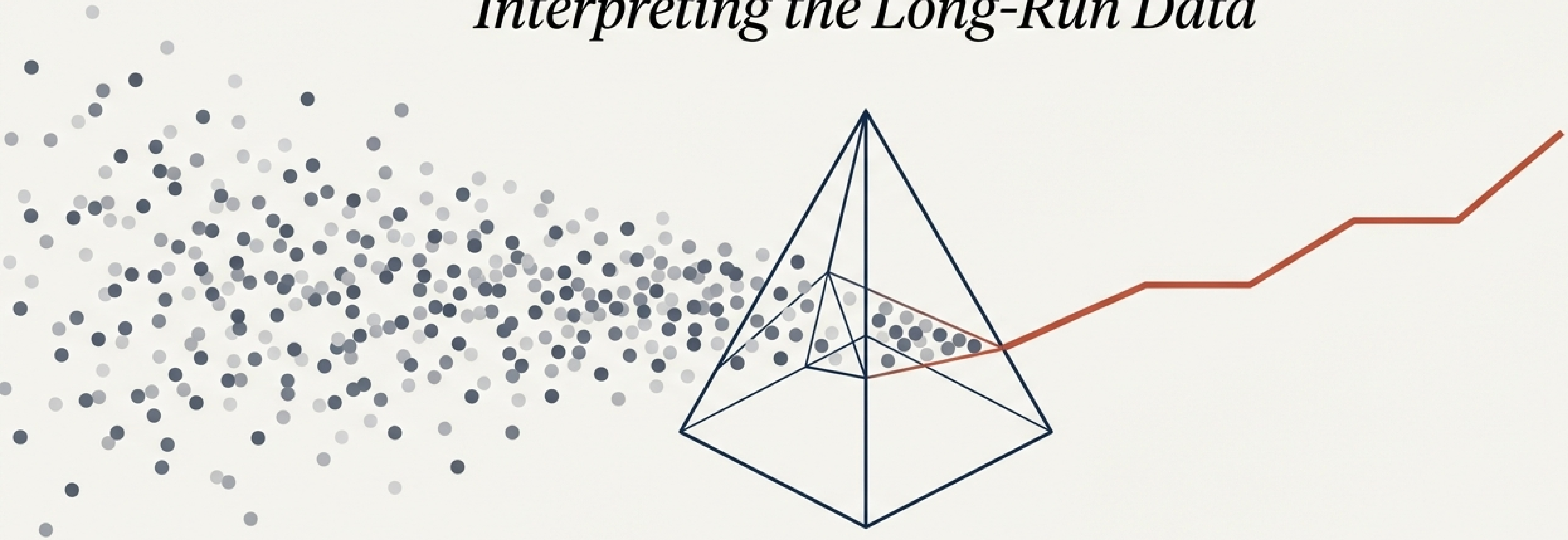
A Framework for Macroeconomics

Interpreting the Long-Run Data



The Context. We examine the "Kaldor Facts"—the stylized realities of the U.S. economy over the last century.

The Mechanism. We reconstruct the Neoclassical Model not as abstract theory, but as the logical solution to historical puzzles.

The Goal. To build a quantitative tool that accounts for the magnitudes of growth, capital, and labor choices.

Tiempos Headline

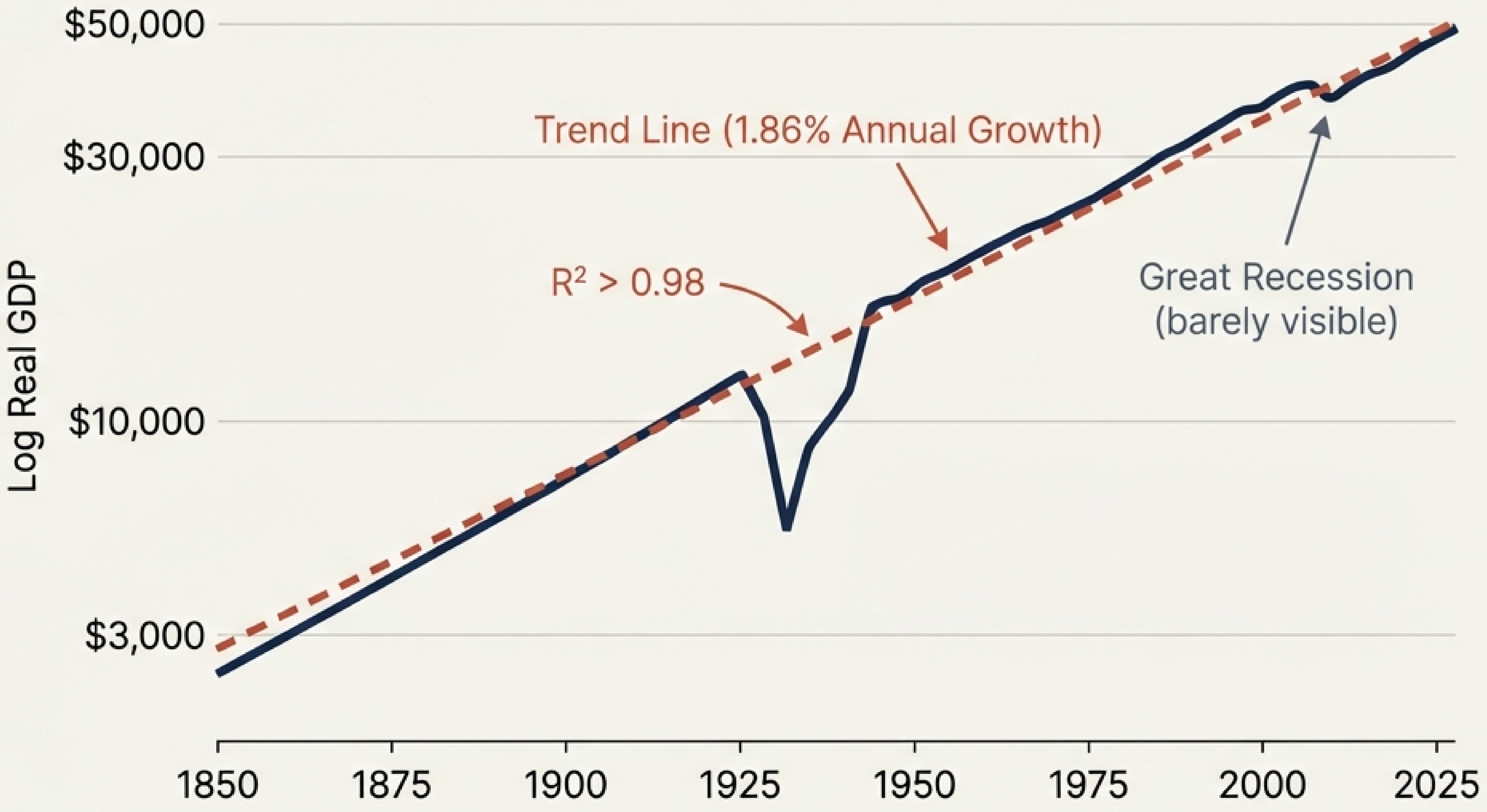
The economy relentlessly returns to a steady growth path

Real GDP per Capita (Log Scale), 1850–2025

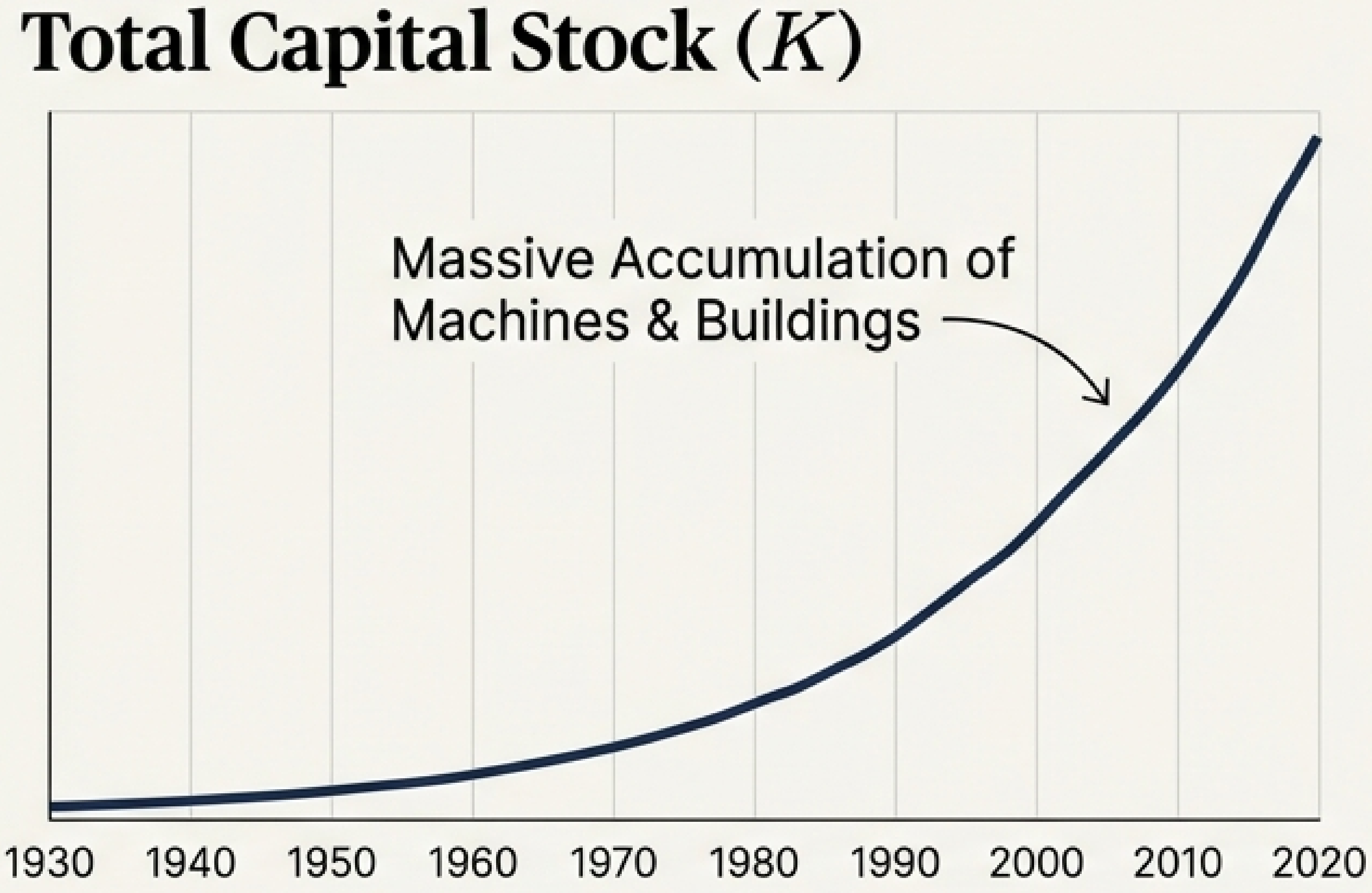
From a bird's-eye perspective, the defining characteristic of the last 150 years is not volatility, but steady, exponential growth.

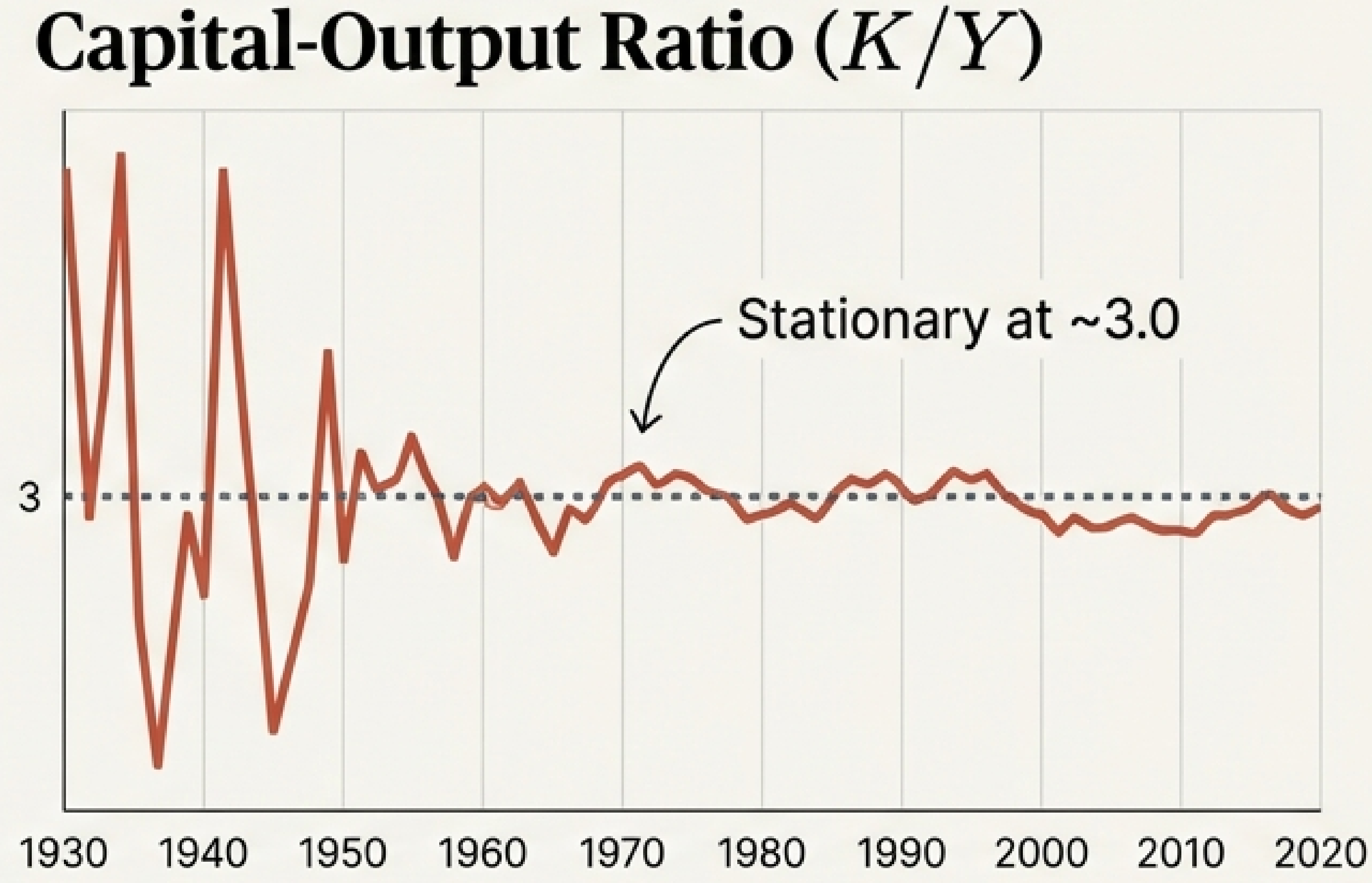
Despite wars and depressions, the U.S. economy lands back on the same trajectory.

Our first challenge is to account for this regularity.



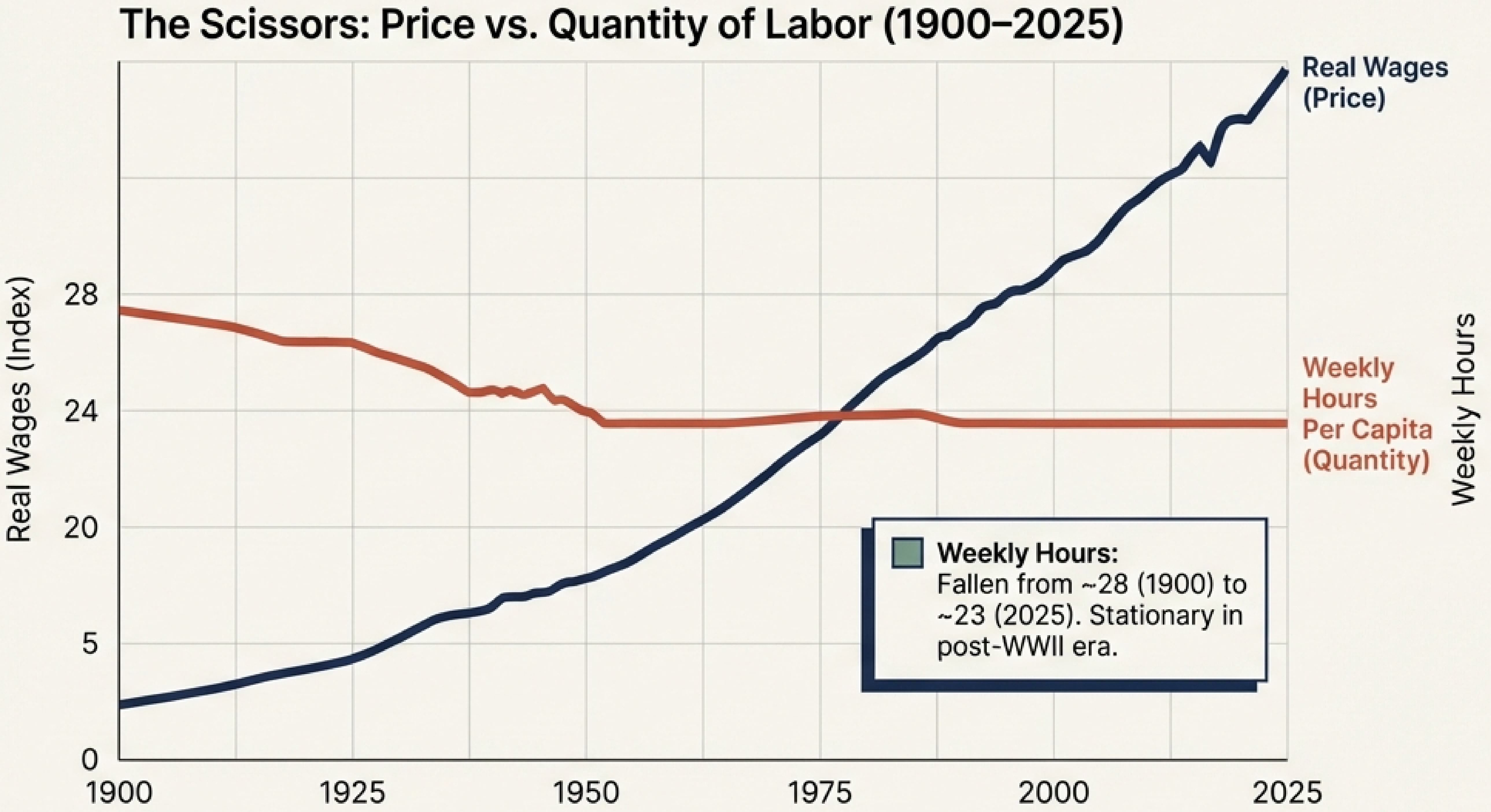
We accumulate capital endlessly, yet its relative size remains constant





Theory suggests that as we get richer, we accumulate more “stuff.” The data confirms this (Left). Yet, the ratio of Capital to Output does not trend upward (Right). It fluctuates, but persistently returns to a constant value. This paradox of “Stationarity amidst Growth” is the central puzzle the Solow model must solve.

Wages rise in lockstep with output, while work hours remain flat



The Puzzle

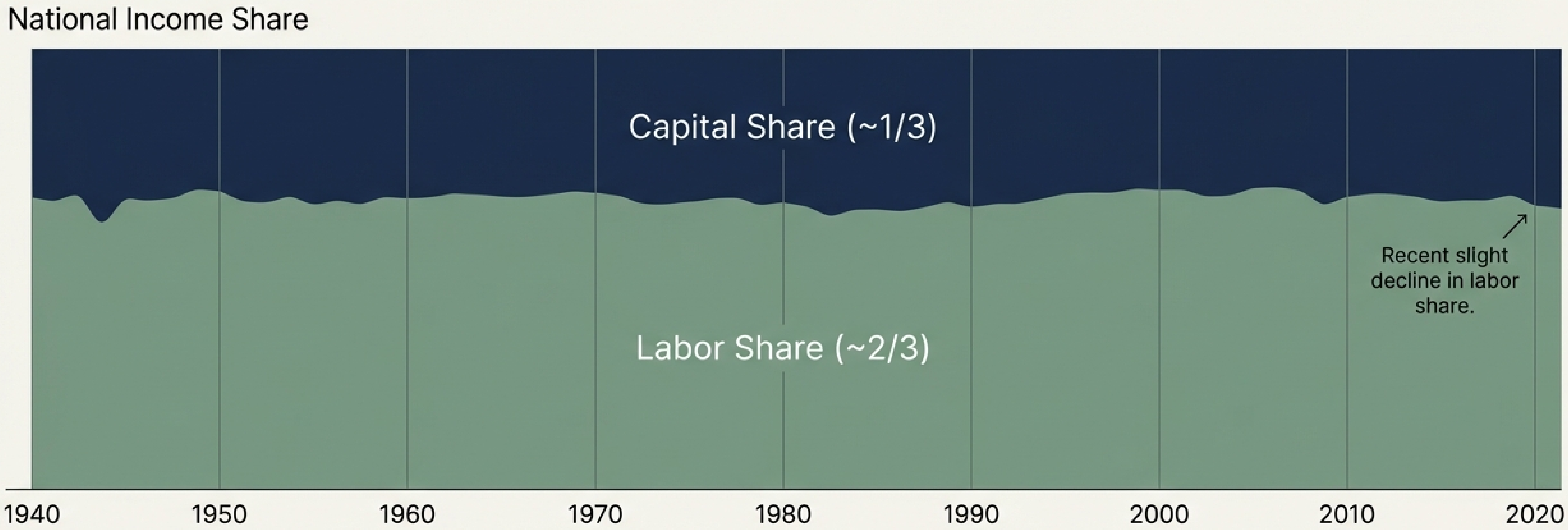
In standard economics, when labor gets expensive (wages rise), we should buy less of it.

Yet employment remains robust.

Simultaneously, as workers become wealthier, they could choose to work zero hours, yet they stabilize at a standard work week.

Why?

The division of the economic pie has remained remarkably stable



This is the most famous 'Kaldor Fact.' Despite the transition from manufacturing to services, and the digital revolution, roughly 66 cents of every dollar produced has historically gone to workers, and 33 cents to owners of capital. Our model must mathematically enforce this stationarity.

The Neoclassical Function resolves the conflict

$$Y = AK^{\alpha}L^{1-\alpha}$$

The Cobb-Douglas Production Function

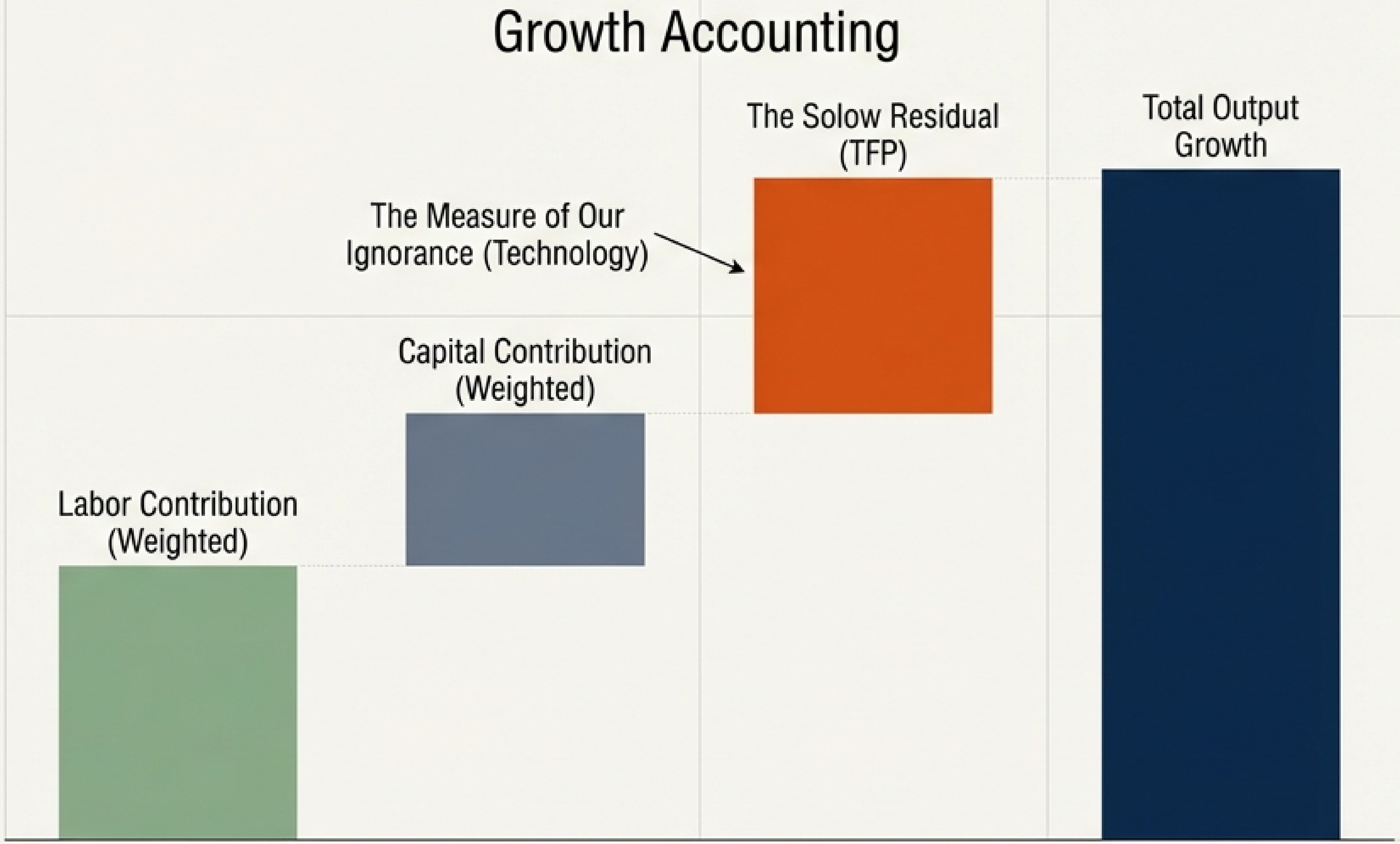
Diminishing Returns to Capital. As K rises, its marginal benefit falls, stabilizing the return on return on investment.

Total Factor Productivity. The multiplier that lifts the whole curve.

Labor Share parameter. Mathematically locks the income division to constant shares (e.g., 0.66), regardless of growth.

Solow's “Aha!” Moment: If labor becomes more expensive, firms substitute with capital. In a competitive market with this specific function, that substitution exactly offsets the price increase, keeping shares constant.

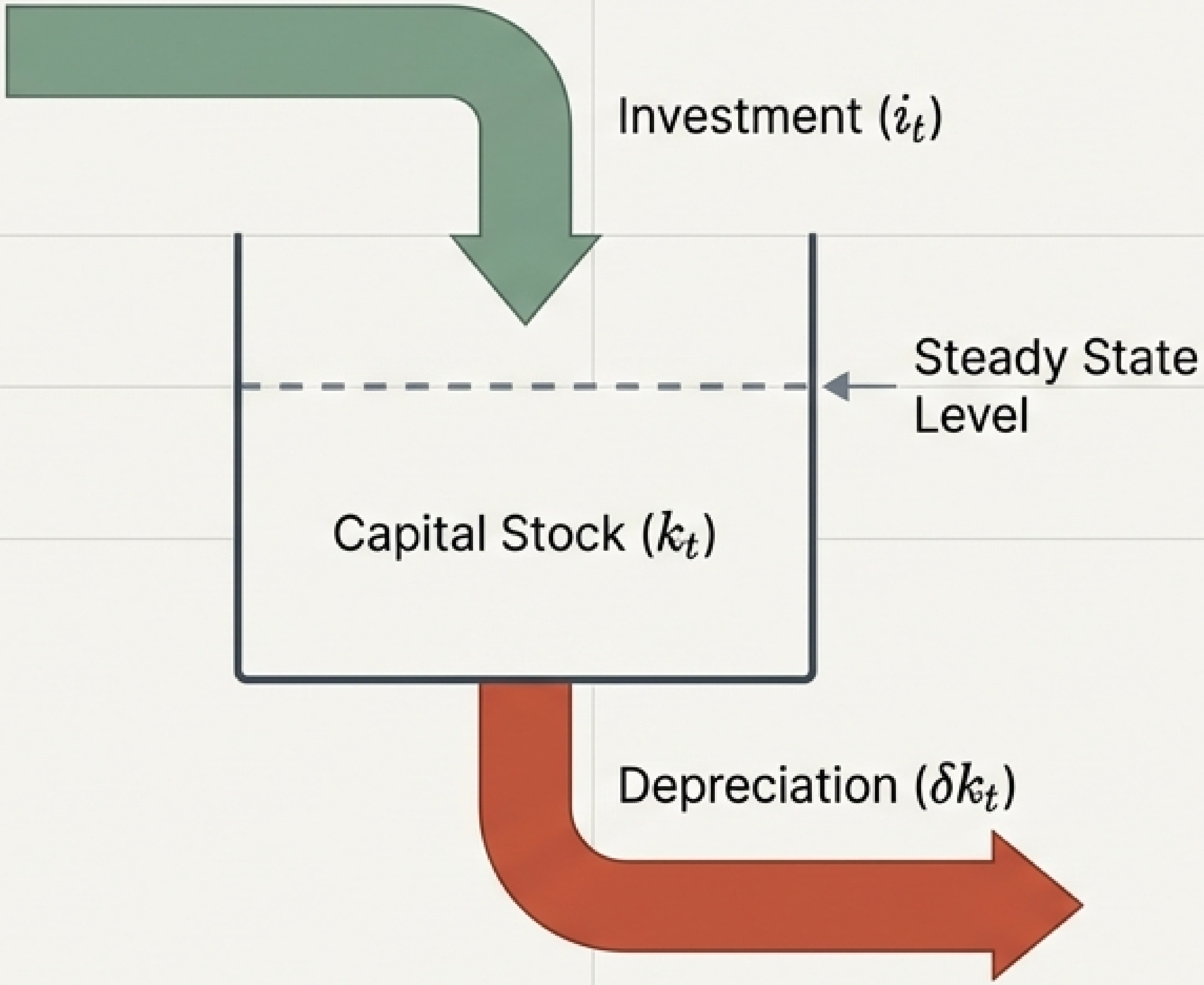
Decomposing the ‘Miracle’: Inputs vs. Efficiency



$$\frac{dy}{y} = \frac{dz}{z} + \alpha\left(\frac{dk}{k}\right) + (1-\alpha)\left(\frac{dl}{l}\right)$$

By subtracting the measurable inputs (Capital and Labor) from the total growth, we are left with the Residual. Historical data puts this “manna from heaven” at just under 2% per year—shifting the production frontier outward even when inputs are constant.

The Dynamic Engine: Reaching a Balanced Growth Path



$$k_{t+1} = (1 - \delta)k_t + i_t$$

Stationarity Condition: Flow In = Flow Out.

The model predicts a constant Capital-Output ratio: $k/y = s/(\gamma + \delta)$.

Validation: Plugging in U.S. data ($s \approx 0.30, \gamma \approx 0.02, \delta \approx 0.08$) yields a ratio of exactly 3. The model matches reality.

Convergence: The magnetic pull of the Balanced Growth Path

This explains the resilience seen in Slide 2.

The further an economy is below its potential (e.g., after the Great Depression), the more powerful the forces pushing it back to trend.

The ‘Ghost in the Machine’: Moving from parameters to people

$\$s \quad l \longrightarrow$

Choice:
Consumption vs. Savings

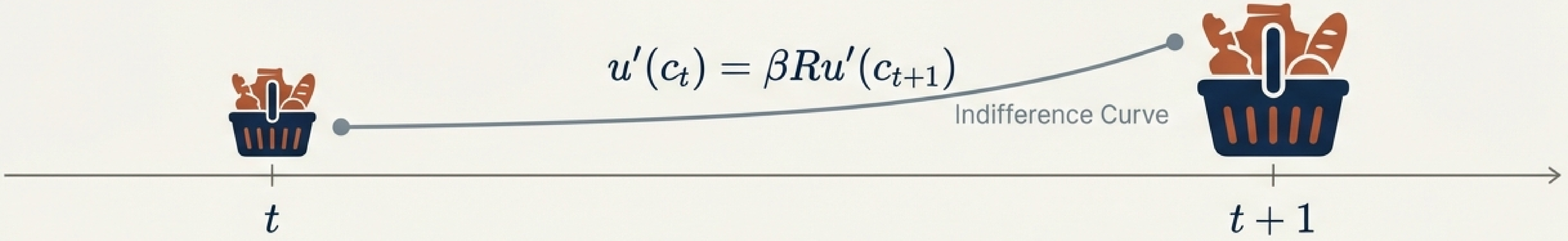
Choice:
Wages vs. Leisure

Critique: The mechanical Solow model assumes investment (s) and labor (l) are fixed constants.

Refinement: In reality, these are choices. We must use Microfoundations (Utility Maximization) to “rationalize” why these variables have remained stable for a century.

Rationalizing Savings: The Euler Equation

Consumption Smoothing



The Logic: We balance the pain of saving today against the pleasure of consuming with interest tomorrow.

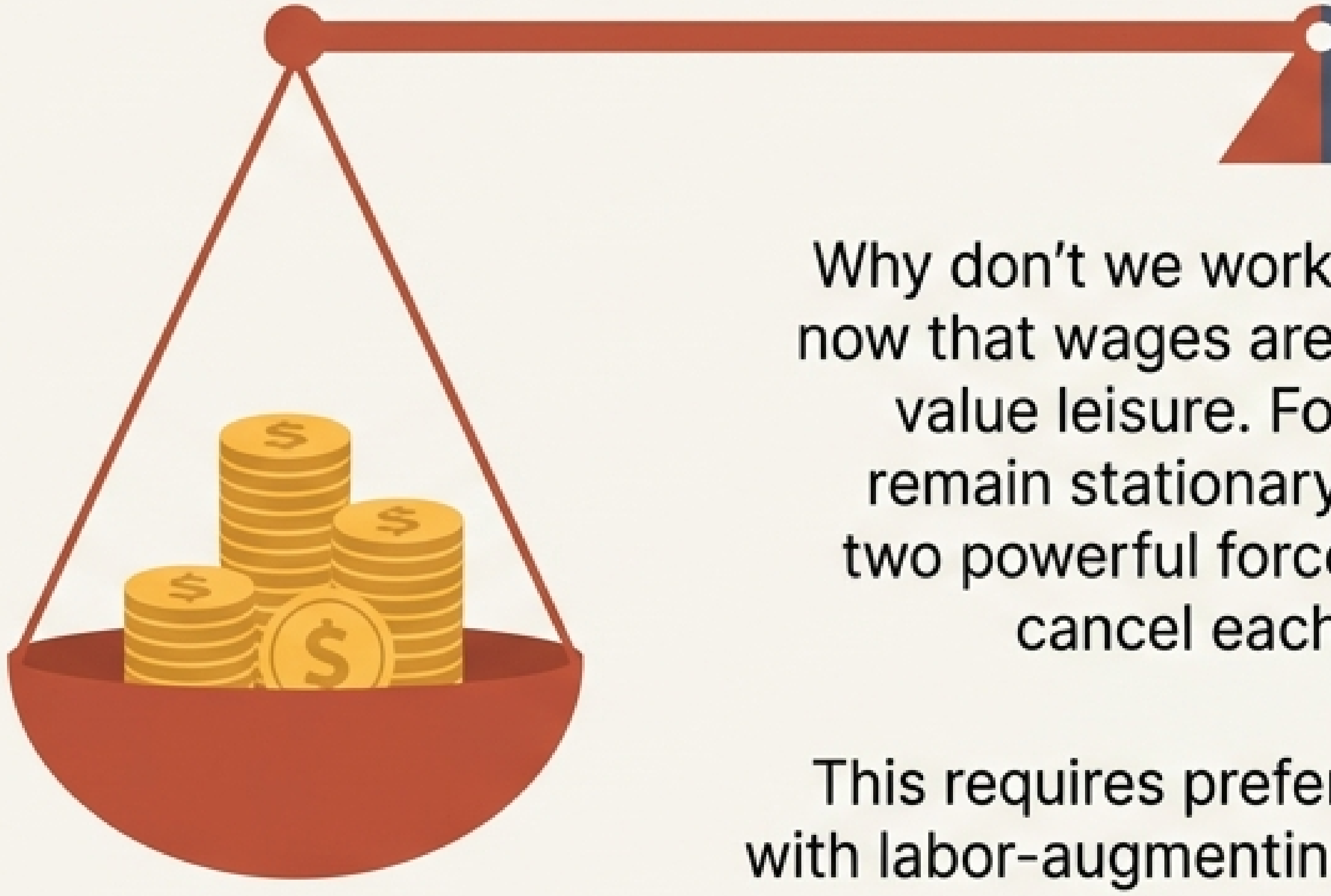
The "Only" Solution: For the savings rate to remain constant while the economy grows endlessly, Income and Substitution **effects** must cancel out. This is only mathematically possible if Utility is a Power Function (CRRA):

$$u(c) = \frac{c^{1-\sigma} - 1}{1 - \sigma}$$

We choose this function because it is the only one consistent with U.S. history.

Rationalizing Labor: The tug-of-war between Income and Substitution

Substitution Effect

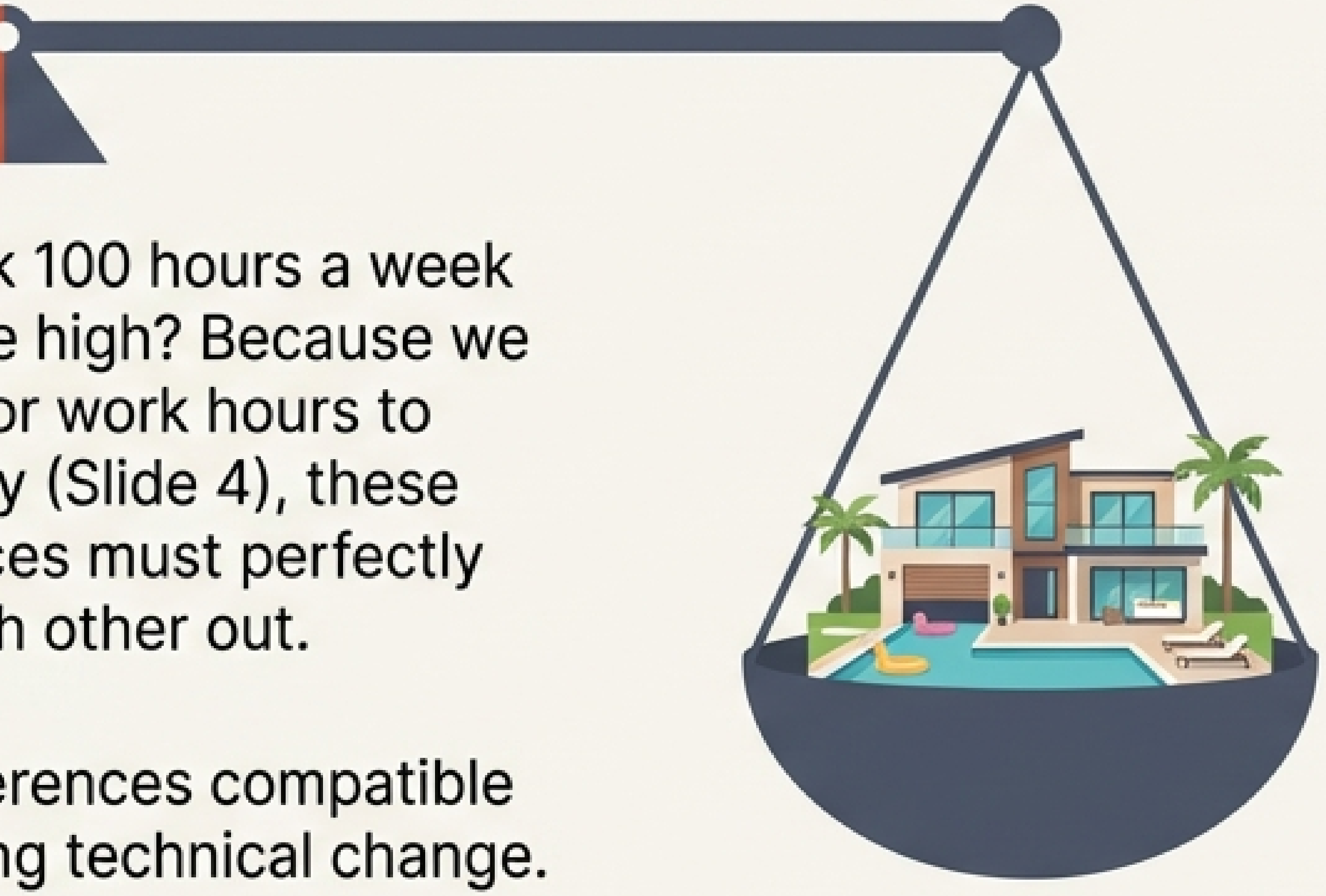


Leisure is expensive.
Work More.

Why don't we work 100 hours a week now that wages are high? Because we value leisure. For work hours to remain stationary (Slide 4), these two powerful forces must perfectly cancel each other out.

This requires preferences compatible with labor-augmenting technical change.

Income Effect



I am rich.
Enjoy Life.
Work Less.

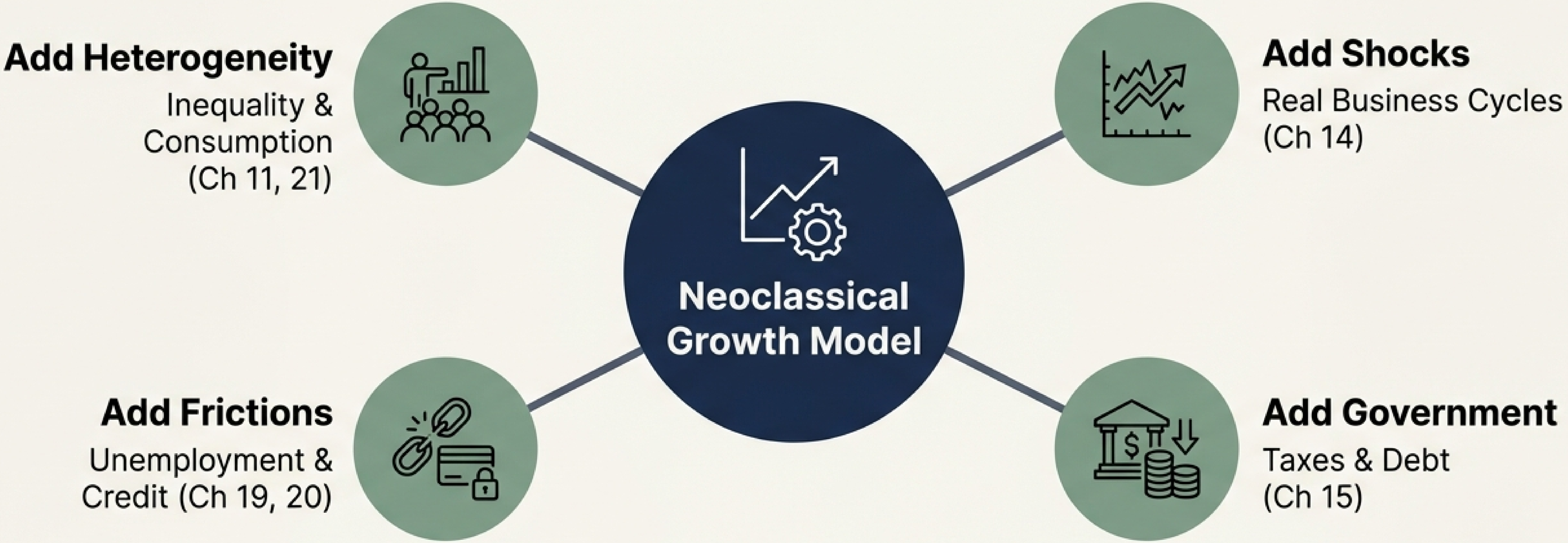
The Neoclassical Scorecard

A quantitative match for the stylized facts

Observed Reality (The Fact)	Model Mechanism (The Explanation)
Capital-Output ratio is constant (~3)	Balanced Growth Path with constant Savings Rate ✓
Labor Share is constant (~0.66)	Cobb-Douglas Production Function ($(1-\alpha)$) ✓
Wages grow at rate of Output	Labor-Augmenting Technology (Uzawa Theorem) ✓
Return on Capital is stable	Diminishing returns offset by Tech Growth ✓

The framework is not just a theory; it is a calibrated mirror of the aggregate data.

Extending the Framework: From the skeleton to the full body



This chapter built the skeleton. By identifying specific market imperfections, we can use this same workhorse model to analyze policy, inequality, and financial crises.

A tool for welfare, not just observation

By basing macroeconomics on utility maximization, we treat people not as variables, but as agents maximizing their well-being. This allows us to judge economic policies not just by how much they increase GDP, but by how they impact human welfare.

The Neoclassical Framework is the essential bridge between the data of the past and the policy choices of the future.