Middle-Class Incomes and Innovation Policy

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1. Trends in Middle-Class Incomes

2. Sources of the Productivity Slowdown

3. Policies to Boost Innovation
   a) Increasing Public Investment
   b) Encouraging Private Investment
   c) Intellectual Property Policy
   d) Competition Policy (Defined Broadly)

4. Innovation and Inequality
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Middle-Class Income Growth Has Slowed in Recent Decades

<table>
<thead>
<tr>
<th></th>
<th></th>
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</tr>
</thead>
<tbody>
<tr>
<td>Median Family Income (Census Bureau)</td>
<td>3.0%</td>
<td>0.4%</td>
</tr>
<tr>
<td>Median Household Income with Benefits (CBO, adj. for household size)</td>
<td>N/A</td>
<td>0.5%</td>
</tr>
<tr>
<td>Median Household Income with Gov't Transfers/Taxes (CBO, adj. for household size)</td>
<td>N/A</td>
<td>1.0%</td>
</tr>
</tbody>
</table>

Note: Income levels from the Census Bureau are deflated with the CPI-U-RS price index, and income levels from the Congressional Budget Office (CBO) are deflated with the personal consumption expenditures price index. CBO median income is extended before 1979 and after 2013 with the growth rate of Census median household income. Source: World Wealth and Income Database; Census Bureau; Congressional Budget Office; CEA calculations.
## Determinants of Middle-Class Income Growth

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Labor Productivity Growth (Annual Average)</strong></td>
<td>2.8%</td>
<td>1.8%</td>
</tr>
<tr>
<td><strong>Income Shares</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Top 1 Percent</td>
<td>11% → 8%</td>
<td>8% → 18%</td>
</tr>
<tr>
<td>Bottom 90 Percent</td>
<td>66% → 68%</td>
<td>68% → 52%</td>
</tr>
<tr>
<td><strong>Labor Force Participation Rate</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Men, 16 and Older</td>
<td>87% → 79%</td>
<td>79% → 69%</td>
</tr>
<tr>
<td>Women, 16 and Older</td>
<td>33% → 45%</td>
<td>45% → 57%</td>
</tr>
</tbody>
</table>

Some Thought Experiments

### Counterfactual Scenarios for Productivity, Equality, and Participation

<table>
<thead>
<tr>
<th>Thought Experiment</th>
<th>Factor</th>
<th>Base Period</th>
<th>Percentage Impact on 2015 Average Income</th>
<th>Income Gain to 2015 Typical Household</th>
</tr>
</thead>
<tbody>
<tr>
<td>Productivity</td>
<td>Total Factor Productivity Growth</td>
<td>1948-1973</td>
<td>65%</td>
<td>$37,000</td>
</tr>
<tr>
<td>Inequality</td>
<td>Share of Income Earned by Middle 20%</td>
<td>1973</td>
<td>19%</td>
<td>$10,000</td>
</tr>
<tr>
<td>Participation</td>
<td>Female Labor Force Participation Rate</td>
<td>1948-1995</td>
<td>6%</td>
<td>$4,000</td>
</tr>
<tr>
<td>Combined Impact</td>
<td>All of the Above</td>
<td></td>
<td>108%</td>
<td>$61,000</td>
</tr>
</tbody>
</table>

Note: These thought experiments are intended to demonstrate the importance of these three factors for middle-class incomes. They do not consider second-order effects or interactive effects. The first thought experiment assumes that an increase in productivity is associated with an equal increase in the Census Bureau’s mean household income. The second thought experiment uses the Census Bureau’s mean income of the middle quintile as a proxy for median income. The third thought experiment assumes that newly-participating women will have the same average earnings as today’s working women. The first and third thought experiments assume that income gains are distributed proportionally such that mean and median incomes grow at the same rate. Dollar gains are calculated off a base of the Census Bureau’s median household income in 2013. The fourth thought experiment compounds the effects of the first three.

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A History of Productivity Growth in the United States

Labor Productivity, Nonfarm Business Sector
Percent Change, Annual Rate (Ten-Year Trailing Average)

Both Capital Deepening and TFP Growth Have Slowed in Recent Years

Source: Bureau of Labor Statistics, Multifactor Productivity; CEA calculations.

Labor Productivity, Private Nonfarm Business Sector
Percent Change, Annual Rate (Trailing Ten-Year Average)

- Contribution of Capital Intensity
- Total Factor Productivity
- Contribution of Labor Composition
- Labor Productivity

Source: Bureau of Labor Statistics, Multifactor Productivity; CEA calculations.
Average Annual Productivity Growth Has Slowed in All of the G-7 Economies

Source: Conference Board, Total Economy Database; CEA calculations.

Labor Productivity Growth, G-7 Countries

Percent, Annual Rate

1995-2005
2005-2015

United States
Canada
Japan
Germany
France
United Kingdom
Italy

Source: Conference Board, Total Economy Database; CEA calculations.
The Sources of the Productivity Slowdown Vary by Country


Change in Average Annual Growth Rate, Percentage Points

- Total Factor Productivity and Labor Composition
- Capital Deepening

Source: Organisation for Economic Co-operation and Development; CEA calculations.
All G-7 Countries Have Seen Slowdowns in Capital Deepening

Source: Organisation for Economic Co-operation and Development; CEA calculations.
Investment Busts Tend to Be Followed by Booms, But Total Factor Productivity Growth is Positively Serially Correlated

Correlation of Five-Year Growth with Prior Five Years' Growth, Labor Productivity and Components (1953-2015)

- Labor Productivity Growth: 0.16
- Total Factor Productivity Growth: 0.10
- Capital Deepening: -0.35

Candidates for Source of Slowdown in TFP Growth

1. Demography: increasingly older population is less innovative (Feyer 2007; Aiyar, Ebeke, and Shao 2016)

2. Lags due to innovation waves or recent subpar investment (Syverson 2013; McAfee and Brynjolfsson 2014; CEA 2016)

3. Low-hanging fruit has been taken (Gordon 2016; Bloom, Jones, Van Reenan, and Webb 2016)

4. Reduced dynamism/competition/churn (OECD 2015; Davis and Haltiwanger 2014; Furman 2016)
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Private R&D Has Grown Rapidly in Recent Years, Hitting Records As a Share of GDP

Real Private Research and Development (R&D) Investment Growth, 2001-2016

Four-Quarter Percent Change

1990-2012 Average (2.9%)

1993-2012 Average (2.9%)

2013-2016 Average (3.8%)

Source: Bureau of Economic Analysis, National Income and Product Accounts; CEA calculations.
Federal Research Has Declined As a Share of GDP Since the 1960s

Source: Bureau of Economic Analysis, National Income and Product Accounts; CEA calculations.
Total R&D Nearing the President’s 3% Goal, With the Composition Shifting to Business Instead of Government

R&D Funding by Source, 1953–2015

Source: National Science Foundation; Bureau of Economic Analysis, National Income and Product Accounts; CEA calculations
Government Contributes Disproportionately to Basic Research

Research and Development by Funding Source, 2013

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Business Tax Reform: Increasing *quantity* of investment or *quality* of investment.

Revenue-Neutral Reform: Hard time substantially increasing quantity, but can increase neutrality, reducing distortions and resulting in better allocation of capital.

Two Methods Intended to Increase Innovation:
- **R&E Credit**: Subsidizes inputs to production
- **Innovation Box (or Patent Box)**: Subsidizes outputs of research
Reasons to Prefer an R&E Credit to an Innovation Box

1. An R&E credit better addresses positive the externality of more basic research spillovers. In contrast, an innovation box rewards more commercializable research.

2. An innovation box leads to windfall gains by rewarding luck, market power, and supernormal returns.

3. An innovation box leads to windfall gains by rewarding past research.

4. An innovation box raises tax policy considerations: it does not improve cash flow (which may matter to more credit-constrained companies), its cost is highly uncertain and potentially very large, and it entails substantial complexity and potential for abuse.
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Patenting has increased rapidly in recent years.

Source: U.S. Patent and Trade Office.

**Patent Grants and Stock: 1964-2012**

- New Patent Grants
- GDP-Deflated Patent Stock (1981=100)

- Chemical
- Computer
- Other

Index of Patents / GDP

Source: U.S. Patent and Trade Office.
Patent Litigation Has Increased Rapidly, Especially Suits by Non-Practicing Entities

Note: AIA stands for the Leahy-Smith America Invents Act.
Source: USPTO; FJC; Lex Machina; CEA calculations; RPX Corporation, 2013 NPE Litigation Report.
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Over the Last 35+ Years, Firm Exit Has Remained Relatively Steady but the Firm Entry Rate Has Decreased Substantially.
Labor Market Dynamism Has Been Declining for Decades

**Source:** Census Bureau, Business Dynamics Statistics; CEA calculations.

**Graph:**

**Labor Market Dynamism, 1977-2014**

- **Job Creation**
- **Job Destruction**

**Rate (Percent)**

- 22
- 21
- 20
- 19
- 18
- 17
- 16
- 15
- 14
- 13
- 12
- 11

- 1975
- 1980
- 1985
- 1990
- 1995
- 2000
- 2005
- 2010
- 2015

**2014**
The Past 30 Years Have Seen an Increase in the Returns to Capital Relative to the Safe Rate of Return

Returns to Capital

- Return to Nonfinancial Corporate Capital
- Return to All Private Capital
- One-Year Real Interest Rate

Note: Shading denotes recession.
Source: Bureau of Economic Analysis; Federal Reserve; Bureau of Labor Statistics; CEA calculations.
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The Probability of an Occupation’s Automation Varies Dramatically by Wage and Educational Attainment

**Probability of Automation by an Occupation's Median Hourly Wage**

<table>
<thead>
<tr>
<th>Median Hourly Wage in 2010</th>
<th>Probability of Automation, Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Less than 20 Dollars</td>
<td>83</td>
</tr>
<tr>
<td>20 to 40 Dollars</td>
<td>31</td>
</tr>
<tr>
<td>More than 40 Dollars</td>
<td>4</td>
</tr>
</tbody>
</table>

**Share of Jobs with Highly Automatable Skills, by Education**

<table>
<thead>
<tr>
<th>Education</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Less than High School Degree or Equivalent</td>
<td>44</td>
</tr>
<tr>
<td>High School Degree or Equivalent</td>
<td>19</td>
</tr>
<tr>
<td>Trade School Certificate</td>
<td>8</td>
</tr>
<tr>
<td>Associates Degree</td>
<td>6</td>
</tr>
<tr>
<td>Bachelors Degree</td>
<td>1</td>
</tr>
<tr>
<td>Graduate Degree</td>
<td>0</td>
</tr>
</tbody>
</table>

Children of Low-Income Parents Are Much Less Likely to Become Inventors Than Children of Higher-Income Parents

Source: Bell et al. (2016).

Figure 1: Probability of Patenting by Age 30 vs. Parent Income Percentile

Source: Bell et al. (2016).