Department of Economics and Centre for Macroeconomics public lecture

The Rise and Fall of American Growth

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The Current Growth Slowdown from the Perspective of the Special Century

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May 11, 2016
Secular Stagnation: The Perspective in 2016

• Today 2015: slowing potential GDP growth
  – Potential Output per Hour
  – Potential Hours of Work
    • Working-age Population
    • Falling Labor-force Participation Rate (LFPR) reduces Hours per capita

Decline in Population Growth
As Seen From 1938 and 2015

Figure 2. Annualized Five-Year Growth Rate of U. S. Population, 1875 to 2060.
Productivity Growth, 1937-40 vs. 2009-14

Figure 3A. Annual Growth Rate of Output per Hour, 1937-40 vs. 2009-14

<table>
<thead>
<tr>
<th>Year</th>
<th>Percent Per Year</th>
</tr>
</thead>
<tbody>
<tr>
<td>1937-40</td>
<td>3.8</td>
</tr>
<tr>
<td>2009-14</td>
<td>0.8</td>
</tr>
</tbody>
</table>
The best organizing principle to think about innovation is to distinguish among the industrial revolutions (IR #1, IR #2, IR #3).

The 1st IR occurred 1770-1840, continued impact through 1900

- Steam engine, railroad, steamships
- Cotton spinning and weaving
- Transition from wood to steel
The 2\textsuperscript{nd} IR occurred 1870-1920, continued impact through 1970

- Electricity, light, elevators, machines, air conditioning
- Internal combustion engine, vehicles, air transport
- Telephone, phonograph, movies, radio, TV
- Running water, sewer pipes, and the conquest of infant mortality
- Chemicals, plastics, antibiotics, modern medicine
- Utter change in working conditions, job & home
Why Did Productivity Grow Faster In the Century Before 1970? The One-Time-Only Inventions

- Polluting flames for light >> instant on-off electric light
- Factory power with steam engines and belts >> electric machine tools and hand tools
- Offices and home cold and hot >> central heating and air-conditioning
- Horses >> motor vehicles and air travel
- Mainly rural 1870 >> mainly urban 1950
Third Industrial Revolution

• Since 1960 the “EICT” Revolution
  – Entertainment: the evolution of TV from color to time-shifting and streaming
  – Information Tech – the evolution from mainframes to PCs, the web, and e-commerce
  – Communications: mobile phones, smart phones
  – Productivity enhancers: ATM, bar-code scanning, fast credit card authorization
The Three Eras of TFP Growth

Figure 1-2. Average Annual Growth Rates of Total Factor Productivity, Selected Intervals, 1890-2014
TFP Growth 1952-2015, Five-Year Moving Average
IR #3 Has Failed the TFP Test

• Failure #1: TFP growth post-1970 barely 1/3 of 1920-70

• Failure #2: IR #3 boosted TFP growth only briefly 1996-2004

• **STARTLING CONCLUSION:** HAS THE PRODUCTIVITY IMPACT OF THE THIRD INDUSTRIAL REVOLUTION ALREADY HAPPENED?
IR #3 Changed Business Practices, Pre-Internet Phase 1, 1970-1995

• 1970 mechanical calculators, repetitive retyping, file cards, filing cabinets
• 1970s. Memory typewriters, electronic calculators
• 1980s. PCs with word processing and spreadsheets
• Late 1980s. E-mail, electronic catalogs, T-1 lines, proprietary software
Completing the Change, 1995-2005

• Late 1990s. The web, search engines, e-commerce
• 2000-05 flat screens, airport check-in kiosks
• By 2005 the revolution in business practices was almost over
Eliminating the Middle in Publishing

• Newspaper publishing circa 1994
  – A newsroom of PC screens (not flat)
  – By then no linotype operator
  – Replaced by linked word processing and publication software
• Newspapers, magazines, books, academic papers
• The whole layer of secretaries, typesetters, middlemen had been eliminated before web browsers arrived
Paper to Electronic Catalogs

• Transformation from 1985 to 2005
  – University and public libraries
  – Parts departments at auto dealers
  – Ordering items at hardware stores
  – Selecting plants at nurseries/ garden shops

• All of these uses have in common
  – Not only are items listed and pictured
  – Available inventory, out-of-stock is indicated
  – Same information available at home as in the library or in the store
Transformation in Retailing
Completed by 2005

• 1980s and 1990s Wal-Mart led big box revolution with innovations in supply chain and inventory management
• Check-out revolution: bar-code scanners, credit/debit card authorization technology
• Impact of self check-out surprisingly small (is it surprising?)
More Achievements
Completed by 2005

• Finance and Banking
  – 1970s and 1980s, ATM machines
  – 1980s and 1990s. Transition from multi-million share trading days to multi-billion share days
  – Commonplace now: empty bank branches

• How Long Ago Were the Creations:
Summary: Stasis Everywhere You Look

• Offices use desktop computers and proprietary information as they did 10-15 years ago
• Retail stasis. Shelves stocked by humans, meat sliced at service counters, checkout bar-code scanning.
• Medicine: electronic medical records largely rolled out, little change in what nurses and doctors do
• Higher Education: cost inflation comes from rising ratio of administrative staff to instructional staff
TFP Growth 1952-2015, Five-Year Moving Average

Chart Title
Declining Business “Dynamism” Measured by New Firm Entry

Figure 5. Rate of New Firm Entry and Old Firm Exit, 1978-2011

New Firm Entry

Old Firm Exit

Percent

16
15
14
13
12
11
10
9
8
7
6

Stagnation Symptom #2: Declining Rate of Net Investment

Figure 17-6. Annual Ratio of Net Private Business Investment to Private Business Capital Stock, 1950-2014

Sources: BEA Fixed Assets Accounts, Tables 4.1, 4.4, and 4.7.
Stagnation Symptom #3: Growth in Manufacturing Capacity

Figure 17-5. Quarterly Annualized One-Year Change in Manufacturing Capacity, 1980-2015

#4 and #5: Computer Prices and the Demise of "Moore’s Law"

Figure 9a. Rate of Change of Deflator for Information and Communications Technology Equipment, 1975-2014

Source: NIPA Table 5.3.4

Figure 9b. Years Taken for Number of Transistors on a Chip to Double

Source: Intel Corporation website
Innovations Continue But How Important Are They? (I only look ahead 25 years)

• Medical Care
  – Life expectancy fell 2015 vs. 2014
    • US lower than Canada, Europe, and Japan
  – Stunning new report on death rates of whites aged 45-54
  – Life expectancy gap rich vs. poor (87 vs. 73)
  – Coming collision between physical wellness and mental illness (Alzheimers)
Innovations Continue But How Important Are They?

• Small Robots
  – Robots date back to 1961, continued development is evolutionary not revolutionary
  – Robot description from NYT

• 3-D Printing
  – Greatly speeded up speed and efficiency of designing prototypes, not mass production
Innovations Continue But Are Evolutionary Not Revolutionary

• Artificial Intelligence
  – Predominant uses of big data are in marketing, zero-sum game
  – Evolutionary change: legal searches, radiology reading, voice recognition, language translation, “Robo-advice”

• Driverless Cars and Trucks
  – Truck drivers don’t just drive trucks, they unload them and stock the shelves
  – Evaluation from Consumer Reports (May 2016)
Slower Growth Goes Beyond Innovation: The Four Headwinds

• The slowing contribution of education to economic growth
• The demographic headwind
• Rising inequality, bottom 99% vs. average including top 1%
• The fiscal headwind
First Headwind: Education

- A major driver of that epochal 20th century productivity achievement was education
  - High school completion rate has barely changed since 1970.
  - Most people drop out of 2-year community colleges
  - College completion is increasing but 40% of recent graduates are in jobs that do not require a college education
  - High cost, growing indebtedness
Education: International Comparisons

- Poor preparation for college. International PISA test scores rank out of 34 OECD countries: US #17 in reading, 20\textsuperscript{th} in science, 27\textsuperscript{th} in math
- U.S. has dropped from #1 to #16 in college completion as percent of population; same for high-school dropouts
- This will reduce future economic growth by -0.3 percent per year compared to the contribution of education to 20\textsuperscript{th} century growth
Demographic Headwind: Decline in Hours per Person

- Retirement of Baby-Boom Generation
- Reduction of Participation of Prime-Age Males
- Youth
  - Employment/Population Ratio 65% in 1988 to 46% in 2012. Only about 1/3 of this decline is accounted for by increased school participation
- Females 20 and Over
  - Labor Force Participation Rate rose 35% in 1968 to 58% in 2000, then fell back to 55% in 2012
Third Headwind: Inequality

• For 1993-2012 the gap between average real income growth of total vs. bottom 99% is -0.53 percent per year.

• This is continuing, it’s not over. Count the ways
  – CEO pay, sports and entertainment stars. ($10-15 million)
  – Wage pushbacks – lower wages, two-tier wages, shaving pension and medical care benefits
  – Firms pushing employees into part-time work to avoid paying medical care benefits
The Fiscal Headwind: Future Debt-GDP Ratio

- Adverse Future Implications
  - More children growing up in poverty
  - Greater likelihood of future high school dropping out
  - Greater likelihood of criminal activity

- Additional adverse effects: 1979-2009 percent with prison records
  - Whites: 4 to 28 percent
  - Blacks: 15 to 68 percent
Socioeconomic Changes: The Decline in Marriage

• Changes 1982 to 2008, children born out of wedlock
  – White high school grads 4 to 34 percent
  – Black high school grads 48 to 74 percent

• Change 1960-2010, bottom 1/3 of white population
  – For 40-year-old women percent of children living with both biological parents declined from 95 to 34 percent
Adverse Future Implications

• Future consequences of single-parent households
  – More children growing up in poverty
  – Greater likelihood of future high-school dropping out
  – Less likelihood of completing college

• Additional adverse effects:
  – 46 percent of 20-24 age black males in Chicago are neither at work or in school (NY & LA 32 percent)
  – 1979-2009 percent of white high school dropouts with prison records 4 to 28 percent
  – Blacks 15 to 68 percent
Combined Effects of Headwinds

- Education headwind reduces productivity growth
- Demographic headwind reduces hours per person
- Inequality headwind reduces median growth below average growth
- Fiscal headwind raises taxes or reduces transfer payments
Figure 18-5. Annual Growth Rate of Alternative Real Income Concepts, Actual Outcomes 1920-2014 and Projected Values 2015-2040

Source: Data underlying Table 18-4.
Conclusions

- 70 percent of all TFP growth since 1890 occurred 1920-70, attributed to IR #2
- The big impacts on TFP of IR #3 were largely completed by 2005
- Innovation continues but is less important
- Much of the slowdown in future growth is caused by the headwinds
- A moderate pace of innovation means that jobs will not disappear *en masse* as predicted by the techno-optimists
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