

### Industry Supply

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### Motivation

- ▶ Last time we looked at supply decision of one firm
- ▶ Now we figure out what the supply decision of the whole industry will be
- ▶ For this section, we are still assuming a competitive market

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### The Industry Supply Curves in the Short Run

- ▶ Suppose there are  $n$  firms, each with supply curve  $S_i(p)$
- ▶ Then the *industry supply curve* is

$$S(p) = \sum_{i=1}^n S_i(p)$$

- ▶ Note that individual supply curves add horizontally

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## Industry Equilibrium in the Short Run

- ▶ We know that equilibrium price is derived from  $y^* = S(p^*) = D(p^*)$
- ▶ What are the possible equilibrium profits for the firm in the short run?
  - ▶ Zero profits:  $p^* = \frac{c(y^*)}{y^*} = AC(y^*)$ 
    - ▶ Note that this means price is equal to the minimum of the AC curve
  - ▶ Positive profits:  $p^* > AC(y^*)$
  - ▶ Negative profits:  $p^* < AC(y^*)$ 
    - ▶ OK as long as we are not below shutdown condition
    - ▶ That is, must have  $p^* > AVC(y^*)$ , ie equilibrium price above the AVC curve

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## Entry and Exit in the Long Run

- ▶ What profits are sustainable in the long-run?
  - ▶ Thus firm profits must be zero in the long run
    - ▶ Note this just means industry is not growing
    - ▶ All inputs are still getting paid for
  - ▶ One caveat: assuming *free entry into industry*
    - ▶ No *barriers to entry* put up by government or incumbent firms

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## The Long Run Supply Curve

- ▶ Suppose there are many firms with identical cost function  $c(y)$
- ▶ Write  $p^*$  for the price equal to the minimum of the average cost curve for any one firm
- ▶ As firms enter one-by-one, industry supply curve moves out and becomes steeper
- ▶ Firms will enter until adding one more firm will lower equilibrium price below  $p^*$ 
  - ▶ Beyond this point, profits for all firms will be negative
- ▶ If the number of firms entering is very large (which we are assuming anyways), then the **LR supply curve is flat (ie perfectly elastic) at price  $p^*$**

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## Long Run Supply: Graphically, Part 1

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## Taxes in the Long Run

- ▶ We have seen that in the short run, in general taxes affect both producer price and consumer price
- ▶ However, in the long run that same tax will fall entirely on the consumer
  - ▶ Producers will supply only at  $p^* = \min AC$ , so tax cannot affect producer price at all

## Monopoly

## Introduction

- ▶ So far our assumption has been that we have a very large number of firms in the market
- ▶ Now we go to the opposite extreme: one firm in the market, ie a *monopoly*
- ▶ Note that the demand curve the firm faces is now the market demand curve
  - ▶ Thus the firm can choose quantity  $y$  and price will be determined by inverse market demand  $p(y)$

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## Monopolistic Equilibrium Graphically

## Maximizing Monopoly Profits

- ▶ The monopolist solves

$$\max_y p(y)y - c(y)$$

where revenue is  $r(y) = p(y)y$  and  $p(y)$  is inverse demand

- ▶ First order condition:

$$MR(y) = p(y) + p'(y)y = c'(y) = MC(y)$$

- ▶ So as usual we have  $MR=MC$ , but the equation for marginal revenue is different because when the monopolist changes their output, price changes as well

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## Elasticity

- ▶ Note that we can re-write the marginal revenue as

$$MR(y) = p(y) \left[ 1 + \frac{dp}{dy} \frac{y}{p(y)} \right]$$

- ▶ Recalling that  $\frac{dy}{dx} = \frac{1}{\frac{dx}{dy}}$ , we can write this as

$$MR(y) = p(y) \left[ 1 + \frac{1}{\epsilon} \right] = p(y) \left[ 1 - \frac{1}{|\epsilon|} \right]$$

- ▶ Note  $\epsilon$  is elasticity of *demand*
- ▶ Will monopolist produce if  $|\epsilon| < 1$ ?

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## Markups

- ▶ Using the fact that  $MR(y) = MC(y)$ , re-arrange the FOC to get

$$\frac{p(y)}{MC(y)} = \frac{1}{\left(1 - \frac{1}{|\epsilon(y)|}\right)} > 1$$

- ▶ Ratio  $\frac{p}{MC}$  called the *markup ratio*, ie how much the monopolist charges relative to their marginal costs
- ▶ What would the markup ratio be for competitive firm?

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## Example: Linear Demand

- ▶ Let inverse demand be given by  $p = a - by$  and cost function be given by  $c(y) = cy$
- ▶ What is monopolistic equilibrium supply and price?
- ▶ What is markup ratio?

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## Example: Taxes and Monopoly

- ▶ Suppose government imposes quantity tax  $t$
- ▶ What is effect on price in previous example?

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## Inefficiency of the Monopoly

- ▶ An allocation is *Pareto efficient* if no one can be made better off without making someone else worse off
- ▶ Is the allocation arrived at in the monopoly setting Pareto efficient?
- ▶ Given this argument, why is  $p_m, y_m$  still an equilibrium?

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## What Causes Monopolies?

- ▶ Cartels, ie collusion between several producers in the market
  - ▶ Examples?
- ▶ Incumbents can use pricing as a deterrent
- ▶ Technology
  - ▶ Define the *minimum efficient scale* (MES) as the output at which the average cost curve (for one firm) is minimized
  - ▶ If  $MES \ll D(p^*)$ , we have a competitive market
  - ▶ If  $MES \approx D(p^*)$ , monopoly is likely
    - ▶ Example: *natural monopolies* like cable and internet providers