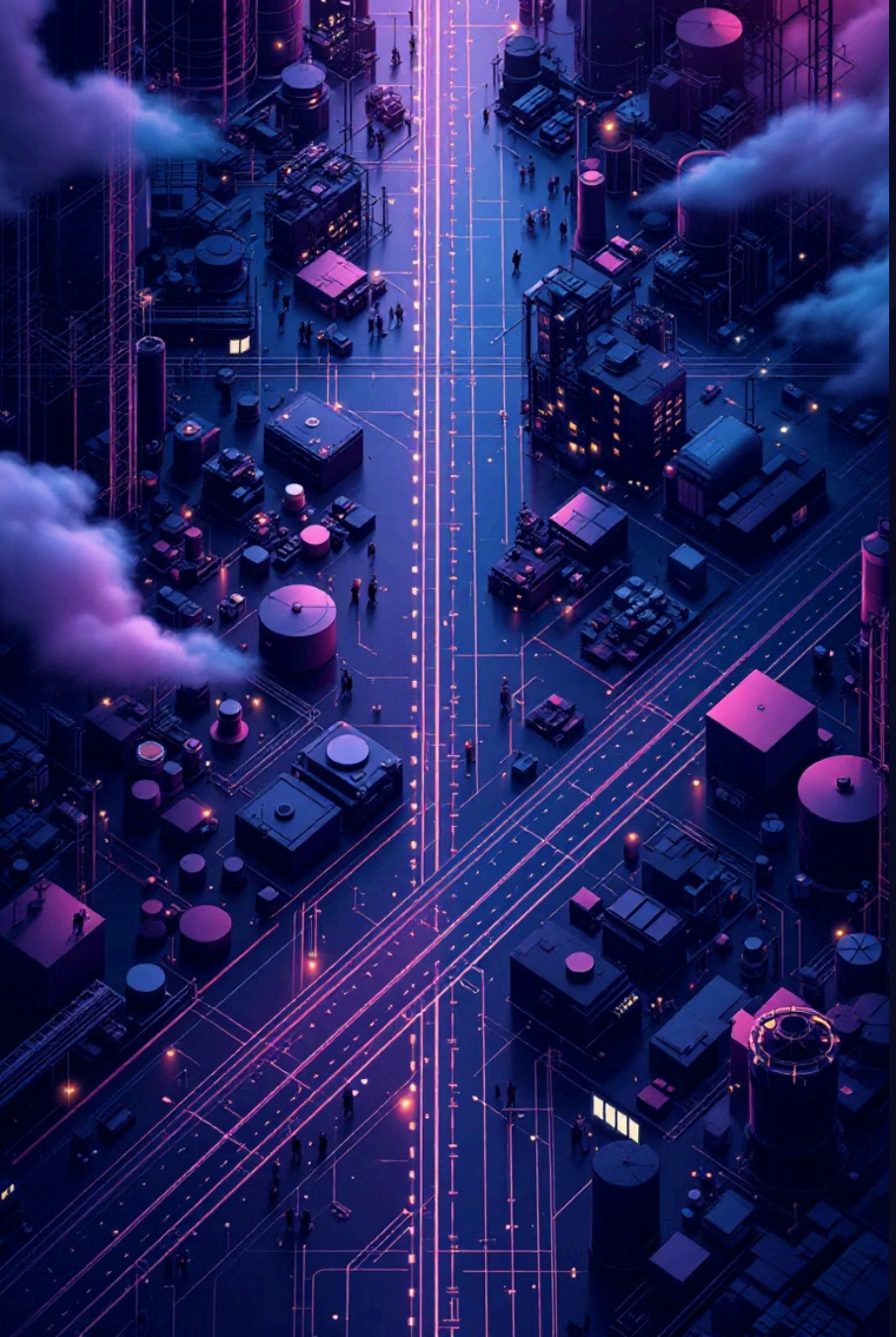

Firms and Production

Costs, Competition, and Pricing

Chaouat Economics Lab — Intro Economics Series

LEARNING OBJECTIVES

What You'll Master Today

01

Production Fundamentals

Explain diminishing marginal returns and how firms transform inputs into output

02

Cost Structures

Distinguish fixed vs variable costs and interpret average vs marginal cost behavior

03

Profit Logic

Apply the profit maximization rule: MR = MC

04

Market Structures

Compare perfect competition vs monopoly outcomes

05

Policy Implications

Link market power to welfare and understand antitrust regulation

Unifying principle: firms make decisions **at the margin**. Costs and demand conditions determine output, pricing, and economic welfare.

What Is a Firm?

Core Function

A firm is an economic entity that combines multiple inputs to create value:

- **Labor:** Human skills and effort
- **Capital:** Equipment, buildings, technology
- **Materials:** Raw inputs and intermediate goods
- **Technology:** Production processes and knowledge

These inputs are transformed into goods and services for the market.

The Profit Equation

$$\pi(Q) = TR(Q) - TC(Q)$$

Where π represents profit, TR is total revenue, and TC is total cost

While profit maximization is a simplification, it powerfully predicts firm behavior. Even nonprofits optimize something—mission impact, output quality, or reach—under resource constraints.

Production and Diminishing Marginal Returns

Production Function

$$Q = f(L, K)$$

Output (Q) depends on Labor (L) and Capital (K)

Short Run Constraint

At least one input is fixed—typically capital equipment, facilities, or plant size

The Law of Diminishing Marginal Returns

When you add more variable input (labor) to a fixed input (capital), **each additional worker produces less extra output** than the previous one.

Classic example: One restaurant kitchen (fixed) with more cooks (variable) eventually causes crowding, confusion, and coordination problems. The 10th cook adds far less output than the 3rd cook did.

This principle helps explain why marginal cost typically rises at higher output levels—each additional unit requires proportionally more variable input to produce.

Cost Basics: Fixed vs Variable

The Cost Equation

$$TC(Q) = FC + VC(Q)$$

Total cost equals fixed cost plus variable cost

Fixed Cost (FC)

Does not vary with output in the short run:

- Rent and lease payments
- Business licenses and permits
- Salaried staff compensation
- Insurance premiums
- Loan interest payments

Variable Cost (VC)

Increases with production volume:

- Raw materials and components
- Hourly labor wages
- Energy and utilities for production
- Shipping and packaging
- Sales commissions

1

Short Run

Some costs are fixed and unavoidable

2

Long Run

All inputs become adjustable; firms can change plant size, technology, or exit entirely

"Fixed" means fixed over a specific time horizon, not permanently. In the long run, even factory capacity becomes a choice variable.

Average vs Marginal Cost

KEY DISTINCTION

Average Costs

Per-unit calculations:

1

Average Total Cost

$$ATC = \frac{TC}{Q}$$

2

Average Fixed Cost

$$AFC = \frac{FC}{Q}$$

3

Average Variable Cost

$$AVC = \frac{VC}{Q}$$

Marginal Cost

The Decision Variable

$$MC = \frac{\Delta TC}{\Delta Q}$$

Cost of producing one additional unit

Critical insight: Marginal cost governs output decisions, not average cost. Firms compare **marginal benefit** (revenue from one more unit) to **marginal cost** when deciding whether to expand production.

Average cost tells you the typical cost per unit. Marginal cost tells you the incremental resource cost of the next unit—the decision-relevant metric.

Why Cost Curves Are U-Shaped

The Anatomy of Average Total Cost

Spreading Fixed Costs

Average fixed cost (AFC) falls continuously as output rises, spreading overhead across more units

Learning and Specialization

At low output, learning effects and worker specialization can reduce average variable cost

Diminishing Returns Kick In

At high output, diminishing marginal returns raise marginal cost sharply

MC Pulls ATC Upward

Rising marginal cost eventually raises average variable cost and average total cost

The Mathematical Rule

1. **When MC < ATC**
   Average total cost tends to fall

2. **When MC > ATC**
   Average total cost tends to rise

Intuition: If the next unit costs less than the current average, it pulls the average down. If it costs more, it pushes the average up.

Marginal cost always crosses average total cost at the ATC minimum—this is an arithmetic inevitability, not an assumption.

Revenue and Market Structure

Total Revenue Formula

$$TR(Q) = P(Q) \cdot Q$$

Revenue equals price times quantity sold

Two Fundamentally Different Cases

Perfect Competition

Price-Taker Behavior

- Market determines price
- Firm accepts P as given
- Can sell any quantity at market price

$$MR = P$$

Marginal revenue equals price

Market Power

Price-Setter Behavior

- Faces downward-sloping demand
- Must lower price to sell more
- Controls price OR quantity, not both

$$MR < P$$

Marginal revenue less than price

Marginal Revenue

$$MR = \frac{\Delta TR}{\Delta Q}$$

Change in total revenue from selling one more unit

This price-taker vs price-setter distinction drives everything about pricing strategy, output decisions, and welfare implications. Competitive firms choose quantity at a given market price; market-power firms choose quantity (or price) along their demand curve.

Profit Maximization

DECISION RULE

Profit Function

$$\pi(Q) = TR(Q) - TC(Q)$$

Optimal Choice

Produce where MR = MC

Logic: If MR > MC, producing more raises profit. If MR < MC, producing less raises profit. Optimal output occurs where these forces balance.

Benchmark Market Outcomes

Perfect Competition

01

Since MR = P, choose output where **P = MC(Q*)**

02

Price equals marginal cost—economically efficient

03

Short-run shutdown rule: Produce only if P > AVC

Even with losses, a firm may operate if revenue covers variable costs and contributes something toward fixed costs.

Monopoly

01

Choose output where **MR = MC**

02

Set price from demand curve at that quantity

03

Result: **P > MC** (markup over cost)

Typically produces **lower quantity** and charges **higher price** than perfect competition, creating deadweight loss.

Policy Implications and Practice

Why Market Power Matters for Policymakers

Inefficient Production

When P > MC, firms underproduce relative to the socially efficient level, leaving mutually beneficial trades unrealized

Surplus Transfer

Market power transfers economic surplus from consumers to producers through higher prices and restricted output

Deadweight Loss

The gap between actual and efficient output creates deadweight loss—value that could have been created but wasn't

Rent-Seeking Behavior

Market power can incentivize wasteful spending on lobbying, barriers to entry, and protecting monopoly position

Complication: Patents and intellectual property protection create temporary monopolies but incentivize innovation. Policy must balance static efficiency against dynamic innovation incentives.

Lab Activity Options

1

Markup Simulation

Given demand and cost curves, find the quantity where MR = MC, then determine the monopoly price and calculate the markup over marginal cost

2

Shock Analysis

Introduce a cost shock (input prices rise, shifting MC up) or demand shock (demand curve shifts). Predict changes in optimal Q, equilibrium P, and firm profit

Practice your economic storytelling: "Input cost shock → MC shifts up → optimal Q falls → P rises (typically) → profit impact ambiguous." This framework applies to taxes, subsidies, regulation, and technological change.