Objectives

• Labour demand in the short run - model, graph, perfectly competitive market

• Labour demand in the long run - model, graph, scale and substitution effects

• Monopoly producers and labour demand

• Elasticity

• Global competition
What is Labour Demand?

- The amount of labour that a firm would choose to employ at a given wage rate
  - Do not distinguish between number of workers and hours per worker
- Derived demand - unlike the demand for goods, the demand for factors of production is called derived demand.
  - Labour is not demanded for it's final use or consumption, but for producing some output that will be consumed
Labour demand in the short run

• Short run - period during which one or more factors are fixed (cannot be adjusted)

• Long run - all factors can be adjusted

• Assume capital K is fixed in the short run
Labour demand in the short run

• Assume perfect competition in product and labour market
  • Large number of firms and workers
  • Firms produce homogeneous good
  • Workers homogeneous
  • Workers and firms are price takers
Labour demand in the short run

Assumptions:
• Firms use two factors of production
  – Labour (N) and
  – Capital (K) to produce Q (output)
  – Thus, \( Q = F(K, N) \) describes the firm's technology
• K is fixed in short run, the only way to change output is to change N
Labour demand in the short run

Firm is a profit maximizer. This implies two decision rules:

1. Shut Down: If total revenue is less than variable costs
2. How much to produce: If the firm does not shut down, it should produce where MC=MR.
Labour demand in the short run

• Terminology:
  – Total Revenue Product (TRP): the total revenue associated with the amount of an input employed
  – Marginal Revenue Product (MRP): the change in total revenue associated with a change in the amount of input employed
    – \( \text{MRP}_N = p \times \text{MPP}_N \)
  – Assume diminishing returns to labour
Marginal Revenue Product of Labour
Average revenue product of labour

- Equals the total output (Q) divided by the total number of workers employed (N)

- If the amount produced by adding an extra worker (MRP N) is greater than the average product (ARP N), then ARP N will rise

- If MRP N < ARP N then ARP N falls

- If MRP N = ARP N then no change
Finding the short run demand for labour

• A competitive firm will employ more labour until the value of the marginal product is just equal to the wage

• *See handout 4*

• A firm will shut down if the total revenue product of labour (ARPxN) is less than the total wage cost (w x N ) so that points on MRP N above the maximum ARP N will not be part of the demand schedule
Profit maximization requires labour to be employed until its marginal cost (the wage) equals its marginal benefit (marginal revenue product). For the wage, $W_0$, the profit-maximizing employment level is $N_0^*$. At wages higher than $W_1$, labour costs exceed the value of output, so the firm will hire no labour. The labour demand schedule is thus $MRP_N$ below where $ARP_N$ reaches its maximum (the thicker part of the curve on the figure).
Labour demand in the short run

- Downward sloping because of diminishing marginal returns to labour
- $\downarrow$ in wage rate will cause $\uparrow$ in demand for labour
- $\uparrow$ in wage rate will cause $\downarrow$ in demand for labour
Labour Demand in the Long-Run

All inputs are variable—no fixed costs

See handout 4
Labour Demand in the Long-Run

Isoquants:

• “Equal quantity”

• Combinations of labour and capital used to produce a given amount of a product (output)

• Slope exhibits a diminishing marginal rate of technical substitution (MRTS)
Isoquants
Labour Demand in the Long-Run

**Isocost Line:**

- All combinations of capital and labour that can be bought for a given total cost

\[ TC = rK + wN \]

- Where,
  
  \[ K = \text{capital and } N = \text{labour} \]
  \[ r = \text{price of capital} \]
  \[ w = \text{wage} \]
Isocost

Higher Cost

Lower Cost

Slope = \(-\frac{w_0}{r_0}\)
Cost-Minimizing

\[ K \]

\[ K_0 \]

\[ K_1 \]

\[ N_0 \]

\[ N_1 \]

\[ Q_0 \]
A Firm’s Labour Demand

The long run labour demand is determined by the long run profit maximizing (cost minimizing) labour requirements such as point $N_0$ in the previous diagram.
The Impact of Wage Increases on Labour Demand

When wage rate changes from $W_0$ to $W_1$, $E_0$ is no longer the profit maximizing equilibrium. The firm also re-evaluates output choices.
Profit Maximizing Output and Derived Labour Demand

\[ \text{Slope} = -\frac{w_1}{r_0} \]

\[ \text{Slope} = -\frac{w_0}{r_0} \]
Derived Labour Demand Schedule

Points $E_0$ and $E_1$ correspond to profit maximizing long run equilibriums.
The Effect of a Cost (Wage) Increase on Output Under Perfect Competition

- ↑ wage rotates isocost line inwards
- The firm will maximize profit by reducing the labour and substituting capital for labour
- ↑ wage also shifts up the firm's marginal and average cost curves
- In a perfect competitive industry each firm reduces output and raises the price of the product
The Effect of a Cost Increase on Output Under Perfect Competition

Price

P₁

P₀

Output

Q₁

Q₀

Firm

MC₁

MC₁
The Effect of a Cost Increase on Output Under Perfect Competition
Substitution and Scale Effects of a Wage Change

Diagram showing the effects of a wage change with labels such as $E_1$, $E_0$, $K_{N}$, and $Q_0$.
Substitution and Scale Effects

- Firm would substitute cheaper inputs for the more expensive labour:

  **SUBSTITUTION EFFECT**

- Firm would reduce its scale of operations because of the cost increase associated with the increase in wage:

  **SCALE EFFECT**
Short and Long Run

• Short-Run
  • amount of capital is fixed
  • no substitution effect

• Long-Run
  • firm has flexibility by varying its capital stock
  • response to a wage change will be larger in the long run
The Effect of a Cost Increase on Output Under Monopoly

Properties:

• Single supplier
• No close substitute for the product
• Price setter
• Profit maximization conditions: \( MR = MC \)
• \( P > MC \)
• Firm and industry demands are the same
• When the monopolist hires more labour to produce more output, both the marginal physical product of labour and the marginal revenue falls
• \( MRP_N = MR \times MPP_N = w \)
The Effect of a Cost Increase on Output Under Monopoly

Price

MC₁

MC₀

MR

D

P₁

P₀

q₁

q₀

Output
Elasticity of Demand for Labour

• Demand for labour decreases as wages increase (negative function)

• Wage increases have an adverse effect on employment

• The magnitude of the effect can be seen by the elasticity of the derived demand for labour
Elasticity of Demand

• Measures the responsiveness of the quantity of labour demanded to the wage rate

• Equals the % change in the quantity of labour demanded divided by the % change in the wage rate
Elasticity of Demand for Labour

- Basic determinants of the elasticity of demand for labour:
  - availability of substitute inputs
  - supply of substitute inputs
  - demand for output
  - ratio of labour cost to total cost
Elasticity of Demand

• If inputs can not be easily substituted, elasticity of labour demand decreases

• If demand for output is not affected by a price increase (due to cost of wage increase) demand for labour will be inelastic

• Demand for labour will be inelastic if labour cost is small portion of total cost
Labour Demand and Globalization

- Outsourcing
- Trade
Outsourcing

- \( TC = W_c N_C + W_F N_F \)
- \( N_C \) & \( N_F \) substitutes
- \( W_c = 10 \)
- \( W_{F0} = 12.50 \)
- \( W_{F1} = 8 \)
- Substitution vs. scale effects

Diagram:
- Canadian employment
- Substitution vs. Scale
- Toy Inc.

Slope equations:
- \( \text{Slope} = -12.5/10 \) at point \( Q_0 \)
- \( \text{Slope} = -8/10 \) at point \( B \)
- \( \text{Slope} = -8/10 \) at point \( C \)
Outsourcing

- TC = $W_C N_C + W_F N_F$
- $N_C$ & $N_F$ complements
- $W_C = 20$
- $W_{F0} = 25$
- $W_{F1} = 5$

Note:
- migrant workers
- Relate later to S & D graphs
Outsourcing

• Cost minimization implies

\[ \text{MRTS} = \frac{\text{MPP}_{NC}}{\text{MPP}_{NF}} = \frac{W_C}{W_F} \]

• Wage costs include trade barriers, \( W_F \) reduced by ICTs

• Both labour costs and productivity matter for the firms decisions

  • Consider isoquant for relatively productive Canadians (flat)
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Output per hour in manufacturing, average annual growth (%), 1979-2009

Source: ILC Tables, Productivity and Unit Labor Costs in Manufacturing, Data tables, 1950-2009, XLS file at http://www.bls.gov/fls/home.htm#productivity
Hourly compensation in National currency (manufacturing), average annual growth (%), 1979-2009

Source: ILC Tables, Productivity and Unit Labor Costs in Manufacturing, Data tables, 1950-2009, XLS file at http://www.bls.gov/fls/home.htm#productivity
Unit Labor Costs in National Currency (Mfg), average annual growth (%), 1979 - 2009

Source: ILC Tables, Productivity and Unit Labor Costs in Manufacturing, Data tables, 1950-2009, XLS file at http://www.bls.gov/fls/home.htm#productivity
Labour Demand and Trade

Slope of $A'A'' = \frac{P_w}{P_b} = MRT = MRS$
Labour Demand and Trade

- World prices matter, wine relatively cheaper
- Sell beer to get wine
- Welfare improving
Labour Demand and Trade
Labour Demand and Trade

- Increase in the overall welfare of the country
- Distributional effects of globalization and trade:
  - What happens to the shrinking industry employees?
  - The case for wage insurance
Reading and references

• Required
  – BGLR Ch. 5

• Suggested
  – *The case for wage insurance* by Robert J. Lalonde,
    http://www.cfr.org/economics/case-wage-insurance/p13661