Chapter 15: Public Goods and Tax Policy Part Two

Tuesday, July 27

QUESTION 1 (equilibrium)

Suppose that there is a competitive market with consumer preferences and production costs as defined by the marginal benefit function and marginal cost function below:

MB = 200 – x/5

MC = 55 + x/20

If no tax is imposed, what is the equilibrium quantity?

A) 1020 **B) 250** **C) 340** **D) 500** **E) 580**

answer to question 1

Suppose that there is a competitive market with consumer preferences and production costs as defined by the marginal benefit function and marginal cost function below:

MB = 200 – x/5

MC = 55 + x/20

$$200 - x/5 = 55 + x/20$$
$$145 = 4x/20 + x/20 = 5x/20 = x/4$$
$$x^* = 580$$

A) 1020 **B) 250** **C) 340** **D) 500** **E) 580**

QUESTION 2 (equilibrium with tax)

Suppose that there is a competitive market with consumer preferences and production costs as defined by the marginal benefit function and marginal cost function below:

MB = 200 – x/5

MC = 55 + x/20

If a tax of $20 per unit is imposed, what is the equilibrium quantity?

A) 1020 **B) 250** **C) 340** **D) 500** **E) 580**

answer to question 2

Suppose that there is a competitive market with consumer preferences and production costs as defined by the marginal benefit function and marginal cost function below:

MB = 200 – x/5
MC = 55 + x/20
If a tax of $20 per unit is imposed, what is the equilibrium quantity?

$$MB = MC + \tau$$
$$200 - x/5 = 75 + x/20$$
$$125 = x/4$$
$$x^* = 500$$

A) 1020 B) 250 C) 340 **D) 500** E) 580

QUESTION 3 (government revenue)

Suppose that there is a competitive market with consumer preferences and production costs as defined by the marginal benefit function and marginal cost function below:

MB = 200 – x/5

MC = 55 + x/20

If a tax of $20 per unit is imposed, the equilibrium quantity will change from 580 to 500. How much revenue does the government receive?

A) 6,000 B) 7,000 C) 8,000 D) 9,000 E) 10,000

answer to question 3

Suppose that there is a competitive market with consumer preferences and production costs as defined by the marginal benefit function and marginal cost function below:

MB = 200 – x/5
MC = 55 + x/20
$\tau = 20$
$Q^* = 500$

$G = \tau \times Q = 20 \times 500 = 10{,}000$

A) 6,000 **B) 7,000** **C) 8,000** **D) 9,000** **E) 10,000**

QUESTION 4 (deadweight loss)

Suppose that there is a competitive market with consumer preferences and production costs as defined by the marginal benefit function and marginal cost function below:

MB = 200 – x/5

MC = 55 + x/20

If a tax of $20 per unit is imposed, the equilibrium quantity will change from 580 to 500. How much deadweight loss results from the tax?

A) 500 B) 600 C) 700 D) 800 E) 900

answer to question 4

$MB = 200 - x/5$

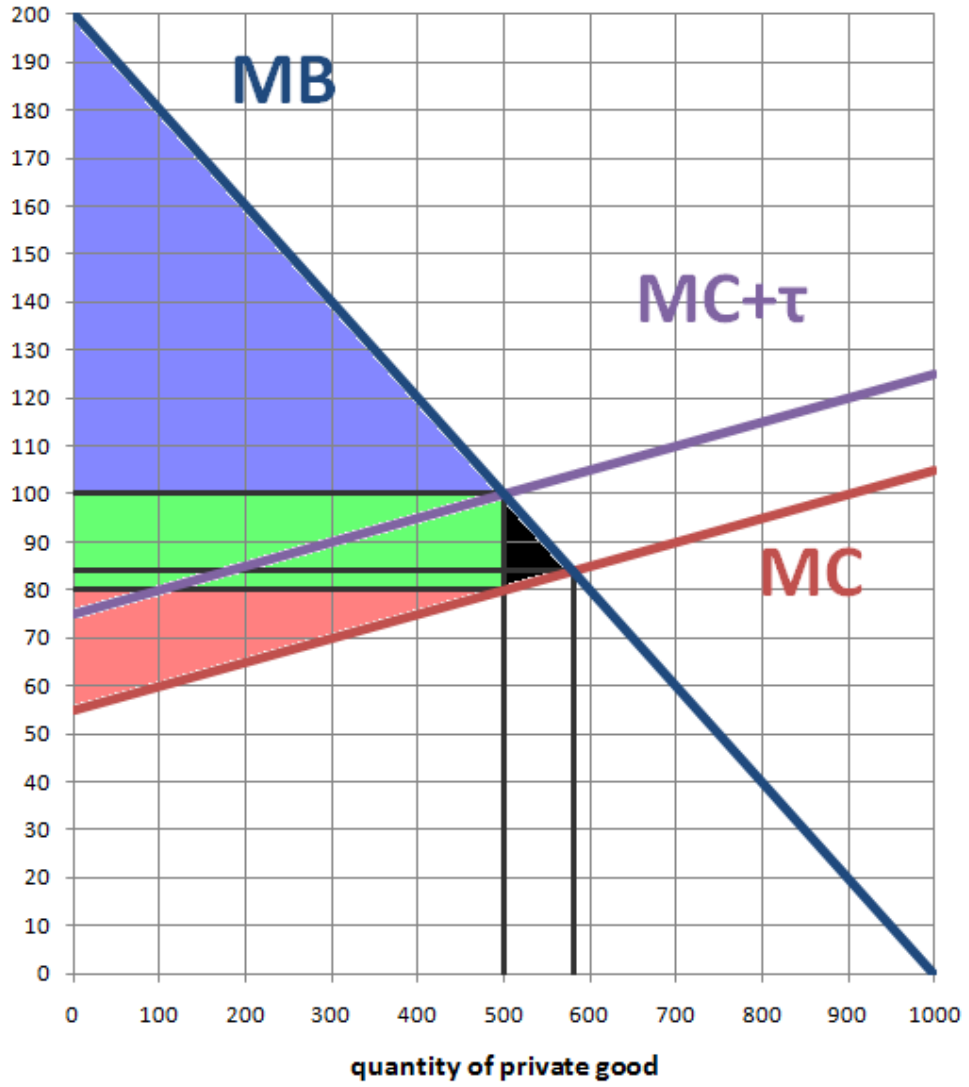
$MC = 55 + x/20$

$\tau = 20$

$Q^* = 500$

$G = 10{,}000$

$DWL = (.5)(\Delta Q)(\tau)$
$= (.5)(80)(20)$
$= 800$



A) 500 B) 600 C) 700 **D) 800** E) 900

QUESTION 5

In some miniature society, there are 10 identical people whose preferences for a non-rival, non-excludable public good are each defined by the individual total benefit function and individual marginal benefit function below:

$TB_i = 14y - y^2/100$ $MB_i = 14 - y/50$

Each unit of the public good costs $100. If there is no possibility for collective action, how much of the public good will be bought?

A) 0 B) 20 C) 40 D) 50 E) 100

answer to question 5

10 identical people, each with

$TB_i = 14y - y^2/100$ $MB_i = 14 - y/50$

$MC = 100$

If there is no possibility for collective action, how much of the public good will be bought?

A) 0 B) 20 C) 40 D) 50 E) 100

QUESTION 6

10 identical people, each with

$TB_i = 14y - y^2/100$ $MB_i = 14 - y/50$

$MC = 100$

What is the socially optimal quantity of the public good?

A) 100 B) 120 C) 150 D) 200 E) 700

answer to question 6

10 identical people, each with

$TB_i = 14y - y^2/100$ $MB_i = 14 - y/50$

$TSB = 140y - y^2/10$ $MSB = 140 - y/5$

$MC = 100$

$140 - y/5 = 100$
$y/5 = 40$
$y^o = 200$

A) 100 B) 120 C) 150 **D) 200** E) 700

QUESTION 6

10 identical each with:

$TB_i = 14y - y^2/100$ $MB_i = 14 - y/50$

$TSB = 140y - y^2/10$ $MSB = 140 - y/5$

$MC = 100$ $y^* = 0$ $y^o = 200$

How much total economic surplus is gained by providing the socially optimal quantity of 200 rather than the Nash equilibrium quantity of 0?

A) 800 B) 2,000 C) 4,000 D) 5,000 E) 7,000

answer to question 6

$MB_i = 14 - y/50$

$MSB = 140 - y/5$

$MC = 100$

$y^* = 0$

$y^o = 200$

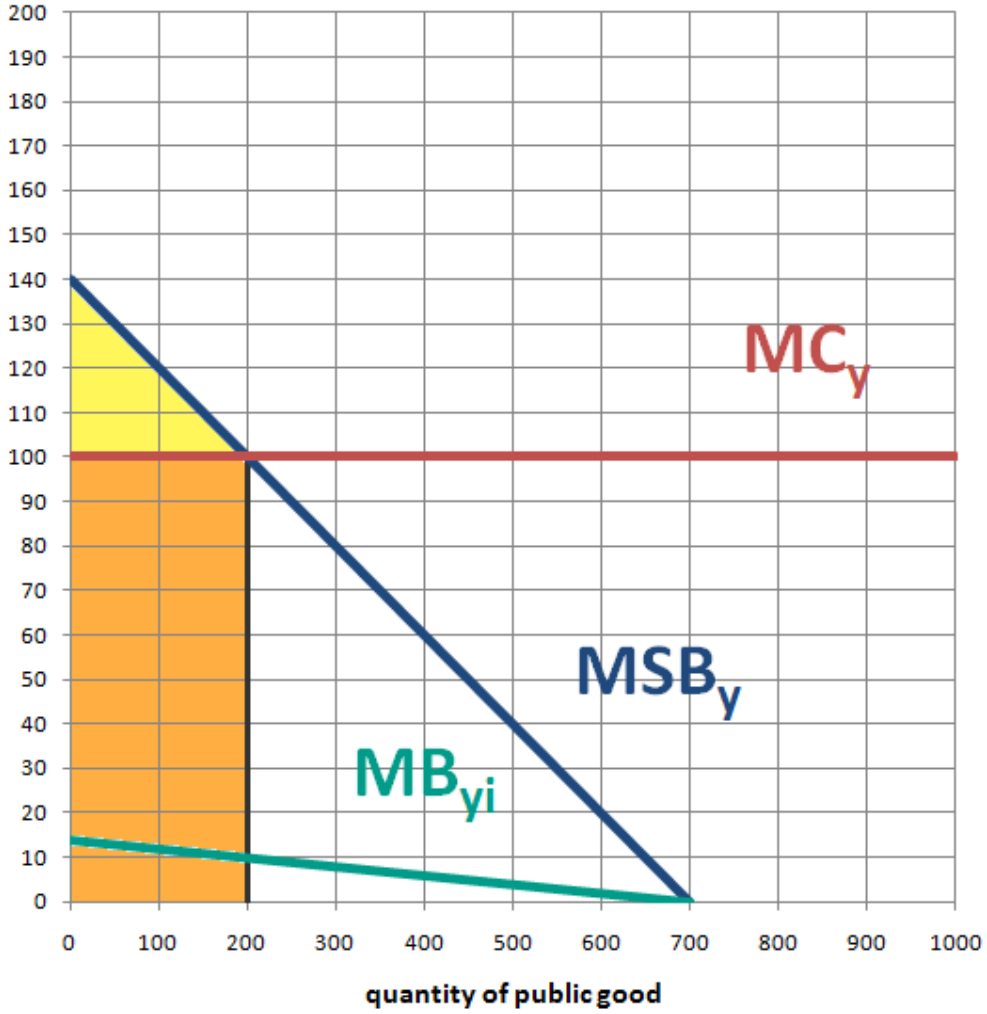
gain from collective action

=

(.5)(200)(40)

=

4000



A) 800 B) 2,000 **C) 4,000** D) 5,000 E) 7,000

FREE RIDER PROBLEM

10 identical people, each with

$TB_i = 14y - y^2/100$ $\quad MB_i = 14 - y/50$

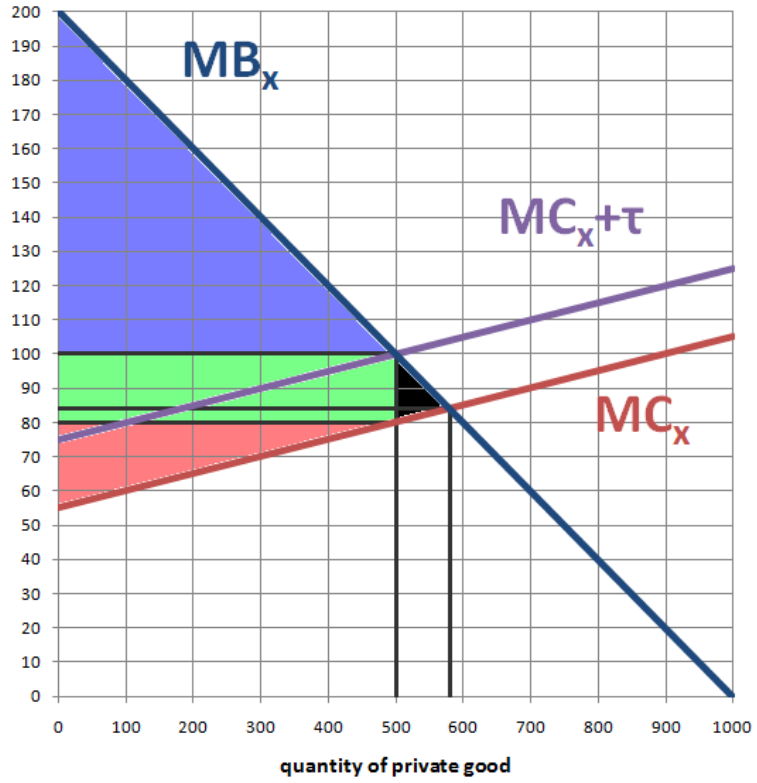
$TSB = 140y - y^2/10$ $\quad MSB = 140 - y/5$

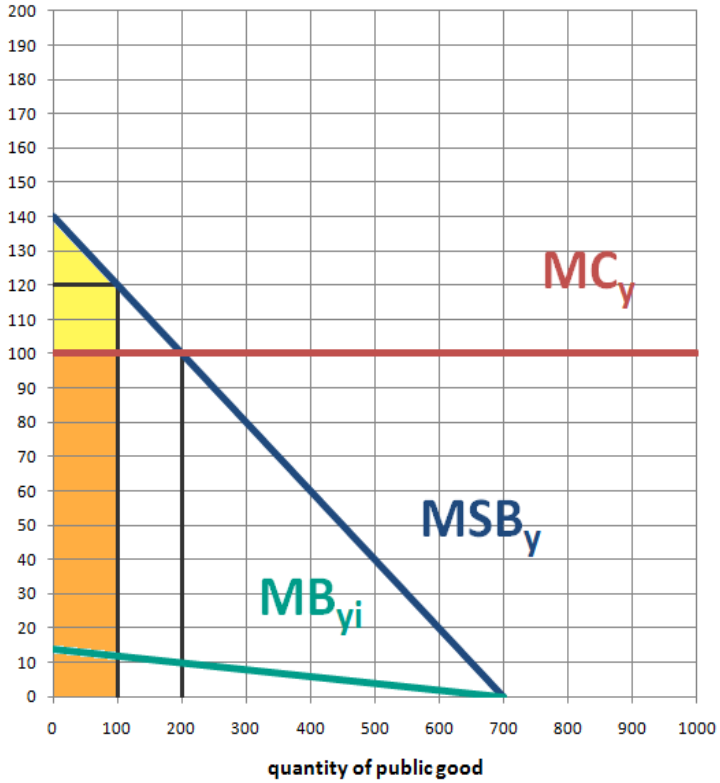
$MC = 100$ $\quad y^o = 200$

Suppose that 200 units of the good are provided, at a cost of 100 each, for a total cost of 20000, (and a total social benefit of 24000). Suppose that this cost is split evenly, so that each person is paying 2000, for 20 units each.

If one person is allowed to withhold their contribution, reducing y to 180, they can save $2000 and only lose $204 in individual benefit. Thus, if given a choice, they will choose to 'free ride' off the others' contributions.

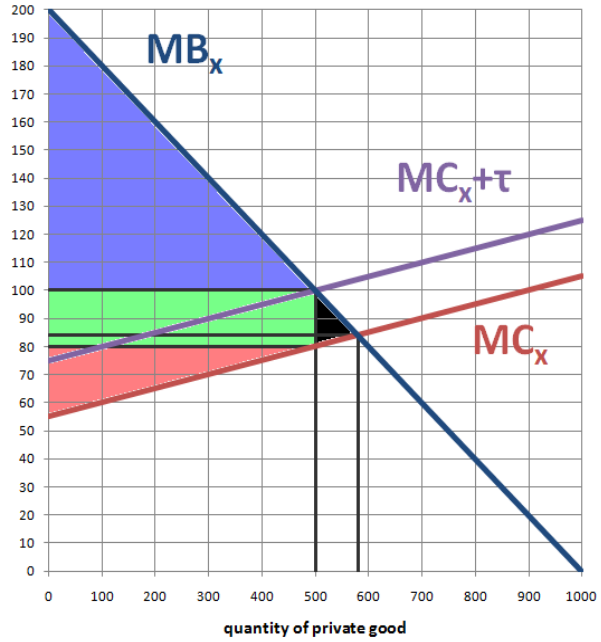
FINANCING PUBLIC GOODS WITH INEFFICIENT TAXES

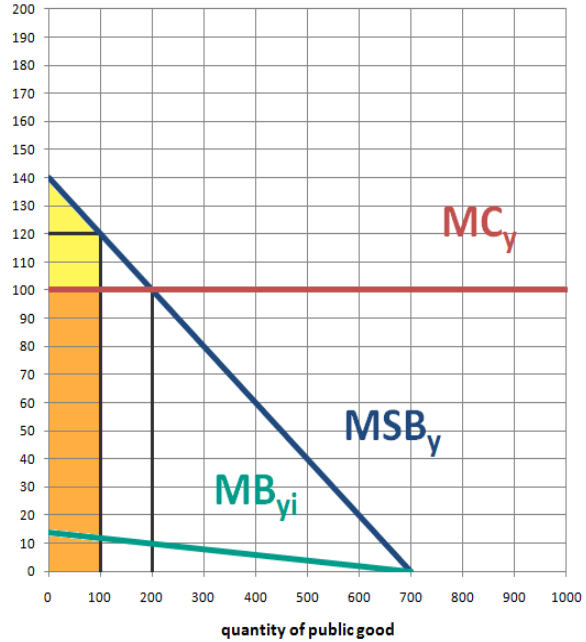




What if the tax revenue from the private market is used to finance the provision of the public good? This isn't a perfect solution, but in some cases it's the best solution available.

HOW MUCH CAN BE PROVIDED?



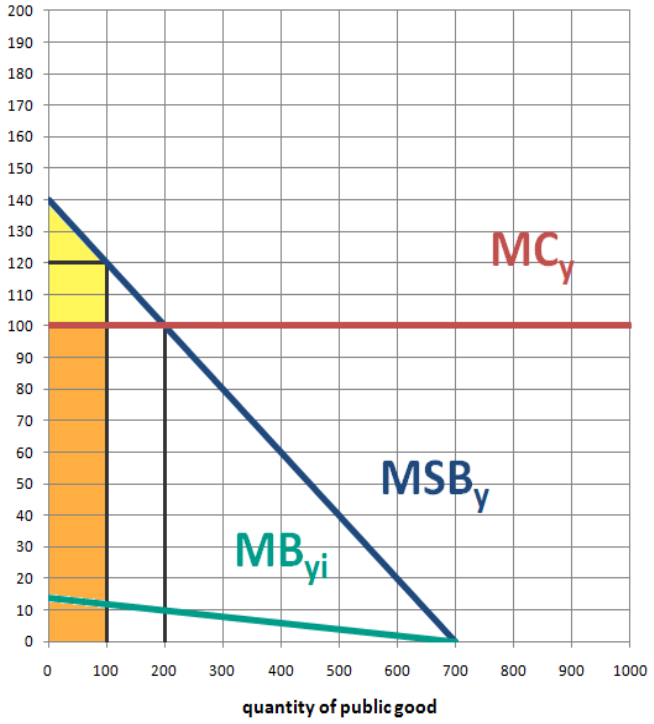


If we happen to have a tax of 20 per unit on the private good, then the tax revenue will be 10000. If each unit of the public good costs 100, we can use this money to provide 100 units.

MB = 200 – x/5
MC = 55 + x/20
τ = 20
Q* = 500
G = 10,000
DWL = 800

MB_i = 14 – y/50
MSB = 140 – y/5
MC = 100

QUESTION 7



If 100 units of the public good are provided, then how much economic surplus will be gained in the public goods market?

To find this gain in surplus (yellow area), subtract the total cost of the public good (orange) from the total social benefit (orange and yellow).

$MB_i = 14 - y/50$

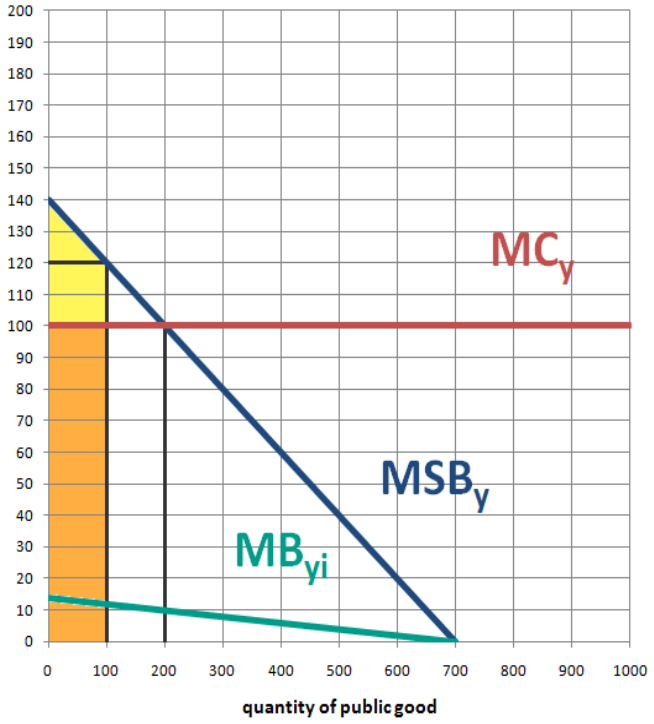
$MSB = 140 - y/5$

$MC = 100$

$G = 10000$

$y = 100$

A) 3,000
B) 4,000
C) 5,000
D) 6,000
E) 7,000



answer to question 7

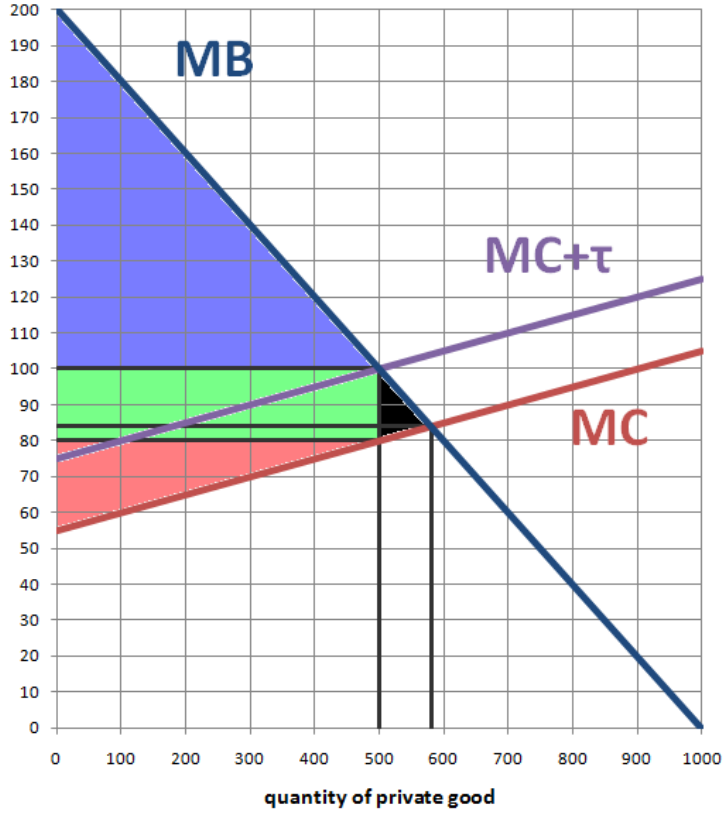
gain in economic surplus in the public goods market
= yellow area (trapezoid)
= base × average height
= (100) × (40+20)/2
= (100) × (30)
= 3000

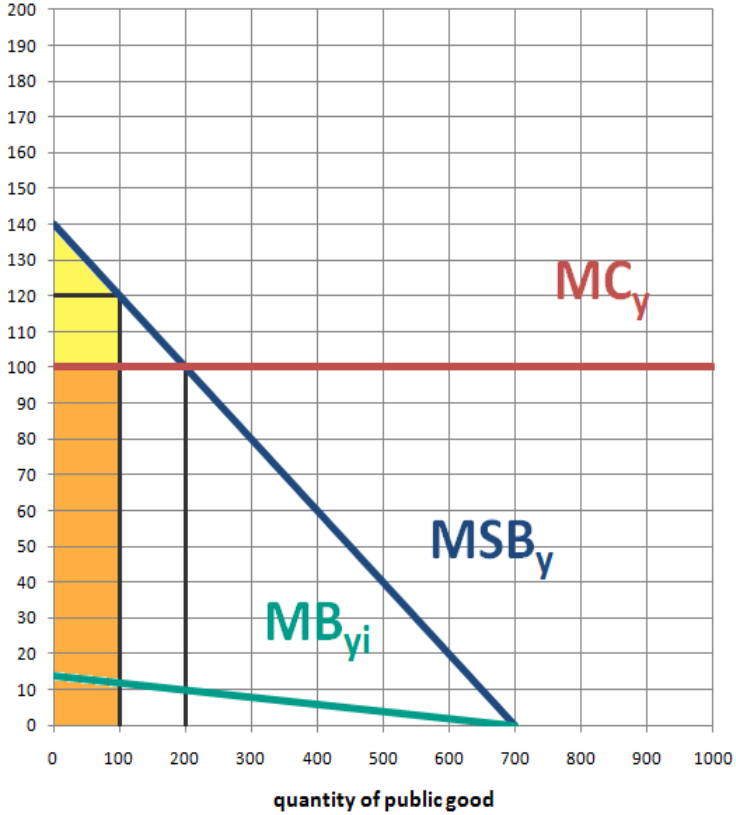
$MB_i = 14 - y/50$
$MSB = 140 - y/5$
$MC = 100$

$G = 10000$
$y = 100$

A) 3,000
B) 4,000
C) 5,000
D) 6,000
E) 7,000

SUMMARY





MB = 200 – x/5

MC = 55 + x/20

τ = 20

Q* = 500

G = 10,000

DWL = 800

MSB = 140 – y/5

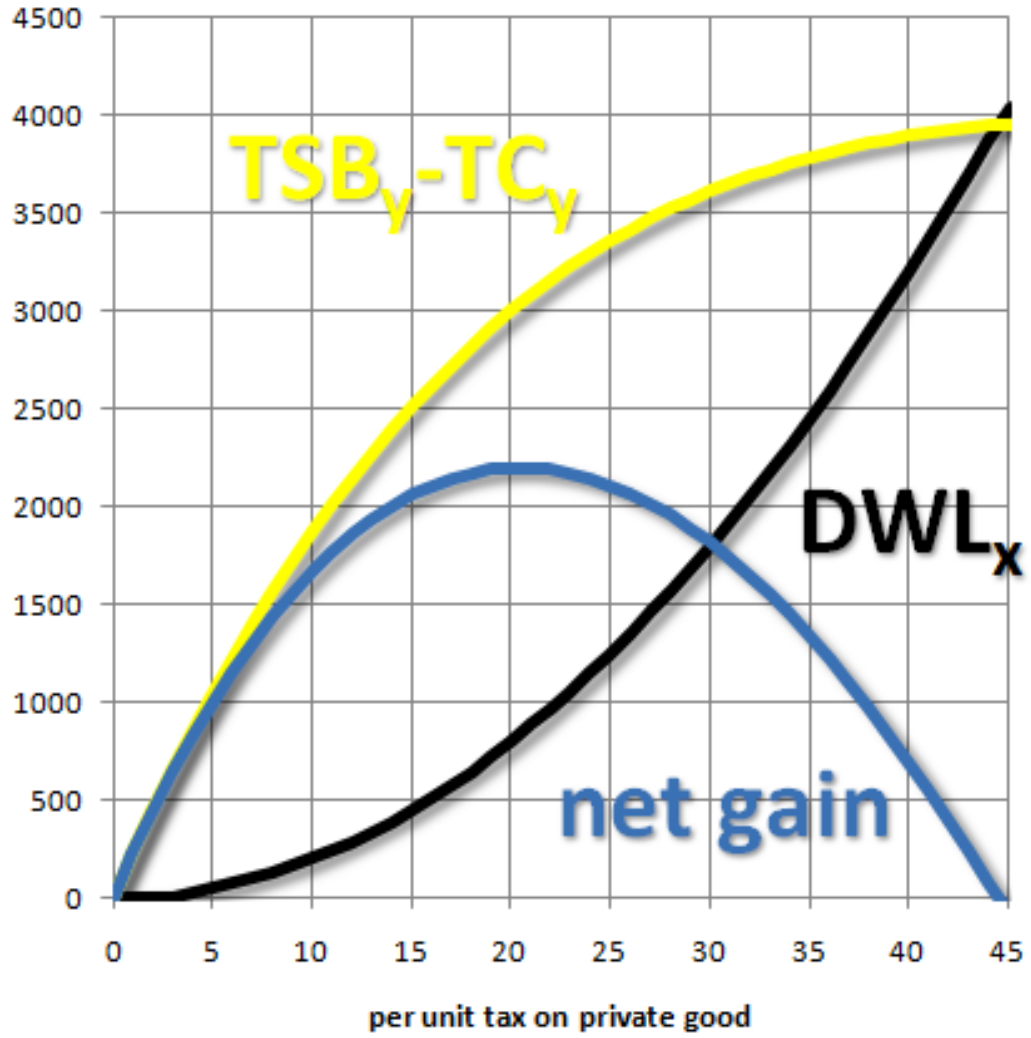
MC = 100

y = G/100 = 100

TES gain = 3000

3000 – 800 = 2200

OPTIMAL TAX



The optimal amount of tax in this situation turns out to be ≈20.44, which gives a net gain of ≈2200.89