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The Illinois Institute for Rural Affairs (IIRA) works to improve the quality of life for rural residents by partnering with public and private agencies on local development and enhancement efforts.



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# **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<sup>2</sup>. In the following pages, I compare

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<sup>2</sup> 2017 US Census of Agriculture. Appendix B: General Explanation and Census of Agriculture Report Form. In 2012, the definition for a new and beginning farmer was an operator with LT 10 years of farming experience; see <https://agcensus.library.cornell.edu/wp-content/uploads/2012-United-States-usappxb-1.pdf>.

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the characteristics of beginning operators and their farming operations with those of experienced producers<sup>3</sup>. 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

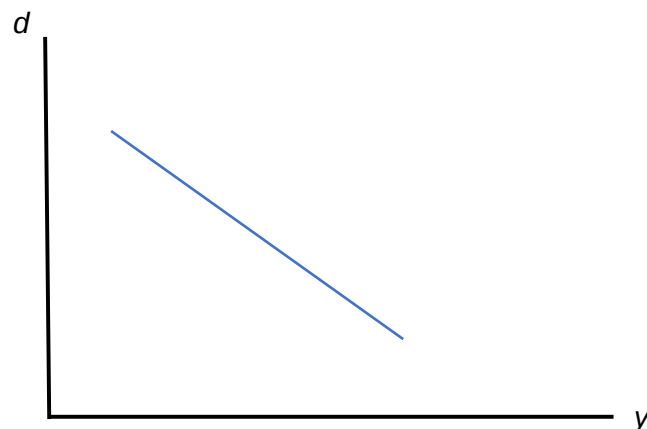
The study of business strategy makes use of the experience-curve concept to prescribe product and pricing strategies<sup>4</sup>. Experience curve is based on learning, or acquisition of

knowledge<sup>5</sup>; 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<sup>6</sup>.

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

**Figure 1: Plot of the Linear Learning Curve**



This simple conceptualization suggests that a higher proportion of experienced farmers will be economically successful than new and beginning farmers. The primary reason for this expectation is

'labor efficiency', experienced farmers would have learned improvements and shortcuts in farming practices; work-method improvement – redesign of work methods - could also be a contributing factor.

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<sup>3</sup> The terms producer and operator are used interchangeably.

<sup>4</sup> Lancaster, G., & Massingham, L. (2017). Strategic marketing planning tools. In *Essentials of Marketing Management* (pp. 402-425). Routledge.

<sup>5</sup> Baddeley, A. D. (1997). *Human memory: Theory and practice*. Psychology press.

<sup>6</sup> Abernathy, W. J. (1979). Limits of the learning curve. *Harvard Business Review*, 52(Sep-Oct), 109-119.

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## Methodology

Data are from the 2017 and 2012 Census of Agriculture<sup>7</sup>. Table 1 shows the variables used in the research; data

analyses were conducted using the framework,  $Data = fit + residuals$ . Both, graphical and numerical analyses were performed.

**Table 1: Variables and their Definitions**

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

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<sup>7</sup> <https://www.nass.usda.gov/AqCensus/>.

## 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).

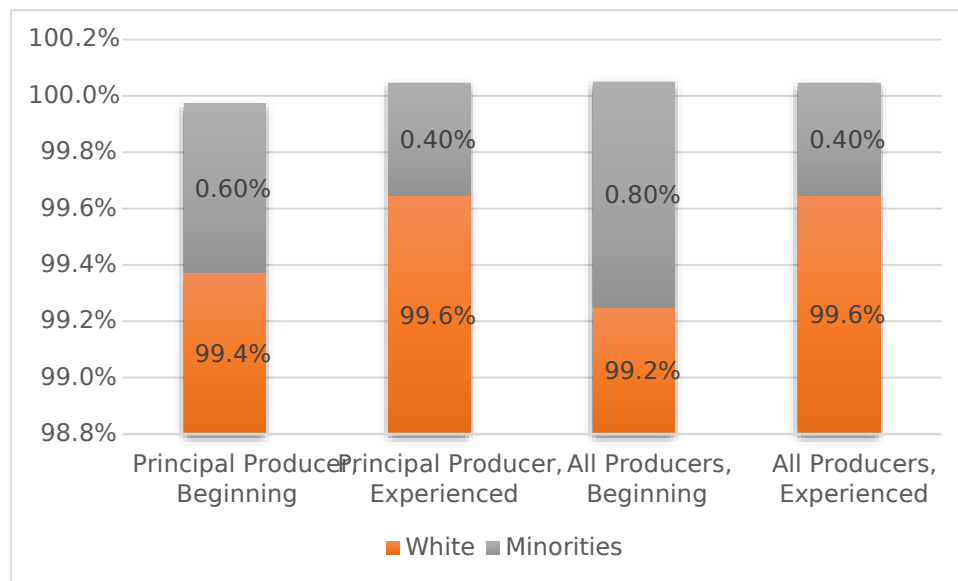
**Table 2: Gender Distribution of Beginning and Experienced Farmers**

Gender	Principal Producer		All Categories	
	Beginning	Experienced	Beginning	Experienced
Male	74%	81%	67%	73%
Female	26%	19%	33%	27%
N	19,803	74,134	26,995	89,422

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**

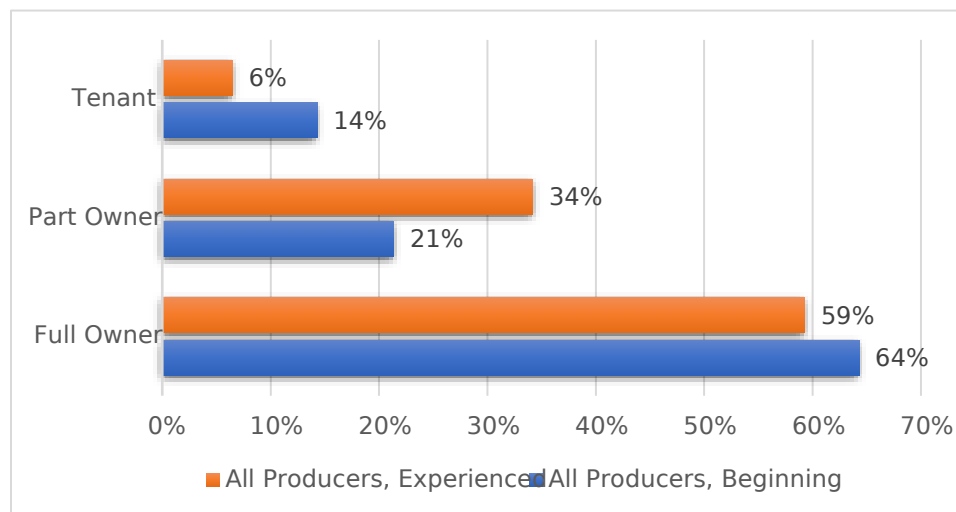
Land Area	Beginning Producers	Experienced Producers
1 to 9.9 Acres	17%	11%
10 to 49.9 Acres	<b>29%</b>	27%
50 to 179 Acres	27%	<b>31%</b>
180 to 499 Acres	14%	21%
≥ 500 Acres	13%	10%
N	18,796	74,432

**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

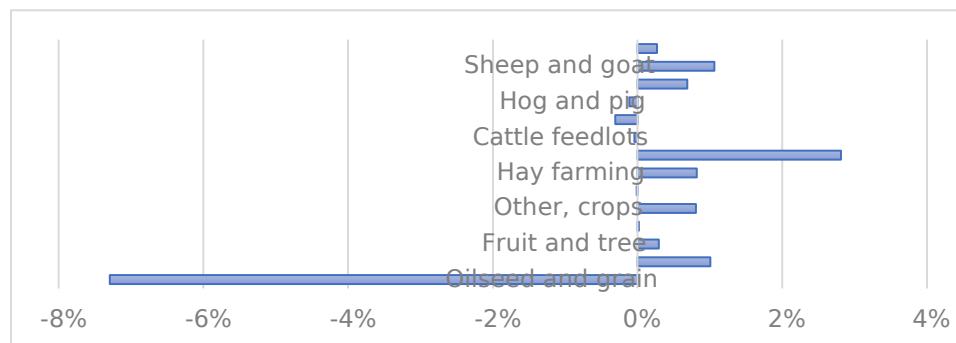
independence between the variables. In other words, business choice is dependent on the type of operator, beginning or experienced. A higher proportion of beginning farmers grow vegetables and engage in cattle, sheep, and goat farming, whereas experienced producers focus on oilseed and grain farming and dairy cattle (Figure 4).

**Table 4: Percentage of Farms by NAICS and Operator Types**

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

**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.**

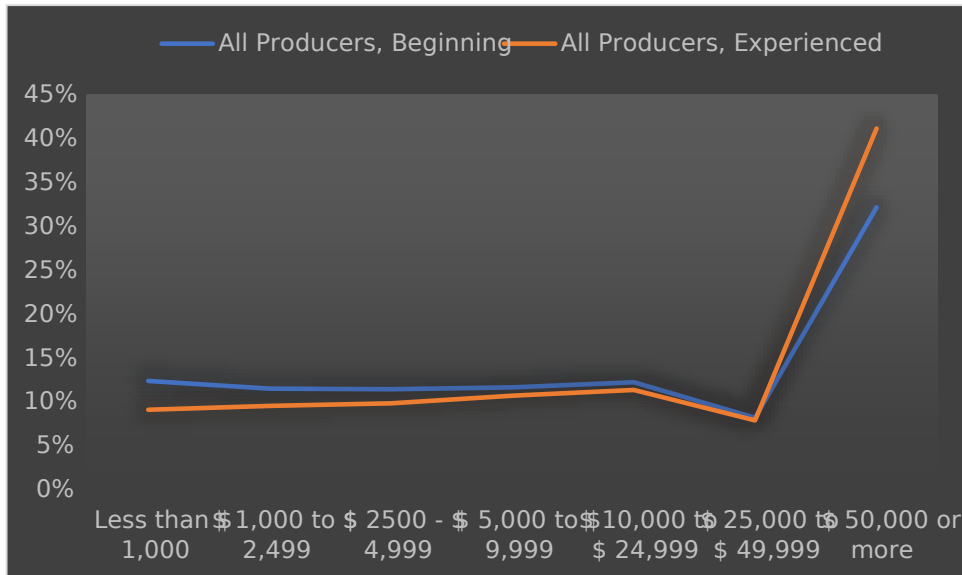
<b>NAICS</b>	<b>Beginning Producer</b>	<b>Experienced Producer</b>
1111: Oilseed and grain farming	37.36%	44.89%
1112: Vegetable and melon farming	0.26%	-0.50%
1113: Fruit and tree nut farming	-0.41%	-0.45%
1114: Greenhouse, nursery	-0.26%	-0.03%
1119: Other, crop farming	17.11%	16.55%
11191: Tobacco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

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 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.

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.



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## Appendix 1: Beginning Farmers: Profiles from the 2012 and 2017 Census of Agriculture

Variable	2012		2017	
	Beginning Operator (N=19,658)	Experienced Operator (N=87,626)	Beginning Operator (N=26,995)	Experienced Operator (N=89,422)
<b>Gender</b>				
- Male	71%	79%	67%	73%
- Female	29%	21%	33%	27%
<b>Race</b>				
- White	99.02%	99.38%	98.92%	99.42%
- Black	0.34%	0.12%	0.33%	0.16%
- Native American	0.16%	0.12%	0.26%	0.10%
- Pacific Islander	0.03%	0.02%	0.11%	0.09%

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## 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**

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

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

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

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