Topic 3.1b – Long-Run Labour Demand

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Economics 370

Long-Run Labour Demand

- In the long-run the firm can now vary both inputs K and N.
- Typically the firms production and employment decisions are examined in 2 stages:
  (i) Cost minimization: firm determines the minimum cost of producing a given level of output (choose K and N).
  (ii) Profit maximization: choose Q to maximize profits.
Cost Minimization

Production function:
\[ Q = Q (K,N) \]

Isoquants: the combinations of labour and capital required to produce a given level of output
i.e. how technology allows labour and capital to be combined to produce output.

Isoquants

Downward sloping:
- The more labour you use to produce \( Q_0 \) (fixed level of output) the less capital you need.
- True if production is "technically efficient"

Convex:
At A:

At B:
**Iso-Cost Curve**

Iso-cost curve:
The combinations of capital and labour the firm can employ given their market price for a given expenditure level (C).

\[ C = \frac{K}{C/r} \]

Slope = \(-\frac{w}{r}\)

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**Cost Minimizing K and N**

Given a chosen level of output the firm will minimize the cost of producing it.

- Firm chooses to produce \( Q_0 \)
- What is the least cost combination of K and N?
- Could produce \( Q_0 \) at A (at a cost of \( C_0 \))
- Could also produce \( Q_0 \) at E (at a cost of \( C_0 < C_1 \))
Deriving the Long-Run Labour Demand Curve

- All we need to do is vary the wage and trace out the new equilibrium amounts of labour
- Start with relatively low wage \((w_0)\)

\[\begin{align*}
K & \quad Q_0 \\
& \quad E_0 \\
N_0 & \quad C_0 \\
& \quad N
\end{align*}\]

- Suppose the wage increases to \(w_1\)
- ...

This implies that the long-run labour demand curve will be downward sloping

\[\begin{align*}
W & \quad W_0 \\
& \quad W_1 \\
N_0 & \quad N_1 \quad N \\
& \quad D
\end{align*}\]

Let’s now consider why output falls and what happens to overall costs
Why will the firm choose to lower output?

- The increase in the wage will shift the firm’s marginal cost curve up to \( MC_1 \).
- Thus, the industry supply curve will shift left and price will rise to \( P_1 \).

Total Costs and Capital

- Total cost could increase (as shown) or decrease.
- “Costs are endogenous for the firm”
- Capital Use could also increase or decrease as we shall see.
- However, the amount of labour will decrease for a wage increase.
- We can prove this using scale and substitution effects.
Scale and Substitution Effects:

**Substitution Effect:**
- Capital becomes relatively cheaper
- Thus, the firms substitutes away from labour

**Scale Effect:**
- The firm reduces its scale of operation

**Overall:**

Scale and Substitution Effects Graphically:

**Substitution Effect:**
- Substitute away from labour \(N_0 - N_1\)

**Scale Effect:**
- Reduces labour requirements \(N_1 - N_2\)
Comparing Short and Long-Run Labour Demand

Can think of the difference between the two in terms of scale and substitution effects

**Short-Run:**
- Capital is fixed
- Labour demand is downward sloping because of scale effect and diminishing marginal product of labour

**Long-Run:**
- Firm has more flexibility

Suppose initially at long-run equilibrium \( E_0 \) and wage rises to \( w_1 \)

**Short-Run:**
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**Long-Run:**
- Firm can adjust capital (substitution effect)
- New equilibrium is at \( E_1 \)
Long-Run Labour Demand Curve:

- The locus of points \((E_0, E_1)\) at which the firm optimally adjusts employment of both labour and capital

**Elasticity of Demand for Labour:**

- It is important to know how responsive Labour demand is to changes in the wage
  - i.e. to have an estimate of the elasticity =
- It is important to know so that the effects of policies (such as the minimum wage which increases the wage) will be known.
- “elastic” –
- “inelastic” –

Elasticity of Demand for Labour:

- The main determinants of the elasticity of demand are (Marshall’s rule):
  - (i) The availability of substitute inputs
  - (ii) The elasticity of supply of substitute output
  - (iii) The elasticity of demand for the output
  - (iv) The ratio of labour cost to total cost
- We will discuss these separately – discussing the case where the elasticity of demand is likely to be inelastic.
(i) Availability of Substitute Inputs

- Extreme case
- Can’t substitute easily
- MRTS is small
- Must use $E_0, K_0$

Availability of substitutes affects the substitution effect.

Could be determined by:
1. Technology:

Factors Affecting the Availability of Substitutes

2. Institutions:
- Examples of workers not easily substitutable:

3. Time:
- In the long-run substitutes are more likely to be available (could consider an alternative production process)
(ii) Elasticity of Supply of Inputs

- Alternative inputs are also affected by changes in the price of the input
  e.g.

- Therefore, the more inelastic is the supply of substitutes the more inelastic is the demand for labour

(iii) Elasticity of Demand for Outputs

- The demand for labour is tied to the demand for the output as we have seen
  
- If demand for the output is inelastic then the derived demand for labour will be inelastic.
  
- The wage increase is passed on to consumers in the form of higher product prices but product demand does not change much
(iv) Ratio of Labour Cost to Total Cost

- Measures the extent to which labour cost is an important component of total cost
- The firm will not have to cut output by much because the increased cost from the wage increase would be small
  i.e. If the ratio is small then the scale effect is likely to be small
  “Importance of Being Unimportant”
  e.g.

Empirical Evidence

- How elastic is the labour demand curve?
- Hammermesh (1976, 1986)
  - Estimates for different types of labour
  - United States data (Private Sector):
    Ranged from –0.09 to –0.62
    Median estimate - 0.32 over 1 year.
  i.e. 1% increase in wages leads to one third of a percent reduction in employment after a year
    (½ subs effect, ½ scale effect)