Productivity Growth in U.S. and Midwest Agriculture

Keith Fuglie
Federal Reserve Bank of Chicago
November 27, 2018

The findings and conclusions in this preliminary presentation have not been formally disseminated by the U.S. Department of Agriculture and should not be construed to represent any agency determination or policy.

This research was supported by the intramural research program of the U.S. Department of Agriculture, Economic Research Service.
Productivity is the primary driver of growth in US agriculture

Source: Wang et al., Economic Research Service
Factors causing productivity to rise

- New technologies
- Economies of scale
- Specialization
- Much of this is driven by investments in research and development (R&D)
Technical change in corn production

Production is moving toward larger farms

Livestock consolidation has been significant everywhere except in beef cow-calf operations

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Annual Number Sold or Removed</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Broilers</td>
<td>300,000</td>
<td>480,000</td>
<td>681,600</td>
<td>680,000</td>
</tr>
<tr>
<td>Fed Cattle</td>
<td>17,532</td>
<td>38,000</td>
<td>35,000</td>
<td>38,369</td>
</tr>
<tr>
<td>Turkeys</td>
<td>120,000</td>
<td>137,246</td>
<td>157,000</td>
<td>160,000</td>
</tr>
<tr>
<td>Hogs</td>
<td>1,200</td>
<td>11,000</td>
<td>30,000</td>
<td>40,000</td>
</tr>
<tr>
<td><strong>Flock/Herd Size</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Egg Layers</td>
<td>117,839</td>
<td>300,000</td>
<td>872,500</td>
<td>925,975</td>
</tr>
<tr>
<td>Beef Cows</td>
<td>89</td>
<td>100</td>
<td>110</td>
<td>110</td>
</tr>
<tr>
<td>Milk Cows</td>
<td>80</td>
<td>140</td>
<td>570</td>
<td>900</td>
</tr>
</tbody>
</table>

Source: MacDonald & Hoppe, Economic Research Service
Compare: Major Consolidation in Dairy, None in Beef Cow-Calf

Half of all cows are in herds larger than the midpoint size, and half of cows are in smaller herds.

Source: MacDonald & Hoppe, Economic Research Service
Crop production is also moving toward larger farms

Cropland is consolidating, even as average farm size is unchanged

Half of all cropland acres are on farms with at least the midpoint acreage, and half are on farms with no more.

Source: MacDonald & Hoppe, Economic Research Service
Farms are becoming more specialized

Crop and livestock production are separating

The percent of livestock production originating on farms with no harvested crop acres

Source: MacDonald & Hoppe, Economic Research Service
Farms are focusing on fewer field crops

The percent of a crop’s production originating on farms with two or fewer crops

Source: MacDonald & Hoppe, Economic Research Service
Drivers of Consolidation and Specialization

Patterns—persistent and widespread—indicate that commodity programs and crop insurance cannot be the dominant forces.

Technology plays an important role, allowing a farmer or farm family to manage more acres or animals.

* Larger, faster, smarter equipment.
* Inputs and practices, tied to seeds and pest management, that reduce labor hours per acre of production.
* Animal housing and feeding systems that allow less labor, and effective management of larger herds/flocks.
For crop farms in the Cornbelt, total factor productivity (TFP) is higher on larger farms.

Points measure TFP relative to midsized farms in 1982 (=1.0).

Source: Nigel Key, Food Policy
What about natural resource use?

Environment inputs (or undesirable outputs) have stayed about the same or declined as farm output has increased.

Main policy instrument affecting productivity is investment in research and development (R&D)

Public investment in agricultural R&D has yielded high returns: at least $10 in benefits to the US economy per $1 in R&D spending (Fuglie & Heisey, Economic Research Service)

USDA Budget Allocation 2016

- Food & Nutrition 65%
- Research & Education 2%
- Natural Resources 7%
- Farm Services 17%
- Other Management 6%
- Risk Management 3%

Total FY2016 USDA budget authority = $166 billion

Sources: Economic Research Service using data from USDA Office of Budget and Program Analysis
The U.S. system for food and agricultural R&D (figures for 2013, in millions)

Source: Clancy, Fuglie & Heisey, Economic Research Service
Private-sector spending on agricultural R&D has eclipsed public-sector spending

Source: Clancy, Fuglie & Heisey, Economic Research Service
Challenges facing future growth in US agricultural productivity:

• Declining investment in agricultural R&D
  – Public sector since 2009
  – Private sector?

• Consumer apprehensions with some new technologies and farming practices

• Climate change
  – May negatively affect crop yields

• Water scarcity (western states) and other environmental issues
Contacts and References

- Keith Fuglie (kfuglie@ers.usda.gov)

ERS Amber Waves articles

Wang et al., U.S. Agricultural Productivity Growth: The Past, Challenges, and the Future

MacDonald & Hoppe, Examining Consolidation in U.S. Agriculture

Clancy, Fuglie & Heisey, U.S. Agricultural R&D in an Era of Falling Public Funding

ERS Reports

Wang et al., Agricultural Productivity Growth in the United States

MacDonald & Hoppe, Three Decades of Consolidation in U.S. Agriculture

Fuglie & Heisey, Economic Returns to Public Agricultural Research