

SOLUTIONS TO PROBLEM ON LABOR MARKETS

1. (a) The labor demand curve may be derived by setting $MPN = w$. Here

$$MPN = 9(25)^{\frac{1}{2}}(0.5)N_d^{-0.5}$$

Then, labor demand curve [remember that the labor demand curve has wages w on the vertical axis] is given by

$$w = \frac{(4.5)(5)}{N_d^{0.5}} = \frac{22.5}{N_d^{0.5}} \quad (1)$$

The labor supply curve is given to you [remember that the labor supply curve has after-tax wages $(1-t)w$ on the vertical axis] and so,

$$\begin{aligned} N_s &= 100[(1-t)w]^2 \\ \Rightarrow [(1-t)w] &= \left(\frac{N_s}{100}\right)^{0.5} \end{aligned}$$

- (b) labor supply falls; check

$$\frac{dN_s}{dt} = 200[(1-t)w](-w) < 0$$

- (c) When $t = 0$,

$$N_s = 100w^2$$

and [from (1)],

$$N_d = \left(\frac{22.5}{w}\right)^2$$

Equating, we get

$$100w^2 = \left(\frac{22.5}{w}\right)^2 \Rightarrow w^* = 1.5$$

- i. $w^* = 1.5$
 - ii. $N^* = 225$
 - iii. labor income of all workers $= (1-t)w^*N^* = 337.5$
- (d) A simple way to answer this question would be to rework part (c) above with a higher value of A (say $A = 10$) and then see if labor income of all workers went up or not. Alternatively, you could note that

$$MPN = A(25)^{\frac{1}{2}}(0.5)N_d^{-0.5}$$

implying that the labor demand curve is given by

$$w = \frac{(0.5A)(5)}{N_d^{0.5}} = \frac{2.5A}{N_d^{0.5}}$$

The labor supply curve is unchanged. Solve for the new w^* and N^* and see if the product of the new w^* and N^* is higher than 337.5 (see part c, iii) when $A > 9$.

- (e) With $t = 0.6$, you can basically rework part (c) and check that
- i. market-clearing real wage is now 2.37

- ii. employment is 90
 - iii. after-tax labor income of all workers is 85.38
- (f) Because labor supply fell when the tax rate went up [why? read about income and substitution effects; an increase in the tax rate reduces after-tax wage]; as a result, the market-clearing wage went up, and consistent with that is that firms cut down on hiring.
- (g) No. A minimum wage of 2 does not bind since employers are willing to pay a higher wage to begin with.
- (h) With $t = 0$ and $w_{\min} = 2$, the wage is 2, $N_s = 400$, $N_d = 126.6$, and so there is unemployment of 273.4. Total labor income is 253.2 lower than part c iii.
- (a) a l-s tax does not change the real wage; it only reduces the worker's wealth; hence there is only an income effect on labor supply.
- (b) If $T = 35$, $NS = 92 + 12w$. Labor demand is given by $ND = 154.5 - \frac{w}{2}$ [use $w = MPN$ and solve for ND to get this]. Then set $NS = ND$ to get $w = 5$, $N = 152$.
- (c) Since equilibrium real wage is less than 7, the min wage is binding, With the minimum wage, $w = 7$ and then $ND = 151$ and $NS = 176$. Hence, there will be unemployment.