



AgEcon SEARCH
RESEARCH IN AGRICULTURAL & APPLIED ECONOMICS

The World's Largest Open Access Agricultural & Applied Economics Digital Library

This document is discoverable and free to researchers across the globe due to the work of AgEcon Search.

Help ensure our sustainability.

Give to AgEcon Search

AgEcon Search
<http://ageconsearch.umn.edu>
aesearch@umn.edu

*Papers downloaded from **AgEcon Search** may be used for non-commercial purposes and personal study only. No other use, including posting to another Internet site, is permitted without permission from the copyright owner (not AgEcon Search), or as allowed under the provisions of Fair Use, U.S. Copyright Act, Title 17 U.S.C.*

Entry, Exit, and the Age Distribution of Farm Operators, 1974-82

Matthew G. Smith

Abstract. *Net entries of young farm operators on commercial-sized farms declined by about 40 percent between 1974 and 1982. Fewer entries of young farmers and the continued aging and retirement of older farmers caused the number of commercial farms to drop between 1978 and 1982. The 1982 age distribution and the 1978-82 entry and exit rates suggest a continuing decline in commercial farm numbers and a redistribution of farm assets. The article uses a modified version of age cohort analysis to estimate rates of net entries and exits of farm operators in 1974-78 and 1978-82.*

Keywords *Age cohort analysis, entry, exit, farm numbers*

Long-term changes in the number of farms come about through the entry and exit of farm operators. Entry and exit has three components. The first, which is regular and predictable, is the aging and eventual retirement of current farmers. The second, which is more variable and often the subject of intense public interest and debate, is the early departure of established farmers. The third, often much less noticed, is the rate of entry of new farmers. Together, these components change the total number of farms.

A traditional method of estimating entries and exits in farming has been to use census data on farm operators by age class to derive changes in farm numbers by age cohort.¹ However, the spacing of censuses conducted since 1974, combined with the age intervals used, has made traditional analysis of age cohorts impossible, because data on operator numbers by age

are published in 10-year intervals, whereas the last two censuses were conducted 4 years apart.

In this article, I describe a method for approximating net entries and exits of farm operators by age cohort from irregularly spaced census data, and I apply this procedure to estimate entry and exit by age group in commercial farming during 1974-78 and 1978-82. I explore the reduction in entries of young operators after 1978 and the anticipated retirements of older farmers together with generational differences in operator financial structure to examine possible consequences for commercial farm numbers and structure through the nineties.

Research Method

Analysts have used age cohort analysis to examine historical changes in farm numbers and to project changes based on observed relationships between cohort ages and sizes (2, 5, 6, 7, 10).² The basic procedure is to use published census data on the number of farm operators by age class and compare them with data from other censuses to identify changes over time in the number of operators born within a given decade. For example, one can observe the change between 1959 and 1969 in the number of operators who were aged 25-34 in 1959 by comparing the group's published size in 1959 with its size (now identified as the 35-44 age class) as published in the 1969 census. If censuses are conducted every 5 years, one can compare the size of any 10-year age cohort directly from alternate censuses and easily compute net entries or exits for each cohort.

Age cohort analysis allows one to compare two aspects of changes in farm numbers. First, analysts can compare cohorts reaching the same age in different periods to examine effects of changing economic conditions on groups of operators at the same point in their lives. Second, changes in the total number of farm operators can be attributed to changing rates of

The author is an agricultural economist with the Agriculture and Rural Economy Division, ERS. An earlier version of this article was presented at the 1987 meeting of the Southern Agricultural Economics Association. A number of ERS colleagues provided helpful comments on earlier drafts, especially Calvin Beale, Dave Trechter, Clark Edwards, Tom Stucker, and Fred Hines.

¹A cohort is defined as any group within a population showing a common characteristic, such as date of first marriage or date of birth. It is used here to denote groups of farmers born in the same decade.

²Italicized numbers in parentheses refer to items in the References at the end of this article.

entry or exit by age class or to constant rates operating on a prior uneven age distribution

Since 1974, the *Census of Agriculture* has been conducted at 4-year intervals (in 1978 and 1982) rather than at 5-year intervals as in the past. The next census will collect data for 1987, resuming the traditional 5-year spacing. Therefore, it will not be until 1992 that two censuses spaced 10 years apart will again be available, but data from the censuses of 1974 and 1978 will still be unusable in traditional age cohort analysis. Yet, this period was one of significant changes in agriculture, and some method of age cohort analysis might help us better understand these changes and their implications.

The method used here to derive net entry and exit rates by cohort for 1974-78 and 1978-82 is to interpolate published data to approximate the single-year age distribution of farm operators, to "age" this distribution by 4 years, and to recombine it into new, synthetic cohort-size estimates. I then compare the size of the synthetic cohort with its observed size 4 years earlier, as published in the previous census. Thus, the 1978 census distribution is interpolated and recombined into synthetic cohorts for comparison with the 1974 census to derive 1974-78 entry and exit rates, and the 1982 distribution is used to arrive at estimates of 1978-82 rates. This procedure allows one to compare different cohorts at the same age in the two periods and to identify the components of changes in farm numbers over each interval.

The choice of interpolation method to apply to the published census data is important when one estimates synthetic cohort sizes. A variety of formulas are available. They range all the way from simple rectangular methods (based on the assumption that all single-year values within a group are equal) to osculatory formulas that rearrange the published group totals to give a smoother curve (9, pp 694-702). Of the available methods, osculatory interpolation procedures that maintain group totals as published are the most appropriate. The procedure used is the Karup-King third-difference formula, an osculatory formula that maintains group totals (9, p 875). I applied the Karup-King coefficients to the 10-year age data to obtain estimates of the farm operator population by year. Table 1 provides an example of these procedures.

Table 1 shows how the numbers of commercial farm operators by age class as given by the Bureau of the Census were interpolated and then recombined to estimate numbers within different age breaks. It shows how the technique was used to estimate net entry of operators aged 25-34 in 1974-78 and 1978-82.

Beginning with census data on the number of operators aged 25-34 and 35-44 in 1974, 1978, and 1982, I interpolated the data mathematically to derive estimates of the numbers of operators aged 25, 26, 27, 44 in each year. A characteristic of this interpolation procedure is that the sum of the estimates by year of age always equals the total by age class as given in the original data. Thus, the sum of the interpolated estimates equals the group total given by the census. (See note 1, table 1, for a more detailed explanation of the interpolation formula.)

To track the net change between 1974 and 1978 in the size of the cohort aged 25-34 in 1974, I summed the interpolated age distribution for 1978 to estimate the number of operators aged 29-38 (the 25-34 year olds of 1974). This ending cohort size in 1978 (table 1, column 2) appears with its beginning size in 1974 (table 1, column 1) to estimate the net change. The same procedure is used to calculate changes between 1978 and 1982.

The analysis focuses on entry to, and exit from, the "commercial" part of U.S. agriculture, in which operators are engaged in an intentional effort to earn all or part of their income from farming. While it is impossible to ascribe particular motives to any group of farmers based solely on their volume of sales, a large number of rural residence, retirement, and hobby farms had to be excluded to sharpen the focus on commercial agriculture. The analysis is confined to operators of farms with sales of at least \$20,000. Although any cutoff point would be somewhat arbitrary and would fail to separate commercial from noncommercial operators completely, the \$20,000 sales level is the approximate point beyond which average net cash returns have been greater than zero in recent years (12, 13).

To control for the effects of inflation on the \$20,000 farm size cutoff, the Bureau of the Census adjusted the data for 1974 and 1978 to 1982 price levels. The price inflator used was the index of prices received by farmers, segmented into crop and livestock components, applied to individual census records. All data discussed here are drawn from the inflation-adjusted tabulation.

Results for U.S. Commercial Farms

Table 2 shows the number of commercial farm operators by age class in 1974, 1978, and 1982 along with the reformulated age distributions for 1978 and 1982 and the entry and exit rates derived from these

Table 1—Computation of net entry/exit rates by cohort, commercial farm operators age 25-34

| Item | 1974 | 1978 | | 1982 | | 1974-78 | 1978-82 |
|---|---------------------|--|-----------|--|-----------|---------|---------|
| | Operators | 25-34-year cohorts of 1974 (age in 1978) | Operators | 25-34-year cohorts of 1978 (age in 1982) | Operators | | |
| | Number of operators | | | | | | |
| Interpolated distribution by age, 25-34 ¹ | | | | | | | |
| 25 | 6,362 | | 9,148 | | 9,523 | | |
| 26 | 7,173 | | 10,314 | | 10,788 | | |
| 27 | 8,026 | | 11,716 | | 12,384 | | |
| 28 | 8,827 | | 12,830 | | 13,576 | | |
| 29 | 9,598 | 13,787 | 13,787 | 14,547 | 14,547 | | |
| 30 | 10,341 | 14,586 | 14,586 | 15,297 | 15,297 | | |
| 31 | 11,054 | 15,228 | 15,228 | 15,828 | 15,828 | | |
| 32 | 11,738 | 15,712 | 15,712 | 16,137 | 16,137 | | |
| 33 | 12,394 | 15,970 | 15,970 | 16,111 | 16,111 | | |
| 34 | 13,017 | 16,278 | 16,278 | 16,210 | 16,210 | | |
| Sum of interpolation ² | 98,530 | | 135,569 | | 140,400 | | |
| Interpolated distribution by age, 35-44 ¹ | | | | | | | |
| 35 | 13,583 | 16,505 | 16,505 | 16,249 | 16,249 | | |
| 36 | 14,193 | 16,899 | 16,899 | 16,505 | 16,505 | | |
| 37 | 14,809 | 17,436 | 17,436 | 16,988 | 16,988 | | |
| 38 | 15,486 | 17,963 | 17,963 | 17,376 | 17,376 | | |
| 39 | 16,212 | | 18,519 | | 17,749 | | |
| 40 | 16,986 | | 19,103 | | 18,108 | | |
| 41 | 17,807 | | 19,716 | | 18,453 | | |
| 42 | 18,677 | | 20,358 | | 18,783 | | |
| 43 | 19,512 | | 20,969 | | 19,072 | | |
| 44 | 20,642 | | 21,785 | | 19,429 | | |
| Sum of interpolation ² | 167,907 | 160,363 | 189,252 | 161,247 | 178,712 | | |
| Cohort size and source | | | | | | | |
| Beginning (census) | | | | | | 98,530 | 135,569 |
| Ending (interpolated sum) ³ | | | | | | 160,363 | 161,247 |
| Change (net entrants) (= ending minus beginning size) | | | | | | 61,833 | 25,678 |
| Average entrants/year (= net change / 4) | | | | | | 15,458 | 6,420 |

Blanks indicate not applicable

¹Ten year age intervals were interpolated to estimate the age distribution by year with the Karup King third degree difference formula. The formula is a set of coefficients that are expressed in the form of differences and applied to grouped data to estimate the distribution within the interval. It does so by fitting a second degree polynomial function (plus an adjustment using third differences to assure a smooth fit between adjacent intervals) to the grouped data. Unlike some other interpolation formulas, the Karup King formula maintains the group sums as originally given. For example, the coefficients for the first fifth of a middle interval (not at either end) are $0.064 \times$ the preceding interval plus $0.152 \times$ the interval to be interpolated plus $-0.016 \times$ the following interval. The number of operators under 25 in 1978 was 29,422. To estimate the first fifth of the 25-34 age class in 1978 (the number of 25 and 26 year olds), use the formula $(0.064 \times 29,422) + (0.152 \times 135,569) + (-0.016 \times 189,252) = 19,462$. A second set of coefficients operates in similar fashion to partition the interpolated fifths into halves to give estimates of operators by each year of age. For a more detailed explanation, see (9, pp 699-700).

²The interpolated values sum to the total for the age class as given by the Bureau of the Census.

³The estimated ending (interpolated sum) cohort size is referred to as the "number of operators aged up to 28, 29 to 38 69 plus" in table 2.

distributions³ The shift in the age distribution of commercial farm operators between 1974 and 1982 is evident from the census tabulation alone In 1974 the single largest group of farmers was between 45 and 54, by 1982 the largest group was between 55 and 64 By 1982 the number of operators aged 44 and under was higher than in 1974, the number aged 45 to 64 was lower, and the number aged 65 and older was again larger than 8 years before The figure compares the interpolated age distributions for 1974 and 1982

Entry and exit rates by cohort derived from the interpolated distribution show that entries of younger operators decreased between 1974-78 and 1978-82⁴

³Note that age cohort analysis only allows us to identify net entries to and exits from a cohort Some operators probably enter a cohort whose total size is decreasing or leave one while it is growing Some operators may also enter and exit between one census and the next Movements of these types cannot be identified Also, because the analysis focuses on commercial farms with annual sales of \$20,000 or more, entry and exit are defined in terms of this threshold rather than as absolute entry or exit Thus, farms could grow or shrink and yet be identified as entries or exits

⁴This analysis differs from previous studies in that increases in the size of growing cohorts are measured in terms of the actual number of additional operators, rather than as a percentage increase from its size in an earlier census or, for the youngest group,

In 1974-78, the average annual increase of cohorts with beginning ages of up to 34 (in 1974) was nearly 29,000 operators each year In 1978-82, annual net entrants with beginning ages up to 34 (in 1978) numbered fewer than 18,000, a decline of nearly 40 percent from the earlier period

In the middle-age groups, with beginning ages from 35 to 54, the pattern of net changes also shifted from 1974 to 1982 The cohort with beginning ages of 35-44 in 1974 grew at a rate of 12,000 farms per year up to 1978, this number dropped to about 1,000 farms per year for the cohort with the same beginning ages in 1978 The next oldest groups, with initial ages of 45-54, shifted from net growth in 1974-78 (1,800 farms per year) to net loss in 1978-82 (6,700 farms per year)

as a proportion of the oldest cohort in the preceding period This procedure seems more appropriate for depicting the circumstances of the seventies and eighties The traditional approach assumed a "normal" pattern of cohort growth based on its size at an early age, yet cohorts have historically exhibited a great deal of variation in their growth patterns (4, pp 366-7) And, with commercial operators relying increasingly on leased cropland and with the rapid obsolescence of specialized livestock facilities, the number of farmsteads given up by retiring operators is less closely linked to entry opportunities now than it was 20-30 years ago

U.S. Commercial farms by operator age, 1974 and 1982

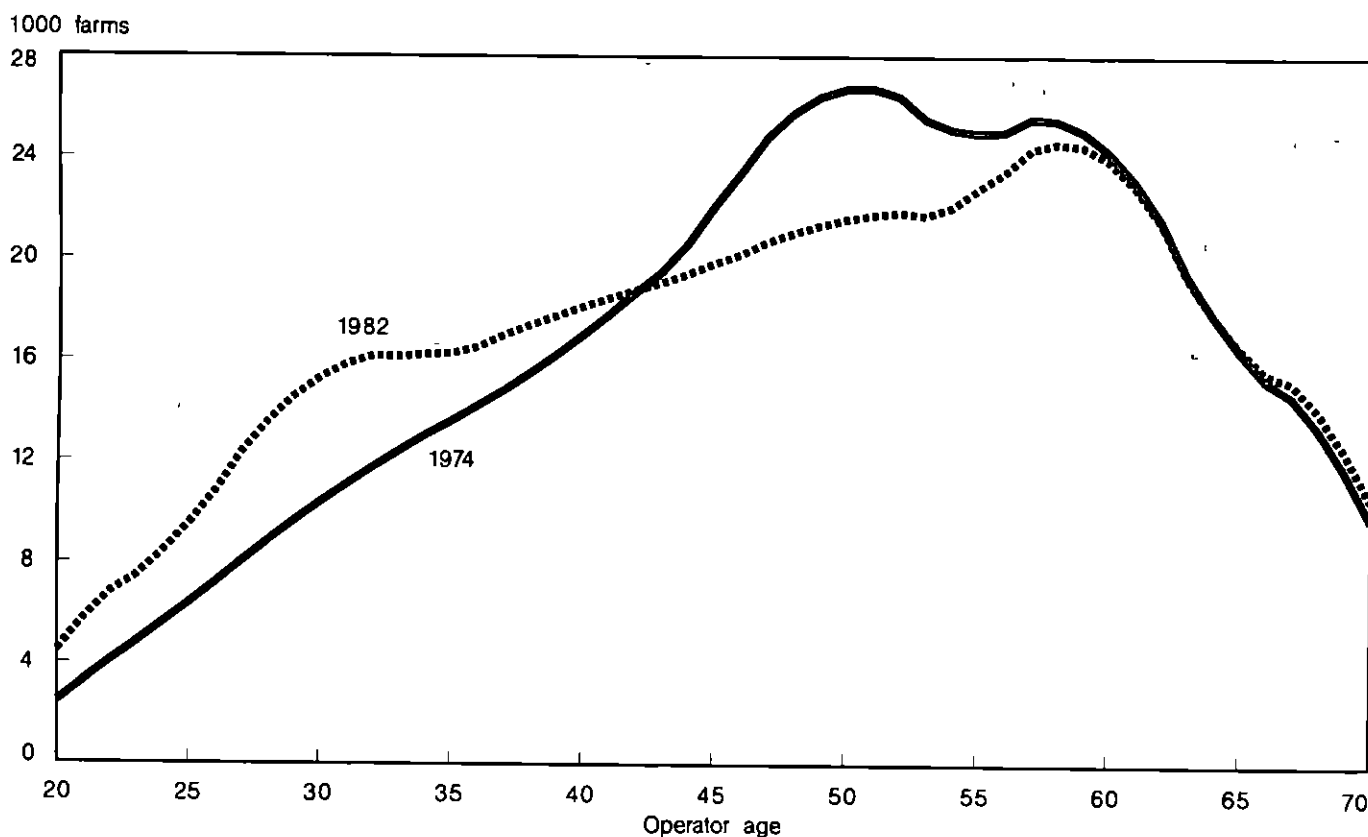


Table 2—Derived net entry and exit of U.S. commercial farm operators, by age, 1974-78 and 1978-82

| Item | Age | | | | | | |
|--------------------------------|--|---------|---------|---------|---------|---------|---------|
| | Up to 24 | 25-34 | 35-44 | 45-54 | 55-64 | 65 plus | Total |
| Census age distribution | <i>Number of operators¹</i> | | | | | | |
| | 19,454 | 98,530 | 167,907 | 253,269 | 232,421 | 93,442 | 865,023 |
| | 29,422 | 135,569 | 189,252 | 252,442 | 242,573 | 92,382 | 941,640 |
| | 28,582 | 140,400 | 178,712 | 212,228 | 225,189 | 98,845 | 883,956 |
| Interpolated age distribution | Age | | | | | | |
| | Up to 28 | 29-38 | 39-48 | 49-58 | 59-68 | 69 plus | Total |
| | <i>Number of operators²</i> | | | | | | |
| | 73,430 | 160,363 | 217,350 | 260,490 | 199,335 | 30,671 | 941,639 |
| Annual change by beginning age | Age | | | | | | |
| | Up to 24 | 25-34 | 35-44 | 45-54 | 55-64 | 65 plus | Total |
| | <i>Number of operators³</i> | | | | | | |
| | 13,494 | 15,458 | 12,361 | 1,805 | -8,272 | -15,693 | 19,154 |
| 1974-78 | <i>Percent change</i> | | | | | | |
| | 69.36 | 15.69 | 7.36 | 0.71 | -3.56 | -16.79 | 2.21 |
| | 11,358 | 6,420 | 1,050 | -6,716 | -12,801 | -13,731 | -14,421 |
| | 38.60 | 4.74 | .55 | -2.66 | -5.28 | -14.86 | -1.53 |

¹Source: Special tabulation, U.S. Department of Commerce, Bureau of the Census. A commercial farm is defined here as one with annual real sales of \$20,000 at 1982 prices. Data for 1974 and 1978 are adjusted to 1982 prices from the index of prices received by farmers. Data for 1978 exclude area sample farms.

²Source: Interpolated census tabulation summed to estimate farm numbers by revised age class. For example, numbers of operators aged 29-38 in 1978 (160,363) and 1982 (161,247) are those derived in table 1. Sum of interpolated distribution does not sum exactly to published total because of rounding.

³Annualized net entry/exit rates calculated as follows: Farms per year = (ending cohort size - beginning cohort size)/4. Percent per year = farms per year as a percentage of beginning cohort size. For example, for the cohort aged up to 24 (for this analysis it is assumed that none was aged less than 15) in 1974, farms per year = (73,430 - 19,454)/4 = 13,494, percent per year = (13,494 / 19,454) * 100 = 69.36 percent.

Among older operators with starting ages of 55 and up, declines were more stable over the two periods. The number of farmers aged 55-64 declined 3.6 percent per year in 1974-78 and declined 5.3 percent per year in 1978-82. However, the average annual decline for the oldest class fell somewhat, from 16.8 percent to 14.9 percent.

These results indicate that the drop in the number of commercial farms in 1978-82, coming on the heels of the 1974-78 increase, can be attributed almost entirely to a decreased net entry of younger operators. These findings are similar to those of Johnston and Tolley (4) and Tolley (10). Using farm/nonfarm income ratios to estimate the elasticity of changes in cohort size with

respect to relative farm and nonfarm income prospects, Johnston and Tolley have shown that cohorts' responsiveness to nonfarm opportunities decreases with age. Thus, most of the response to changing economic conditions comes from younger cohorts—those who under "normal" circumstances would be expected to increase

Regional Variations

Table 3 shows net entry and exit rates by age group and region. I derived these estimates by applying the procedure just outlined to regional data on commercial farms by operator age in 1974, 1978, and 1982. Results for the 10-year age groups are combined into 20-year intervals in the table for the sake of brevity.

Table 3—Annual net entry and exit by region and age group, 1974-82¹

| Region | Under 35 years | | | 35-54 years | | | 55 and over | | |
|-----------------|-----------------------|---------|---------------------|-----------------------|---------|---------------------|-------------------------|---------|---------------------|
| | 1974-78 | 1978-82 | Change ² | 1974-78 | 1978-82 | Change ² | 1974-78 | 1978-82 | Change ² |
| | <i>Farms per year</i> | | <i>Percent</i> | <i>Farms per year</i> | | <i>Percent</i> | <i>Percent per year</i> | | <i>Percent</i> |
| Northeast | 1,747 | 1,275 | -27 | 440 | -383 | -187 | -8 04 | -7 20 | -10 |
| Appalachia | 2,885 | 1,502 | -48 | 2,695 | -486 | -118 | -4 68 | -7 66 | 64 |
| Southeast | 1,626 | 620 | -62 | 1,290 | -515 | -140 | -7 01 | -8 34 | 19 |
| Lake States | 3,981 | 3,512 | -12 | 857 | -344 | -140 | -8 64 | -8 63 | 0 |
| Corn Belt | 8,257 | 4,628 | -44 | 3,045 | -2,171 | -171 | -7 78 | -8 71 | 12 |
| Delta | 1,462 | 690 | -53 | 817 | -536 | -166 | -8 69 | -8 88 | 2 |
| Southern Plains | 2,110 | 890 | -58 | 2,090 | -778 | -137 | -4 66 | -7 87 | 69 |
| Northern Plains | 3,711 | 2,757 | -26 | 209 | -531 | -354 | -9 03 | -7 38 | -18 |
| Mountain | 1,590 | 930 | -42 | 1,067 | -174 | -116 | -6 05 | -6 82 | 13 |
| Pacific | 1,585 | 975 | -38 | 1,656 | 251 | -85 | -5 59 | -5 88 | 5 |
| United States | 28,953 | 17,777 | -39 | 14,167 | -5,666 | -140 | -7 35 | -7 92 | 8 |

¹Age classes are combined from classes presented in table 2. For example, net entry of operators aged under 35 combined the results for the "up to 25" and "25-34" age classes in table 2. Slight differences between the totals reported for the combined age intervals here and the sums of the 10-year classes reported in table 2 are due to rounding.

²Percentage change, 1978-82 rate over 1974-78 rate.

Table 4—Implied change in commercial farm numbers at 1978-82 entry/exit rates

| Region | Actual rate | Implicit rate ¹ | | | |
|-----------------|-----------------------|----------------------------|---------|---------|---------|
| | 1978-82 | 1982-86 | 1986-90 | 1990-94 | 1994-98 |
| | <i>Percent change</i> | | | | |
| Northeast | -4 17 | -4 61 | -4 39 | -3 80 | -2 90 |
| Appalachia | -6 12 | -6 17 | -5 62 | -4 69 | -3 53 |
| Southeast | -11 39 | -11 69 | -11 00 | -9 79 | -8 22 |
| Lake States | -8 2 | -1 20 | -4 8 | 44 | 1 41 |
| Corn Belt | -8 44 | -6 62 | -6 86 | -5 51 | -3 91 |
| Delta | -9 26 | -4 02 | -5 08 | -4 64 | -3 59 |
| Southern Plains | -12 03 | -12 01 | -11 26 | -9 86 | -8 00 |
| Northern Plains | -3 97 | -4 41 | -3 92 | -2 91 | -1 58 |
| Mountain | -5 13 | -6 02 | -5 83 | -5 05 | -3 89 |
| Pacific | -8 0 | -2 07 | -2 46 | -2 32 | -1 73 |
| United States | -6 13 | -6 16 | -5 48 | -4 37 | -3 01 |

¹Implicit changes in future farm numbers are calculated as follows. The 1978 and 1982 census age distributions (table 2) were interpolated as in table 1 and were then used to calculate net changes in farm numbers for each year of age of the 1978 operator population. For operator age groups growing in size, the rate of change is expressed as the number of net entrants in 4 years. For age groups declining in size, the rate of change is expressed as the percentage of operators leaving within 4 years. All operators are assumed to exit by age 75.

These 1978-82 rates of change in operator numbers by age were derived for each region and for the United States and were then applied to the 1982 age distribution to arrive at the implicit distribution for 1986. The 1986 implicit distribution was then summed and compared with the 1982 total to arrive at the implicit change in the total number of commercial farms between 1982 and 1986. The implicit 1986 age distribution was then used to derive the implicit distribution in 1990, again from the 1978-82 entry and exit rates. This iterative process was used to derive the total change in commercial farm numbers to 1998, implicit in the 1978-82 entry/exit pattern and the 1982 age distribution.

A sharp drop is apparent in the number of younger operators entering during 1978-82. Three southern regions—the Southeast, Southern Plains, and Delta—had the most severe declines in net entries, with the number of new operators aged under 39 by 1982 falling by more than half compared with the earlier period. Net entry of younger operators held up best in the Lake States, where the 1978-82 entry rate was 88 percent of the 1974-78 level. This phenomenon may partly reflect the relatively favorable outlook for dairy operations that persisted into the early eighties, even as the outlook for other commodities began to dim. The general reduction in net entries during 1978-82 was also probably tempered somewhat by the decline in rural nonfarm job opportunities that was apparent by 1982.

The two middle cohorts, aged 35-54, show an abrupt change from net entry in 1974-78 to net withdrawal in 1978-82, except in the Pacific region, where net entries dropped to 15 percent of their earlier level.

Among older operators, aged 55 and up, average annual exits as a percentage of initial cohort size show far more stability. Regional exit rates are remarkably consistent, except for the Appalachian and Southern Plains regions, where 1974-78 exit rates were somewhat depressed.

The regional analyses buttress the results at the national level. They indicate a steep drop in the number of younger operators beginning farming after 1978, combined with a quite stable rate of retirement of established older operators. Yet, net entry rates do vary by region.

Implications for Future Farm Numbers

The sharply reduced net numbers of young people entering commercial agriculture in 1978-82, combined with the shift in the overall age distribution of operators, could significantly affect the number of commercial farms in the short run (table 4).

I computed future changes in the number of commercial farm operators implicit in the 1978-82 entry and exit rates by comparing the interpolated 1978 age distribution with the interpolated 1982 distribution, "aged" 4 years, to derive changes in the size of a single year's age group during 1978-82. For example, I compared the number of operators aged 35 in 1982 (estimated by interpolation) with the estimated number of operators aged 31 in 1978 to obtain the 1978-82 growth rate for farmers aged 31 in 1978. I then applied these age-specific rates of growth or shrinkage to the 1982 age distribution to arrive at a projected age distribution for 1986. Using the same

procedure on the projected age distribution, I derived subsequent projections of operator numbers by age for years beyond 1986. I computed and applied rates of growth for cohorts increasing in size in terms of the number of net entrants, rates of decline for older cohorts are applied in terms of the percentage of operators in the previous period. It is assumed that all operators exit farming by age 75.

The projected farm numbers for 1986 and beyond thus serve as a baseline from which to observe the effects of the age distribution of current operators on short-term changes in the total number of farms, if the net number of younger entrants remains constant at the 1978-82 level. Given the inelastic rate of change in older cohorts, any additional impacts of current economic conditions on younger age groups, such as an increase in the rate of departure from middle-age groups or further reductions in the entry of younger operators, would be expected to decrease the number of commercial farms even more.

Note that the assumption of a constant level of net entry of young operators actually implies an increase in the entry rate of farm-born youth into commercial farming. The most recent survey data (1973) continue to show that the overwhelming majority of farm operators come from farm backgrounds. This situation would presumably be even more apparent for the commercial operators considered here. However, the size of the pool of farm-born youth is shrinking. The total number of U.S. births peaked about 1960, it may have peaked somewhat earlier among farm families, which were declining in number throughout the period (1). Therefore, the largest recent cohort of potential farm entrants is now in its mid- to late twenties, the age at which entry into farming has historically been most common (5). For the number of net younger entrants to remain constant at the 1978-82 level, an increasing proportion of entrants would need to be drawn from the smaller cohorts that follow.

The 6-percent reduction in the number of commercial farms in the Nation between 1978 and 1982 would have increased slightly to 1986 as the "bulge" of older operators continues to retire. The somewhat smaller groups following them would decrease the rate of retirement thereafter, reaching a net decline of 3 percent during 1994-98.

One can make a tentative check of the results for 1986 by comparing them with those reported by the National Agricultural Statistics Service (NASS) in its 1986 estimate of U.S. farm numbers (14). NASS estimated approximately 823,600 farms with sales of \$20,000 and over in 1986, a decline of just under 7 percent from the total reported in the 1982 *Census of*

Agriculture If the NASS estimates are accurate, they show a decline in commercial farm numbers about 10 percent higher than those suggested by the 1978-82 entry/exit rates and the 1982 age distribution. The data suggest some combination of further reductions in entries of younger operators and increases in early departures of established operators.

There is a great deal of regional variability in the implicit patterns of change (table 4). This variability stems from the combination of the operator age distribution in 1982 and the observed age-specific rates of entry and exit in each region. If the 1978-82 entry and exit rates were maintained, the age distribution would boost the rate of net decrease in total farm numbers in 6 of the 10 farm production regions in 1982-86 (the Northeast, Southeast, Lake States, Northern Plains, Mountain, and Pacific). The 1978-82 rate would hold nearly steady in the Southern Plains and Appalachia, it would fall 57 percent in the Delta and 22 percent in the Corn Belt. Most regions would experience decreasing rates of net decline after 1986, however, the total number of farms in the Lake States would begin to increase again after 1990, if the relatively high entry rate of 1978-82 were to continue. The Delta and Corn Belt are exceptions, their rates of net departures are projected to increase in 1986-90 before declining again. In neither region is any future rate of decline projected to exceed the 1978-82 level, however. The net rate of decline is also projected to increase through

1990 in the Pacific region, and then to ease somewhat.

Operator Entry and Financial Stress

Analysis of the age distribution of commercial farm operators indicates that there was a substantial entry of young people into farming in the seventies, which fell significantly by 1982. In the same period, the peak of the age distribution shifted from about 50 to 58 years. Thus, one legacy of the seventies and early eighties to U.S. farm structure was a commercial operator population that is in a sense both younger and older than it was in 1974 (see figure). This age distribution has potentially important implications for the number of commercial farms, particularly if the rate of entry of younger operators falls further. These developments go well beyond farm numbers, however.

The conditions and expectations that attracted young people to farming in the seventies also drove up the cost of farm assets. Thus, many entrants of the mid- and late seventies took on heavy debt loads to acquire production assets. The result is illustrated by data from the 1985 Farm Costs and Returns Survey (table 5). Although these data are for all operators, farms with sales of \$20,000 and up held almost 80 percent of all assets and over 90 percent of all debt, the data thus approximate generational differences in the financial structure of commercial farms.

Table 5—Selected financial characteristics by age class, all operators, January 1986

| Age | Assets | Debts | Equity | Interest expense | Debt/asset ratio of 0.4 or less | Debt/asset ratio of 0.4 or less and positive cashflow |
|------------|------------------|-------|--------|------------------|---------------------------------|---|
| | Percent of total | | | | Percent of class | |
| Under 35 | 10.84 | 17.81 | 8.81 | 15.98 | 55.13 | 30.33 |
| 35 to 44 | 21.09 | 28.58 | 18.91 | 27.70 | 66.99 | 30.24 |
| 45 to 54 | 24.69 | 26.57 | 24.14 | 27.00 | 78.53 | 34.13 |
| 55 to 64 | 25.77 | 20.77 | 27.22 | 22.60 | 89.39 | 47.95 |
| 65 plus | 17.61 | 6.27 | 20.92 | 6.72 | 96.53 | 47.15 |
| | Billion dollars | | | | | |
| U.S. total | 504 | 114 | 390 | 12.6 | 78.66 | 38.55 |

Source: Derived from (13, tables 23 and 28).

As of January 1986, operators under the age of 45 held 32 percent of total assets, but 46 percent of the debt, and only 27 percent of total equity. However, operators aged 55 and over held about 44 percent of total assets, 27 percent of debt, and 48 percent of total equity. Thus, nearly half the production assets of U.S. agriculture are currently held by a group of operators from which a high rate of retirements can be expected over the next decade. Under normal circumstances many of these assets would be acquired by a younger generation of operators through purchase and inheritance. However, this transfer is complicated by the high debt load already carried by farmers who entered agriculture in the seventies.

Although debt/asset ratios in themselves are only crude indicators of ability to carry additional debt, they do indicate the number of highly leveraged producers who are most at risk of having financial difficulty. The proportion of farms with debt/asset ratios of 0.4 or less drops dramatically, from over 97 percent among operators aged 65 and over to 55 percent among operators aged under 35. This relationship is not unexpected, given the paying off of land loans over an operator's lifetime. However, the proportion of operators aged under 45 with low debt/asset ratios and positive cash flows drops to 30 percent when one excludes farms with a negative cash flow after principal and interest payments so as to identify the most likely candidates for absorbing additional debt. Given the recent tendency for most farm assets to be acquired by established farmers rather than by new entrants or investors, it seems that this 30 percent of younger operators is now the group most able to acquire the assets soon to be released by retirement of older operators.

The combined impact of age, debt, and asset distributions in U.S. agriculture could be profound. We have already seen that fewer entries of younger operators, combined with the inescapable retirement of older operators, would hasten the decline in the total number of U.S. farms. If financial difficulties force more early departures of some operators, these departures will most likely come from among younger farmers who entered farming in the seventies. This situation would accelerate the decline in farm numbers.

This situation might also accelerate the redistribution of assets and equity in the farm sector. Nearly half of all assets are nearing release by their current operators, less than one in three younger operators is in a strong position to acquire ownership of these assets. A number of possibilities arise for transferring these assets. First, they might pass into the hands of those among the younger generation of operators who are in good financial condition, thereby concentrating

farm assets among far fewer operators. Second, they might be held by retirees and their heirs and be operated under lease arrangements, shifting the capital structure of operators and further fragmenting the ownership of farm resources. Or, third, they might pass into the hands of nonfarm investors, shifting the control of, as well as the returns to, agricultural assets further away from rural communities.

Fewer entries of new young operators and more exits of younger established operators might also have important effects on the aggregate efficiency of the farm sector. If early withdrawals from farming have increased in the eighties, those leaving the sector are far more likely to do so because of financial, rather than technical, inefficiency (essentially, guessing wrong on asset values) (8). Increased departures from this group of mainly younger operators may reduce the technical efficiency of the farm sector at a time of increasing international competition. Furthermore, a farm operator population increasingly skewed toward older age groups may not adopt new technologies as quickly as a younger population might.

However, entry into agriculture is cyclical, falling off when entry costs are high and prospective returns low and increasing again as barriers shrink and prospects improve. Recent declines in farm asset values and imminent retirements of established operators may improve opportunities for profitable entry over the next decade. For the number of net commercial entrants to increase from the 1978-82 level, however, some combination of reduced exits of established younger operators, increased rates of entry from the smaller oncoming cohorts of farm-born youth, or more entrants from nonfarm backgrounds would be needed.

The number of future entrants into commercial farming will be affected by a number of factors: international monetary and trade policies, the relative performance of the nonfarm economy in providing attractive alternatives to farming, and technological changes. Domestic agricultural policy will also play an important role. Commodity policies designed to protect the incomes of existing operators may both encourage new entrants by providing a more secure environment for the nascent firm and discourage new entrants by inflating asset prices and raising entry costs. Output-restricting policies will likely pose entry barriers, particularly if pursued through production quotas. Credit programs targeted to assist beginning farmers have been deemphasized recently because of concern over production surpluses. Perhaps it would now be useful to sharpen the distinction between output-increasing investments and those that transfer production assets from one generation to the next.

Conclusions

The peak of the age distribution of commercial farm operators (defined here as those with farms having real sales of \$20,000 or more) trended upward between 1974 and 1982, from about 50 to 58 years. A secondary "bulge" of operators about 30 years of age also appeared during the same period. Age cohort analysis indicates that this trend resulted from a relatively high rate of net entry of younger operators in 1974-78, which then dropped significantly in 1978-82. Net departures of older operators continued at a stable rate in both periods.

Assuming that the 1978-82 entry and exit rates by age groups remain unchanged, the rate of decline in the number of U.S. commercial farms would be expected to accelerate slightly in 1982-86 and slow thereafter. Regional rates of change would vary widely because of differences in entry and exit rates and operator age distributions in 1982.

Whether or not the 1978-82 net entry rate of younger operators will be sustained is an open question. A diminishing pool of farm-born youth from which to draw entrants, current widespread financial distress in the farm sector, and uncertainty about the future of agricultural policy may dampen entry further. However, fewer entry barriers in the form of lower land, interest, and used machinery costs may induce entrants from among those put off by the high capital and carrying costs of 1978-82.

Because the retirement of aging operators is inescapable, the number of young people entering farming in the next decade and the kinds of farms they operate will largely determine the structure of U.S. agriculture at the end of the century. In this connection it is important to note that two recent sets of projections of U.S. farm numbers and sizes in the year 2000 reached widely differing results. However, each was derived without any explicit consideration of the age distribution of farm operators and the implied numbers of new entrants required to meet various totals of farm numbers by the turn of the century (3, 11). Future attempts at modeling the future of the farm sector could benefit from greater attention to the demographic aspect of farm structure.

References

- 1 Beale, Calvin "A Note on the Potential Supply of Young Farmers." Unpublished manuscript. U.S. Dept. of Agr., Econ. Res. Serv., Econ. Devt. Div., 1981.
- 2 Clawson, Marion "Aging Farmers and Agricultural Policy," *Journal of Farm Economics*, Vol. 45, No. 1, 1963, pp. 13-30.
- 3 Edwards, Clark, Matthew G. Smith, and R. Neal Peterson "The Changing Distribution of Farms by Size: A Markov Analysis," *Agricultural Economics Research*, Vol. 37, No. 4, Fall 1985, pp. 1-16.
- 4 Johnston, W. E., and G. S. Tolley "The Supply of Farm Operators," *Econometrica*, Vol. 36, No. 2, 1968, pp. 365-82.
- 5 Kanel, Don "Age Components of Decrease in Number of Farmers, North Central States, 1890-1954," *Journal of Farm Economics*, Vol. 43, No. 2, 1961, pp. 247-63.
- 6 _____ "Farm Adjustments by Age Groups, North Central States 1950-1959," *Journal of Farm Economics*, Vol. 45, No. 1, 1963, pp. 47-60.
- 7 Lin, William, George Coffman, and J. B. Penn "Age Cohort Analysis," in *U.S. Farm Numbers, Sizes, and Related Structural Dimensions Projections to Year 2000* TB-1625 U.S. Dept. of Agr., Econ. Stat. Coop. Serv., 1980, pp. 45-53.
- 8 Runge, Carlisle Ford *Inefficiency and Structural Adjustments in American Agriculture: Who Will Quit and Why?* Staff Paper 85-39 Univ. of Minnesota, Dept. of Agricultural and Applied Economics, 1985.
- 9 Shyrock, Henry S., Jacob S. Siegel, and Associates *The Methods and Materials of Demography* Rev. ed. U.S. Department of Commerce, Bureau of the Census, 1975.
- 10 Tolley, G. S. "Management Entry into U.S. Agriculture," *American Journal of Agricultural Economics*, Vol. 52, No. 4, 1970, pp. 485-93.
- 11 U.S. Congress, Office of Technology Assessment *Technology, Public Policy, and the Changing Structure of Agriculture* OTA-F-285 1986.
- 12 U.S. Department of Agriculture, Economic Research Service *Economic Indicators of the Farm Sector* National Financial Summary, 1984 ECIFS 4-3 Jan. 1986.
- 13 _____ *Financial Characteristics of U.S. Farms, January 1, 1986* AIB-500 Aug. 1986.
- 14 U.S. Department of Agriculture, National Agricultural Statistics Service, Agricultural Statistics Board *Crop Production* Aug. 1986.