INDIAN INSTITUTE OF TECHNOLOGY KHARAGPUR

Stamp/Signature of the Invigilator

MID-SEMESTER / END-SEMESTER EXAMINATION	SEMESTER (Autumn / Spring)

Roll Number	14ME30025	Section		Name	KSHITIJ GAURAV VERMA
Subject Number	HS40085	Subject Name	LABOUR ECONOMICS		
Department/Centre/School	MECH. ENGG.	Additional Sheets			

Important Instructions and Guidelines for Students

1. You must occupy your seat as per the Examination Schedule/Sitting Plan.
2. Do not keep mobile phones or any similar electronic gadgets with you even in the switched off mode.
3. Loose papers, class notes, books or any such materials must not be in your possession; even if they are irrelevant to the subject you are taking examination.
4. Data book, codes, graph papers, relevant standard tables/charts or any other materials are allowed only when instructed by the paper-setter.
5. Use of instrument box, pencil box and non-programmable calculator is allowed during the examination. However, the exchange of these items or any other papers (including question papers) is not permitted.
6. Write on both sides of the answer-script and do not tear off any page. **Use last page(s) of the answer-script for rough work**. Report to the invigilator if the answer-script has torn or distorted page(s).
7. It is your responsibility to ensure that you have signed the Attendance Sheet. Keep your Admit Card/Identity Card on the desk for checking by the invigilator.
8. You may leave the Examination Hall for wash room or for drinking water for a very short period. Record your absence from the Examination Hall in the register provided. Smoking and the consumption of any kind of beverages are strictly prohibited inside the Examination Hall.
9. Do not leave the Examination Hall without submitting your answer-script to the invigilator. **In any case, you are not allowed to take away the answer-script with you**. After the completion of the examination, do not leave your seat until the invigilators collect all the answer-scripts.
10. During the examination, either inside or outside the Examination Hall, gathering information from any kind of sources or exchanging information with others or any such attempt will be treated as **'unfair means'**. Don't adopt unfair means and also don't indulge in unseemly behavior.

Violation of any of the above instructions may lead to severe punishment.

Kshitij

Signature of the Student

To be Filled by the Examiner

Question Number	1	2	3	4	5	6	7	8	9	10	Total
Marks Obtained											

Marks Obtained (in words)	Signature of the Examiner	Signature of the Scrutineer

(1) $U(C, L) = (C - 200) \times (L - 80)$

here, Non Labour Income, $V = \$320$

Wages, $W = \$5$

Total Time, $T = 168$ hours.

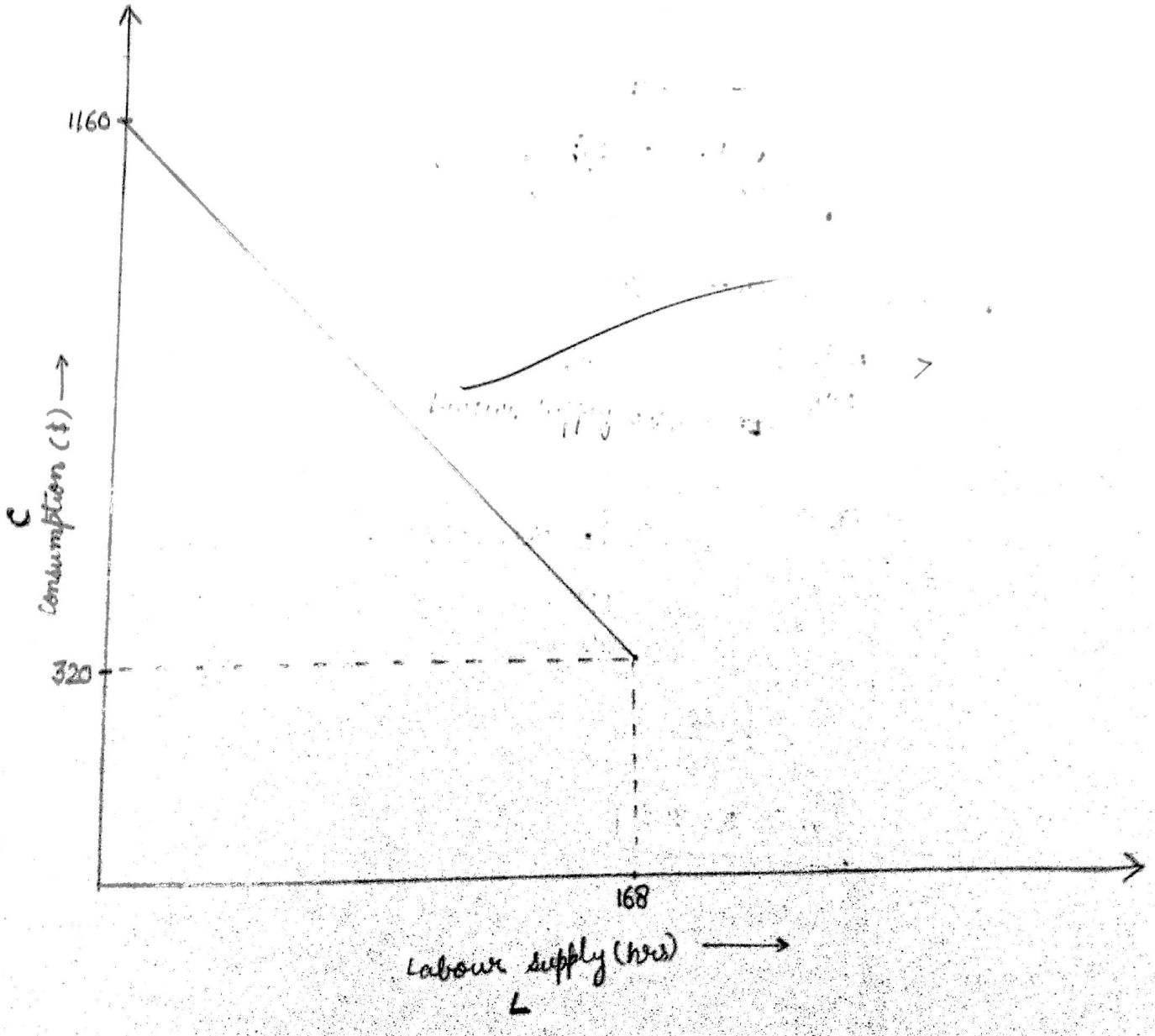
We know, the budget line of an individual is given by

$(WT + V) - WL = C$

$\therefore (5 \times 168 + 320) - 5L = C$

$\Rightarrow 1160 - 5L = C$

(a)



$U = CL - 200L - 80C + 16000$

$\therefore MU_L = (C - 200)$

$MU_C = (L - 80)$

$\therefore$ Marginal Rate of substitution

$$= \boxed{\frac{\Delta C}{\Delta L} = -\frac{MU_L}{MU_C}}$$

$\boxed{L = 100}$ and she is on her budget line

$\therefore 1160 - 5L = C$

$\Rightarrow \boxed{C = \$660}$

$$\therefore \frac{\Delta C}{\Delta L} = -\frac{(660 - 200)}{(100 - 80)}$$

$$= \frac{-460}{20}$$

$$= -23 \ \$/hr$$

$$\therefore \boxed{\left|\frac{\Delta C}{\Delta L}\right| = 23 \$/hr}$$

(c). For the reservation wage,

$$\left.\frac{MU_L}{MU_C}\right|_{L=T,\ C=V} = W_R$$

$$\Rightarrow W_R = \left.\frac{C - 200}{L - 80}\right|_{L=168,\ C=320}$$

$$= \frac{320 - 200}{168 - 80}$$

$$= \$\frac{120}{88}$$

$$\boxed{W_R = \$1.363}$$

(d) For optimal consumption & leisure, we have

$$\frac{MU_L}{MU_C} = -\text{Slope of Budget Line.}$$

$$\therefore \frac{MU_L}{MU_C} = W$$

$$\therefore \frac{C-200}{L-80} = 5$$

$$\Rightarrow C - 200 = 5L - 400$$

$$\Rightarrow C + 200 = 5L \quad \text{---(i)}$$

$$1160 - 5L = C \quad \text{---(ii)}$$

8

$$1160 - 5L + 200 = 5L$$

$$\Rightarrow 1360 = 10L$$

$$\Rightarrow \boxed{L^* = 136 \text{ hrs}}$$

$$\therefore \boxed{C^* = \$480}$$

(2) $q = 4k^{1/2} + 2E^{1/2}$

We know, profit of a firm is given by

$$\Pi = pq - wE - rK$$

$$\therefore d\Pi = p\,dq - w\,dE$$

$$\Rightarrow \frac{\partial \Pi}{\partial E} = p\frac{\partial q}{\partial E} - w = 0 \quad \text{(Profit Maximization)}$$

$$\therefore \boxed{p \times MP_E = w}$$

Here, $MP_E = \frac{\partial q}{\partial E} = 2 \cdot \frac{1}{2} E^{-1/2} = \frac{1}{\sqrt{E}}$

4

$$\therefore \frac{p}{\sqrt{E}} = w$$

$$\Rightarrow \frac{p}{w} = \sqrt{E}$$

$$\Rightarrow \boxed{E = \left(\frac{p}{w}\right)^2}$$

Also, $\frac{\partial^2 q}{\partial E^2} = -ve$

∴ This is the profit maximizing labour demand

---

(3) The key actors in the labour market are:

1. Workers
2. Firms

} Primary actors.

3. Government
4. Trade Unions

} Secondary actors

MOTIVES

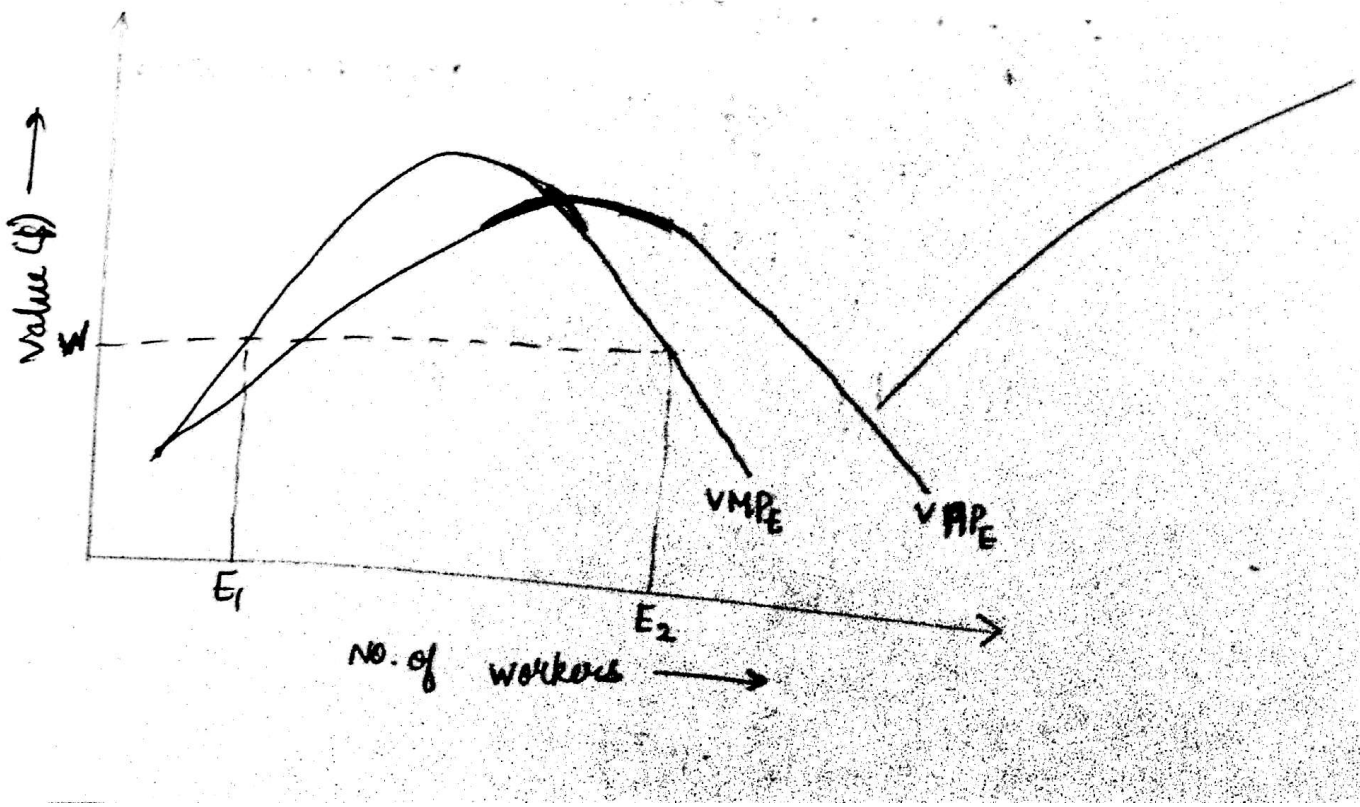
Workers supply labour (set of physical and mental skills) to the firms demanding them and hence in return, they get remuneration in the form of wages which are given by the firms.

∴ Workers : supply labour in expectation of wages.

Firms : Demand labour ~~[illegible]~~ by paying the wages.

---

(4). For a typical firm in the short run, the graphs of VMP_E and VAP_E are given as:



For a profit maximising firm,

$$\pi = pq - wE - rk$$

$$\therefore \frac{\partial \pi}{\partial E} = p\frac{\partial q}{\partial E} - w = 0 \qquad \text{(Profit Maximization)}$$

$$\Rightarrow PMP_E = w$$

$$\Rightarrow \boxed{VMP_E = w}$$

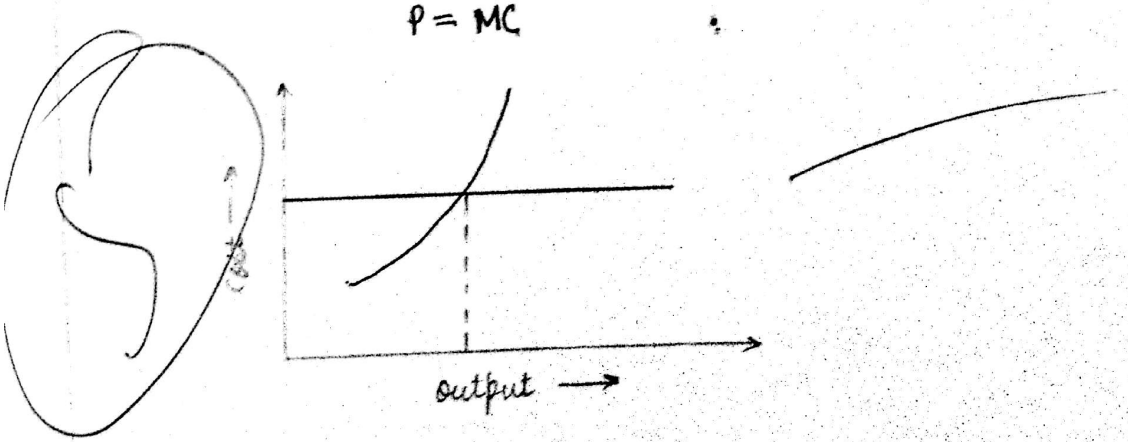
From this condition, we see that a profit maximising firm hires workers upto the point where the wage equals the VMP_E.
But again from the curves, we see that this condition holds good when the No. of workers is E_1 and E_2. So which one to take?

At E_1, the slope of VMP_E is increasing, so hiring an additional worker would benefit the firm because the firm gets a value that is higher than what it pays. So it keeps on adding workers until it reaches E_2 no. of workers. Here, slope of the VMP_E curve is declining, so adding an extra worker will cause the firm to pay more than what it gets back.
So, it will stop at E_2 workers

$\therefore$ $\boxed{VMP_E = w \quad \text{and} \quad VMP_E \text{ is declining}}$ ← Profit Maximization Condition

For a profit Maximizing firm, we know that

$$P = MC$$



for a firm, we have

w wages are paid for every additional worker hired

We know,

Marginal Cost, $MC = \frac{dc}{dq}$ $\quad C \rightarrow$ cost, $q \rightarrow$ output

$\therefore$ for every worker hired, the firm pays w and gets an output of MP_E

$$\therefore \quad MC = \frac{dC}{dq}$$

$$= \frac{w}{MP_E}$$

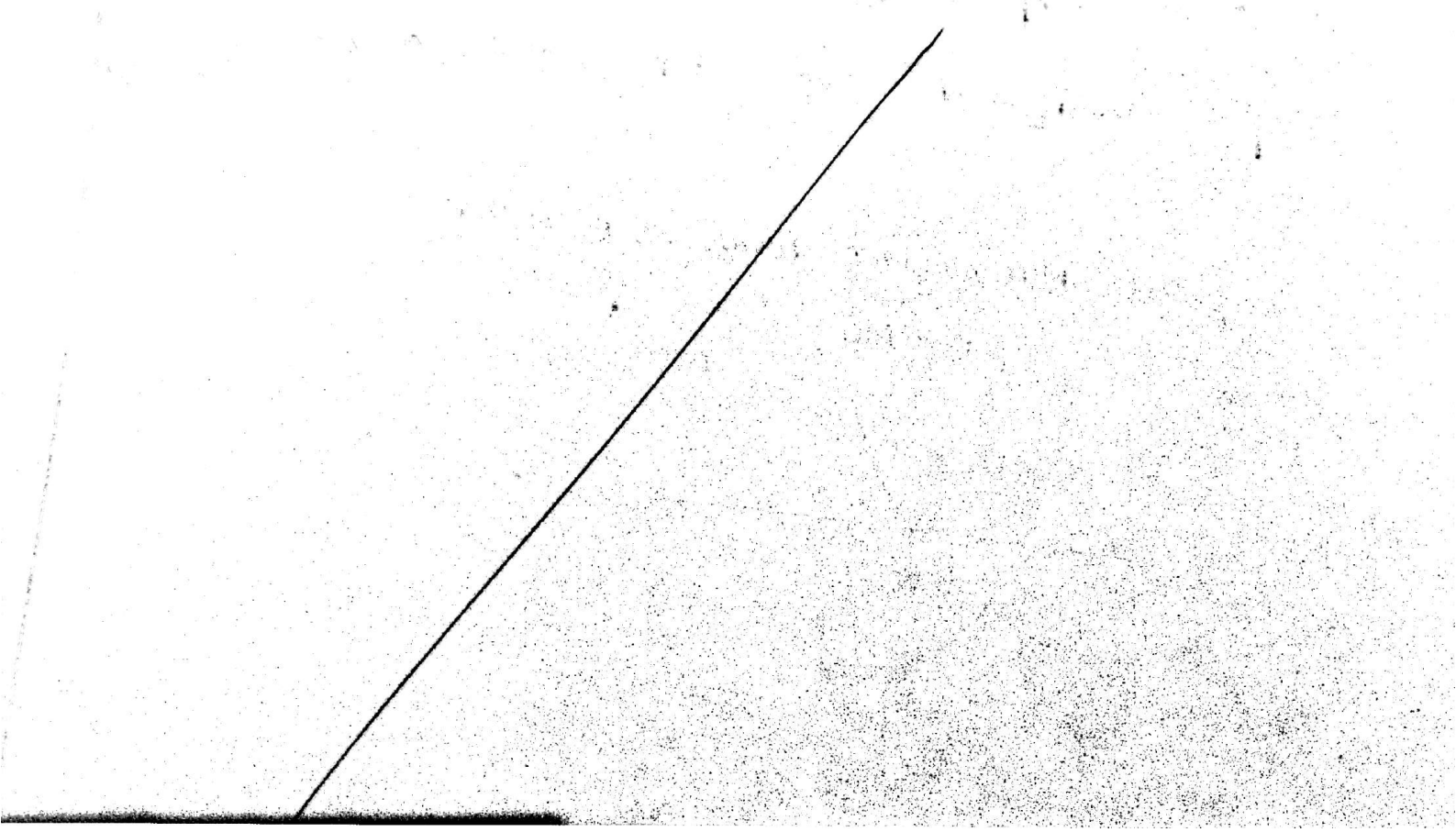
from the profit maximising condition of a firm, we have

$$MC = P$$

$$\therefore \quad P = \frac{w}{MP_E}$$

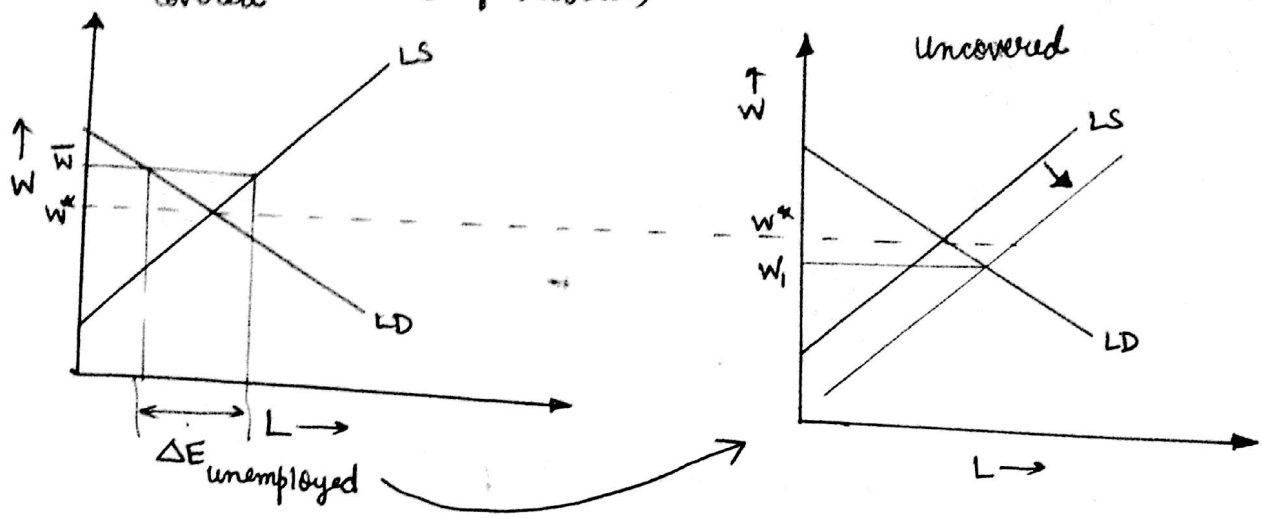
$$\Rightarrow \quad P\, MP_E = w$$

$$\Rightarrow \quad \boxed{VMP_E = w} \Rightarrow \text{same condition as obtained from earlier discussion.}$$



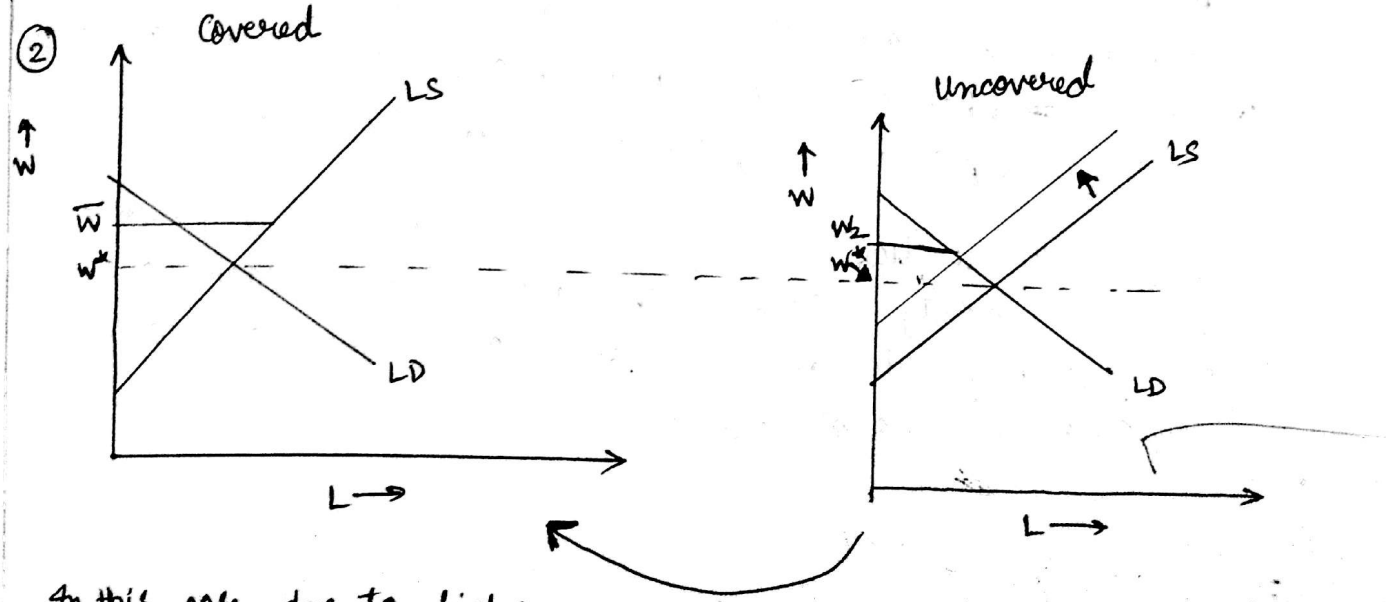
(5) When there is a minimum wage act, two scenarios are possible: (Assuming free mobility of labour)

(1)



In this case, due to minimum wage rule, those who have been unemployed move to the uncovered sector, thus increasing the labour supply of the uncovered sector.

(2)



In this case, due to higher wages being offered in the covered sector, people move from uncovered sector to covered sector thus decreasing the supply of uncovered sector

These two are counterbalancing effects

Covered sector offers higher wages but not everyone gets a job.

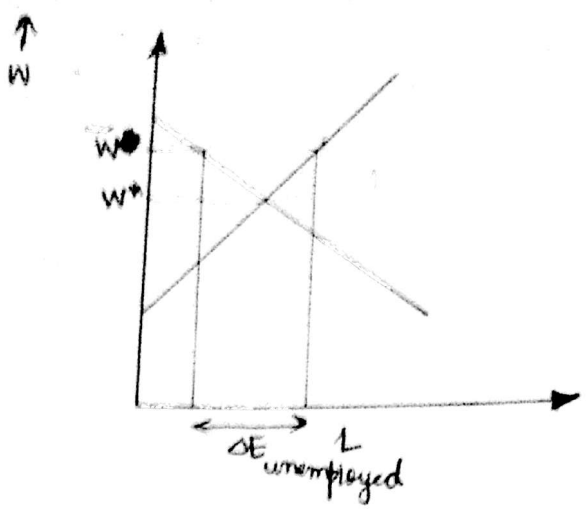
Uncovered sector offers lower wages and everyone gets a job.

The equilibrium is reached when expected wages become same.

$$\therefore \quad \bar{W}p + 0(1-p) = W^*$$

$$\rightarrow \boxed{\bar{W}p = W^*} \longrightarrow \text{condition for equilibrium}$$

p = probability of getting a job in covered sector



We know that minimum wage policy has two opposite effects:

(1) It increases the standards of those employed.

(2) It decreases the employment due to reduction in demand and increase in supply

Minimum wage act can be an effective policy when

A. Those who are employed are from poor background.

B. Those unemployed are from better off households.

Empirically it has been seen that minimum wage act increases poverty because people from poorer backgrounds are generally laid-off and those from better households are employed (behavioral impact)

(6). $q = E^{1/2} K^{1/2}$

∴ For the short run, profit maximising condition states that.

$$\boxed{VMP_E = W}$$

$$\therefore p \times \frac{\partial q}{\partial E} = W$$

~~$\Rightarrow p \cdot \frac{1}{2} E^{-1/2} = W$~~

$$\Rightarrow p \cdot K^{1/2} \cdot \frac{1}{2} E^{-1/2} = W$$

$$\Rightarrow \frac{p}{2} \sqrt{\frac{K}{E}} = W$$

$\Rightarrow \frac{50}{2}\sqrt{\frac{1600}{E}} = 10$

$\Rightarrow$ [redacted] $E = 10,000$

$\therefore$ 10,000 [redacted] units of labour should be employed by the firm.

$q = E^{1/2} K^{1/2} = 10,000^{1/2} \times 1600^{1/2} = 4000$ units

$\therefore$ Profit $= Pq - WE - rK$

[redacted]

$= \$(50 \times 4000 - 10 \times 10\,000 - 25 \times 1600)$

$\pi = \$60,000$