Based on THE NEW KALDOR FACTS: IDEAS, INSTITUTIONS, POPULATION, AND HUMAN CAPITAL

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Kaldor Facts
In 1961, Nicolas Kaldor stated six now famous “stylized” facts. He used them to summarize what economists had learned from their analysis of 20th-century growth and also to frame the research agenda going forward.
1. Labor productivity has grown at a sustained rate.
2. Capital per worker has also grown at a sustained rate.
3. The real interest rate or return on capital has been stable.
4. The ratio of capital to output has also been stable.
5. Capital and labor have captured stable shares of national income.
6. Among the fast growing countries of the world, there is an appreciable variation in the rate of growth “of the order of 2–5 percent.”
\[
\dot{K} = sY - \delta K = sF(K, A(t) L) - \delta K
\]
\[
= sA(t) LF \left( \frac{K}{A(t) L}, 1 \right) - \delta K
\]
\[
\dot{L} = n; \quad \dot{A} = \theta; \quad x(t) = \frac{K(t)}{A(t) L(t)}
\]
\[
\dot{x} = sF \left( \frac{K}{A(t) L}, 1 \right) - (\delta + n + \theta) x
\]
\[
= sf(x) - (\delta + n + \theta) x
\]
\[
\gamma = \frac{\dot{x}}{x} = s \frac{f(x)}{x} - (\delta + n + \theta)
\]

At the steady state \( x^* \)

\[
\dot{x} = sf(x^*) - (\delta + n + \theta) x^* = 0
\]
Fact 1: At the steady state \(x^*, \frac{Y}{AL} = F\left(\frac{K}{A(t)L}, 1\right) = F(x^*, 1)\) is constant, so labor productivity \(\frac{Y}{L}\) grows at the same rate as \(A\).

Fact 2: At the steady state \(x^* = \frac{K(t)}{A(t)L(t)}\) becomes constant but then capital per worker \(k = \frac{K(t)}{L(t)}\) grows at the rate \(A\).

Fact 3: The return on capital at the steady state, \(\frac{\partial F(x^*,1)}{\partial x} = \frac{\partial f(x^*)}{\partial x}\) has to be constant.

Fact 4: The capital output ratio \(\frac{K}{Y} = \frac{K}{Y}\) is constant since \(\frac{Y}{L}\) and \(\frac{K}{L}\) both grow at rate \(A\).

Fact 5: Let \(Y = K^\alpha (AL)^{1-\alpha}\) (Cobb-Douglas). Constant labor share:

\[
L \frac{\partial Y}{\partial L} = L \left( \left( (1-\alpha)AK^\alpha (AL)^{-\alpha} \right) \right) = \left( (1-\alpha)A^{1-\alpha}K^\alpha (L)^{1-\alpha} \right) = (1-\alpha)
\]

Fact 6: \(A\) differs across countries.
New Facts?
Fact 1: Increases in the extent of the market. Increased flows of goods, ideas, finance, and people — via globalization, as well as urbanization — have increased the extent of the market for all workers and consumers.

Figure 1: The Rise in Globalization

World Trade / World GDP (percent, left scale)
World FDI / World GDP (percent, right scale)

Note: World trade is the sum of world exports and imports as a share of world GDP from the Penn World Tables 6.1. FDI as a share of GDP is from the World Bank’s *World Development Indicators*.
"While trade and FDI are key facets of the rising extent of the market, the fact itself is even broader and includes the flow of ideas and people, within as well as across borders. International flows of ideas are indicated by cross-country patent statistics. For example, in 1960, 83% of patents granted by the U.S. Patent and Trademark Office were to domestic entities. In recent years, that fraction has fallen to about 50%. Within countries, urbanization rates have risen sharply. The fraction of the world’s population living in cities increased from 29.1% in 1950 to 49.4% in 2007 and is projected to rise even further to 69.6% by 2050 (United Nations, 2008). Finally, with the rise of the World Wide Web, information flows both across and within countries have exploded."

Interpretation: Increased connectedness helps spread ideas (nonrival ideas-technology diffusion) that increase productivity worldwide. There may be increasing returns in ideas: the more ideas there are, the cheaper it is to produce new ideas.
Fact 2: Accelerating growth: For thousands of years, growth in both population and per capita GDP has accelerated, rising from virtually zero to the relatively rapid rates observed in the last century.

Figure 2: Population and Per Capita GDP over the Very Long Run

Log Scale, Initialized to 1.0

Note: Population and GDP per capita for “the West,” defined as the sum of the United States and 12 western European countries. Both series are normalized to take the value 1.0 in the initial year, 1 A.D. Source: Maddison (2008).
Figure 4.2 World Population, 10,000 B.C. to A.D. 2005

"Nordhaus (1997) provides a tangible example linking accelerating growth to ideas in his famous “price of light” calculation. Between 38,000 B.C. and 1750 B.C., the real price of light fell by a total of about 17%, based on the transition from animal or vegetable fat to sesame oil as a fuel. The use of candles and whale oil reduced the price by a further 87% by the early 1800s, an average annual rate of decline of 0.06% per year. Between 1800 and 1900, the price of light fell at an annual rate that was 38 times faster, 2.3%, with the introduction of the carbon filament lamp. And then in the 20th century, the price of light has fallen at the truly remarkable pace of 6.3% per year with the use of tungsten filaments and fluorescent lighting. New ideas are very clearly at the heart of this accelerating productivity growth."

Interpretation: More people over time lead to more ideas. Feedback loop between population growth and ideas? Or is it a Malthusian process?
Here is a very simple economic model to combine the Mathusian idea with the notion that the larger the population, the more non-rival ideas are produced.

\[ Y_t = A_t X^\beta L_t^{1-\beta}, \quad 0 < \beta < 1 \]

where \( X \) is fixed land, \( Y_t \) is output and \( L \) is population.

New ideas are produced by people, even as they produce goods, \( Y \):

\[ \dot{A}_t = \alpha L_t \]

Mathusian assumption: Population adjusts instantly to "subsistence" level 1:

\[ \bar{y} = \frac{Y_t}{L_t} = 1 \]

Substituting the last two equations into the first:

\[ \dot{A} = \alpha X (A_t)^{\frac{1}{\beta}} \]

Since \( \frac{1}{\beta} > 1 \), growth of ideas is accelerating. Do you agree with the second equation \( \dot{A}_t = \alpha L_t \), ?
Fact 3: Variation in modern growth rates: The variation in the rate of growth of per capita GDP increases with the distance from the technology frontier.

Triangle Shape: The lower the income, the faster the catchup? Evidence for convergence clubs (even after adjusting for savings rates etc??)

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Fact 4: Large Income and TFP differences: Differences in measured inputs explain less than half of the enormous cross-country differences in per capita GDP.

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Fact 5: Rising human capital: Human capital per worker is rising throughout the world.

As we saw, this rise in education could raise "effective units of labor" and prevent the fall of the marginal product (return) on capital.
Fact 6: Long-run stability of relative wages: The rising quantity of human capital relative to unskilled labor has not been matched by a sustained decline in its relative price.

Skilled biased technical change?? Supply vs Demand for college graduates? For the new 6 Facts, do we need a Grand Unified Theory?