Economics Lecture 6

2016-17

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Course Outline

1   Consumer theory and its applications

1.1 Preferences and utility

1.2 Utility maximization and uncompensated demand

1.3 Expenditure minimization and compensated demand

1.4 Price changes and welfare

1.5 Labour supply, taxes and benefits

1.6 Saving and borrowing

2   Firms, costs and profit maximization

2.1 Firms and costs

2.2 Profit maximization and costs for a price taking firm

3. Industrial organization

3.1 Perfect competition and monopoly

3.2 Oligopoly and games

1.5 Labour supply, taxes and benefits

1.5 Labour supply, taxes and benefits

1. The budget constraint

2. Income and substitution effects of an increase in the real wage

3. Income tax

4. Benefits

The labour economics budget constraint and utility

Notation

- T endowment of time
  e.g. one year = 365 x 24 = 8760 hours
- n hours not in paid employment *(leisure)*
- T-n hours in paid employment (*work)*
- c consumption of composite good
- P price of composite good
- W hourly wage rate (that is earnings per hour)

- w = W/P real wage rate

Assume that:

 Utility u(c,n) depends only on consumption c and time outside paid employment "leisure" n

 Non satiation, utility is increasing in both consumption and
    "leisure".

A **standard** but **bad assumption**
    if the gain from working is not only the money earned, but
    also other benefits such as: status, meaning and purpose,
    on the job consumption and social contact.

The other assumptions of consumer theory are satisfied
    completeness, transitivity, continuity and convexity

1. The budget constraint

total consumption $\leq$ total earnings

$Pc \leq W(T - n)$ or $Pc + Wn \leq WT$

or, dividing by P and recalling that $w = W/P$

budget constraint can be rewritten as:

$c + wn \leq wT$

Consumption + w "leisure" $\leq$ value of total time available

Non satiation implies that the budget constraint is satisfied as an equality $c + wn = wT$

The Budget Constraint

Standard consumer theory budget

$p_1x_1 + p_2x_2 \leq m$ term m on RHS given along with
prices p_1, p_2

Labour economics budget constraint $c + wn \leq wT$

price of c is 1, price of n is w

term wT on RHS depends on the real wage w.

- Does consumption = earnings each week in this model?

- Does consumption = earnings each week in reality?

- When does consumption = earnings?

- Does consumption = earnings each week in this model? yes

- Does consumption = earnings each week in reality?

- When does consumption = earnings?

- Does consumption = earnings each week in this model? Yes

- Does consumption = earnings each week in reality? Sometimes, but often not

- When does consumption = earnings?

- Does consumption = earnings each week in this model?
  Yes

- Does consumption = earnings each week in reality?
  Sometimes, but often not

- When does consumption = earnings?
  If you have no savings and no debt.

Whose behaviour is being modelled?

Whose behaviour is being modelled?

An individual?

Whose behaviour is being modelled?

An individual?

A family?

Whose behaviour is being modelled?

An individual?

A family?

A group?
Simple labour economics does not say, more sophisticated models look at this.

The Beatles 1963 © Getty Images

Paul McCartney and Heather Mills © Getty Images

LIPA's 10th Anniversary & Liverpool Performs 2006 Launch © Getty Images

c

Budget constraint: c + wn = wT

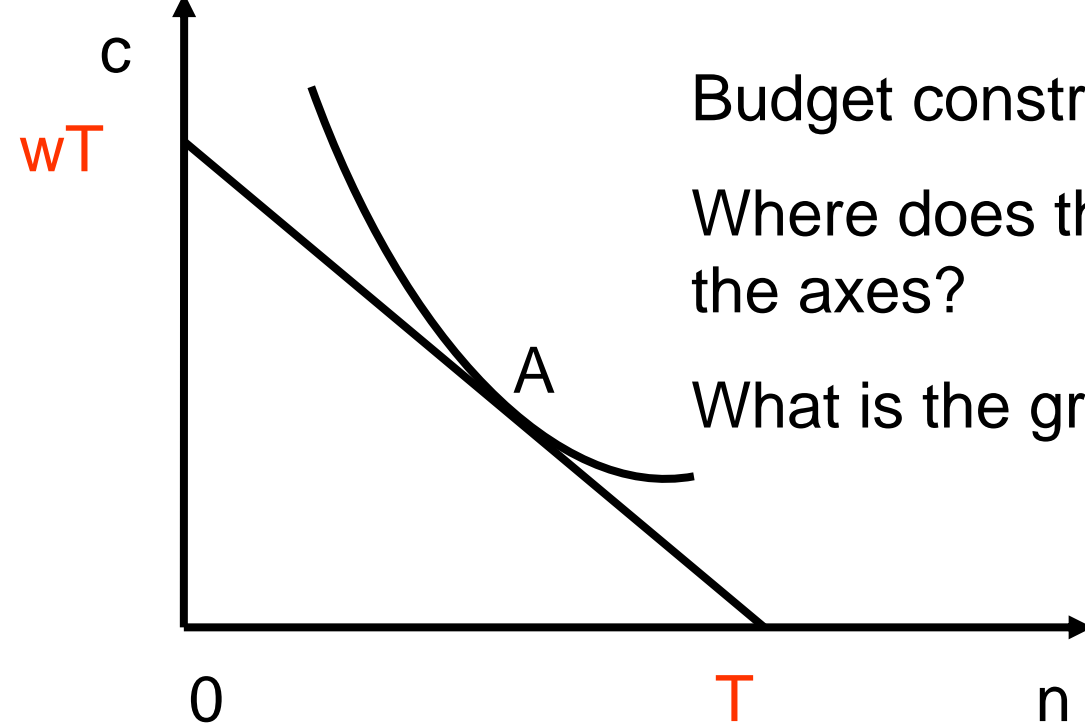Where does the budget constraint meet the axes?

A

What is the gradient of the budget line?
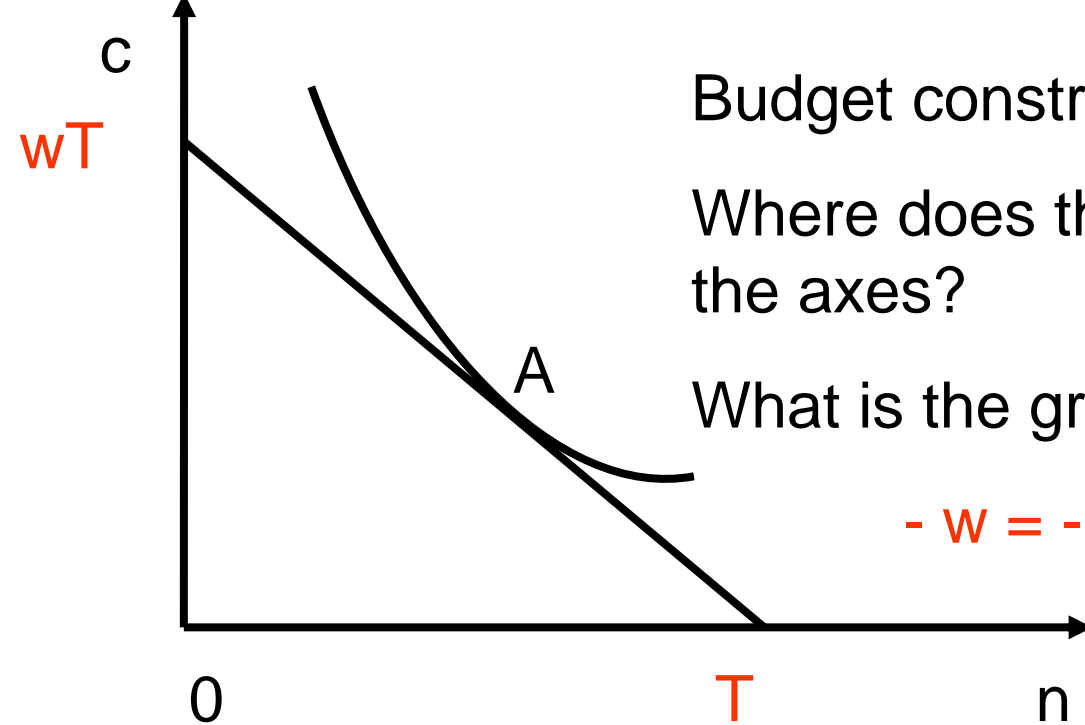
0   n

Preferences are represented by indifference curves.

A corner solution (0 consumption or 0 leisure is most unlikely).

At a tangency solution MRS =

What happens to the budget line when w increases?

c

wT

Budget constraint: c + wn = wT

Where does the budget constraint meet the axes?
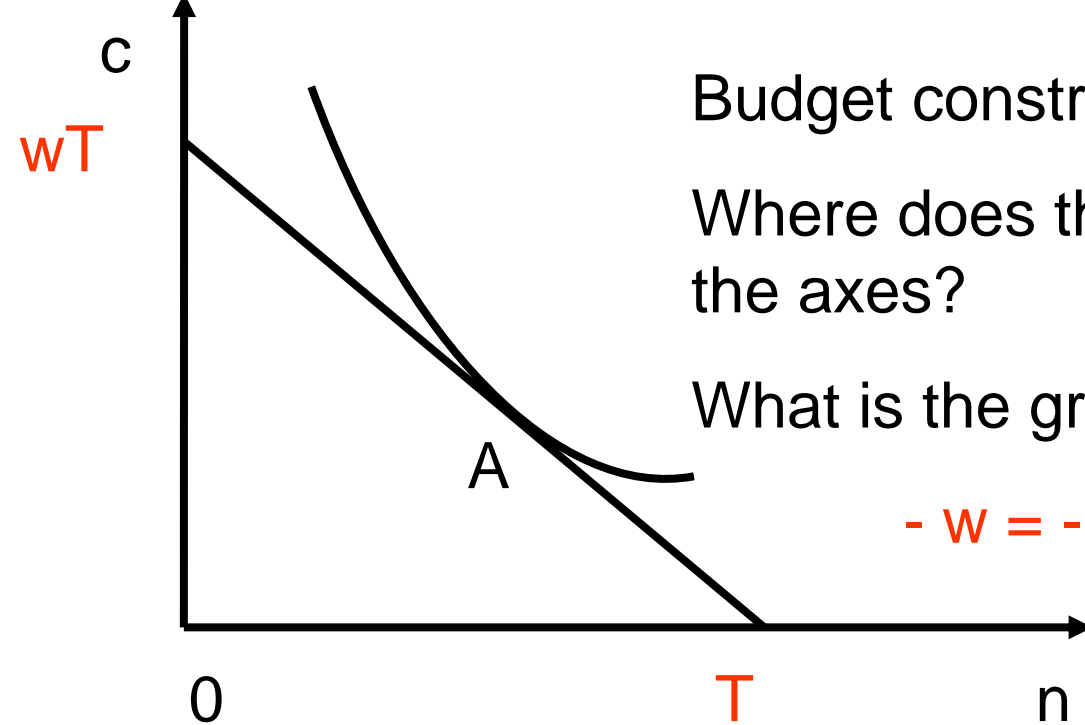
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0   T   n

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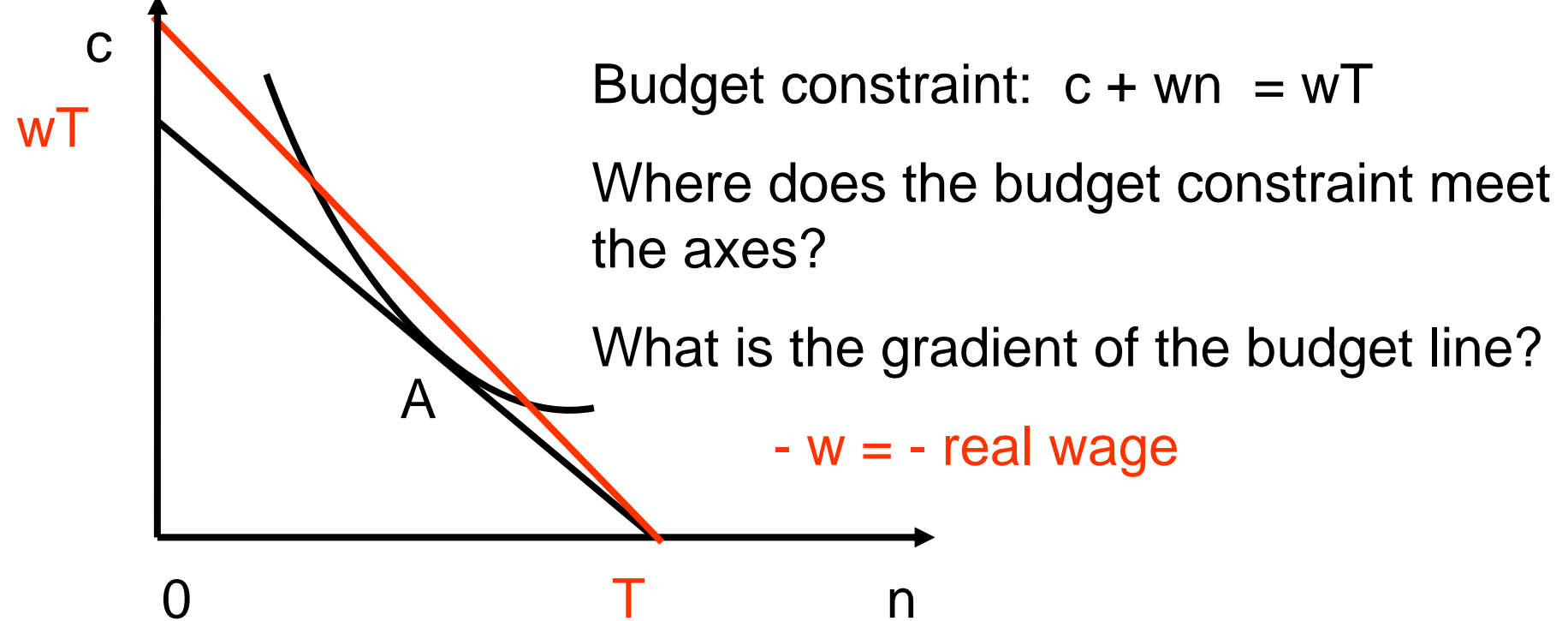
- w = - real wage

0   T   n

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0   T   n

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wT

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0

T

n

Budget constraint: c + wn = wT

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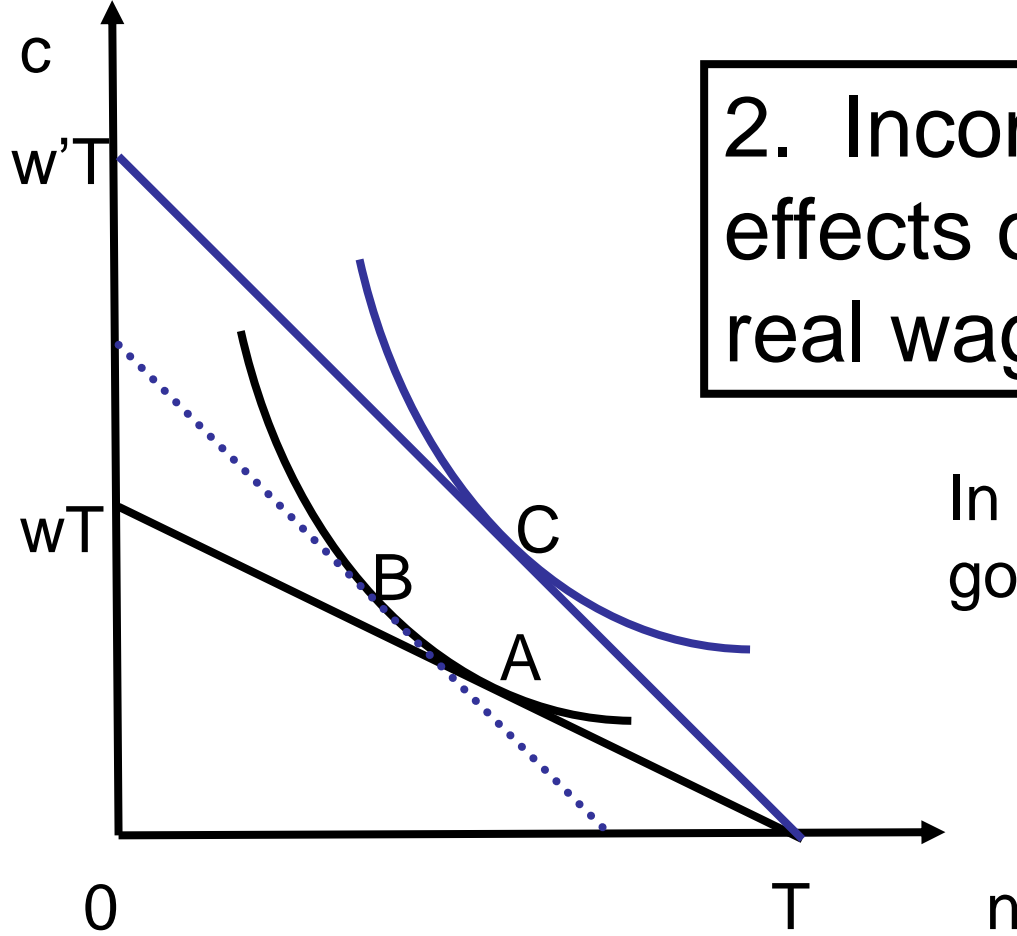
Becomes steeper
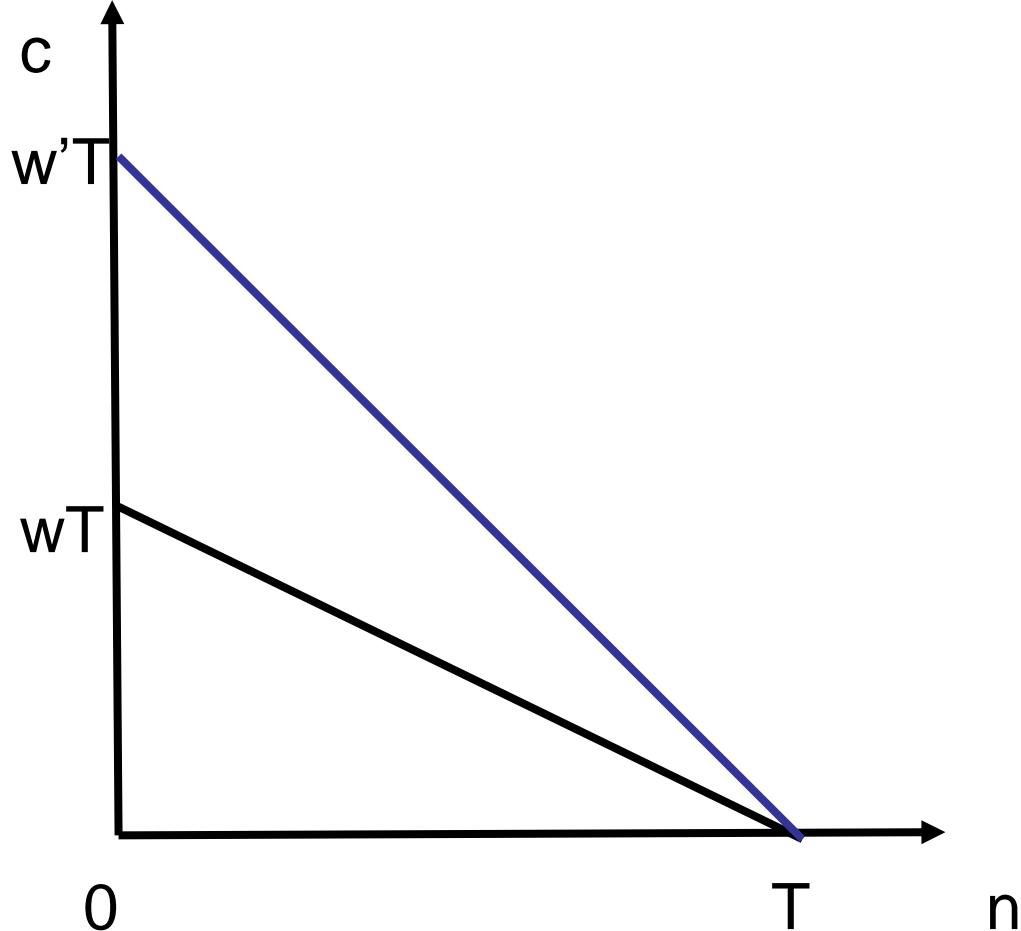
An increase in the real wage w is like a decrease in the price of good 2 in standard consumer theory.

When w increases the budget line meets the horizontal axis at the same point T, but becomes steeper.

Income and substitution effects on labour supply

c

w'T

wT

0

C

B

A

T   n

2. Income and substitution effects of an increase in the real wage w.
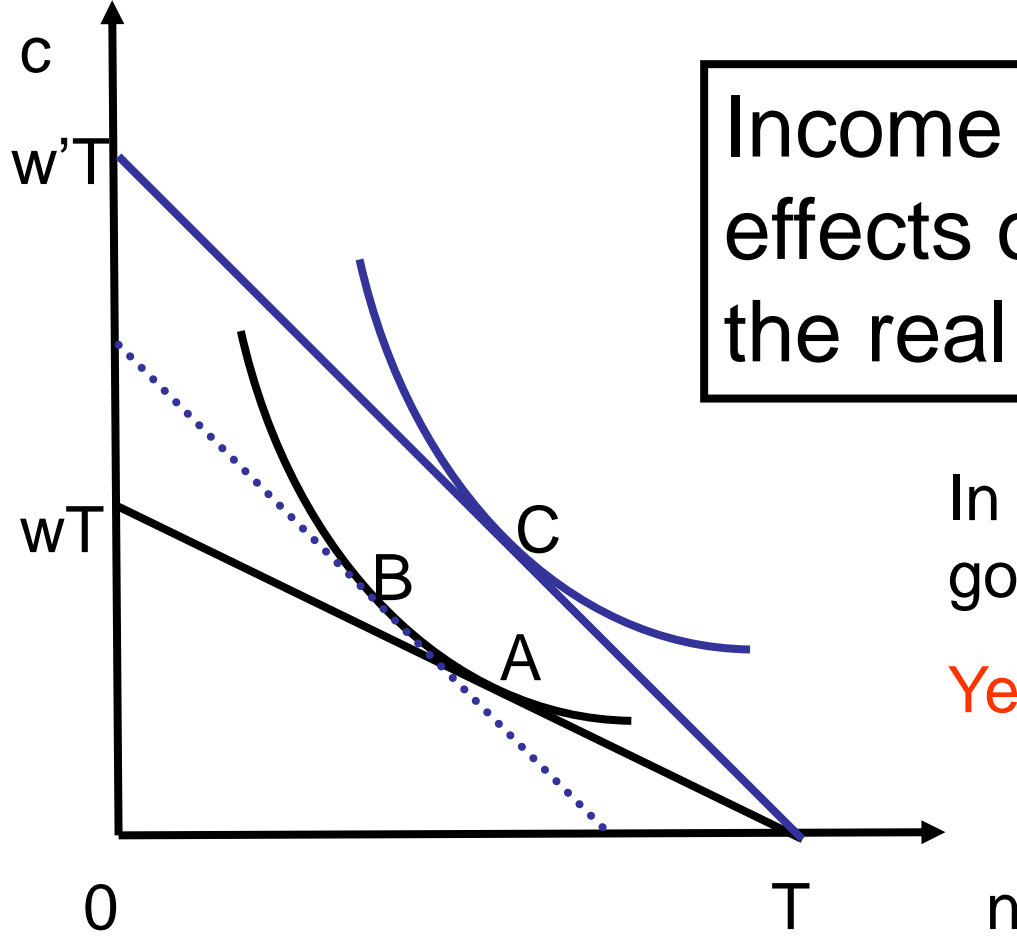
In this diagram is n a normal good? ❓

Substitution effect A to B, what happens?

Income effect B to C, what happens?

Income and substitution effects on labour supply work in
directions.

c

w'T

wT

0   T   n

Income and substitution effects of an increase in the real wage w.

In this diagram is n a normal good?

Yes, a standard assumption

C

B

A

Substitution effect A to B, what happens?

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Income and substitution effects on labour supply work in directions.

c

w'T

wT

0   T   n

C

B

A

Income and substitution effects of an increase in the real wage w.

In this diagram is n a normal good?

Yes, a standard assumption

Substitution effect A to B decreases n, increases labour supply.

Income effect B to C, what happens?

Income and substitution effects on labour supply work in
          directions.

Income and substitution effects of an increase in the real wage w.
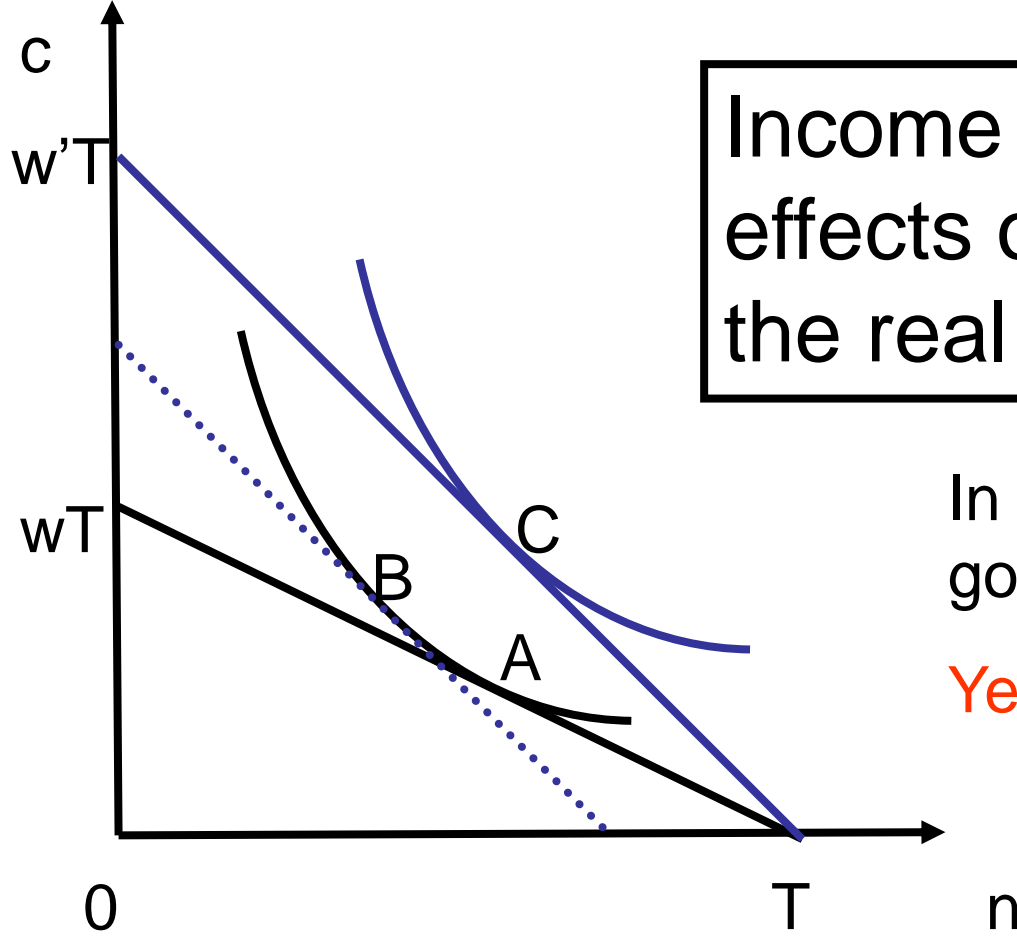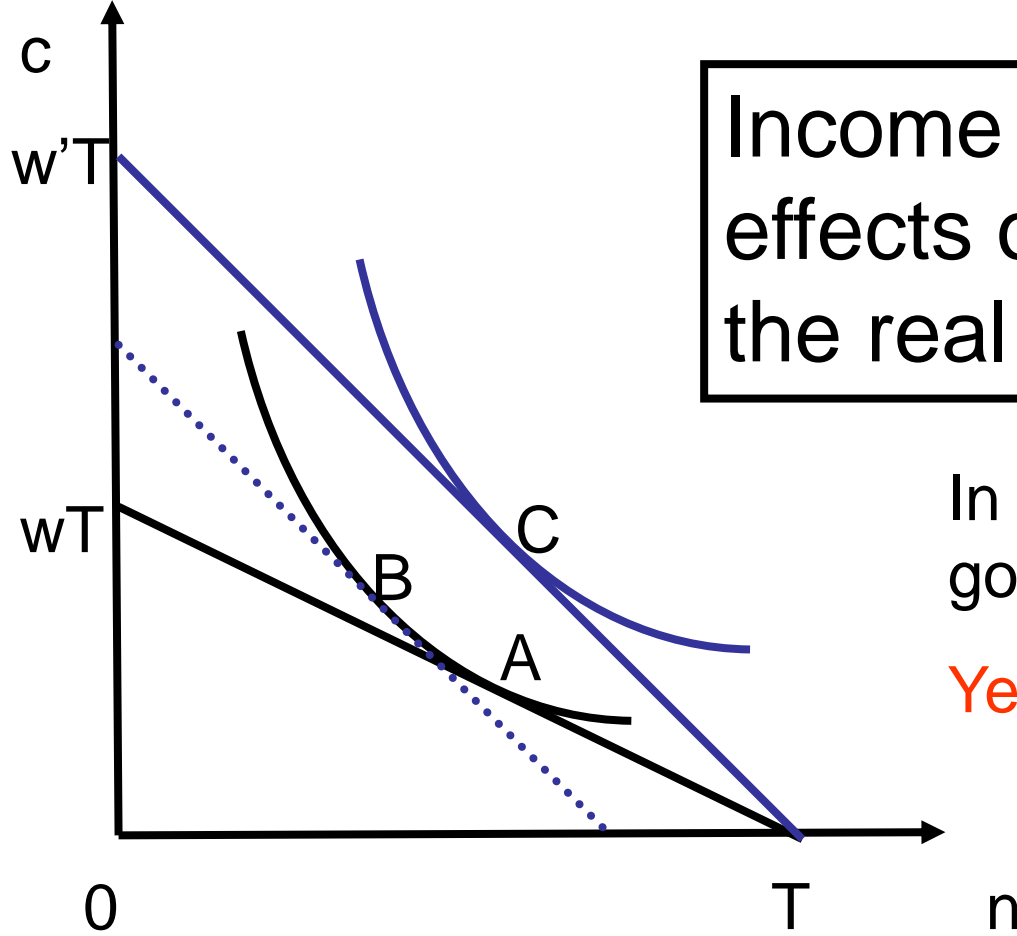
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Income and substitution effects of an increase in the real wage w.

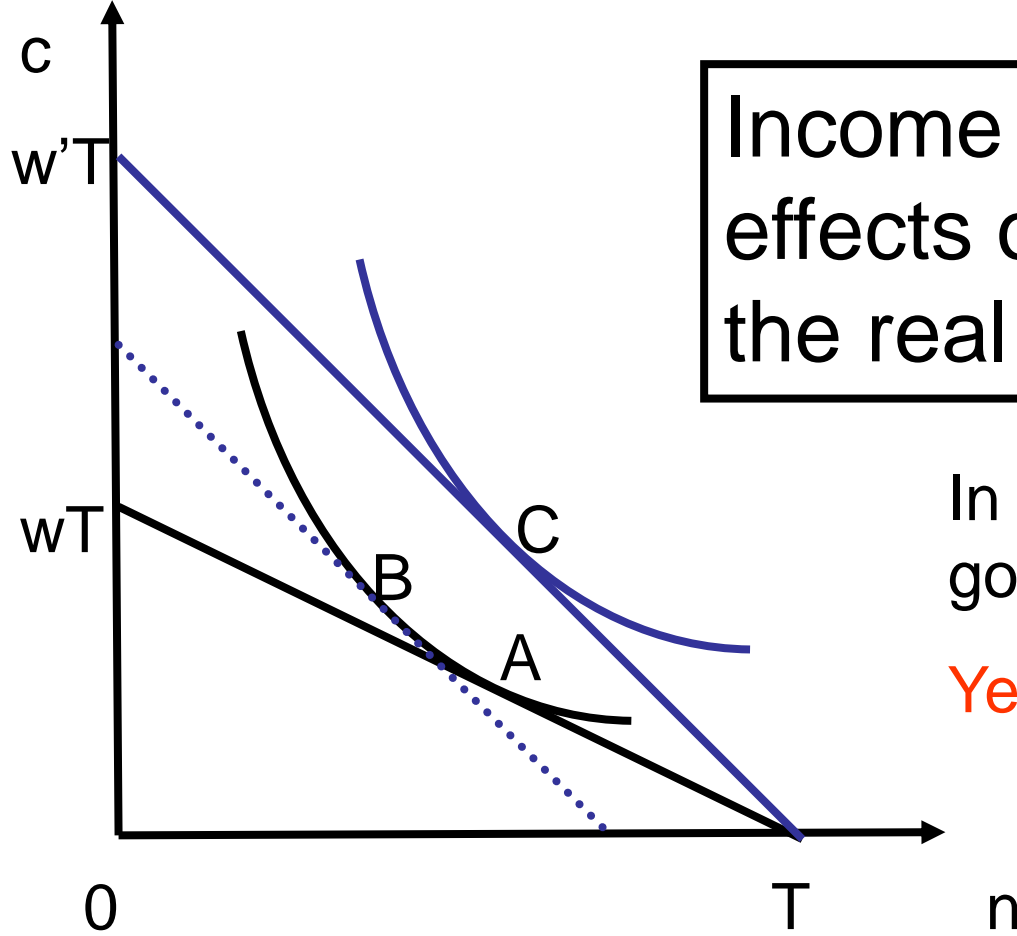In this diagram is n a normal good?

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Substitution effect A to B decreases n, increases labour supply.

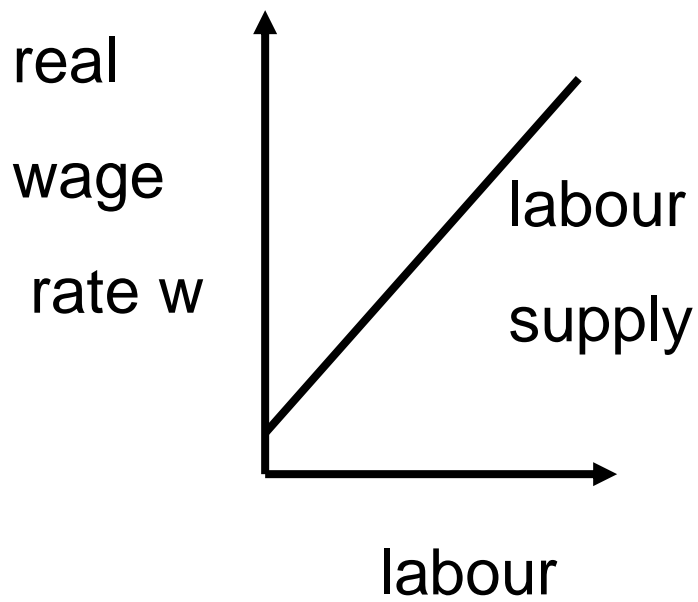Income effect B to C increases n, decreases labour supply.

Income and substitution effects on labour supply work in opposite directions.

- I argued using the Slutsky equation that the size of the income effect on demand for good 1 is small when the budget share $p_1 x_1 / m$ is small.

- Here the budget share of n ("leisure) is

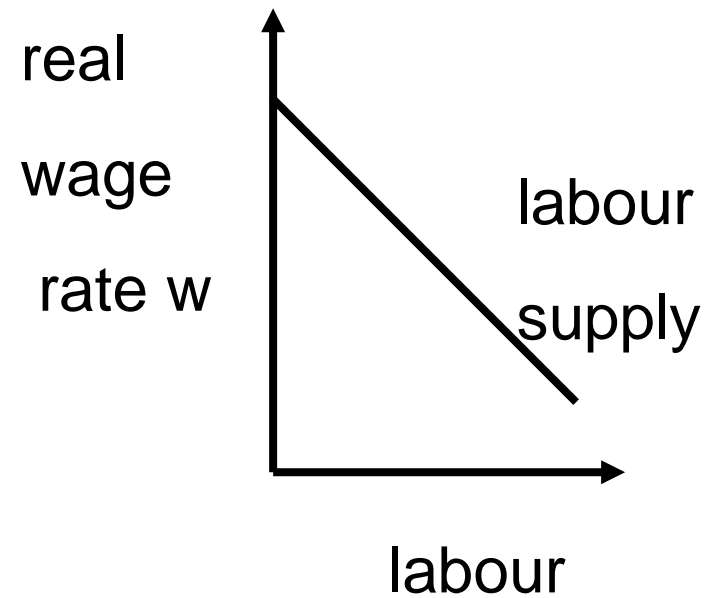 $wn/wT = n/T$ "leisure"/total time.

- Is this budget share small?

- I argued using the Slutsky equation that the size of the income effect on demand for good 1 is small when the budget share $p_1 x_1 / m$ is small.

- Here the budget share of n ("leisure) is

   $wn/wT = n/T$ "leisure"/total time.

- Is this budget share small?

      No, so income effects may be important.

real wage rate w

labour supply

labour

Labour supply increases when the wage rate rises

which is bigger

substitution effect or income effect?

real wage rate w

labour supply

labour

Labour supply decreases when the wage rate rises

which is bigger

substitution effect or income effect?

real wage rate w

labour supply

labour

Labour supply increases when the wage rate rises

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real wage rate w

labour supply

labour

Labour supply decreases when the wage rate rises

which is bigger
substitution effect or income effect?

real
wage
rate w
labour
supply

labour

Labour supply
increases when
the wage rate
rises

which is bigger
substitution effect or
income effect?

real
wage
rate w
labour
supply

labour

Labour supply
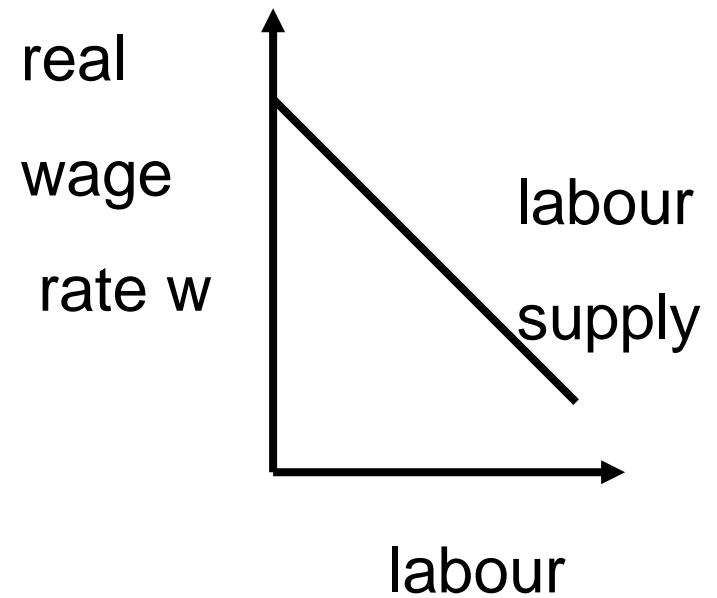decreases when
the wage rate
rises

which is bigger
substitution effect or
income effect?

real wage

w*
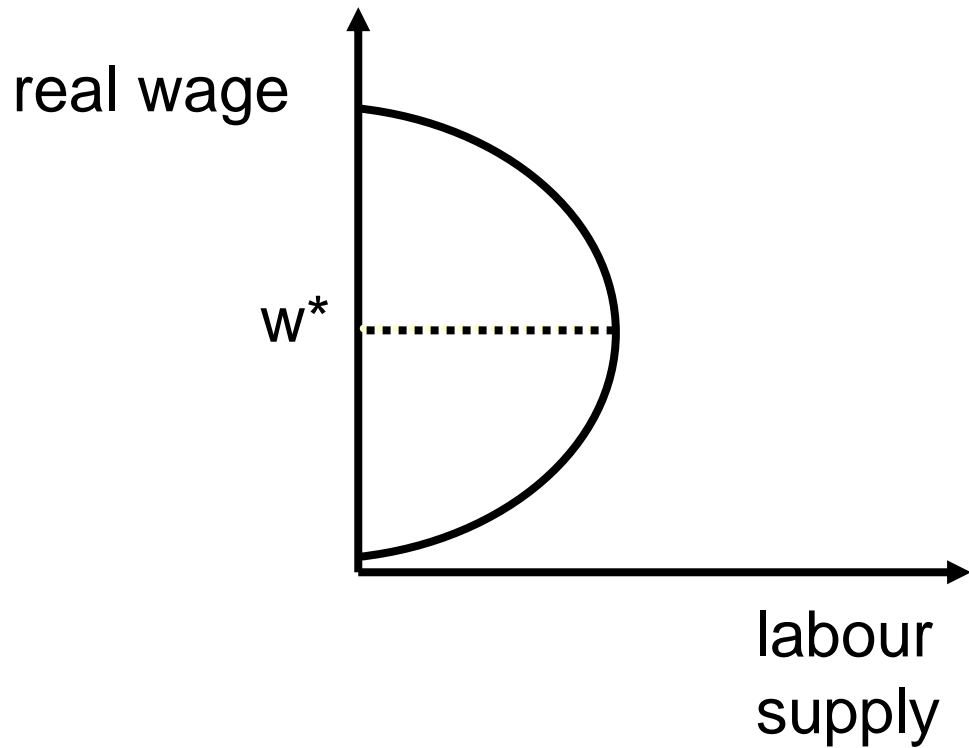
labour
supply

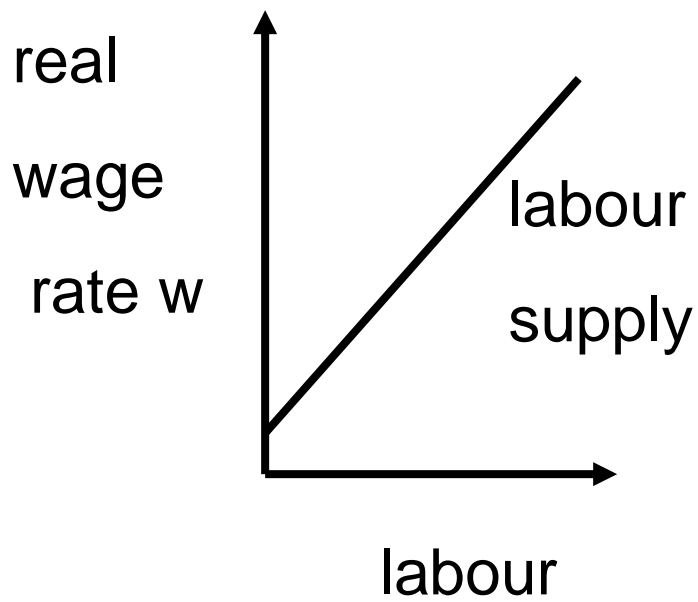The labour supply curve is **backward-bending** when the substitution effect dominates the income effect for wages below a certain wage w*, and the income effect dominates the substitution effect above w*.

Estimating the elasticity of labour supply is hard due to

- complicated budget constraints, depending on family circumstances

- linked decisions
    whether to get paid employment
    how many hours, child care?

- people who are not on their labour supply schedule,
    unemployment, conventional hours.

- There is very little evidence for workers whose pay does not depend on current hours worked, e.g. professionals.

	Husbands	Wives
Mean uncompensated labour supply elasticity	0.207	0.844
Mean compensated labour supply elasticity	0.169	0.941

Women's labour supply is generally more elastic than men's

source Ashenfelter, "The Labor Supply Response of Wage Earners", in Palmer & Pechman, Welfare in Rural Areas, The North Carolina-Iowa Income Maintenance Experiment" Brookings,1978" Data collected in1970 - 72

Effects of Unemployment

- The labour supply model tells us that the cost of unemployment to a worker is lost consumption.

In fact, the costs of unemployment in reality extend far beyond just the monetary:

"Unemployment is a disaster similar to marriage break-up: in each case you cease to be needed…there is a huge psychic cost…on top of whatever income an unemployed person loses."

(Richard Layard, "Happiness – Has social science a clue?" Robbins Lectures 2002/3, LSE)

Income & consumption taxes: the simplest model

3. Modelling the effects of an income tax

Budget constraint without tax

$Pc = W(T - n)$ or $Pc + Wn = WT$

or $c + wn = wT$

Budget constraint with 20% proportional income tax

total tax paid $= 0.2 W (T-n)$

Budget constraint $Pc = W(T - n) - 0.2 W(T - n)$

or $Pc = 0.8 W(T - n)$ or $c + 0.8 wn = 0.8wT$

Modelling the Effects of a Tax on Consumption

Assume at 25% tax rate on consumption and so the price increases to 1.25P. Tax revenue 0.25 Pc.

Budget constraint with consumption tax

$$(1.25) \; Pc \; = \; W \, (T - n) \quad \text{or} \quad Pc = 0.8 \; W \, (T - n)$$

or $c + 0.8 \, wn = 0.8wT$ same as with 20% income tax.

Tax revenue $= 0.25Pc = 0.25(0.8 \; W \, (T - n)) = 0.2 \; W(T-n)$ same as 20% income tax.

In general a proportional income tax at rate t_m and a proportional consumption tax at rate t_c raise the same revenue and have the same effect on the budget constraint if

$(1 - t_m) \, (1 + t_c) = 1$.

Tax revenue given T- n* and c* as labour and consumption

= 0.20 W (T – n*)

(0.2 = tax rate, W wage, T – n* labour)

= W T – 0.8 WT - 0.2 W n*

= WT – (Pc* + 0.8 W n*) – 0.2 W n*

(because from the budget constraint 0.8 WT = Pc* + 0.8Wn*)

= WT – (Pc* + Wn*)

= WT – cost of (c*, n*) at pre tax prices P and W

wT

This diagram is distorted to make it easier to follow. The gradient of the budget line with tax is much too small.

How to measure the tax revenue?

0.8wT

(c*, n*)

budget constraint with tax
gradient – 0.8 w

budget constraint no
tax gradient - w

0

T

n

This diagram is distorted to make it easier to follow. The gradient of the budget line with tax is much too small.

tax revenue = WT − (Pc* + Wn*)
= P (wT − (c* + wn*))
=

wT

c* + wn*

0.8wT

(c*, n*)

gradient - w

budget constraint with tax
gradient − 0.8 w

budget constraint no
tax gradient - w

0   T   n
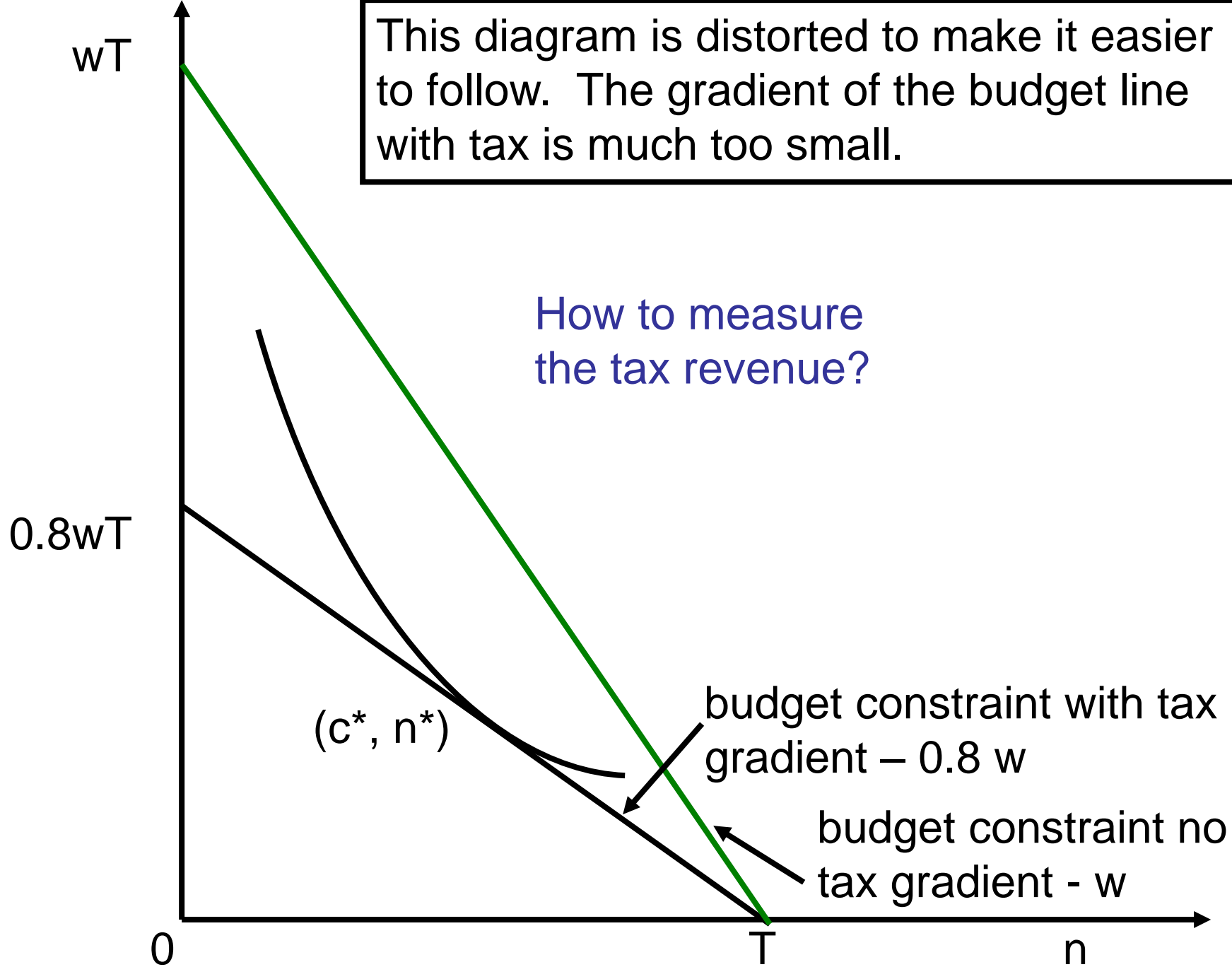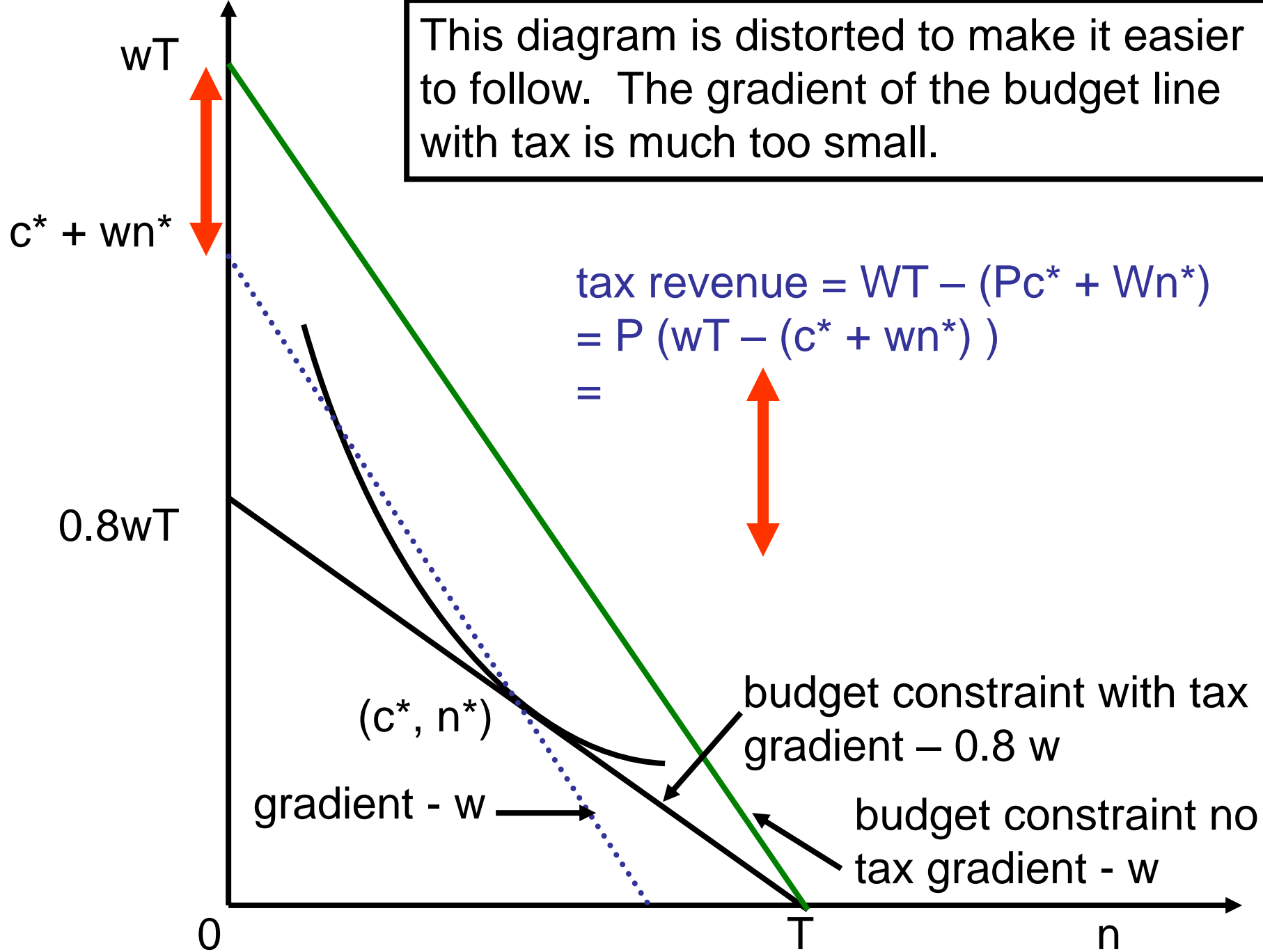
Definition: **Equivalent Variation for a price change**
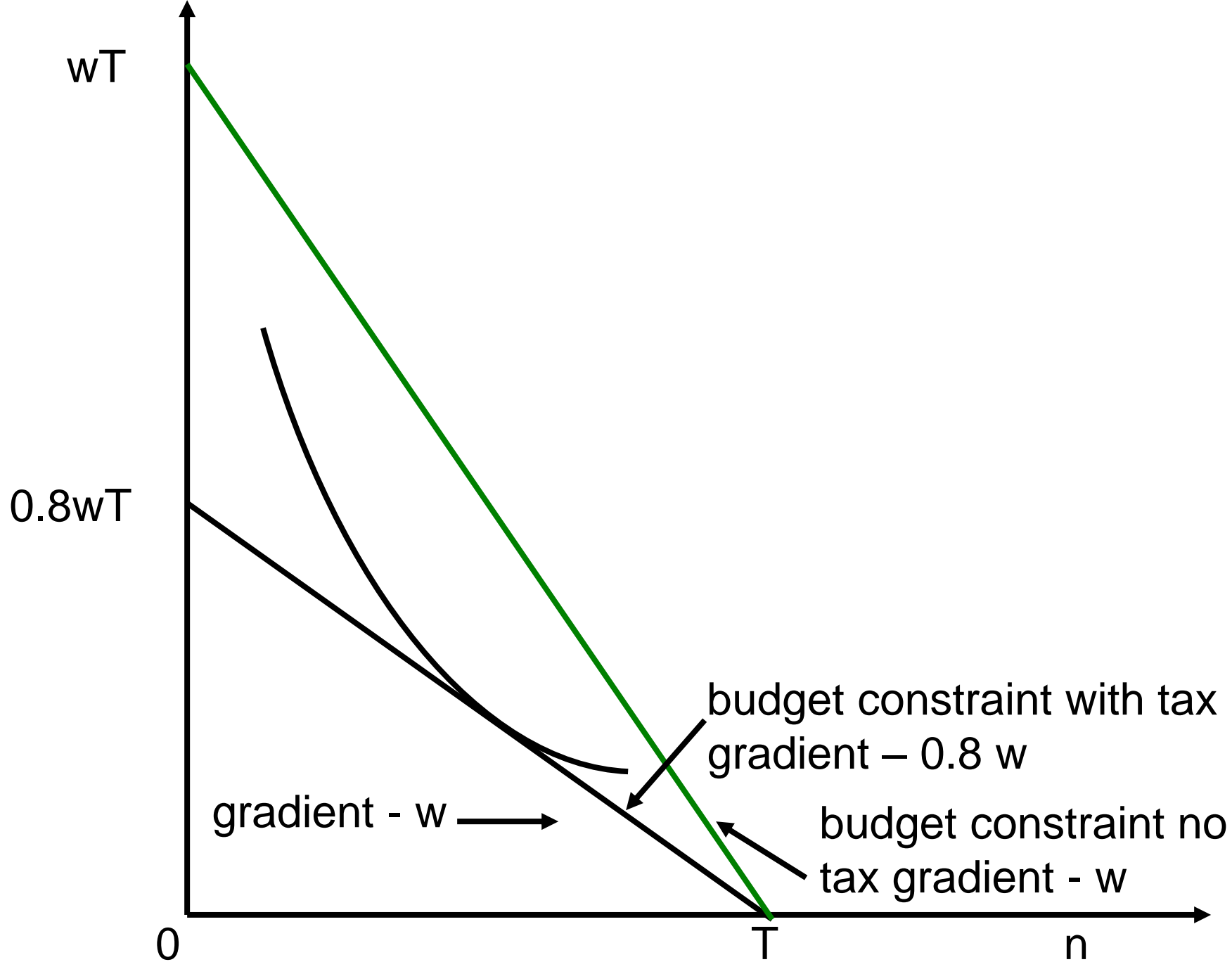
- The price of good 1 starts at p_{1A} giving utility u_A.

- The price of good 1 rises to p_{1B}

- p_2 does not change.

- Taking away the <u>equivalent variation</u>, EV, without changing p_1 from p_{1A} has the same effect on utility as increasing p_1 from p_{1A} to p_{1B} without changing income.

Definition: **Equivalent Variation of a tax**

- The tax changes the price of good 1 "leisure" from W to 0.8W.

- Taking away the <u>equivalent variation</u>, EV, without changing the price of "leisure" has the same effect on utility as imposing the tax.

wT

0.8wT

budget constraint with tax
gradient – 0.8 w

gradient - w →

budget constraint no
tax gradient - w

0   T   n

wT

tax revenue =

c* + wn*

0.8wT

budget constraint with tax
gradient – 0.8 w

gradient - w

budget constraint no
tax gradient - w

0

T

n

equivalent variation =

wT

0.8wT

budget constraint with tax
gradient – 0.8 w

gradient - w

budget constraint no
tax gradient - w

0   T   n

wT

c* + wn*

0.8wT

tax revenue =

equivalent variation =

excess burden =
equivalent variation - tax revenue
=

budget constraint with tax
gradient – 0.8 w

gradient - w

budget constraint no
tax gradient - w

0   T   n

wT

c* + wn*

Taking ⬍ from the consumer as a lump sum gives the budget constraint which gives the same tax revenue as the income tax but is better for the consumer.

0.8wT

budget constraint with tax gradient – 0.8 w

gradient - w

budget constraint no tax gradient - w

0   T   n

This is a general argument.

A lump sum tax that reduces income by a fixed amount that does not depend on anything the consumer does reduces utility by less than a tax raising the same amount of revenue where the revenue can be changed by changing consumption, work or saving.

(e.g. excise tax, VAT, income tax…)

The only feasible lump sum tax is a "poll tax" where everyone pays the same amount.

Is a poll tax ethically desirable?

Is a poll tax politically possible?

Income tax:
a more realistic model

A more realistic model of income tax

Divide income into **tax brackets**.
e.g. €0 - €5 000, €5 000 - €20 000,   > €20 000

* An income tax system gives a marginal tax rate for each bracket, with higher brackets having higher marginal tax rates.

* If the tax rates are
    0 % in bracket 1
    20% in bracket 2
    40 % in bracket 3

* Total income tax =
* 0.00 (income in bracket 1) + 0.20 (income in bracket 2)
    + 0.40 (income in bracket 3).

Usual description of this tax scheme

total annual €	marginal tax income rate
< 5000	0 %
5000 - 20000	20 %
> 20000	40 %

# Definition: Marginal and Average Income Tax Rates

Marginal income tax rate is the number of extra pennies tax you pay on €1 extra earnings.

With this income tax scheme the marginal income tax rate for someone earning €15000 is 20%.

Average income tax rate = $\dfrac{\text{total income tax}}{\text{total income}}$

If someone earning €15000 pays €2000 tax

the average income tax rate = $\dfrac{2000}{15\,000}$ = 13%

Income €15 000

€0 in bracket 3

€20 000

€10 000 in bracket 2

€5 000

€5000 in bracket 1

€0
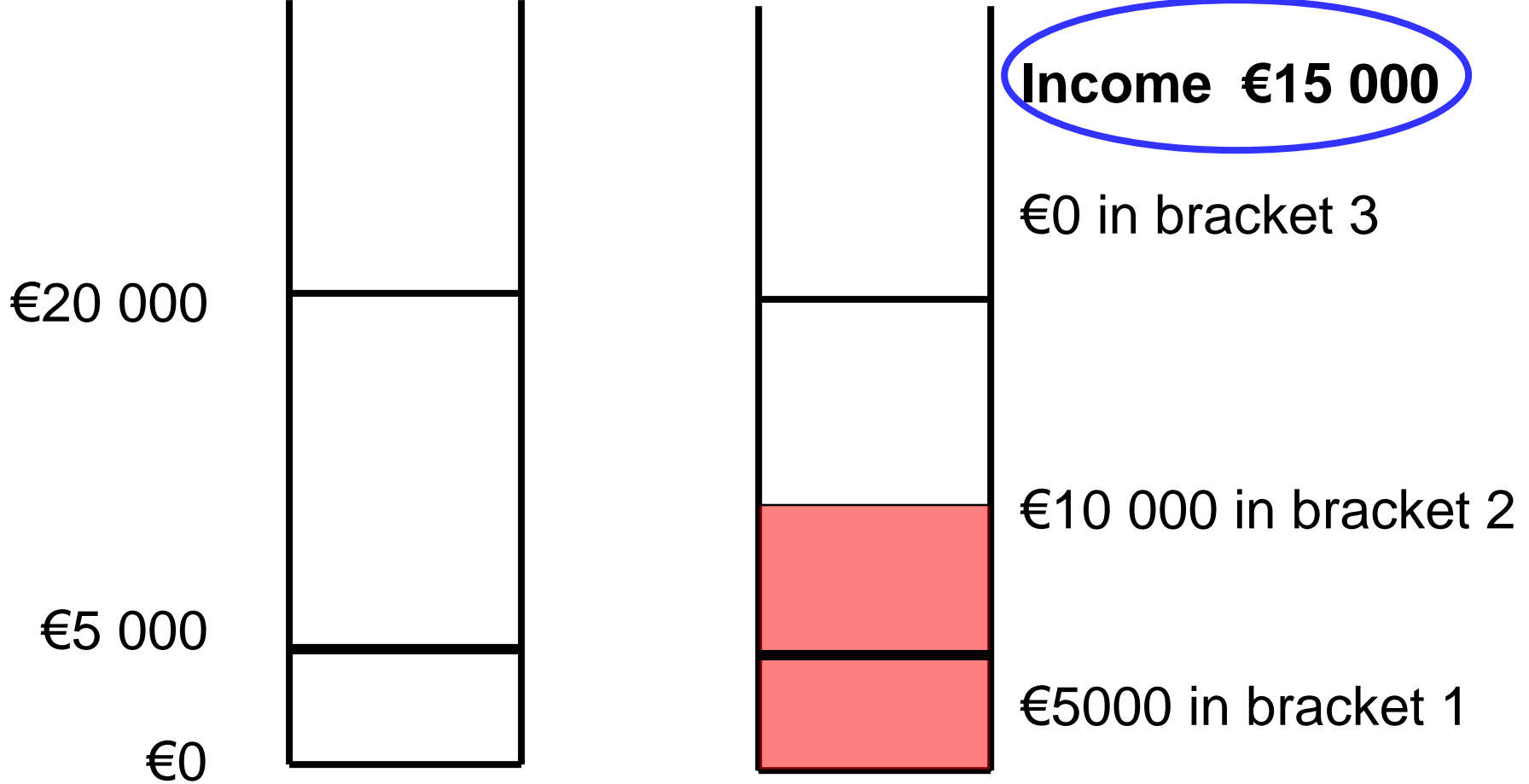
With an income of €15 000 you have €5000 in bracket 1
€15 000 – €5000 = €10 000 in bracket 2. €0 in bracket 3.
Total tax = (0.00 x 5000) + (0.20 x 10 000) + (0.40 x 0) = €2000
Marginal tax rate = 20%

Average tax rate = $\dfrac{\text{tax}}{\text{income}}$ = $\dfrac{2000}{15000}$ = 13%

Income €30 000

€10 000 in bracket 3

€20 000

€15 000 in bracket 2

€5 000

€5000 in bracket 1

€0
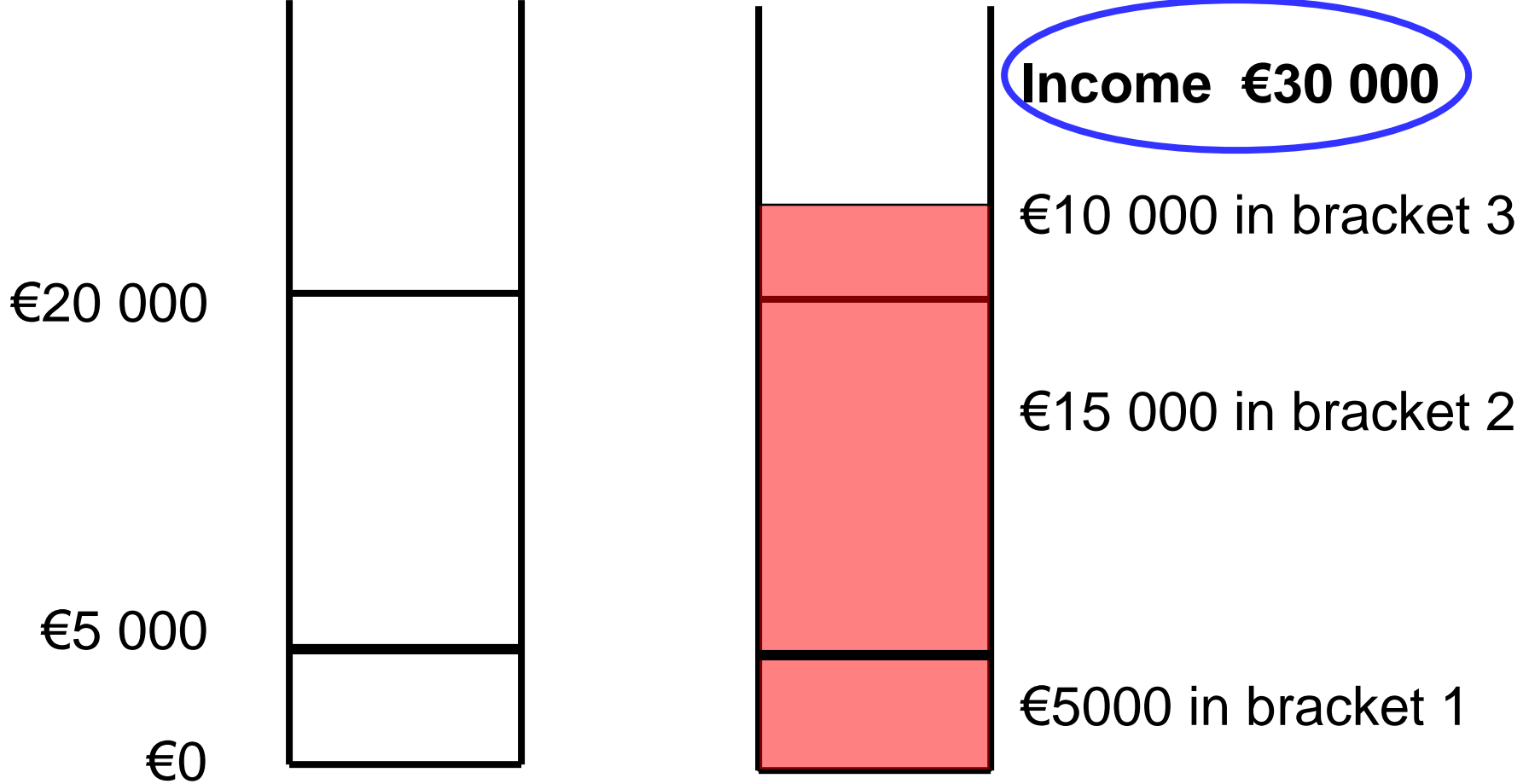
With an income of €30 000 you have €5000 in bracket 1
€15 000 in bracket 2. €10 000 in bracket 3.
Total tax =(0.00 x 5000)+(0.20 x 15 000)+(0.40 x 10 000) = €7000
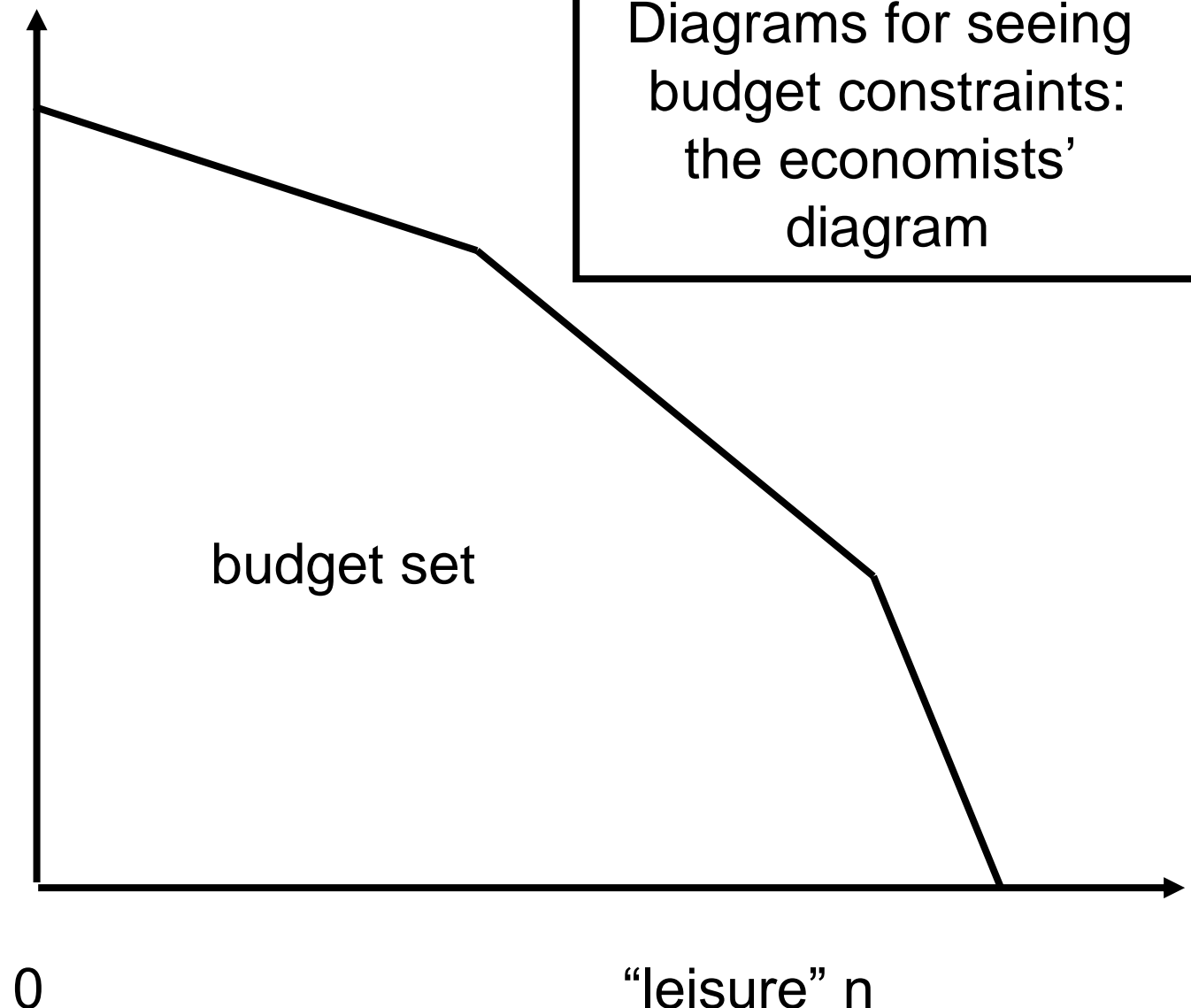Marginal tax rate = 20%

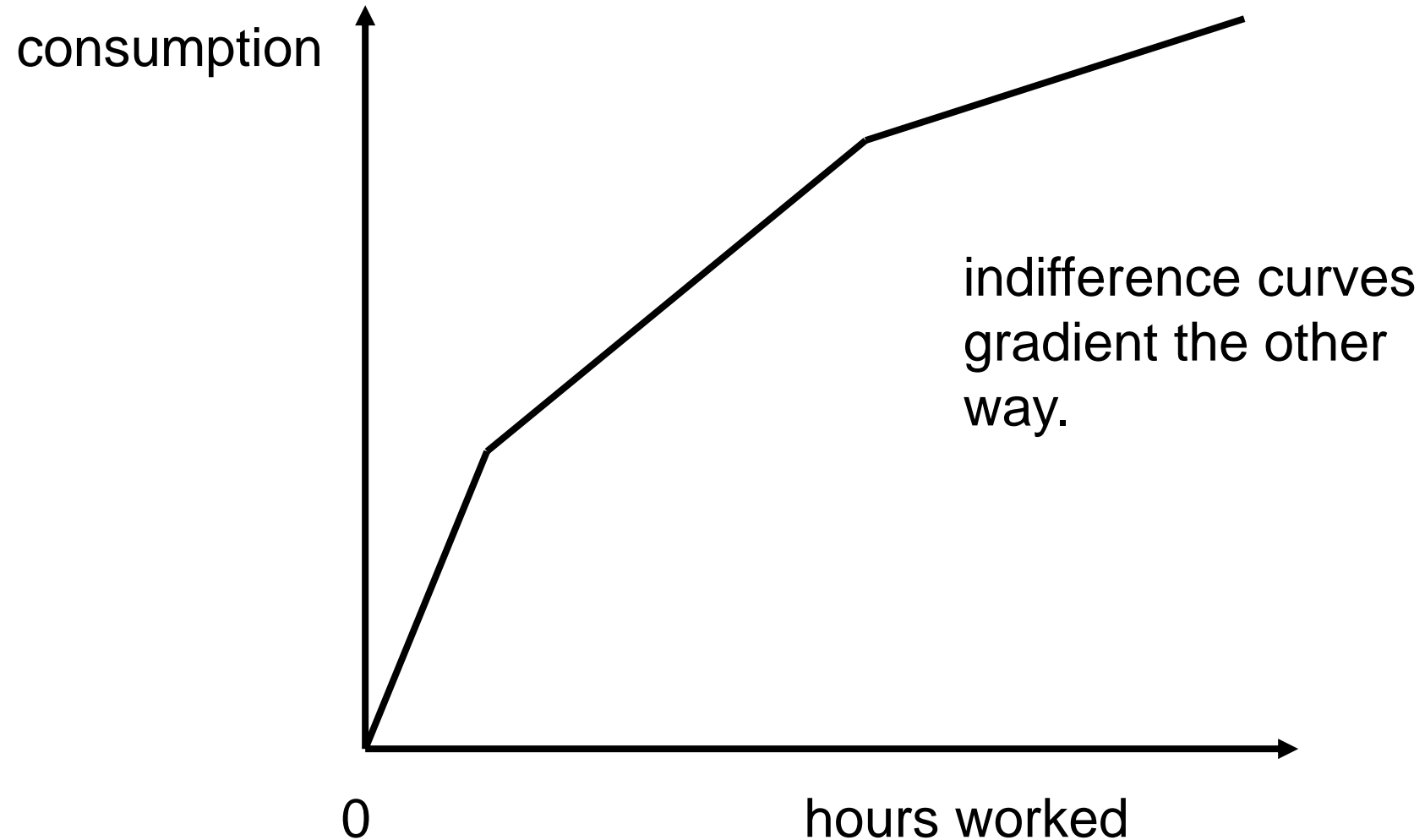Average tax rate = $\dfrac{\text{tax}}{\text{income}}$ = $\dfrac{7000}{30000}$ = 23%

consumption

c

The economists' diagram has the advantage that indifference curves have their usual shape.
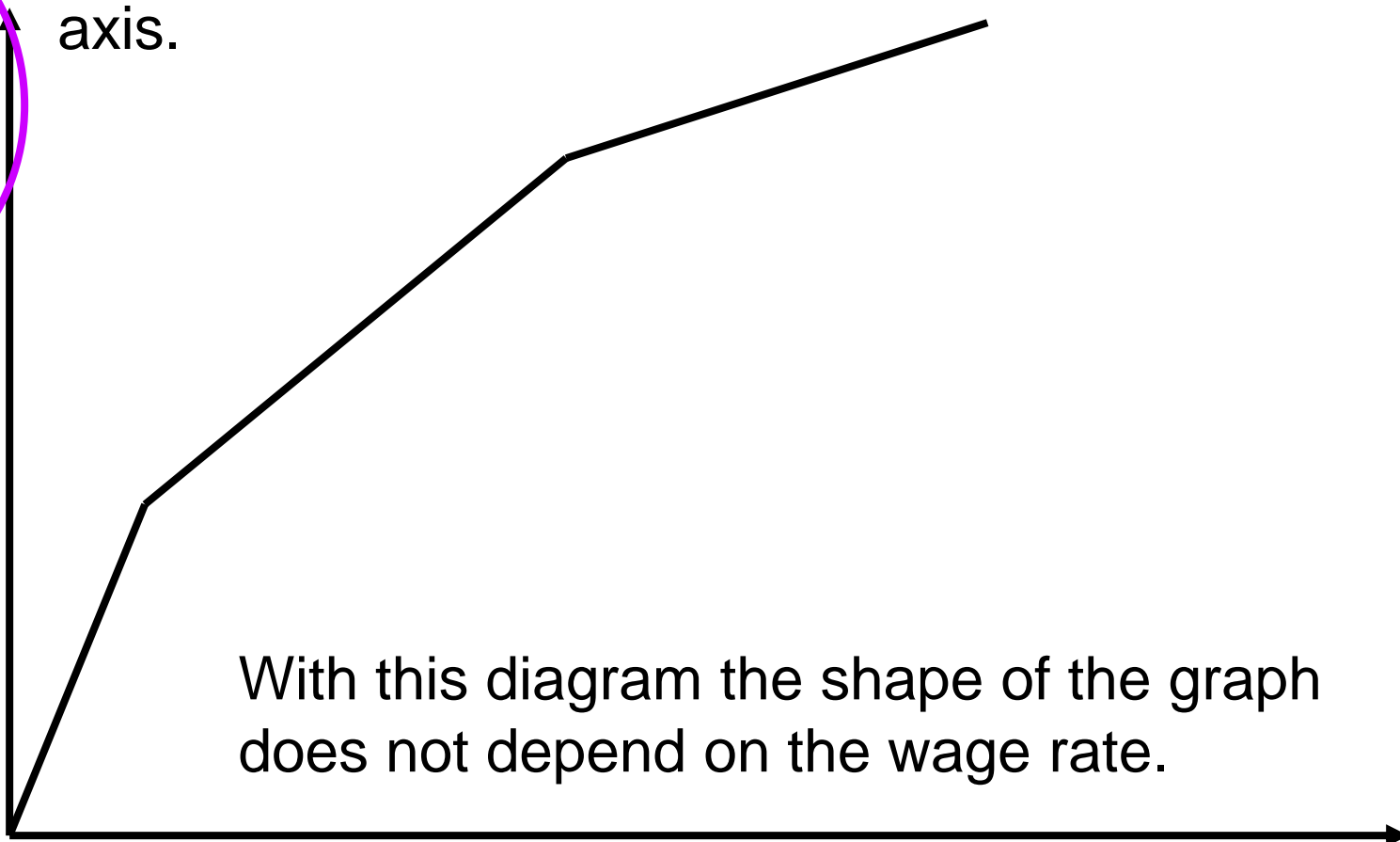
But non economists don't understand it.

budget set

0

"leisure" n

consumption

indifference curves gradient the other way.

0   hours worked

This diagram makes much more sense to non economists.

You often see diagrams with earnings before tax rather than hours worked on the horizontal axis.

income

after tax

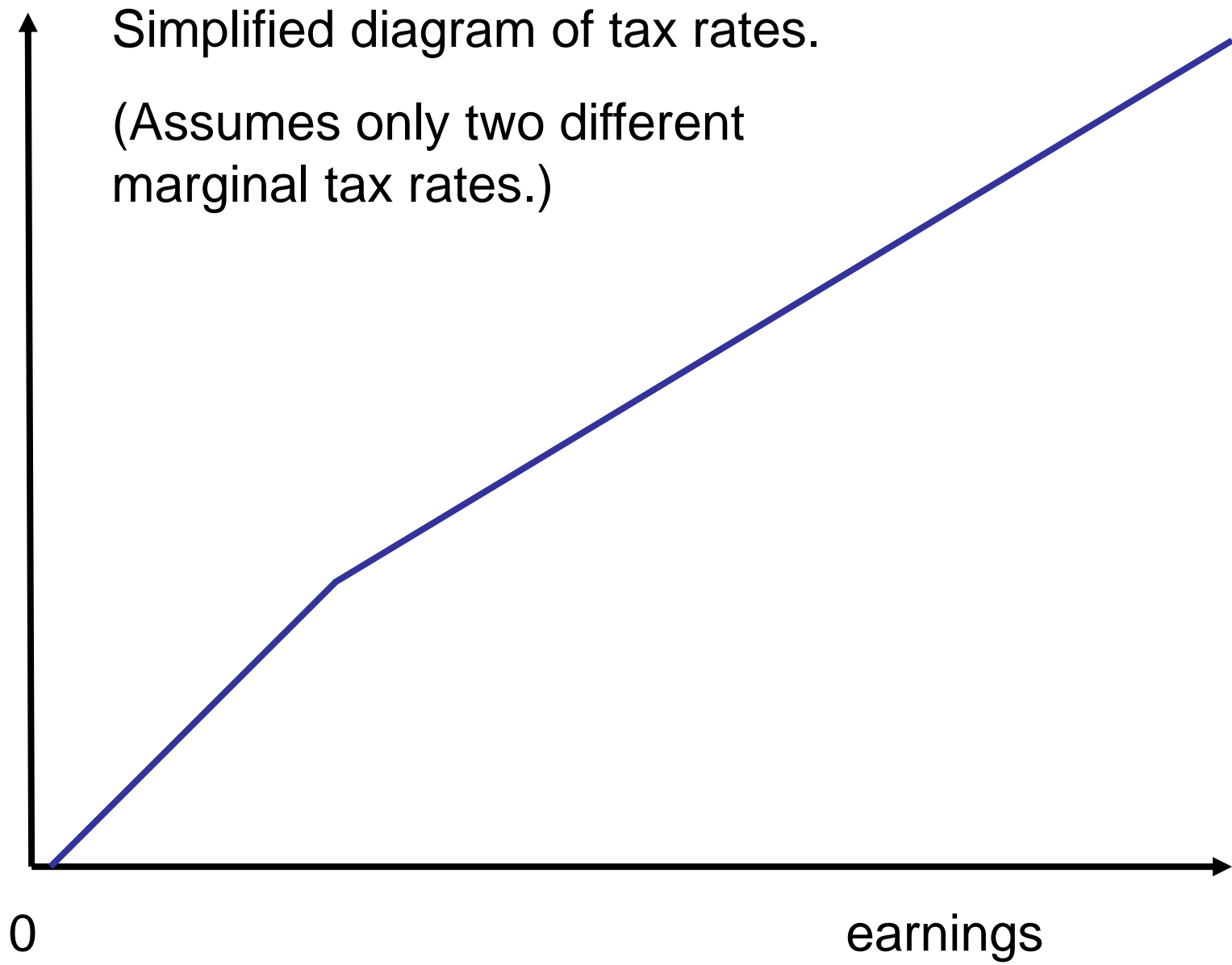With this diagram the shape of the graph does not depend on the wage rate.
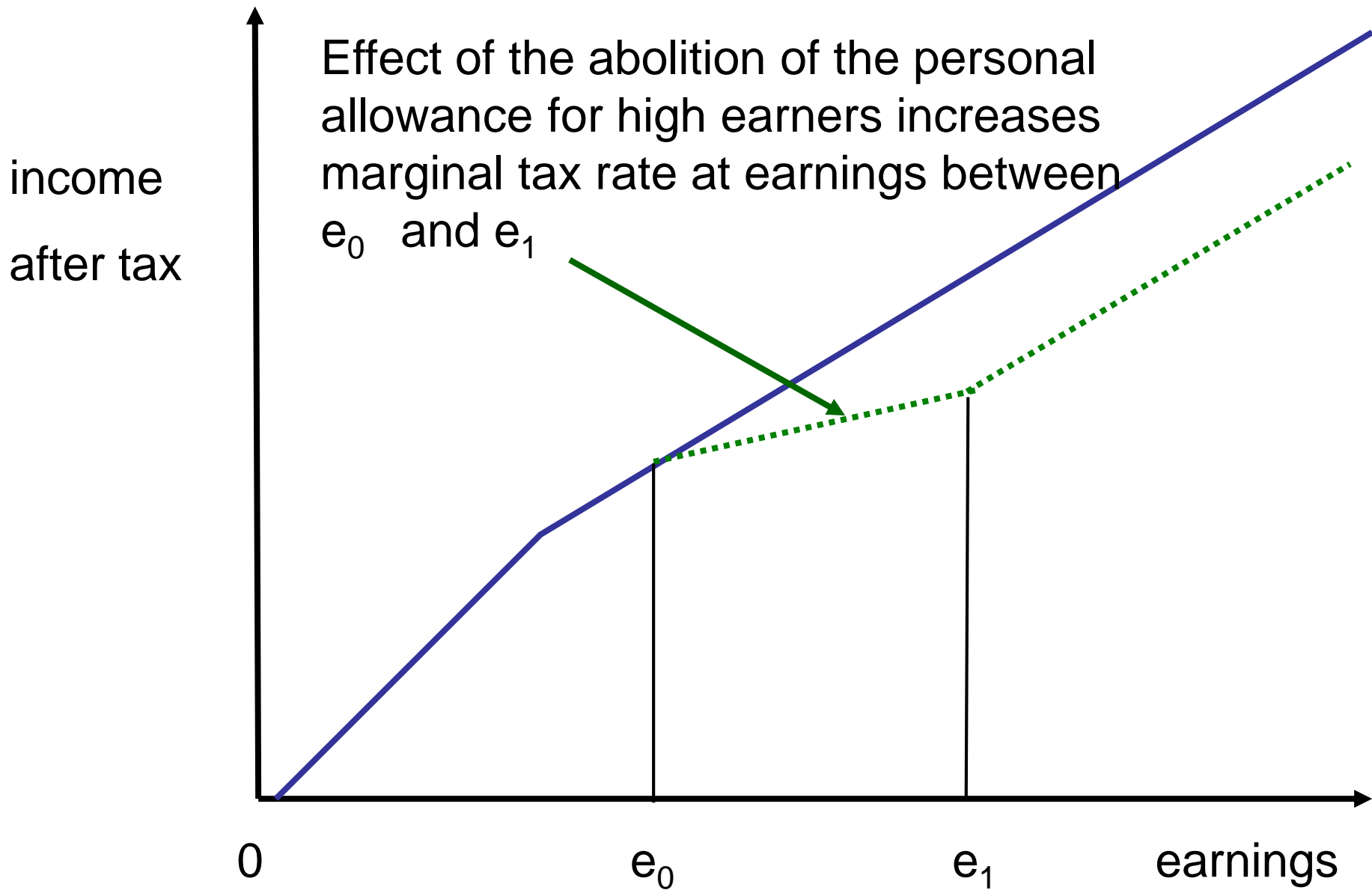
0

earnings

Contrast with previous slides.

income

after tax

Simplified diagram of tax rates.

(Assumes only two different marginal tax rates.)

0

earnings

income
after tax

Effect of the abolition of the personal
allowance for high earners increases
marginal tax rate at earnings between
e_0 and e_1

0   e_0 e_1 earnings

income

after tax

effect on those
earning above e_1

A

C

decrease in utility,

does this stop people
working?

0   e_0 e_1 earnings

no substitution effect

A to C, income effect, increases labour supply

income

after tax

effect on those earning
between $e_0 - e_1$ and e_1

sign of overall effect on
labour supply unclear.

A

B

C

decrease in utility,

does this stop people
working?

0   e_0 e_1 earnings

A to B, substitution effect decreases labour supply

B to C, income effect, increases labour supply

Benefits

4. Benefits

There exist many different benefits including

Do not try to remember this list.

- Income Support,
- Jobseeker's Allowance,
- Employment and Support Allowance
- Housing Benefit,
- Child Tax Credit
- Working Tax Credit.
- Council Tax Benefit
- Universal Credit

These are paid to people with low or zero income.

Amount depends on earnings and other circumstances in complicated ways.

Benefits that depend on earnings

The inevitable conflict

- Suppose the objective is that every family should have at least €200 per week.

- This can be done by giving every family a cash benefit €200 so they have €200 + y

  where y is earned income.

- But this is badly targeted, the rich get as much as the poor.

- It is expensive. The money has to come from somewhere, taxes or government borrowing.

What can we do?

- Suppose the objective is that every family should have at least €200 per week.

- This can be done by giving every family earning income y less than €200 a benefit of €200 - y

  where y is earned income.

- This is targeted on the poorest families.

- It is much less expensive than giving €200 to all families so there is less need for taxes or government borrowing.

Benefits and Budgets Constraints

- Assume for simplicity that this is a household that pays no taxes.

- Suppose that the benefits system is designed to give this family at least €200 per week.

- If the family earns above €200 its gets no benefit.

- If the family earns less than €200 it gets benefit €200 – y.

Definition: The Benefit Withdrawal Rate

- This is the amount by which the benefit is withdrawn if someone earns €1 more.

- If benefit = €200 – y the benefit withdrawal rate is 100% because benefit is withdrawn by 100% of €1 when income increases by €1.
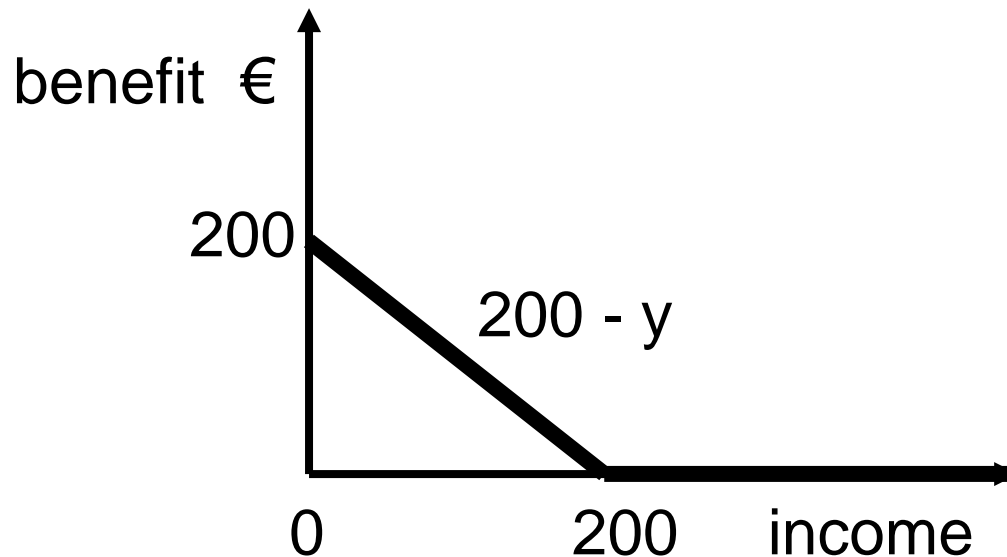
benefit €

200

200 - y

0   200   income

income after benefits €

200

45°

0   200

y income before benefits   €

Would anyone with this budget constraint take a job paying less than €200 per week?

income after benefits €

200
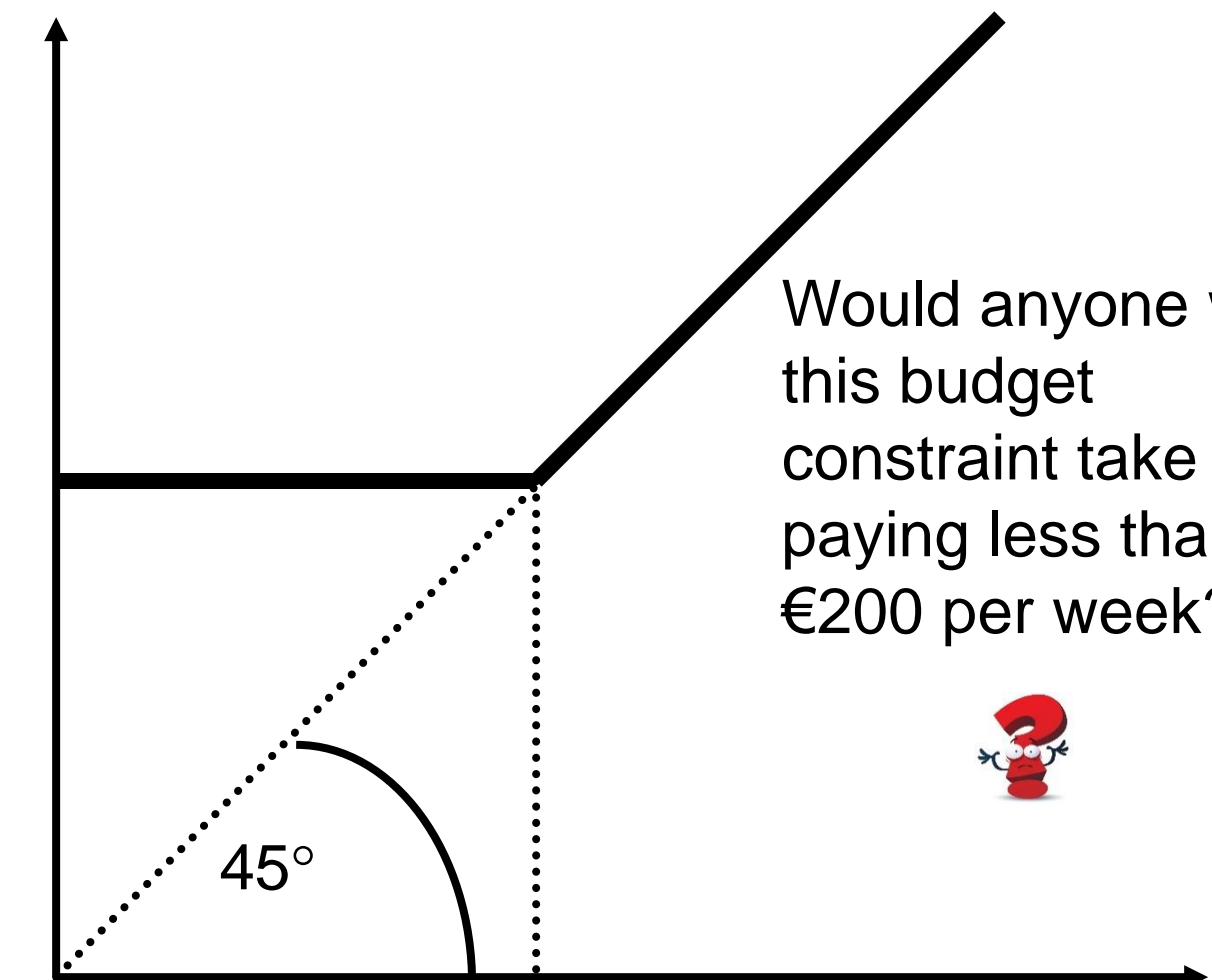
45°
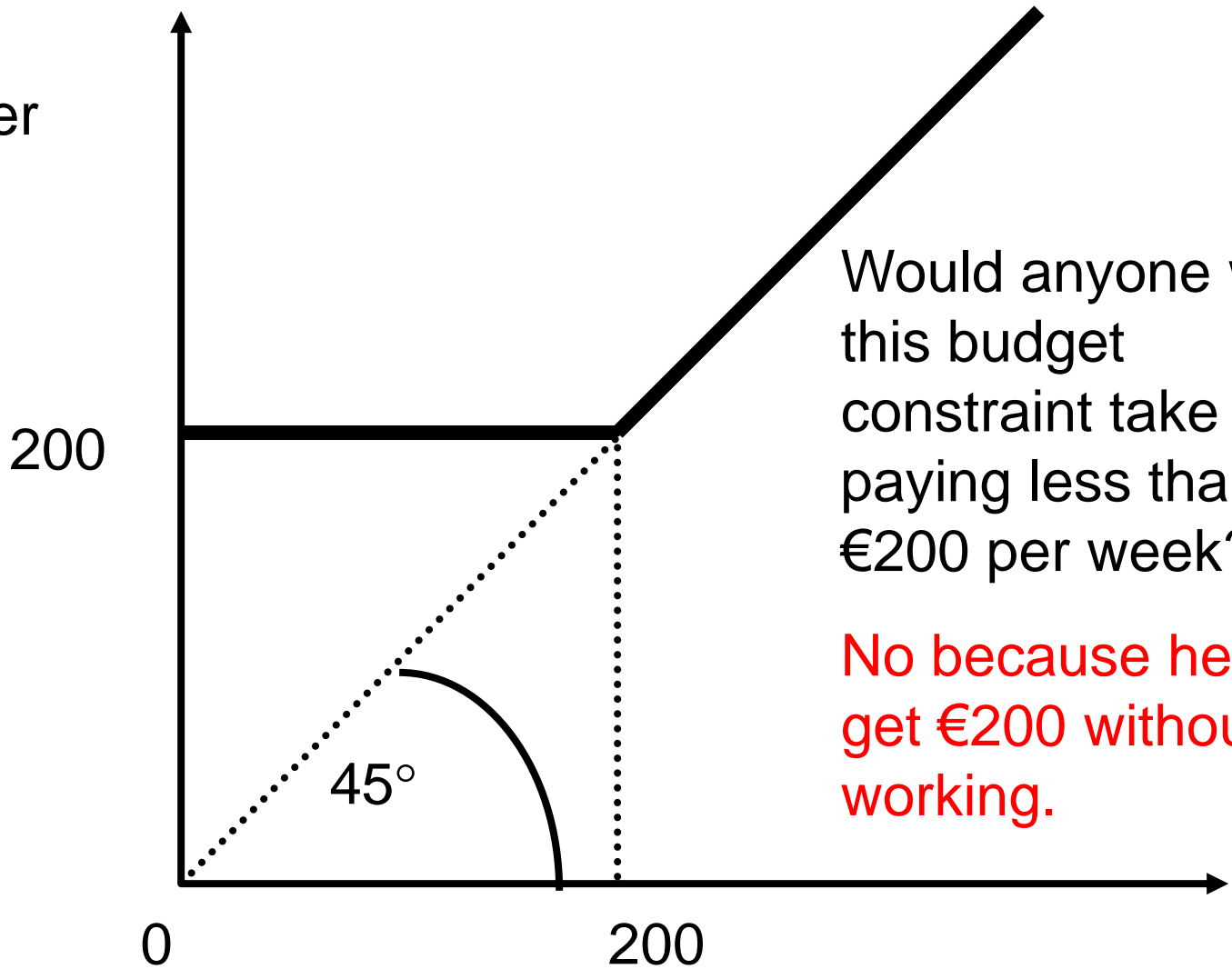
0   200

y income before benefits €

Would anyone with this budget constraint take a job paying less than €200 per week?

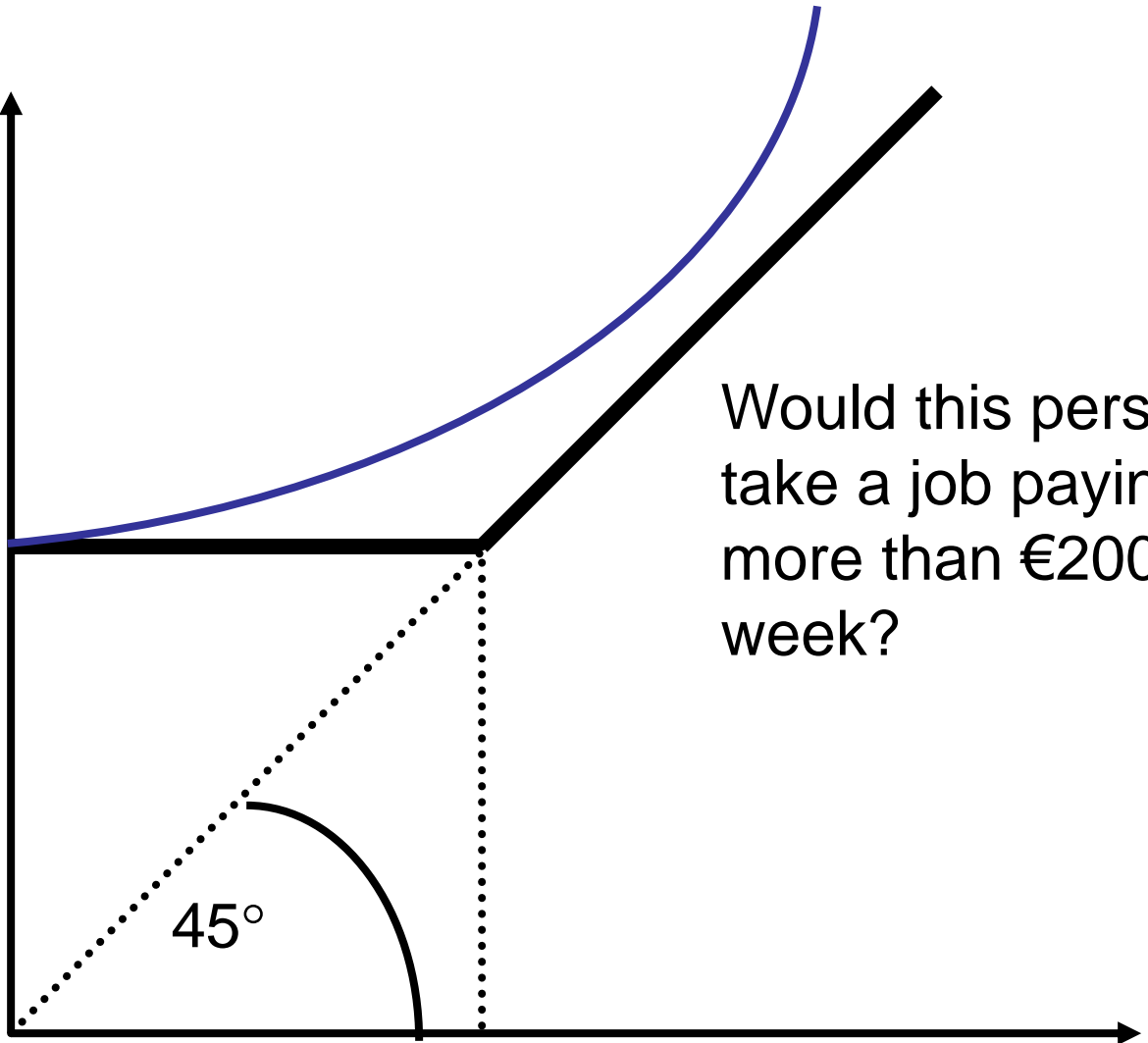No because he can get €200 without working.

income after
benefits €

200

45°

0   200

y income before benefits   €

Would this person
take a job paying
more than €200 per
week?

income after
benefits €

Would this person
take a job paying
more than €200 per
week?

No.

200

45°

0   200

y income before benefits   €

income after benefits €

200

45°

0   200

y income before benefits   €

Would this person take a job paying more than €200 per week?

income after benefits €

200

45°
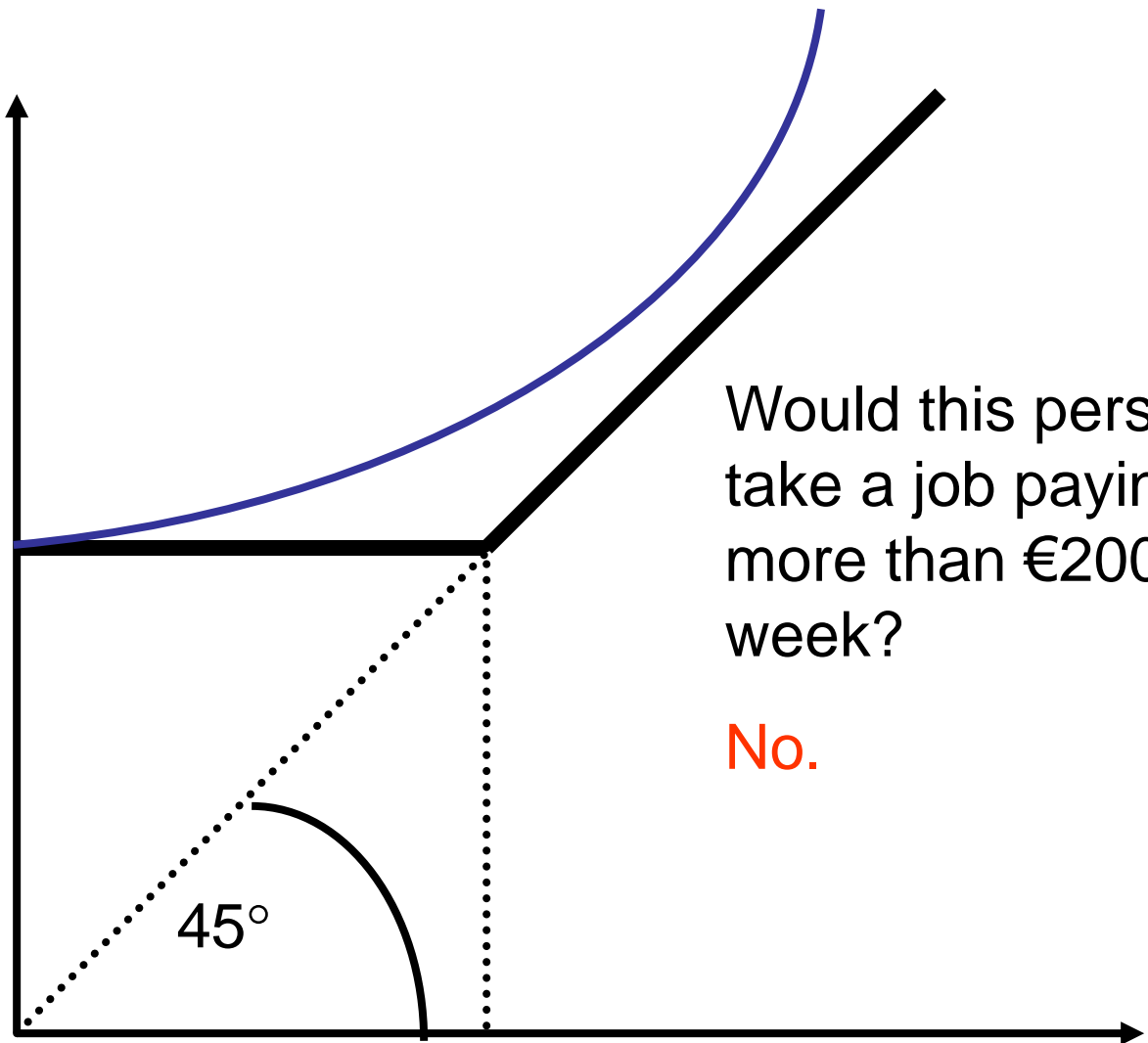
0   200

y income before benefits   €

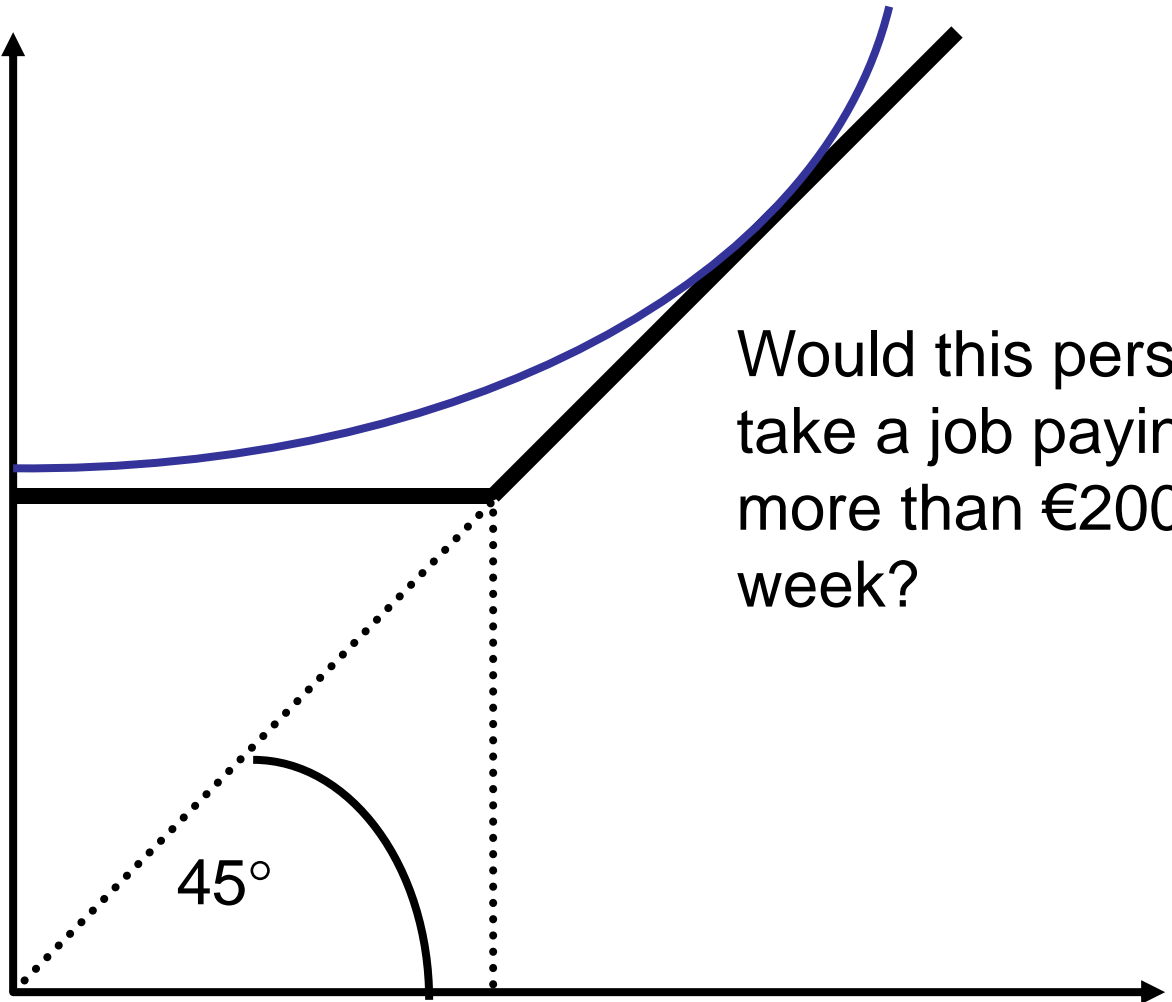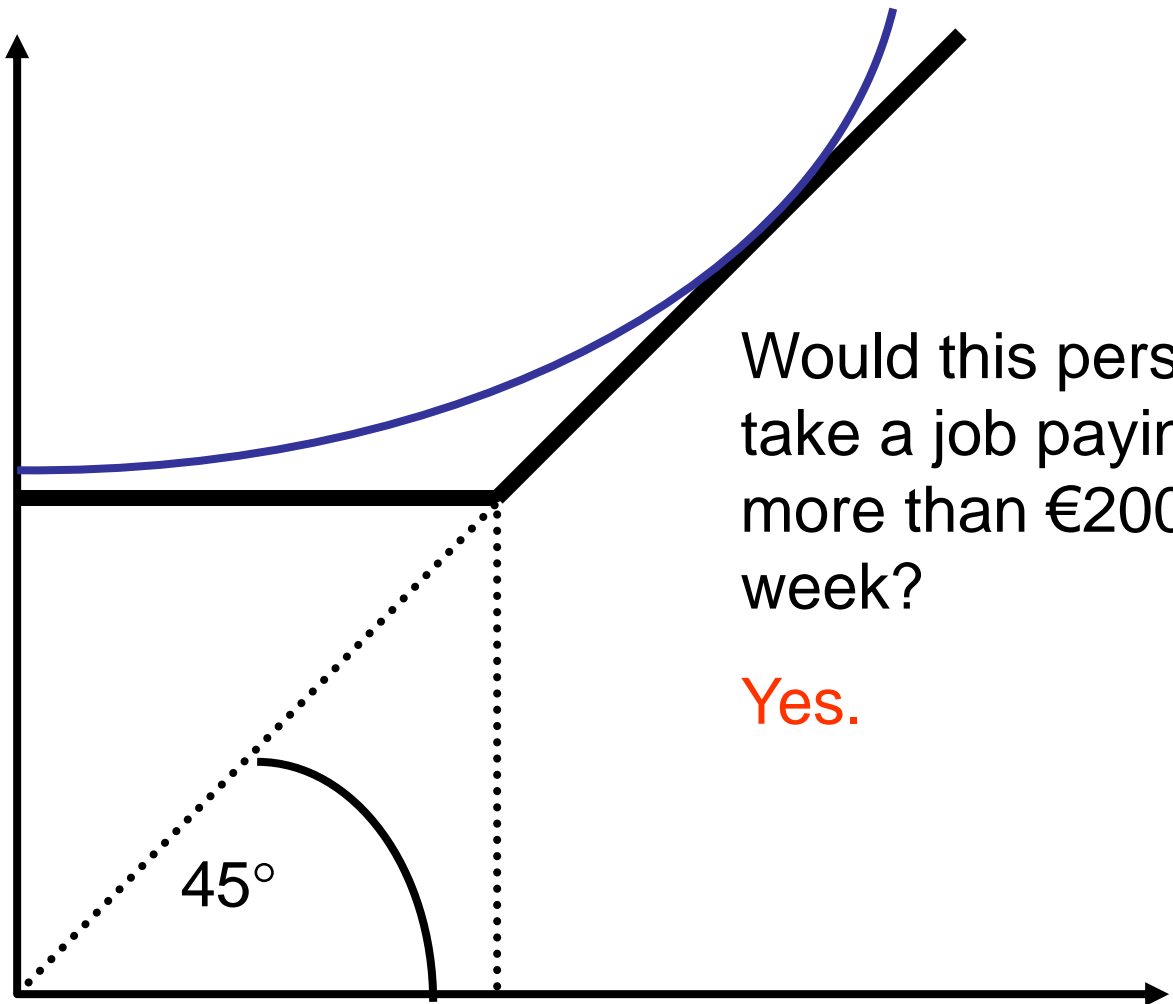Would this person take a job paying more than €200 per week?

Yes.

Making Work Pay

The policy response to this disincentive to work caused by the benefit system was to introduce a form of benefit called a **tax credit**.

Tax credits are paid to people in work.

Earned Income Tax Credit (USA)

Working Families Tax Credit (UK 1999 – 2003)
Child Tax Credit and Working Tax Credit
UK 2003 onwards.

Universal Credit 2014 partial introduction.   2017 ?

With a 100% benefit withdrawal rate there is no incentive to work for less than €200.

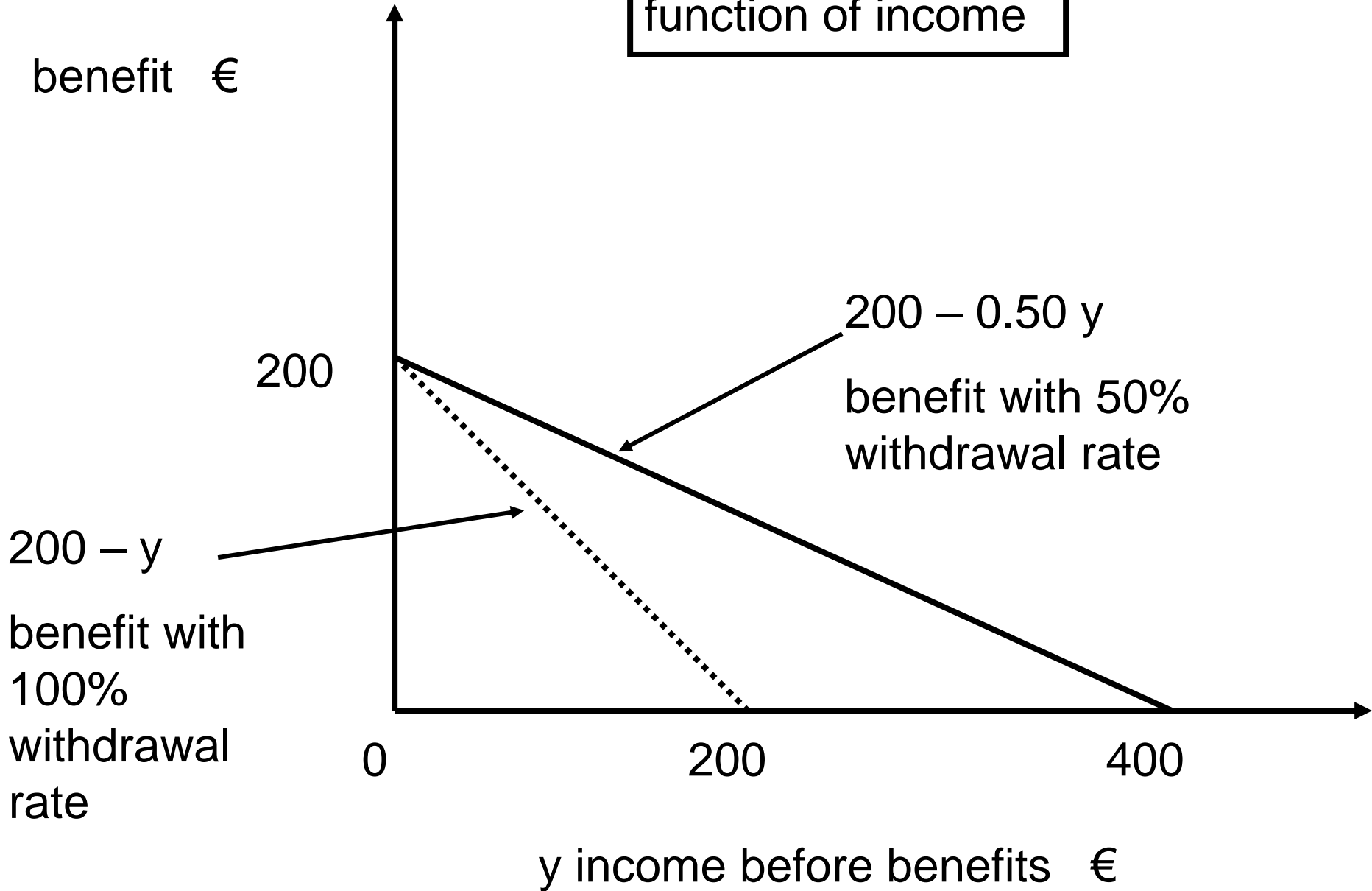What happens with a lower withdrawal rate?

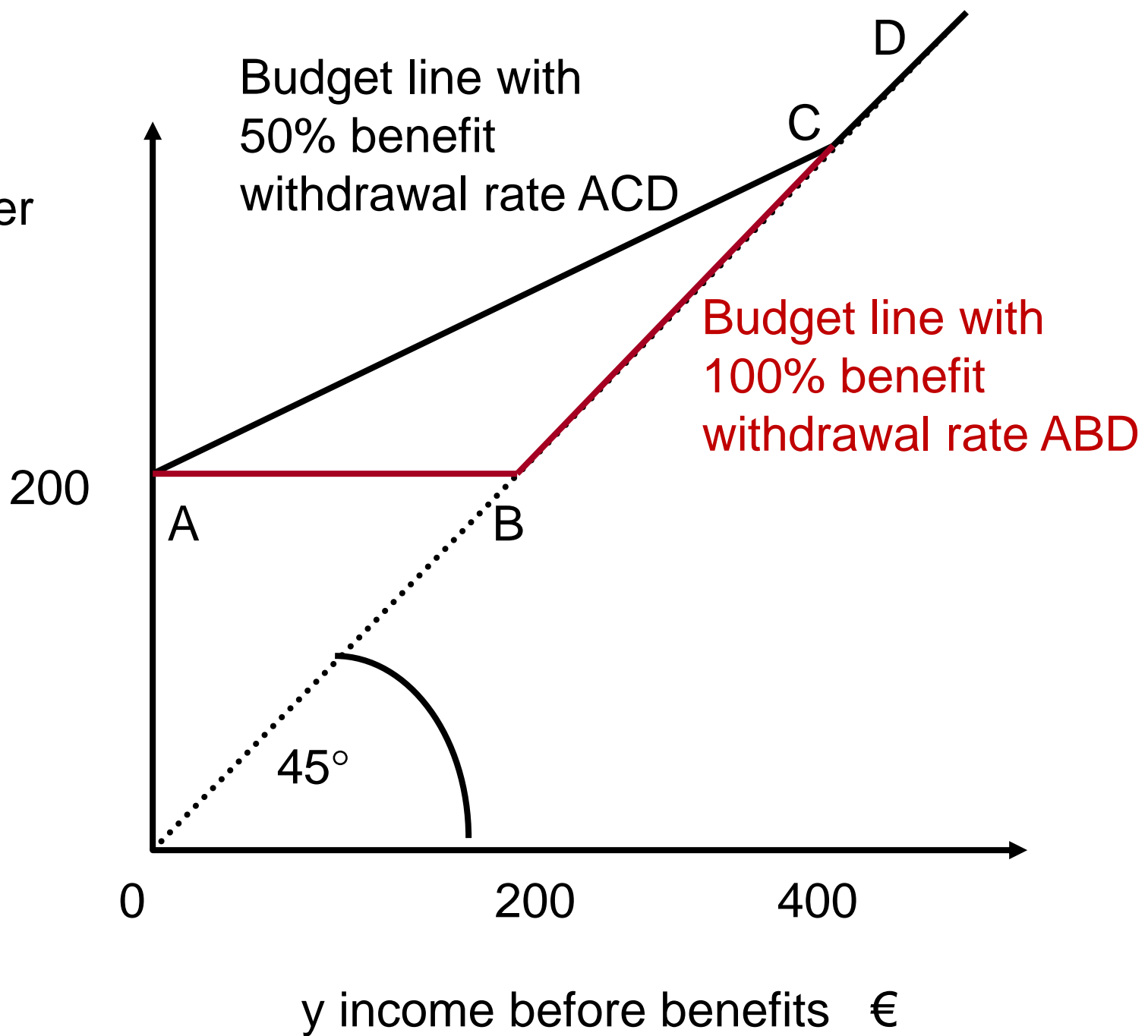Suppose the withdrawal rate is 50%.

Benefit is €200 for someone earning 0.

Benefit is €200 − 0.50 y for someone earning y < €400

Benefit is 0 for someone earning y ≥ €400.

Benefit as a function of income

benefit   €

200 − 0.50 y

benefit with 50% withdrawal rate

200

200 − y

benefit with 100% withdrawal rate

0   200   400

y income before benefits   €

income after benefits €

Budget line with 50% benefit withdrawal rate ACD

Budget line with 100% benefit withdrawal rate ABD

200

A

B

C

D

45°

0

200

400

y income before benefits €

income after
benefits €

IC

B

200

A

This person
moves from A
to B when the
withdrawal
rate falls.

Labour supply
increases.

0   200   400

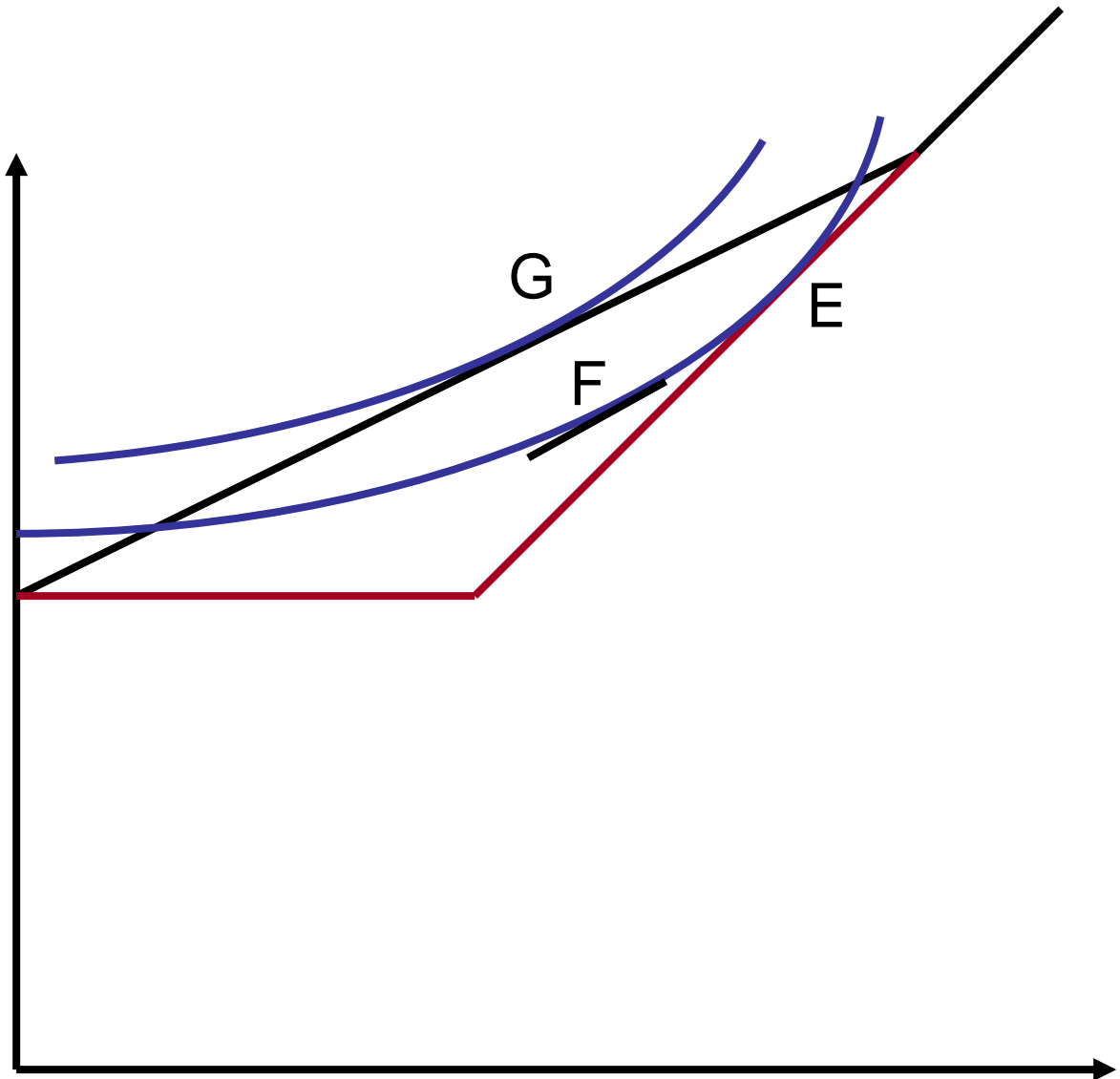y income before benefits   €
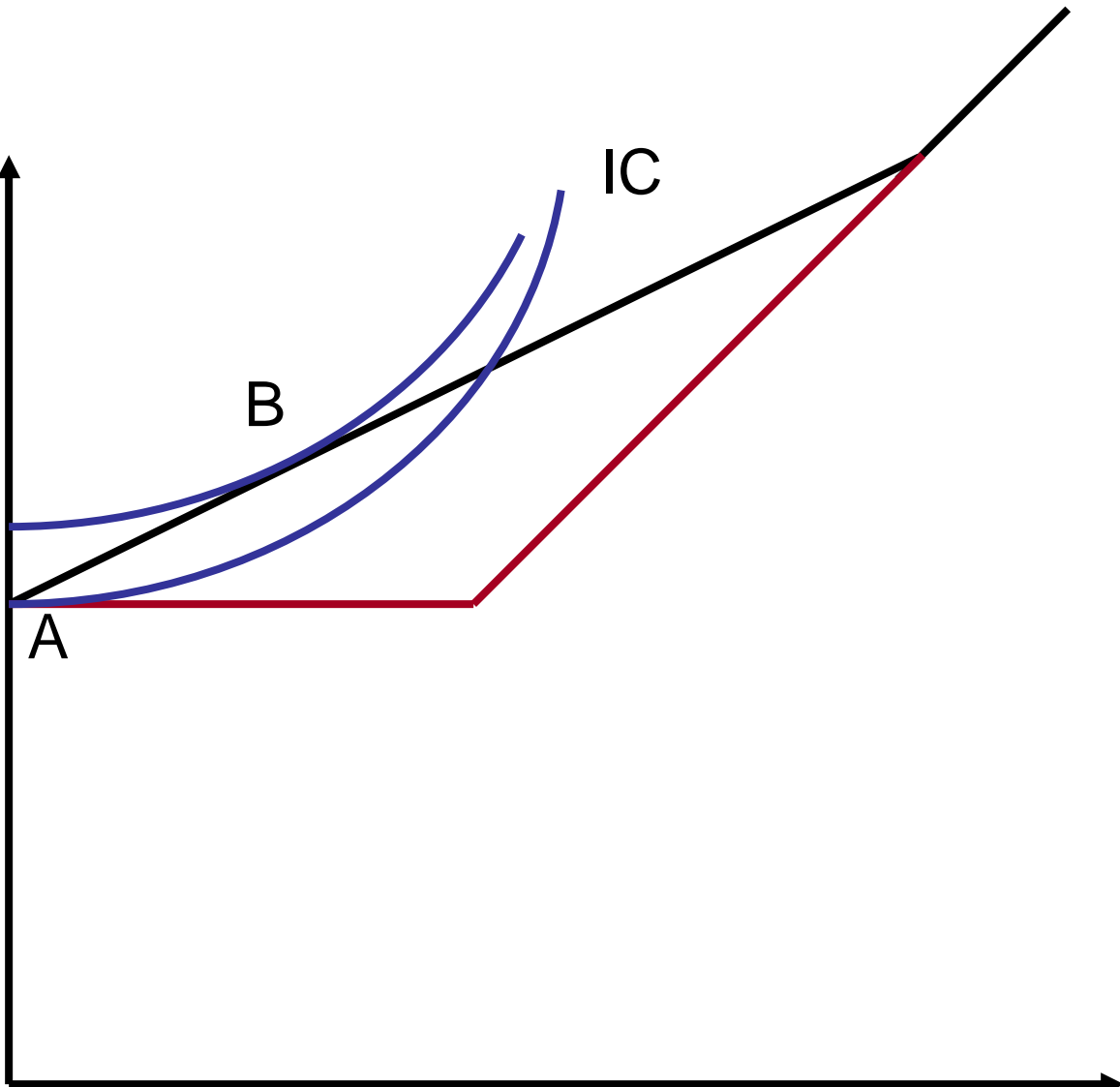
income after
benefits €

200

G

E

F

This person
moves from E to
G when the
withdrawal rate
falls. Subst effect
EF and income
effect FG both
decrease labour
supply.

0   200   400

y income before benefits   €

The tax credit trade off

- Reducing the withdrawal rate from 100% to 50% improves work incentive for people earning less than €200 but worsens work incentives for people earning between €200 and €400.

- More generally lower withdrawal rates improve work incentives for low earners and worsen work incentives for moderate earners.

- This is an inevitable trade off.

- Lower withdrawal rates result in more benefits being paid so are more expensive.

- The money has to come from somewhere (taxes or government borrowing)

- Lower withdrawal rates result in more people receiving benefits and make the benefit system more difficult to administer.

- Up to now I have been looking at someone who gets benefits but does not pay taxes.

- In fact many people both get benefits and pay taxes.

When someone earns €300 per week earns €1 extra it

pays extra income tax   €0.20
pays extra insurance   €0.12

losses benefit (tax credit)   €0.41

so looses in total   €0.73

and thus takes home only additional €0.27.

Definition: Effective Marginal Tax Rate EMTR

If this guy on €300 per week earns €1 more it pays extra tax
   (income tax + insurance) of €0.32.
Its marginal tax rate **t** is 32 %.

It losses benefit €0.41.
Its benefit withdrawal rate **b** is 41%.

Its **effective marginal tax rate** is m = t + b = 0.32 + 0.41 = 73%.

This is how much it loses from extra taxes and lower benefits
   when it earns €1 more.

When a family on €3,000 per week earns €1 extra it

pays extra income tax   €0.45
pays extra insurance   €0.02

losses benefit (tax credit)   €0.00

so looses in total (EMTR)   €0.47

and thus takes home an additional €0.53.

EMTR = 47%.

What have we achieved

- Model with useful insights on labour supply and the effects of taxes & benefits.

- But what aspects of work matter to people other than current hours?