Additional Independent Variables

Other independent variables are added to the model in order to measure how variation in that particular variable affects the probability of exit, after controlling for age and sales class. Including other variables allows us to compare adjusted exit probabilities for specific groups of farms. In particular, we compare exit probabilities for the following:

- Farms operated by Blacks and Whites.
- Farms operated by women and men.
- Farms with different specializations.
- Farms the operators of which report different levels of off-farm work.
- Farms of different ages.

Two findings from the general model also apply to each of the specific groups just listed. First, exit probabilities decline with farmers' age until farmers become 45-54 years old and then rise and peak for operators 65 year old or older. Second, within a given operator age group, exit probabilities fall as sales increase, although this situation is not always true for elderly operators, those at least 65 years old.

Minority Status and Gender

One might hypothesize that farms run by women and minority farmers are more likely to exit, given allegations of discrimination, including discrimination in the USDA program-delivery system (Effland et al., 1998, p. 16). Note, however, that there are many possible economic and institutional causes of exit for minority farmers. For example, the very small size of most Black-operated farms, the historic dependence of Black-operated farms on cotton sharecropping, and fragmented farmland ownership among Blacks played an important role in the long-term decline in their numbers (Beale, 1991; Kalbacher and Rhoades; 1993, Effland et al., 1998).

Comparing exit probabilities over time may help in understanding trends in the effects that minority status and gender have on survival in farming. Calculating exit probabilities controlled for age and sales class makes comparisons with farms run by White and male farmers easier because age and size distribution vary by race and gender among farmers.

Controlling for age and sales class is particularly important for farms operated by Blacks and women, given their older age distribution and smaller farms (USDA, NASS, 1999, pp. 25-6). About one-third of Black and female operators were at least 65 years old in 1997 compared with one-fourth of all operators (of whom 89 percent were White males). Average sales per farm in 1997 amounted to $103,000 for all U.S. farms but $41,500 for farms operated by women and $25,800 for farms operated by Blacks.

Black and White Farm Operators

Rather than presenting adjusted exit probabilities for farms operated by members of each minority group, we focus on exit probabilities for farms with Black operators, for the sake of brevity. Blacks make up the largest

group of minority farmers, and they are the only group of minority farmers that did not stabilize or increase in number in the 1980s and 1990s (Effland et al., 1998, p. 17).

Black and White exit probabilities are presented in table 3. For brevity, we present probabilities for two sales classes in this and subsequent tables: sales greater than $250,000 and sales from $1,000 to $9,999. These sales classes encompass the range in exit probabilities with only one-third of the estimates that would appear if all the sales classes were used.[6]

For each age and sales class category, the 1992-97 exit probability was 5-7 percentage points higher for farms with Black operators than for farms with White operators. Within a particular age group, the Black/White difference declined somewhat as sales increased. Nevertheless, even in the highest sales class, exit probabilities were still 5-6 percentage points higher for Black-operated farms than for White-operated farms. Even after controlling for age and sales, Black-operated farms are more likely to exit.

Although the Black/White differences in table 3 may appear large, they are smaller than in the recent past. Table 4 summarizes the Black/White differences in adjusted exit probabilities for the last three intercensus periods. Between 1982 and 1987, Black/White differences ranged from 9 to 10

[6]Farms with sales of less than $1,000 were not selected as the lower end of the sales spectrum because they are "point farms." If an establishment does not have the $1,000 in sales necessary to meet the farm definition, a "point system" assigns values for acreage of various crops and head of livestock to estimate a normal level of sales. Point farms have less than $1,000 in sales but points worth at least $1,000. See appendix I.

Table 3
Selected exit probabilities by race and gender, controlled for operator age and sales class, 1992-97

Race, gender, and sales class[1]	Operator age			
	Younger than 45	45-54	55-64	65 or older
	Percent			
Blacks and Whites:				
$1,000-$9,999—				
Black	44.1	41.1	44.2	54.0
White	37.7	34.8	37.8	47.4
Difference[2]	6.4	6.3	6.4	6.6
$250,000 or more—				
Black	31.3	28.6	31.3	40.3
White	25.8	23.5	25.9	34.1
Difference[2]	5.5	5.1	5.4	6.2
Females and males:				
$1,000-$9,999—				
Female	45.7	42.6	45.7	55.2
Male	37.1	34.2	37.1	46.4
Difference[3]	8.6	8.4	8.6	8.8
$250,000 or more—				
Female	33.0	30.3	33.0	42.0
Male	25.8	23.4	25.7	33.7
Difference[3]	7.2	6.9	7.3	8.3

[1]Sales class is expressed in constant 1997 dollars, using the Producer Price Index for Farm Products to adjust for price changes.
[2]Black exit probability minus White exit probability.
[3]Female exit probability minus male exit probability.

Source: Compiled by ERS from the 1997 Census of Agriculture Longitudinal File.

percentage points (depending on sales and age of operator), which is substantially more than the range between 1992 and 1997. Even for small groups—such as Black-operated farms—changes in exit probabilities over time are statistically significant because of the large number of observations in the longitudinal file.

Male and Female Operators

Female/male differences in adjusted exit probabilities are larger than Black/White differences (table 3). The 1992-97 exit probabilities for female-operated farms are 7-9 percentage points higher than those for male-operated farms compared with Black/White differences of 5-7 percentage points.

Although exit probabilities for both Black- and female-operated farms declined, relative to their comparison groups, exit probabilities for Black-operated farms declined faster. The Black/White difference in exit probabilities declined by 3 or 4 percentage points for each age and sales category between 1982-87 and 1992-97 (table 4). In contrast, female/male differences narrowed by 1 or 2 percentage points.

Table 4

Selected Black/White and female/male differences in exit probabilities, controlled for operator age and sales class by intercensus period

Race, gender, sales class, and period[1]	Operator age			
	Younger than 45	45-54	55-64	65 or older
	Percentage points			
Black/White differences:[2]				
$1,000-$9,999—				
1982-87	10.1	10.0	10.1	10.1
1987-92	8.8	8.7	8.9	9.0
1992-97	6.4	6.3	6.4	6.6
$250,000 or more—				
1982-87	9.7	8.9	9.2	9.9
1987-92	7.4	7.0	7.4	8.2
1992-97	5.5	5.1	5.4	6.2
Female/male differences:[3]				
$1,000-$9,999—				
1982-87	10.1	9.8	10.0	10.0
1987-92	9.3	9.1	9.3	9.3
1992-97	8.6	8.4	8.6	8.8
$250,000 or more—				
1982-87	9.4	8.7	9.0	9.8
1987-92	7.8	7.4	7.7	8.6
1992-97	7.2	6.9	7.3	8.3

[1]Sales class is expressed in constant 1997 dollars, using the Producer Price Index for Farm Products to adjust for price changes.
[2]Black exit probability minus White exit probability.
[3]Female exit probability minus male exit probability.

Source: Compiled by ERS from the 1997 Census of Agriculture Longitudinal File.

Controlling for Age and Sales Matters

Black/White differences in adjusted exit probabilities, although substantial, are much lower than Black/White differences in the aggregate exit rate. The exit rate was 11 percentage points higher for Black-operated farms than for White-operated farms during the 1992-97 intercensus period and even higher in earlier periods (table 5). Regardless of the intercensus period, however, the gap between the difference in the exit rate and the highest difference in exit probabilities was 4-6 percentage points (fig. 7), which means that controlling for age and level of sales reduces Black/White differences. Female/male differences also declined, but the gap between the difference in the exit rate and the highest difference in exit probabilities was smaller, 3 or 4 percentage points (fig 8).

Table 5

Exit rate by operator race and gender, 1982-87, 1987-92, and 1992-97

| Race and gender	1982-87	1987-92	1992-97
	Percent		
All farms	40.4	38.5	37.2
Farms by operator race:			
Black	55.4	53.0	48.0
White	40.1	38.2	37.1
Difference[1]	15.3	14.8	10.9
Farms by operator gender:			
Female	53.1	50.7	48.1
Male	39.7	37.7	36.4
Difference[2]	13.4	13.0	11.7

[1]Black exit rate minus White exit rate.
[2]Female exit rate minus male exit rate.

Source: Compiled by ERS from the 1997 Census of Agriculture Longitudinal File.

Figure 7

Black/White difference in exit rates and probabilities by intercensus period

Controlling for age and sales class makes a larger difference for Blacks and Whites...
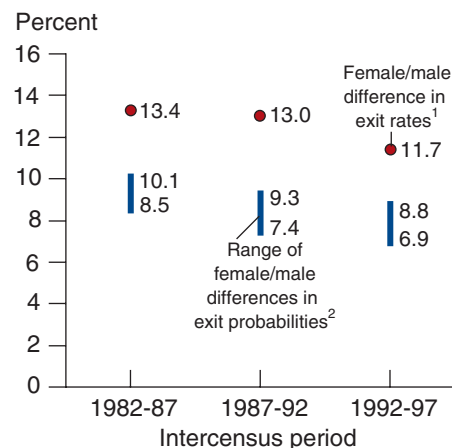

Percent
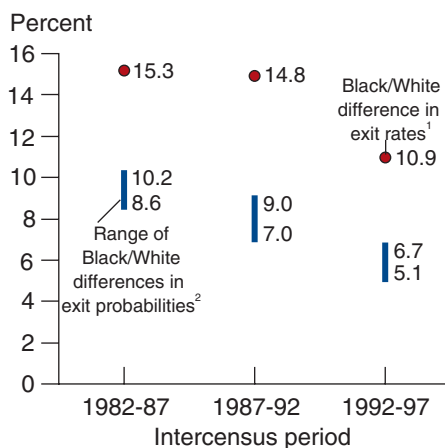
[1]From table 5.
[2]Each racial group has 24 probabilities (6 sales classes X 4 age groups) in each intercensus period, and thus, 24 Black/White differences, 1 for each sales-age combination.

Source: Compiled by ERS from the 1997 Census of Agriculture Longitudinal File.

Figure 8

Female/male difference in exit rates and probabilities by intercensus period

...than for females and males

Percent

[1]From table 5.
[2]Each gender has 24 probabilities (6 sales classes X 4 age groups) in each intercensus period, and thus, 24 female/male differences, 1 for each sales-age combination.

Source: Compiled by ERS from the 1997 Census of Agriculture Longitudinal File.

Selected Specializations

Rather than examining adjusted exit probabilities for a large array of farm specializations, we make two comparisons. The first comparison involves farms specializing in beef cattle (including feedlots) and farms specializing in cash grains. This comparison covers the majority of U.S. farms because beef and cash grain farms account more than half of U.S. farms—and more than two-fifths of sales of farm products—in all the census years examined.

Food and feed grains, the principal product of cash grain farms, are among the commodities traditionally covered by farm programs that make government payments to farmers. In contrast, no such programs exist for beef cattle. One might, therefore, expect cash grain farms to have lower exit probabilities because one of the goals of farm programs is to support farm income (Effland, 2000), which would be expected to help farms survive. Government programs, however, might speed the exit of smaller grain farms by providing funds for larger grain farms, which receive larger payments, to buy up smaller farms.

The second comparison involves farms specializing in beef cattle and farms specializing in hogs. Beef cattle farms account for a slowly increasing share of farms, while hog farms make up a decreasing share of farms. One might expect substantially higher exit probabilities for hog farms, given structural changes underway in the pork industry (McBride and Key, 2003).

Cash Grain Farm Exits Versus Beef Cattle Farm Exits

Cash grain farms had higher exit probabilities than beef cattle farms for the last intercensus period, regardless of sales class or operator age (table 6). The difference in exit probabilities declined somewhat with sales class for each age group but still amounted to 5 or 6 percentage points for most age groups among the largest farms.

Cash grain farms also have had higher exit probabilities than have beef farms since the 1982 Census of Agriculture (table 7). The differences in exit probabilities between the two types of farms did narrow between the 1982-87 and 1992-97 intercensus periods. The decline was modest, however, 1 or 2 percentage points for each age/sales combination.

Hog Farm Exits Versus Beef Cattle Farm Exits

Hog farms also had higher 1992-97 adjusted exit probabilities than did beef cattle farms (table 6). Unlike cash grain/beef differences in exit probabilities, however, hog/beef differences have increased since 1982 for each combination of operator and sales class, by 2-4 percentage points, with most of the increase between 1987-92 and 1992-97 (table 7). This increase does not appear to be directly related to cash receipts from hogs; hog cash receipts actually trended upward slightly between 1992 and 1997.

Rising adjusted exit probabilities for hog farms during the 1990s are consistent with trends in the industry. The 1992 and 1997 Censuses occurred during a period of rapid consolidation in hog production (McBride and Key, 2003, p. 5). Between 1994 and 1999, for example, the number of

farms producing hogs declined by more than 50 percent, but hog inventories remained relatively stable. As a result, the share of hogs and pigs on farms with at least 2,000 head increased from 37 percent to nearly 75 percent between 1994 and 2001.

Beef Cattle Farms' Low Exit Probabilities

This discussion shows that beef farms have lower adjusted exit probabilities than do cash grain or hog farms. In addition, the exit probabilities for beef cattle farms are lower than those from the base model for each size/age category for all intercensus periods examined. Two factors help explain the low exit probabilities for beef cattle farms. First, beef cattle are less labor-intensive than crops. Cattle can also be left alone with little direct supervision (unlike other livestock), except when calving. These attributes make it easier for operators to combine off-farm work with farming (Cash, 2002, p. 21), which may make farm survival easier (see next section, "Off-Farm Work").

Second, cattle operations can be low-cost enterprises, which limits their cash requirements and reduces their vulnerability if revenues from marketing fall. Variable costs for cattle production (other than feedlots) are typically lower than are variable costs for field crop enterprises. Cattle can eat grass and require little additional feed, except during the winter or adverse weather.

Table 6

Selected exit probabilities by farm specialization, controlled for operator age and sales class, 1992-97

	Operator age			
Specialization and sales class[1]	Younger than 45	45-54	55-64	65 or older
	Percent			
Grain and cattle:				
$1,000-$9,999—				
Grain	39.9	37.2	40.6	50.7
Cattle	33.8	31.3	34.4	44.2
Difference[2]	6.1	5.9	6.1	6.5
$250,000 or more—				
Grain	25.7	23.6	26.2	34.9
Cattle	21.0	19.2	21.5	29.2
Difference[2]	4.7	4.4	4.8	5.7
Hogs and cattle:				
$1,000-$9,999—				
Hogs	43.6	40.8	44.3	54.5
Cattle	33.8	31.3	34.4	44.2
Difference[3]	9.8	9.5	9.9	10.3
$250,000 or more—				
Hogs	28.7	26.5	29.3	38.4
Cattle	21.0	19.2	21.5	29.2
Difference[3]	7.7	7.3	7.8	9.2

[1]Sales class is expressed in constant 1997 dollars, using the Producer Price Index for Farm Products to adjust for price changes.
[2]Grain exit probability minus cattle exit probability.
[3]Hog exit probability minus cattle exit probability.

Source: Compiled by ERS from the 1997 Census of Agriculture Longitudinal File.

Fixed costs for land, water access, and fencing make up the largest costs of cattle enterprises. However, these costs represent long-lived assets that require only maintenance and repair to remain functional.

Off-Farm Work

Days of off-farm work by the operator are used here to examine the effects of working off the farm on exit probability.[7] For the off-farm model used here, we collapse the days of work into three categories:

- No days of off-farm work.
- 1-199 days of off-farm work.
- 200 days or more of off-farm work.

Off-farm work has become important to farm operators. About one-third of farmers have worked off the farm at least 200 days per year—essentially full-time—since 1978. Off-farm work could hypothetically affect exits in two ways. First, off-farm work may be the first step in an exit from farming, which would be reflected in higher exits for farms the operators of which work off-farm. Second, off-farm work might lower the probability of exit by providing farm operator households with another source of income.

[7]Another variable related to off farm work is also included in the longitudinal file: major occupation of the operator. This variable, however, forces operators into a farming/non-farming dichotomy. The days-of-work variable is used here because it better accommodates farmers who combine farm and off-farm work.

Table 7

Selected differences in exit probabilities by specialization, controlled for operator age and sales class, by intercensus period

Sales class, specialization and period[1]	Operator age			
	Younger than 45	45-54	55-64	65 or older
	Percent			
Cash grain/beef cattle differences:[2]				
$1,000-$9,999—				
1982-87	7.8	7.5	7.7	7.9
1987-92	8.1	7.9	8.2	8.5
1992-97	6.1	5.9	6.1	6.5
$250,000 or more—				
1982-87	6.6	6.1	6.4	7.2
1987-92	6.0	5.6	6.1	7.1
1992-97	4.7	4.4	4.8	5.7
Hog/beef cattle differences:[3]				
$1,000-$9,999—				
1982-87	6.3	6.0	6.2	6.4
1987-92	7.2	7.0	7.2	7.5
1992-97	9.8	9.5	9.9	10.3
$250,000 or more—				
1982-87	5.3	4.8	5.1	5.8
1987-92	5.3	4.9	5.3	6.2
1992-97	7.7	7.3	7.8	9.2

[1]Sales class is expressed in constant 1997 dollars, using the Producer Price Index for Farm Products to adjust for price changes.
[2]Grain exit probability minus cattle exit probability.
[3]Hog exit probability minus cattle exit probability.

Source: Compiled by ERS from the 1997 Census of Agriculture Longitudinal File.

The days-of-work model supports both hypotheses (table 8). On the one hand, working full-time off-farm is associated with a slightly higher exit probability than either of the alternatives (hypothesis 1). On the other hand, combining some off-farm work (1-199 days) with farm work leads to lower exits than working full-time on or off the farm (hypothesis 2).[8] Note, however, that the range in exit probabilities is fairly narrow, about 2 percentage points, for any sales-age category. The next section discusses a factor (business age) that contributes more to variation in exit probabilities.

Business Age

Studies of nonfarm industries find a strong, inverse relationship between age of business and the probability of exit (Davis et al., 1996; Dunne et al., 1989; and Evans, 1987). In other words, recent entrants are more likely to exit than older, more established firms for such reasons as undercapitalization and the management learning curve. We find a similar pattern among farm businesses. Results from the longitudinal file are presented in table 9, which is organized differently than previous tables. It shows the probability of exit during the 1992-97 period by age of farm business in 1992, for a given operator age and sales class.[9]

For a given operator age and farm sales class, exit probabilities are lowest for the oldest farms and increase substantially as business age decreases. For example, the difference in exit probability between farms at least 14 years old and those less than 5 years old ranges from 13 to 17 percentage points, depending on the age of operator and sales class. The lowest exit probabilities are for farms 14 years old or more that are in the largest sales class and have operators younger than 65. If farms are large and have been in business for a while, their exit probabilities fall precipitously.

[8]The same patterns held for the 1987-92 intercensus period (not shown). The longitudinal file includes days of off-farm work from 1987 forward, which means that the days-of-work model can be prepared for only the 1987-92 and 1992-97 periods.

[9]In this case, we have included the 1978 Census because we are using it only to determine business age, not to analyze exits in the 1978-82 intercensus period.

Table 8

Exit probabilities for farms by days of off-farm work and operator age and sales class, 1992-97

Sales class and days of off-farm work[1]	Operator age			
	Younger than 45	45-54	55-64	65 or older
	Percent			
$1,000-$9,999:				
No days	37.6	34.7	37.7	47.4
1-199 days	36.2	33.4	36.3	45.9
200 days or more	38.4	35.5	38.5	48.3
$250,000 or more:				
No days	25.9	23.6	26.0	34.4
1-199 days	24.8	22.5	24.9	33.1
200 days or more	26.6	24.2	26.7	35.2

[1]Sales class is expressed in constant 1997 dollars, using the Producer Price Index for Farm Products to adjust for price changes.

Source: Compiled by ERS from the 1997 Census of Agriculture Longitudinal File.

Table 9

Selected exit probabilities by business age, controlled for operator age and sales class, 1992-97

Sales class and age of business in 1992[1]	Census in which farm first appears	Operator age, 1992			
		Younger than 45	45-54	55-64	65 or older
		Percent			
$1,000-$9,999:					
14 years or more	1978[2]	27.6	27.3	31.2	41.8
10-13 years	1982[3]	30.5	30.3	34.3	45.3
5-9 years	1987[4]	35.2	34.9	39.3	50.6
Less than 5 years	1992[5]	43.1	42.9	47.5	58.9
$250,000 or more:					
14 years or more	1978[2]	19.1	18.9	21.9	30.8
10-13 years	1982[3]	21.4	21.2	24.5	33.9
5-9 years	1987[4]	25.2	25.0	28.6	38.9
Less than 5 years	1992[5]	32.0	31.8	35.9	47.0

[1]Sales class is expressed in constant 1997 dollars, using the Producer Price Index for Farm Products to adjust for price changes.

[2]Farms entering in 1978 would be 14 years old by 1992. Farms appearing in the 1978 Census, but established earlier, would be older.

[3]Farms entering between 1979 and 1982 would first appear in the 1982 Census. Their ages would range between 10 and 13 years by 1992.

[4]Farms entering between 1983 and 1987 would first appear in the 1987 Census. Their ages would range between 5 and 9 years by 1992.

[5]Farms entering between 1988 and 1992 would first appear in the 1992 Census. These farms would be less than 5 years by 1992.

Source: Compiled by ERS from the 1997 Census of Agriculture Longitudinal File.