

# Externalities

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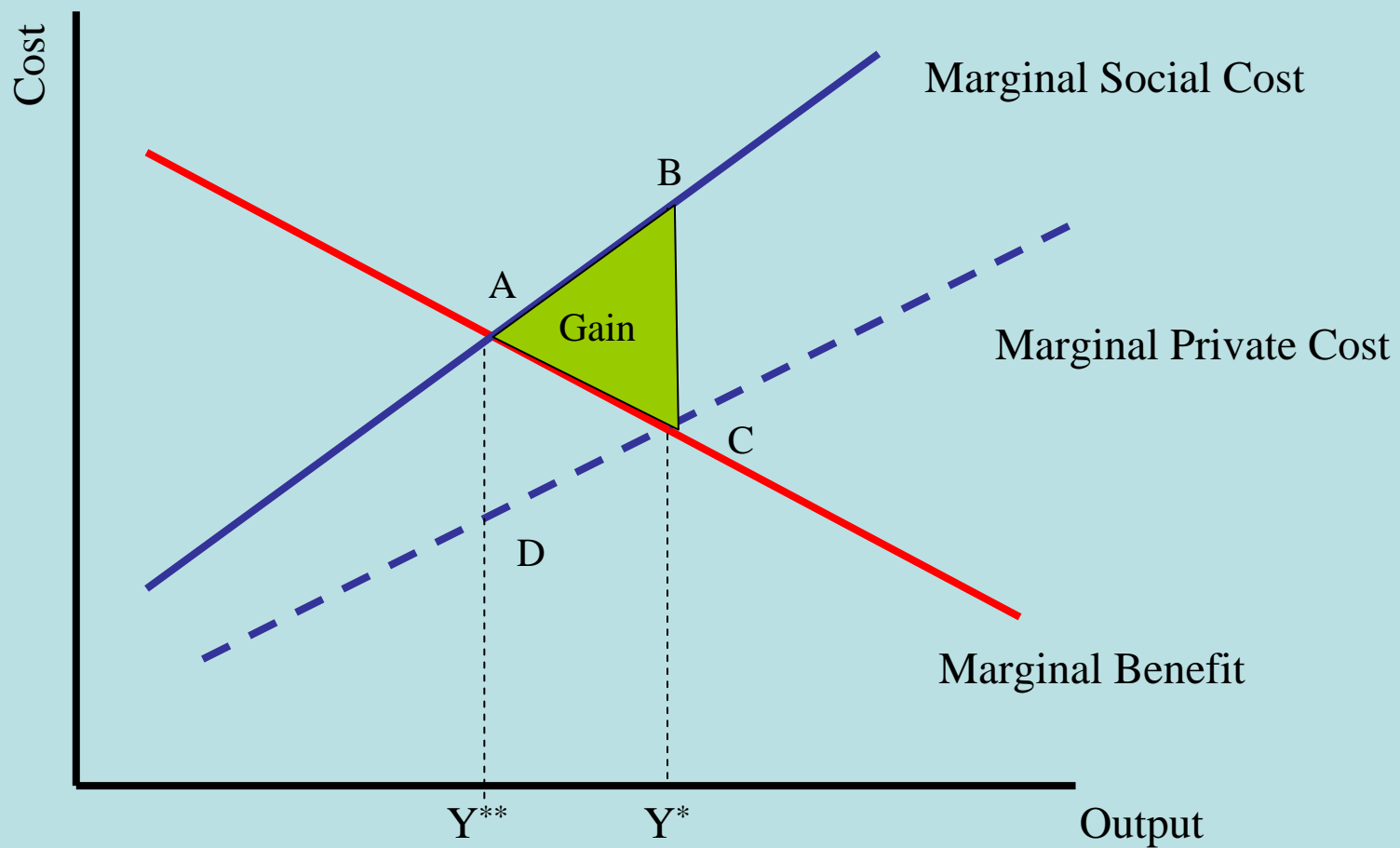
# Definition

- An *externality* exists when the action of one agent unavoidably affects the welfare of another agent. The affected agent may be a consumer, giving rise to a *consumption externality*, or a producer, giving rise to a *production externality*.
- The externality may affect the other agent beneficially (*positive externality*) or detrimentally (*negative externality*)

# Private versus Social Optimum

- The profit of firm 1 is:  $\pi_1 = pY - C(Y)$
- The profit of firm 2 is:  $\pi_2 = -E(Y)$
- Firm 1 maximises profits when:  $MB = C'(Y)$  and produces  $Y^*$
- But society should maximise:  $\pi = p(Y) - C(Y) - E(Y)$   
and produce  $Y^{**}$  when:  $MB = C'(Y) + E'(Y)$
- MR is marginal benefit (revenue) of Firm 1
- $C'(Y)$  is marginal private cost
- $C'(Y) + E'(Y)$  is marginal social cost
- $E'(Y)$  is marginal damage
- $Y^*$  is the private optimum  $> Y^{**}$ , the social optimum

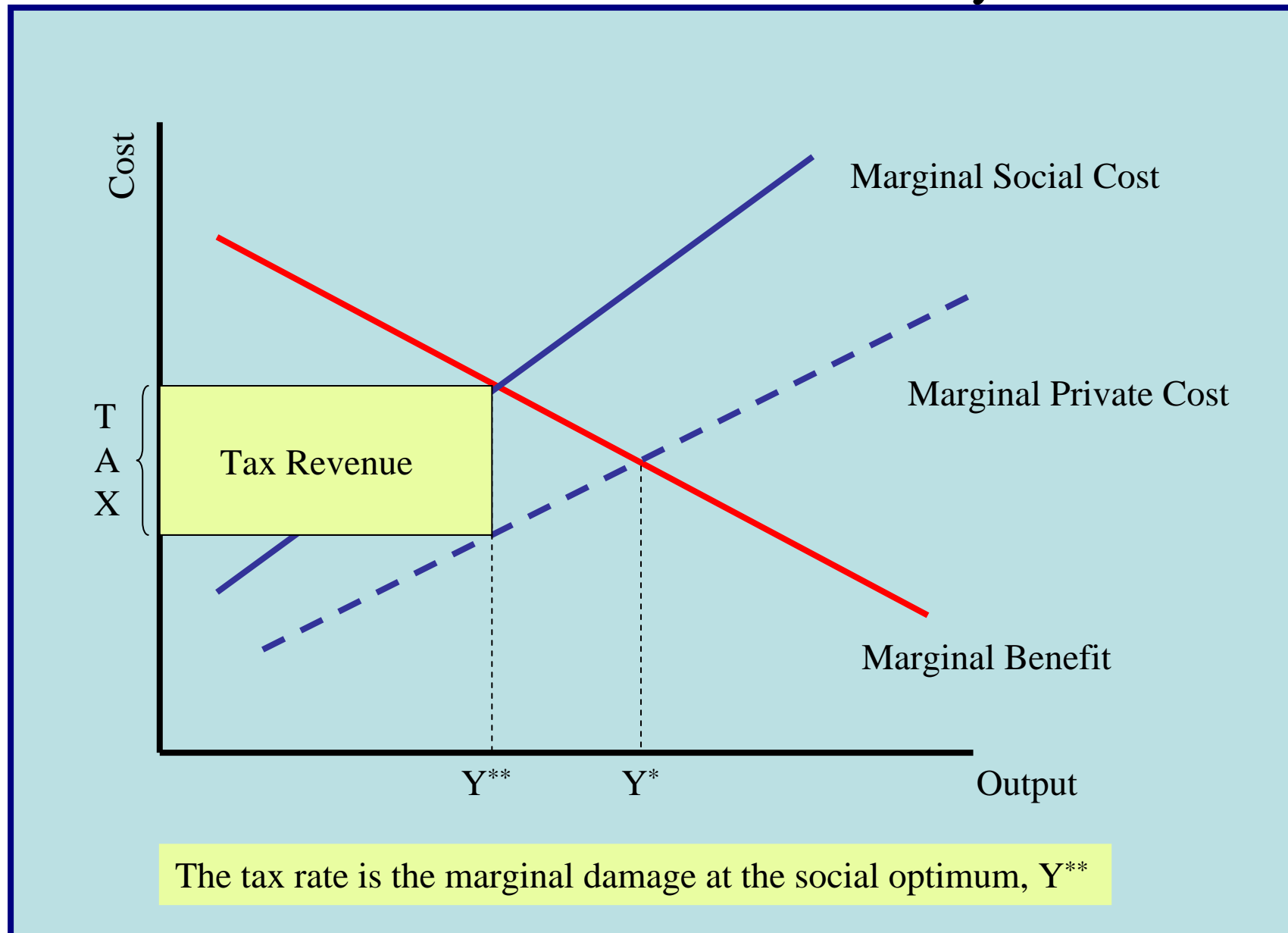
Gain to Firm 2 from output reduction = ABCD; loss to Firm 1 = ADC;  
Net gain = ABC



# Internalising Externalities

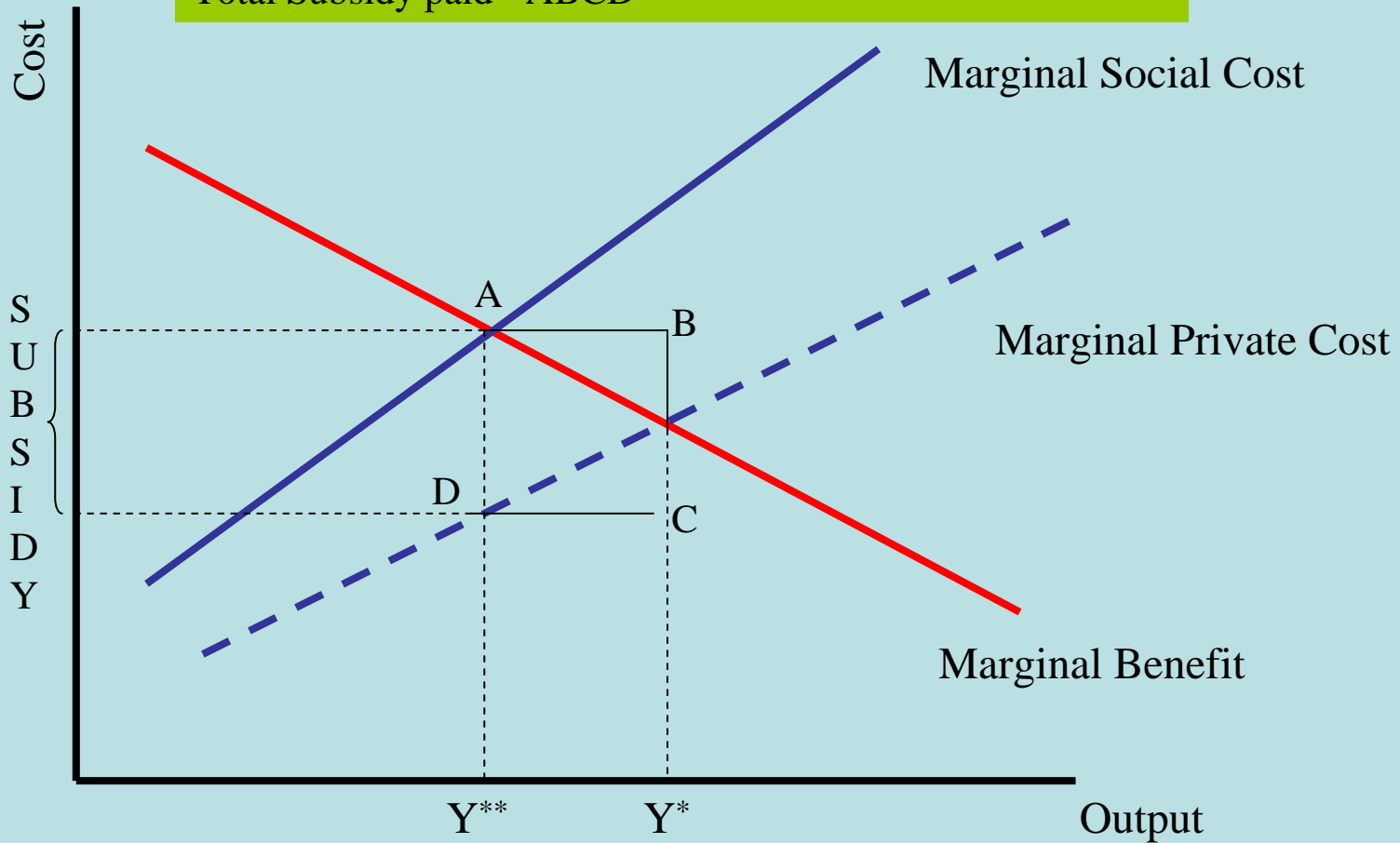
- The externality that firm 1 imposes on firm 2 can be eliminated by forming a single firm from 1 and 2
- This firm maximises:  $\Pi = pY - C(Y) - E(Y)$  and the socially optimum level of output,  $Y^{**}$ , is produced
- The externality has been eliminated by being *internalised*

# A Tax to Correct an Externality



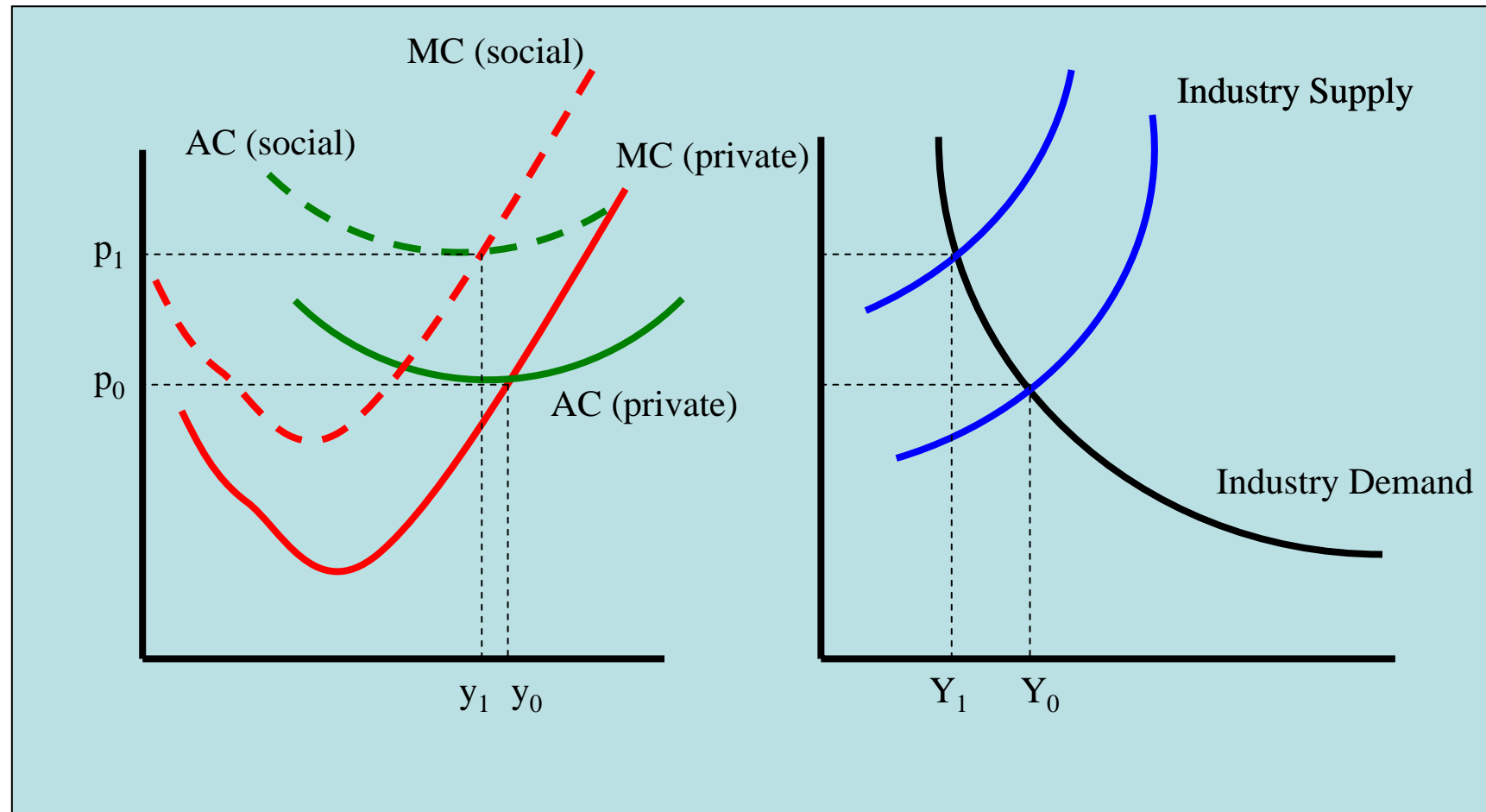
# A Subsidy to Correct an Externality

A subsidy is paid on every unit reduction in output below  $Y^*$   
Total Subsidy paid = ABCD



The subsidy rate is the marginal damage at the social optimum,  $Y^{**}$

# Subsidy-Seeking Behaviour



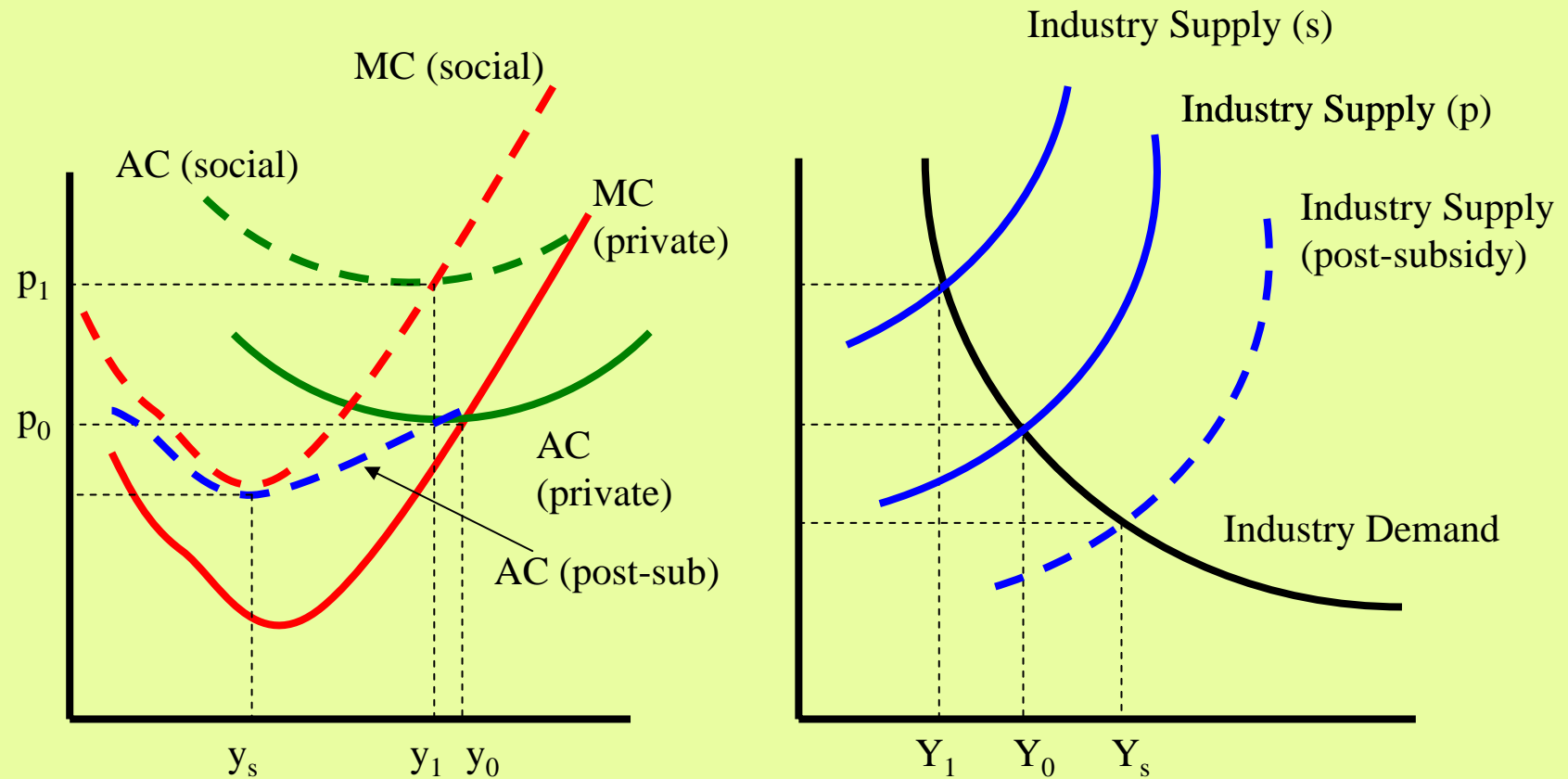


# Average Cost Under Subsidy

- A subsidy is offered on each unit of output below  $y_0$
- This subsidy is the marginal damage at  $y^{**}$  which is  $p_1 - p_0$
- Because of this subsidy the MC curve shifts from MC (private) to MC (social)
- But average cost net of the subsidy is:

$$\frac{TC(y) - s \times (y_0 - y)}{y} = AC(y) - s \times \left( \frac{y_0}{y} - 1 \right)$$

# Subsidy-Seeking Behaviour



Each firm produces less but, attracted by the subsidy, there are more firms in the industry so industry output *increases!!*

# Creating a Market for the Externality: I

- The reason firm 1 can ignore the effects of its actions on firm 2 is that “externality generation” is a costless activity. A market for the externality is “missing”
- Suppose firm 2 has the right to be free of the externality but it can sell to firm 1 the right to “externality generation” for a price of  $\$q$  per unit of output

## Creating a Market for the Externality: II

➤ Firm 2's profits are now:  $\pi_2 = q \times y_1 - E(y_1)$

➤ So, firm 2 will allow Firm 1 to produce up to:

$$q = E'(y_1)$$

➤ So firm 1's profits are now:

$$\pi_1 = p \times y_1 - C(y_1) - q \times y_1$$

➤ So, for firm 1, in equilibrium:

$$p = C'(y_1) + q = C'(y_1) + E'(y_1)$$

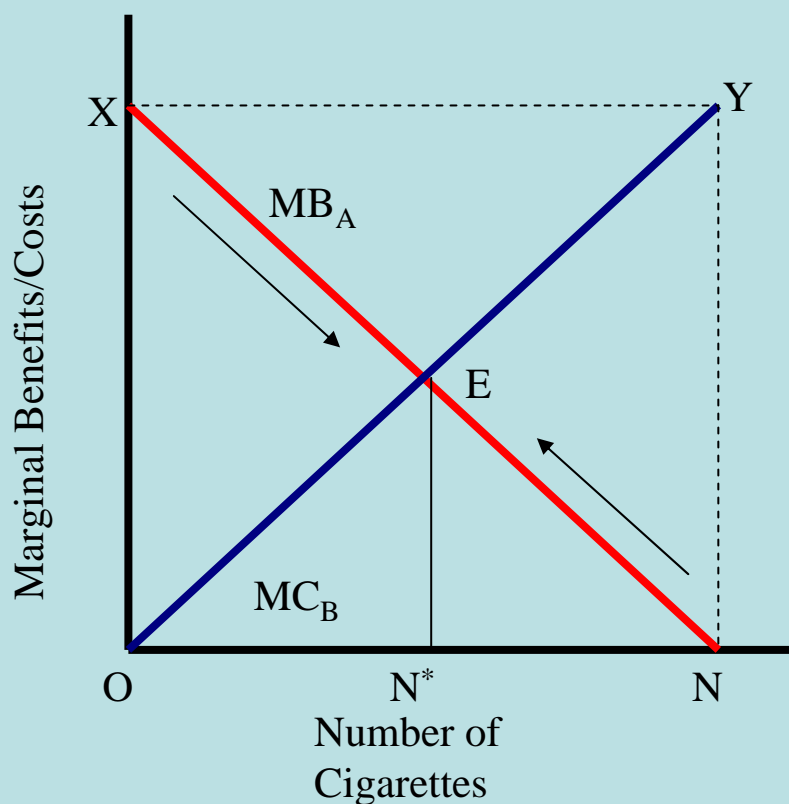
➤ Which is the condition for a social equilibrium

# The Coase Theorem

- The Coase theorem is named after Ronald Coase, from the University of Chicago, who won the Nobel Prize in Economics in 1991
- It proposes that externalities between people can be easily eliminated through negotiation between them, without any need for third-party involvement, provided that the costs of such negotiation are not too high

# The Coase Theorem Analysed

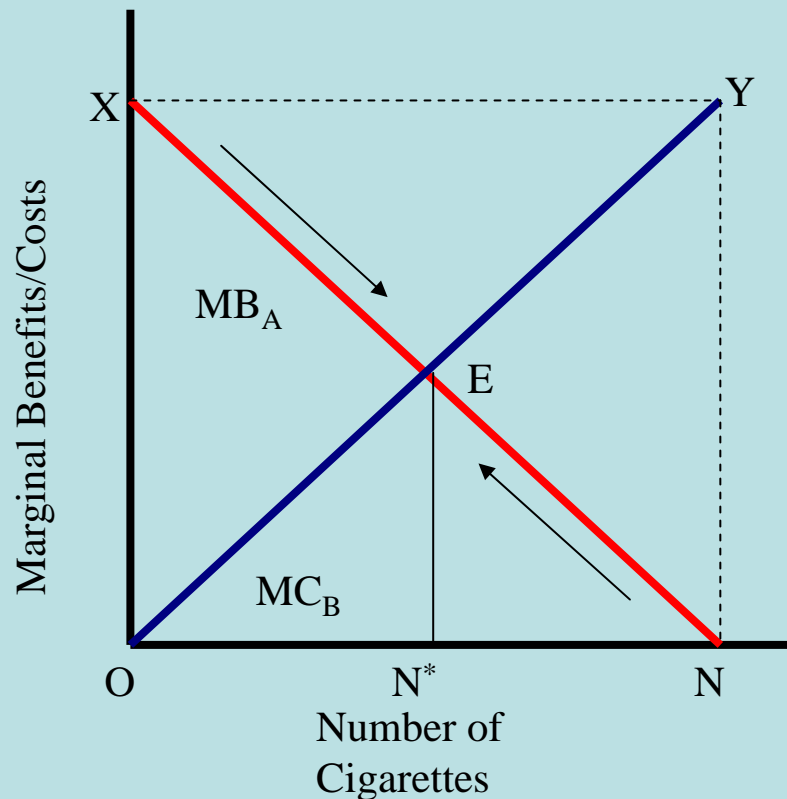
E may be reached by A reducing smoking from N or increasing smoking from 0



- There are two persons in a room, A (smoker) and B (non-smoker)
- $MB_A$  is the marginal benefit to A, and  $MC_B$  is the marginal cost to B, from a given number of cigarettes
- If A has “property rights”: he will smoke N cigarettes  
 $MC_B(N) > MB_A(N) = 0$   
So B can pay A not to smoke
- If B has “property rights”: he will want A to smoke 0 cigarettes  
 $MB_A(0) > MC_B(0) = 0$   
So A can pay B for permission to smoke
- Coasian equilibrium is at point E, when  $MC_B = MB_A$  and  $N^*$  cigarettes are smoked

# The Market for “not smoking”

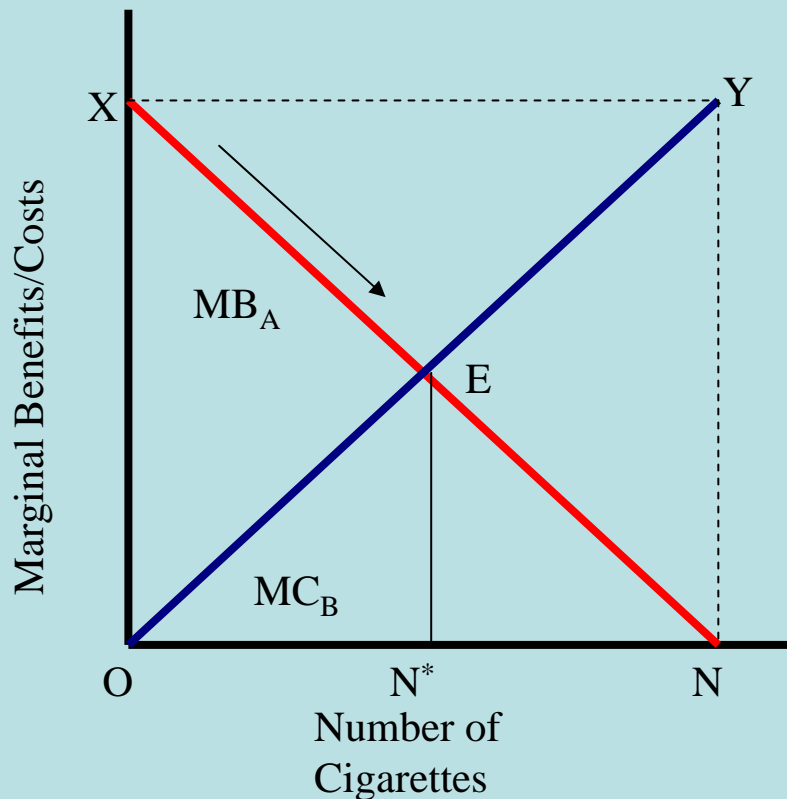
E may be reached by A reducing smoking from  $N$  to  $N^*$



- At the point E, net benefit, = total benefit to A from smoking – total cost of smoking to B is maximised
- So, E represents equilibrium in the market for “not smoking”
- At E, the net gain to society from reducing smoking from  $N$  to  $N^*$ , is the area: EYN

# The Market for “smoking”

E may be reached by A increasing smoking from 0 to  $N^*$



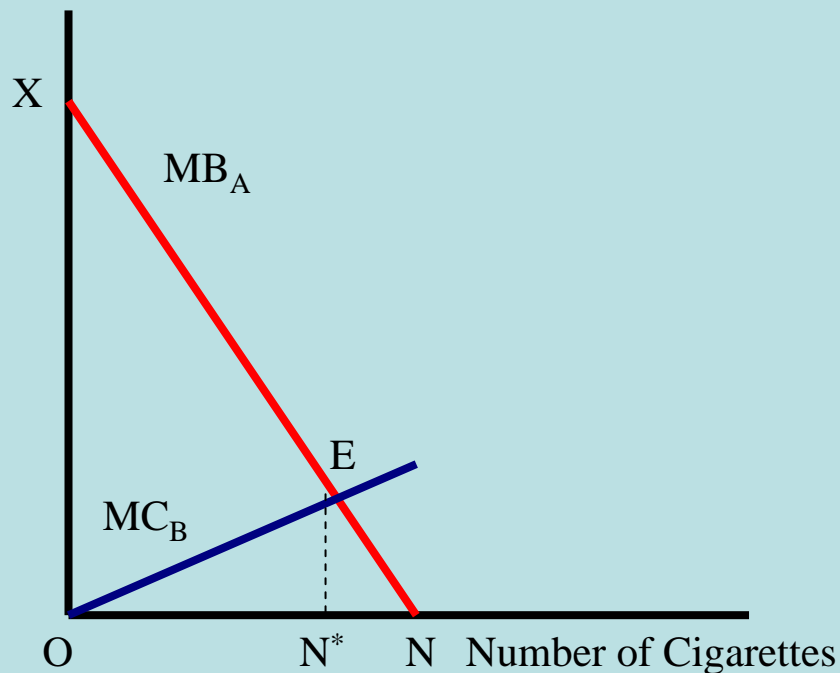
- At the point E, net benefit, = total benefit to A from smoking – total cost of smoking to B is maximised
- So, E represents equilibrium in the market for “smoking”
- At E, the net gain to society from increasing smoking from 0 to  $N^*$ , is the area: XEO



# Who Should be Awarded Property Rights? Least Cost Avoidance

If A has the right to smoke, B would have to pay  $ENN^*$  to get A to reduce to  $N^*$

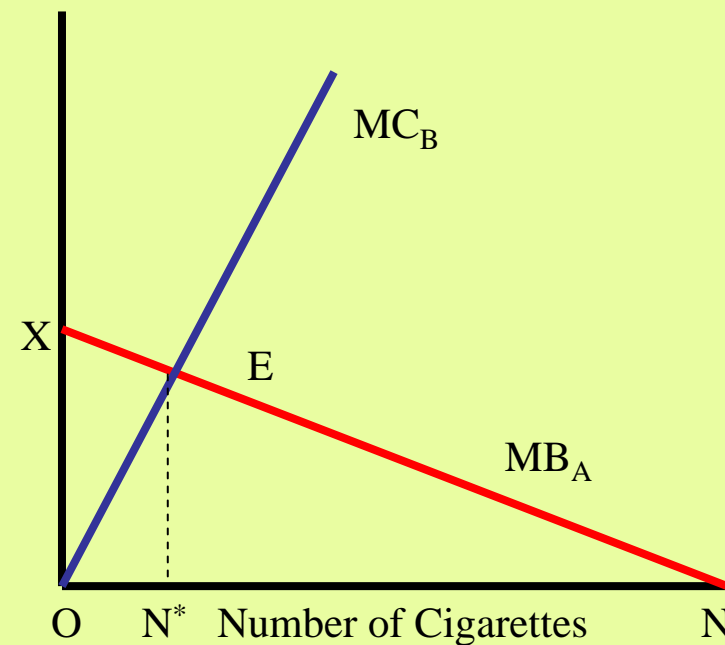
If B has the right to be smoke-free, A would have to pay  $OXEN^*$  to B for permission to smoke  $N^*$



B is the least-cost avoider: A should have the right to smoke

If A has the right to smoke, B would have to pay  $ENN^*$  to get A to reduce to  $N^*$

If B had the right to be smoke-free, A would have to pay  $OXEN^*$  to B for permission to smoke  $N^*$



A is the least-cost avoider: B should have the right to be smoke-free

# Main Points of the Coase Theorem

- ❖ Externalities are the joint product of the ‘offender’ and the ‘victim’ *and the most efficient system of avoiding an externality is to put the onus for avoidance on the party which can avoid it at the least-cost.*
- ❖ The traditional “polluter pays” solution would only be efficient if the pollutee was the least cost avoider
- ❖ In order to remove the ill-effect of an externality, neither regulation nor taxes are necessary

# Main Points of the Coase Theorem

- ❖ If transaction costs were zero then bargaining between the parties would lead to an efficient outcome, regardless of how property rights were defined
- ❖ The problem was not one of externalities but, rather, one of transaction costs which prevented externalities being bargained out of existence
- ❖ So, when we observe externalities in the real world, we should enquire about the level of transaction costs which prevent externalities being bargained away

# The Market for Divorce: I

- There is a husband and wife and they have a child
- There is a private good which is rivalrous between husband and wife
- The child is a public good since it can be jointly consumed
- If  $X$  represents family resources available for buying the private good, the wife's share is  $\theta$  and the husband's share is  $1-\theta$

# The Market for Divorce: II

- If they get divorced, the wife's share of family resources is  $\beta$  and the husband's share is  $1-\beta$ : we assume  $\beta < \theta$
- If they get divorced, the child becomes a private good since it can no longer be jointly consumed
- The wife's share of the child is  $\alpha$  and the husband's share is  $1-\alpha$

# The Market for Divorce: III

- The utilities of the husband and wife in marriage are  $U_H^M$  and  $V_W^M$  where:

$$U_H^M = U((1 - \theta)X, 1)$$

$$V_W^M = V(\theta X, 1)$$

- The utilities of the husband and wife in marriage are  $U_H^D$  and  $V_W^D$  where:

$$U_H^D = U((1 - \beta)X, 1 - \alpha)$$

$$V_W^D = V(\beta X, \alpha)$$

# The Market for divorce: IV

- The husband and wife will be indifferent between marriage and divorce if:

$$U_H^M = U_H^D \text{ and } V_W^M = V_W^D$$

- The husband and wife will prefer divorce to marriage and divorce if:

$$U_H^M < U_H^D \text{ and } V_W^M < V_W^D$$

- The husband and wife will prefer marriage to divorce if:

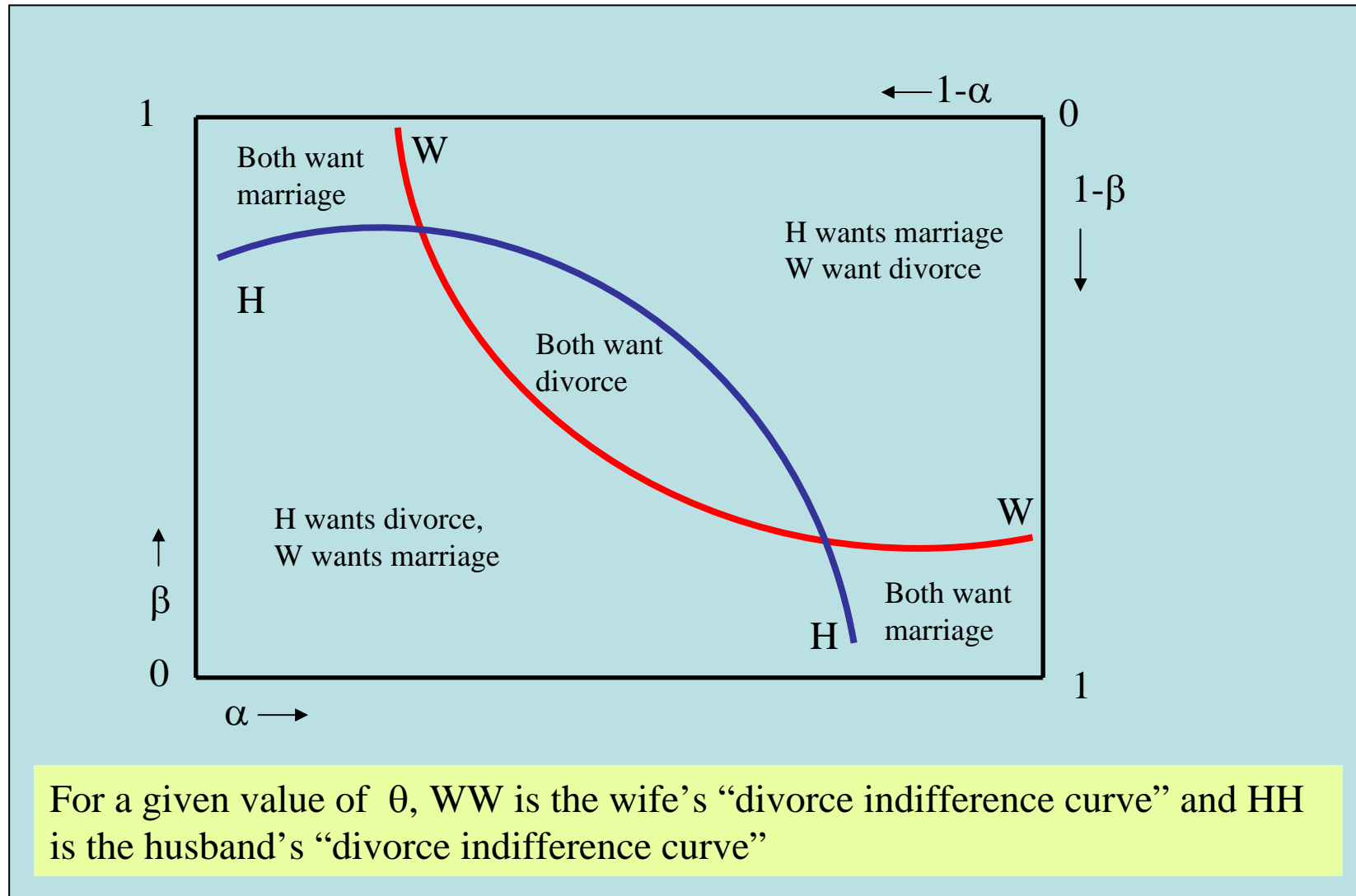
$$U_H^M > U_H^D \text{ and } V_W^M > V_W^D$$

# The Market for Divorce: $V$

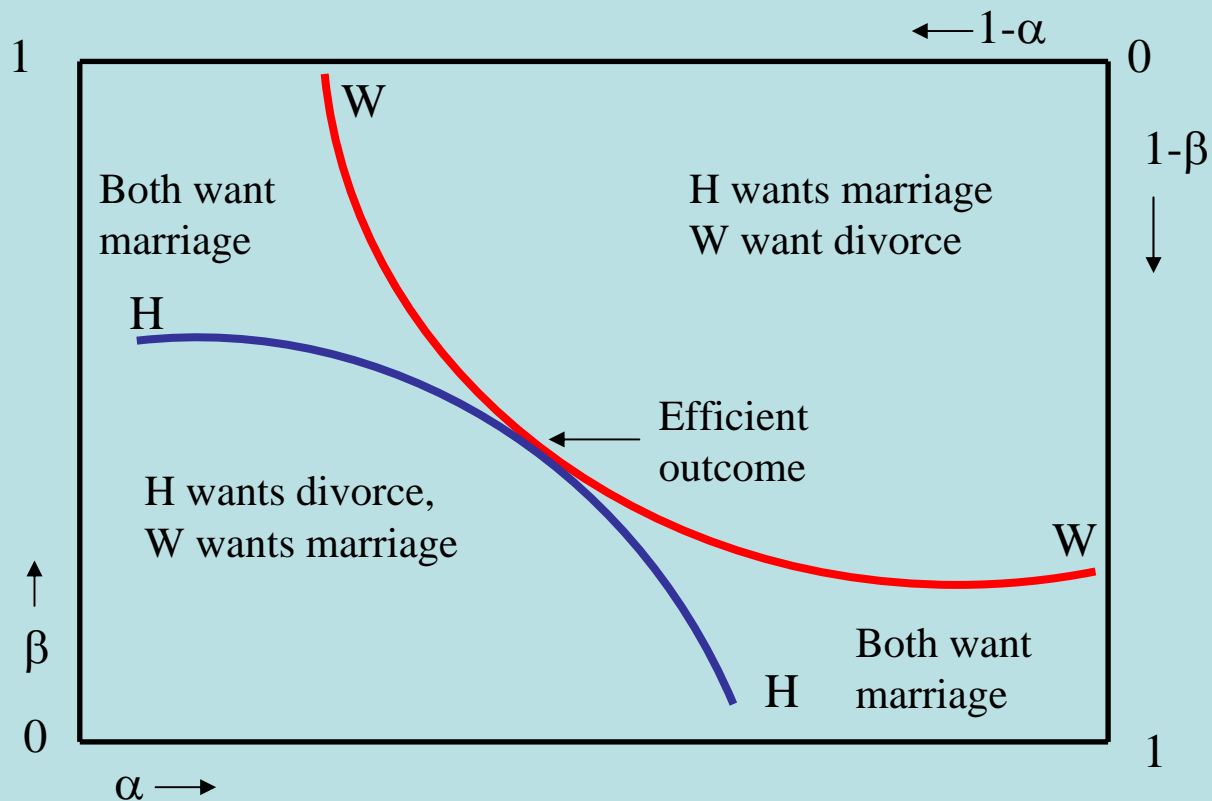
1. Husband and wife want to stay married
2. Husband and wife want divorce
3. Husband wants divorce, wife wants to stay married
4. Wife wants divorce, husband wants to stay married



# The Market for Divorce

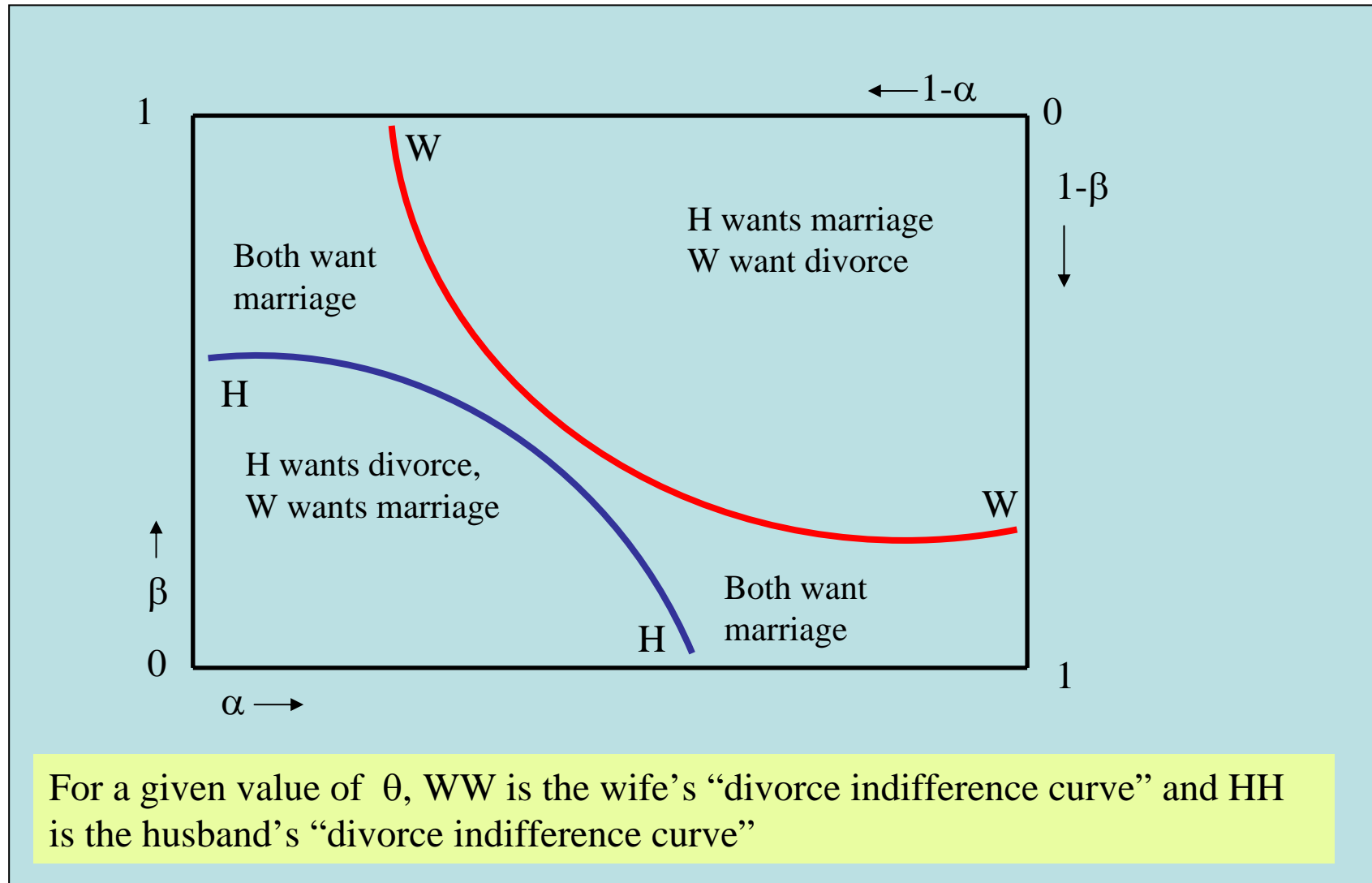


# The Market for Divorce



For a given value of  $\theta$ , WW is the wife's "divorce indifference curve" and HH is the husband's "divorce indifference curve"

# The Market for Divorce

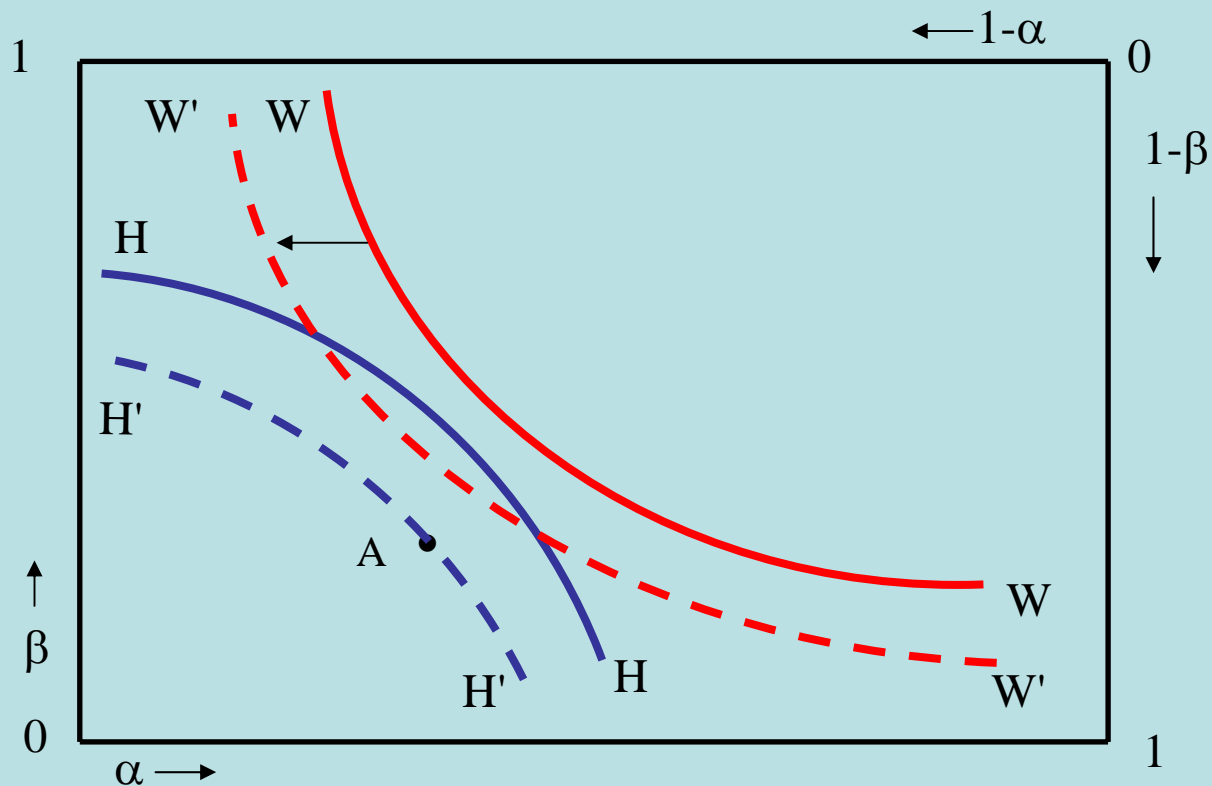


# Divorce Laws

Suppose husband wants divorce, wife does not

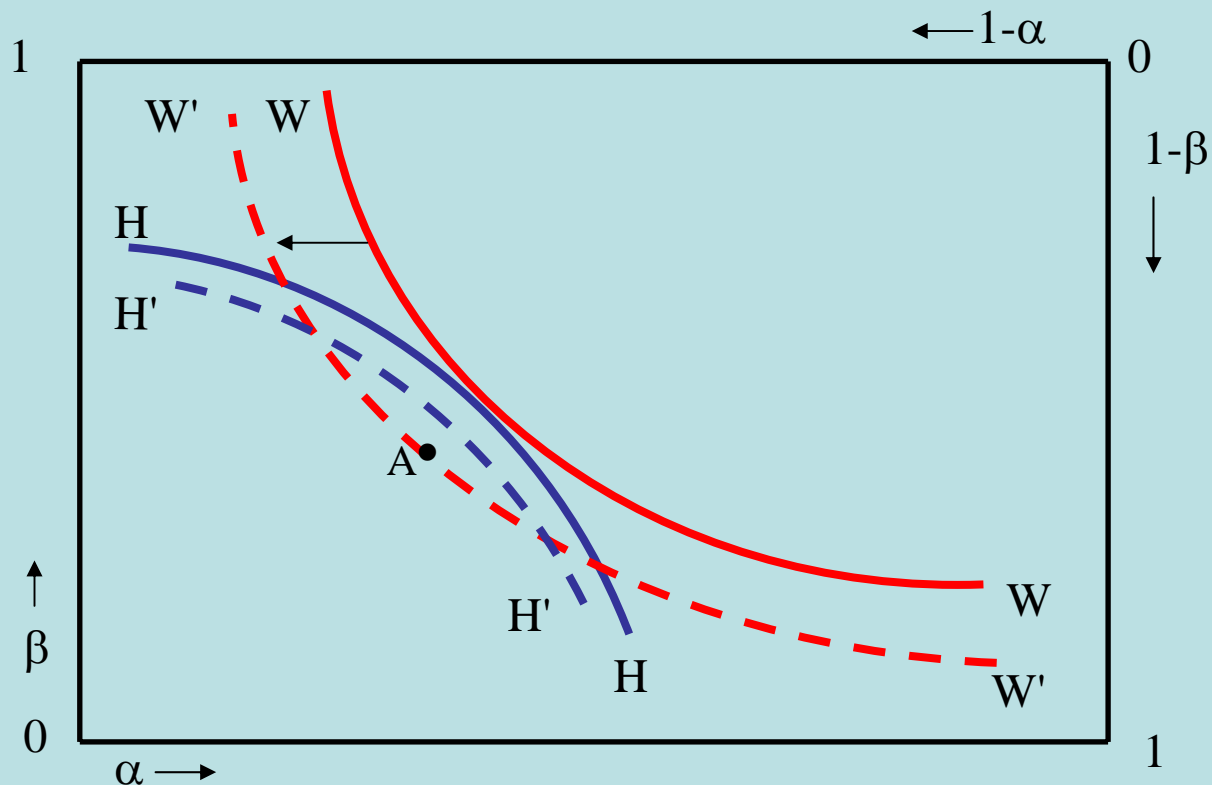
- No-fault: either husband or wife can seek divorce and wife has to “persuade” husband to continue in marriage
- Mutual consent: both husband and wife must consent to divorce and husband has to “persuade” wife to give him divorce

# Wife Persuades Husband to Continue



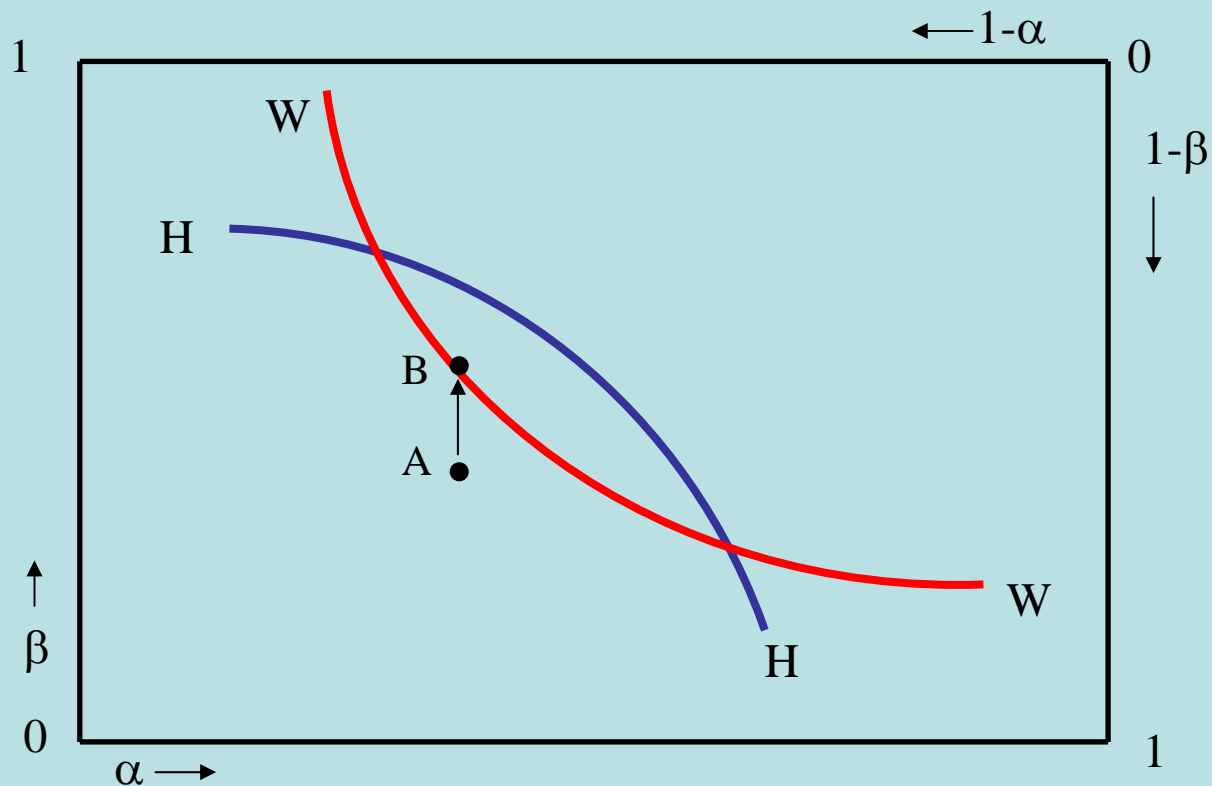
At A, the husband wants a divorce but the wife wants marriage (A is below the HH and WW curves). To persuade the husband to stay, the wife, by accepting a lower  $\theta$ , transfers in-marriage benefits to the husband. Her curve shifts to W'W' and husband's to H'H': husband is now indifferent between marriage and divorce; wife continues to want marriage.

# Wife Cannot Persuade Husband to Continue



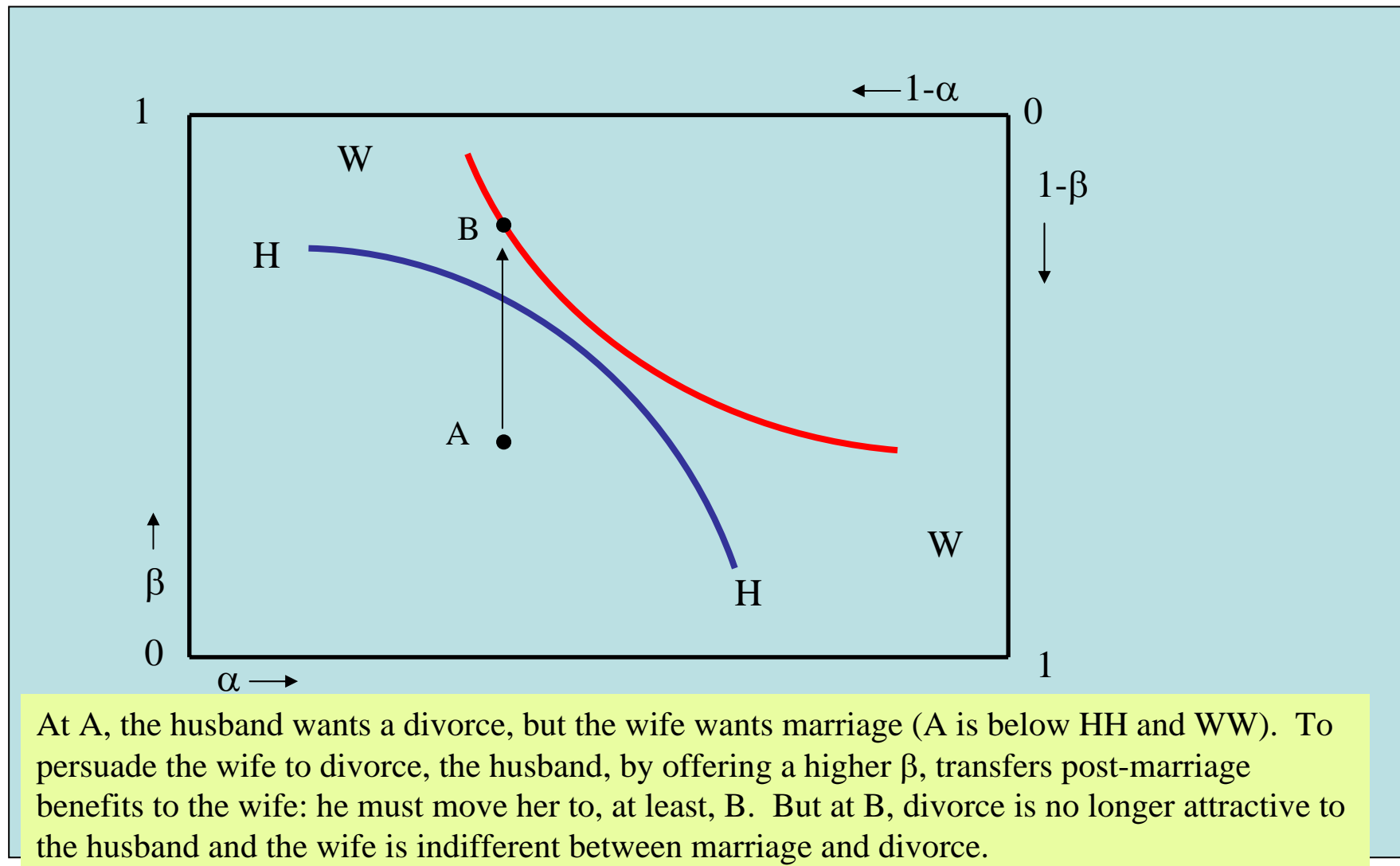
At A, the husband wants a divorce but the wife wants marriage (A is below the HH and WW curves). To persuade the husband to stay, the wife, by accepting a lower  $\theta$ , maximises in-marriage benefit transfers to the husband. Her curve shifts to W'W' and husband's to H'H': but the husband continues to prefer divorce; the wife is indifferent between marriage and divorce.

# Husband Persuades Wife to Split Up



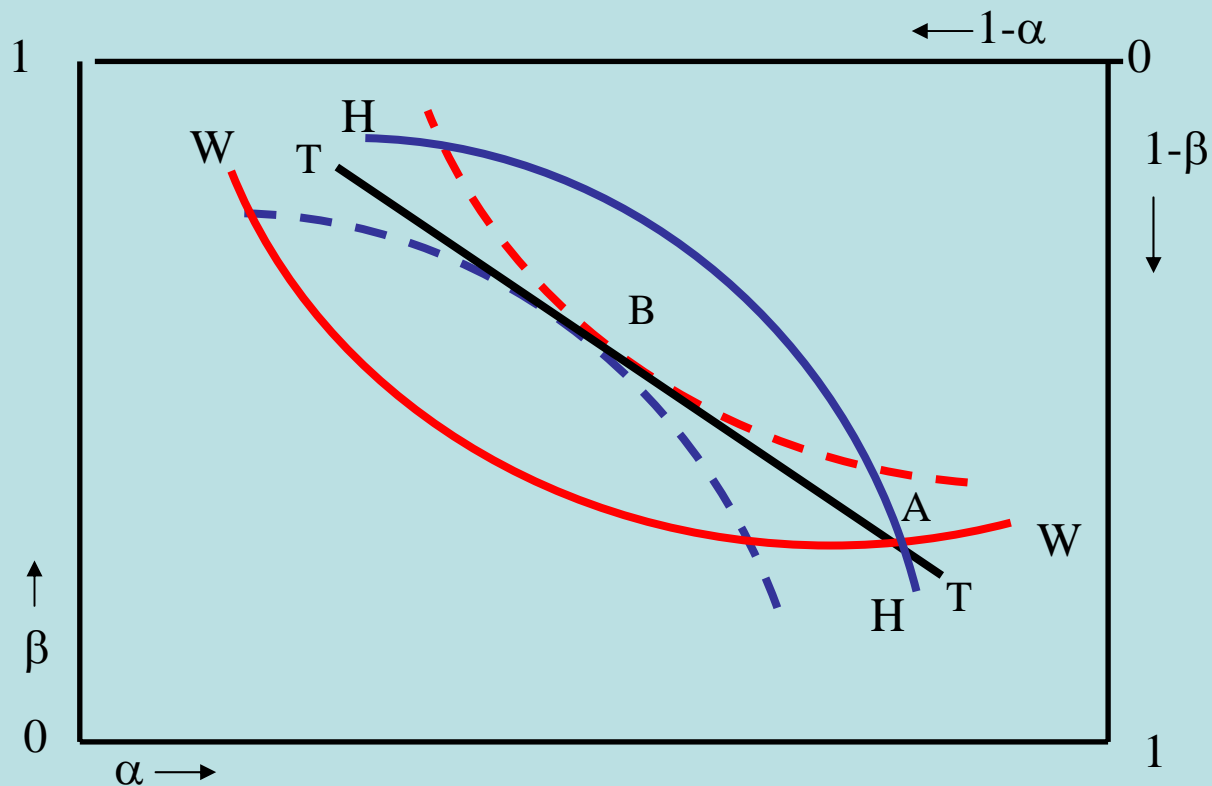
At A, the husband wants a divorce, but the wife wants marriage (A is below HH and WW). To persuade the wife to divorce, the husband, by offering a higher  $\beta$ , transfers post-marriage benefits to the wife: he must move her to, at least, B. At B, the husband still wants divorce and the wife is indifferent between marriage and divorce.

# Husband Cannot Persuade Wife to Split Up





# Post-Divorce Bargaining



Point A represents the initial post-divorce endowment of  $\alpha$  and  $\beta$ . The husband is on HH and the wife is on WW. By trading  $\alpha$  for  $\beta$  along the line TT they can both move to point B which is the Pareto efficient point. They are both better off at B than at A.