Understanding Inflation

Why Prices Rise and How Central Banks Respond

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Three questions for today

1. What is inflation and how is it measured?
2. Is inflation good or bad?
3. What do central banks do, and at what cost?

A receipt from the same store, 24 years apart



Item	2002	2026	Change
Rice, 5 kg	¥980	¥4,200	+329%
Milk, 1 L	¥98	¥260	+165%
Eggs, 10	¥78	¥310	+297%
Bread, 1 loaf	¥68	¥210	+209%
Cabbage	¥58	¥230	+297%
Total	**¥1,282**	**¥5,210**	**+306%**

Store: JUSCO Hadano, 12 May 2002 → AEON Hadano, 12 Oct 2026

(same supermarket; JUSCO was later renamed AEON)

Average of the five product increases: $(329 + 165 + 297 + 209 + 297) \,/\, 5 = \mathbf{259\%}$

Average inflation per year (compound): $\left(\dfrac{\text{final}}{\text{initial}}\right)^{1/\text{years}} - 1 = \left(\dfrac{5210}{1282}\right)^{1/24} - 1 \approx \mathbf{6\%}$

Do you think 6% is the inflation rate?

Milk rose 165%; rice rose 329%.
Whose basket — and how should items be weighted?

The Consumer Price Index

Definition

The cost of a **fixed basket** of goods and services relative to a **base period** (the cost in the base period is normalized to 100).

What's in the basket



Food	27.5%
Housing	21.8%
Transport	14.4%
Health	4.7%
Other	31.5%

Statistics Bureau of Japan, 2025 base

The Consumer Price Index — from prices to CPI

$$\mathrm{CPI}_T = 100 \times \frac{\sum_{j=1}^{J} p_T^j \, q^j}{\sum_{j=1}^{J} p_0^j \, q^j}$$

	Good 1	Good 2	$\cdots$	Good J	Total expenditure	CPI
Base period $T{=}0$	p_{01}	p_{02}	$\cdots$	p_{0J}	$\sum_j p_{0j}\, q_j$	100
Period T	p_{T1}	p_{T2}	$\cdots$	p_{TJ}	$\sum_j p_{Tj}\, q_j$	$100 \times \dfrac{\sum_j p_{Tj}\, q_j}{\sum_j p_{0j}\, q_j}$

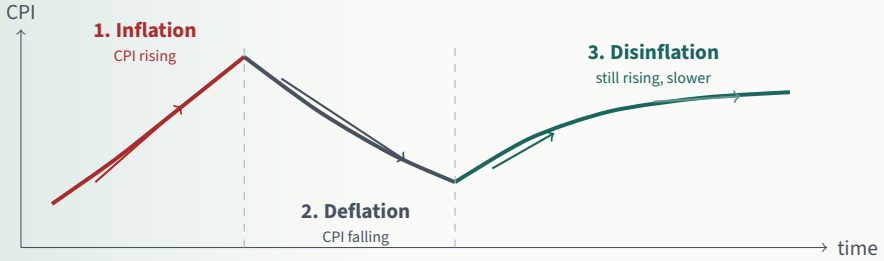
q_j = fixed basket quantity · prices change; quantities stay fixed

Inflation, Deflation, and Disinflation

CPI = a *level*. The inflation rate measures how fast that level is changing:

$$\pi_t = \frac{\text{CPI}_t - \text{CPI}_{t-1}}{\text{CPI}_{t-1}}$$

1. Inflation: CPI rising ($\pi > 0$). **2. Deflation:** CPI falling ($\pi < 0$). **3. Disinflation:** CPI still rising, but π falling.



Example: milk and rice

Question

Basket $=$ **2 L milk** $+$ **2 bags rice**. Compute the CPI at $t = 0, 1, 2$, then π_1 and π_2. Is $t = 2$ deflation?

Prices

	$t = 0$ (base)	$t = 1$	$t = 2$
Milk	¥100	¥120	¥125
Rice	¥200	¥240	¥250

Example: milk and rice

Question

Basket = **2 L milk** + **2 bags rice**. Compute the CPI at $t = 0, 1, 2$, then π_1 and π_2. Is $t = 2$ deflation?

Prices

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Solution

	$t = 0$	$t = 1$	$t = 2$
Cost $= 2p_m + 2p_r$	$2 \times 100 + 2 \times 200 =$ **600**	$2 \times 120 + 2 \times 240 =$ **720**	$2 \times 125 + 2 \times 250 =$ **750**
CPI $= 100 \times$ cost$/600$	**100**	**120**	**125**
π_t	—	$(120 - 100)/100 =$ **20%**	$(125 - 120)/120 \approx$ **4.2%**

CPI rose both periods $\Rightarrow$ **inflation**. π fell 20% $\to$ 4.2% $\Rightarrow$ **disinflation**, not deflation.

Three costs of inflation

1. Shoe-leather

Cash loses value when prices rise. People hold less cash and make more trips to the bank — time wasted protecting money.

2. Menu costs

Firms change prices more often (menus, websites, shelves). Prices update at different speeds $\Rightarrow$ price confusion.

3. Unexpected inflation

Moves wealth around when inflation differs from expectations: borrowers gain, lenders and fixed pensions lose. Unpredictable inflation creates uncertainty — planning gets harder for everyone.

Benefits of inflation

1. Encourage investment	Cash in a bank account gradually loses value each year. That pushes people to invest in the real economy — like new business equipment — instead of letting it sit still.
2. Dilute government debt	Debt is usually fixed in nominal terms. Modest inflation erodes its real value over time — easing the burden on public finances.
3. Grease the job market	Firms rarely cut nominal pay. With a little inflation, real wages can adjust down without a pay cut — helping keep unemployment lower.

Hyperinflation: Zimbabwe

What it is	Extremely rapid price increases — prices can double in hours or days.
Zimbabwe	2008 peak: inflation exploded; people abandoned the Zimbabwean dollar, turned to foreign currency and barter.
Why	Money printed to cover deficits; confidence in the currency collapsed.
Today	Argentina and Venezuela still hyperinflationary; Zimbabwe's new currency is still watched closely.



Tool 1: Interest rates

Which tool to use depends on how costly inflation is.

Raise rates	Borrowing gets more expensive $\Rightarrow$ spending and investment cool $\Rightarrow$ demand falls $\Rightarrow$ inflation eases.
Lower rates	Borrowing gets cheaper $\Rightarrow$ spending and investment rise $\Rightarrow$ demand rises $\Rightarrow$ can push inflation up.
Tradeoff	Fighting inflation with higher rates often means slower growth.

Tool 2: Quantitative easing & yield curve control

When short rates hit zero — using bond purchases to lower long-term rates.

QE (quantity)	Central bank buys a set amount of long-term bonds (and assets) to inject cash and push long-term yields down.
YCC (rate target)	Same mechanism, targeting a yield instead of a quantity: buy bonds as needed to pin long-term yields near a target.
Japan’s case	BOJ used QE (2001), QQE (2013), and YCC (2016) to keep long-term borrowing cheap across the yield curve.

Tool 3: Reserve requirements

The share of deposits banks must keep as reserves.

Raise the ratio	Banks must hold more cash idle ⇒ less lending ⇒ money and demand tighten ⇒ inflation pressure falls.
Lower the ratio	Banks can lend more ⇒ credit expands ⇒ spending can rise ⇒ inflation pressure rises.
Idea	Control credit at the source — how much banks are allowed to create.

Diagnosing the cause

Three channels — illustrations from the United States.

1. Demand	COVID “helicopter money”: cash sent to households ⇒ spending rises faster than supply ⇒ prices are pulled up.
2. Supply	Oil shocks (Gulf / Hormuz) and trade wars: higher energy costs, tariffs, broken chains ⇒ costs rise ⇒ prices are pushed up.
3. Expectations	Inflation high ⇒ workers expect higher prices ⇒ demand higher wages ⇒ firms pass on costs ⇒ inflation stays high ⇒ …

The output–inflation tradeoff

Different causes need different responses.
Fighting a supply shock only by cutting demand can cause **stagflation**.

Demand-driven

Raise rates ⇒ spending cools ⇒ inflation falls.

Cost: slower growth.

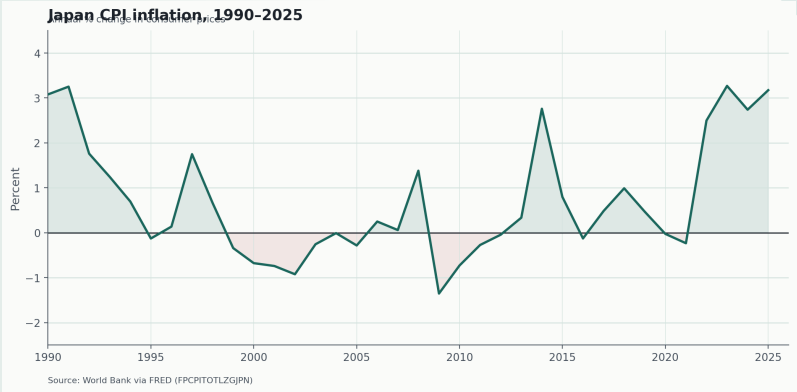
Supply-driven

Oil / trade war: prices up, output down — **stagflation**.

Cutting demand alone deepens the slump.

Case study: Japan's CPI inflation over time

Annual % change in consumer prices, 1990–2025. Source: World Bank via FRED (series FPCPITOTLZGJPN).



Periods to read: bubble peak ∼1990 → long near-zero/negative stretch → 2008–09 dip → 2013–14 uptick → COVID dip → 2022+ pickup.

Reading the chart: bubble, deflation, 2008

1. Bubble $\sim$1990	Late-1980s stock and land boom; BOJ raised rates in 1989–90; equity prices collapsed in 1990. CPI inflation was still about 3% in 1990–91, then faded as the bust hit balance sheets.
2. Long deflation	CPI inflation turned negative in 1995 and stayed near zero or below for years: weak demand, bad loans, and expectations that prices would keep falling.
	BOJ response: zero rates (1999), QE (2001), then QQE / negative rates / YCC (2013–16).
3. 2008–09 dip	Inflation briefly positive in 2008, then about -1.4% in 2009 — oil prices crashed after the 2008 surge, and demand weakened in the global crisis.

Reading the chart: Abenomics, COVID, turnaround

4. 2013–14 uptick	April 2013: QQE and a 2% price target. 2014 CPI rose about 2.7%, but much of that was the consumption-tax hike (5%→8%); underlying inflation stayed softer.
5. COVID dip	All-items CPI: 0.0% in 2020, −0.2% in 2021 — prices slipped again during the pandemic lull.
6. 2022+ pickup	Core CPI (excl. fresh food) above 2% since April 2022. Drivers: weaker yen, imported energy costs, then stronger wages (2024 spring talks: largest in decades).
	March 2024: BOJ ended negative rates and YCC — from fighting deflation to managing inflation.