Technology, Innovation, Employment and Wages
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Des Moines, Iowa
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The current unemployment rate is below any standard estimate of full employment.
The current expansion has set the record for consecutive months of employment growth.
But we have not had much growth in real compensation per hour.
Technology and Wages

Wages are tied to labor productivity

\[
W = 7.37 + 1.06 \frac{Q}{L} \quad \text{R-square} = 0.99
\]

\((21.4) \quad (196.6)\)

Growth in wages is tied to labor productivity

Hourly compensation is nearly 4 time its 1947 level. Productivity is nearly 5 times its 1947 level.

Source: Bureau of Labor Statistics Multifactor Productivity Database
Technology and Employment

Hours are tied to labor productivity

Source: Bureau of Labor Statistics Multifactor Productivity Database
Not everyone gains. Technologies complement high-skill and substitute for low-skill workers.

Real Wages have fallen for workers with less than a Bachelor’s degree.


https://www.everycrsreport.com/reports/R45090.html
As a country develops---labor demand shifts toward services and away from manufacturing and agriculture

Federal Reserve Bank of Dallas. 2007. *Opportunity Knocks Selling Our Services to the World*  
Technical change shifts the need for labor across sectors –

Flexible labor markets insure that benefits are spread across sectors

Example – the rural to urban shift
Slow growth in wages is driven by slow growth in labor productivity during the recovery.
Why are we experiencing slow productivity growth and should we care?

Labor market: We have lost flexibility
Innovation and investment: pace of innovation, entrepreneurship has slowed
Education: We no longer lead the world
Government: Loss of government support for basic research. Budget priorities? Regulation?

Implications for rural America
Advantage for the U.S. versus Europe and Japan: Flexible Labor Market

Productivity Enhanced by workers switching from shrinking to growing opportunities

About 25% of U.S. Productivity Growth is the demise of inefficient firms and the entry of efficient firms

Job Shopping: Average worker has 12 different jobs between 18-50. Average 6 jobs between 18-24.
The decline in Migration Rates in the United States

The U.S. population has gotten less mobile

Especially during the recession and recovery

Quarterly Rates of Job Reallocation, Worker Reallocation and Churning for the U.S. Nonfarm Private Sector, 1990 to 2013

Less mobility across jobs overall

Hires Plus Separations

Excess Hires Plus Separations

Job Creation and Destruction

Job Reallocation Rate by Major Sector, 1979 - 2010

Less mobility across and within industries

Changes in Job Reallocation Rates by State from 1988-90 to 1998-00 and from 1998-00 to 2008-2010

Less mobility in every state.

High labor flexibility has been tied to wage growth and productivity growth

At least part of the slow productivity growth is due to the decline of new start-ups
Percentage of Firms Surviving After up to 23 Years After Birth, Firm Birth Cohorts from 1994 - 2013

Why is innovation necessary?  
Most firms die

Source: Bureau of Labor Statistics, Business Employment Dynamics
The importance of innovation

Of the 100 largest firms in the world in 1912

29 declared bankruptcy (as of 1995)
7 are still among the 100 biggest firms (as of 2018)
Most have disappeared

Still in top 100: 7 firms based on current ranking in Fortune Global 500
Royal Dutch Shell: El Aguila; Exxon: Jersey Standard, Mobil, Virginia-Carolina Chem; BP: Amoco, Burmah Oil, ARCO, Anaconda; Chevron: Texaco, California Standard, Mexican Petroleum; General Electric; Siemens; Procter & Gamble

Why is innovation necessary?

Authors computations based on the U.S. Bureau of the Census Statistics of U.S. Businesses
Role of new firms as a source of job mobility has declined.

Share of Total Employment in firms aged 5 years or less

Effect is common across sectors

Effect is common across counties

But most severe in the least populous counties

Birth rates and death rates go together

Accumulated Net Births
Metro 11.9%
Rural -2.8%

Authors computations based on the U.S. Bureau of the Census Statistics of U.S. Businesses
Metro and large urban areas have dominated net firm entry, which means they dominate employment and wage growth.
Nonmetro wages lag metro wages by 14%

<table>
<thead>
<tr>
<th>Metro Areas</th>
<th>MEDIAN WAGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ames, IA</td>
<td>18.44</td>
</tr>
<tr>
<td>Cedar Rapids, IA</td>
<td>18.36</td>
</tr>
<tr>
<td>Davenport-Moline-Rock Island, IA-IL</td>
<td>16.66</td>
</tr>
<tr>
<td>Des Moines-West Des Moines, IA</td>
<td>18.68</td>
</tr>
<tr>
<td>Dubuque, IA</td>
<td>16.08</td>
</tr>
<tr>
<td>Iowa City, IA</td>
<td>17.72</td>
</tr>
<tr>
<td>Sioux City, IA-NE-SD</td>
<td>15.76</td>
</tr>
<tr>
<td>Waterloo-Cedar Falls, IA</td>
<td>16.36</td>
</tr>
<tr>
<td>Omaha-Council Bluffs, NE-IA</td>
<td>17.54</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Nonmetro Areas</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Northeast Iowa</td>
<td>15.34</td>
</tr>
<tr>
<td>Northwest Iowa</td>
<td>15.74</td>
</tr>
<tr>
<td>Southwest Iowa</td>
<td>15.3</td>
</tr>
<tr>
<td>Southeast Iowa</td>
<td>15.39</td>
</tr>
</tbody>
</table>
The Globalization of Innovation

We spend 2.8% of GDP on R&D vs. 2.3% average for the top 25 countries.
Basic Research is a public good. The U.S. has been cutting its public commitment.
Automatic Expenditures are Consuming a Growing Share of the Budget

Discretionary Spending as a share of GDP has declined since 1985

1973: 53% Discretionary, 40% Mandatory, 7% Net Interest
1993: 38% Discretionary, 49% Mandatory, 14% Net Interest
2013: 34% Discretionary, 60% Mandatory, 6% Net Interest
2023*: 24% Discretionary, 62% Mandatory, 14% Net Interest

Source: Congressional Budget Office, February 2013.
New technologies will be in information, energy, life sciences, biotechnology, defense.

Our ability to maintain our pace of technological growth depends on our ability to attract the best minds.
The Ethnic Share of U.S. Patents

Summary Statistics from the Annual Survey of Entrepreneurs, High Technology Sectors

Immigrants are 20% of High-Tech Entrepreneurs, 16% of population

Table 5. Descriptive Statistics: Innovation Measures

<table>
<thead>
<tr>
<th>VARIABLES</th>
<th>All</th>
<th>Immigrant</th>
<th>Native</th>
</tr>
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<tbody>
<tr>
<td>Innovation Activities</td>
<td></td>
<td></td>
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<tr>
<td>Innovation dummy</td>
<td>69.39</td>
<td>72.01</td>
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<tr>
<td>Innovation count</td>
<td>3.58</td>
<td>3.89</td>
<td>3.50</td>
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<td>Production Innovation dummy</td>
<td>56.90</td>
<td>60.55</td>
<td>56.00</td>
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<td>Process Innovation dummy</td>
<td>60.30</td>
<td>61.61</td>
<td>59.98</td>
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<tr>
<td>R&amp;D Activities</td>
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</tr>
<tr>
<td>R&amp;D activity (any type)</td>
<td>23.11</td>
<td>28.02</td>
<td>21.90</td>
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<tr>
<td>Work toward patent</td>
<td>13.40</td>
<td>16.98</td>
<td>12.52</td>
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<tr>
<td>Developed prototypes</td>
<td>13.29</td>
<td>17.18</td>
<td>12.34</td>
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<tr>
<td>Applied scientific/technic. knowled.</td>
<td>11.16</td>
<td>15.26</td>
<td>10.14</td>
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<tr>
<td>Produced publishable findings</td>
<td>9.68</td>
<td>12.55</td>
<td>8.97</td>
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<tr>
<td>Created generalizable research</td>
<td>11.34</td>
<td>15.73</td>
<td>10.26</td>
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<tr>
<td>Work to discover scientific facts</td>
<td>6.02</td>
<td>9.27</td>
<td>5.22</td>
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<tr>
<td>Work to extend understanding of scientific facts</td>
<td>10.51</td>
<td>14.37</td>
<td>9.56</td>
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<tr>
<td>Intellectual Property</td>
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<td>Copyright or Trademark</td>
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<td>16.79</td>
<td>20.83</td>
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<tr>
<td>Patent granted or pending</td>
<td>6.60</td>
<td>8.50</td>
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<tr>
<td>Observations</td>
<td>11,000</td>
<td>2,000</td>
<td>9,000</td>
</tr>
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</table>

Note: These are percentages of owners by innovation measures (except for innovation count) from the ASE high-tech sample.

Immigrants disproportionately start high tech businesses

Lead natives in 15/16 R&D measures
Small towns, small business have a disadvantage in attracting H1B visas

Universities and affiliated nonprofit research institutions are exempt from the H1B cap

Reductions in state support for research have reduced the Midwest presence of international researchers
The American Century was the Human Capital Century. The U.S. had the highest education levels in the world.

The U.S. has lost its advantage in educated labor.

Figure 1.5
U.S. Math Test Scores for 8th Graders Remain Below OECD Averages

The U.S. is falling further behind

Source: OECD, PISA 2009 database.

How are Technologies driving Farm Size and Farm Incomes?
Farm Size is a function of off-farm income opportunities and technological means to substitute for farm labor
Farm household income has averaged above nonfarm household income since 1995.

80% of farm household income is earned off the farm.
Proportion of Employed Individuals who work in another county, by size of county job market, 2009 - 2013

Number of Employed in the County

- ≤4,000
- 4,001 - 10,000
- 10,001 - 20,000
- >20,000

Proportion of Resident Employed in the County

- ≤4,000: 0.4
- 4,001 - 10,000: 0.35
- 10,001 - 20,000: 0.25
- >20,000: 0.2