2. The Direct Effects of Price Changes

[FP Ch. 8.4; S&W Ch 9]

Revise the definition of *consumer's surplus* (*CS*)

producer's surplus (*PS*)

What if the existence of the project will affect market prices?

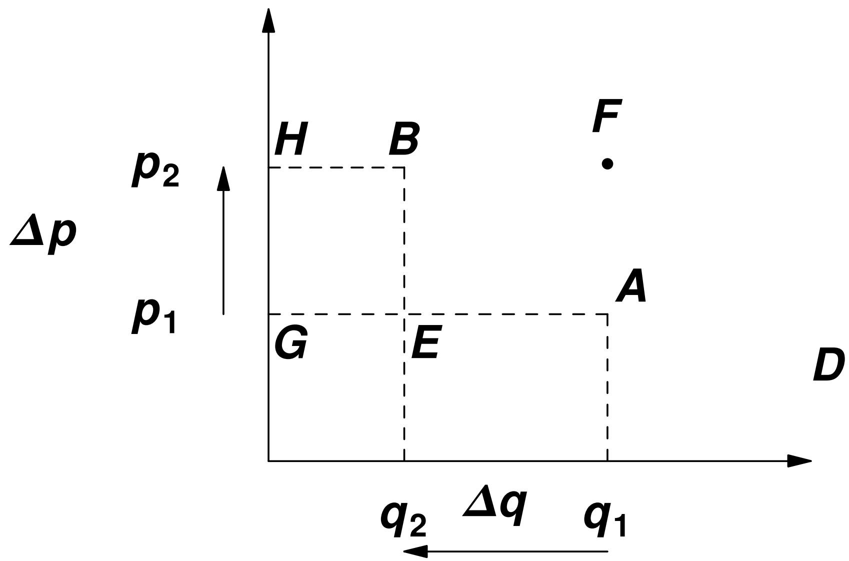
This will affect the welfare of consumers, in addition to the *financial* effect. (= out-of-pocket)

To reiterate: costs are only included in CBA when they measure the use of resources, but not transfers from one person or group to another.

(Remember: a transfer is a one-sided allocation — something for nothing.)

2.1 Consumer's Surplus [C&B pp. 148–152]

The net willingness to pay that consumers retain after paying for the good or service: for each unit sold, the difference between the maximum which the market would pay for that unit and the price actually paid.
e.g. a higher price of gas from p_1 to p_2



The financial gain to the sellers of gas = the financial loss to the gas buyers, but this is only a transfer payment, not a use of resources, a cost.

If the demand for gas is completely price inelastic, then this is straightforward.

But if the quantity of gas demanded falls, because of the higher price, how are consumers worse off above and beyond the higher price?

The Individual Consumer:

The amount of gas demanded is a function of the price of gas, the prices of substitutes and complements, and the consumer's income.

The question is: how much has the consumer lost with the increase in price? or: what increase in his money income would just compensate him for the price rise?

Use a Revealed Preference Argument: Consider four states, two of which (*A* and *B*) are actual, and two of which (*E* and *F*) are hypothetical.

state A	initial	p_1, q_1
state B	final	p_2, q_2
state E		p_1, q_2
state F		p_2, q_1

Since at the new price p_2 the consumer could choose q_1 but does choose quantity q_2, we can see that he prefers *B* to *F*. Similarly, at the old price p_1 the consumer could choose q_2 but does choose quantity q_1, we can see that he prefers *A* to *E*.

Note: When demand is completely price-inelastic (vertical), then ΔCS (negative) = ΔP (positive) = change in price $\times$ unchanging quantity.

The change in consumer surplus.

In the hypothetical move from *A* to *F*, spending would increase by the amount $(p_2 - p_1)\times q_1$ = area GHFA, so this amount would completely compensate for the move. In practice, the move is not to *F*, but to the preferred point *B*, so area GHFA more than compensates for the move from *A* to *B*: a maximum estimate of the loss.

In the hypothetical move from *E* to *B*, spending would increase by the amount $(p_2 - p_1)\times q_2$ = area GHBE, so this amount would completely compensate for the move. In practice, the move is not from *E*, but from the preferred point *A*, so area GHBE is less than necessary to compensate for the move from *A* to *B*: a minimum estimate of the loss.

The true estimate of ΔCS, the *change in consumer surplus*, is between these two amounts:

$$(p_2 - p_1)\times q_2 \ \le\ \Delta\mathrm{CS} \ \le\ (p_2 - p_1)\times q_1$$

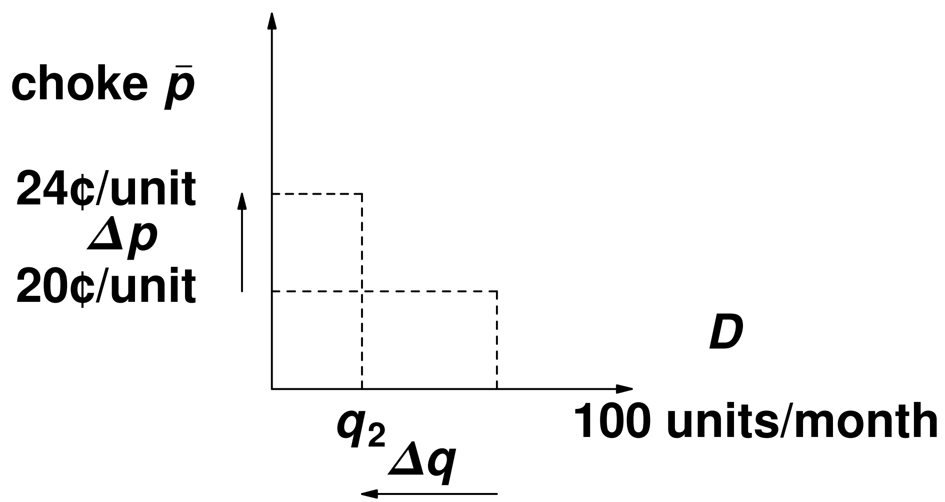
At the limit we see that the shaded area is the actual estimate of the change in consumer's surplus associated with the price rise.

e.g. A numerical example:

p_1 = 20¢/unit
∴ 100 units/month costs $20/month

If a fixed "connect" charge of $16/month is acceptable to the buyer, but any increase in this fee would result in the decision to disconnect, then we can conclude that the (net) consumer's surplus associated with a 20¢/unit usage charge is $16/month.

We should expect a higher usage charge to be associated with a lower consumer's surplus: for example, 24¢/unit might result in a fall of consumer's surplus of $3.50 to $12.50/month.



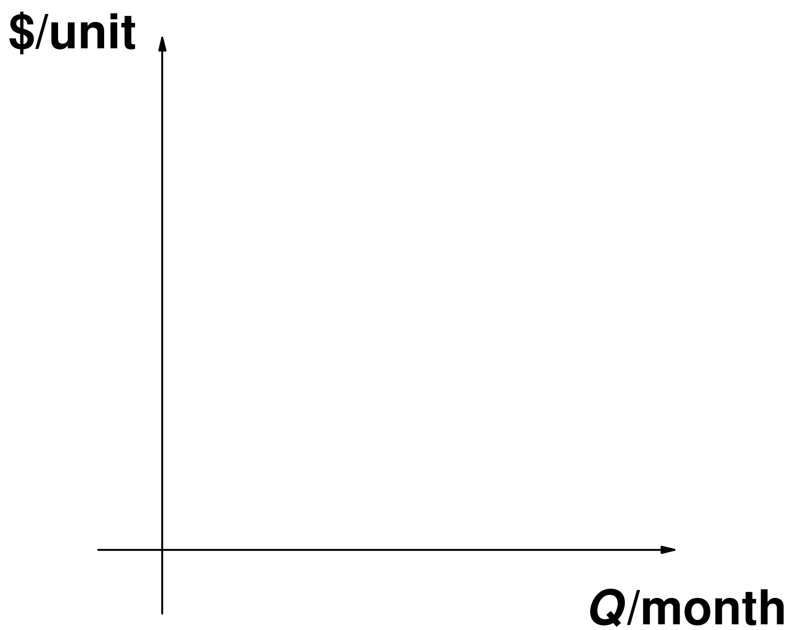
Example (cont.): Total Quantity

Since we construct the total demand function by horizontal summation of individuals’ demand curves, the shaded area is the change in consumers’ surplus for the market too.

The change in price results in a change in the welfare of all consumers, and is not merely reflected in the financial effect.

Ex: Consider a proposal to supply piped gas to a new rural area.

If the situation is as plotted below, then there exists no level of monthly output at which the average costs of the supplier will be covered by the price (or average revenue). From a purely financial standpoint this is the end: since the seller cannot supply profitably, the supply will not proceed.



Example (cont.): Is the supply a PPIC?

From a CBA perspective the supply might still be a Potential Pareto Improvement (PPI):

If the gain in consumers' surplus associated with a fall in price in the region from the "choke" price of $\bar{P}$ to the price P_1 which minimises the loss of the supplier is greater than this loss, then the project will *improve the nation's allocative efficiency*, ceteris paribus.

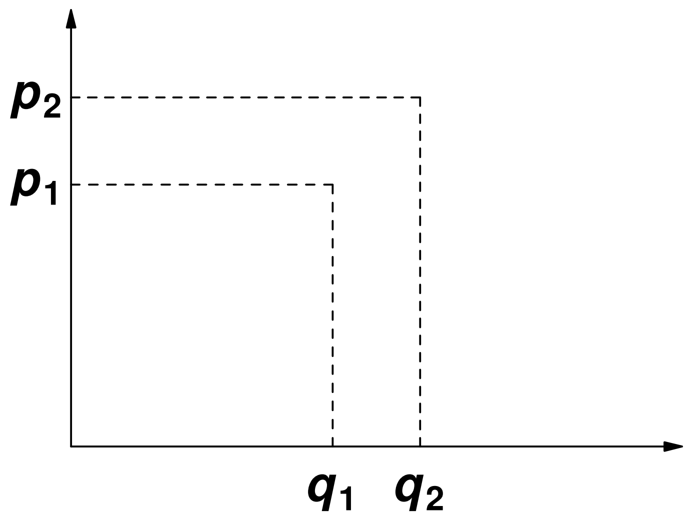
The winners (the buyers) could, from their increased consumers' surplus, in theory compensate the losers (the supply company) while still remaining ahead themselves.

This is the essence of efficiency improvements, or PPIs.

If CS > firm's loss = $Q_1(AC_1 - P_1)$, then OK (PPIC).

2.2 Producers' Surplus [C&B p.152]

By analogy, the *change in producers' surplus PS* is the strip to the left of the supply curve, bounded by the lower and upper prices.



If a firm is buying inputs (labour), using machines (capital) to make output, and selling output (screws), then the difference between its revenue and payments to workers is the producers' surplus to owners of capital (or quasi-rent).

- **A higher price for output with no change in the price for inputs will increase the producers' surplus by ΔPS;**
- **a higher price for inputs with no change in the price for output will reduce producers' surplus, as the supply curve shifts to the left.**

2.3 Example: A Labour-Training Scheme (LTS) [S&W Ch. 9.4]

We are *not* trying to analyse
how the labour market works —
it's not as simple as other markets.

We observe unemployment,
so the opportunity cost of labour
= the opportunity cost of workers' leisure
$\leq$ the market wage (price)

(For involuntarily unemployed workers who would work, the opportunity cost of leisure is very low.)

$\therefore$ Projects which increase employment are socially more attractive than an FA would indicate (and vice versa):

because the costs of labour in shadow-price terms < the money costs actually paid.

Indeed, it is possible that a project:

with FA: NPV < 0, but
with CBA: NPV > 0

because of the external benefits of the project (reduced unemployment ...).

LTS: Financial Analysis v. Cost-Benefit Analysis

	Costs	*Benefits*
FA:	**staff costs \$/hr. facility (rent ...) equipment materials**	**Fee, payment What's the max society should pay?**
CBA:	**[ditto] trainees' time shift → in demand**	**increased employment (measured by wage after) external benefits (reduced drug use, crime)**

Complications:

— **transfers: don't count**

— **Δ wages as a result of the scheme**

— **taxes (distort prices)**

Net benefits calculated with alternative assumptions:

Assumption I: no changes in skilled wages

Assumption II: fall in skilled wages.

2.3.1 LTS (cont.): No effect on skilled wages.

If an additional person being trained results in no changes to the welfare of others, then CBA and FA are identical.

But how might the scheme result in externalities whereby there are changes to the welfare of others?

Three possible spillovers:

1. **The trainees are paid while training.**

   For trainees, the payment is a benefit.
   Is this a cost under CBA?
   No: payments to trainees are *transfer* payments, from taxpayers to trainees. *Only if resources are used does a cost occur.*
   But to the extent that the transfer payments are used by the trainees to cover their travel costs etc., then indirectly taxpayers are covering costs, and this should be counted as a cost under CBA, but *if prices are competitive*, then we should ignore these costs.

   Another cost is the costs of the program (lecturers, rents, etc.)

LTS: Possible Spillovers (cont.)

2. **If one person's decision to supply (or withhold) his labour affects others, then CBA counts this too.**

   When there is unemployment among unskilled workers (& sticky wages), there are two possibilities:

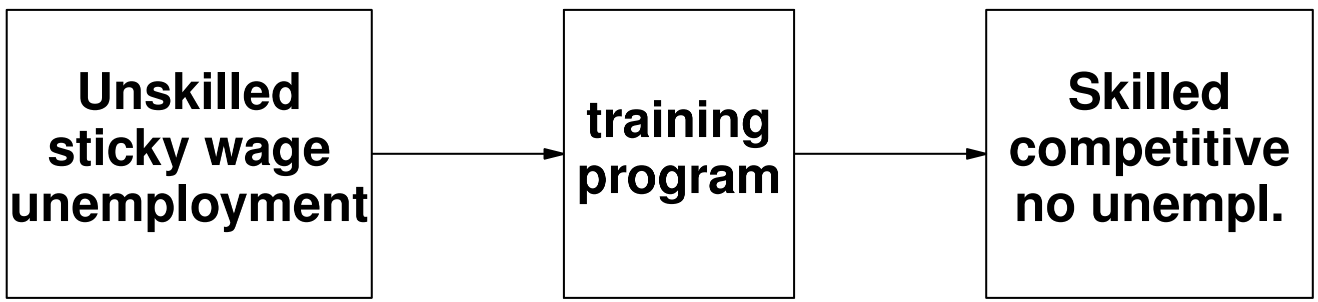
   - **the *replacement* effect of a worker leaving, allowing another to be employed**
   - **the *displacement* effect when a worker takes a job, precluding another from doing so**

   Or, if wages are competitively determined (& no unemployment):
   then a change in the number of workers will result in a change in the wage rate for all, and hence in the welfare of others.

3. **If income from wages is taxed,**
   and if there are higher wages after training,
   then higher tax revenues (cet. par.) and perhaps lower taxes for others, if the government has revenue targets.

LTS: More specifically:

Consider a local training scheme, with unemployment amongst unskilled workers (implying “sticky,” uncompetitive wages), and no unemployment among skilled (“trained”) workers (implying competitively determined wages).



***Assumption I*: no effect on wage w' in skilled market as successful trainees graduate.**

***Assumption II*: wage in skilled market falls to w'' as successful trainees swell the supply of skilled labour.**

LTS: Small Program Doesn't Affect Skilled Wages

***Assumption I*: the program is sufficiently small that there is no effect on wages from the scheme's graduating skilled workers.**

The program *does not affect*:

- **the trainers, who are free to sell their labour at the going rate before, during, and after the program; or**
- **the employers of both skilled and unskilled labour: since neither wage rate is affected by the scheme, they are free to hire workers at the going wage rates.**

The program *does affect* unskilled workers who don't enter, because there will be fewer rivals for the limited number of jobs available, as some enter the program and succeed in gaining skilled jobs later.

(Consider Work-for-the-Dole recipients as employed unskilled.)

LTS: Social Benefits

Consider trainees and the remaining unskilled together:

- **during the training, the number of unskilled employed is unchanged,**
- **but the number of unskilled unemployed drops:**
- **After the training, the "successful" trainees are employed (skilled employment: rising from n to n' after), while the rest are either employed as unskilled, or unemployed.**
- **So the number of unskilled workers falls by the number of successful trainees = $n' - n$.**

The net effect of the program on *money incomes*
= the total after-tax wages of successful trainees
(= $(n' - n)w'$, where w' is the skilled wage)
– the reduction in net income of the unskilled group from the transfer payments (the dole+training allowances)

But CBA ignores transfer payments, (taxes & allowances) so the net effect = the *social benefit* = the total before-tax wages of the successful trainees, $w'(n' - n)$. (2)

(If previously employed, then the change in wages × change in the number.)

LTS: Social Costs

**So far we have only considered money incomes,
ie. we have assumed that workers are indifferent between:**

1. **working as unskilled**
2. **working as skilled**
3. **receiving training**
4. **being unemployed**

except to the extent that each state determines money wages.

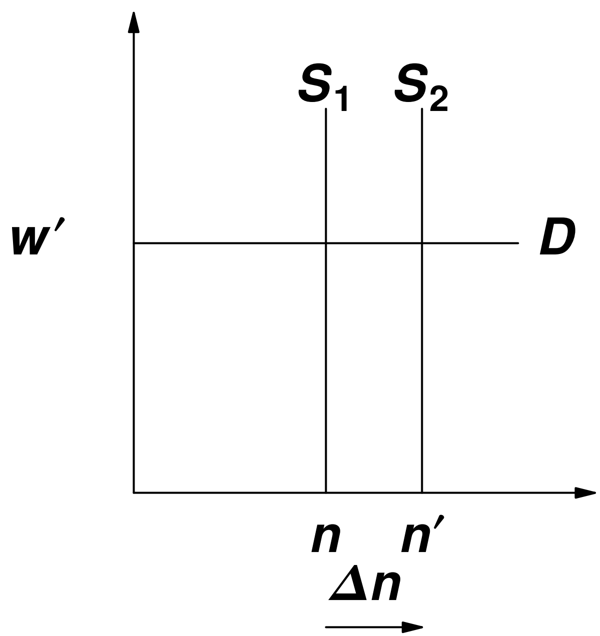
The assumption is reasonable except for the fourth state, *unemployment,* if involuntary.

The reduction of leisure may be considered a non-money cost of the program when previously unemployed workers find jobs or enter the training program.

**The costs of the training program must be considered:
We have above considered the opportunity costs to trainees of forgoing earning opportunities;
We have above netted out the payment allowances (which cancel out); — which leaves us with the wages of trainers, the rent, etc. as costs of the training program.**

LTS: Net Social Benefits

If workers are indifferent between working or not, then the *net social benefit* of the program
= the P.V. of before-tax future earnings of successful trainees
– the operating costs of the program.



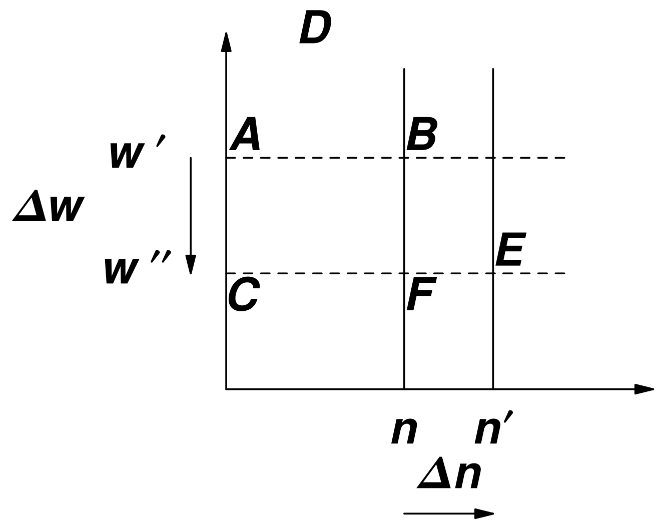
The skilled labour market.
– costs of the program

2.3.2 LTS: Price changes in the skilled market.

Now relax the assumption that the program will have no effect on competitively determined wages in the skilled labour market.

***Assumption II*: through the increase in skilled workers ($n \to n'$), the program leads to a fall in skilled-labour wages ($w' \to w''$). (The unskilled wage is fixed, and unemployment persists in that market.)**

Consider the two groups: employers and workers in the skilled labour market.



- **The derived demand for skilled labour is unchanged. (D unshifted.)**
- **Supply increases from n to n', and the wage falls from w' to w''.**
- **Skilled labour supply S is shown as completely price-inelastic (vertical).**

LTS: The Net Social Gain

The positive Δ Firms' (buying) surplus is area ABEC
$= n(w' - w'') + \frac{1}{2}(n' - n)(w' - w'')$.

Existing skilled employees lose surplus area ABFC = $n(w' - w'')$ (a transfer)

$\therefore$ **the net gain = area BEF = $\frac{1}{2}(n' - n)(w' - w'')$** **(1)**

Note that before, the net benefits:

= the total wages of the successful trainees (with no change in wages)

= $(n' - n)\, w''$ **(2)**

$\therefore$ **The Sum Of The Net Benefits Of The Program (1)+(2), excluding the training-program costs:**

= $\frac{1}{2}(n' - n)(w' + w'')$, which is the average of before and after wages times the number of successful trainees.

= $\frac{1}{2}(n' - n)(w' - w'') + (n' - n)w''$

2.3.3 LTS: Taxation Considerations

If income taxes are considered:

assume a uniform tax rate of t

then employers pay before-tax wages of w' and w'', and employees' after-tax wages fall from $w'(1-t)$ to $w''(1-t)$

So the loss of surplus borne by skilled workers is $n(w'-w'')(1-t)$.

The net loss to the government because of the fall in tax receipts is

$$n(w'-w'')t$$

So the sum of the losses to workers and government is $n(w'-w'')$, as before; i.e., in this case, taxes cancel.

3. Welfare (i.e. efficiency) Economics

Gains (or losses) in welfare (i.e. efficiency) from moving from where we are to somewhere else.

Policy change $\rightarrow$ improved social welfare, greater efficiency, a larger economic pie

Changes in economic welfare to consumers: ΔCS

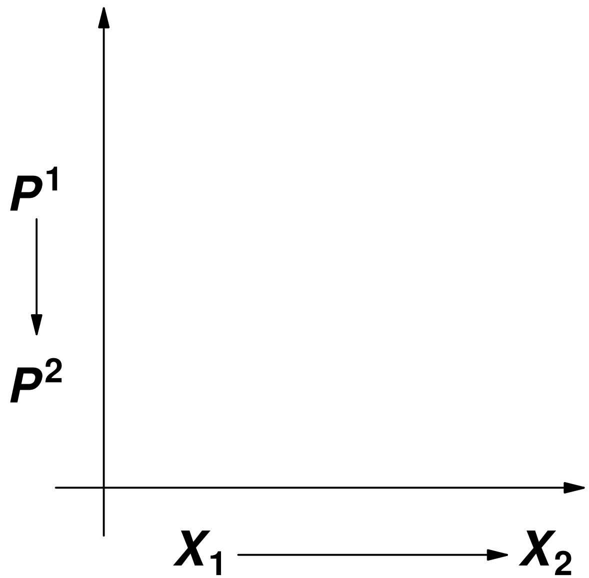
Changes in economic welfare to suppliers: ΔPS

$\therefore$ Net Δ social welfare = $\Delta CS + \Delta PS$

Prices $\sim$ monetary measures of

marginal benefits to households

marginal costs to firms



units

total value of new sales

$\therefore$ **net surplus to consumers'**

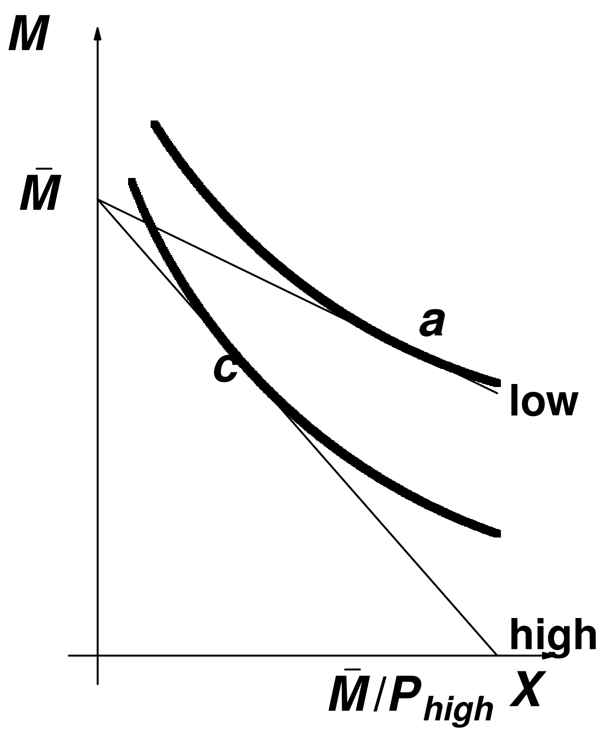
& **net surplus of old sales'**

DD = demand curve

$\therefore$ $P^1abP^2 =$ **consumer's surplus associated with the price fall. (a gain)**

Question.

The price P of a good X increases from P_{low} to P_{high}, cet. par., with a budget of $\bar{M}$. Plot purchases of good X against purchases of All Other Goods (price=\$1). Plot indifference curves & budget constraints:

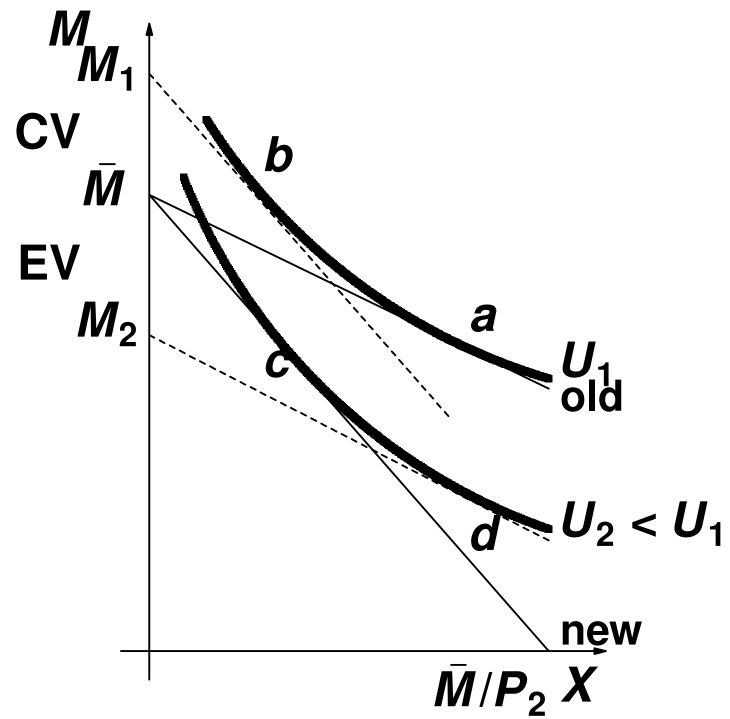


Q: **How much would you sacrifice from your budget $\bar{M}$ to have the price of X fall from P_{high} back to P_{low} (WTP)?**

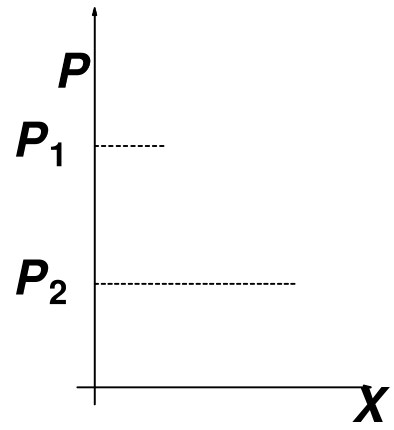
A: **An amount ΔM = the Equivalent Variation (EV).**

3.1 Consumer Surplus in Dollar Terms [C&B pp. 171–174]

The price rises from P_1 to P_2; a budget of $\$\bar{M}$. By how much in dollars (ΔM = EV) is the consumer worse off as a consequence? Or: from the new chosen bundle c, by how much could the budget $\bar{M}$ grow (CV) and still leave the consumer no worse off than before the price fell?



EV: Equivalent Variation (ΔM at old price)
CV: Compensating Variation (ΔM at new price)



Consumer's Surplus with a price change.

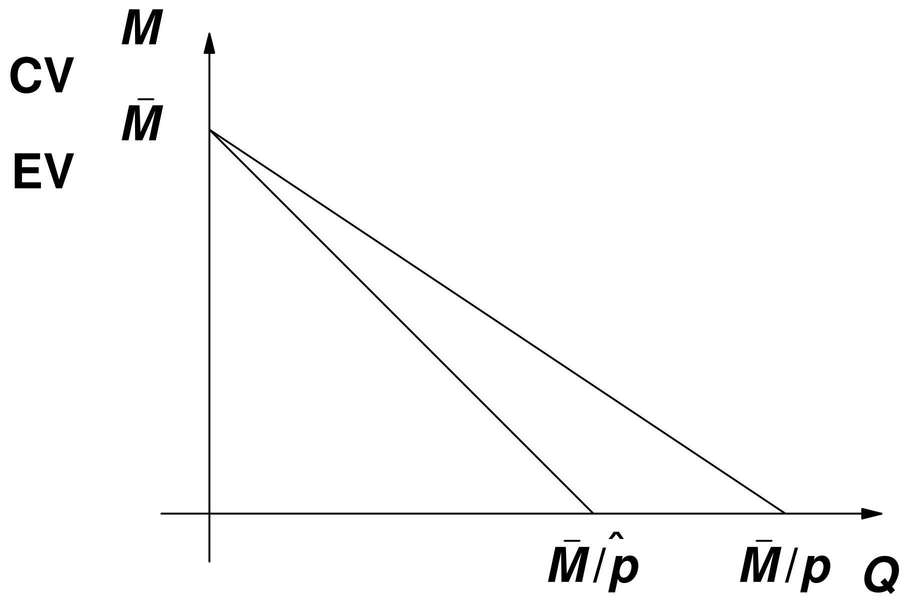
Equivalent Variation: **(EV) is thus the max. amount the consumer would pay for the project (of reducing the price from P_1 to P_2) = $\bar{M} - M_2$.**

Utility = function (quantity Q of good or service, money M spent on all else).

Maximise utility, s.t. budget constraint of $\bar{M}$.

Example: Imposition of a Tax (a price increase)

Consider a tax imposed on the product, which raises the price, from p to $\hat{p}$, and so makes the consumer worse off.



Equivalent Variation: **(EV) the maximum amount the consumer would pay to avoid the tax, i.e., to keep the price at p rather than have it change to $\hat{p}$ (at the old price p)**

Compensating Variation: **(CV) how much minimum extra income would the consumer need to have to be as well off after the tax as before (at the new price $\hat{p}$) [C&B pp. 171–174]**

With no income effects, EV (WTP) = CV (WTA) = Δ CS, willingness to pay = willingness to accept = change in consumer surplus

Summary of Lecture 6

This lecture revised concepts from Welfare Economics.

- **Producers surplus and consumers surplus.**
- **The net change in social welfare (the size of the pie) = the change in consumers surplus plus the change in producers surplus.**

∴ **A transfer from, say, consumers to producers in general will have no impact on social welfare overall: a transfer.**

- **How changes in utility can be expressed in money terms: so-called Equivalent Variation (WTP paying to avoid), and Compensating Variation (WTA being paid to accept).**

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