

## 2.2 First Model of the Macroeconomy: Firm Behavior

*References:*  
Williamson, Chs. 4.

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## Assignment #3

- Read Chapter 4
- Work on Problems 2,3,4,6,12 to prepare for QUIZ on Wednesday, Oct 14. (Problems will not be collected.)

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## Production of Goods

- What are goods good for?
- “Technology”: the Production Function:  
$$Y = zF(K, N^d)$$
  - K and  $N^d$  are inputs or “factors of production”.
  - z is total factor productivity.
- K is determined by past investment
- $N^d$  may be varied in the short run.

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## Marginal Products, $MP_N$

- Marginal product of labor (MPN) is the amount of additional output produced by adding an additional unit of Nd (holding K fixed).

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## Marginal Products, $MP_K$

- Marginal product of capital (MPK) is the amount of additional output produced by adding an additional unit of K (holding Nd fixed).

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## Cobb-Douglas Production Fn

- $Y = zK^a (N^d)^b$

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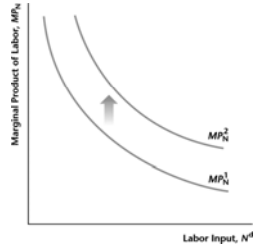
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*Complementarities in prod'n:*

5. MPN increases as K increases  
(and MPK increases as N increases).



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## Assumptions about the production function

1. Constant returns to scale (CRS)

*Increasing production fn:*

2.  $\uparrow K$  or  $\uparrow N$  causes  $\uparrow Y$

Equivalent statement:  $MPN > 0$ ,  $MPK > 0$ ,

*Diminishing marginal products:*

3. MPN decreases as N increases.

4. MPK decreases as K increases.

*Complementarities in production:*

5. MPN increases as K increases  
(and MPK increases as N increases).

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## What's z?

- Total factor productivity represents level of technology or efficiency in prod'n.
- Examples of z changes
  - technological advance, discovery of new techniques, etc.
  - Random economic shocks (weather)
  - Inefficiency induced by gov't regulation
  - Energy price shocks

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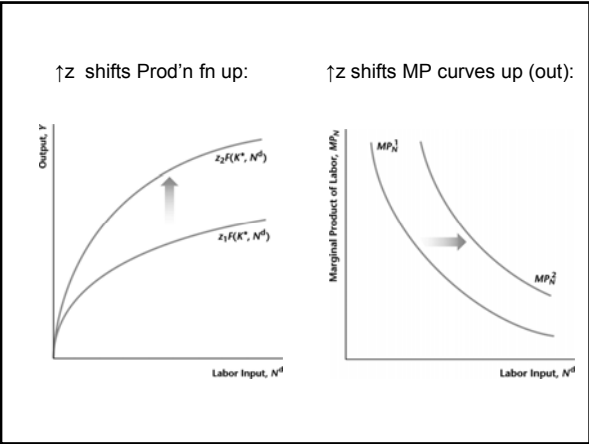
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The Objective of the Firm is...

- MAXIMIZE PROFIT!
- Profit is...
  - Revenue minus costs:

$$\pi = Y - w \cdot N^d$$

$$= zF(K, N^d) - w \cdot N^d$$


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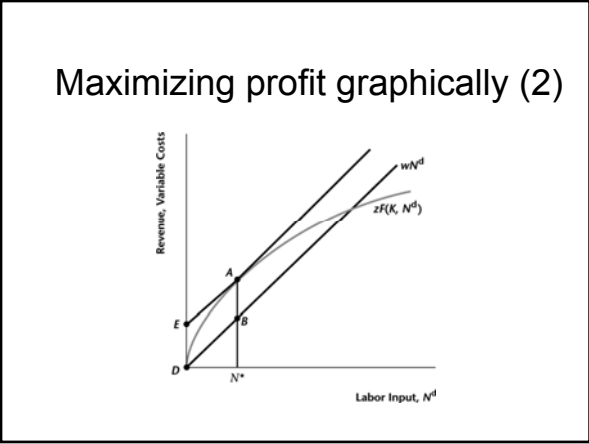
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## Firm's Labor Demand Curve (2)



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## Cobb-Douglas Production fn and the Solow Residual

- $Y = zK^a (N^d)^b$ 
  - Exhibits CRS if  $b = 1 - a$
- Theory says that share of  $Y$  paid to labor should be  $1-a$ :

$$1 - a = w^*N / Y$$

- Looking at data, set  $1 - a = .64$  ( $a = .36$ ).
- The "Solow residual" is measure of TFP ( $z$ ) obtained this way:

$$z = Y / ( K^{.36} (N^d)^{.64} )$$

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