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Economic Growth and
Economic Fluctuations

Notes on the Zero-Profit Result

In Lecture 3, I gave examples of firms operating in a competitive industry that make zero profit in the short-run, but I didn't fully explain when such a situation would arise.

Firms in competitive industries may make positive profits in the short-run, but – if there is free entry into the industry and firms face constant returns to scale over some range of output – then in the long-run, the firms' profits will be driven to zero.

one reason why profits go to zero in the long run

Suppose that there is free entry into the industry in which my firm operates, that the technology I use is widely available and that my firm is making positive profits in the short run. Since I'm making positive profits, another person (call him John) will use the same technology that I am using to produce output.

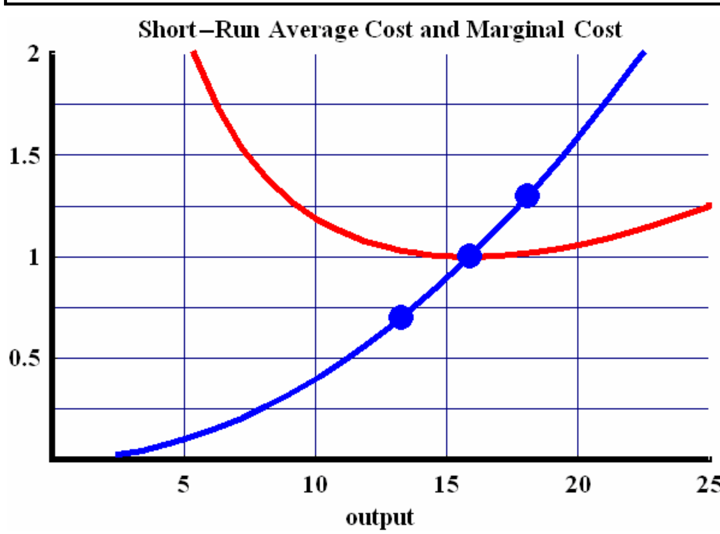
John will enter the industry, increase the market supply and lower the market price. This will reduce my profit, but if John and I are still making a positive profit, then yet another person (call her Jane) will enter the industry and use the same technology to produce output. Jane's output will further increase market supply and lower the market price. This process will continue until there are no more profits to be made.

Eventually, John, Jane and I will all be producing output at the minimum point along our long-run average cost curves – this corresponds to the point where our firms all face constant returns to scale.

The table shows that the firm maximizes profit by employing labor up to the point where the wage equals the price times the marginal product of labor. (Here, capital is held fixed since this is the short-run)**.**

The graph corresponds to the table and shows that the firm maximizes its profit by producing up to the point where price (marginal revenue) **equals marginal cost.**

case where p = \$1.30 and where r = w = \$0.53					
X	**K**	**L**	**MPL**	**p*MPL**	**profit**
17.32	20	13	0.44	0.58	5.06
17.76	20	14	0.42	0.55	5.09
18.17	**20**	**15**	**0.40**	**0.52**	**5.10**
18.57	20	16	0.39	0.50	5.09
18.95	20	17	0.37	0.48	5.05
case where p = \$1.00 and where r = w = \$0.53					
X	**K**	**L**	**MPL**	**p*MPL**	**profit**
14.74	20	8	0.61	0.61	-0.08
15.33	20	9	0.57	0.57	-0.02
15.87	**20**	**10**	**0.53**	**0.53**	**0.00**
16.39	20	11	0.50	0.50	-0.02
16.87	20	12	0.47	0.47	-0.06
case where p = \$0.70 and where r = w = \$0.53					
X	**K**	**L**	**MPL**	**p*MPL**	**profit**
11.70	20	4	0.97	0.68	-4.51
12.60	20	5	0.84	0.59	-4.41
13.39	**20**	**6**	**0.74**	**0.52**	**-4.39**
14.09	20	7	0.67	0.47	-4.42
14.74	20	8	0.61	0.43	-4.50



returns to scale

As we saw in Lecture 8, it's assumed that firms have a U-shaped long-run average cost curve. At low output levels, firms face increasing returns to scale. At high output levels, they face decreasing returns to scale. At the minimum point on the long-run average cost curve, they face constant returns to scale.

If a firm facing **constant returns to scale** doubles all of its inputs, then its output will exactly double. For example, if a firm's production function is given by:

$$X = K^{2/3} \cdot L^{1/3}$$

then if it doubles its inputs of capital and labor, its output doubles.

$$\begin{aligned} 2X &= (2K)^{2/3} \cdot (2L)^{1/3} \\ &= 2^{2/3} \cdot K^{2/3} \cdot 2^{1/3} \cdot L^{1/3} \\ 2X &= 2 \cdot K^{2/3} \cdot L^{1/3} \end{aligned}$$

Similarly, you can easily see that when a firm doubles all of its inputs, its output:

- **more than doubles** when it faces **increasing returns to scale**
- **less than doubles** when it faces **decreasing returns to scale**.

increasing returns to scale:

$$\begin{aligned} X &= K^{2/3} \cdot L^{2/3} \\ 2X &< (2K)^{2/3} \cdot (2L)^{2/3} \\ &< 2^{2/3} \cdot K^{2/3} \cdot 2^{2/3} \cdot L^{2/3} \\ 2X &< 2^{4/3} \cdot K^{2/3} \cdot L^{2/3} \end{aligned}$$

decreasing returns to scale:

$$\begin{aligned} X &= K^{1/3} * L^{1/3} \\ 2X &> (2K)^{1/3} \cdot (2L)^{1/3} \\ &> 2^{1/3} \cdot K^{1/3} \cdot 2^{1/3} \cdot L^{1/3} \\ 2X &> 2^{2/3} \cdot K^{1/3} \cdot L^{1/3} \end{aligned}$$

two more reasons why profits go to zero in the long run

Since a firm facing constant returns to scale can double its output by doubling each of its inputs, then if it doubled its inputs and output, its profits would also double.

$$\begin{aligned} \Pi &= p \cdot X \quad - w \cdot L \quad - r \cdot K \\ 2\Pi &= p \cdot (2X) - w \cdot (2L) - r \cdot (2K) \end{aligned}$$

But if the firm can double its profit by doubling its inputs and output, then it could also quadruple its profit by quadrupling its inputs and output. So when exactly would a firm ever maximize its profit? The only reasonable assumption to make therefore is that the firm's profits go to zero in the long run. (Two times zero is zero).

There are three reasons why the profits of firms operating in competitive industries go to zero in the long run. The first reason was discussed above – as firms enter they drive down the market price to the point where no firm profits.

Another reason is because at very high levels of output, a firm may encounter logistical difficulties. For example, it may have difficulty coordinating the activities of all of its plants. Coordination difficulties at high levels of output are simply an example of decreasing returns to scale.

Finally, if the firm were lucky enough to face increasing returns to scale over all ranges of output, then it could always make ever higher profits by growing ever larger. Such a firm would eventually dominate its industry and become a monopolist – thus, the firm no longer operates in a competitive industry.