3. Labor Demand
E151A: C.Cameron

- What happens when wage changes?
  In short-run?
  In long-run?
- What happens if markets are not competitive due to monopoly or monopsony?
- What is effect of payroll tax?

3A. Labor Demand Model

1. Firms maximize profit (rev - cost).
Implies produce where marginal profit = zero.
Maintained assumption throughout course.

2. Two homogeneous factors of production: labor and capital.
Q = f(K, L) (Relaxed later)
a. Short-run (capital is fixed)
b. Long-run (capital may vary)

3A. Model (cont.)

3. Price of labor = hourly wage rate.

Implies no fringe benefits and no distinction between increasing labor by increasing the number of workers and increasing labor by having current workers work more.

Relax this assumption in ch. 5.

3A. Model (cont.)

4. Firms are price-takers in input and output markets.
Then marginal cost equals price
and marginal revenue equals price.

Relax to allow:
Monopoly: Price-maker in output good market
Monopsony: Price-maker in input good market

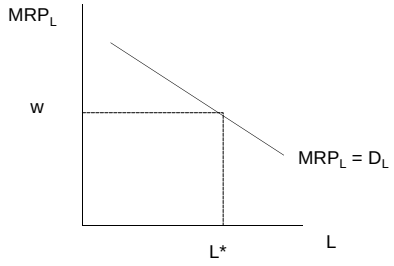
3B. Short-Run Labor Demand

- MRP_L = Marginal Revenue Product of L
  = Increase in Revenue due to one unit increase in Labor
  = MR x P (P is price)
- ME_L = Marginal Revenue Product of L
  = Increase in Expenses due to one unit increase in Labor
- Profit-maximizer hires until $MRP_L = ME_L$

3B. Short-Run (cont.)

- Price-taker in labor market:
  Then always $ME_L = w$
  So hire until $MRP_L = w$
  So MRP_L curve is labor demand curve.
- Price-taker in output market
  Then always $MRP_L = MP_L \times P$
- So in competitive markets hire until
  $MP_L \times P = w$ or $MP_L = w/P$
- MP_L slopes down $\Rightarrow$ D_L slopes down

MRP$_L$ IS LABOR DEMAND CURVE



3C. Long-Run Labor Demand

- Hire inputs until increasing output costs same if by more labor or more capital.
- Cost of one more unit of output
  = w/MP$_L$ if labor used
  = c/MP$_K$ if capital used (c=user cost of K)
- So w/MP$_L$ = c/MP$_K$ or w/c = MP$_L$/MP$_K$
- e.g. $w_{skilled}/w_{unskilled} = MP_{skilled}/MP_{unskilled}$

3C. Long-Run (cont.)

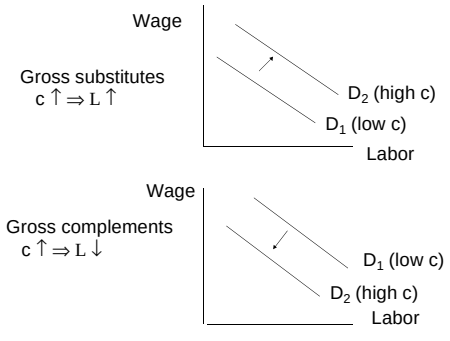
- When wage increases
  1. Scale effect:
     output ↓ ⇒ L ↓
  2. Substitution effect:
     K ↑ as relatively cheaper ⇒ L ↓
- Overall: wage ↑ ⇒ labor demand ↓

3D. Net Substitutes/Complements

- Substitutes in production (net substitutes)
  Greater use of one input can compensate for reduced use of the other
  e.g. unskilled labor & capital
- Complements in prodn (net complements)
  Greater use of one input requires more use of the other
  e.g. skilled labor & capital
- Need more than 2 inputs for complements.

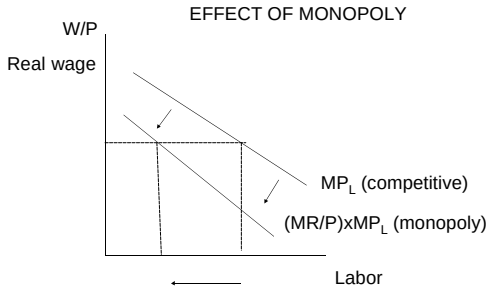
3D. Gross Substitutes/Complements

- When price of capital increases both
  1. Scale effect: output ↓ ⇒ L ↓
  2. Substitution effect:
     Capital relatively more expensive ⇒
     a. Substitutes in prodn: L ↑
     b. Complements in prodn: L ↓
- Overall: price capital ↑ ⇒ labor D ?
- Labor demand ↑ then gross substitutes
  Labor demand ↓ then gross complements



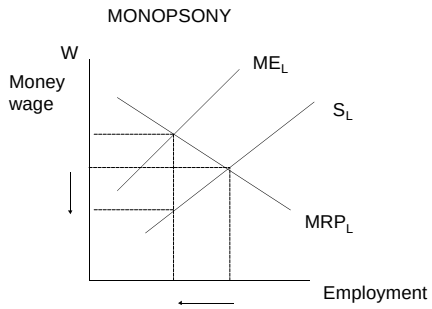
3E. Monopoly labor demand

- Monopolist: MR < P as only producer so faces market demand curve.
- Then $MRP_L = MR \times MP_L$ with MR < P
- Hire labor until $MRP_L = w$
  $\Rightarrow MR \times MP_L = w$
  $\Rightarrow (MR/P) \times MP_L = w/p$
  $\Rightarrow$ Hire less labor as MR/P < 1
- Expect as monopolist has lower output.



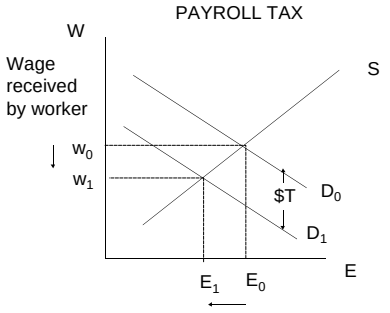
3F. Monopsony labor demand

- Firm only user of labor so faces upward-sloping labor supply curve.
  $\Rightarrow ME_L > w$ (as increase w to all)
- Hire labor until $MRP_L = ME_L > w$
  $\Rightarrow$ Further back up MRP_L
  $\Rightarrow$ Hire less labor
- e.g. coal miners, nurses in remote areas



3G. Payroll Tax

- Payroll tax is tax physically paid by employer to government
- It leads to difference in wage paid by employer and wage received by worker.
- Cost is borne in part by employer and in part by worker.
  Actual amounts depend on elasticities of labor demand and supply.



3H. Cobb-Douglas Production

- Example: $Q = 100xK^{.5}xL^{.5}$
- Then $MP_L = dQ/dL$
  $= 100xK^{.5}x.5xL^{-.5}$
  $= 50xK^{.5}/L^{.5}$
  which decreases as L increases
- Given K, w and P can solve for L
  using hire L until $P \times MP_L = w$

3I. Labor Demand Summary

- 1. Firms maximize profit.
  2. Q = f(K, L): Short-run and long-run
  3. Price of labor = hourly wage rate
  4. Firms are price-takers.
- SR and LR conditions
  Monopoly and monopsony
  Substitutes and complements
  Payroll Tax