An Empirical Analysis of the Attributes of New and Beginning Farmers in Illinois

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Abstract

This paper compares the characteristics of beginning operators and their farming operations with those of experienced producers using data from the census of agriculture. Results of data analysis reveal that 99% of all beginning producers are White. Of the very few minority beginning producers, N = 202, 44% are African Americans, 34% Asians, and 22% other minorities. A higher proportion of beginning farmers grow vegetables and engage in cattle, sheep, and goat farming, whereas experienced producers focus on oilseed and grain farming and dairy cattle. This research is a first step towards building up an empirically based set of observations and findings about beginning farmers.

Introduction

The concept of clustering arises from the recognition that the elements of a population could differ, but sub-groups which are homogeneous in one or more attributes of interest can be identified and enumerated. The sub-group which is of interest in this paper is new and beginning farmers, that is, farm operators with less than 11 years of farming experience. In the following pages, I compare

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the characteristics of beginning operators and their farming operations with those of experienced producers. Also, changes in the attributes of the beginning farmers are explored using data from both the 2012 Census of Agriculture and the 2017 Census of Agriculture.

**Conceptual Model**

The study of business strategy makes use of the experience-curve concept to prescribe product and pricing strategies. Experience curve is based on learning, or acquisition of knowledge; for example, people learn and hence do a given task in less time.

This 'learning' can be expressed as an equation, \( d = ay^{-(b)} \), where \( d \) is the total time to complete a specific task, \( y \) is the total cumulative years of experience in the job, and \( a \) and \( b \) are parameters.

The relationship between \( d \) and \( y \) is linear in logs, \( \ln(d) = a - b*\ln(y) \), as shown in Figure 1; it suggests that completion times decline by a constant proportion each time experience increases.

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3 The terms producer and operator are used interchangeably.
Methodology

Data are from the 2017 and 2012 Census of Agriculture\(^7\). Table 1 shows the variables used in the research; data analyses were conducted using the framework, 

\[ \text{Data} = \text{fit} + \text{residuals}. \]

Both, graphical and numerical analyses were performed.

Table 1: Variables and their Definitions

<table>
<thead>
<tr>
<th>Variable</th>
<th>Operational Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Farms</td>
<td></td>
</tr>
<tr>
<td>Operations</td>
<td>Number of farms.</td>
</tr>
<tr>
<td>Area</td>
<td>Area operated; five levels; 1 = LT 10 acres; 2 = 10 to 49 acres; 3 = 50 to 179 acres; 4 = 180 to 499 acres, and 5 = GT 500 acres.</td>
</tr>
<tr>
<td>Tenure</td>
<td>Three levels: 1 = full owner; 2 = part owner, and 3 = tenant.</td>
</tr>
<tr>
<td>NAICS</td>
<td>Industry classifications; 13 levels, from NAICS 1111 to NAICS 1129.</td>
</tr>
<tr>
<td>Economic class</td>
<td>Sum of value of agricultural products sold and Federal farm program payments; seven levels: 1 = less than $1,000, ..., 7 = GTE $50,000.</td>
</tr>
<tr>
<td>Producers</td>
<td></td>
</tr>
<tr>
<td>Gender</td>
<td>1 = Male; 2 = Female.</td>
</tr>
<tr>
<td>Race</td>
<td>1 = White; 2 = Black; 3 = Asian; 4 = American Indian or Alaska Native; 5 = Native Hawaiian or Pacific Islander.</td>
</tr>
<tr>
<td>Age</td>
<td>Age of the operator; six levels; 1 = LE 35; 2 = 35-44; 3 = 45-54; 4 = 55-64; 5 = 65 to 74; 7 = 75+.</td>
</tr>
</tbody>
</table>

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\(^7\) [https://www.nass.usda.gov/AgCensus/](https://www.nass.usda.gov/AgCensus/)
Findings

Majority of the beginning producers are male (67%). The proportions of beginning female producers are more than the proportions of experienced female producers; the opposite is true for males (Table 2).

Table 2: Gender Distribution of Beginning and Experienced Farmers

<table>
<thead>
<tr>
<th>Gender</th>
<th>Principal Producer</th>
<th>All Categories</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Beginning</td>
<td>Experience</td>
</tr>
<tr>
<td>Male</td>
<td>74%</td>
<td>67%</td>
</tr>
<tr>
<td>Female</td>
<td>26%</td>
<td>33%</td>
</tr>
<tr>
<td>N</td>
<td>19,803</td>
<td>26,995</td>
</tr>
</tbody>
</table>

Ninety-nine percent of all beginning producers are White. Of the very few minority beginning producers, N = 202, 44% are African Americans, 34% Asians, and 22% other minorities, for example, native Americans (Figure 2). Unlike the females in Table 2, minorities are minimally represented in the “beginning producer” category.

Figure 2: Producers’ Race
The beginning producers tend to be young, the modal age is less than or equal to 35. A majority are less than 45 years of age (51%) and slightly more than one-in-ten are older than 65.

While most beginning producers operate farms that are less than 50 acres in size, most experienced producers operate 50-179 acres. However, the relationship between producer status and area operated is nonlinear; a larger proportion of beginning producers operate farms that are 500 acres or more in size (Table 3).

Table 3: Acreage Operated: Beginning versus Experienced Producers

<table>
<thead>
<tr>
<th>Land Area</th>
<th>Beginning Producers</th>
<th>Experienced Producers</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 to 9.9 Acres</td>
<td>17%</td>
<td>11%</td>
</tr>
<tr>
<td>10 to 49.9 Acres</td>
<td>29%</td>
<td>27%</td>
</tr>
<tr>
<td>50 to 179 Acres</td>
<td>27%</td>
<td>31%</td>
</tr>
<tr>
<td>180 to 499 Acres</td>
<td>14%</td>
<td>21%</td>
</tr>
<tr>
<td>≥ 500 Acres</td>
<td>13%</td>
<td>10%</td>
</tr>
<tr>
<td>N</td>
<td>18,796</td>
<td>74,432</td>
</tr>
</tbody>
</table>

Note: Modal values are in bold.

A majority of beginning and experienced producers are full owners of their farms. However, a higher proportion of beginning producers tend to farm leased land (Figure 3). Appendix 1 compares data on beginning producers for the 2012 and 2017 census years.

Figure 3: Farm Tenure: Beginning and Experienced Producers

Note: N = 89,422 for experienced producers and 18,796 for beginning producers.
Learning Curve Effects

Table 4 lists the production choices of both beginning and experienced producers. The numbers seem similar; for both types of producers, oilseed and grain farming is the most preferred business and dairy cattle and milk production is one of the least preferred choices. However, a Chi-square test rejected the null hypothesis of independence between the variables. In other words, business choice is dependent on the type of operator, beginning or experienced. A higher proportion of beginning farmers grow vegetables and engage in cattle, sheep, and goat farming, whereas experienced producers focus on oilseed and grain farming and dairy cattle (Figure 4).

Table 4: Percentage of Farms by NAICS and Operator Types

<table>
<thead>
<tr>
<th>NAICS</th>
<th>Beginning Producer</th>
<th>Experienced Producer</th>
</tr>
</thead>
<tbody>
<tr>
<td>1111: Oilseed and grain farming</td>
<td>39%</td>
<td>46%</td>
</tr>
<tr>
<td>1112: Vegetable and melon farming</td>
<td>2%</td>
<td>1%</td>
</tr>
<tr>
<td>1113: Fruit and tree nut farming</td>
<td>1%</td>
<td>1%</td>
</tr>
<tr>
<td>1114: Greenhouse, nursery</td>
<td>1%</td>
<td>1%</td>
</tr>
<tr>
<td>1119: Other, crop farming</td>
<td>19%</td>
<td>18%</td>
</tr>
<tr>
<td>11191: Tobacco farming</td>
<td>0%</td>
<td>0.02%</td>
</tr>
<tr>
<td>11193, 11194, 11199: Hay, etc.</td>
<td>19%</td>
<td>18%</td>
</tr>
<tr>
<td>112111: Beef cattle ranching</td>
<td>10%</td>
<td>7%</td>
</tr>
<tr>
<td>112112: Cattle feedlots</td>
<td>1%</td>
<td>1%</td>
</tr>
<tr>
<td>11212: Dairy cattle and milk production</td>
<td>1%</td>
<td>1%</td>
</tr>
<tr>
<td>1122: Hog and pig farming</td>
<td>1%</td>
<td>1%</td>
</tr>
<tr>
<td>1123: Poultry and egg production</td>
<td>1%</td>
<td>0%</td>
</tr>
<tr>
<td>1124: Sheep and goat farming</td>
<td>2%</td>
<td>1%</td>
</tr>
<tr>
<td>1125, 1129: Other, animal farming</td>
<td>5%</td>
<td>5%</td>
</tr>
<tr>
<td><strong>N</strong></td>
<td><strong>23,074</strong></td>
<td><strong>108,699</strong></td>
</tr>
</tbody>
</table>

Note: \( \chi^2 \): 1030; critical = 22.36; p < 0.05.

Figure 4: Plot of Difference Scores from Table 4: Beginning versus Experienced Producers

Note: Positive values show the type of businesses that are favored by the beginning producers; see Table 4 for numerical values and NAICS codes for industry descriptions.
To further explore the data given in Table 4, a “fit + residual” analysis was performed; each value of the table was modelled as the sum of ‘producer type’ and ‘industry affiliation. Table 5 displays fits for each producer type; the median values are provided at the bottom of the table with residuals in the center. Each fit plus residual equals the original cell data.

Table 5: Residual Percentage of Producers in Various Agricultural Businesses After a First Pass at Removing the ‘Type of Producer’ Fit.

<table>
<thead>
<tr>
<th>NAICS</th>
<th>Beginning Producer</th>
<th>Experienced Producer</th>
</tr>
</thead>
<tbody>
<tr>
<td>1111: Oilseed and grain farming</td>
<td>37.36%</td>
<td>44.89%</td>
</tr>
<tr>
<td>1112: Vegetable and melon farming</td>
<td>0.26%</td>
<td>-0.50%</td>
</tr>
<tr>
<td>1113: Fruit and tree nut farming</td>
<td>-0.41%</td>
<td>-0.45%</td>
</tr>
<tr>
<td>1114: Greenhouse, nursery</td>
<td>-0.26%</td>
<td>-0.03%</td>
</tr>
<tr>
<td>1119: Other, crop farming</td>
<td>17.11%</td>
<td>16.55%</td>
</tr>
<tr>
<td>11191: Tobacco farming</td>
<td>-1.42%</td>
<td>-1.17%</td>
</tr>
<tr>
<td>11193, 11194, 11199: Hay, etc.</td>
<td>17.11%</td>
<td>16.54%</td>
</tr>
<tr>
<td>112111: Beef cattle</td>
<td>8.15%</td>
<td>5.59%</td>
</tr>
<tr>
<td>112112: Cattle feedlots</td>
<td>-0.89%</td>
<td>-0.60%</td>
</tr>
<tr>
<td>11212: Dairy cattle and milk production</td>
<td>-0.83%</td>
<td>-0.28%</td>
</tr>
<tr>
<td>1122: Hog and pig farming</td>
<td>-0.26%</td>
<td>0.10%</td>
</tr>
<tr>
<td>1123: Poultry and egg production</td>
<td>-0.28%</td>
<td>-0.73%</td>
</tr>
<tr>
<td>1124: Sheep and goat farming</td>
<td>0.85%</td>
<td>0.03%</td>
</tr>
<tr>
<td>1125, 1129: Other, animal farming</td>
<td>3.52%</td>
<td>3.50%</td>
</tr>
<tr>
<td><strong>Fit, Median</strong></td>
<td><strong>1.43%</strong></td>
<td><strong>1.18%</strong></td>
</tr>
</tbody>
</table>

In Table 5, negative residuals indicate low-option farming businesses and positive residuals highlight high-option businesses or choices. For beginning producers, beef-cattle ranching is a high-option business and poultry and egg production is a low-option business. Experienced producers value oilseed and grain farming. Appendix 2 models the values associated with industry effects.

Figure 5 shows the impact of farming experience (learning) on income, economic class. A larger proportion of beginning producers is represented at the lower end of the economic-class scale; the reverse is true for experienced producers.
Figure 5: Impact of Farming Experience on Farm Income

Note: $\chi^2$ statistic = 603.43; critical value of $\chi^2 = 14.067$; $p < 0.05$.

Summary and Conclusion

This research profiles beginning farmers in Illinois using the 2017 agricultural census data. Data analysis shows that the economic class of farms vary positively with the work experience of the operator, as predicted by the experience-curve effects.

A typical beginning farm operator is a White male, less than 35 years of age, who farms about 10 to less than 50 acres of oilseed and grain in his fully-owned land. In contrast, an experienced producer typically farms 50 to less than 180 acres.

A first step has been made at building up an empirically based set of observations and findings about beginning farmers. We plan to build on this by exploring micro data on the topic from the USDA’s Agricultural Resource Management Survey.
### Appendix 1: Beginning Farmers: Profiles from the 2012 and 2017 Census of Agriculture

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Gender</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Male</td>
<td>71%</td>
<td>79%</td>
<td>67%</td>
<td>73%</td>
</tr>
<tr>
<td>- Female</td>
<td>29%</td>
<td>21%</td>
<td>33%</td>
<td>27%</td>
</tr>
<tr>
<td><strong>Race</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- White</td>
<td>99.02%</td>
<td>99.38%</td>
<td>98.92%</td>
<td>99.42%</td>
</tr>
<tr>
<td>- Black</td>
<td>0.34%</td>
<td>0.12%</td>
<td>0.33%</td>
<td>0.16%</td>
</tr>
<tr>
<td>- Native American</td>
<td>0.16%</td>
<td>0.12%</td>
<td>0.26%</td>
<td>0.10%</td>
</tr>
<tr>
<td>- Pacific Islander</td>
<td>0.03%</td>
<td>0.02%</td>
<td>0.11%</td>
<td>0.09%</td>
</tr>
</tbody>
</table>
Appendix 2: Industry Affiliation: Residual Assessment

Table A2.1: Additive 'Producer Type' and 'Agricultural Businesses' with Residuals and Overall Fit from Median Smoothing of Table 5

<table>
<thead>
<tr>
<th>NAICS</th>
<th>Beginning Producer</th>
<th>Experienced Producer</th>
</tr>
</thead>
<tbody>
<tr>
<td>1111: Oilseed and grain farming</td>
<td>-5.08%</td>
<td>-2.47%</td>
</tr>
<tr>
<td>1112: Vegetable and melon farming</td>
<td>-0.92%</td>
<td>1.68%</td>
</tr>
<tr>
<td>1113: Fruit and tree nut farming</td>
<td>-1.29%</td>
<td>1.33%</td>
</tr>
<tr>
<td>1114: Greenhouse, nursery</td>
<td>-1.42%</td>
<td>1.19%</td>
</tr>
<tr>
<td>1119: Other, crop farming</td>
<td>-1.03%</td>
<td>1.59%</td>
</tr>
<tr>
<td>11191: Tobacco farming</td>
<td>-1.44%</td>
<td>1.17%</td>
</tr>
<tr>
<td>11193, 11194, 11199: Hay, etc.</td>
<td>-1.02%</td>
<td>1.59%</td>
</tr>
<tr>
<td>112111: Beef cattle</td>
<td>-0.03%</td>
<td>2.59%</td>
</tr>
<tr>
<td>112112: Cattle feedlots</td>
<td>-1.45%</td>
<td>1.16%</td>
</tr>
<tr>
<td>11212: Dairy cattle and milk production</td>
<td>-1.58%</td>
<td>1.02%</td>
</tr>
<tr>
<td>1122: Hog and pig farming</td>
<td>-1.49%</td>
<td>1.13%</td>
</tr>
<tr>
<td>1123: Poultry and egg production</td>
<td>-1.09%</td>
<td>1.52%</td>
</tr>
<tr>
<td>1124: Sheep and goat farming</td>
<td>-0.89%</td>
<td>1.71%</td>
</tr>
<tr>
<td>1125, 1129: Other, animal farming</td>
<td>-1.30%</td>
<td>1.32%</td>
</tr>
</tbody>
</table>

Table A2.2: Fit Values for Agricultural Businesses, NAICS

<table>
<thead>
<tr>
<th>NAICS</th>
<th>Fit Statistic</th>
</tr>
</thead>
<tbody>
<tr>
<td>1111: Oilseed and grain farming</td>
<td>42.43%</td>
</tr>
<tr>
<td>1112: Vegetable and melon farming</td>
<td>1.18%</td>
</tr>
<tr>
<td>1113: Fruit and tree nut farming</td>
<td>0.88%</td>
</tr>
<tr>
<td>1114: Greenhouse, nursery</td>
<td>1.16%</td>
</tr>
<tr>
<td>1119: Other, crop farming</td>
<td>18.14%</td>
</tr>
<tr>
<td>11191: Tobacco farming</td>
<td>0.01%</td>
</tr>
<tr>
<td>11193, 11194, 11199: Hay, etc.</td>
<td>18.13%</td>
</tr>
<tr>
<td>112111: Beef cattle</td>
<td>8.18%</td>
</tr>
<tr>
<td>112112: Cattle feedlots</td>
<td>0.56%</td>
</tr>
<tr>
<td>11212: Dairy cattle and milk production</td>
<td>0.75%</td>
</tr>
<tr>
<td>1122: Hog and pig farming</td>
<td>1.23%</td>
</tr>
<tr>
<td>1123: Poultry and egg production</td>
<td>0.80%</td>
</tr>
<tr>
<td>1124: Sheep and goat farming</td>
<td>1.74%</td>
</tr>
<tr>
<td>1125, 1129: Other, animal farming</td>
<td>4.82%</td>
</tr>
</tbody>
</table>

Note: The original data from Table 4 can be recreated by adding producer fit from Table 5 and business fit from Table A2.2.