



Twice the bakers, twice the bread?

One oven, more bakers: why output and costs curve the way they do.

1

Short run vs long run

what can change?

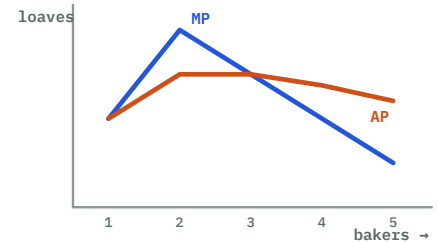
- **Short run** → ≥ 1 input fixed (the oven) · only labor changes
- **Long run** → every input changes, even the number of ovens
- Hire a 5th baker / buy flour = short run · buy a 2nd oven = long run

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Product of labor

bakers → loaves

- **Marginal product (MP)** = loaves the next baker adds → 20, 40, 30, 20, 10 · **total** = 20, 60, 90, 110, 120
- **Average product (AP)** = total ÷ bakers → 20, 30, 30, 27.5, 24
- MP up (2nd baker: specialize) → then down: **diminishing marginal returns** = fixed oven shared by more hands
- $MP > AP \Rightarrow AP$ rises · $MP < AP \Rightarrow AP$ falls · $MP = AP \Rightarrow AP$ peaks (3 bakers: $30 = 30$)
- Same MP can sit on both sides of the peak: 1st baker 20 (rising), 4th baker 20 (crowded)



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Fixed, variable, total

the cost table

- **Fixed cost (FC)** → same at any output: oven \$180/day
- **Variable cost (VC)** → grows with output: wages, $\$120 \times \text{bakers}$
- $TC = FC + VC$ → 1 baker \$300 · 2: \$420 · 3: \$540 · 4: \$660 · 5: \$780
- Wage \$120 → \$150 ⇒ VC and TC rise (4 bakers: $\$600 + \$180 = \$780$) · FC unchanged

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Average costs

per loaf

loaves	20	60	90	110	120
AFC	9.00	3.00	2.00	1.64	1.50
AVC	6.00	4.00	4.00	4.36	5.00
ATC	15.00	7.00	6.00	6.00	6.50

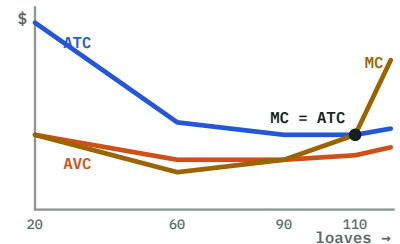
- $AFC = FC \div Q$ · $AVC = VC \div Q$ · $ATC = TC \div Q = AFC + AVC$
- AFC always falls (same \$180 spread wider) · ATC U-shaped: falls (spreading FC), then rises (crowding)
- Rent ↑ (\$180 → \$270) ⇒ only **ATC** shifts up (+ \$270 ÷ Q: at 90 loaves \$6 → \$7) · AVC, MC stay put

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Marginal cost

and the average rule

- $MC = \Delta TC \div \Delta Q$ (Δ = change in) → 2nd → 3rd baker: $\$120 \div 30 = \4 · MC by baker: 6, 3, 4, 6, 12
- **Marginal-average rule** (like a test average) → $MC < \text{average} \Rightarrow \text{average falls}$ · $MC > \text{average} \Rightarrow \text{average rises}$ · $MC = \text{average} \Rightarrow \text{average at its minimum}$
- MC cuts AVC and ATC at their lowest points · AVC min = \$4.00 (60–90 loaves) · ATC min = \$6.00 (90–110 loaves) = **efficient scale**
- Above 110 loaves: $MC \$12 > ATC \Rightarrow ATC \uparrow$ (\$6.50 at 120)



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Long run: scale

more ovens

- 1 oven: up to 120/day, lowest \$6.00 · 2 ovens: up to 240, **\$5.00** · 3 ovens: up to 350, \$7.00
- **Economies of scale** → ATC falls as the firm grows (bulk buying, split jobs) · **diseconomies** → ATC rises (hard to manage)
- 240 loaves a day → 2 ovens, \$5.00 a loaf

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Economic profit

explicit + implicit

- **Explicit cost** = money out (wages, rent) · **implicit cost** = what the owner gives up (job \$150 + savings in a bank \$50 = \$200)
- $\text{Accounting profit} = \text{revenue} - \text{explicit}$ · $\text{Economic profit} = \text{accounting} - \text{implicit}$
- 3 bakers: $90 \times \$8 = \$720 - \$540 = \$180 \rightarrow - \$200 = - \20 (loss)
- 4 bakers: $110 \times \$8 = \$880 - \$660 = \$220 \rightarrow - \$200 = + \20
- Positive accounting profit can hide an economic loss