is given by $TC = 3Q^2$.

Jane's next door neighbor, Michael, likes the smell of the pies. His marginal external benefit is given by $MEB = 12 - Q$.

1. *Calculate the number of pies that Jane will produce on her own, and the efficient number from society's point of view. Calculate the deadweight loss from the private market providing pies.*

Private quantity: $P = MC \Rightarrow 28 - Q = 6Q \Rightarrow Q = 4$.

Optimal quantity:

$$MSB \equiv MB + MEB = MC \Rightarrow (28 - Q) + (12 - Q) = 6Q \Rightarrow Q_{SOCIAL} = 5$$

To calculate the height on the deadweight loss triangle:

$$height = (MSB - MSC)\Big|_{Q_{PRIVATE}} = \left[(40 - 2Q) - (6Q)\right]\Big|_{Q_{PRIVATE}=4}$$

$$base = \left|Q_{SOCIAL} - Q_{PRIVATE}\right|$$

$$DWL = \frac{1}{2}(5 - 4)(32 - 24) = 4.$$

The DWL is the area between the MSB and MSC curves between the private quantity and socially optimal quantity. Graphically:

***** SEE FIGURE 4-9 *****

Figure 4-9: How are positive externalities different from public goods? Where is DWL?

2. *If the government were to provide a subsidy to Jane for baking her pies, what per-unit subsidy would achieve the optimal quantity? How much would this cost the government?*

The per-unit subsidy shifts the MC curve downward for Jane. The subsidy induces Jane to produce the optimal quantity only by taking into account her private actions:

$MB = MC - s \Rightarrow 28 - Q = 6Q - s \Rightarrow s = 7Q - 28$. Since $Q_{SOCIAL} = 5 \Rightarrow s = 7(5) - 28 = 7$. The cost to the government is $sQ_{SOCIAL} = 35$.

3. *If Jane were a monopolist, would she privately produce a quantity of blueberry pies that was closer to the socially efficient level than if she were*

in a perfectly competitive industry?

No. A monopolist produces less than a perfect competitor. With a positive externality, even a perfect competitor under provides the good. Therefore, a monopolist's quantity is even further away from the socially optimal level, and results in a larger DWL.

B. Establishing Property Rights: The Coase Theorem

Coase Theorem: When there are externalities, assigning property rights will cause the parties to produce the socially efficient quantity, assuming transaction costs are small and the parties can bribe each other.

*Doesn't matter to whom the property rights are assigned – the parties will arrive at the efficient solution whether the steel firm or the fishery is assigned "the right to pollute" or "the right to a clean river." Property rights affects who receives the bribe, however. Thus, assigning property rights has distributional implications.

*Ill defined property rights are an important part to externality.

*The basic idea: the socially efficient level makes the total surplus as big as possible. It is possible to make everyone happier if the surplus is as large as possible.

Total Surplus = Producer Surplus+Consumer Surplus+Total External Benefit-Total External Cost

Note: Except for initially assigning property rights, the government doesn't intervene, yet the parties still arrive at the efficient solution!

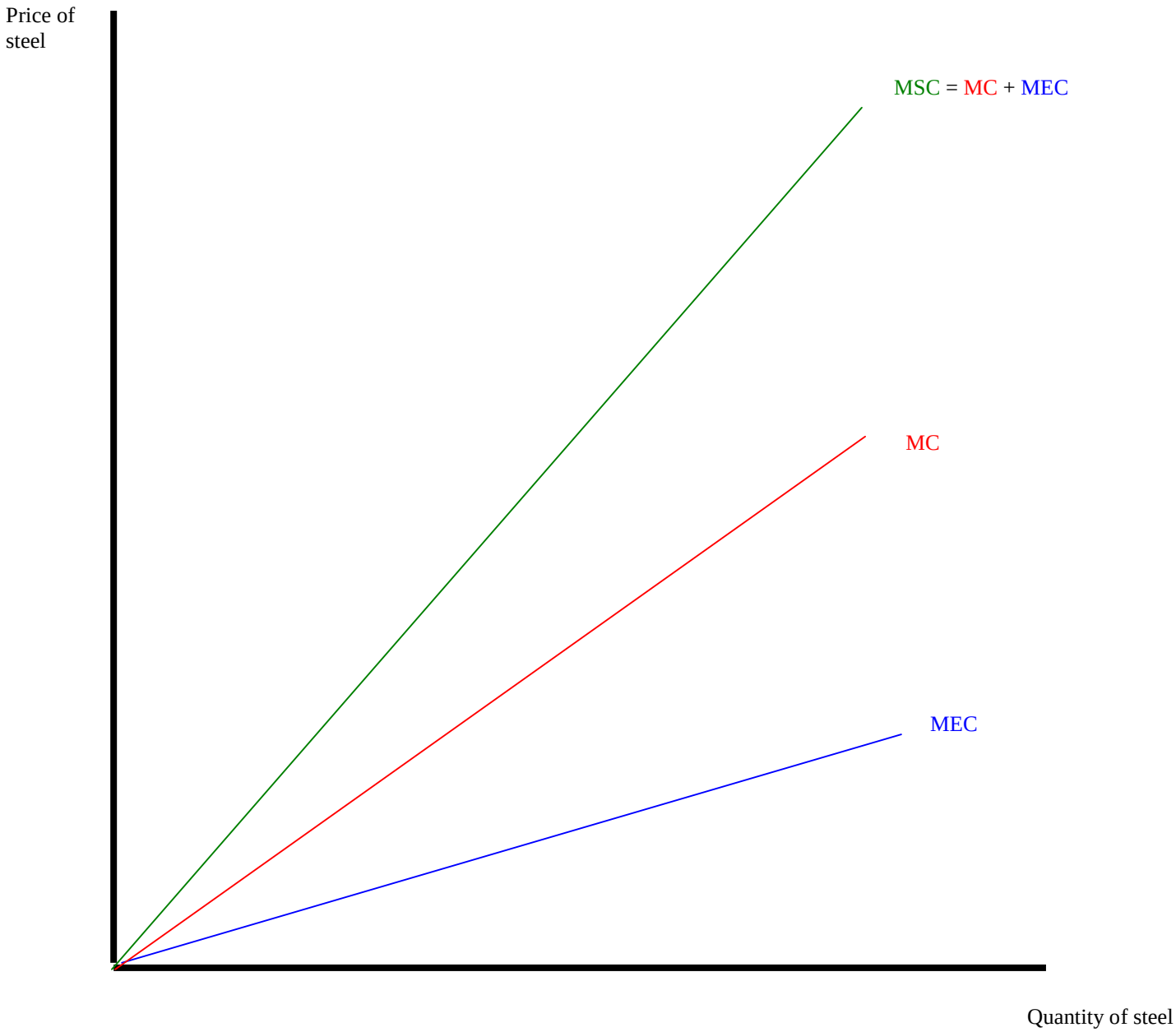
C. Bribes with the Coase theorem: return to the "negative externalities example" from above.

Assume the construction firm had the property rights. *What is the largest bribe that the professors are willing to give to the construction firm to move from $Q_{PRIVATE}$ to Q_{SOCIAL}? What is the smallest bribe that the construction firm would accept?*

The professors would be willing to give up the area under the marginal external cost curve between those two quantities. The construction firm needs a bribe that at least makes it surplus equal to that at $Q_{PRIVATE}$.

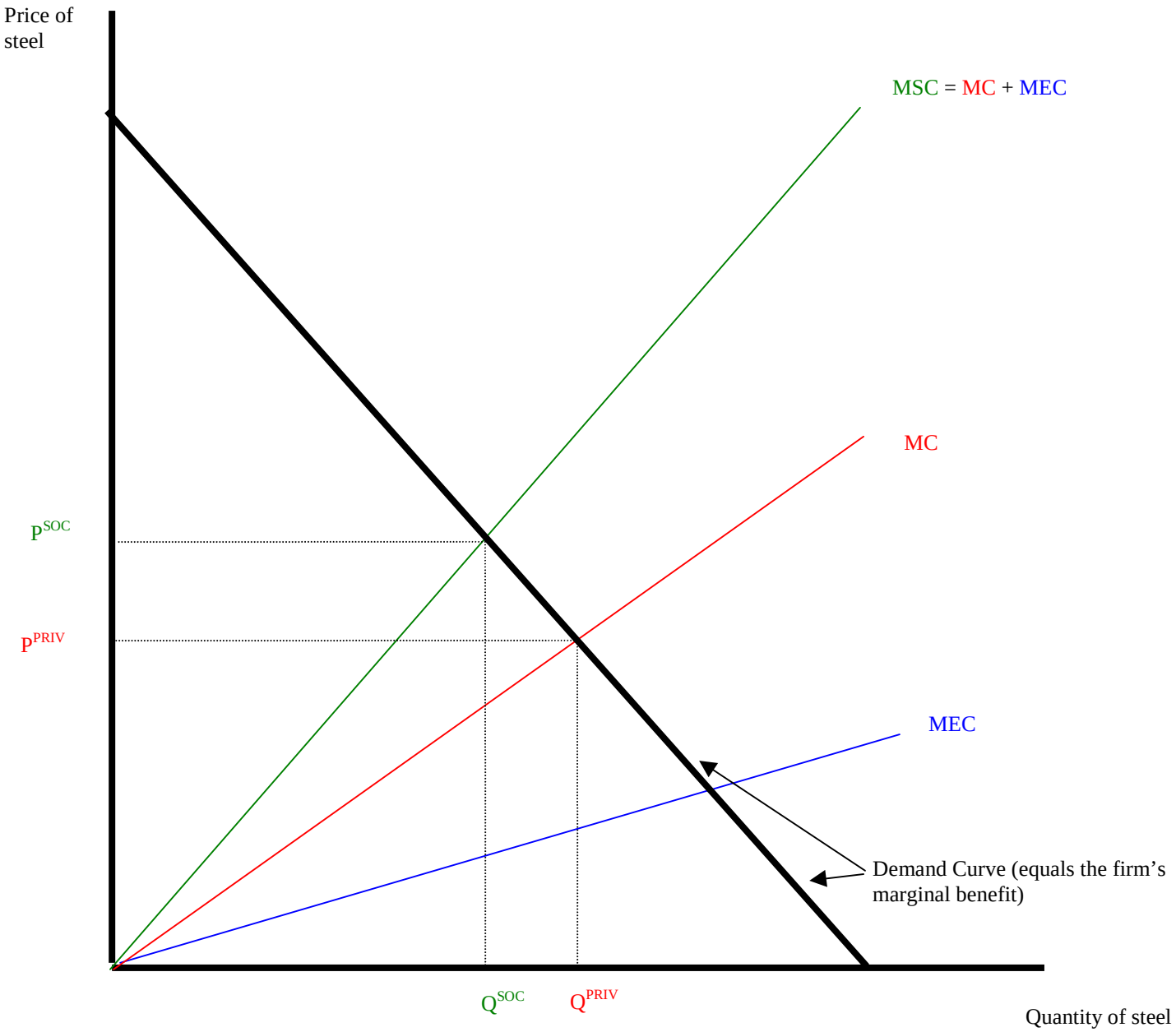
***** SEE FIGURE 4-10 *****

Figure 4-1 – Negative externality imposes external cost



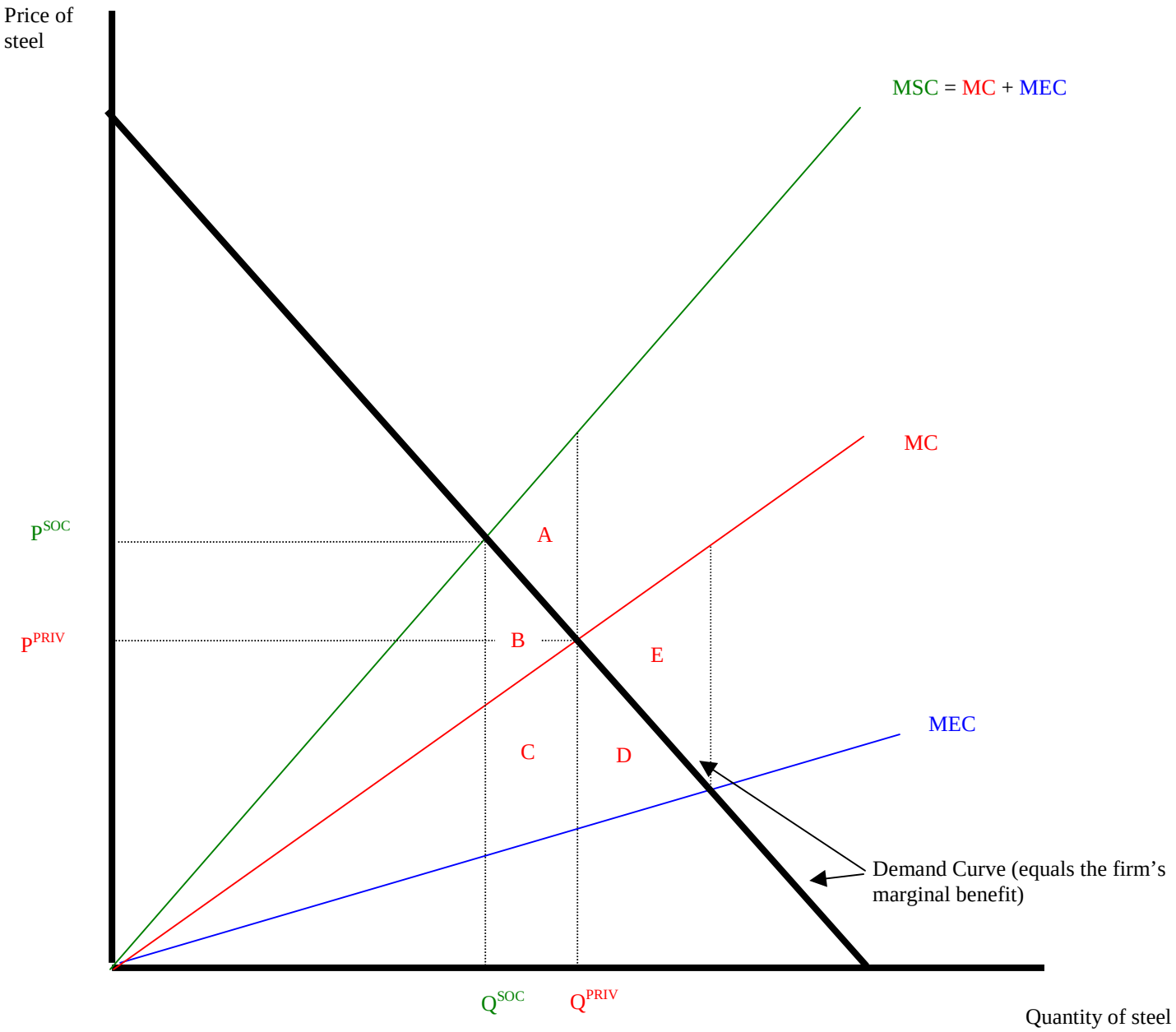
Add marginal cost and marginal external costs vertically

Figure 4-2 – Socially Optimal Quantity and Private market outcome



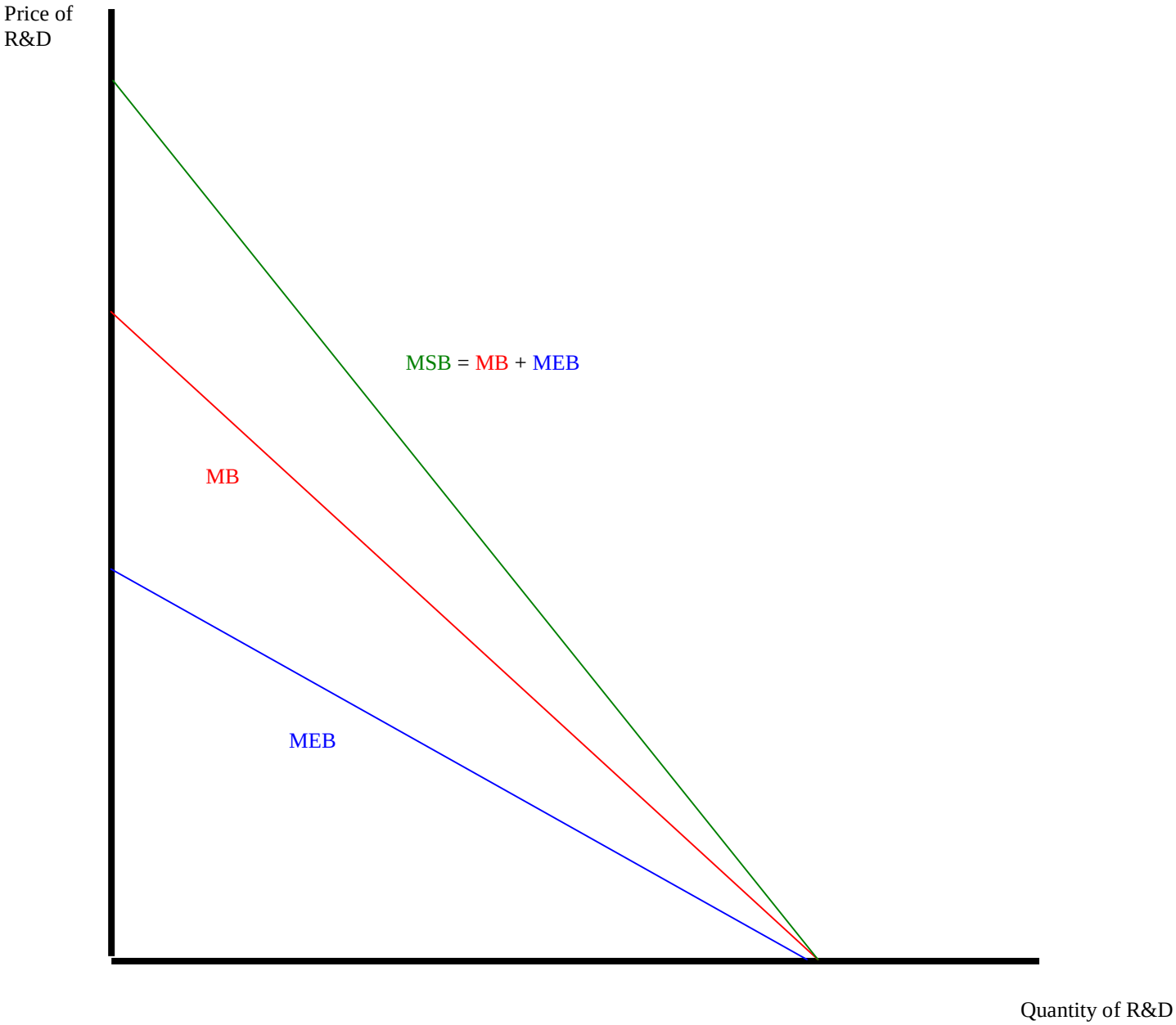
Firm sets P=MC, chooses Q^{PRIV}
Social planner sets P=MSC, chooses Q^{SOC}

Figure 4-3 – Compute deadweight loss from negative externality



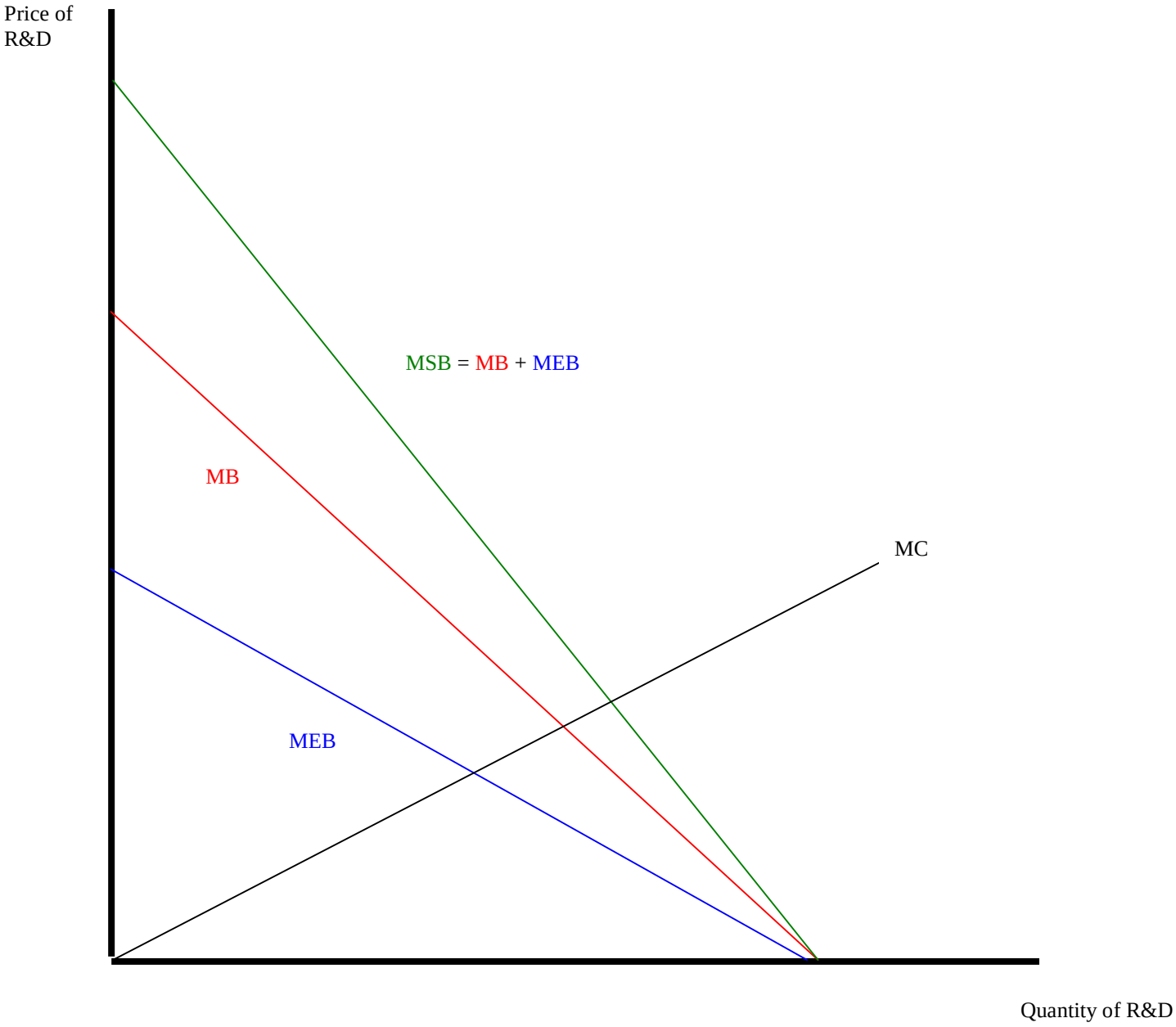
DWL triangle is triangle A.

Figure 4-4 – Positive externality imposes external benefit



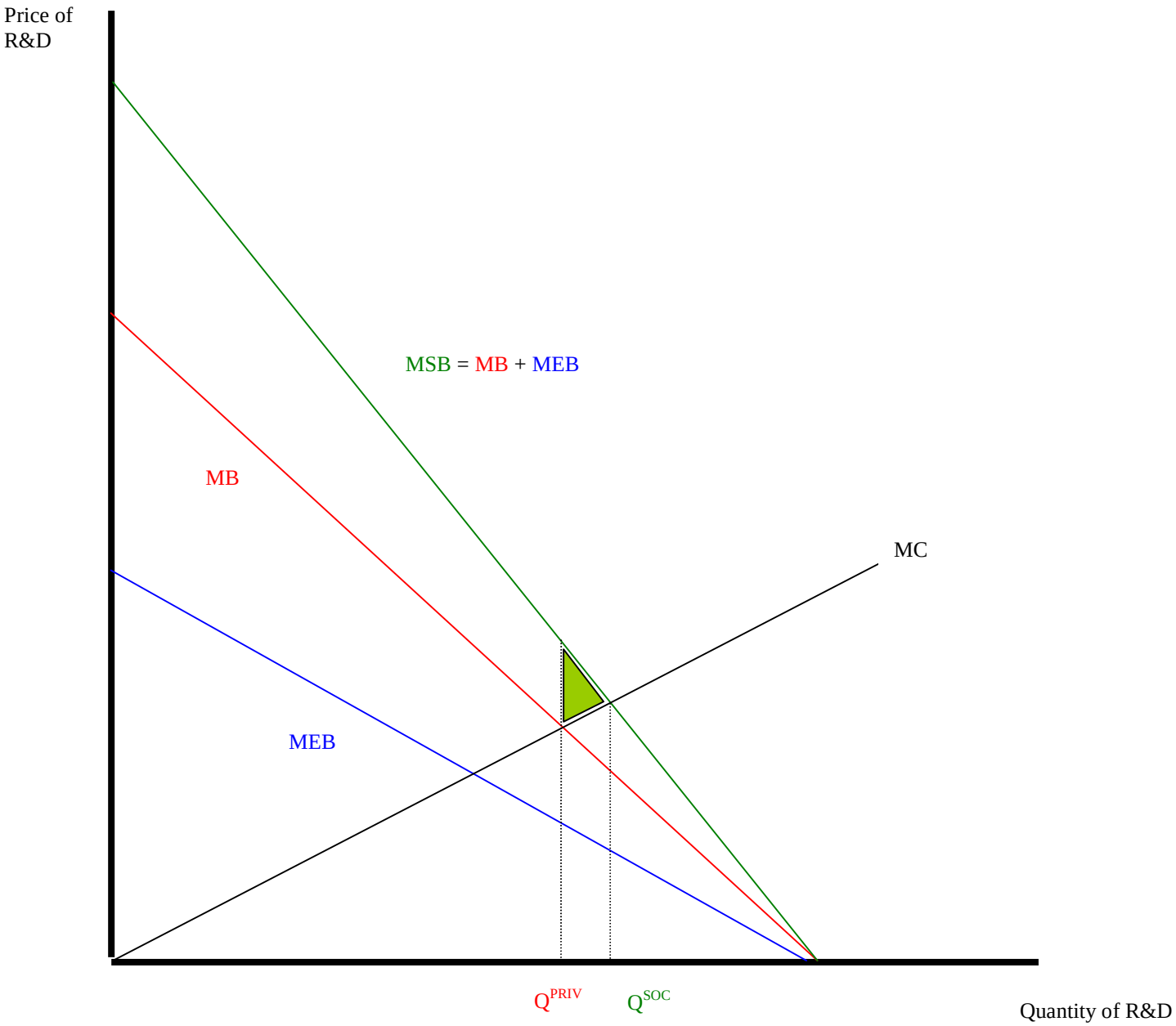
Add marginal benefit and marginal external benefit vertically

Figure 4-5 – Socially Optimal Quantity and Private outcome



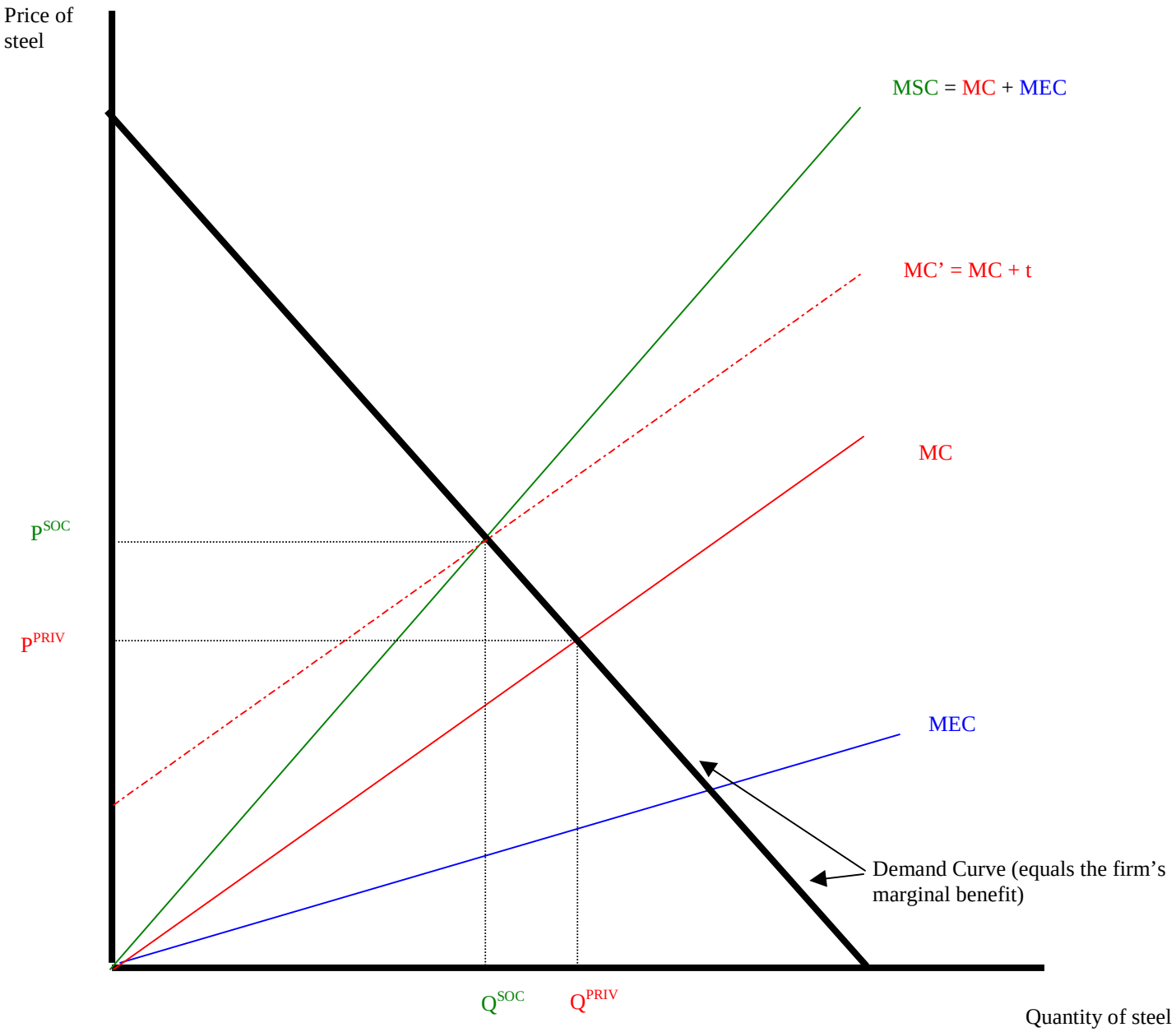
Where are Q^{SOC} and Q^{PRIV}? Is R&D over-produced or under-produced?

Figure 4-6 – Deadweight loss with positive externality



DWL triangle goes from Q^{PRIV} to Q^{SOC}.
How can you figure out the height?

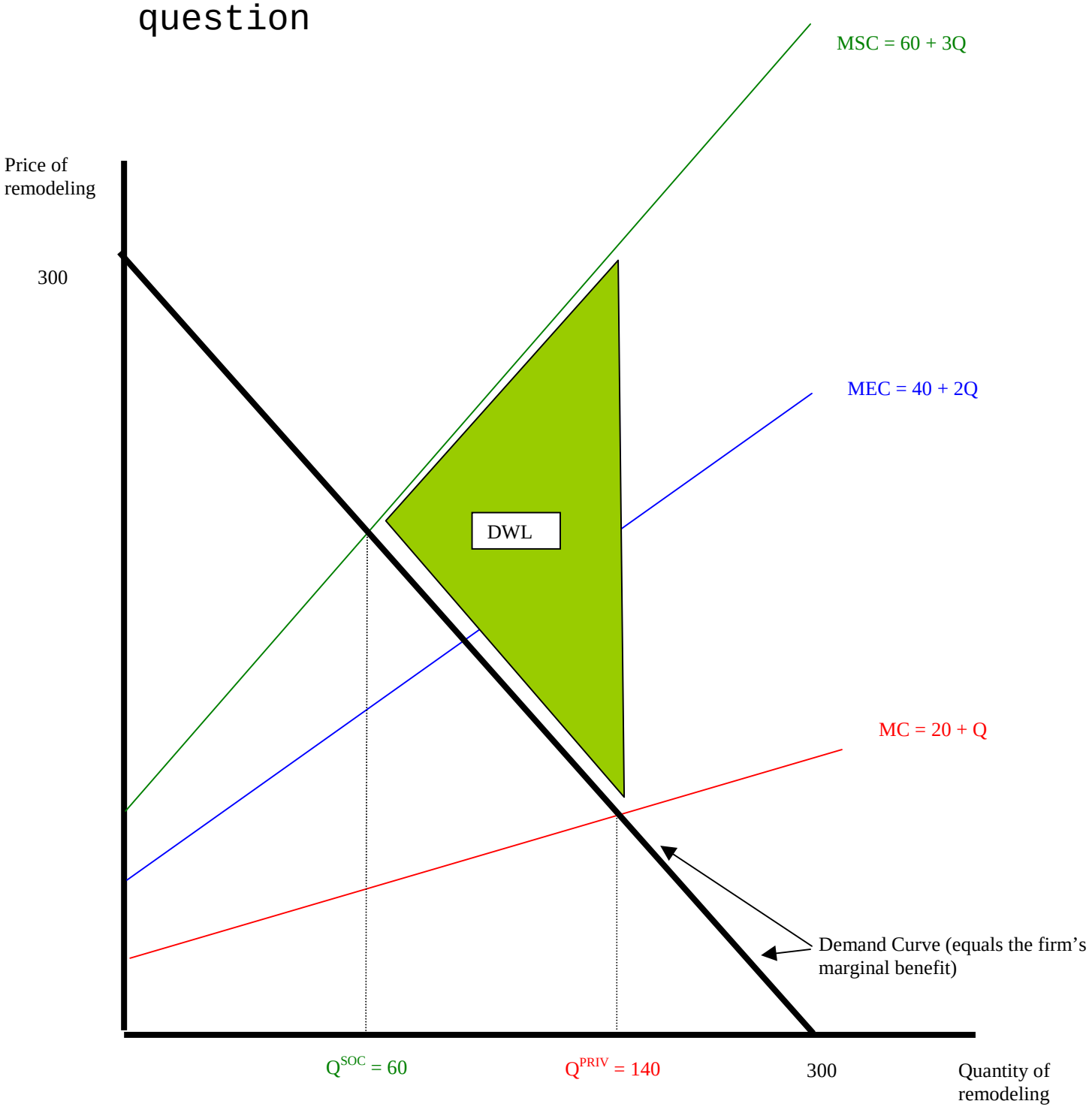
Figure 4-7 – Per unit tax (Pigouvian tax) to correct externality



Set tax as follows: $t = MEC(Q^{SOC})$

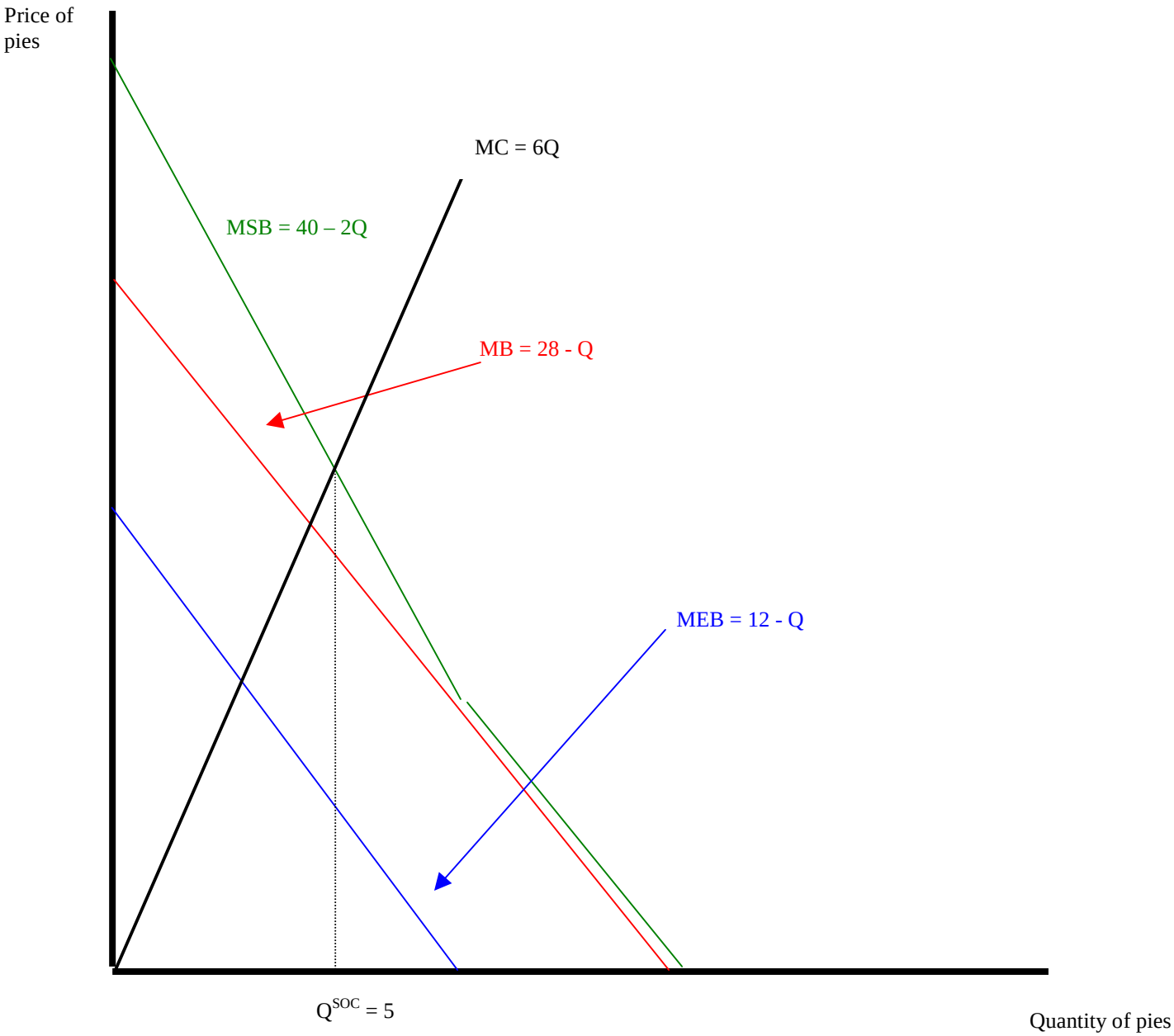
MC' = MC + t , parallel to original MC curve.

Figure 4-8 – Illustration of question



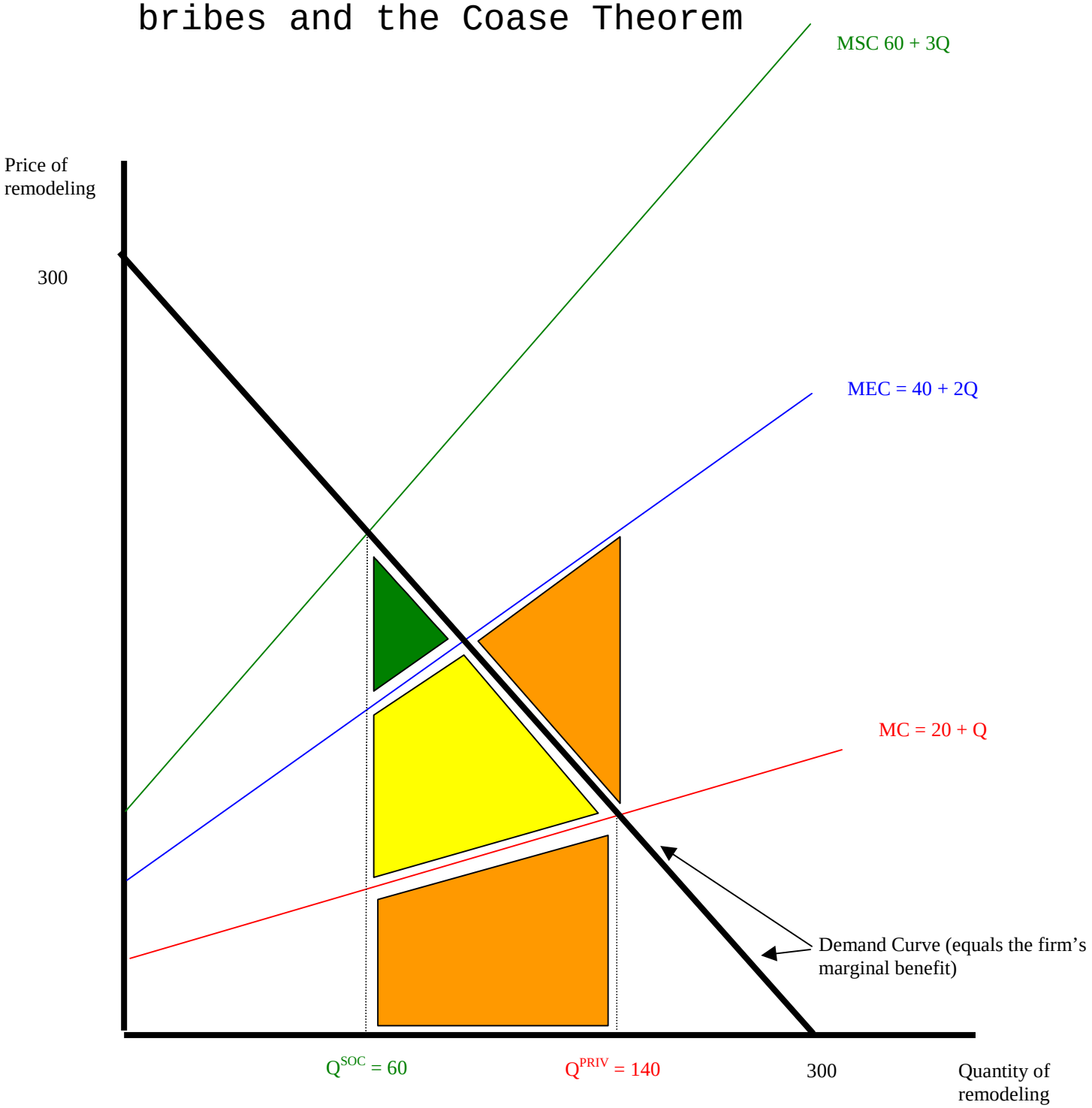
Make sure you understand why this is the right deadweight loss triangle !

Figure 4-9



Note the kink in the MSB curve.
Can you compute the DWL ?

Figure 4-10 – Computing bribes and the Coase Theorem



The yellow and green areas are the smallest bribe to the firm (and its consumers); the yellow and orange areas are the professor's largest bribe.

LECTURE 5

EXPENDITURE PROGRAMS ON THE POOR

I. BACKGROUND ON POVERTY
- A. Definition of poverty line and poverty rate
- B. Cash vs. in-kind benefits, definition
- C. Characteristics of Welfare Programs
  1. means-tested
- D. Categorical Aid
- E. Welfare programs and academic research

II. BUDGET CONSTRAINTS
- A. Creating graphs with Food and Clothing example

Example 1, Example 2, Example 3

-budget constraint of leisure and consumption goods

III. CASH VS. IN-KIND BENEFITS
- A. Criticism #1, #2, #3

Example 4 cash vs. in-kind transfer, which one is better?

IV. CASH WELFARE (previously called "AFDC," now called "TANF")

-definition, facts of the program

V. MEDICAL HEALTH INSURANCE
- A. Facts
- B. Effects of Health Insurance
- C. "The Medicaid Notch"

Example 5, Medicaid

VI. PUBLIC HOUSING

-Facts of public housing

Readings: Rosen, chapter 7 and 8, and supplemental handouts & charts

You may want to review the following problems:
Midterms

Winter 1995, Question 2
Spring 1995, Question 2
Fall 1995, Question 3
Winter 1996, Question 3
Spring 1996, Question 3
Fall 1997, Question 1
Winter 1998, Question 3
Spring 1999-1, Question 3
Spring 1999-2, Question 3
Fall 1999-1, Question 3
Fall 1999-2, Question 3

Finals
Fall 1995, Question 2
Winter 1996, Question 5
Spring 1996, Question 3
Spring 1996, Question 4
Fall 1997, Question 2
Winter 1998, Question 3
Spring 1999-1, Question 2
Spring 1999-2, Question 2
Fall 1999-1, Question 1
Fall 1999-2, Question 1

I. Some Background

A. Poverty in the U.S.: the poverty line is the income level that affords a minimally decent level of consumption.

- It was $14,355 for family of 4 in 1992. Median family income was much higher, $30,786.
- The poverty rate is the fraction of individuals who have income under the poverty line. Around 15% of the U.S. population lives in poverty; the elderly have lower poverty rates than average, while children have higher poverty rates than average. Households headed by female heads have very high poverty rates (greater than 35% in this group). African-Americans and Hispanics have very high poverty rates as well. In 1996, 13.7% of the U.S. population was in poverty.

B. As a way of alleviating poverty, the U.S. provides transfers to the poor in the form of cash and in-kind benefits (such as free medical care, housing, and energy). These programs are controversial: they *may* have weakened the incentives for welfare recipients to seek employment, contributed to the breakup of families, and contributed to the "culture of poverty."

C. Characteristics of welfare programs

1. Eligibility: all welfare programs are means-tested, so only individuals with low incomes can receive benefits. In addition, many programs have other rules, usually related to family structure and assets.

2. Size: For many years, they were growing as a share of GDP. In 1968, they were 1.8 % of GDP. In 1992, they were 4.9 %. The growth has come primarily through in-kind benefits such as Medicaid. The programs have been shrinking in recent years.

D. Should aid be given to all poor people (broad-based aid), or only those in certain groups (categorical aid). *In the U.S., aid is given only to certain groups*.

Examples:

1. SSI: poor elderly, blind, and disabled. Considerable controversy about who is "disabled."
2. AFDC/TANF: single-parent families with dependent children.

E. Efficiency and equity issues

1. Categorical aid may induce individuals to fall into the category; e.g., allegations that AFDC has contributed to the breakup of families; the departure of a low-wage father may increase total income by making the rest of the family unit eligible for AFDC.
2. Why have categories? It might provide more effective redistribution. Enables targeting to the most needy, and potentially reduce the disincentives inherent in the program. E.g., by targeting SSI to the elderly, the program is unlikely to reduce labor supply of the elderly.
3. Equity: Should two people who are equally poor, one who is young, another who is old, receive the same amount from the government?
4. Stigma: Categorical aid likely to create stigma: approximately 1/3 of the those eligible for AFDC benefits do not participate.

F. Other comments

1. Data sets with thousands of people can be used to analyze programs. These data sets are produced by the government in a timely fashion, and available to the public. For example, you can visit the Census web site:

http://www.census.gov/ftp/pub/DES/www/welcome.html

2. There is intense policy interest in welfare; welfare reform signed into law in 1996.
3. 50 different "labs" – because welfare programs vary across states.

II. Budget Constraints

A. First a budget constraint with "food" (F) and "clothing" (C)

***** SEE FIGURE 5-1, 5-2 *****

- You would be given a utility function, income, and prices
- Utility maximization implies setting MRS equal to ratio of prices

- Shifting and rotating of the budget constraint

- What happens if I increases? Or P_F increases? Or P_C increases?

B. Next, change the goods to "leisure" (L) and "consumption" (C)

***** SEE FIGURE 5-3 *****

- You would be given a utility function, time endowment (T), and prices
- The wage rate (w) is the price of leisure
- Time endowment is, perhaps, 24 hours per day, or some other number.
- When you give up leisure, you work: $T - L \equiv H$ (hours worked). Receive income equal to wH.
- Labor force participation occurs when $L < T$, that is $H > 0$.
- The budget constraint is $wL + P_C C = wT$

C. Next, add in nonlabor income, G, to the previous budget constraint. Nonlabor income includes transfers from the government, or the allowance you get from mom and dad.

***** SEE FIGURE 5-4, 5-5, 5-6 *****

- Can you consume more leisure than T?
- The budget constraint shifts outward, but constrained in hours of leisure can consume.
- The budget constraint is $wL + P_C C = wT + G$

D. Add taxes (J) to the previous budget constraint.

***** SEE FIGURE 5-7, 5-8, 5-9 *****

- How does this change the budget constraint?
- Does the person work more or less than before?
- Hours of work vs. LFP
- The budget constraint is $(1-\tau)wL + P_C C = (1-\tau)wT + G$
- Note that regardless of the tax rate or nonlabor income, the person can always consume $L = T$.

Example 1

Sidney's preferences given by: $U(L,C) = L^{\frac{3}{2}}C^{\frac{1}{2}}$. *Sidney's wage rate is $10 per hour, the price of consumption goods is $1, and Sidney has a time endowment of 200 hours.*

1. How many hours will Sidney work?

Sidney's demand curve for leisure is: $L^* = \frac{3}{4}\left(\frac{wT}{w}\right) = 150$. She therefore works $H^* = T - L^* = 50$. L^* is a demand curve from a Cobb-Douglas utility function, where wT represents potential income. Sidney consumes $C = 500$.

Now the government introduces a welfare system with the following features: a person receives a grant of $500 per month, and this grant is reduced by $1 for each $1 earned in the labor market.

2. What is the tax rate on earned income in this example?
It is 100%.

3. Illustrate Sidney's budget constraint after this welfare system is introduced, clearly labeling the intercepts and any kink points. How many hours will Sidney work after the welfare system is introduced?
***** SEE FIGURE 5-10, *****
Sidney withdraws from the labor force. She consumes $L = 200, C = 500$, which gives higher utility than the bundle in part (1).

Where on the budget constraint is Sydney is out of the labor force? On welfare? Off welfare?

Example 2
Amanda has a time endowment of 100 hours per month. When she works, she receives a wage of $5 per hour. Her preferences are: $U(L,C) = \min\{2L, C\}$. *The price of consumption goods is $2.50 per unit.*

1. To maximize her utility, how many hours will Amanda work?
Setting the arguments of the perfect complements utility function equal

to each other, $2L = C$, and then substituting that expression into the budget constraint of $wL + P_C C = wT \Rightarrow 5L + 2.5C = 500$, gives a solution of $L = 50, H = 50$.

Suppose that the government introduced a welfare system with the following features:
- the basic grant is $80
- for any earnings above $20, this grant is reduced dollar-for-dollar with earnings.

2. Draw Amanda's new budget constraint, carefully labelling the axes, intercepts, and all kink points.
The budget constraint looks like this:
***** SEE FIGURE 5-11 *****

3. Under this new budget constraint in part (b), how many hours will Amanda now work?
She does not change her behavior. You can show that the point $L = 100, C = 40$ is at least weakly preferred to any point on the budget constraint introduced this welfare system. The utility from $L = 100, C = 40$ is $U = 40$, and this is clearly less than the utility in part (a).

Example 3

Marge has the following preferences: $U(L,C) = L^{\frac{1}{2}} C^{\frac{3}{2}} + 8$. *She has a time endowment of 400 hours per month. If she works, she receives a wage of $3 per hour. The price of consumption goods is $1 per unit.*

1. How many hours will Marge work?
$L = \frac{1}{4}\left(\frac{I}{w}\right) = \frac{1}{4}\left(\frac{1200}{3}\right) = 100$. Therefore $H = 300, wH = 900, C = 900$.

In addition, now suppose that a welfare system is implemented with the following features:
- It offers a basic grant, G, of $100 per month if Marge has zero earnings.
- It has a standard deduction, D, of $300.

- For non-deductible earnings, it reduces the basic grant at a tax rate of $\tau = 50\%$

2. Carefully draw Marge's new budget constraint, labelling all intercepts and kink points.
***** SEE FIGURE 5-12 *****

3. How many hours will Marge now work?
Her hours of work will not change. Evaluate the bundle she gets from working before the welfare system $L = 100, C = 900$ to the following point – $L = 400, C = 500$. This second point is better than any point that the new welfare system offers. But the utility is STILL lower than $L = 100, C = 900$.

In addition to all the previous information, suppose that the government now imposes a work requirement. To qualify for the welfare grant, Marge must work at least 50 hours.

4. Carefully draw the budget constraint under these circumstances, labeling all kink points and intercepts.
***** SEE FIGURE 5-13 *****

III. Cash vs. In-Kind Benefits

A. A large proportion of transfers to the poor are in-kind, that is, targeted toward specific commodities. This leads to three sets of criticisms.
Criticism 1: Administratively costly.
- Each program (Medicaid, food stamps, public housing, energy assistance) is run separately.
- Several different agencies determine eligibility for each program.
- Eligibility standards function of income, family size, family structure.

Criticism 2: In-kind benefits lead to different choices than a similar amount of cash, and this is not utility-maximizing.
Criticism 3: The government should not be paternalistic.

B. Inefficiencies from in-kind benefits
1. Consider utility maximization subject to a budget constraint with food

stamps. This program changes the budget constraint.

CASE 1
***** SEE FIGURE 5-14 *****

CASE 2
***** SEE FIGURE 5-15, 5-16 *****

In CASE 1 – if the individual consumes more than his food stamp allotment. The food stamp program is no different from a cash grant. In CASE 2 – This individual purchases no food beyond his food stamp allotment. If he were given an equivalent cash grant, he would consume less than that in food.

Example 4

Kremer has preferences over food and clothes, $U(F,C) = F^{\frac{1}{3}}C^{\frac{2}{3}}$. *The price of food is \$5, while the price of clothes is \$4. His income is originally \$200.*

The government now decides give Kremer a transfer, and is debating two different transfer schemes:
Transfer 1: \$100 in cash
Transfer 2: 12 foods and 10 clothes.
Kremer still keeps his original \$200, in addition to the transfer.

1. Clearly illustrate his budget constraint before the transfer, and how each of the transfer schemes changes the budget constraint.
***** SEE FIGURE 5-17, 5-18 *****

2. <u>In this specific example</u>, is Kremer happier with Transfer 1 or Transfer 2?

$F^* = \frac{1}{3}\left(\frac{I}{P_F}\right)$, so with a cash transfer, his income is \$300 and he consumes $\frac{1}{3}\left(\frac{300}{5}\right) = 20$ food. He also consumes 50 clothes. Since this bundle is also attainable under the in-kind scheme (since 20 F > 12 F and 50 C > 10 C),

then he is indifferent between the two transfers.

3. Ignore all the previous information. Convincingly evaluate the following statement. "Suppose that a unit of food costs $5. Then providing a person with 20 units of food can make her no better off (and possibly worse off), than providing him with a cash grant of $50."
False; the expenditure on food is $100. Thus, if the person has strong preferences for food (versus clothing, for instance), he would prefer the in-kind transfer.

IV. Cash welfare
- A. Details
  1. Provides cash assistance to families with children where one parent is absent, incapacitated, or dead. The program was introduced in 1935.
  2. In 1993, 4.9 million families participated, 14.1 million people (of whom 9.5 million were children).
  3. Federal and state governments share responsibility in financing programs. The federal government's share varies by state: in California, the federal government pays 50% of expenses, in Mississippi, its share is almost 80%.
  4. There is wide variation in benefit levels across state. For example, the benefits for a family of 3 in Connecticut were more than four times as large as for the same family in Alabama.
  5. Income and asset limits.
  6. For the most part, aimed at female-headed households.
  7. High tax rates. What does a tax rate mean in this instance? It is how fast the benefits are reduced, and varies between 66-100%. Combined with other programs, the tax rate on earnings can exceed 100%.
  8. Many studies show AFDC generates work disincentives. For every dollar transferred to AFDC recipient, earnings fall by 37 cents.

  ***** SEE SUPPLEMENTAL HANDOUT FOR MORE DETAILS ON AFDC/TANF *****

V. Medicaid
- A. Some facts

1. Health insurance for the poor, which provides free services to the recipients.
2. Medicaid has huge growth; spending doubled between 1990 and 1993.
3. The payments are large: Medicaid expenditure in 1995 was $152 billion. In contrast, AFDC costs around $20 billion.
4. Administered by the states: program eligibility rules and services vary by state.

B. Effects on health care utilization and health status and access.
1. Number of physician contacts per person fairly close across income classes
2. Medicaid's introduction in the 1960s coincided with increased hospitalization rates of poor.
3. Life expectancy has increased and infant mortality has declined. *Is this due to Medicaid, however?* Changes in lifestyle, better health care technology.
4. Around 1 in 7 Americans lack health insurance, 3 in 10 below poverty line.

***** SEE SUPPLEMENTAL HANDOUT FOR MORE DETAILS ON MEDICAID *****

C. Medicaid's interactions with AFDC: "the Medicaid notch"
1. Traditionally eligibility for Medicaid linked to AFDC eligibility. A household loses coverage completely for earning more than the "breakeven amount."
2. Tax rate far greater than 100%.
3. In recent years, coverage has been extended to low-income pregnant women and children with no other ties to the welfare system.
***** SEE FIGURES 5-19, 5-20 *****

For example, in some states, a family can earn up to 33% of poverty line before losing Medicaid. The expansions allowed the household with a five year old to earn up to 133% of poverty line. What predictions does this have?

4. Creates "dominated" part of the budget set – set of points where we do not expect to see people locating on.
5. Use **revealed preference**: labor force participation increases, AFDC participation decreases.

D. Evidence: Medicaid is important reason why people participate in welfare. Universal health care could decrease the welfare rolls by 15 % or so.

Example 5

Jane lives in a state that offers a maximum cash benefit (G) of $500. Earnings of $100 is allowed through a deduction (D) before cash benefits are reduced at $\tau = 50\%$. Jane also receives Medicaid, which she values at $200. Medicaid is lost when cash welfare eligibility is lost. Jane is endowed with 300 hours of leisure. The price of consumption goods is $1. Jane's wage rate is $10 per hour.

1. Draw the budget constraint facing Jane, clearly labeling the axes, intercepts and any kink points. Is there any region of hours which Jane will definitely not work? If so, what region? At what level of earnings is Medicaid eligibility lost?

***** SEE FIGURE 5-21 *****

The level where Medicaid is lost is at $1100. This corresponds to $\frac{G}{\tau} + D = \frac{500}{0.5} + 100 = 1100$. Earnings of $1100 corresponds to 110 hours of work (at which consumption of other goods is 1300, and leisure is 190 hours). Since Medicaid is valued at $200, earning the extra $1 that moves Jane from $1100 to $1101, makes her bundle of consumption goods fall from 1300 to 1101. Jane would not work between 110 hours and 130 hours, corresponding to 170 to 190 hours of leisure.

Suppose the government charges Jane for Medicaid: the charge is equal to 10% of any earnings above the first $100 that Jane receives while on cash welfare. Medicaid eligibility is still contingent on cash welfare eligibility.

2. Draw the new budget constraint facing Jane, clearly labeling the

axes, intercepts and any kink points. Is there any region of hours which Jane will definitely not work? If so, what region? Compared with part 1, clearly illustrate what predictions can be made about labor force participation, hours of work, and cash welfare participation.

***** SEE FIGURE 5-22 *****

The region of hours of work that Jane will definitely not work now shrinks to between 110 and 120 hours of work. While cash welfare and Medicaid eligibility are lost at $1,100 in earnings, this now corresponds to the {L,C} bundle {190, 1200} (since the premium on Medicaid at $1100 of earnings is (1100-100)*0.10).

Compared with part 1:

- Cash welfare participation falls. The {L,C} bundles that were taken away all were where Jane participated in cash welfare.
- The effect on hours of work is ambiguous. For those initially working between 10 and 110 hours per week, the after-tax wage falls from $5 per hour to $4 per hour, by the imposition of the Medicaid premium. This has income and substitution effects: since the price of leisure is cheaper than before, the substitution effect would lead towards consuming more leisure. Since Jane feels poorer from her wage being lowered, her real income falls, and she will cut back on the amount of leisure she consumes (assuming that it is a normal good).
- Labor force participation either stays constant or falls. It falls if the indifference curves are not convex.

Return to the original case where the government does not charge for Medicaid. Suppose the law requires all employers are required to provide health insurance equivalent to Medicaid to workers who work at least 200 hours per month.

3. Draw the new budget constraint facing Jane, clearly labeling the axes, intercepts and any kink points. Compared to part 1, clearly illustrate what predictions can be made about labor force participation, hours of work, and welfare participation.

***** SEE FIGURE 5-23 *****

- Cash welfare participation falls: all the new {L,C} bundles occur

where the woman is working and off cash welfare.
- Hours of work: ambiguous. For those initially working less than 200 hours, hours will either not change or will increase. For those working more than 200 hours initially, the health insurance is simply an income effect, so hours should presumably decrease.
- LFP: Either increases or no change. All the new bundles occur where Jane is participating in the labor force.

Return to the original case where employers do not provide health insurance to their employees. Suppose the government eliminates half of the services that Medicaid provides (all the services are valued equally).

4. Compared to the case with full Medicaid services, will Medicaid spending fall by more, less, or exactly one-half? Why?
Cutting Medicaid services had two effects. First, for those that remain on welfare, Medicaid expenditure falls from $200 to $100. Second, some people leave welfare, so Medicaid expenditure falls from $200 to $0. In total, Medicaid expenditure falls by more than one-half.
***** SEE FIGURE 5-24 *****

Return to the original case. The government now modifies the deduction (that was previously $100 per family) so that a welfare recipient can deduct $100 per child.

5. What earnings level will cash eligibility be lost at for Jane, who has one child? What earnings level will cash eligibility be lost at for Amanda, who has two children?

Jane's limit is: $\frac{G}{\tau} + D_{CHILD} = \frac{500}{0.5} + 100 = 1100$. Amanda's limit is: $\frac{G}{\tau} + 2D_{CHILD} = \frac{500}{0.5} + 200 = 1200$.

6. Evaluate the entire following statement: Lowering the implicit tax rate (τ) on earnings would encourage welfare recipients to work and reduce the number of welfare recipients.
False. Lowering the tax rate may encourage work, but it may not: it

depends on the income and substitution effects. The second part is definitely false: lowering the tax rate increases the income eligibility limit for cash welfare and should increase participation.

VI. Subsidized housing

A. Public housing and Section 8 vouchers. More than 1.2 million units.

B. Administered by local agencies – more than 3,200 Public Housing Authorities in United States.

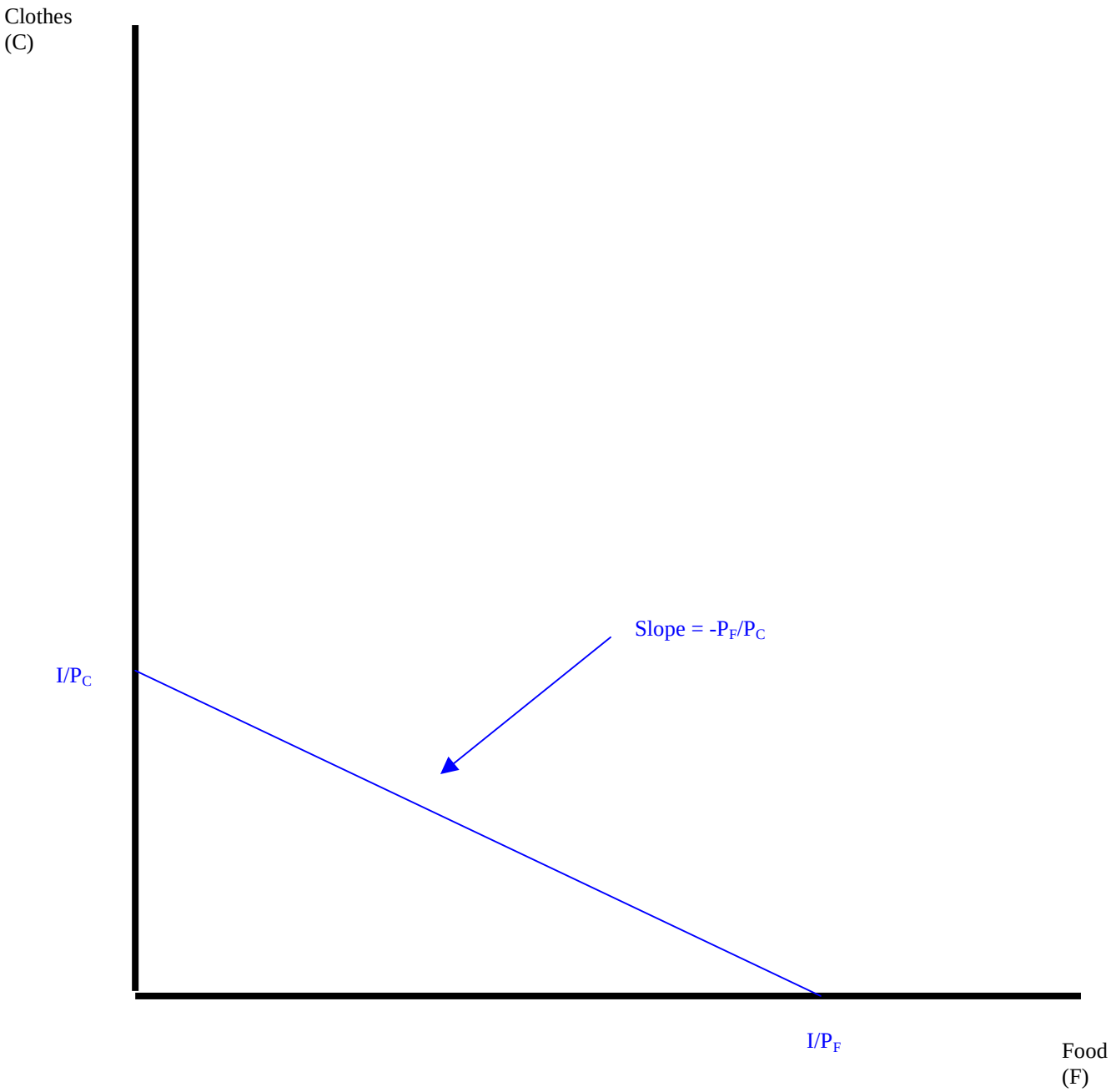
C. Projects have lots of crime. Facilities have been accused of breeding crime and social decay

C. With projects, benefit provided in-kind. Estimated to be 80% of cash value.

D. Public housing is not an entitlement. Being eligible does not automatically entitle a family to benefits. Long waiting lists. While public housing gives large value per recipient, most receive nothing from it.

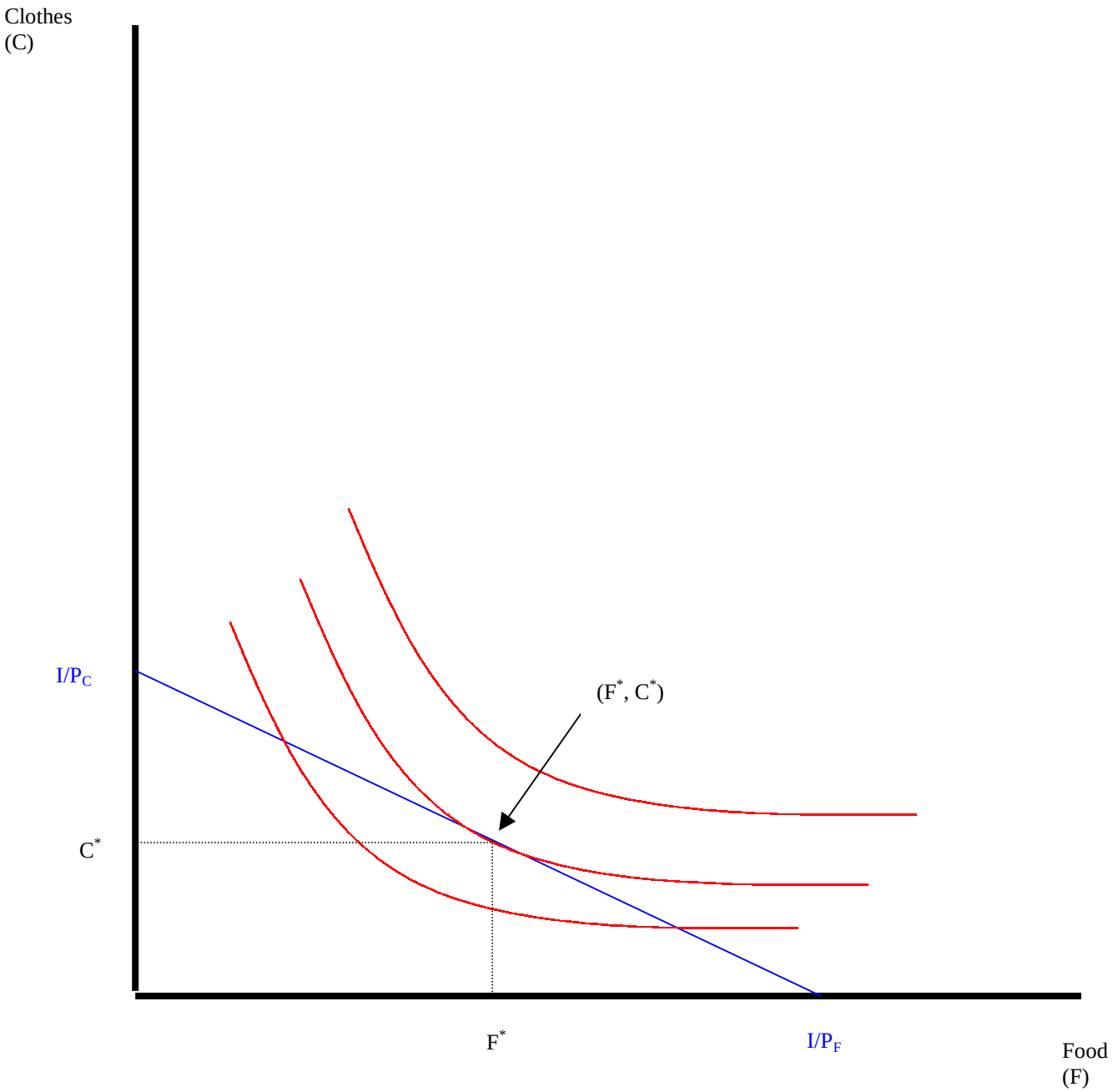
E. Sharp shift from public housing to vouchers.

Figure 5-1 – Linear budget constraint for food and clothing



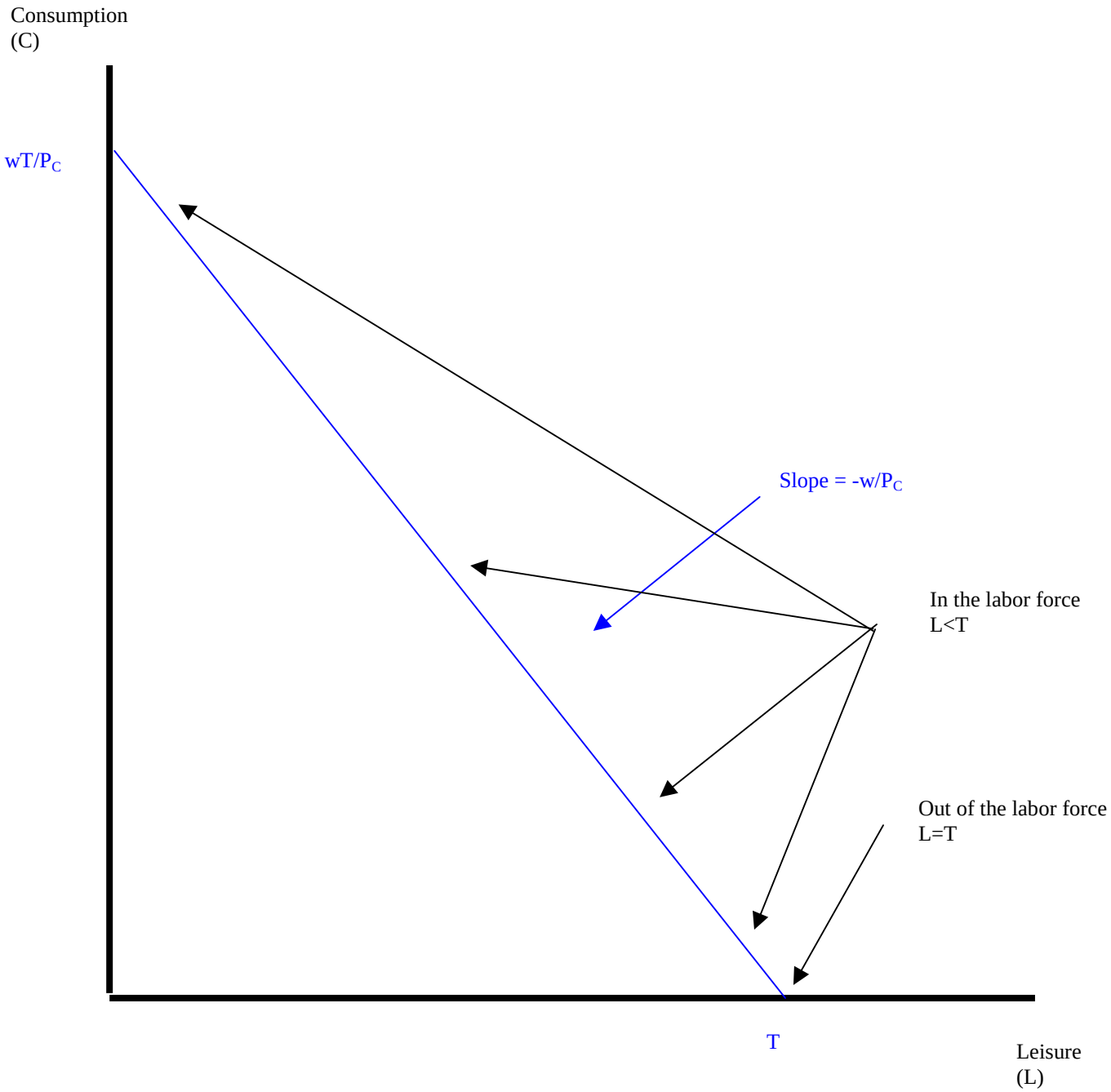
"F" and "C" represent the quantities of food and clothing, "P_F" and "P_C" the prices, and "I" the income.

Figure 5-2 – Utility maximizing bundle



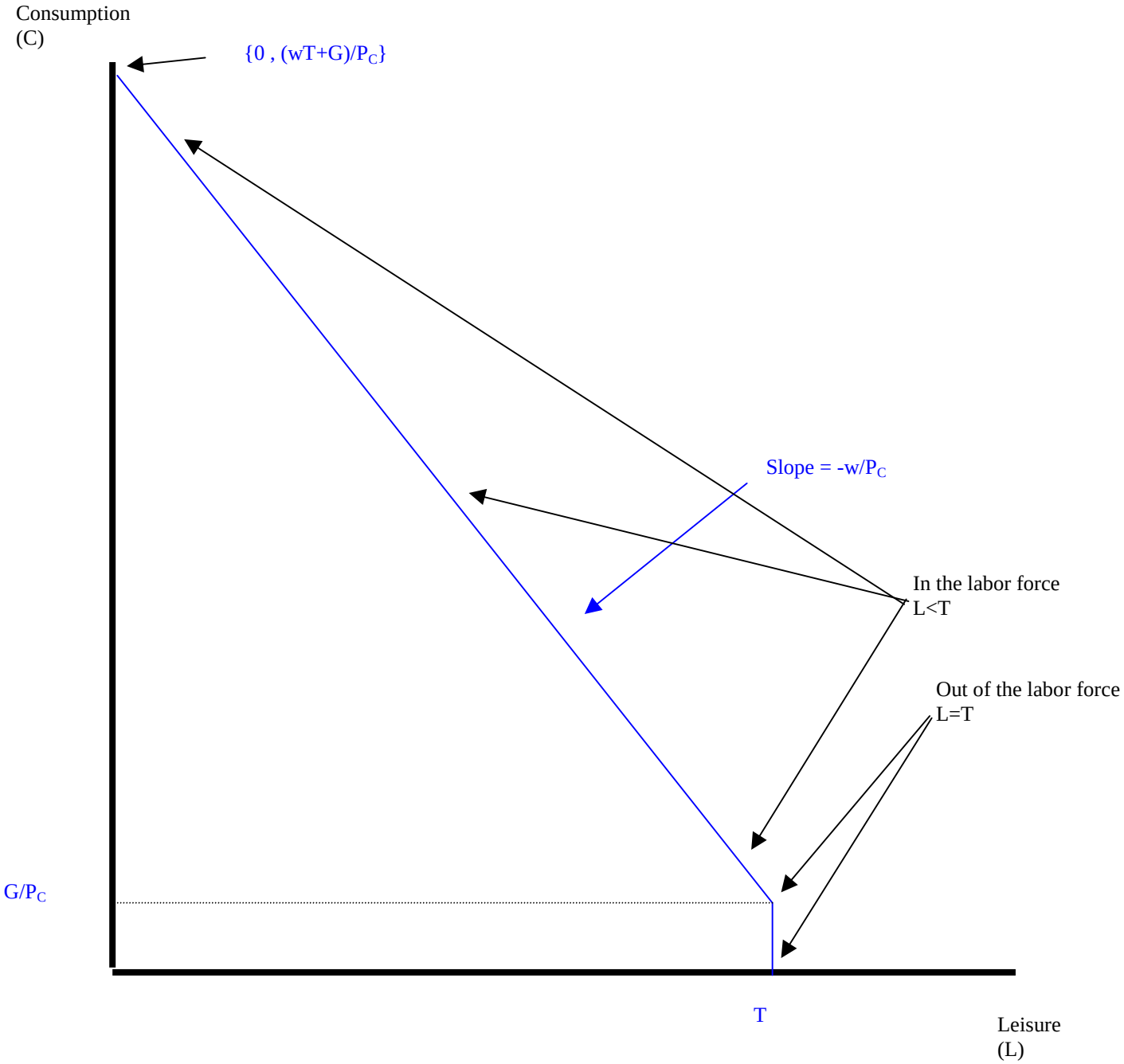
Set MRS = ratio of the prices, and satisfy the budget constraint.

Figure 5-3 – Change the goods to “Leisure” and “Consumption Goods”



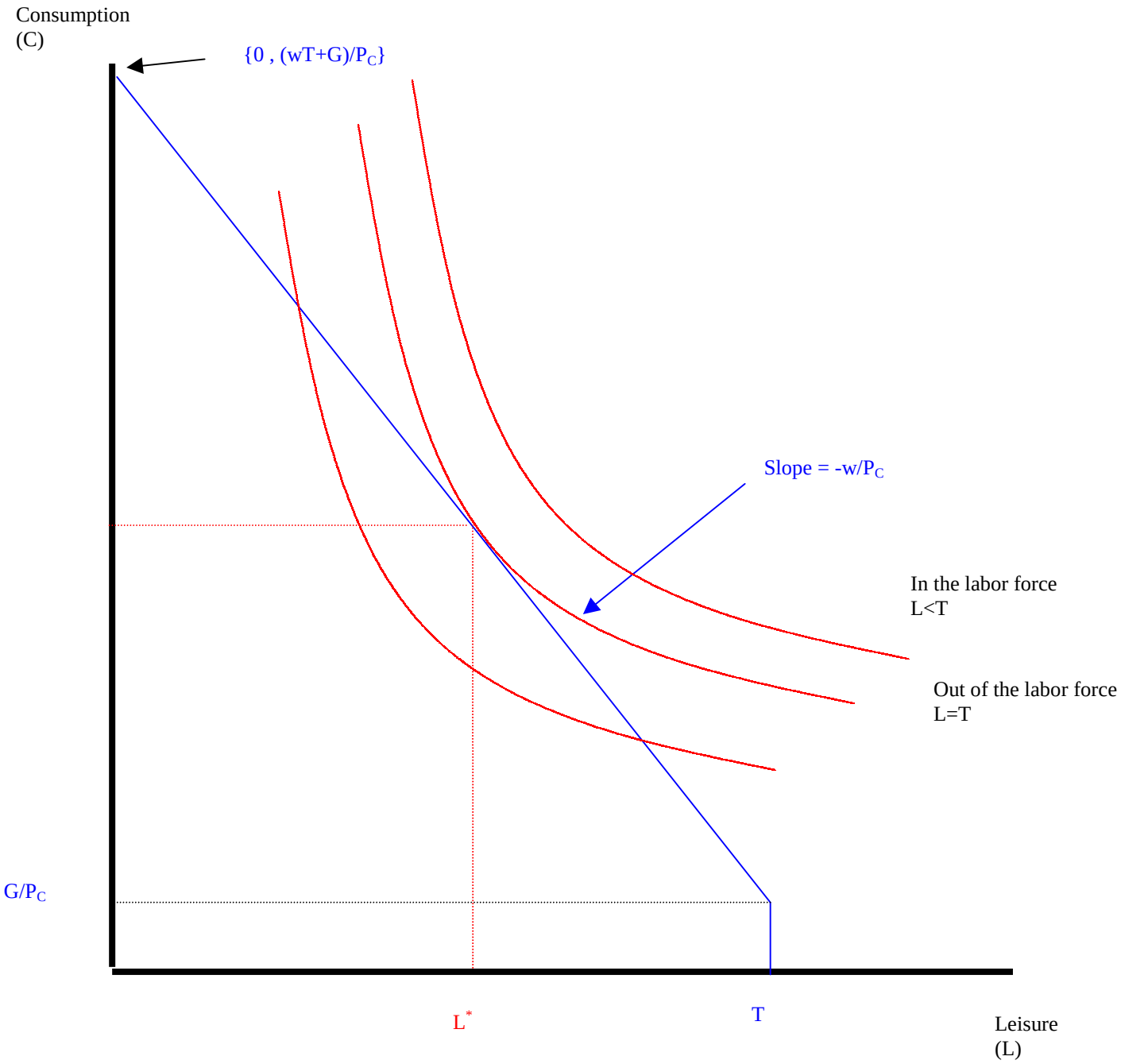
“T” is the time endowment (e.g., 24 hours per day), “w” is the wage rate, and wT represents the “full income.”

Figure 5-4 – Add “non-labor" income such as a welfare grant (G)



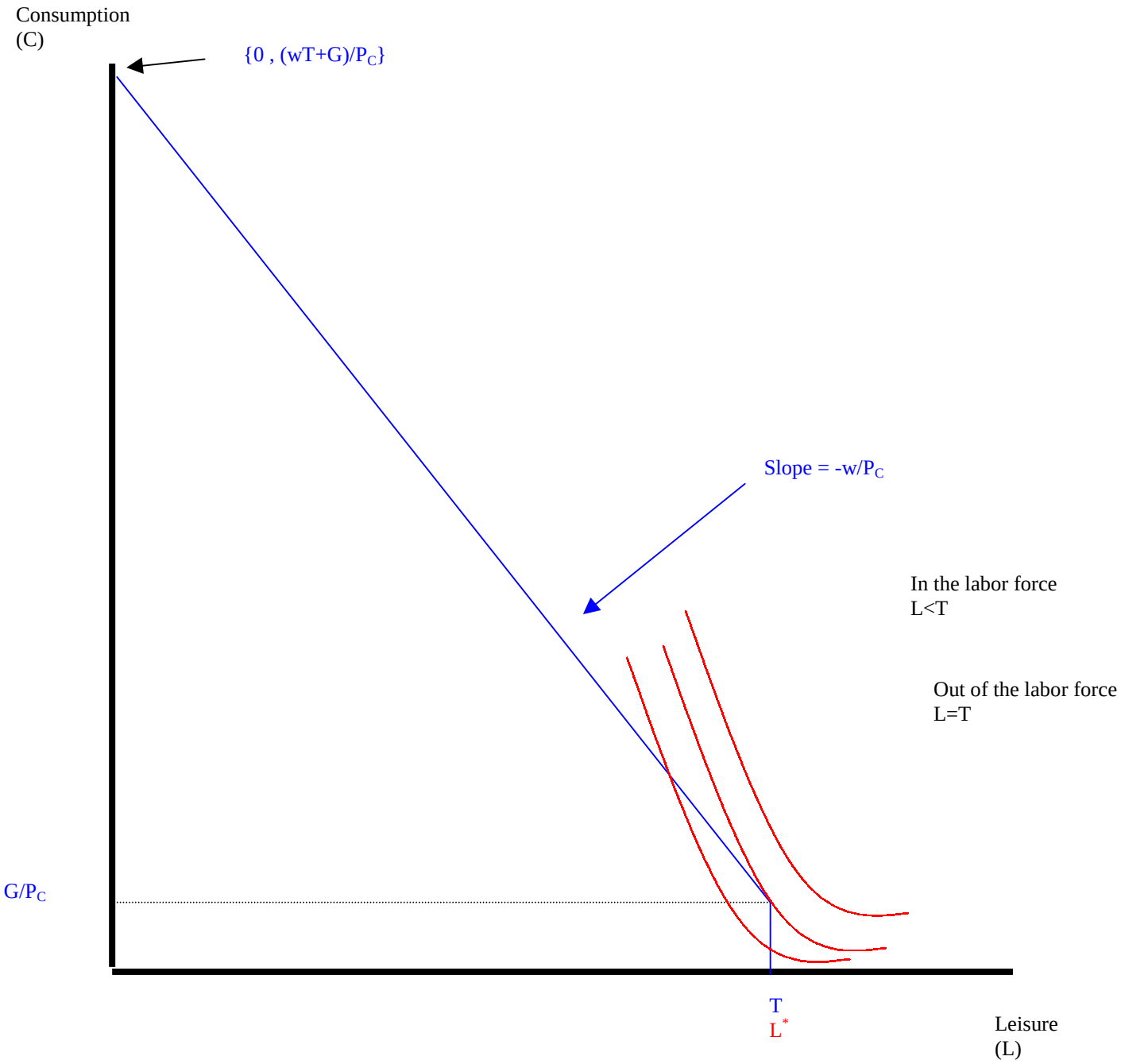
The full budget constraint is:
$P_C C + wL = wT+G$
First you “sell” your leisure, and then buy some of it back.

Figure 5-5 – In the labor force



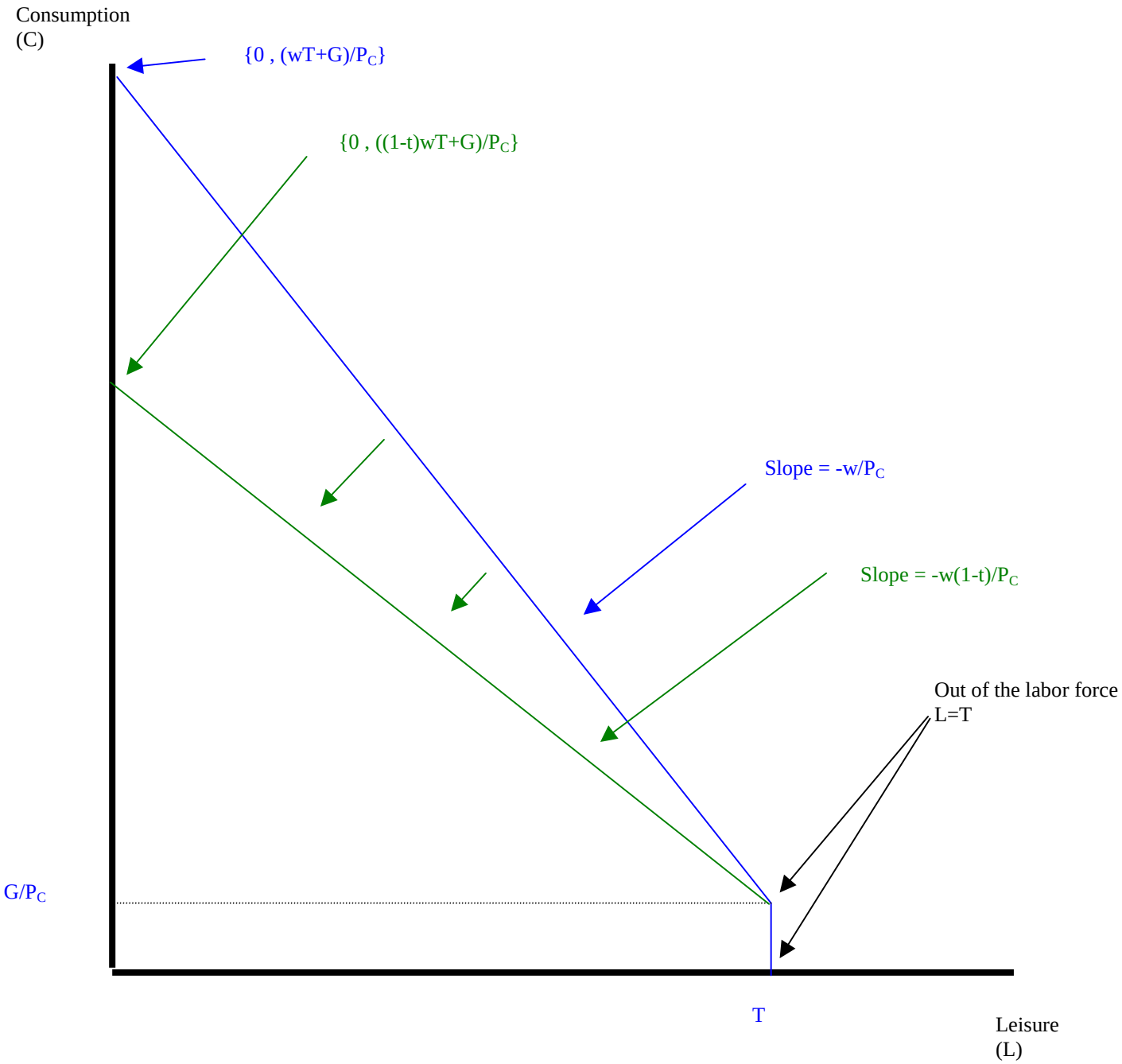
With these indifference curves, the consumer works hours H=T-L*

Figure 5-6 – Out of the labor force



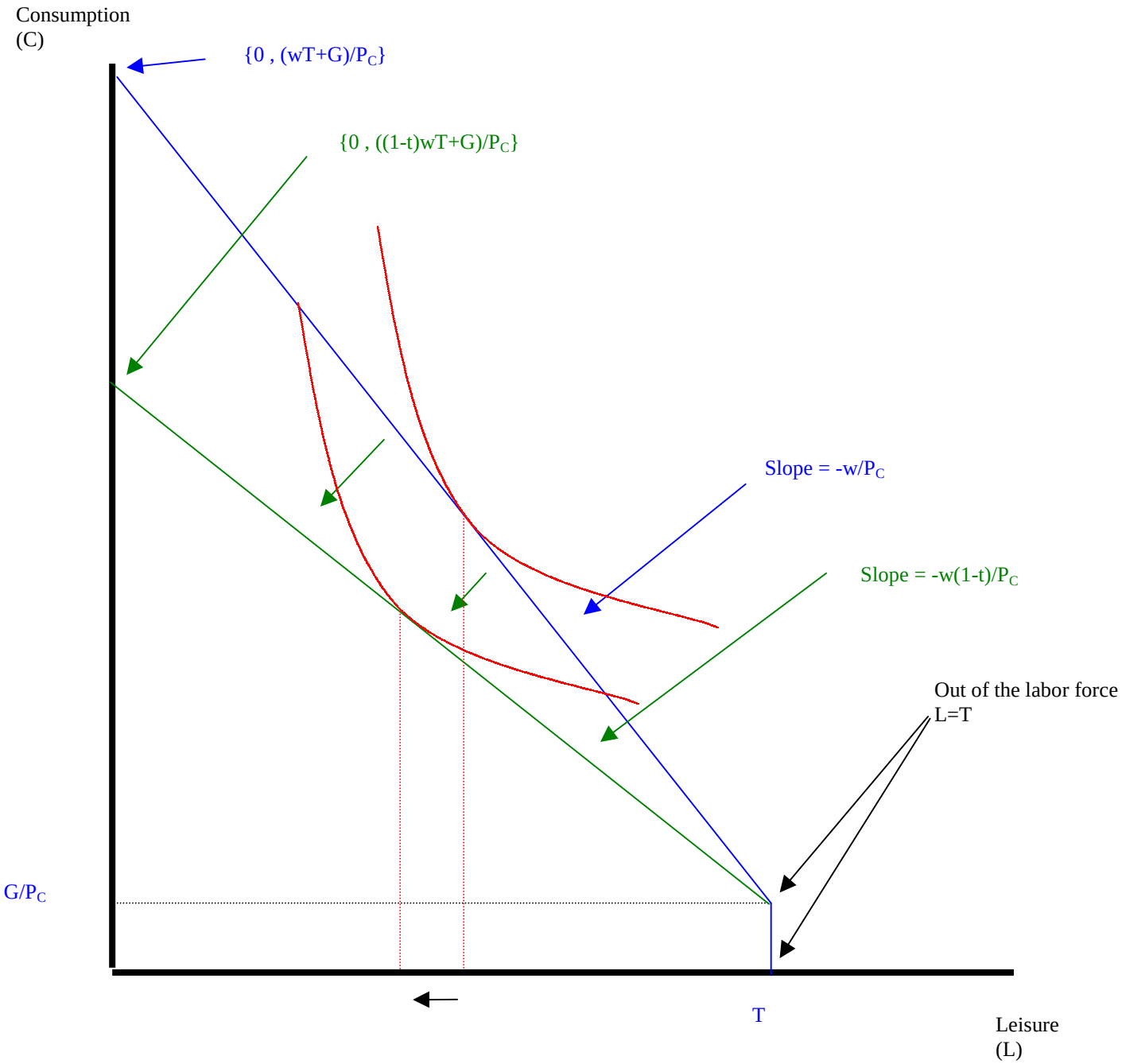
With these indifference curves, the consumer does not work

Figure 5-7 – Add a tax (t) on the wage rate



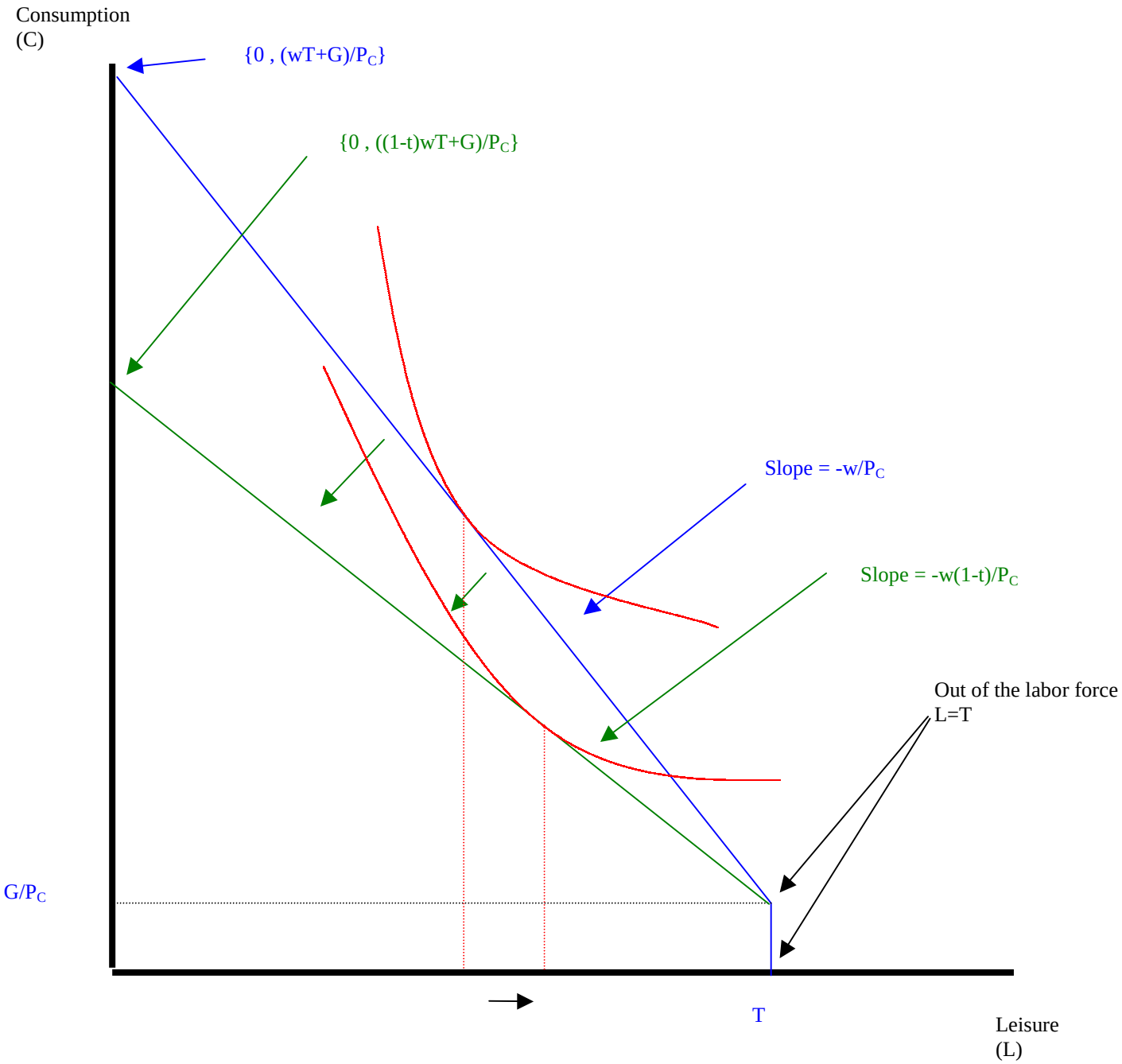
With a tax, does the person work more or less than before ???

Figure 5-8 – Case where person works more than before



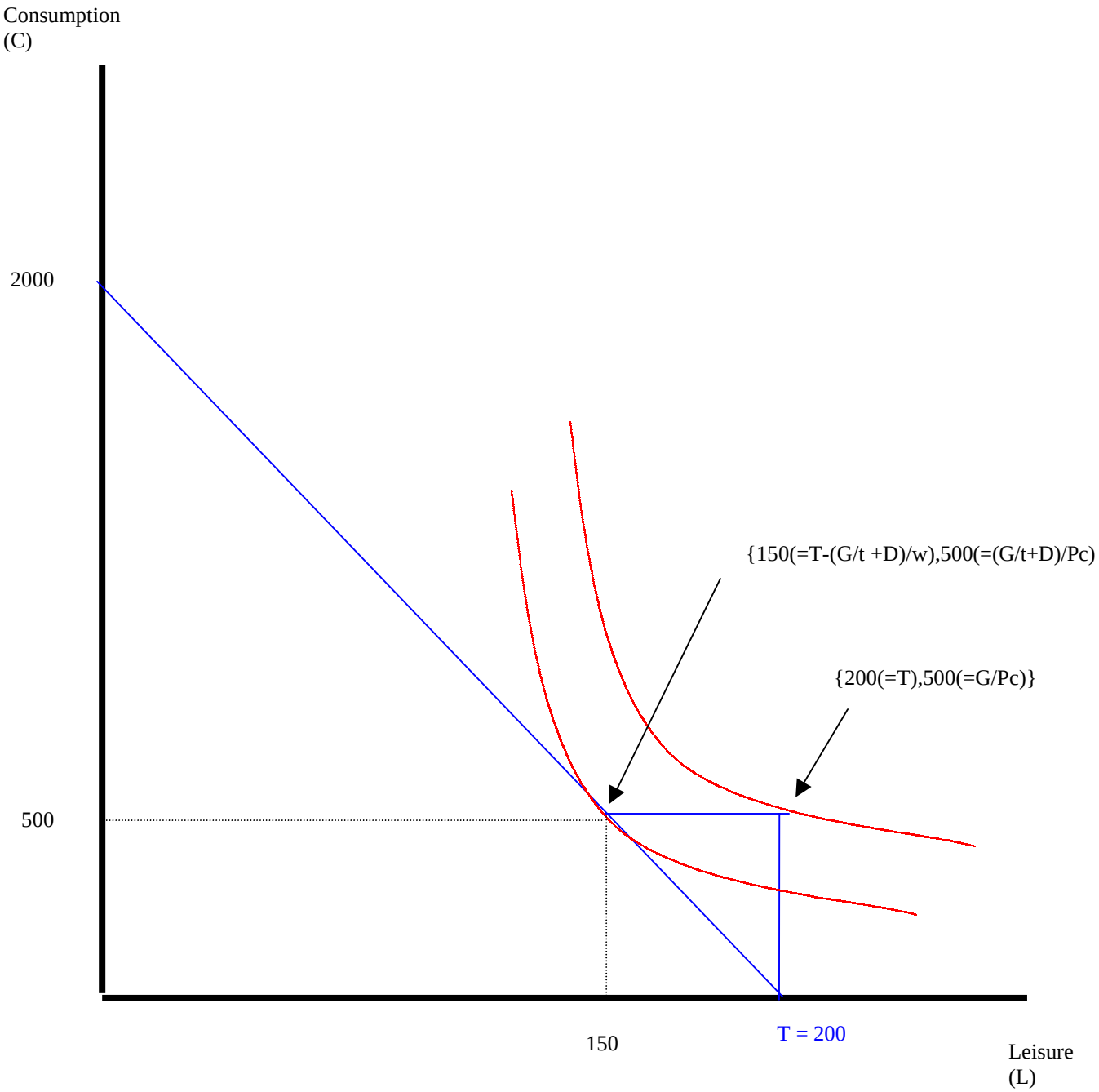
Person gives up leisure with these preferences, works more.

Figure 5-9 – Case where person works less than before



Person consumes more leisure with these preferences, works less.

Figure 5-10 – Sidney's budget constraint



Where is Sidney on welfare? Off welfare? In the labor force? Out of the labor force?

Figure 5-11 – Amanda's budget constraint

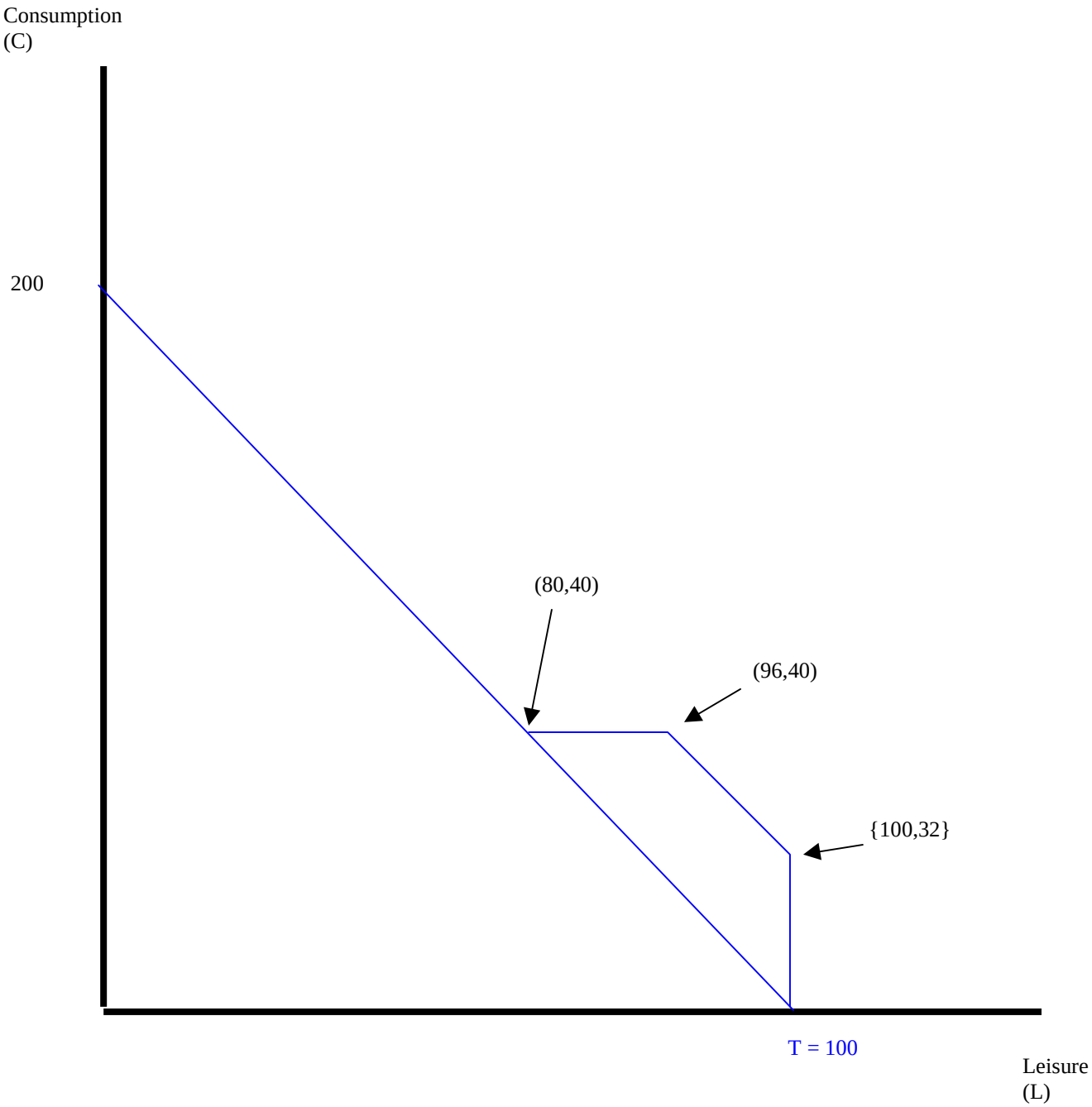


Figure 5-12 – Marge's budget constraint

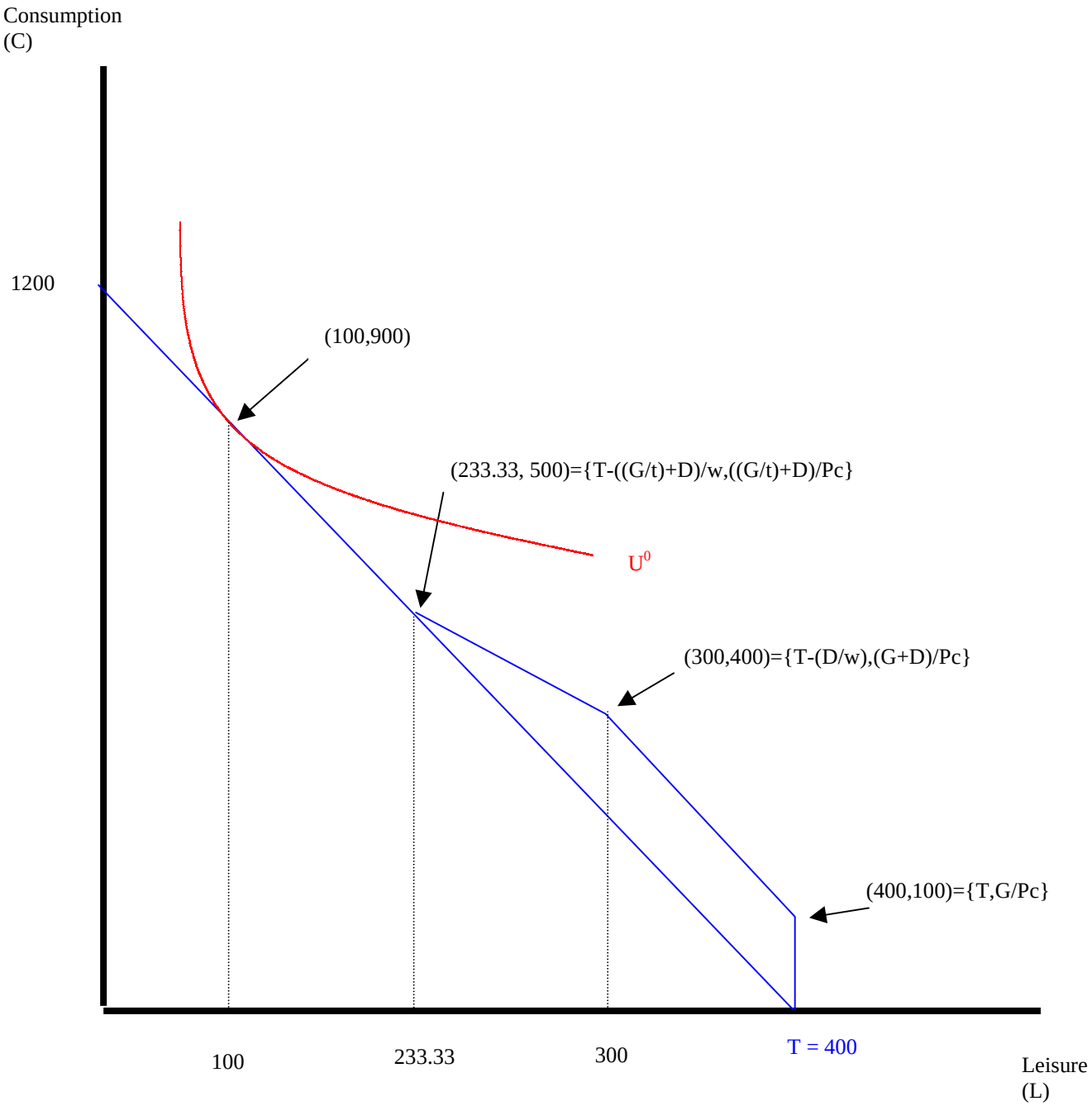
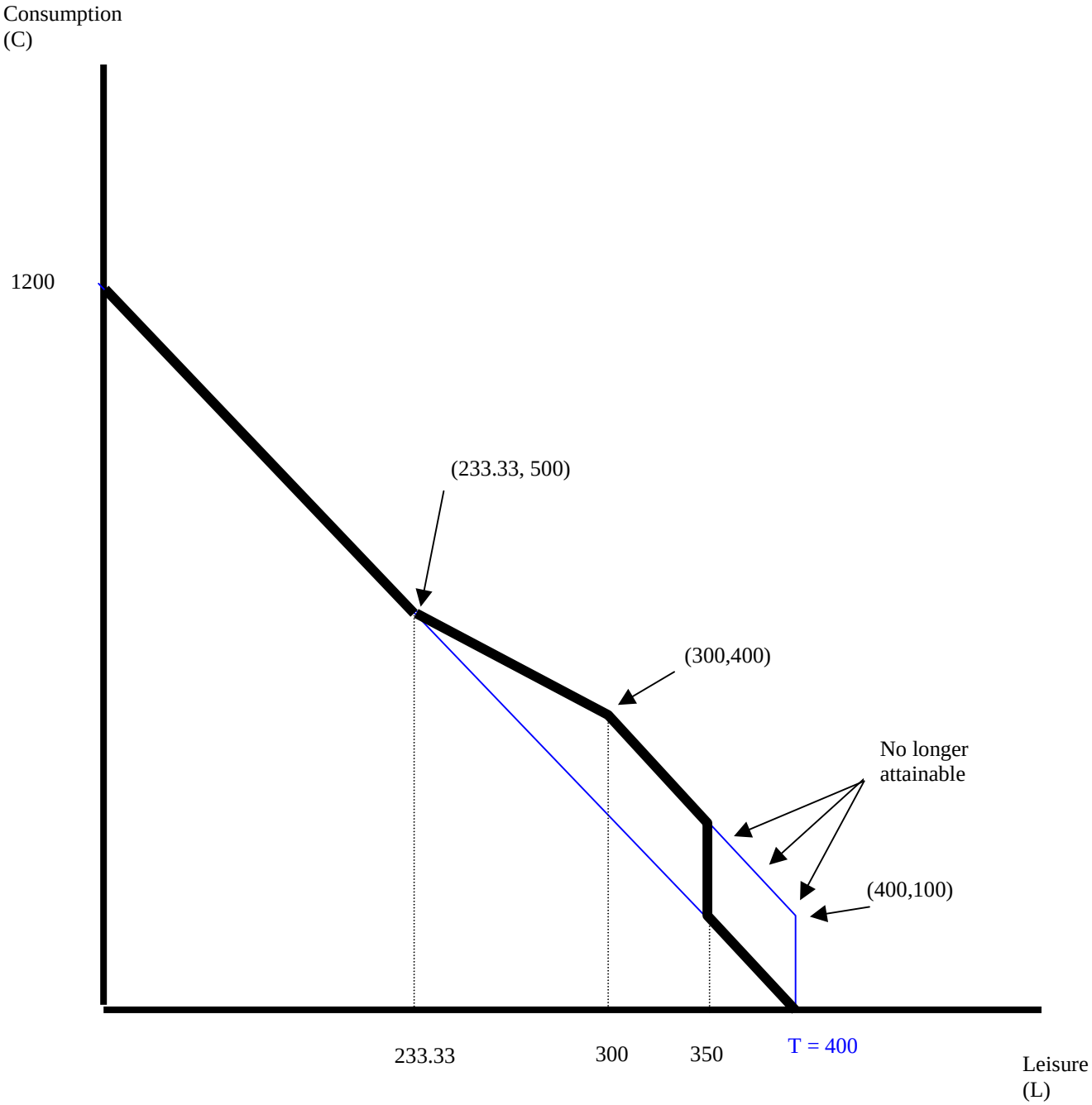
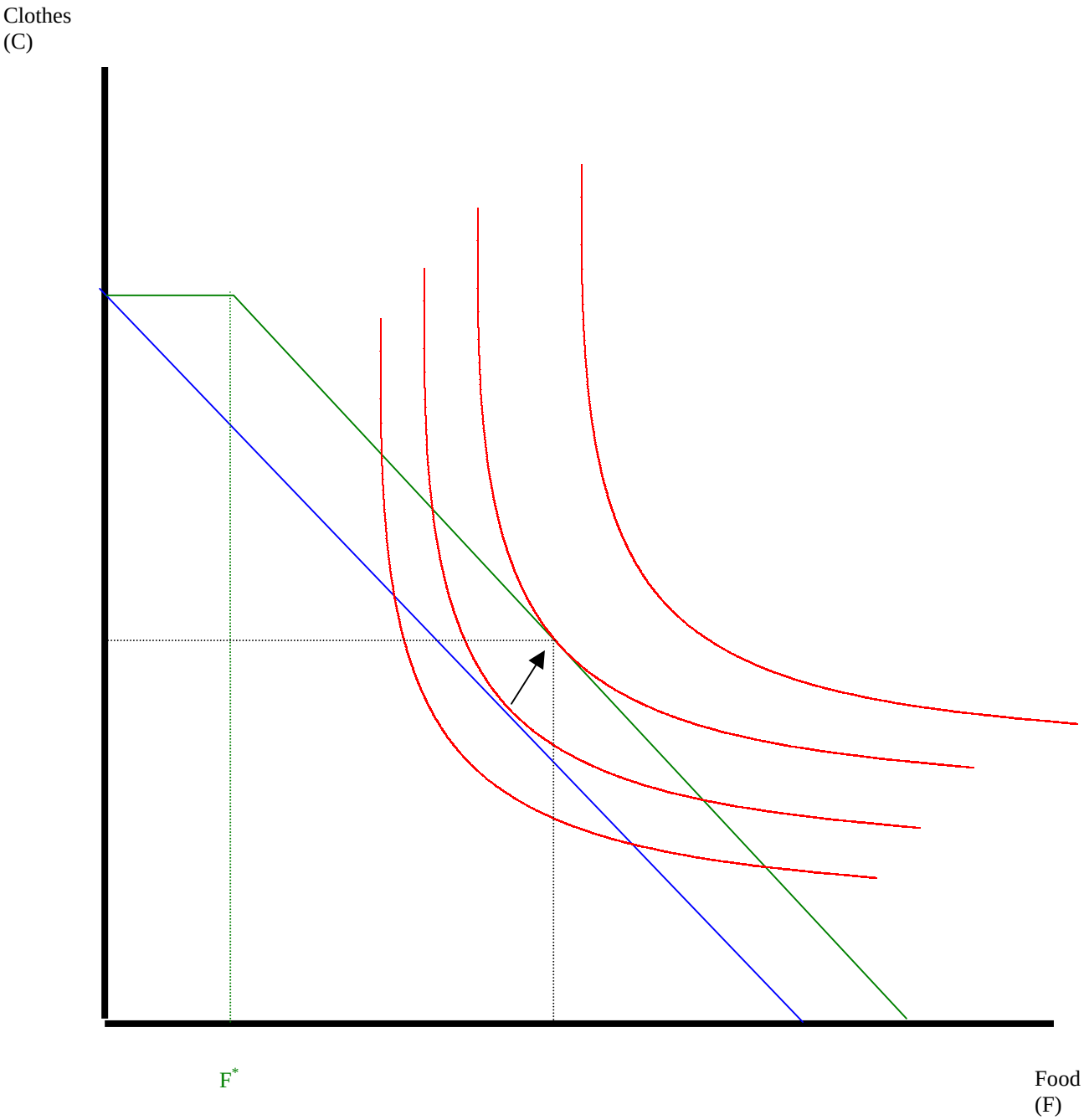


Figure 5-13 – Add work requirements to welfare receipt



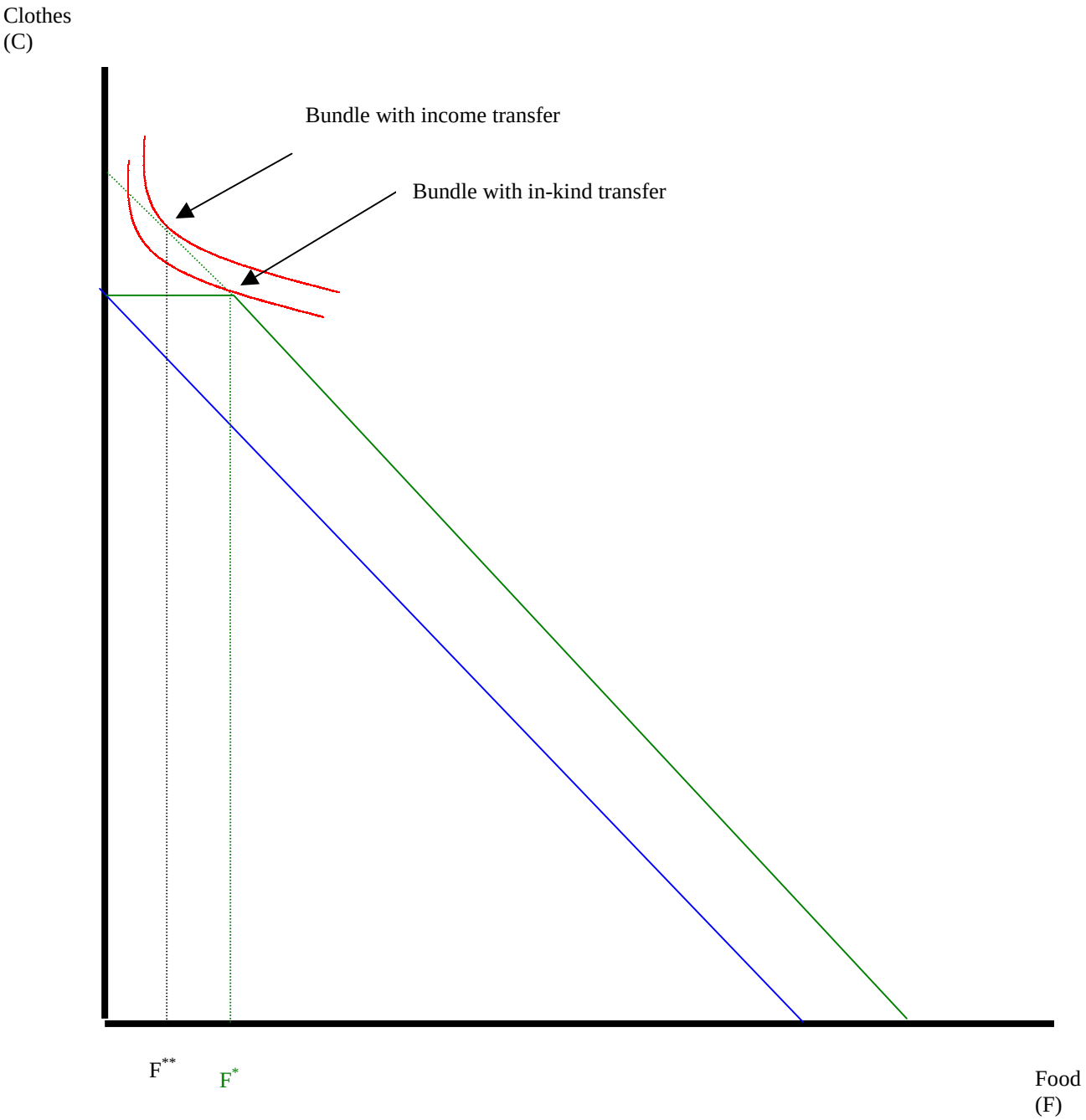
The thick black budget constraint now represents Marge's choices with a work requirement.

Figure 5-14 – Example with no inefficiency from in-kind transfer



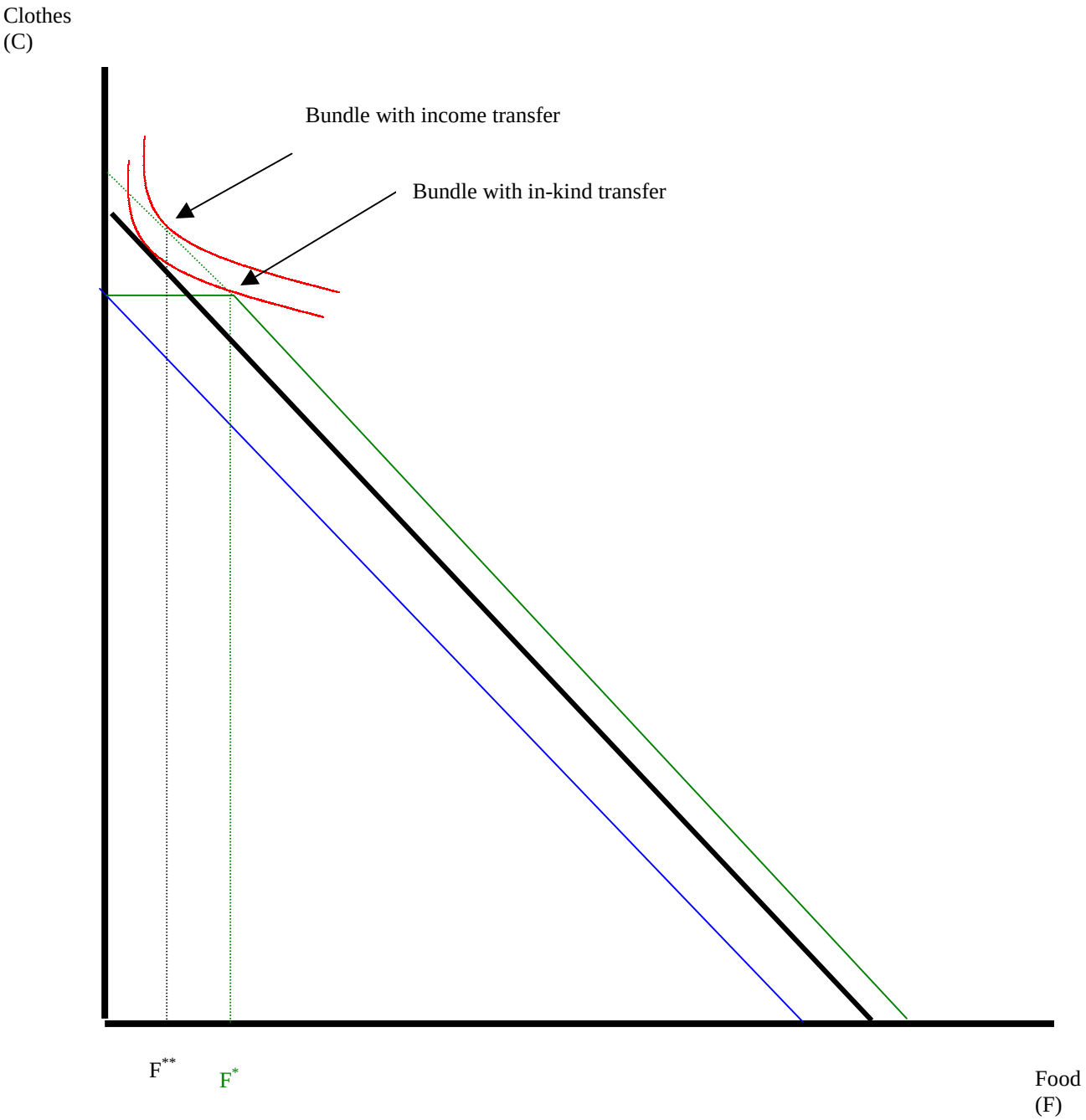
The person consumes more food than the in-kind transfer gives him.

Figure 5-15 – Example where there is inefficiency



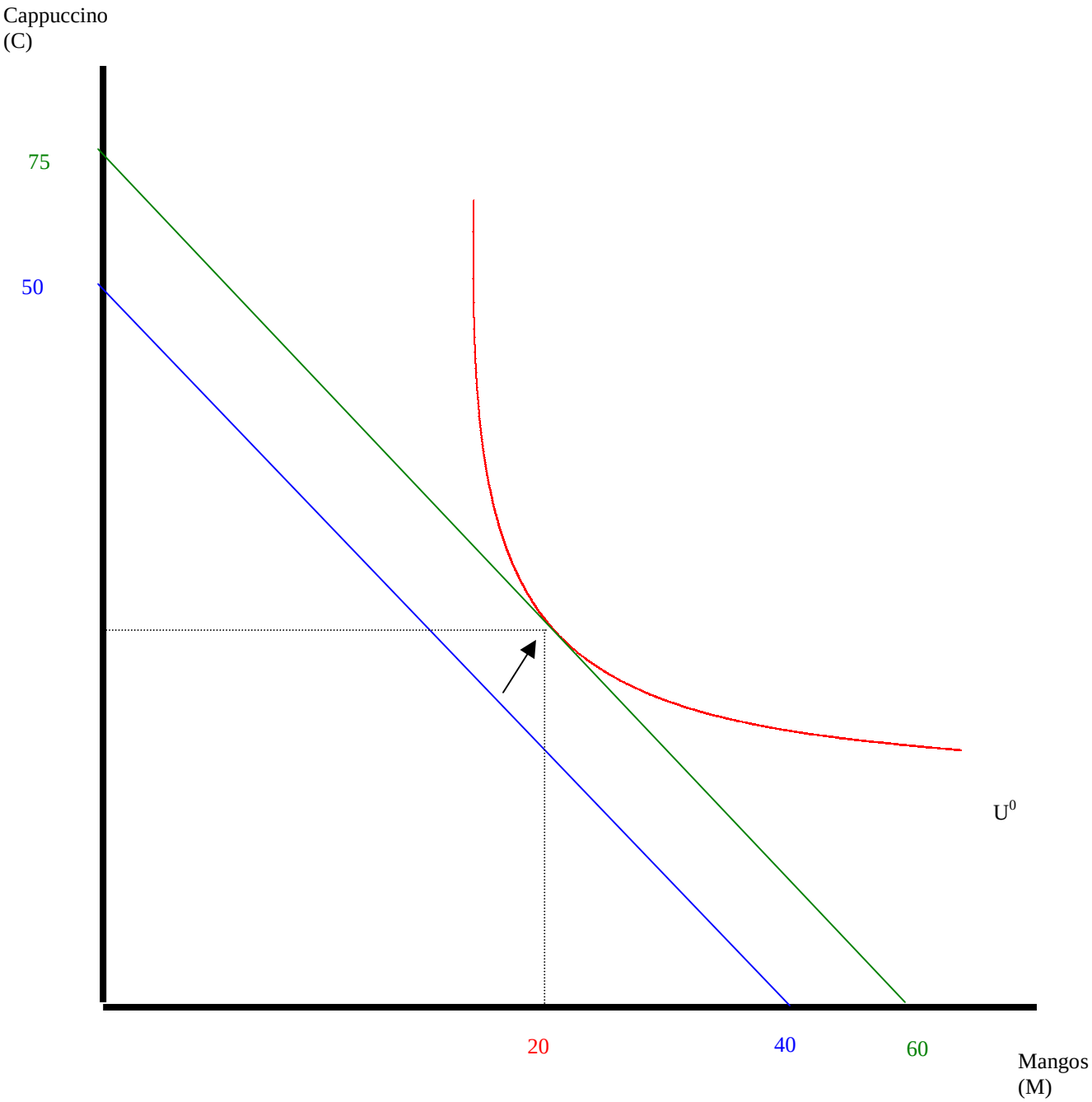
The person would consume less food with an equivalent income transfer

Figure 5-16 – Cash equivalent to in-kind transfer



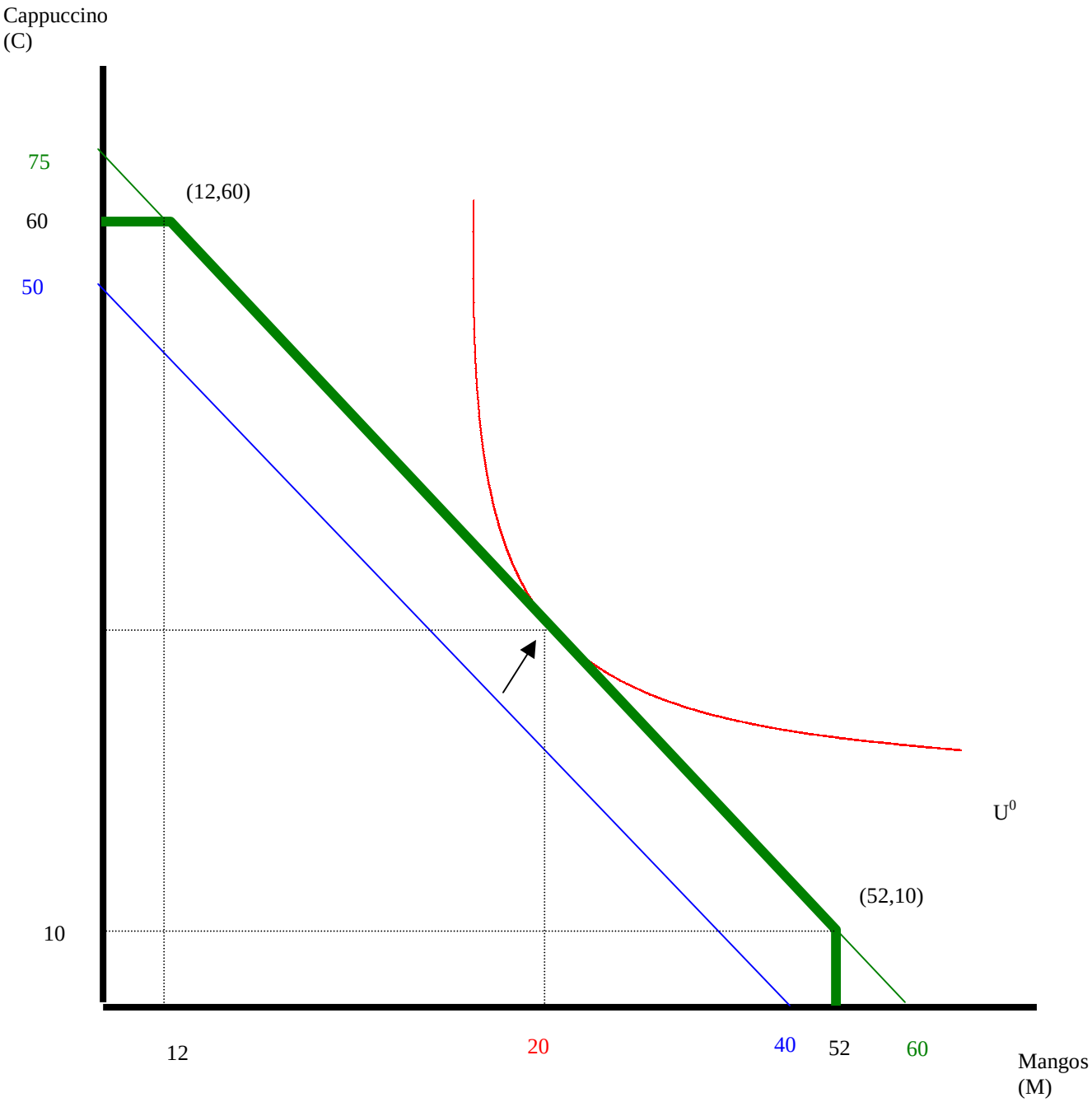
The thick black line represents an income transfer that gives the same utility as the in-kind transfer, and is less expensive.

Figure 5-17 – Kremer's optimization problem with $100 transfer



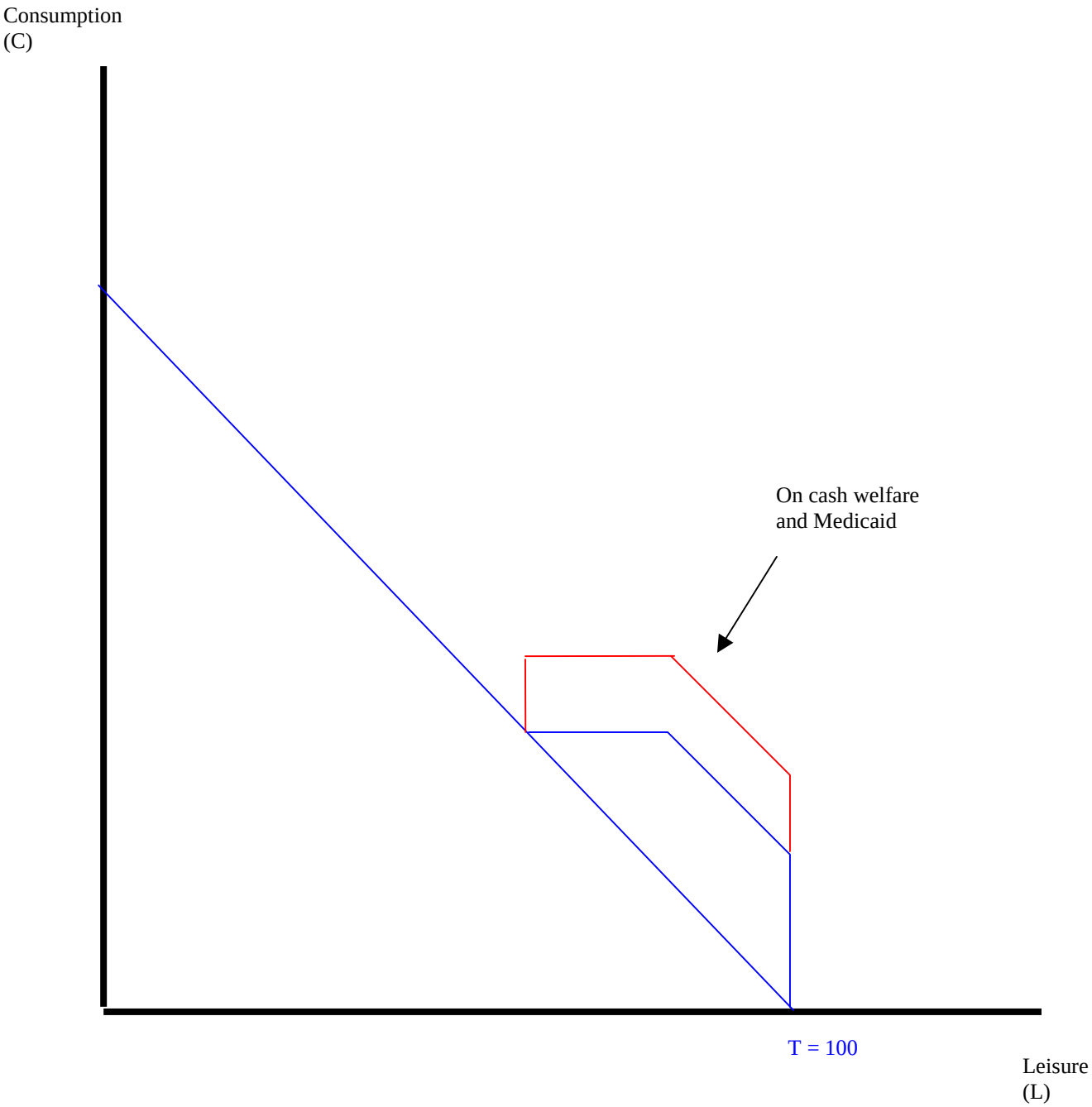
Kremer consumes (20,50) with the income transfer. Not drawn to scale.

Figure 5-18 – Kremer's optimization problem with in-kind transfer



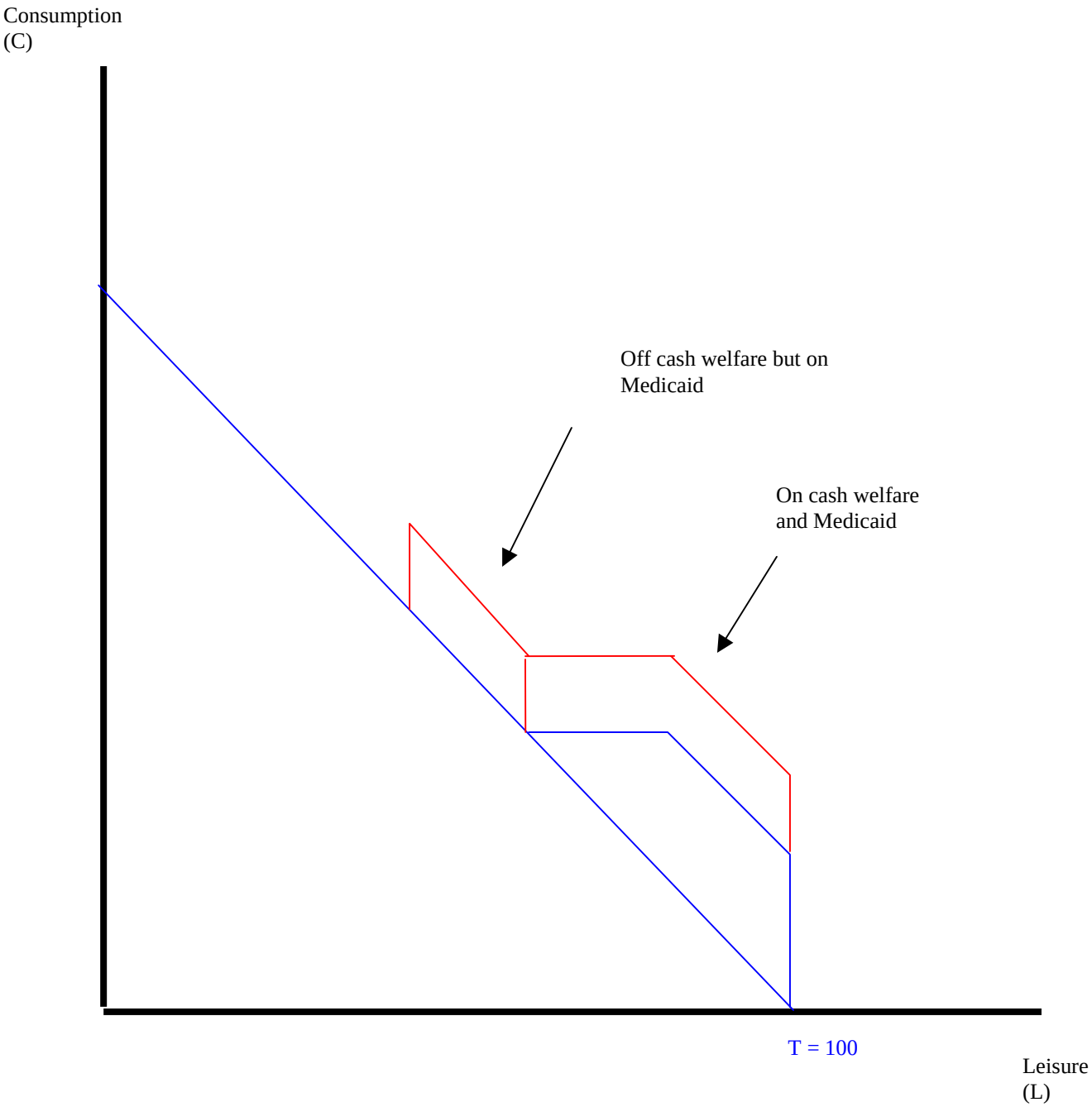
Kremer consumes (20,50) with the income transfer. Not drawn to scale.

Figure 5-19 – Adding Medicaid into the budget constraint



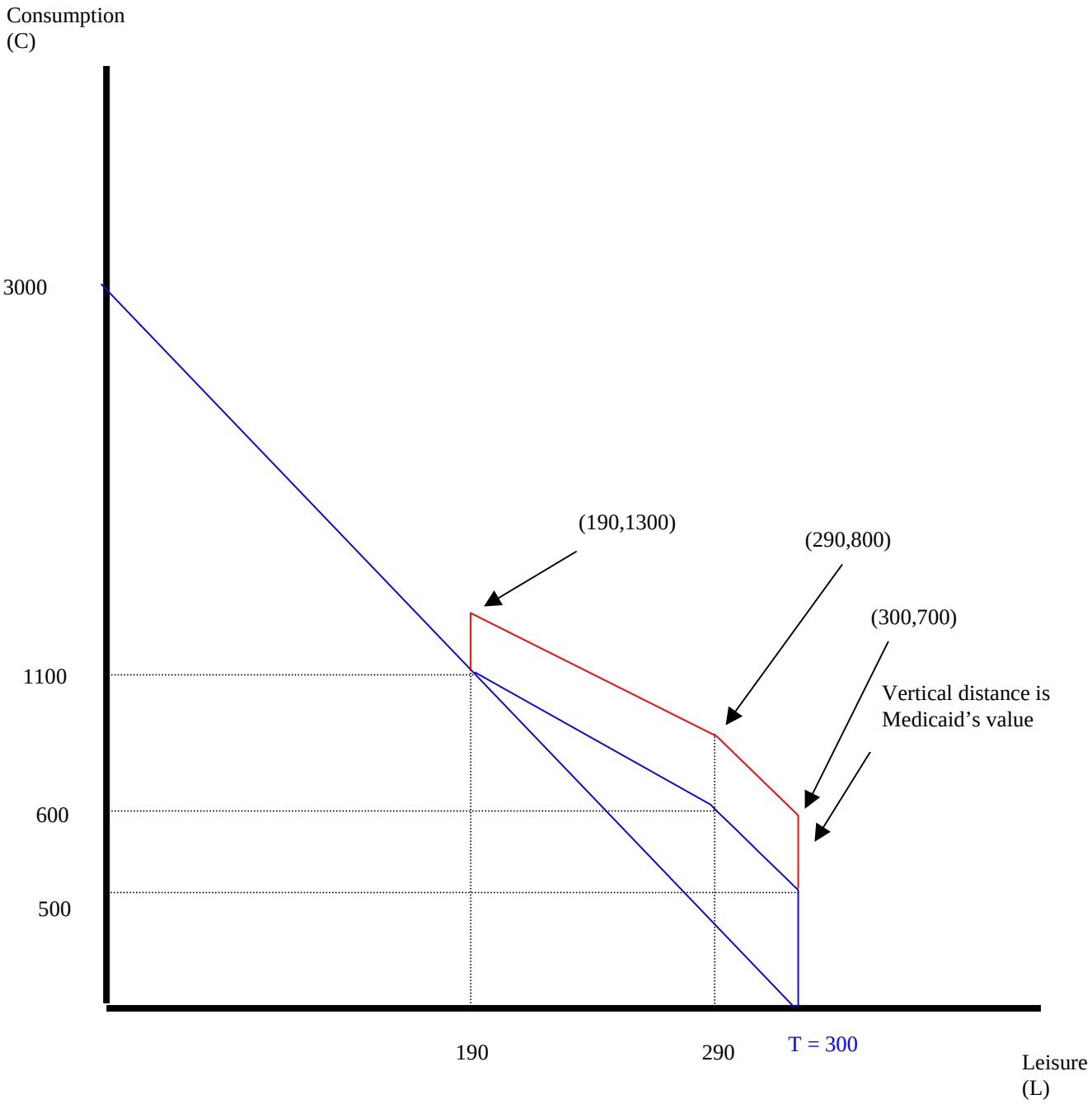
Medicaid is an “all-or-nothing” decision, which creates a tax rate in excess of 100 percent.

Figure 5-20 – Budget constraint after Medicaid expansion



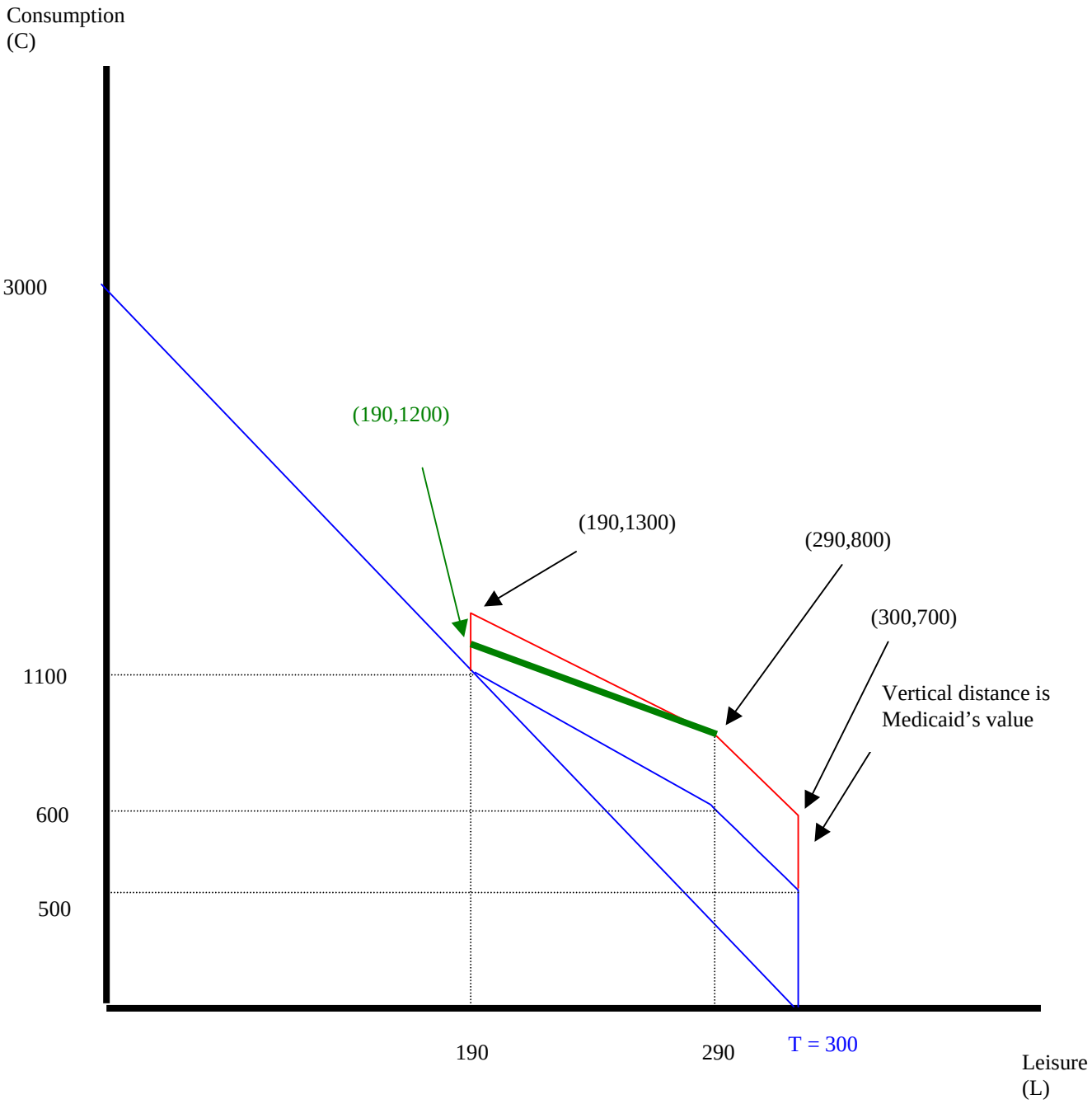
Medicaid is an “all-or-nothing” decision, which creates a tax rate in excess of 100 percent.

Figure 5-21 – Graphing the budget constraint



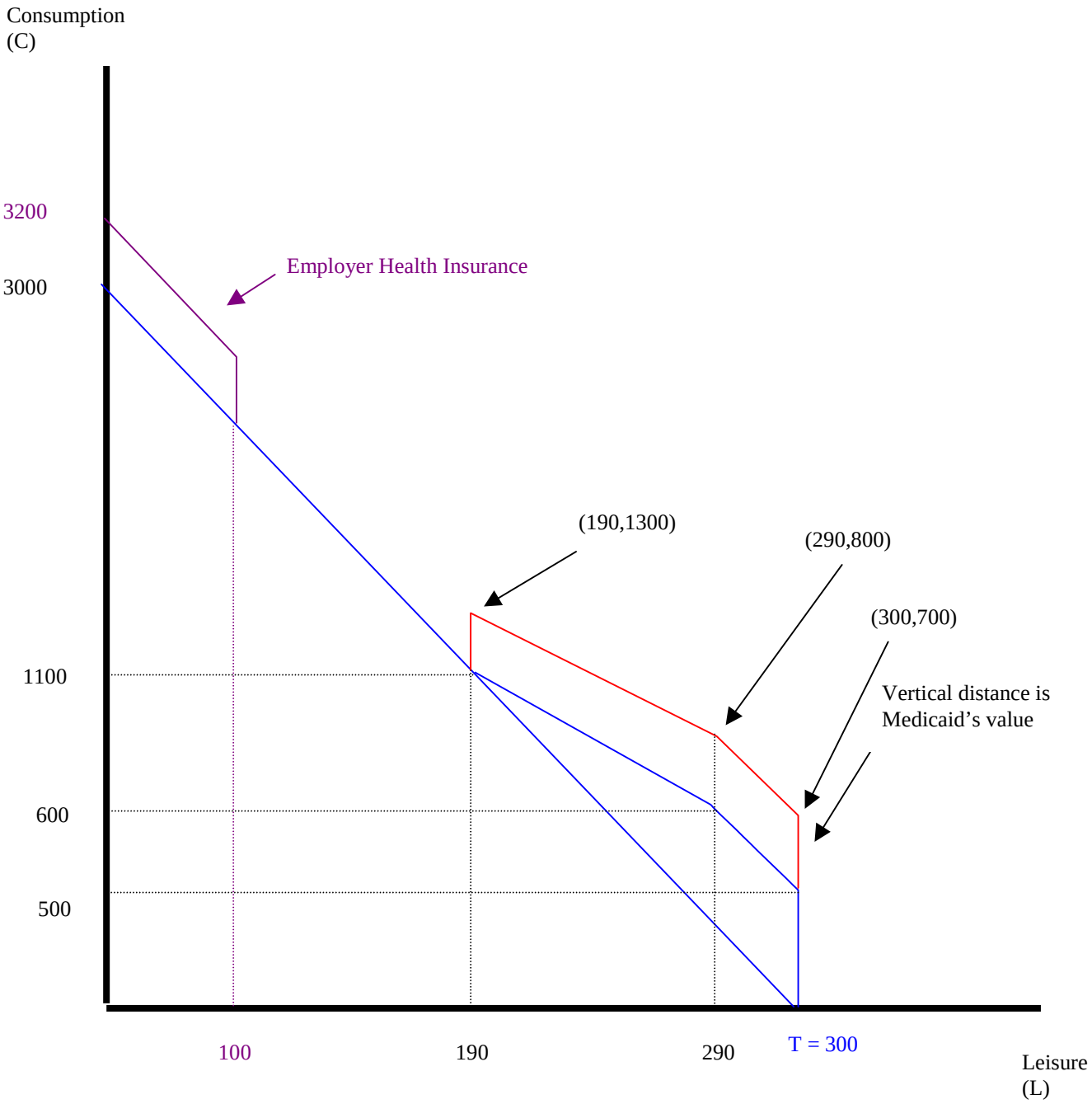
Tax rate is initially 0%, and then it is 50%.

Figure 5-22 – Cost sharing for Medicaid



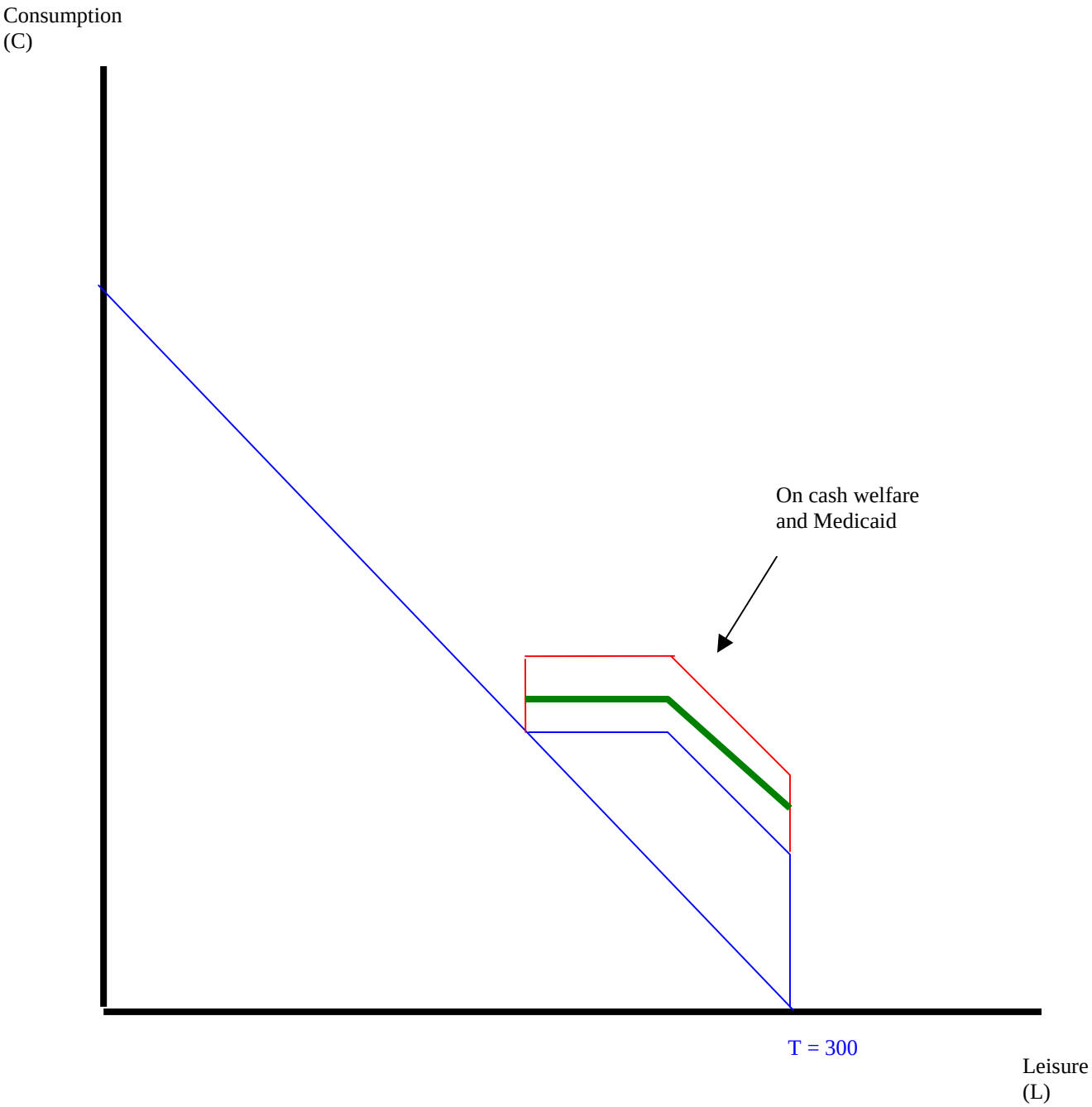
The effective tax rate is now 60%.

Figure 5-23 – Employer health insurance for full time job



For those working less than 200 hours, hours of work increases or remains the same.

Figure 5-24 – Cut Medicaid services by 50 percent



Costs fall by more than 50 percent, because some people will leave AFDC and Medicaid.

LECTURE 6

I. SOCIAL INSURANCE
-definition, examples of Social Insurance
-characteristics:
1. participation is compulsory
2. eligibility and benefits depend on past contributions
3. benefits begin with some identifiable occurrence
4. NOT means-tested

II. FAILURES OF SOCIAL INSURANCE
A. Adverse Selection and Moral Hazard

III. REASONS FOR SOCIAL INSURANCE
1. Paternalism
2. Economies of Scale
3. Redistribution

IV. STRUCTURE OF SOCIAL SECURITY
A. Basic Components
- financing, benefits
-Replacement Rate equation
B. Who benefits?...who doesn't?

V. EFFECTS ON ECONOMIC BEHAVIOR
A. Savings Behavior
1. Wealth Substitution Effect
2. Retirement Effect
3. Bequest Motives
4. Uncertainty about Life
B. Retirement

VI. THE TRUST FUND
A. Facts
CAPITAL ACCUM.= PUBLIC SAVINGS+PRIVATE SAVINGS

You may want to review the following problems:

Midterms
Fall 1997, Question 3

Finals
Spring 1995, Question 3
Fall 1995, Question 6
Winter 1996, Question 6
Spring 1999, Lecture 2, Question 6
Fall 1999, Lecture 1, Question 4

I. Introduction

A. Insurance is used as protection against bad outcomes – you pay premium and then receive benefits in adverse circumstances.

B. This not only occurs in private markets – the federal government also replaces income losses that are outside of personal control through social insurance. These programs include: Social Security, Medicare, Unemployment Insurance, Disability Insurance, and Workers Compensation.

C. Characteristics of social insurance programs:

1. Participation is compulsory.
2. Eligibility and benefits depend in part on past contributions.
3. Benefits begin with some identifiable occurrence such as unemployment, illness, injury, or retirement.
4. The programs are not means-tested.

II. Why have social insurance?

What market failures cause the fundamental welfare theorem to fail?

A. Adverse selection and moral hazard

- Private markets for insurance may fail to emerge. One important example could be health insurance coverage for specific ailments such as AIDS. Why? We can expect an individual who knows he is likely to collect benefits to have an especially high demand for insurance, which is known as "adverse selection." Even with rigorous testing, the individual still probably has better information than the insurer. Therefore, only the high risks takeup the insurance, so the plan loses money if it is set for the whole population. Therefore, increase premium, but this in turn exacerbates adverse selection.

- Another example could be "grade insurance." Suppose your professor offered you the following insurance plan: if you receive a grade of C- or below, your grade will be brought up to a C. On the other hand, your grade will be lowered by half a grade if you get a C+ or better. That is, if you get deserve to get a B+, you will be

awarded a B. If you deserve to get an A, you will get an A-. First, who would take up this plan? Many of the students who expect a low grade would take it up, while those who expect a higher grade would not. That is adverse selection. Second, the presence of insurance could change the student's behavior – why bother studying if the lowest grade one can receive is a C? This second effect is called moral hazard.

B. Other justifications

1. Paternalism: people may not be farsighted enough to buy sufficient insurance for the own good and therefore the government must force them to. For example, people might not save enough for an adequate retirement. Also, individuals who can opt out of a social insurance program may believe that if they put themselves in a sufficiently desperate situation, society will feel obliged to come to their aid. This gaming of the system could be perceived as an externality if society cannot refuse to give care.

2. Economies of Scale: if there is a sense of a "right" insurance policy, could be cheaper to provide it through one big body.

3. Redistribution: Although they are not welfare programs, the link between some programs to previous contributions quite weak.

III. Structure of Social Security

Officially "OASDI" – Old Age, Survivors, and Disability Insurance. Largest single domestic program in terms of dollars spent.

Structure:
- during working life, the employee and employer pay contributions through a payroll tax.
- when the employee retires, he or she collects benefits as a function of previous contributions.

A. Basic Components:

1. *Why go through all these details?*

When we discussed welfare programs, we avoided a lot of the numbers. But very few U.K. students will ever be on welfare. Virtually all students will collect Social Security someday, and everyone pays into the system through the payroll tax. Thus, you should be more self-interested in Social Security.

2. Partially funded financing

How do we pay for Social Security? When it started out, it was fully funded – a person would pay into the system, the deposits would accumulate interest, and the benefits would be paid out upon retirement.

The system quickly turned into pay-as-you-go system, meaning the benefits of current retirees come from current workers. Each generation of retirees is supported by payments made by current generation of workers, not by drawing down an accumulated fund.

In 1983, the Social Security Trust Fund (SSTF)was created, with purpose of supporting baby boom's retirement (people born from 1945-1964). It currently has substantial surpluses, because this group has not reached retirement age. SSTF means that current contributions from baby-boomers also going for their future retirement. Therefore current system is neither fully funded nor pay-as-you-go.

3. Benefit structure

Benefit level, B=f(earnings history, age, other personal circumstances)

> Step 1: Calculate average indexed monthly earnings (AIME) – average wages (indexed for inflation) over the length of his/her working life. There is a ceiling, so someone earning $1,000,000/mo has same AIME as someone earning $2,000,000/mo. Also lowest five years of earnings may be dropped, which implies that the contributions while young (when wages tend to be low) may not count.
>
> Step 2: Substitute AIME into benefit formula to find primary insurance amount (PIA), which is basic benefit amount for worker who retires at 65.

$0 < \frac{\partial PIA}{\partial AIME} < 1$, that is benefits increase with contributions, but not one-for-one.

For person turning 65 in 1993 (the "normal" retirement age), PIA is:
90% of first $401 of AIME
32% of AIME between $402 and $2,420
15% of AIME above $2,402 up to the maximum.

Those with low wages get a payout that is a larger proportion of their previous earnings than those with high wages. For a "low earner," the replacement rate is around 60% of earnings, for "high earner" the replacement rate is 25%.

Step 3: Age at which benefits are drawn
- can retire as early as 62 (but benefits are reduced by 20 %)
- benefits increased if retire after 65
- Starting in year 2000, retirement age (for full benefits) gradually increased.

Age To Receive Full Social Security Benefits

Year Of Birth	Full Retirement Age
1937 or earlier	65
1938-1942	65 + (Birth Year - 1937)*2 months
1943-1954	66
1955-1959	66 + (Birth Year - 1954)*2 months
1960 and later	67

Source: http://www.ssa.gov

- the normal retirement age for most U.K. students will therefore be 67.

Step 4: Family status

- Fully insured retired worker retires at 65, benefit equals PIA.
- If the worker has a dependent wife, husband, or child, another 50% is added to the PIA. That is, the benefit may be increased dramatically.

Step 5: Outside earnings

- For a person collecting OASDI benefits, there is an "earnings test" In 1993, for those between 65 and 69, earnings in excess of $10,560 reduced social security benefit by one-third. Does not apply to those over age 70.
- Up to 85 % of OASDI benefits received by individuals whose incomes exceed certain amount subject to federal income tax. $34 K for single, $44 for married.
- Note that this changes the budget constraint in {Leisure, Consumption} space.

Step 6: Benefits are indexed for inflation

In the past year there has been heated discussion about changing the CPI (consumer price index). The argument revolves around whether the CPI accurately measures inflation – it does not really account for changes in quality of goods (very important for electronics and computers), and it does not account for changes in tastes (for example, consumers in the U.S. eat less red meat and smoke fewer cigarettes than 30 years ago) in a very satisfactory way. Why is this related to Social Security? Changing (reducing) the measured inflation rate lowers government expenditures on Social Security – by many billions of dollars. Implicitly, CPI changes amount to a reduction in the real Social Security benefit level.

4. Financing

Government raises money through a payroll tax, a flat percentage of an employee's annual gross wages up to a certain amount.

On paper, one-half of tax paid by employee, one-half by employer. However, employer may be able to shift part or all of their share of their

share to the employee in the form of a lower pre-tax wage. It is unlikely that true division of costs is really split equally.

Payroll taxes have grown over time (as have benefits and expenditures). It is currently 6.2% on employer and employee (12.4% altogether). There is also payroll tax on Medicare (health insurance for the elderly) of 1.45% for both employee and employer. These two taxes combined amount to 15.3%.

B. Distributional Issues

Some generations and income groups benefit from OASDI, others are clobbered by it.

How do we figure this out? Several steps:

- calculate Social Security wealth: how much benefit is the worker entitled to?
- lifetime costs of payroll taxes paid

Generally younger cohorts do not benefit very much, as do higher income earners. Also, women gain more than men because longer life expectancies. Since African-Americans have shorter life expectancies, they lose. Married people with non-working spouses gain more than single people, because of 50% of AIME and survivors benefits. One earner couples benefit more than two earners, because second person's earnings are subject to payroll taxes but it does not increase OASDI benefit very much. Smokers lose because they die sooner.

C. Economic Status of the Aged

Poverty rate for elderly has fallen dramatically. In 1970, they were a disadvantaged group, now their poverty rates are lower than the general population.

At same time, the elderly are working less . . . labor force participation among elderly men has fallen from 27% in 1970 to 16% in 1992.

Elderly widows have not fared very well, however. Many widows live in

poverty.

IV. Effects on Economic Behavior

A. Savings Behavior

- Saving decisions are based on lifetime considerations. During their working lives, individuals save some portion of their incomes to accumulate wealth from which they can finance their retirement.

- Social Security can alter lifetime savings. Why?

1. In exchange for their contributions, a person is guaranteed a retirement annuity. Thus, one would save less on their own if Social Security does saving for them. This is called the "wealth substitution effect."

2. Social Security may induce people to retire earlier than they would have. There is a "spike" in retirement rates at age 65. By retiring earlier, there is a longer amount of time which need to finance retirement; this increases saving and is called the "retirement effect."

3. Bequest motives – If parents want to leave bequests to children, and realize that Social Security redistributes across generations, they may increase bequests to mitigate intergenerational inequities. This "bequest effect" would increase savings.

- These three effects go in different directions, one must go to data to resolve how important Social Security is for saving.

- Draw budget constraint with consumption during working years and during retirement. How does Social Security affect saving decision? Price equals the market interest rate. $U = U(C_1, C_2)$.

***** SEE FIGURE 6-1 *****

Feldstein (1974): wealth substitution effect dominates bequest/retirement effects. Social security wealth increases current consumption, and crowds out savings. But numbers are controversial.

B. Retirement (labor supply)

- Labor force participation of elderly men has declined over time. More women have entered the labor force, however.

Year	1930	1950	1992
Fraction of elderly men in the labor force	54%	41%	16%

- Compared to working, Social Security provides good replacement rates. One example in Rosen's textbook shows that after account for interactions of Social Security with the tax system, earning another $1 increases income by 23 cents.

- Some studies conclude that Social Security may have accounted for one-half the increase in the retirement rate of older men. However many variables are unaccounted for and are difficult to measure, such as health status, local labor market conditions, and wealth from pensions.

V. The Trust Fund

A. Some Facts

- It was motivated by fact that there are 74 million people born between 1946 and 1964, or 30 % of population. Currently there are 3.3 workers per retiree, by 2030 will be about 1.9 workers per retiree.

- Payroll tax is currently 12.4%; it would increase to 33% if government continued on a Pay-As-You-Go system.

- Currently revenue from payroll taxes exceeds the benefits paid out, but there will be shortfalls in future. The trust fund will grow until 2025 (when it will reach $4.9 trillion), and will be exhausted by 2040 (around time that you will retire!!!).

B. Does the Trust Fund make sense?

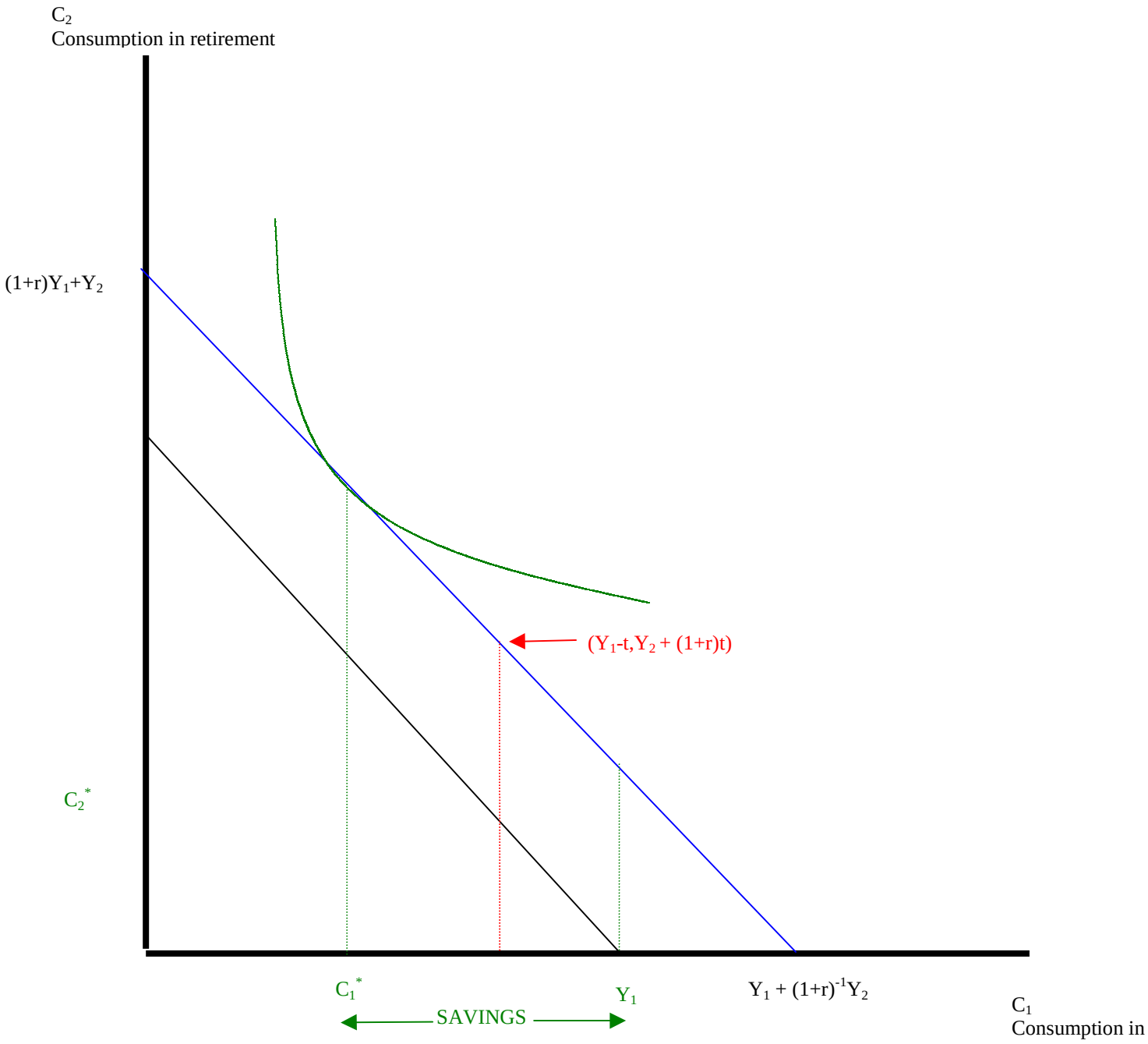
- *Will it increase the current capital stock? Are the surpluses being used to finance investment?*

- The trust fund can only invest its money in federal debt, it cannot buy stock in firms that invest in plant and equipment. BUT this does mean that less private sector money is needed to finance the debt, frees up that money to invest in private sector.

- CAPTIAL ACCUM=PUBLIC SAVINGS + PRIVATE SAVINGS

- Between 1983-1990, the surplus in Social Security counted as revenue for computing deficit. It made the deficit look artificially small during that time period. There were fears that with a smaller official deficit, government expenditures would increase (less political concerns) and that the taxes would essentially be financing current consumption.

Figure 6-1 – Consumption in the future is just another "good"



The price of consumption in the future is divided by the interest rate, r.

LECTURE 7

I. WHAT'S SPECIAL ABOUT HEALTH CARE?

II. WHAT MARKET FAILURES EXIST IN THE HEALTH CARE SYSTEM?

1. Poor information
2. Adverse Selection and moral hazard
3. Paternalism

III. THE U.S. HEALTH CARE MARKET

A. Health expenses

B. Employer provided insurance

*Effect on Labor Supply:

1. Job lock
2. Welfare lock
3. Early Retirement

Example 1

C. Cost based reimbursement

Capitation based reimbursement

IV. THE ROLE OF GOVERNMENT

A. Medicare

1. Structure of Medicare
2. Bankruptcy
3. Cost Containment Measures

B. Employer Health Insurance – not taxed

V. ACCESS AND COST

*Why are costs rising?

1. The population is Aging
2. Income Growth
3. Third-party payments
4. Improvements in quality

VI. RECENT CHANGES IN THE HEALTH CARE SYSTEM

A. HIPPA

1. Portability of Health Insurance

2. Deductions for the self-employed
3. Medical Savings Accounts (MSA)

B. Future Changes

You may want to review the following problems:
Midterms
Fall 1997, Question 3

Finals
Winter 1995, Question 5
Fall 1995, Question 5
Spring 1995, Question 5
Fall 1996, Question 5
Spring 1999, Lecture 1, Question 6
Fall 1999, Lecture 2, Question 4
Fall 1999, Lecture 2, Question 6

I. WHAT'S SPECIAL ABOUT HEALTH CARE?

Health care is an important commodity, but so are food and housing. Much more attention is given to health care, however. Perhaps this is because government spending on health care is more than $300 billion (between Medicare and Medicaid).

Health care expenditures were 7.4% of GDP in 1970, and are greater than 14% now. Should we be concerned that people are spending more on this commodity? People spend more on personal computers, CD players, etc., than in the past yet there is no discussion about government intervention in those markets. Medical inflation has slowed down since 1994, but it still outpaces the general consumer price index (CPI).

Year	General CPI	Medical CPI
1970	100	100
1975	138	144
1980	212	231
1985	277	350
1990	336	503
1991	351	548
1992	361	589
1993	372	628
1994	381	660
1995	392	694
1996	404	719

Source: Economic Report of the President, 1997

This table illustrates that price levels increased by approximately a factor of four, for general goods and services between 1970 and 1996; for medical services, it increased much faster, by approximately a factor of seven. From 1990 to 1996,

general price levels increased by 20.2% (which is equal to $\frac{404}{336} - 1$). Medical inflation was approximately double that number, 42.9%.

What market failures exist in the health care system?

A. Poor information

- Patients may not have a good sense of what medical procedures are appropriate. Patients tend to rely on advice from physician who is selling the commodity. Could lead to "physician induced" demand. Of course, a patient could consult another doctor before making a decision on getting medical treatment.

B. Adverse selection and moral hazard

- Health care costs can be uncertain and large, which implies that insurance is appropriate and can improve social welfare. But several complications arise.

- *Adverse selection:* When company sets an insurance rate for groups of people, those individuals within the group who have the highest risk for sickness will tend to buy it. The average buyer of insurance has a higher risk than the average person in his/her group. If the company sets the premium for the population, it will lose money if coverage is less than 100%. People who value health insurance if it could be provided at lower price (i.e. low-risk individuals) forego the insurance.

How can government intervention eliminate the adverse selection problem? By forcing people to join the insurance pool.

- *Moral hazard:* The presence of insurance distorts other behavior. A person may take less care to avoid risks (this seems less likely with health insurance, however). More importantly, people have incentive to "over-consume" health care because insurance pays all or part of the cost.

C. Paternalism

- People may lack foresight to buy insurance and hospitals can't turn away people in need

II. THE U.S. HEALTH CARE MARKET

Health care comprises 14% of GDP, and spending is more than $1 trillion annually. Hospital spending is 39%, physician spending is 18%. Other categories include nursing homes, and prescription drugs.

A. Private Insurance

- 22% of health expenses paid out-of-pocket,
- private health insurance pays for 32%, government 43%, rest from other sources like charity.

B. Employer provided insurance and the labor market

Employment is the leading source of health insurance coverage.

Most people (70.2 %) were covered by a private insurance plan for some or all of 1996. A private plan is one that was offered through employment (either one's own or a relative's) or privately purchased. Almost all private insurance was obtained through a current or former employer or union (that is, was employment-based).

This link between health insurance and employment has at least three consequences on an individual's labor supply decision:

1. Job lock
2. Welfare lock
3. Early retirement

1. Job lock: 90% of private health insurance provided through employers to employees. The reason why is that non-wage benefits such as health care not subject to income taxes. But this link to employment means that one leaves a job, he or she loses health insurance.

Policy Question: Does this deter job mobility, that is, do people stay at

a job that they would otherwise leave because of losing health insurance (and are unable to purchase a new policy because of "pre-existing conditions" clauses?

Evidence is mixed, but much anecdotal evidence.
A study by Brigitte Madrian (Quarterly Journal of Economics, February 1994) compares job mobility rates for those with high and low expected medical costs.

- Husbands with and without pregnant wives. The intuition behind this comparison is that families who are expecting a baby have a large, anticipated cost ahead of them, and a new insurance policy would not cover this "pre-existing" condition.
- Big versus small families. The intuition here is that big families have higher expected medical costs, and family coverage usually does not adjust the price for dependents. Bigger families therefore get a larger implicit subsidy from insurance.
- Following individuals with and without health insurance over time.

- Madrian (1994) finds that losing health insurance reduces job mobility rates by 25 % (4 percentage points). That is, without losing health insurance, job mobility is 16% per year, with health insurance, job mobility is only 12%.

2. Welfare lock: Medicaid and AFDC.

Medicaid was the most widespread type of coverage among the poor. About 45.5 % of all poor people were covered by medicaid at some time during the year. In the lectures on welfare, we went through the incentives of the Medicaid program on AFDC participation; you may want to refer to those lectures (and associated readings) for a discussion.

3. Early retirement: While there is declining labor force participation for men both before and after age 65, and although an earner can

collect Social Security as early as age 62, he or she cannot collect Medicare until age 65. For the group aged 55-64 who are contemplating retirement, losing employer provided health insurance might preclude retirement.

C. Diversity in Provision

- "Cost based reimbursement" – most policies (until early 1980s) provided reimbursement to provides based on actual costs of treating patient.

- "Capitation based reimbursement" – providers receive annual payments for each patient, <u>regardless of services actually used</u>. This is the usual sort of reimbursement for health maintenance organizations, called HMOs. are becoming much more popular – 1982, 11 million people, 1992, 41 million.

Creates incentives for HMO to skimp on the quality of care, since same payment is received regardless of services provided. Also, people who select HMO instead of fee-for-service plan likely to be healthier. *It is hard to tell whether HMOs result in lower costs per patient because of selection issues or true economic incentives.*

III. THE ROLE OF GOVERNMENT

A. Medicare

- Provides health insurance to people aged 65 and older. $143 billion in 1993, 2.3% of GDP. Second largest domestic spending program after Social Security.

- Why such massive government involvement for elderly? Both earnings and health decline are anticipated foreseeable events. Adverse selection problems more acute. By forcing everyone to purchase HI, problem avoided. Government also economizes on administrative costs.

- Pays 44% of health expenditure for elderly. Medicaid around 12%, other

sources such as "Medigap" or employer provided retiree health insurance, 44%.

1. The Structure of Medicare

Eligibility requirement is being over 65. In 1993, 32 million enrollees. Program administered by government and is nationally uniform. It is not means-tested, unlike Medicaid.

- Benefits
Two parts of coverage, called "Part A" and "Part B." Part A is hospital insurance, participation is compulsory. $90 billion in 1993. 90 days of inpatient care, and 100 days in skilled nursing facility. Does not cover long-term institutional services such as nursing homes. Nursing homes can cost well over $30,000 per year.

Part B: Supplemental medical insurance (SMI), pays for physicians. Enrollment voluntary, premium varies over time, $40/month. 99% of eligible population enrolls.

- Financing
Financed through a payroll tax of 1.45% on employee and employer each, no ceiling unlike social security. health insurance Trust fund, pay as you go basis. Medical bills of today's retirees are paid by today's workers. Pays for part A. Part B (SMI) relies on general revenues, not payroll tax. Also monthly premium, which pays for 25% of costs.

2. Foreboding of bankruptcy

- Growth in Medicare enormous. The health insurance trust fund not growing fast enough to keep pace with expenses. The government would need to substantially increase the health insurance payroll tax rate (more than doubling). Also, SMI contributes to deficit.

3. Cost containment measures
- In early 1980s, part A moved from cost-based reimbursement to

prospective reimbursement, where health insurance pays hospital an amount for illness before treatment applied. Part B has frozen physicians fees, put in quantity controls as well.
- Growth has continued however.
- Medicare HMOs are becoming more prevalent.

B. The implicit subsidy for health insurance

- Government taxes an individual's wage, but employer contributions to health insurance not subject to tax.
- If $\tau = 30\%$, and employer increases wages by $2000, get $1400 in take home pay. If provides health insurance with value of $2000, not taxed.
- Government loses $56 billion per year because of this.
- Subsidy to health insurance leads to larger share of compensation in form of health insurance. More generous plans and more plans altogether. Subsidy induces people to consume insurance in more than efficient amounts, and hence consume too many medical services.

IV. ACCESS AND COST

A. Access

- In 1980, 12.5% of U.S. population was without health insurance for an entire year. By 1993, it rose to 16%. It has remained steady since then: an estimated 41.7 million people in the United States (15.6 %) were without health insurance coverage during the entire 1996 calendar year. This number was up 1.1 million from 1995.

- The poor are least likely to have coverage. Despite the existence of programs such as Medicaid and Medicare, 30.8 % of the poor (11.3 million) had no health insurance of any kind during 1996. This percentage--which was double the rate for all people--was statistically unchanged from 1995. Poor people comprised 27.0 % of all uninsured people, although they make up only 13.7 % of the total population in 1996.

- The absence of health insurance and absence health care are not same thing. Charity care makes up some of the gap.

B. Cost

- Costs are increasing rapidly. The U.S. has higher levels of health care expenditure than other countries, but the growth of expenditures not extraordinarily different from other countries.

- Why are costs rising?

1. The population is aging

- People are living longer and average age in population getting higher.
- But changing demographic structure doesn't apparently explain much of the growth – demographics change slowly, while health care spending has increased rapidly.

2. Income growth

- Health care is a normal good, $\varepsilon_I = 0.4$. 10% increase in income leads to 4% increase in expenditure.
- Explains less than 10 % of growth in expenditure.

3. Third-party payments

- Insurance presents moral hazard, increases demand. This would not explain continual growth, however.

4. Improvements in quality

- More than half of growth is attributed to changing technology. Techniques have improved over time. The treatment of kidney stones today is not the same "commodity" as treatment of kidney stones in 1960. But improvements are costly.

This would also explain international growth. All countries had technological innovation. It raised the question: Are rising costs bad if getting higher quality better services?

V. RECENT CHANGES IN THE HEALTH CARE SYSTEM

Although universal health care is no longer on the political agenda, a number of smaller reforms have taken place over the past two years. In addition, some further reforms are probable.

A. The Health Insurance Portability and Accountability Act of 1996

(HIPAA)

- Took effect in July, 1997

1. Portability of health insurance

- Eliminated "preexisting conditions" clauses for health insurance coverage, and eliminated waiting periods (e.g., 90 days or so) associated with those conditions.

- Eliminating this clause increases access to health insurance for people with serious conditions, such as AIDS or Parkinson's disease, and with lesser ailments, such as attention deficit disorder or back pain -- all of which have been cited by insurers as reasons for denying health insurance coverage.

- The portability is not given to everyone, however:
Only if you have been in a group plan for at least 18 months continuously (or with a break of no more than 63 days). You must also exhaust any coverage you have through COBRA, the federal law that lets you extend employer-based coverage for at least 18 months--even if it's more expensive than a plan you find on your own.

- The benefits/services may not be identical:
The federal law says insurers offering individual coverage must allow a choice of at least two plans; states can set their own rules as long as they meet or exceed federal guidelines. Nineteen states are using high-risk pools they sponsor themselves for that purpose.

2. Deductions for the self-employed

- In 1997, self-employed people can get a tax deduction of 40% of the cost of health insurance for themselves and their families. This tax advantage gets more generous as the write-off gradually rises to 100% of premiums in 2007. Note that premiums paid by employers for the employees are already untaxed.

3. Medical savings accounts

- Medical savings accounts (MSAs) allow self-employed people and those working for companies with fewer than 50 employees to set up tax-deferred accounts for medical expenses.

- The trial program limits the number of participants to 750,000 people by the year 2001.

- To qualify for an MSA, you must first buy a health plan with a deductible of $1,500 to $2,250 ($3,000 to $4,500 for families). By paying a lower premium on a high-deductible plan, you free up pretax funds to deposit each month into the MSA--up to the legal annual limit of 65% of the deductible for individuals and 75% for families. During the year, you withdraw money tax-free from the account for qualifying medical expenses, including those not covered by your health policy--say, eyeglasses or orthodontia. What you haven't spent by the end of the year simply stays in your account. Before age 65, if you take money out of your MSA for nonmedical expenses, you'll pay taxes on the amount you withdraw plus a 15% penalty. But after age 65, you can withdraw funds for any reason without penalty.

B. Future Changes

Continuing expansions in the Medicaid program for children – the expansions that were started in the 1980s now cover all children who live in poverty who were born after September 30, 1983. Thus, children 14 and under are covered. There is discussion about increasing both the age limit (to 18), and the income limit.

LECTURE 8
TAXATION AND THE INCOME DISTRUBUTION

I. INTRODUCTION
-Distribution of income
-Statutory incidence
-economic incidence
Example 1, taxes

II. TAX INCIDENCE

III. PARTIAL EQUILIBRIUM MODELS
A. Per-unit tax
Example 2, tax on consumers
Example 3, tax on suppliers
Example 4, per-unit subsidy on demanders
Example 5, tax on demanders

You may want to review the following problems:
Finals
Winter 1995, Question 3
Spring 1995, Question 1
Fall 1995, Question 3
Winter 1996, Question 3
Spring 1996, Question 5
Fall 1997, Question 6
Winter 1998, Question 6
Spring 1999, Lecture 1, Question 3
Spring 1999, Lecture 2, Question 3
Fall 1999, Lecture 1, Question 5
Fall 1999, Lecture 2, Question 5

I. INTRODUCTION

How do taxes affect the distribution of income? By using the term "distribution of income," we mean who wins and loses from a tax. Assessing this question is not as simple as asking who pays for the tax legally. If the government imposes tax on sellers of cigarettes, for example, but the tobacco firm raises prices, the firm does not "bear" the full burden of the tax. Instead, part of the tax is shifted onto the consumers of cigarettes.

Statutory incidence: who is legally responsible for the tax.

Economic incidence: who really pays for the tax. The economic incidence is the change in the distribution of income brought about by the tax. The economic incidence may differ from the statutory incidence because the tax might be "shifted."

One example might be helpful in thinking about these two concepts. If the government imposed a tax on all brands of cigarettes, and taxed the firms, it might be easy for the firms to pass this tax increase onto consumers because cigarettes are inelastically demanded – it is unlikely that smokers will either quit or find a good substitute. In this case, the statutory incidence would be on the firms, but the consumers bear most of the tax. On the other hand, suppose the government imposed a tax on only one brand of cigarettes. Because the cross-price elasticity between cigarette brands is likely to be quite high, consumers can easily switch if the price for only one brand increased. Thus, the firm would have difficulty in raising its price, and the statutory incidence would be similar to the economic incidence.

II. TAX INCIDENCE: GENERAL REMARKS

A. Only people can bear taxes

- "Business paying its fair share" does not have much meaning in tax incidence. Taxes are borne by people: stockholders, workers, landlords, firms, and consumers.

B. Both sources and uses of income should be considered

- consumers, clearly, can be hurt through tax increase
- factors of production, such as laborers, might suffer as well.

We will usually focus on either input or output market, but this focus is only appropriate if there are not spillovers.

C. Incidence Depends on How Prices are Determined

Different models give different price changes to the same tax. For example, an anticipated tax on cigarettes gives a very different price path than an unanticipated tax increase. The competitiveness of the market matters, too. The tax incidence in a monopolistic setting differs from that of a competitive setting.

D. Incidence Depends on how the money is spent

- Balanced budget incidence: analyzes the combined effect of levying tax and spending the money. For example, taxing the poor and spending the money on public housing projects generates different incidence that spending the money on golf courses.
- Differential tax incidence: Ignores how the government spends the money, and simply examines how incidence of one tax differs from another.

III. PARTIAL EQUILIBRIUM MODELS

Partial equilibrium models of price determination: models that look only at the market in which the tax is imposed and ignore the ramifications in other markets.

A. Per-Unit tax

A per-unit tax is a fixed tax per unit of commodity sold. Key step: *in presence of a tax, the price paid by consumers and the price received by suppliers differ.*

Suppose that the statutory incidence is on the consumer. How does the tax affect the demand schedule? It shifts it downward, parallel to the old demand curve. Recall that the demand curve is the maximum willingness to pay for

the next unit of the good. But now producers do not receive the full amount, instead only the price minus the tax. *The shifted demand curve is the one that is now perceived by the suppliers.*

Example: suppose initially market for cigarettes is:

$$Q^D = 100 - 2P$$
$$Q^S = 20 + 2P$$

Initially equilibrium is at $P = 20, Q = 60$.

And now we slightly modify this framework ...

The government imposes a per unit tax of $8 per cigarette smokers. This tax creates a wedge between the price the smoker pays and the price the tobacco firm receives. We can rewrite the above demand and supply curves as:

$$Q^D = 100 - 2P^D$$
$$Q^S = 20 + 2P^S$$
$$P^D = P^S$$

Before the tax, $P^D = P^S$. In equilibrium,
$Q^D = Q^S \Rightarrow 100 - 2P^D = 20 + 2P^S \Rightarrow P = 20.$

After an $8 per unit tax is imposed on the smokers, the price the tobacco firm receives is 8 dollars less than the price the consumer pays. Thus,
$P^D - 8 = P^S \Rightarrow 100 - 2P^D = 20 + 2(P^D - 8) \Rightarrow P^D = 24, P^S = 16, Q = 52$

Graphically,

***** SEE FIGURE 8-1, 8-2, 8-3 8-4, 8-5, 8-6 *****

In this instance the tobacco firm absorbs half of the $8 tax: it used to receive $20, and now it receives $16. The price facing the smoker does not increase by the full $8; instead only $4. The tax raises $416 in revenue.

Is there deadweight loss from imposing this tax?

Exercise: what if the government imposed the tax of $8 per unit on the tobacco firm instead of the smoker? In this case, the "effective supply curve" shifts inward. Calculate the prices and quantities in this case.

Comment #1: the economic incidence of a per-unit tax is independent of whether it is levied on consumers or producers.

The same per unit tax above, levied on firms gives the exact same prices and quantity. The difference in prices paid and received is known as the "tax wedge."

More generally, a tax J levied on consumers shifts down the demand curve as perceived by the firm: $P^S = P^D - \tau$. The same tax J levied on firms shifts up the supply curve as perceived by the consumers: $P^D = P^S + \tau$. Clearly these two equations lead to the same answers.

Comment #2: the incidence of a tax depends on the elasticities of supply and demand.

Consider two sets of $8 per-unit taxes on the demanders, with the same demand curve, but let the slope of the supply curve vary: one supply curve is steeper (more inelastic) than the other. The share of the tax paid by consumers increases in the second case, with more elastic supply.

- Generally, the more elastic the demand curve, the less of the tax borne by consumers, ceteris paribus. The more elastic the supply curve, the less of the tax borne by producers, ceteris paribus. The intuition is that the elasticity represents a person's sensitivity to price. Sensitivity to price is a measure of the person's ability to escape the tax.

Comment #3: subsidies are simply "negative taxes."

Comment #4: With per-unit taxes and subsidies on demanders and suppliers, the relationship becomes

$$P^D - \tau^D + s^D = P^S + \tau^S - s^S$$

where P^D=price demanders pay, τ^D=per unit tax imposed on demanders, s^D=per unit subsidy imposed on demanders, P^S=price received by suppliers, τ^S=per unit tax imposed on suppliers, and s^S=per unit subsidy imposed on suppliers. Thus a per unit subsidy of $8 per unit on demanders, along with an $8 per unit tax imposed on suppliers yields identical answers to no taxes or subsidies at all.

Example 1

Suppose that the market for child immunizations is characterized by the following supply and demand curves:

$$Q^S = 12 + 2P$$
$$Q^D = 150 - P$$

a. Suppose that the government decides it wants parents to immunize their children, so imposes a per-unit subsidy of $15 on the demanders of immunizations. After the subsidy is imposed, what is:

- the price that consumers pay
- the price that producers receive
- the total expenditure by the government
- the equilibrium quantity

Note that before the subsidy, $P = 46, Q = 104$. Intuitively, a subsidy should increase demand for the good. The subsidy creates a wedge between the prices consumers pay and firms receive. The wedge is equal to: $P^S = P^D + 15$. That is, the demand curve (as perceived by the firm) is higher than before. First, substitute this equation into the supply curve: $Q^S = 12 + 2(P^D + 15) = 42 + 2P^D$. The set supply equal to demand: $42 + 2P^D = 150 - P^D$. This gives $P^D = 36, P^S = 51, Q = 114$. The government spends $sQ = 1710$.

Graphically,

***** SEE FIGURE 8-7, 8-8 *****

b. Calculate the deadweight loss from this subsidy.

Since there was no mention of externalities, we can assume that the quantity the private market provides is the socially optimal level. After the subsidy, there is "too much" of this good. $DWL = \frac{1}{2}(114 - 104)15 = 75$.

c. As an alternative to the proposal of the $15 subsidy for demanders, suppose that the government offered a per-unit subsidy of $5 to demanders and a per-unit subsidy of $10 to suppliers. Calculate the price that consumers pay, the price that producers receive, the total expenditure by the government, and the equilibrium quantity.

The numbers will be exactly the same as before – on paper the subsidy appears to be different, but the economic incidence is the same.

d. (True or False, define the underlined term) While the statutory incidence of a $15 subsidy on the demanders *or* a $15 tax on the suppliers differs, the economic incidence is the same because both policies lead to identical equilibrium quantities, producer prices and consumer prices.

First, the statutory incidence is who legally bears the tax. But the statement is false, because a tax leads to different economic incidence than a subsidy. That is, a $15 subsidy on suppliers or demanders leads to the same conclusions, but this is not what the question asked. If the question had asked whether a $15 subsidy leads to the same conclusions as a $10 subsidy, the answer is clearly "no." A tax is simply a negative subsidy – thus, does a $15 subsidy lead to the same conclusions as a -$15 subsidy? A tax would shift the demand or supply curve inward (and reduce Q), while a subsidy would shift the demand or supply curve outward (and increase Q).

B. Ad Valorem Taxes

In real-life, most taxes are not "per-unit" taxes (although taxes on cigarettes are per-unit taxes). Instead, most taxes are a fraction of the price, known as "ad-valorem" taxes. Sales taxes are a good example of this.

Now instead of moving the demand curve down by the same absolute amount for each quantity, the ad valorem tax lowers it in the same *proportion.* Graphically:

***** SEE FIGURE 8-9 *****

Unlike a per-unit tax, which shifts the demand curve downward by a fixed amount, with an ad-valorem tax it shifts by a proportional amount.

An ad-valorem tax J^D levied on consumers leads to the "effective" demand curve of: $P^S = (1 - \tau^D)P^D$. An ad-valorem tax J^S levied on firms shifts up the supply curve as perceived by the consumers: $P^D = (1 + \tau^S)P^S$. In this case, an equal ad-valorem tax on suppliers or demanders does not lead to the same answer – if the tax on demanders was 25 %, the equivalent tax on suppliers would be 33%:

$$\tau^D = 0.25 \Rightarrow P^S = (1 - \tau^D)P^D = 0.75P^D \Rightarrow P^D = \left(\frac{1}{0.75}\right)P^S = (1 + .\overline{3})P^S \Rightarrow \tau^S \approx 0.33.$$

Example 2

Suppose the cigarette market is characterized by the following demand and supply curves:

$$Q^D = 200 - 4P$$
$$Q^S = 50 + P$$

a. Suppose the government imposes a $25 *per-unit* tax per on the smokers of cigarettes. What price does the cigarette smoker pay after the tax? How much money does the government raise?

The effective demand curve is shifted inward: $P^S = P^D - 25$. Thus, $200 - 4P^D = 50 + (P^D - 25) \Rightarrow P^D = 35, P^S = 10, Q = 60$. The revenue raised is $25*60=$1500.

b. What is the statutory incidence of the tax in part (a)? What is its economic incidence?

The statutory incidence falls 100% on the demanders. Since the original price was $P = 30 \Rightarrow \frac{(35-30)}{35} = 20\%$ of the economic incidence falls on the demanders.

c. Evaluate the following statement: "If the government imposed a $15 per unit tax on smokers and a $15 per unit tax on firms, this combination would produce exactly the same deadweight loss as the tax proposed in part (a)."

False. If the initial tax had been $30, the deadweight loss would be the same. The deadweight loss is smaller with the $25 tax than with the new scheme.

d. Instead, suppose the government imposes a 25% *ad-valorem* tax on the smokers of cigarettes. What price does the cigarette firm receive after this tax? What price does the consumer pay after this tax?

Now, $P^S = (1-0.25)P^D = 0.75P^D$. Thus $200 - 4P^D = 50 + (0.75P^D) \Rightarrow P^D \approx \$31.57$. The cigarette firm receives $P^S = (1-0.25)P^D \approx \$23.68$.

e. Suppose the government imposes a $25 *per-unit* tax on the suppliers of cigarettes. What price does the cigarette smoker pay after the tax? How much money does the government raise?

The economic incidence is the same as in part (a), where the per-unit tax was levied on smokers rather than the firms.

f. Evaluate the following statement: "If the government imposed a $15 per unit tax on smokers and a $10 per unit subsidy on firms, this combination would produce exactly the same deadweight loss as the tax proposed in part (a)."

False, this is equivalent to a $5 per unit tax, not a $25 per unit tax.

g. Does a 40 % *ad-valorem* tax on producers has the same economic incidence as a 40 % *ad-valorem* tax on consumers.

No, it does not. A 40 % ad-valorem tax on producers corresponds to a tax of roughly 29 % on consumers.

$$P^D = (1+0.40)P^S \Rightarrow P^S = \frac{1}{(1+0.40)}P^D \Rightarrow P^S \approx 0.71P^D = (1-0.29)P^D \ .$$

C. Taxes on factors of production: Labor and capital

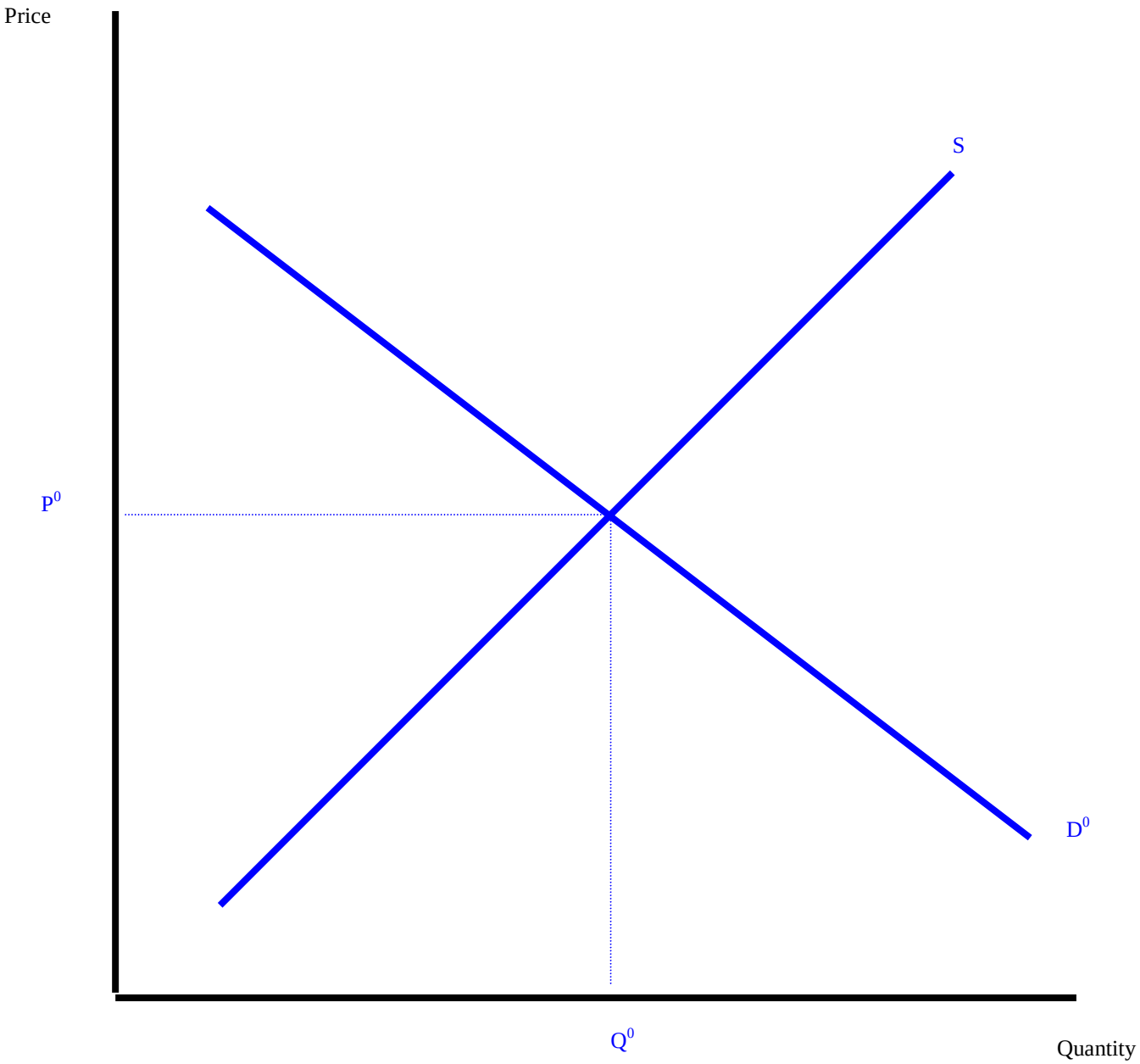
1. Labor

Instead of taxing output (say, cigarettes), we could instead tax the inputs (namely, labor and capital).

One important example of taxing inputs is the social security payroll tax. Together with Medicare, this tax totals 15.3 %, of which 7.65 % is legally paid by workers, the other half by firms. As with the previous taxes, the statutory distinction between workers and firms is irrelevant. The economic incidence of this tax is determined by the elasticities of labor supply and labor demand.

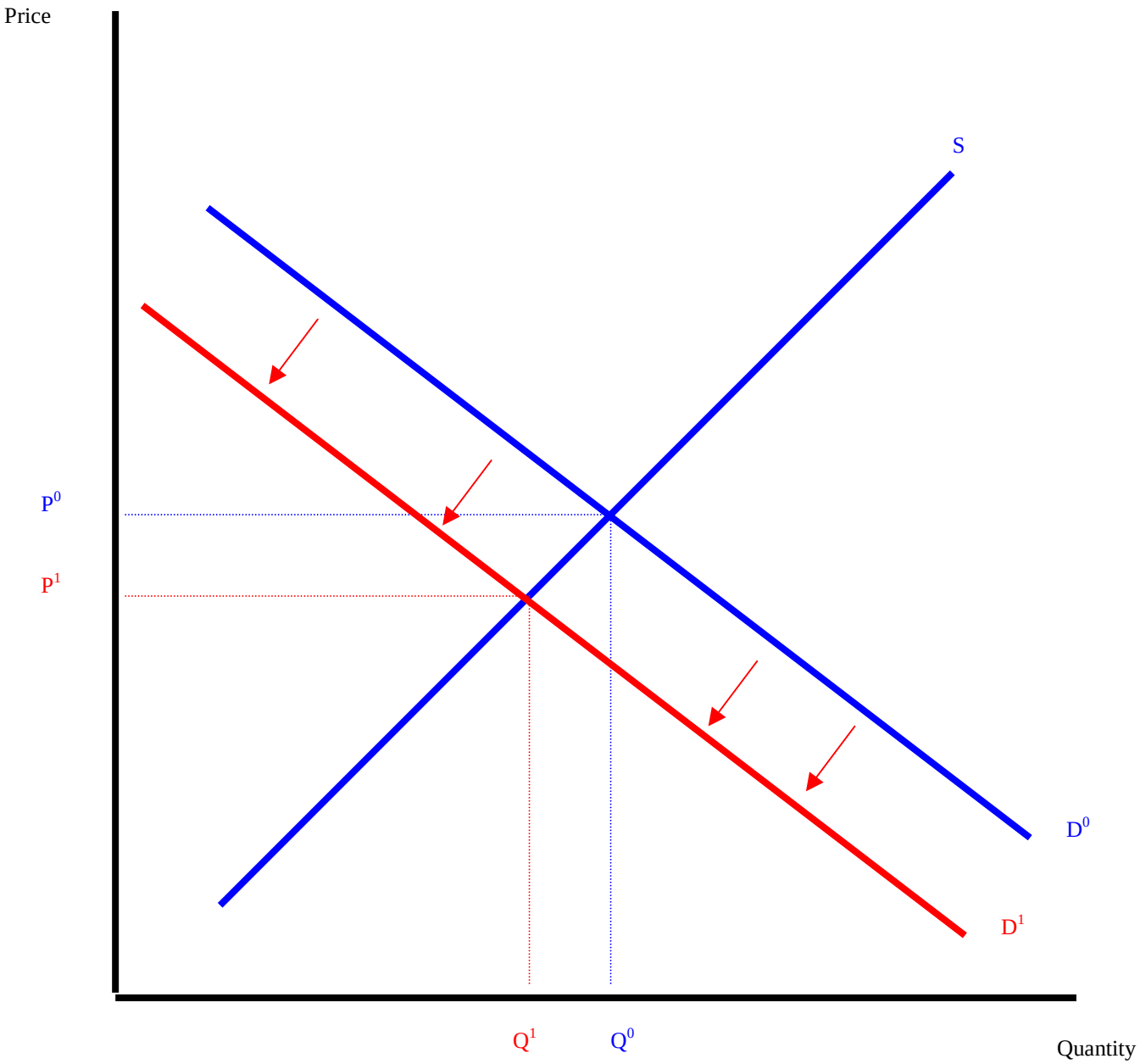
Suppose the supply of labor was perfectly inelastic (which is close to true for adults between the ages of 25 and 54), and this ad-valorem tax was imposed. With perfectly inelastic labor supply, the tax is fully passed to the worker in lower wages.

Figure 8-1 – Initial supply and demand curves before a tax



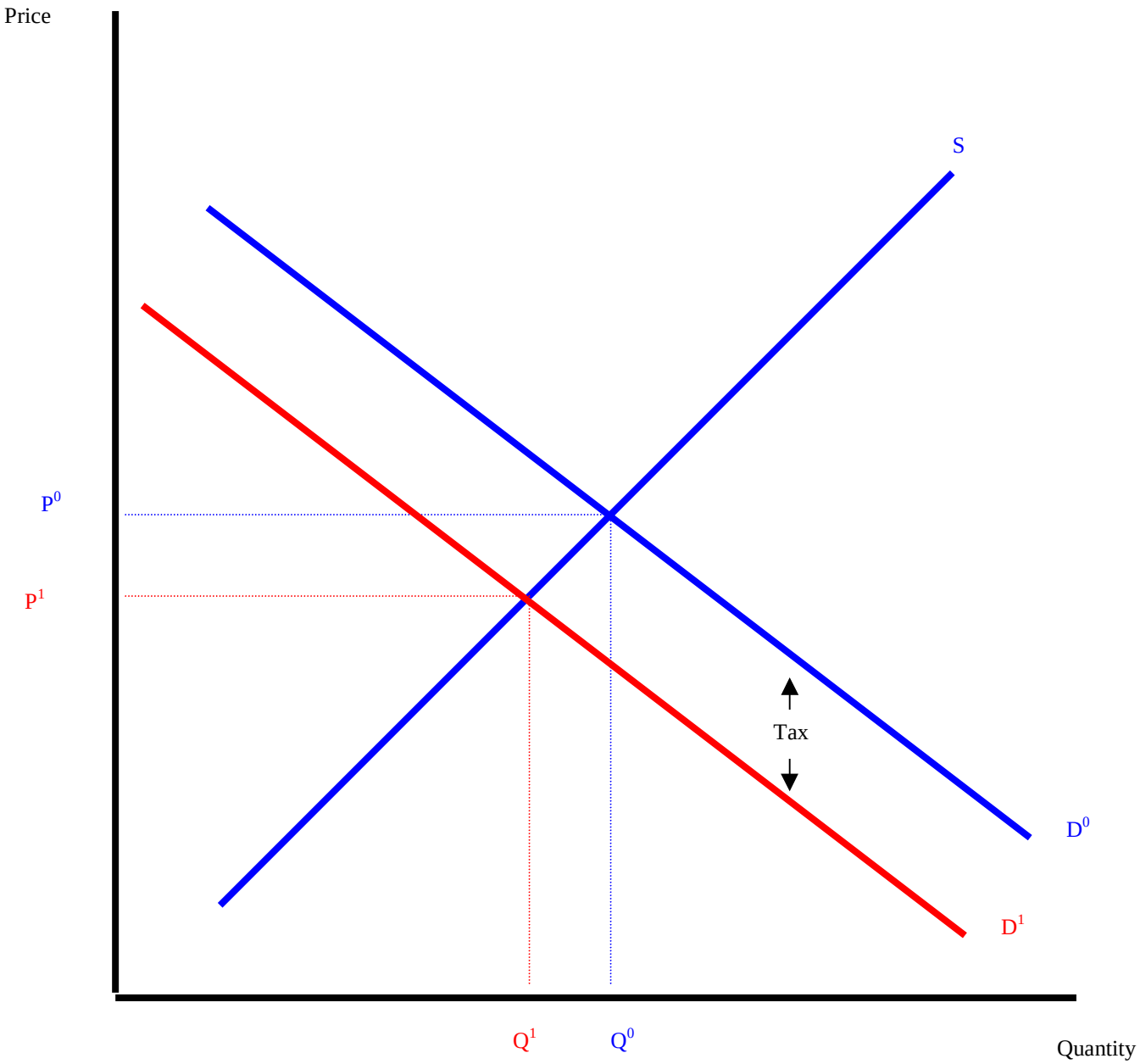
Initial price and quantity labeled Q^0 and P^0.

Figure 8-2 – Per unit tax on demanders shifts demand inward



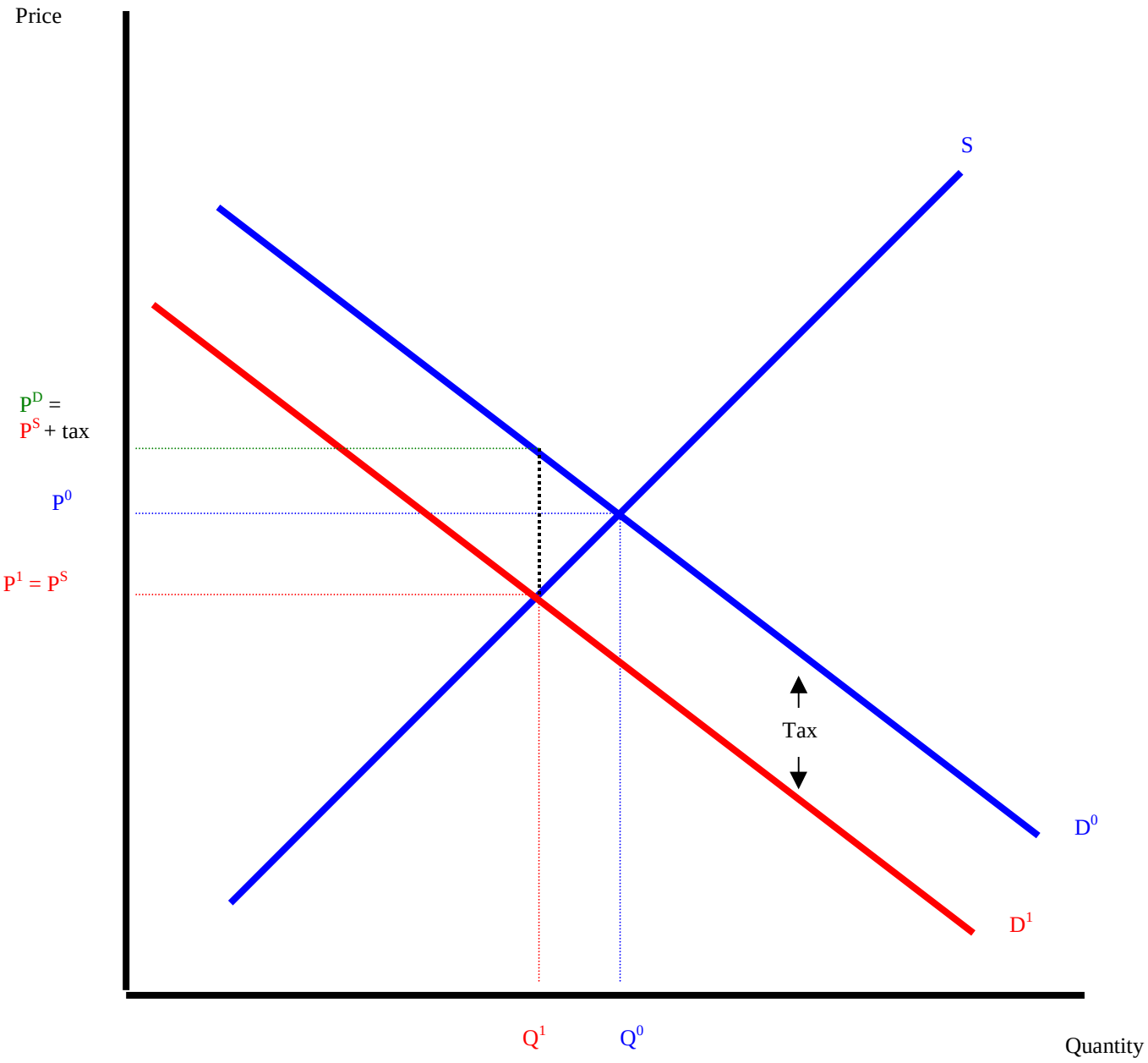
P^1 is the price paid by demanders.
The new quantity is Q^1.

Figure 8-3 – Vertical distance between D^0 and D^1 is tax.



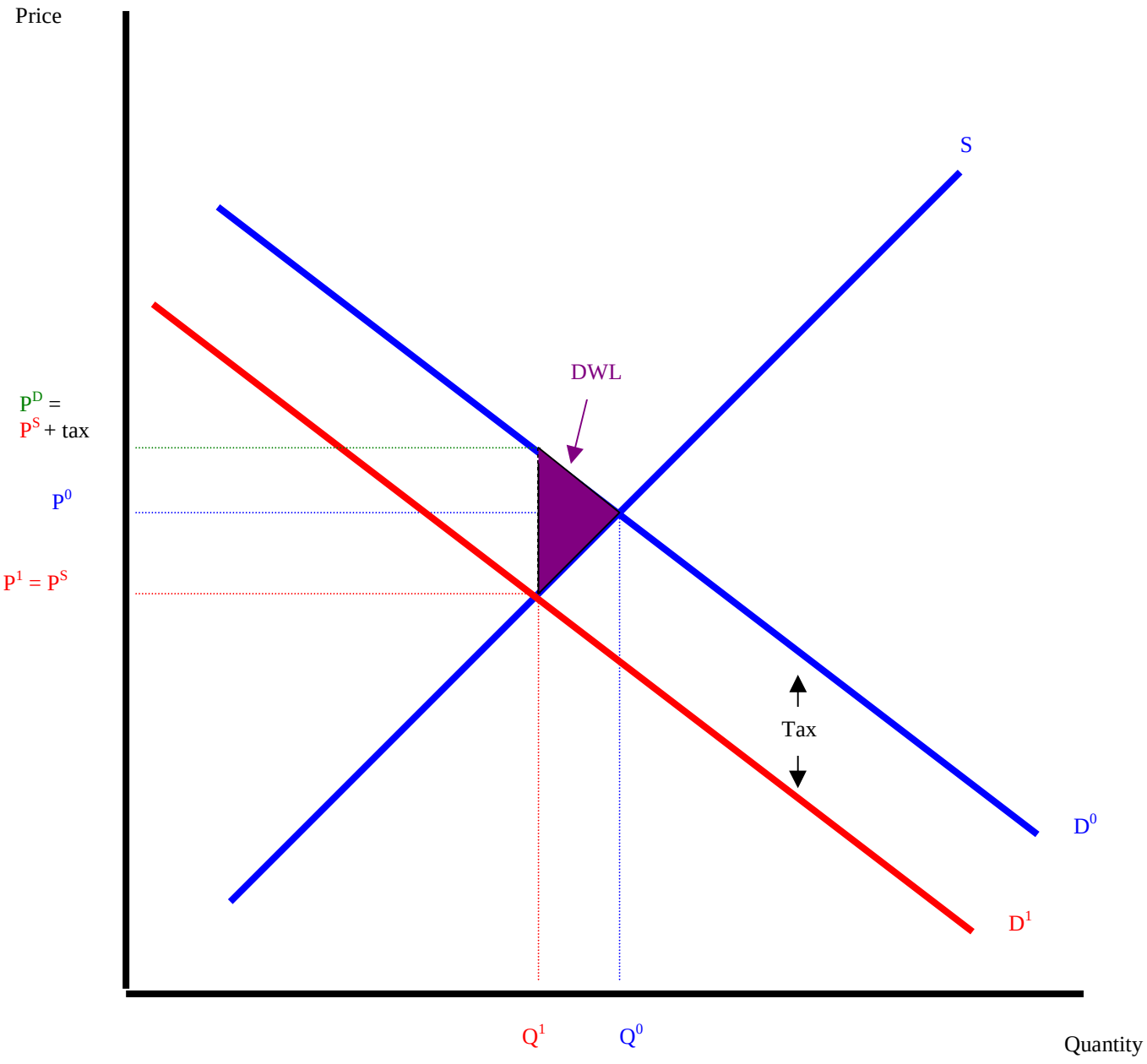
The tax creates a wedge between the price suppliers receive and demanders pay.
$P^D = P^S + Tax$

Figure 8-4 – Finding P^S and P^D after the tax.



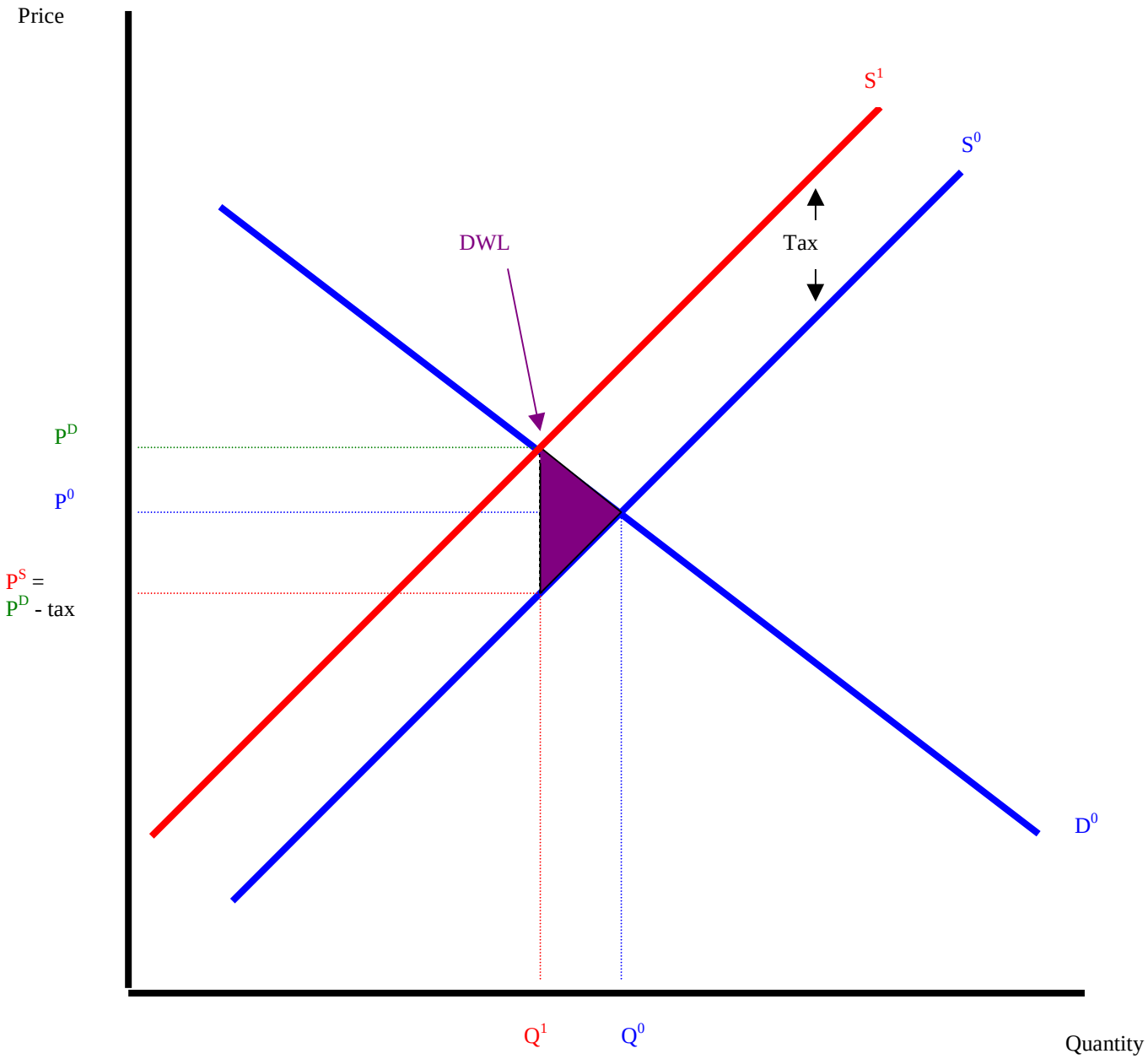
Demanders pay more than suppliers receive. The government gets the rest.
$P^D = P^S + Tax$

Figure 8-5 – The tax creates a deadweight loss



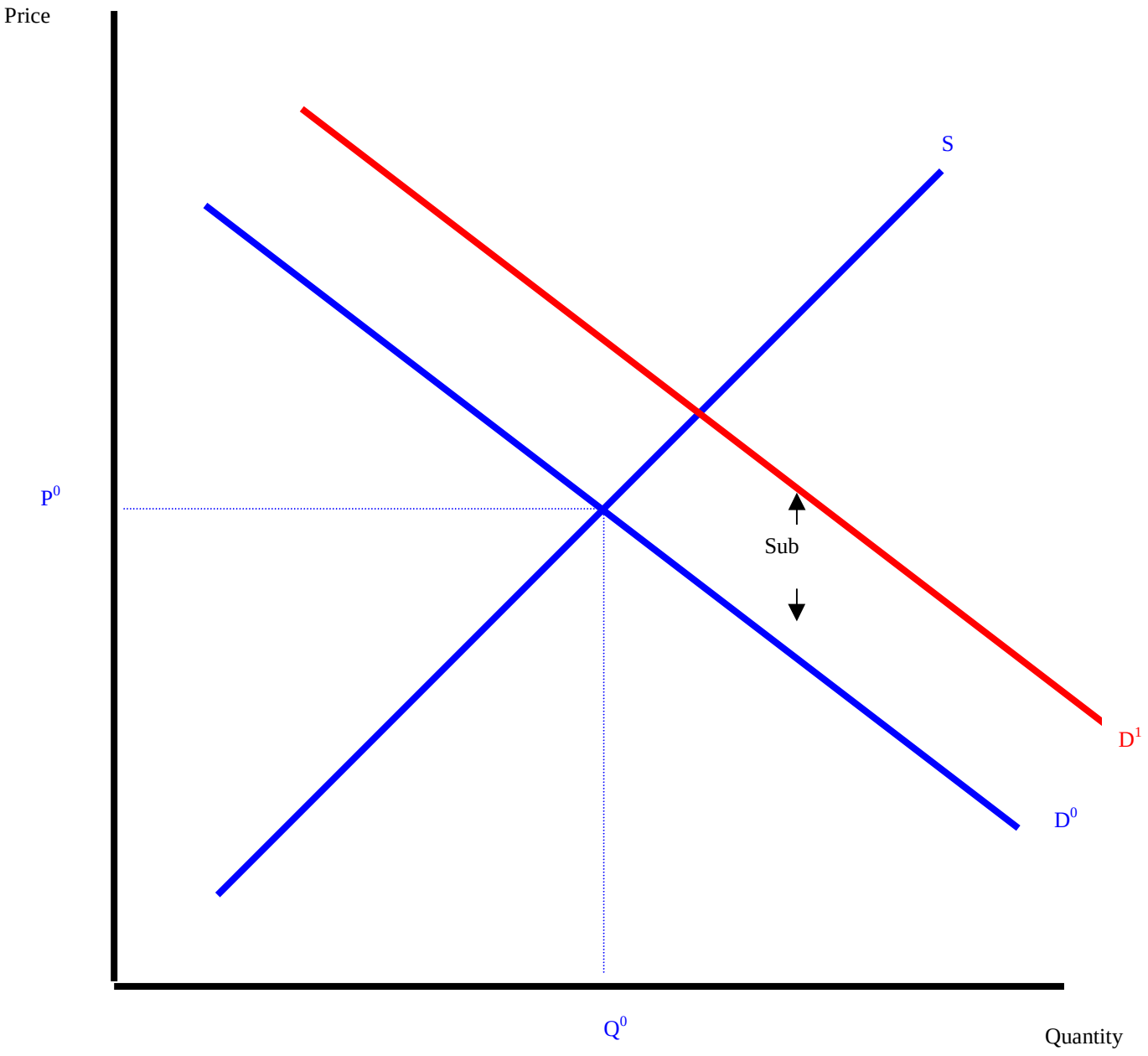
Since there are no preexisting distortions, Q^0 is the socially optimal quantity. The purple triangle is the deadweight loss.

Figure 8-6 – An equal per-unit tax on suppliers



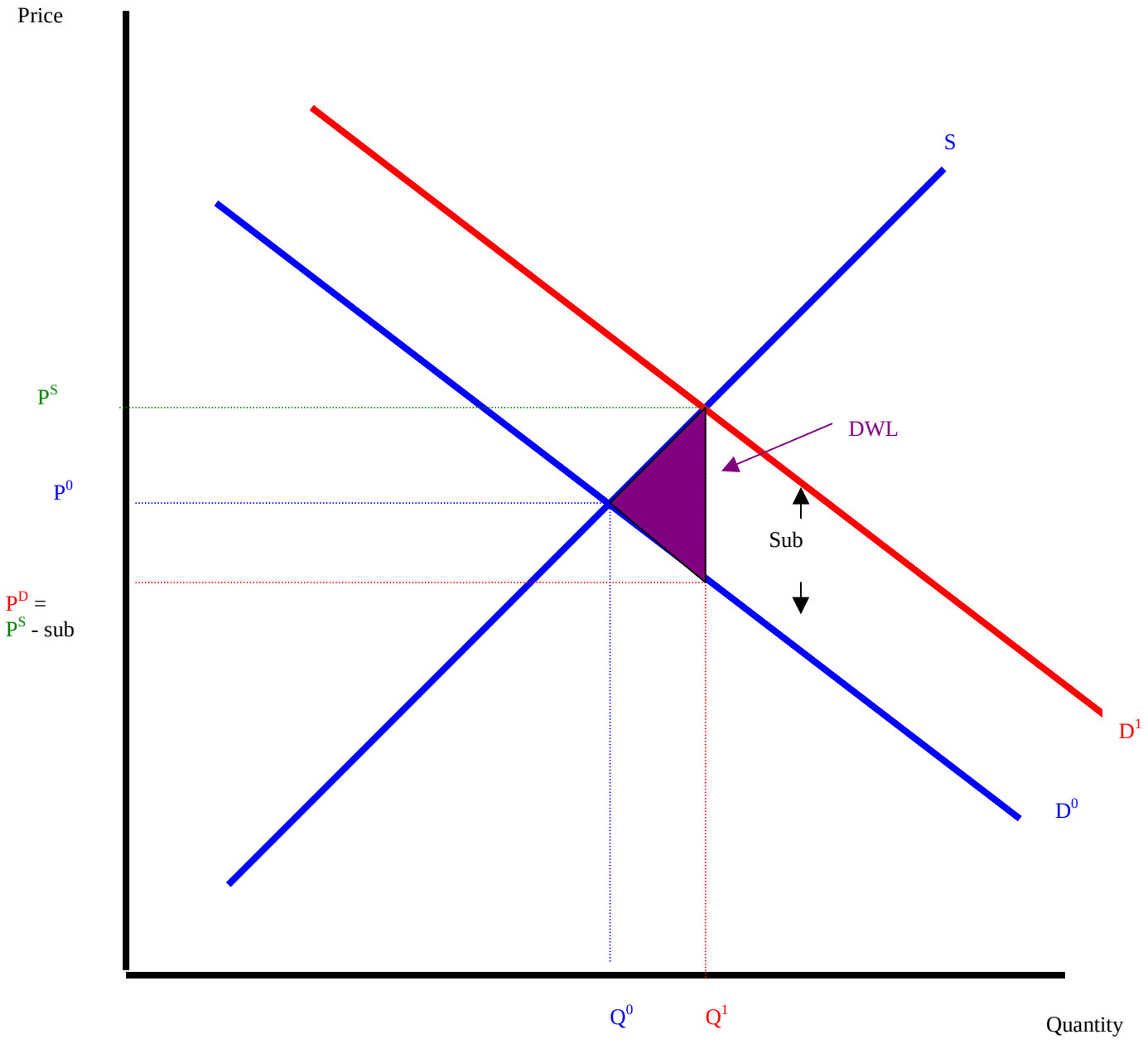
An equal per unit tax on supplier leads to same prices, quantity, and DWL.

Figure 8-7 – A per-unit subsidy on demanders.



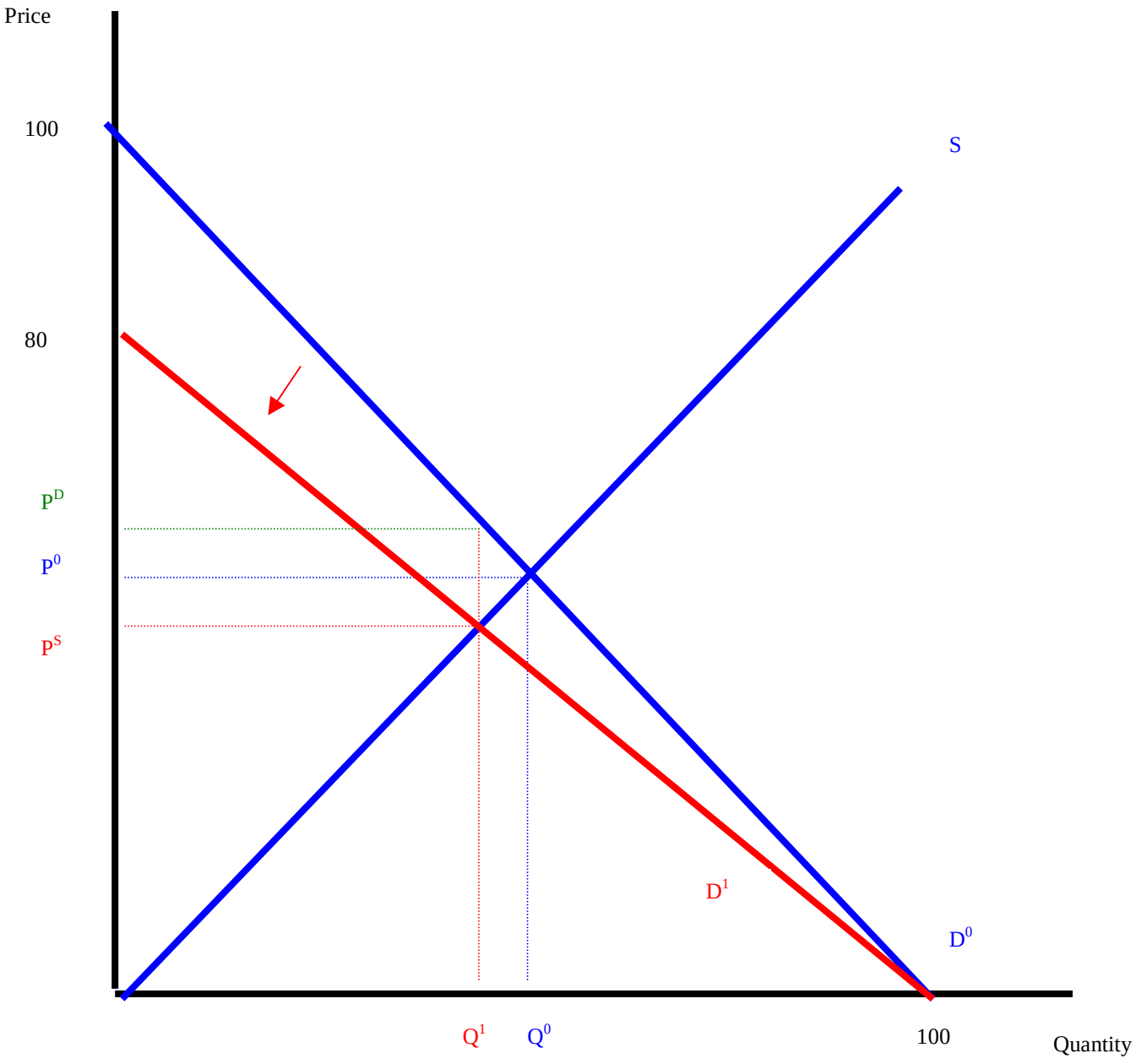
Find the equilibrium quantities, prices, and DWL after the subsidy is implemented.

Figure 8-8 – Outcome of a per-unit subsidy on demanders.



Make sure to understand the DWL triangle. Demanders now pay less than suppliers receive.

Figure 8-9 – An ad-valorem tax of 20%.



Initial price and quantity labeled Q^0 and P^0. Demand rotates inward.

LECTURE 9
TAXATION AND EFFICIENCY

I. INTRODUCTION
-Excess Burden, definition

II. EXCESS BURDEN WITH INDIFFERENCE CURVES
-lump sum tax

III. EXCESS BURDEN: QUESTIONS AND ANSWERS
Example 1, indirect utility function
Example 2, Slutsky Equation

IV. EXCESS BURDEN MEASUREMENT WITH DEMAND CURVES
-See Figure 9-3
-**Excess Burden Equation= ½ , wL_1J^2**

I. BRIEF INTRODUCTION

- Suppose the government imposes a tax on food, and the person stops buying food. Is the person unaffected by the tax, since he or she pays nothing? No ... as long as the person was initially choosing his or her utility maximizing bundle, this change in behavior leads to lower utility.

- If a tax changes economic decision making (such as reducing the consumption of food), it may bring about an excess burden – a loss in economic welfare beyond the tax revenues raised. This welfare cost can be thought of as deadweight loss.

II. EXCESS BURDEN WITH INDIFFERENCE CURVES

- Utility maximization problem: the decision maker maximizes U(Food, Clothing) subject to income and prices.

Assume the government impose an ad-valorem tax on food, so its after-tax price per unit is $(1+\tau)P_F$.

***** SEE FIGURE 9-1 *****

- The vertical distance in this example shows how much extra clothing the person has to forego in order to consume the same amount of food as before the tax were imposed. For example, at the bundle F_2, the cost in clothing foregone is E_1E_2.
- The tax rotates the budget constraint; unless person was consuming only clothing before the tax, he or she must be worse off after it is imposed.

The key question is: what is the most efficient way to raise the revenue? If the government can raise the same amount of revenue with a smaller utility loss, then there is excess burden from the food tax illustrated above.

How much worse off is person made by moving to lower indifference curve in terms of income? The equivalent variation is the amount of income the government would have to take away from the person to induce him or her to move to lower indifference curve. Taking money away is equivalent to a parallel shift in budget line. Simply shift the budget line until it is just tangent to the lower indifference

curve.

Note that at this new point, F_3, the amount of clothing foregone (money raised) is RE_3. This vertical distance is bigger than at E_1E_2, it is instead equal to E_1S. The result: the food tax makes the person worse off in dollar terms than it raises in revenue. For example, perhaps the person is made worse off by $10, but it only raises $5. The excess burden would be the gap E_2S.

Not every tax entails excess burden, however. A lump sum tax is defined as a tax that must be paid regardless of the taxpayer's behavior. Unlike ad-valorem taxes, lump sum taxes do not change relative prices. The food tax is not a lump sum tax because the revenue raised depends on the person's food consumption.

A lump sum tax can leave the person just as well off (that is, on same indifference curve). The lump sum tax must be parallel to initial budget set because the government is simply taking away income. In addition, the new budget constraint must touch lower indifference curve. How much revenue does this lump sum tax raise? The amount RE_3. That revenue equals the equivalent variation (by definition). Since revenue raised equals the equivalent variation, a lump sum tax has no excess burden. In other words, lump sum tax generates more revenue for government than food tax, but leaves the person on the same indifference curve.

III. Excess Burden: Questions and Answers

A. If lump sum taxes are so efficient, why aren't they widely used?

- political constraints and unfairness

I.e. simply taking away $2000 per year per person could be perceived as unfair, since some people are more needy than others.

In 1990, Margaret Thatcher, the former prime minister of England, implemented a "poll tax" – a lump sum tax per person. It was very unpopular, and there were compliance problems.

It may seem reasonable to condition the tax payment on income. If the government

tries to condition on income, however, the tax payment loses the lump sum aspect. Part of a person's income could be derived from labor supply, and leisure is a "good" in a utility maximization problem.

- To construct an equitable system of lump sum taxes, the government would need to figure out earnings potential, not realized earnings. But this is clearly impossible to implement.

B. If the demand for a commodity does not change when it is taxed, is there excess burden? Yes.

Graphically:

***** SEE FIGURE 9-2 *****

Here $F_1=F_2$ even after the ad-valorem tax on food is imposed. Note that the equivalent variation is RE_3, which is greater than the revenue raised, E_1E_2. The excess burden is the distance E_2S.

Why doesn't food consumption change? There are two different effects of increasing the price of food, the "income effect" and the "substitution effect." The income effect is the change in food demand moving from one indifference curve to another, while the substitution effect is the change in food demand moving along one indifference curve (thus, holding utility constant).

The sum of the income and substitution effects is called the uncompensated response. If food was an inferior good, the income effect implies food consumption increases after a price increase. If the income effect exactly offsets the substitution effect, there is no change in food consumption. When we derive demand curves from indifference curves, we simply change prices and see the total response to quantity. The demand curves that measure both responses are called "Marshallian demand curves."

Graphically, the movement from E_1 to E_3 is the income effect: the change in food consumption due to less income, holding relative prices constant. The movement from E_3 to E_2 is substitution effect – the change in relative prices of goods, and

compensating the person to remain on the same indifference curve as before.

The compensated response (or substitution effect) is needed for excess burden to arise. By construction, compare tax collections at E_2 and E_3.

Marshallian ordinary demand curve: how Q changes when P changes.

Hicksian compensated demand curve: how Q changes when P changes AND simultaneously giving or taking away income so that the individual's commodity bundle remains on the same indifference curve.

Exercise on deriving demand curves -

1. Ordinary (Marshallian) demand curves - change price in (F,C) space, see what happens to food consumption. With Cobb-douglas utility function, leads to our "usual" demand function.

2. Compensated (Hicksian) demand curves - only the substitution effect, holding utility constant.

3. Algebraically, substitute the ordinary demand curves into the utility function to get the indirect utility function –> V=f(income, prices). Then rearrange, so that income is a function of indirect utility and prices. Then substitute in for income into the ordinary demand curves to get the Hicksian demand curves. Note that Hicksian demand curves are a function of all prices, even if the ordinary demand curve is not.

Example 1

From the utility function $U = F^{\frac{1}{2}}C^{\frac{1}{2}}$, the ordinary demand curves are $F = \frac{1}{2}\left(\frac{I}{P_F}\right)$ and $C = \frac{1}{2}\left(\frac{I}{P_C}\right)$.

Substitute these demand curves into the utility function to get the indirect utility function:

$$V = F^{\frac{1}{2}}C^{\frac{1}{2}} = \left(\frac{1}{2}\frac{I}{P_F}\right)^{\frac{1}{2}}\left(\frac{1}{2}\frac{I}{P_C}\right)^{\frac{1}{2}}$$

which can be rewritten as:

$$V = \left(\frac{1}{2}^{\frac{1}{2}} I^{\frac{1}{2}} P_F^{-\frac{1}{2}} \right) \left(\frac{1}{2}^{\frac{1}{2}} I^{\frac{1}{2}} P_C^{-\frac{1}{2}} \right)$$

and then, by rearranging the terms,

$$V = \frac{1}{2}^{\frac{1}{2}} \frac{1}{2}^{\frac{1}{2}} I^{\frac{1}{2}} I^{\frac{1}{2}} P_F^{-\frac{1}{2}} P_C^{-\frac{1}{2}}$$

which then simplifies to:

$$V = \frac{I}{2 P_F^{\frac{1}{2}} P_C^{\frac{1}{2}}}$$

We can then rearrange the above equation in terms of income:

$$I = 2V P_F^{\frac{1}{2}} P_C^{\frac{1}{2}}$$

And then substitute this expression in for income into the ordinary demand curves:

$$F = \frac{1}{2} \left(\frac{I}{P_F} \right)$$

$$F = \frac{1}{2} \frac{\left(2V P_F^{\frac{1}{2}} P_C^{\frac{1}{2}} \right)}{P_F}$$

which then simplifies to:

$$F = V \left(\frac{P_C}{P_F} \right)^{\frac{1}{2}}$$

and by similar calculations,

$$C = \frac{1}{2} \frac{\left(2V P_F^{\frac{1}{2}} P_C^{\frac{1}{2}} \right)}{P_C}$$

which simplifies to:

$$C = V \left(\frac{P_F}{P_C} \right)^{\frac{1}{2}}$$

4. Recall that the Slutsky equation breaks down the income and substitution effects – the income effect is moving from one indifference curve to another, holding

prices constant, while the substitution effect is moving along an indifference curve, hold utility constant.

5. Slutsky equation: $\frac{dQ}{dP} = \frac{dH}{dP} - Q\frac{dQ}{dI}$, where $\frac{dQ}{dP}$ is the ordinary (Marshallian) demand, $\frac{dH}{dP}$ is the change in Hicksian demand with respect to price, Q=quantity, and $\frac{dQ}{dI}$ is the change with respect to income.

6. Can rearrange Slutsky equation in terms of elasticities: multiply each term in the above equation by $\frac{P}{Q}$. The first two terms turn into price elasticities. The final term is messy. Multiply the final term by one, in the form of $\left(\frac{I}{Q}\right)\left(\frac{Q}{I}\right)$. Then the final term contains the income elasticity, and the rest of the expression simplifies into the share of the budget spent on that good.

uncompensated price elasticity = compensated price elasticity - (share of budget*income elasticity)

$$\varepsilon_P = \varepsilon_P^H - s\varepsilon_I$$

Recall that elasticities are $\frac{\%\Delta DependentVariable}{\%\Delta IndependentVariable}$

Example 2
If the uncompensated demand elasticity $\varepsilon_P = -0.50$, and the compensated elasticity was $\varepsilon_P^H = -0.20$, then $s\varepsilon_I = 0.30$ (note the negative sign in the Slutsky equation). The term s has to be positive, which implies that E_I is positive – the good in question is a normal good.

IV. Excess Burden Measurement with Demand Curves

A. Measurement
Consider downward sloping demand curve and perfectly elastic supply. Recall the

notion of consumer surplus: how much are consumers willing to pay versus how much they actually pay for the good.

***** SEE FIGURE 9-3 *****

Suppose tax again levied on food: price is now $(1+J)P_F$. In this case the supply curve shifts upward.

In this case:
1. Consumers lose the area between the two supply curves.
2. Revenue is equal to the rectangle, the number of units purchased times tax price per unit.
3. The sum of the new consumer surplus plus the tax revenue is smaller than original consumer surplus.

Dollar measure for excess burden (DWL):

- We can recompute the deadweight loss triangle. If we rewrite this, however, we gain some additional intuition.

(1) $$DWL = \frac{1}{2} base * height$$

(2) $$DWL = \frac{1}{2}(\Delta Q)(\Delta P)$$

Examine the term, ΔP. It is just difference in net and gross prices :

(3) $$\Delta P = (1+\tau)P - P = \tau P$$

Now examine the term ΔQ, and recall the definition of a compensated demand elasticity:

(4) $$\eta = \frac{\Delta Q}{\Delta P}\frac{P}{Q}$$

Rewrite (4) in terms of ΔQ:

(5) $$\Delta Q = \eta\left(\frac{Q}{P}\right)\Delta P$$

From the definition of ΔP in equation (2):

(6) $$\Delta Q = \eta\left(\frac{Q}{P}\right)\tau P$$

Which simplifies to:

(7) $$\Delta Q = \eta Q \tau$$

Then substitute the definitions of (3) and (7) into formula (2):

(8) $$DWL = \frac{1}{2}\eta Q \tau \tau P$$

– or –

(9) $$DWL = \frac{1}{2}|\eta|(PQ)\tau^2$$

where $|\eta|$ is the absolute value of the compensated price elasticity of demand.

WHY GO THROUGH THIS CALCULATION? The following implications emerge.

1. High $|\eta|$ implies high DWL.
   - 0 means big change in Q to change in P. Implies big distortion in decision.
2. PQ = total revenue spent on food initially. Greater share spent initially greater the excess burden.
3. J^2 – as tax rate increases, excess burden goes up with its square!
   - Everything else equal, doubling a tax quadruples its excess burden.
   - The marginal excess burden greater than average.

B. Preexisting Distortions

- monopoly
- externalities
- preexisting taxes

The analysis is complicated when there are already preexisting distortions. It is not necessarily true that two distortions are worse than one.

For example: recall the tax on food, J. This tax changed relative prices. If the government then imposed a tax on the other good, clothing to return to the original slope of the budget set, there is less excess burden than before.

C. The excess burden of a subsidy

Just as a tax imposes an excess burden, so does a subsidy. Graphically, suppose that the government gives a subsidy of s % to housing producers.

***** SEE FIGURE 9-4 *****

Consumer surplus has increased, but from society's point of view, the subsidy is not worthwhile because the extra people that buy housing value it at less than its marginal cost.

Important policy implication: help some group by subsidizing a commodity that they use heavily. Inefficient way to aid people. Better to give as direct grant. Graphically, the group above would be indifferent to the smaller area that is the change in the consumer surplus to the larger area which is the cost to the government.

D. The excess burden of income taxation

Graphically, upward sloping labor supply curve:

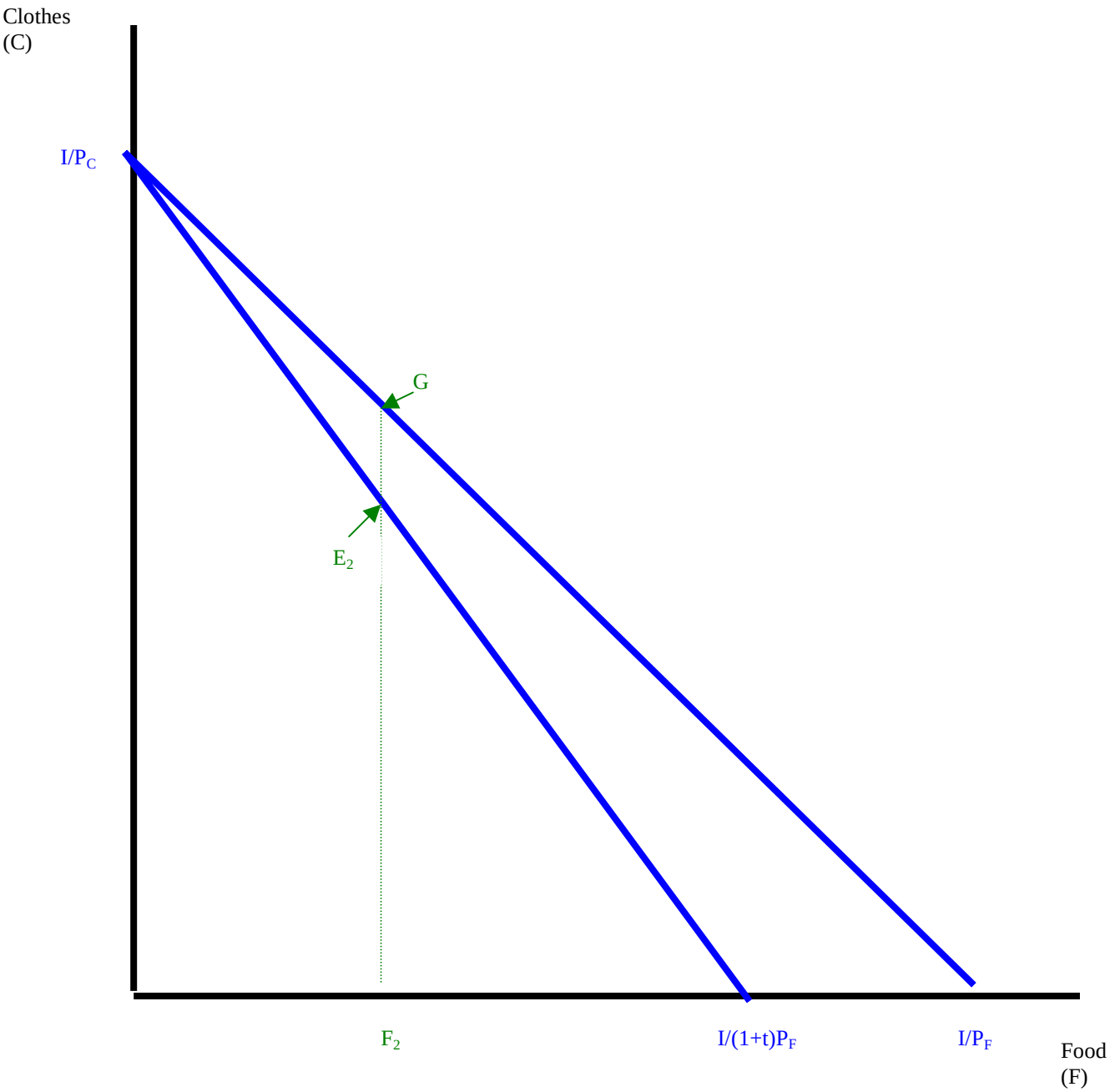
***** SEE FIGURE 9-5 *****

Recall, the formula for the excess burden is:

$\frac{1}{2}, wL_1 J^2$

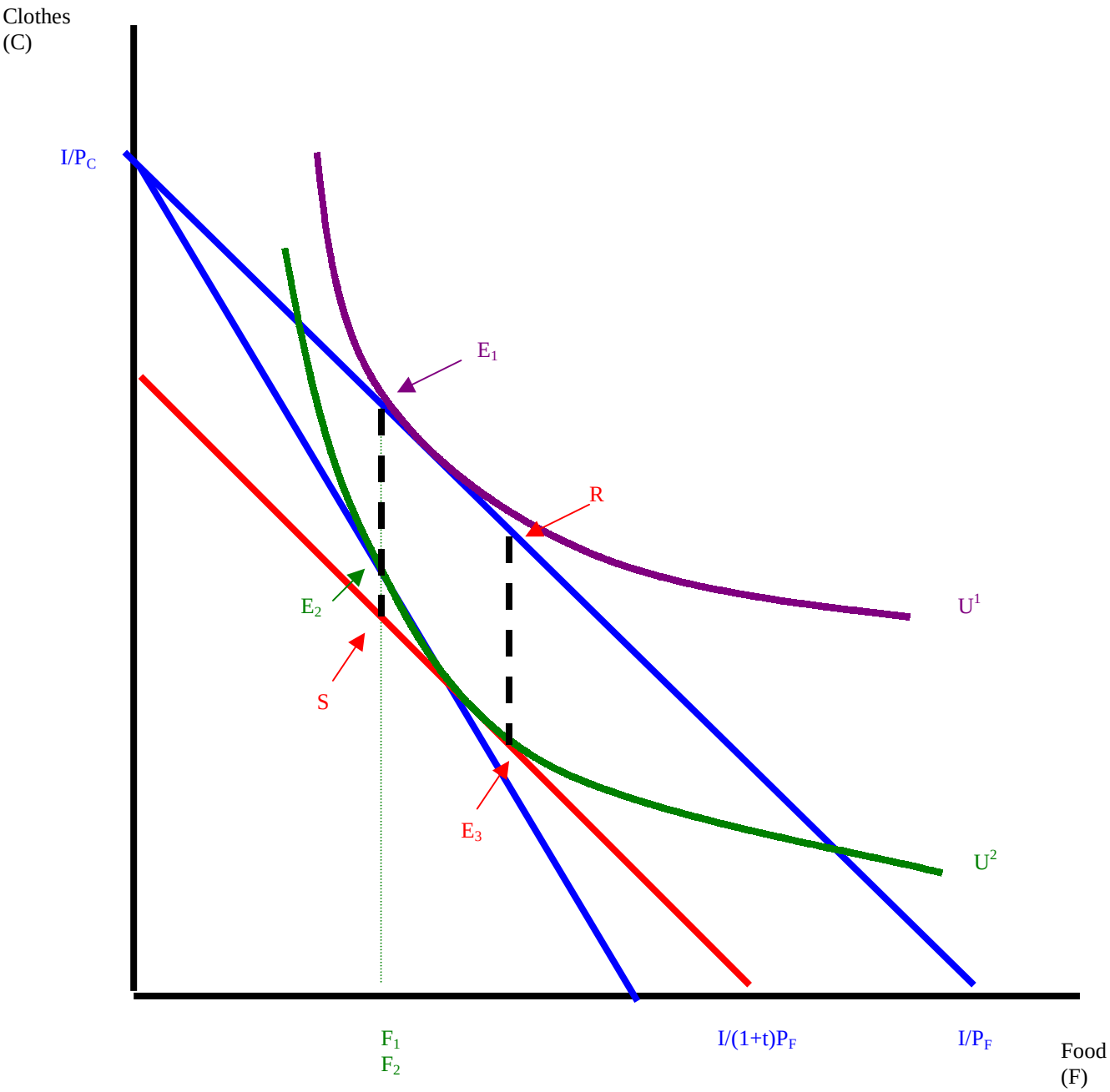
where γ is the elasticity of hours of work with respect to the wage. Let $\varepsilon = 0.2, L_1 = 2000, w = 20, \tau = 0.4$. Then excess burden is \$640 annually. Tax revenue $= \tau w L_1 = 16000$. Thus $\frac{640}{16000} = 4\%$ of tax revenue.

Figure 9-1 – Ad valorem tax on food



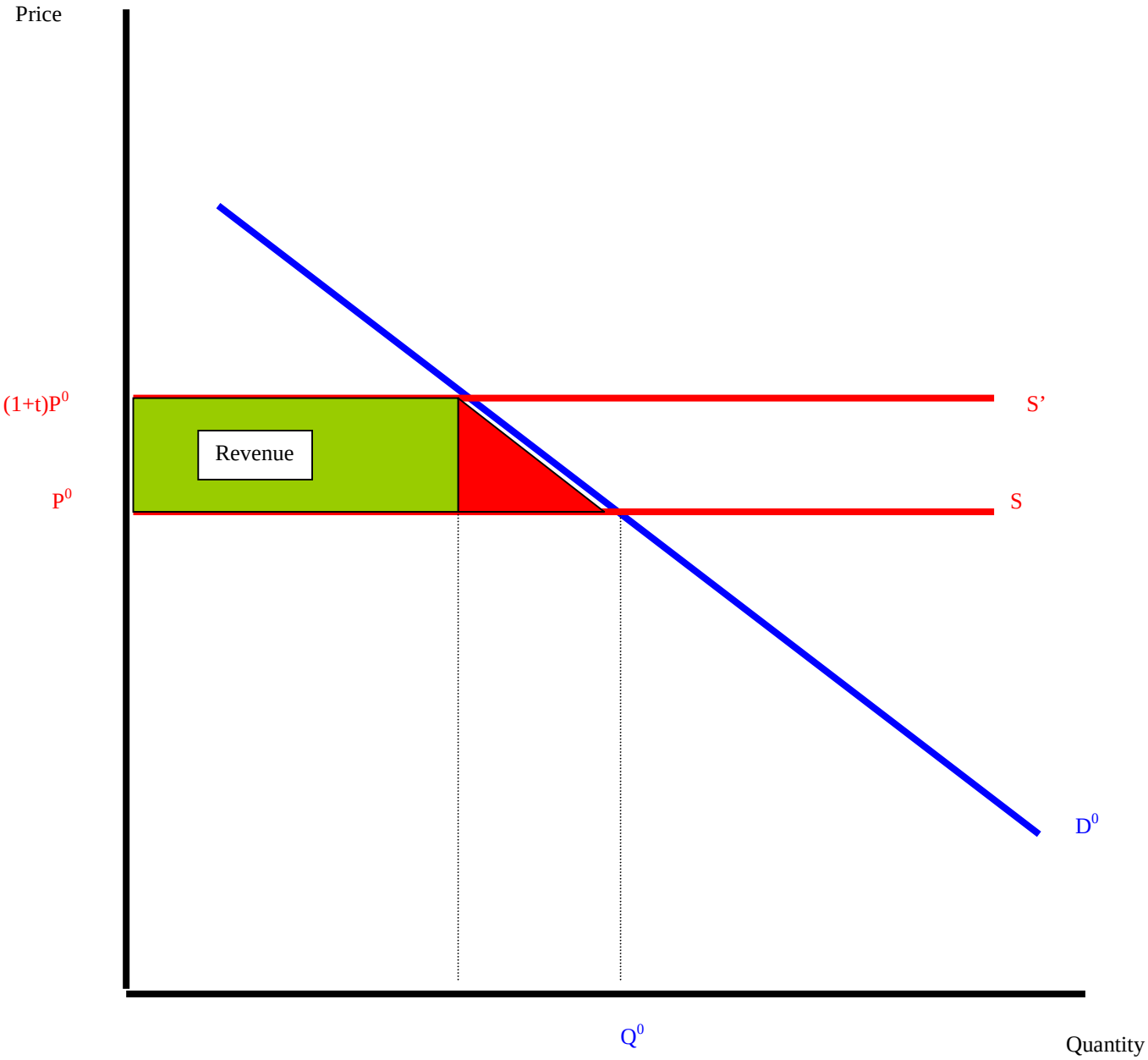
Vertical distance GE_2 is the amount of Clothes foregone if food constant remains at F_2.

Figure 9-2 – Deriving excess burden graphically



Both E_2 and E_3 give the same utility. But government raises more money at E_3, as shown by the dashed black line.

Figure 9-3 – Measuring excess burden with Hicksian demand curves

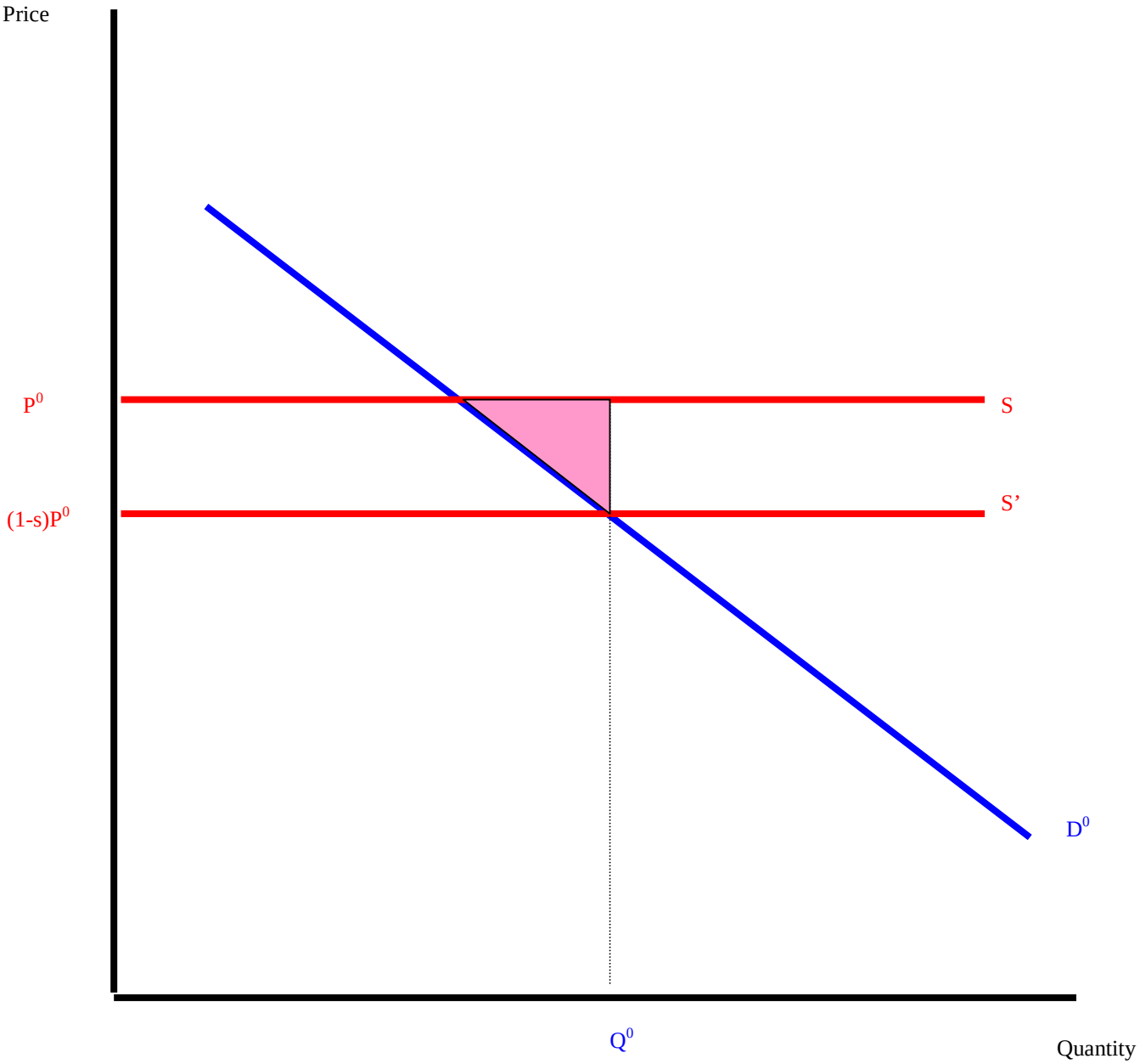


To compute excess burden we assume:

(a) The supply curve is perfectly elastic, and

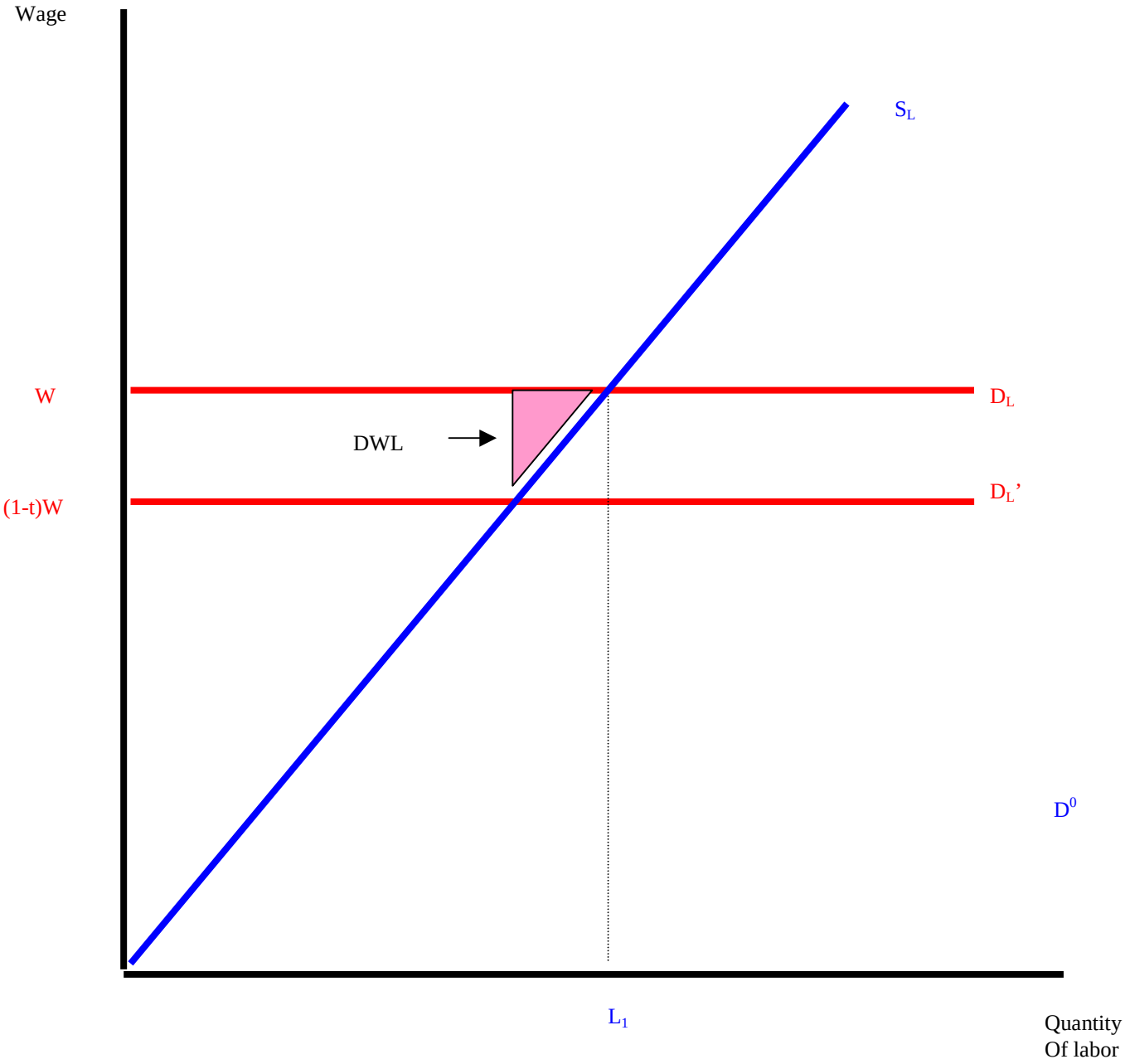
(b) The downward sloping demand curve is the Hicksian compensated demand curve.

Figure 9-4 – Measuring excess burden with a subsidy



With a subsidy, too much of the good is produced and there is deadweight loss.

Figure 9-5 – Excess burden from income taxation



Given a wage, compensated supply elasticity, initial hours of work, and tax rate, we can compute the excess burden of the tax.

LECTURE 10
EFFICIENT AND EQUITABLE TAXATION

I. OPTIMAL TAXATION WHEN THE GOVERNMENT CAN TAX ALL GOODS

-Equivalent to a lump sum tax

II. OPTIMAL TAXATION WHEN SOME GOODS CANNOT BE TAXED

A. The Ramsey Rule

B. Reinterpretation of the Ramsey Rule

Example 1, Example 2

-compensated/uncompensated elasticities

-calculate excess burden

You may want to review the following problems:
Finals
Spring 1995, Question 4
Fall 1995, Question 4
Winter 1996, Question 4
Spring 1996, Question 6
Fall 1997, Question 5
Winter 1998, Question 5
Spring 1999, Lecture 1, Question 4
Spring 1999, Lecture 2, Question 4
Fall 1999, Lecture 1, Question 3
Fall 1999, Lecture 2, Question 3

I. Optimal Taxation When the Government Can Tax All Goods: A tax on all goods at the same rate is equivalent to a lump sum tax.

The goal of the government may be to finance a budget with the minimum excess burden possible, and without using lump sum taxes (which are politically unfeasible). Assume there are three goods in the economy – food, clothing, and leisure. The reason we will use three goods, rather than two, is because in the next section we will only impose a tax on two of the three goods. The utility function is represented by:

$$U = U(F, C, L)$$

And the budget constraint is written down as:

$$w(T - L) = P_F F + P_C C$$

where T is the time endowment. It can be rewritten as the "full budget constraint"

$$wT = P_F F + P_C C + wL$$

Consider the following ad-valorem taxes: tax goods F, C and L at the same rate τ. This tax raises the prices to $(1+\tau)P_F, (1+\tau)P_C, (1+\tau)w$.

It follows that the budget constraint is now:

$$wT = (1+\tau)P_F F + (1+\tau)P_C C + (1+\tau)wL$$

– or –

$$\frac{wT}{(1+\tau)} = P_F F + P_C C + wL$$

The key point is that a tax on all commodities, including leisure, at the same tax rate, is equivalent to reducing the value of the time endowment. Since w and T are fixed, wT is fixed. Therefore, equivalent to a lump sum tax!

This leads to the obvious point that a tax on all commodities at the same tax rate is

equivalent to a lump sum tax.

On the other hand, it may be impossible to tax one of the good (for example, leisure). Taxing the two other goods, F and C, at the same tax rate is usually not efficient.

II. Optimal Taxation When Some Goods Cannot Be Taxed
A. The Ramsey Rule

Assuming the third good (leisure in this example) cannot be taxed, how should the government set taxes on food and clothing? The objective function of the government is to minimize total excess burden (TEB), subject to raising sufficient revenue (TREV). The implication is that the marginal excess burden per marginal government revenue raised from each commodity must be equal.

Suppose $\frac{MEB_F(\tau_F)}{REV_F(\tau_F)} > \frac{MEB_C(\tau_C)}{REV_C(\tau_C)}$. Then the government can raise the same revenue, but with less TEB to society. In this case it should lower the tax on food, and raise it on clothing.

Consider special case where F and C are unrelated commodities: they are neither substitutes or complements for each other. In addition, assume the supply curve for food is perfectly elastic with a price of P_0.

Now impose a small per-unit tax, u_F, on food. Graphically the TEB is the triangle ABC:

***** SEE FIGURE 10-1 *****

Thus $TEB = \frac{1}{2} u_F \Delta F$, and revenue raised $TREV = u_F F_1$.

To minimize TEB, we need to know information on the MEB of the last dollar of revenue collected. Graphically, increase the tax from u_F to u_F+1 (that is, raising the per-unit tax rate by \$1). The difference between the new, bigger triangle and the old, smaller triangle is the MEB.

Step 1: find the MEB from tax increase
Step 2: compute the associated increase in tax revenue
Step 3: divide MEB by marginal increase in tax revenue.

Step 1: $TEB = \frac{1}{2}(u_F + 1)\Delta F$ (note that) F only technically correct for infinitesimal change)

Before the \$1 tax increase, $TEB = \frac{1}{2}(u_F)\Delta F$; the difference between the two triangles gives $MEB = \frac{1}{2}\Delta F$.

Graphically this area is approximately the difference between the excess burden associated with the tax rate u_F+1 and the original tax u_F. It ignores the small trapezoid in the figure, however.

Step 2: The marginal government revenue is the new revenue minus the old revenue, $\left[(u_F + 1)F_1 - u_F F_1\right] = F_1$.

Step 3: Dividing the MEB per additional dollar raised gives: $\frac{1}{2}\left(\frac{\Delta F}{F_1}\right)$

Similarly the MEB per dollar raised on clothing would be: $\frac{1}{2}\left(\frac{\Delta C}{C_1}\right)$

The Ramsey Rule: When only a subset of the goods in the economy can be taxed, in equilibrium the MEB per dollar raised must be equal across those goods:
$\frac{\Delta F}{F_1} = \frac{\Delta C}{C_1}$.

This does <u>not</u> say that MEB is equalized across goods. Instead, MEB per dollar raised is equalized in order to be efficient.

Also note that the change in a variable,) , divided by its total value is just the

percentage change in that variable (recall the definition of an elasticity $\left(\frac{\Delta Q}{Q}\Big/\frac{\Delta P}{P}\right)$). The Ramsey rule implies that to minimize total excess burden, tax rates should be set so that the percentage reduction in the quantity demanded of each commodity is the same.

B. A reinterpretation of the Ramsey rule

Assume goods F and C are unrelated, so that a price change in one market does not affect the other market. Recall that the excess burden on F can be written as $\frac{1}{2}\eta_F P_F F \tau_F^2$ and the excess burden on C can be written as $\frac{1}{2}\eta_C P_C C \tau_C^2$. By adding these two expressions together, the total excess burden is:

$$EB = \frac{1}{2}\eta_F P_F F \tau_F^2 + \frac{1}{2}\eta_C P_C C \tau_C^2$$

The government's problem is to minimize, through its choice of tax rates J and J_C, the total excess burden subject to a revenue constraint, $P_F F J_F + P_C C J_C = R$.

We can set this up as a Lagrangian:

$$\min L = \frac{1}{2}\eta_F P_F F \tau_F^2 + \frac{1}{2}\eta_C P_C C \tau_C^2 + \lambda\left[R - P_F F \tau_F - P_C C \tau_C\right]$$

Then set $\frac{dL}{d\tau_F} = 0 \Rightarrow \eta_F P_F F \tau_F - \lambda P_F F = 0 \Rightarrow \lambda = \eta_F \tau_F$.

Similarly for tax rate on C, set $\frac{dL}{d\tau_C} = 0 \Rightarrow \lambda = \eta_C \tau_C$. Thus $\eta_F \tau_F = \eta_C \tau_C$.

By rearranging the terms, we obtain the "inverse elasticity rule":

$$\frac{\tau_F}{\tau_C} = \frac{\eta_C}{\eta_F}$$

As long as two goods are unrelated in consumption, the tax rates should be

inversely proportional to their elasticities. The higher the compensated elasticity on C relative to F, the low the tax rate on C. The intuition is as follows: an efficient set of taxes should distort behavior as little as possible. The government therefore taxes relatively inelastic goods.

Example #1

As a policy maker, you are provided with the following information.

- The compensated elasticity of demand for clothing with respect to the price, denoted as $0^{CLOTHING}$, is equal to -0.5.
- The uncompensated elasticity of demand for clothing with respect to the price, denoted as $,^{CLOTHING}$, is equal to -1.0.
- On average, 1,000 units of clothing are sold per year at a price of $10 per unit.
- The supply curve for clothing is perfectly elastic.

a. Calculate the excess burden from a 25 % ad-valorem tax on clothing. How about a tax of 15 %? 30 %?

b. If you were instead told that the elasticity of supply was less than perfectly elastic, would your calculation in part (a) overestimate or underestimate the true excess burden? Why?

Now suppose you are given the two additional pieces of information.

- The compensated elasticity of demand for food with respect to the price, denoted as 0^{FOOD}, is equal to -0.5.
- The uncompensated elasticity of demand for food with respect to the price, denoted as $,^{FOOD}$, is equal to -2.0.

c. Assume that clothing and food are the only goods in the economy. If the government needs to raise money and can impose an ad-valorem tax on both goods, how should it set the ratio of the tax rates, $\frac{\tau^{CLOTHING}}{\tau^{FOOD}}$, to minimize excess burden?

d. Suppose that there are only two goods, clothing and food. Illustrate how an ad valorem tax on food can lead to excess burden even if there is no change in food consumption. Clearly mark the excess burden in your picture.

C. An application to taxation of family labor supply

Under current law, the unit of taxation is family, not the individual. Both the husband and wife are taxed on the sum of their incomes. That is, if the wife earned an extra dollar, the family pays the same additional taxes to the government as if the husband had earned the extra dollar.

$U=u(C, L_{HUSBAND}, L_{WIFE})$

A tax on earnings (W_H and W_W) creates excess burden. How should tax rates be set to minimize the burden? Assume the husband's and wife's hours of work are unrelated goods – so that an increase in one's wage does not affect the other's hours.

The inverse elasticity rule implies imposing a higher tax rate on commodity that is relatively inelastically supplied. To enhance efficiency, whoever's labor supply is relatively inelastic should bear the relatively high tax rate. Among adults aged 25 to 54, the labor supply of men is much more inelastic than women; it is efficient to impose higher tax rates on men rather than women.

Example #2

As a policy maker, you are provided with the following information on the labor market.

- The compensated elasticity of hours of work supplied with respect to the after-tax wage rate for men, denoted as 0^{MEN}, is equal to 0.4.
- The uncompensated elasticity of hours of work supplied with respect to the after-tax wage rate for men, denoted as $,^{MEN}$, is equal to 0.1.
- On average, men work 1,000 hours per year at a wage rate of $7 per hour.
- The demand curve for male labor is perfectly elastic.

a. If wages increase by 10 %, by what percentage will hours of work of men increase?
b. Calculate the excess burden arising from an 50 % ad-valorem tax on wages of

men.

Suppose that there are 3 goods in the economy: consumption goods (C), leisure of men (L^{MEN}), and leisure of women (L^{WOMEN}). Furthermore, assume that each good is neither a complement nor a substitute for the other two goods. Finally, suppose that you are provided with the following additional information:

- The compensated elasticity of hours of work supplied with respect to the after-tax wage rate for women, denoted as 0^{WOMEN}, is equal to 0.3.
- The uncompensated elasticity of hours of work supplied with respect to the after-tax wage rate for women, denoted as $,^{WOMEN}$, is equal to 0.2.
- On average, women work 800 hours per year at a wage rate of $9 per hour.
- The demand curve for female labor is perfectly elastic.

c. If the government is able to impose an ad-valorem tax all three goods, what will be the ratio of the tax rate on the wages of women to the tax rate on the wages of men that will minimize excess burden, that is, $\frac{\tau^{WOMEN}}{\tau^{MEN}}$?

d. If the government is only able to impose an ad-valorem tax on the leisure of women and the leisure of men but not on consumption goods, what will be the ratio of the tax rate on the wages of women to the tax rate on the wages of men that will minimize excess burden? Do men or women face a higher tax rate?

LECTURE 11
THE PERSONAL INCOME TAX

I. MOTIVATIONS AND BASIC STRUCTURE OF THE TAX SYSTEM
-Figuring out how much you owe in taxes; 3 steps

II. DEFINING INCOME
Examples

III. EXCLUDABLE FORMS OF INCOME
A. Interest on State and Local Bonds
Example 1, interest on state and local bonds

B. Capital Gains Before Recent Legislation
C. Capital Gains After Recent Legislation
D. Employer Contributions to Benefit Plans
E. Some Employee Saving for Retirement
1. Traditional IRA
-2 benefits and 1 cost
F. Changes to IRA's
G. Do IRA's increase savings?

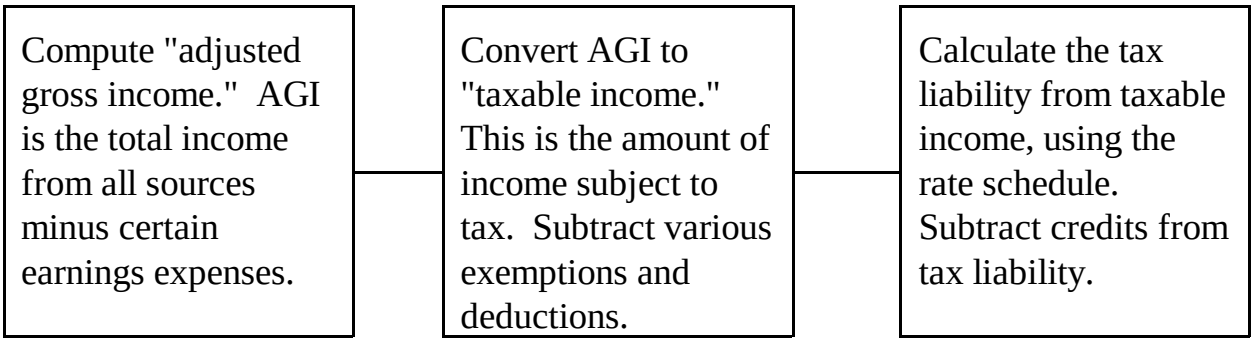
IV. EXEMPTIONS, DEDUCTIONS AND CREDITS
Tax Liability=t*(AGI-Deduction-Exemptions)

You may want to review the following problems:
Finals
Winter 1996, Question 2
Spring 1996, Question 7
Fall 1997, Question 4
Winter 1998, Question 4
Winter 1998, Question 7
Spring 1999, Lecture 1, Question 5
Spring 1999, Lecture 2, Question 5
Fall 1999, Lecture 1, Question 6
Fall 1999, Lecture 2, Question 6

I. Motivations and Basic Structure of the Tax System

The goal of this lecture is to give you an idea what principles underlie a good tax system, and compare those principles to what our tax system actually looks like. Although the U.S. tax code is far from ideal, there are inherent ambiguities in defining "income."

The basics: Your household files an annual tax return (due by April 15 of the next calendar year). Figuring out how much you owe in taxes falls into three steps:



We will define these terms more precisely in Sections III and IV.

Please note the following when reading these notes and studying for the exam:

1. Some of the numbers are outdated. These numbers usually refer to the 1994 tax year. In some places where the tax law has recently changed (for example, regarding capital gains taxes and individual retirement accounts), the discussion in the notes will differ from the textbook.

2. There is a lot of institutional detail in the U.S. tax code. For the exam, you are only responsible for understanding the concepts and numbers discussed in lecture.

II. Defining Income

A. Definition

How should "income" be defined? Public finance economists use their own standard, an "ideal" definition:

> Haig-Simons (H-S) definition of income: Income is the money value of the net increase in the individual's power to consume during a period.

This definition implies that both actual consumption and additions to wealth are increases in income (for example, if the stock market increased your wealth by $5,000, it should be counted as income regardless of whether or not you sell your stocks).

B. Items that should be included in the H-S definition, but not always counted as income in the tax code:

Examples –

- Employer contributions to retirement plans – even though not directly given to recipient.
- Employer contributions to the employee's insurance plans – health, disability, legal, dental.
- Transfer payments like Social Security.
- Capital gains – increases in an asset's value are "capital gains," and decreases are "capital losses." In the tax code, you only pay taxes on capital gains when you sell the asset (meaning that the capital gain is realized). You do not pay taxes if it is unrealized.
- In-kind income – one prominent example is owner-occupied housing. A landlord rents out a home, collects rent, and pays taxes. A homeowner receives value from his home even though he does not rent it out, and does not pay taxes on this imputed rent. The H-S definition requires that the homeowner pay taxes equal to rental payments he would have received if he had rented out home, rather than consuming housing.

C. Some Obvious Difficulties with the H-S Definition and Previous Examples

- Unrealized capital gains are hard to measure for some assets, like a house or piece of art. In addition, it may be difficult for the person to pay the tax bill unless he sells the asset.

- Some durable goods, like housing or cars, give "imputed income" for many periods. How does the person depreciate the asset?

- In-kind services (like housework) are clearly valuable, but are hard to monitor and somewhat difficult to value.

- The definition implies only net-of-business expenses should be counted as income, but it is hard to distinguish an expense that also gives personal value. For example, what fraction of business lunch should be counted as income?

III. Excludable Forms of Income

You do not pay taxes on every form of income received. Some prominent examples include income from government bonds, capital gains, and certain job benefits.

A. Interest on State and Local Bonds

- Unlike the interest from your Bank of America checking account, income from state and local bonds is not subject to federal tax. If investors do not have to pay federal tax on interest received from state and local bonds, they should be willing to accept lower rate of return. The exclusion of this income from the tax bill encourages investment in state and local governments.

Assume a person faces a tax rate (J) of 31%, and the rate of return (ROR) on taxable securities is 15%. If the state government offered a bond with a rate of return higher than (1-J)*ROR (=0.69*0.15=0.104), the person will invest in the state's bond.

People with different incomes face different marginal tax rates. The U.S. tax structure is progressive, meaning those with higher incomes face a higher marginal tax rate (see Section V for an illustration). Therefore the required ROR for someone with J=15% to invest in state bonds would be 0.1275 (=0.85*0.15). To induce both the high income (J=31%) and low income (J=15%) people to buy the state bonds, part of surplus goes to high-income person – he is willing to accept a return of 10.4% from the state bond, but he instead gets 12.75%.

The progressive tax structure means that the federal government loses more in foregone tax revenue than the state government saves in foregone interest

payments. Assume the state borrows $100 at 12.75% instead of 15%; the state saves $2.25 in interest payments (it would have to pay the private market ROR without the tax deductibility). If only low income people (J=15%) bought the state's bond, the federal government loses $2.25 (before the low income person paid tax on $15 he received in interest at the private market interest rate of 15%; the taxes he paid was equal to J*return in dollars = 0.15*$15). For a high income person with the higher tax rate of 31%, the federal government loses 0.31*$15=$4.65. More than half of the tax loss to the government ($2.40) is not translated into a gain for the state.

Example from an old final exam

The interest from state bonds is not counted as taxable income on a individual's federal income tax form. Suppose that private market bonds yield a rate of return, ROR, of 20%. Also assume that there are 3 Federal tax brackets – 0% (low income), 15% (moderate income), and 28% (high income).

a. If the return on state bonds was only 16%, which group (if any) would purchase state bonds? Why?

The after-tax rate of return on private investment is 1.00*0.20=20% for those with low income. It is 0.85*0.20=17% for those with moderate incomes, and is 0.72*0.20=14.4% for those with high incomes. Thus, the state's ROR exceeds the private ROR only for those with high incomes.

Suppose that individuals in the first bracket (0%) are willing to purchase, at most, $100,000 worth of state bonds. Individuals in the second bracket (15%) will purchase up to $75,000, while individuals in the third bracket (28%) are willing to purchase up to $250,000.

b. If the state government needs to raise $100,000 in revenue, what rate of return should it offer? How about for $175,000?

The state could raise either $100,000 or $175,000 by offering a ROR greater than 14.4%. The high income people are willing to supply this amount of money; thus, there is no need to raise the ROR even higher.

c. If the state government sold $325,000 worth of bonds, how much does it save in interest payments compared to when the interest is taxable? How much does the federal government lose in tax payments because of the deductibility?

To raise $325,000, the state must sell to both the moderate income and high income investors; thus it offers a ROR of 17%. The state can therefore offer a ROR that is 3% lower than it would have to if interest payments were not tax deductible. Altogether it saves 0.03*325,000=$9,750. The federal loses more however. The amount of tax revenue foregone from the moderate income group is 0.03*$75,000, and from the high income people is 0.056*$250,000. In total, the revenue loss is $16,250.

B. Capital Gains Before Recent Legislation

It used to be the case that all realized capital gains are taxed as ordinary income for most taxpayers. Maximum rate was 28 %, however (which gives break for those with marginal tax rates greater than 28 %). Capital losses, decreases in an asset's value, can be offset against gains (and capped at minus $3,000) This means that if one stock gained $10,000 and another lost $15,000, the total deduction from income is $3,000, not $5,000.

Feature #1. It is the case both before and after recent tax changes, that only realizations taxed: unless a gain is "cashed in" no tax is levied. And tax payments are deferred until the gain is realized. Postponing tax payments can have enormous consequences, because of compound interest.

The textbook has an excellent example on pages 366-367.

- Purchase asset for $100,000
- Annual return of 12%
- Hold asset for 20 years
- The tax rate on <u>realized</u> gains is 28%

If a person does not realize the gains until the end of 20 years, the asset is worth $\$100{,}000 * (1.12)^{20} = \$964{,}629$. The total capital gains are $864,629, and the tax liability is $242,096. His total net gain is **$622,533**.

If the person does realize the capital gains each year and then reinvests it into the asset, the "effective" annual return is (1-.28)*.12=.086. After 20 years, the value of the asset is $100,000*(1.086)^{20} = $524,560, and the net gain is **$424,560**. Since taxes were paid all along, there is no adjustment at the end.

The presence of capital gains taxes makes investors less likely to adjust their portfolios; this is called the "lock-in effect." Capital may be misallocated, because it no longer flows to highest ROR investments.

Feature #2. Capital gains are not realized at death.

- The value of the asset is "stepped up" at death, meaning if the child sells the asset immediately after the parent's death, the child does not pay very much in taxes. In the example above, if the asset valued at $964,629 was bequeathed to the child, and the child sold it after the death, the child avoids the $242,096 in taxes.

C. Capital Gains After Recent Legislation

The treatment of capital gains has changed in 1997. For a readable description of these changes, visit the internet site

http://www.kiplinger.com/

If you sold stock, bonds, mutual funds or other assets after May 6, 1997 you get a capital-gains break regardless of your income. In the past, only those in the highest tax brackets benefitted as a 28% cap on the tax rate for long-term gains short-circuited the 31%, 36% and 39.6% brackets. Now, if you're in the 28% or higher bracket (with taxable income, including investment profits, of more than $24,650 on an individual return or $41,200 on a joint return), your long-term gains are taxed at a flat 20%. If you have less income--and live in the 15% bracket--long-term gains are taxed at 10%.

D. Employer Contributions to Benefit Plans

- Employer contributions to pension and health insurance are not taxed.
- Represent additions to potential consumption.

- When we reviewed "health care," we mentioned that this provides an implicit subsidy to employer provided health insurance. You also saw a question like this on the midterm exam.

E. Some Employee Saving for Retirement

Workers can engage in tax-favored saving for their retirement.

1. "Traditional" individual retirement accounts (IRA): person without a pension at work can deposit up to $2000 per year in a qualified account. It is easy to get started on this – the form you fill out is one page, and you deal with whatever mutual fund company or bank you choose. The income limits for IRAs (and Roth IRAs) are going to increase, effective 2002. The $2000 limit had been in place since 1981. From 2002-2004, the limit will increase to $3000 per year; from 2005-2007, $4000 per year; from 2008 onward, $5000 per year and indexed for inflation.

There are two key benefits and one cost of traditional IRAs:

a. The interest accrues at the before tax ROR. That is, if you receive $100 in interest in year 1, the whole $100 is reinvested in year 2. If your marginal tax rate was 31%, on the other hand, the same investment in a normal bank account would only add $69 to be invested in year 2.

b. You can deduct your IRA contribution from your AGI if your income is under a certain level. For example, if your AGI was previously $20,000, it is now $18,000 after your contribution. You do pay income taxes when you withdraw the money during retirement, however.

c. There are penalties if the money is withdrawn before age 59.5.

- Note that you can invest IRA money in anything that you would normally invest in, i.e. can pick to invest in stocks, bonds, etc.

- Not all investments are good for IRAs (or 401k's) however! State and local bonds already are treated favorably by the tax system; thus you lose benefit (a). Surprisingly, a lot of people invest in things that are already treated favorably by the tax system.

2. 401(k) plans are named for a section of the income tax code (and for non-profits and universities, 403(b) plans). They are offered by employers (although there is no requirement that they be offered).

a. You earmark a portion of salary (up to 15% of your salary) for the 401(k), and no income tax liability incurred on that portion. The limit is currently *much* higher than IRAs – $10,500 per year for 401k's and 403b's. This limit is increasing, effective 2002. It increases to $11,000 in 2002, $12,000 in 2003, $13,000 in 2004, $14,000 in 2005, $15,000 in 2006, and indexed for inflation thereafter.
b. Your investment accrues at before tax ROR.
c. Some firms "match" some or part of your contribution – for each $1 you contribute, companies often contribute 50 to 75 cents (up to some cap). U.K. has a 200% match rate on the first 5% of salary, UCLA has 0%. Thus, an employee making $30,000 at U.K. could contribute $1500 to the 403(b) and U.K. would contribute $3000, for a total of $4500. The employee could then contribute additional money to the 403(b) plan (with the tax savings), but no employer match.
d. When you graduate from U.K. and get a job, you should definitely look into your company's benefits; you usually have to take active steps to start contributing.

3. 457(b) plans - are similar to 401(k) and 403(b) plans in most respects regarding taxes and deductibility, except that these plans are targeted toward state and local organizations. These plans will become <u>much</u> more in 2002 and beyond because of the tax reform in June 2001 (known as The Economic Growth and Tax Relief Reconciliation Act of 2001, EGTRRA). Before 2002, 457(b) plans are pretty much substitutes for 401(k) or 403(b) plans – if you contributed $1000 to a 457(b), the amount you could contribute to a 403(b) fell by $1000. Effective 2002 and beyond, 457(b) plans are no longer substitutes – an employee can potentially contribute another $11,000 above and beyond the 403(b) limit – e.g., $22,000 if the firm offers both plans. The limits for 457(b) plans are also going up the same way that 401(k) and 403(b) plans are going up. Some public universities, like University of Kentucky, qualify for both plans, which is a huge benefit to those employees who are saving a lot for their retirement.

F. Some Recent Changes to IRAs

You can still choose a "traditional" IRA, but for many people, the contributions are not tax deductible. The new IRA--dubbed the Roth IRA after its chief cheerleader in the Senate, William Roth (R-Del.)--is called back-loaded because the tax breaks come at the end of the line. Rather than deducting contributions and paying tax on withdrawals, after-tax money goes into the accounts and tax-free money comes out. These IRAs will be a big hit with higher-income taxpayers, who are forbidden to deduct IRA contributions.

As with traditional IRAs, there's a $2,000 limit on annual deposits. And you can't contribute the full $2,000 if your AGI is more than $95,000 on an individual return or $150,000 on a joint one. The door to this IRA slams closed when your AGI passes $110,000 on an individual return or $160,000 on a joint one.

For withdrawals to be tax-free, you generally can't tap a Roth IRA until you're at least age 59.5 and the account has been open for at least five years. If you open a Roth IRA in 1998, the first year for tax-free withdrawals would be 2003. Dipping in early means withdrawals might be taxed and hit with a 10% penalty.

The limits for Roth IRAs are going up effective 2002; see IRAs above.

Starting in 2006, Roth 401(k)’s will be implemented – who should contribute to that plan?

IV. Exemptions, Deductions, and Credits

Once AGI is determined, certain subtractions are made to determine taxable income. These exemptions and deductions decreased the taxable base from $3.2 trillion to $2.1 trillion in 1992, a reduction of 35 %.

A. Exemptions

- A subtraction from AGI.
- There is an exemption for each family members, adjusted annually for inflation.
- In 1994, $2,450 per person, so a husband, wife, and three kids had

exemption of $12,250.
- It is phased out for those with high incomes, which essentially leads to higher tax rate.
- Why have exemptions? It might adjust for ability-to-pay in the presence of children. Also, tax relief to poor families: the higher the exemption, the greater AGI must be before any income tax is owed.

B. Deductions

A subtraction from AGI. There are two types of deductions:

1. Itemized deductions – for specific expenditures cited in law, like charitable contributions, mortgage interest, and state and local income taxes. The taxpayer must list each deduction separately on tax form, and prove (in principle) that expenditures have been made.

– or –

2. Standard deductions – instead of itemizing, can take a fixed amount which does not require documentation. Instead of accounting for all contributions to things like charity, medical expenses that are not reimbursed, etc. you can take standard deduction, which was $6,350 for joint filers and $3,800 for singles in 1994. Around 72 % of forms take standard deduction.

A taxpayer would choose (1) or (2) based on the one that minimized tax liability.

3. Specific Itemized Deductions

a. Unreimbursed medical expenses above 7.5 % of AGI

- essentially lowers the price of health care services

b. State and local taxes

- State and local income taxes (not sales taxes) are deductible, as

are property taxes. Amounted to $143 billion in 1992.
- The deduction makes paying state and local taxes less painful, increases political support for tax increases at state level.

c. Certain interest expenses
- Some of the interest expenses from a business
- Interest on home mortgages. Deductible interest on home equity loans is limited to $100,000 per year.

d. Charitable contributions

- Can deduct the value of contributions made to charities (either in property or in money, but not in time services). It cannot exceed 50% of AGI.

- In 1992, $54 B in deductions for charity.

- The tax price of contributing to charity falls from $1 to $1(1-J). Effectiveness of deduction to giving depends on $,_p$ – if very responsive, will change behavior in response to tax code. Quite elastic, if believe estimates. Deductibility stimulates charitable contributions.

C. Credits

A reduction in your tax liability, regardless of your marginal tax rate.

Two prominent examples are the Earned Income Tax Credit (called either the EITC or EIC), and the child credit. These credits are taken off of the tax you owed, and if your tax liability is less than zero, you are owed money (the EITC is refundable, although the child credit is not). The child credit gives $500 per year per child reduction in the tax liability.

D. Deductions vs. Credits

Tax Liability = J*(AGI-Deduction-Exemptions) - Credit for an

itemizer!

Under a deduction, a poor person with lower J benefits less than rich person. Under credit, both tax liabilities fall equally.

V. Rate Structure

A. Some History

Tax Rates for 1994

Single Returns		Joint Returns	
Taxable Income	Marginal Tax Rate	Taxable Income	Marginal Tax Rate
$0-$22,750	15%	$0-38,000	15%
$22,751-$55,100	28	$38,001-91,850	28
$55,101-$115,000	31	$91,851-140,000	31
$115,001-$250,000	36	$140,001-250,000	36
$250,001 and over	39.6	$250,001 and over	39.6

- Once calculate taxable income, brackets define marginal tax rates. Different marginal tax rates for different brackets (actually 4 schedules, also married people who file separately and single people who are heads of households).
- MTRs have varied substantially over time.
- In 1940s, MTR ranged from 23 % to 94 %.
- In 1980s, 14 brackets ranging from 11 to 50 %.
- Tax reform act of 1986 – drastic change in rate structure, fewer brackets, maximum tax rate was 28 %.
- 1990: 31 % bracket added, 1993: 36%, 39.3%.

B. Rates for Low-Income Individuals

Exemption was approximately equal to 2,450*number of people, and standard deduction ($6,350 for married, $3,800 for single).

For family of four with AGI = $16,150 = 6,350 + 4*2,450 has no tax liability.

In addition, low income families with dependents (children under some age that they support) receive the Earned Income Tax Credit (EITC) = subsidy to earnings of low-income families. Has been dramatically expanded in past few years.

Subsidy depends on number of children – in 1996, family with 2 or more children can receive tax credit of 40% of first $9,470 (=$3,788). Also, if credit exceeds tax liability, difference is refunded. Credit is phased out from around $12,000 to $30,000 of earnings at a rate of 21% for another dollar earned.

The EITC changes the budget constraint in the following way:

***** SEE FIGURE 11-1 *****

- In the phaseout range, the EITC confronts poor families with higher marginal tax rates than those faced by many of their higher income counterparts.

- Does the EITC provide work incentives to the poor? In the phase in range, after tax wage is equal to (1+s)*wage = 1.4w. But in phase out range, the after tax wage is equal to 0.79*w.