U.S. Farmer Age and Productivity

Loren Tauer and Harold Fried

The average age of the U.S. farmer has been increasing. In 2012 the average age was 58.3 years (U.S. Agricultural Census), an increase of eight years from thirty years ago when the average age was 50.5 years old. This increased age is occurring in most other developed countries. The average age of farmers in Japan is 67 years. More than one third of European farmers are older than 65. Even in developing countries the average age of farmers is increasing.

This maturing of the farmer has potential implications for agriculture production if older farmers are not as productive as younger farmers. The implication is not only a potential reduction of agricultural output but also the survival of individual farm operations where succession of the next generation should occur before productivity of the farm business decreases. In earlier studies, the productivity of U.S. farmers was first found to increases and then decreases with age (Tauer and Lordkipanidze, 2000).

The productivity of U.S. farmers by age cohort is measured using data from the most recent 2012 U.S. Agricultural Census. This productivity is further decomposed into technological change and efficiency change. Productivity may first increase as newer technology is used by older farmers but then productivity may decrease with age as the efficiency of the farmer falls. Scale may also be a factor in productivity as older farmers garnish more resources as they age and thus capture any economies of size in farming.

The technique used is DEA (Data Envelopment Analysis) to construct Malmquist productivity indices between age cohorts. Malmquist indices from DEA are often derived to determine productivity over time, or between regions to determine productivity differences between those regions. Our application will be across age cohorts at a point in time.

The U.S. Agricultural Census reports aggregated farm data for the six age cohorts of under age 25, age 25 to 34, age 35 to 44, age 45 to 54, age 55 to 54, and age 65 and older. From each cohort, the output and inputs by state is used to determine productivity of each age cohort relative to the proceeding age cohort, resulting in five age productivity changes per state. Given non-disclosure rules some age cohorts are missing from some states, especially in the under age 25 group. There are few farmers under the age of 25 in Hawaii, for instance, and disclosing the data for those that are under the age of 25 might permit the identification of the financial situation and performance of individual farmers.

A single output consisting of agricultural sales is used. Five inputs are used and consist of crop expenses, livestock expenses, hired labor expenses, capital expense, and operator days worked on the farm. Paul Wilson's R code is used to derive empirical results with 1,000 bootstraps.

Preliminary results vary by state. However, productivity changes between age-cohorts averaged over the states in which data are available are shown in table 1, which clearly shows an initial increase and then a continuous decrease in productivity with age, where the age cohort of 25-34 years of age is the most productive. That higher productivity is due to much greater efficiency over the farmers younger than age 25, which is understandable given the learning necessary. However, because the output variable is sales (rather than production, which was not collected), the result from the age cohort of under 25 years of age to age 25-34 might be biased because the youngest farmers as a group may be selling fewer livestock to build up their breeding livestock herds and thus reporting lower sales than the older age cohorts. In contrast, the farmers over age 65 might be liquidating their herds as a way to wind down their operations and generate more sales, biasing their productivity measure.

Technology change over the age cohorts is not as significant as efficiency change over the age cohorts. The exception is from the age cohort 45-54 to age cohort 55-65, when the technology drops 0.831. Technology increases over the following age cohort of over age 65, but that may be a biased estimate from farmers gradually liquidating their livestock assets, which would be reflected in greater output.

Further analysis using various definitions of aggregated inputs will be conducted to determine the robustness of these empirical results.

Table: Productivity, Efficiency, and Technological Change of U.S. Farmers by Age Cohort Relative to Preceding Age Cohort

Age	Productivity	Technology	Efficiency	Number of States (Out of 50)
Under 25	1.0	1.0	1.0	27
25-34	3.72	0.987	3.767	28
35-44	0.837	0.912	0.918	43
45-54	0.613	1.020	0.598	47
55-65	0.872	0.831	1.048	48
Over65	0.816	1.039	0.785	47

Tauer, L.W. and N. Lordkipanidze (2000) Farmer Efficiency and Technology Use with Age. *Agricultural and Resource Economics Review* 29(1):24-31.