Journal of Agricultural and Resource Economics 35(1):133–152

Succession Decisions in U.S. Family Farm Businesses

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Farm transfer or succession by the "next generation" holds a place of central importance in the determination of industry structure and total number of farmers and has profound implications for farm families. The family farm sector relies heavily on intergenerational succession. Succession and retirement are linked and reflective of the life cycles of the farm household and the farm business. A large farm-level data set and a logistic regression model were used to examine the determinants of farm succession decisions in the United States, with special emphasis given to the treatment of endogenous wealth and farm size variables. Results point to the importance of farmer's age, educational attainment of farm operators, off-farm work by the operator or operator and spouse, expected household wealth, and farm business location on the decision to have succession plans.

Key Words: education, endogeneity, farm household wealth, farm transfer, household income, intergenerational succession, life cycle, logit model, off-farm work

Introduction

Most farm households control a substantial amount of wealth. In 2001, U.S. farm households had an average net worth of $545,869 compared with $395,500 for nonfarm households (Mishra et al., 2002). Failure to plan carefully for retirement and estate transfers can result in serious problems such as financial insecurity, personal and family dissatisfaction, and unanticipated capital losses. Intergenerational transfers can be classified by their timing into the forms of transfers and bequests (Altig and Davis, 1992). They also can be classified by type into the forms of physical capital and human capital (Nerlove, Razin, and Sadka, 1984). Physical capital can be further classified into liquid and illiquid assets. This last classification is particularly interesting when relatively illiquid assets are indivisible and when they constitute a large fraction of family wealth. Examples include productive assets owned by self-employed individuals or family businesses. For family farms, the farm itself constitutes a physical asset that is highly illiquid, indivisible to a large extent, and in most cases represents a large fraction, if not all, of family wealth. Further, Rosenszweig and Wolpin (1985) argue that returns to land-specific experiences create incentives for farm offpsring to work on

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Review coordinated by Myles J. Watts.

the family land when young, and the transfer of farm-specific human capital from parent to child increases the value of the transferred physical asset.

Previous studies have shown that even when farming cannot provide the family with an adequate standard of living, farmers refrain from selling farm assets (Chambers and Vasavada, 1983) and attempt to supplement their income from other sources, such as off-farm work (Mishra and Goodwin, 1997; Mishra and Sandretto, 2002; Mishra et al., 2002). This tends to delay structural change within the sector (Kimhi and Nachlieli, 2001). According to Pesquin, Kimhi, and Kislev (1999), the family farm sector relies heavily on intergenerational succession. Gale (1994) points out that entry into farming by the "next generation" holds a place of central importance in the determination of industry structure and total number of farmers and farm families.

Family farms are more than profit-maximizing enterprises. The productive life of farm assets may extend well beyond that of operators, and future value depends crucially on continuity. Farms are places of residence, and land often has symbolic importance that exceeds its economic value in many societies. Moreover, the market value of a farm may be below its value as a "going concern," illustrating that retirement and succession cannot be disentangled from day-to-day farm management decisions (Dunaway, 1991). Gasson and Errington (1993) examined the development cycle of the farm family and the growth and decay cycle of the farm business, and concluded that "synchronizing these two cycles may itself be crucial for the continuance of the farm family business" (p. 266). Clearly, intergenerational succession is one of the important links between those two cycles.

The phenomenon of predominant intrafamily transfer is observed in many economies (Bryden et al., 1992).[1] Kotlikoff and Spivak (1981) argue that intrafamily succession enables the extended family to enjoy the benefits of intergenerational risk-sharing when annuity markets are imperfect. Pesquin, Kimhi, and Kislev (1999) mention additional advantages of intrafamily farm succession, such as "smooth" transition, reduction in transfer cost, and lower transfer taxes. Additionally, Tweeten and Zulauf (1994) point out that intrafamily farm succession allows entering farmers to overcome borrowing constraints.

In contrast to the limited existing literature, the present paper is devoted to analyzing the factors that are likely to influence succession decisions on U.S. family farms. Farm, operator, and family characteristics which may contribute to succession, either to family or nonfamily members, will be identified. This study differs from earlier research in two important ways. First, we use a specific definition of succession.[2] Second, unlike previous studies, which assumed wealth as an exogenous factor in succession decisions, we take into account that wealth is endogenous to succession decisions. In particular, the wealth-generating capacity of each household is estimated, and this predicted value of household wealth is then used to estimate the succession decision of the family farm business. An understanding of the factors that influence succession is important as it allows policy makers to develop policies related to succession planning and prevent or promote structural changes, depending on the prevailing social and economic goals. The analysis is conducted on a national farm-level basis with the unique feature of a large sample, comprising farms of different economic sizes and in different regions of the United States.

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[1] The terms "transfer" and "succession" are used interchangeably in this study.

[2] Stiglbauer and Weiss (2000) and Kimhi and Bollman (1999) used a definition of transfer or succession based on age differentials between past and present farm operators. That method could be inaccurate and is only applicable to panel data. In our study, farmers were queried about whether they had developed a transfer or succession plan for their farming operation.

Literature Review

Succession planning is a component of a household's risk management strategy for its farm business inasmuch as it is aimed at continuity of the business management team. A unique feature of the farming sector, as opposed to most other sectors of the economy, is that businesses are traditionally passed on within families. The study of farm succession has a long tradition in the rural sociology literature (Gasson and Errington, 1993; Blanc and Perrier-Cornet, 1993; Carroll and Salamon, 1988; Coughenour and Kowalski, 1977; Friedberger, 1983). Only a few studies have investigated the reasons and factors affecting the predominance of intergenerational succession within the farm sector (Kimhi and Nachlieli, 2001; Weiss, 1999; Glauben, Tietje, and Weiss, 2004; Stiglbauer and Weiss, 2000). Most economics literature on the topic of farm succession is confined to a discussion of how succession is affected by tax considerations (Boehlje and Eisgruber, 1972; Harl, 1989; Harlin, 1992; Tauer, 1985). In the early 1990s, economics historians examined farm succession practices while investigating Irish emigration (Guinnane, 1992).

Some studies cited in the literature relate to farm succession and farm investment. For example, Potter and Lobley (1992) found the on-farm investment behavior of farmers without successors was radically different from that of farmers whose successor already had been identified. Perrier-Cornet et al. (1991) report that in France, the Netherlands, and Belgium, farm modernization is associated with intergenerational succession. However, farms located in the United Kingdom, Greece, and Italy did not show any significant relationship between these factors. Kimhi, Kislev, and Arbel (1995) used panel data from 1970s Israeli farms and found that succession contributed tremendously to farm expansion (both in terms of farm size and intensity of production). However, due to a widespread farm financial crisis in the 1980s, the expansionary phase did not continue. Indeed, the farm financial crisis actually forced many successors to seek off-farm employment. Phimister (1994) argues that financial pressures arising from intergenerational farm asset transfers may have a negative impact on subsequent farm investment.

Using panel data from Austrian farms, Weiss (1999) reported a strongly significant effect of intra-family succession on farm survival. Analyzing actual farm succession on the basis of census data for Upper Austria, Stiglbauer and Weiss (2000) found the probability of succession to be significantly influenced by farm as well as personal characteristics. Their results suggest that an increase in farm size, family size, and degree of farm diversification raises the probability of farm succession. They also identified a significant life-cycle pattern in farmers' succession behavior.

Kimhi and Nachlieli (2001) studied the likelihood of intra-family intergenerational succession on Israeli family farms. Age of the operator, level of schooling of the operator, and the age of the oldest child were found to be significant factors in having an intra-family successor. Further, number of children and off-farm work did not have any impact on the probability of having an intra-family successor. The authors also reported that farms with more land have a lower probability of intra-family succession.

Glauben, Tietje, and Weiss (2004) used survey data from Northern Germany and a competing risk approach model to examine farm and family characteristics affecting the choice and the timing of intergenerational farm transfers. Their findings indicate farm characteristics significantly influence succession decisions because farm characteristics affect the value of the farm for the potential successor. The study also found a significant nonlinear relationship between the farm operator's age and the timing of succession, suggesting succession is accelerated first as the age of the farm operator increases and then is delayed. The authors argue that farmers may have incentives to announce a willingness to hand over farm operations at a relatively early age to lure successors into waiting. Once a potential successor has credibly committed, a farm operator can delay his or her retirement decisions.

Theoretical Background

Two motivations are often provided for transferring assets and wealth: altruism and exchange (Cox and Rank, 1992). In the altruism framework (Becker, 1974, 1991), a benevolent individual (say parent) cares about the well-being of other individuals (the children). In the exchange model (Bernheim, Shleifer, and Summers, 1985), parents transfer wealth to children in return for services received from them. Wealth transfers in cases where farm households fit the second motive cover annuity income, household production, and labor supply. For example, parents (former farmers) transfer wealth (farm and nonfarm) to children, who continue to farm, with the expectation that their children will provide them with a place for retirement and support their living expenses. Further, parents mentor children by providing invaluable farming experience and a helping hand if necessary. In return, children must take care of the parents in their old age. Also, as a reviewer noted, wealth transfers may be related to family legacies, emotional ties to land, and other personal factors.

Following closely the model of private transfers by Cox (1987), assume two farm household individuals represented by a parent, who is the donor, and by a child, who is the recipient. The parent's objective function is written as:

$$\text{(1)} \qquad \text{Max } U_p = U\big(C_p, S_c, V\big(C_c, S_c\big); \theta\big),$$

where U_p and V are the parent's (p) and the child's (c) levels of well-being, respectively; C is consumption; S_c denotes support and services the child provides to the parent; and θ represents other variables that affect the parent's utility. Equation (1) is a classical case of both altruism and exchange. In this case, the parent cares about the well-being of the child; therefore, $\partial U_p / \partial V > 0$. In turn, the child provides services, such as a place for retirement, share of farm income, savings, and investments related to the farm business. The partial derivatives of other arguments in equation (1) are all positive. Consumption by parents and children is assumed to be a normal good (Cox, 1987). The assumption that children dislike providing services implies that $\partial V / \partial S_c < 0$.

The following two budget constraints and an additional constraint reflecting the child's "threat point" utility, V_0, are introduced into the parent's utility maximization problem:

$$\text{(2)} \qquad C_p \le E_p - T,$$

$$\text{(3)} \qquad C_c \le E_c + T,$$

$$\text{(4)} \qquad V_0\big(E_c, 0\big),$$

where E_p and E_c denote parent and child incomes, respectively; T denotes wealth transfers from the parent to the child; and V_0 is the level of utility associated with providing no services and consuming out of own income. The change in child utility from entering into the transfer-service relationship with the parent must be nonnegative (Cox, 1987), as in:

$$V\left(E_c, S_c\right) \geq V_0\left(E_c, 0\right). \tag{5}$$

Assuming that constraints (2) and (3) are binding, their substitution into (1) results in the following Lagrangian function:

$$L = U_p\left(E_p - T, S_c, V(E_c + T, S_c); \theta\right) + \lambda\left(V(E_c + T, S_c) - V_0(E_c, 0)\right). \tag{6}$$

The following Kuhn-Tucker conditions will yield the levels of T and S_c that will in turn maximize (6) for the parent:

$$\frac{\partial L}{\partial T} = -U_c + U_v V_c + \lambda V_c \leq 0,\ T\frac{\partial L}{\partial T} = 0, \tag{7}$$

$$\frac{\partial L}{\partial S_c} = -U_{S_c} + U_v V_{S_c} + \lambda V_{S_c} \leq 0,\ S_c\frac{\partial L}{\partial S_c} = 0, \tag{8}$$

$$\frac{\partial L}{\partial \lambda} = V\left(E_c + T,\ S_c\right) - V_0\left(E_c,\ 0\right) \geq 0,\ \lambda\frac{\partial L}{\partial \lambda} = 0. \tag{9}$$

As noted by Cox (1987), the parent's marginal utility of consumption (U_c) is equated with the child's marginal utility of consumption from the parent's perspective by means of transferred wealth, T (i.e., $U_v V_c$, where $U_v = \partial U_p / \partial V$). Similarly, the value of the child's services (S_c) is determined when the parent's marginal utility of services (U_{S_c}) is equated with the child's marginal disutility of services from the parent's perspective ($U_v V_{S_c}$).

We can write an expression for the latent variable that determines the transfer decision as:

$$t^* = \left(\frac{\partial U}{\partial C_c}\right) - \left(\frac{\partial U}{\partial C_p}\right), \tag{10}$$

and $T > 0$ iff $t^* > 0$; $T = 0$ otherwise. Assuming diminishing marginal utility of consumption for parent and child implies:

$$\left(\frac{\partial t^*}{\partial E_c}\right) < 0,\ \left(\frac{\partial t^*}{\partial E_p}\right) > 0. \tag{11}$$

The latent variable that determines the transfer decisions is inversely related to the child's wealth level and positively related to the parent's wealth. Additionally, the transfer decision is also affected by farm income, farm growth potential, other production factors, and household variables. Accordingly, this paper uses a utility maximization framework to estimate the impact of factors leading to the succession decision by the parents.

Having a successor provides an incentive to earn higher farm income (i.e., to make it attractive for the next generation) by means of investing and adopting capital-intensive production technologies, increasing production efficiency, and therefore increasing income. Further, having a successor saves on estate taxes and creates additional money that can be divided between the parents and child or between two generations.[3] This type of succession is

[3] Under present U.S. estate law, taxable gifts that cumulatively total more than $1 million are subject to gift taxes. However, the amount of estate tax owed on a farm or business can be reduced in several ways. If a decedent has left heirs minority interests in a business, the estate may claim a reduced value for those interests for tax purposes, thus lowering the taxable value of the estate (Congressional Budget Office, 2005).

mutually agreeable to both parties because it is in both of their best interests.[4] The parent receives money from the farm business (assuming the parent has a valid interest in the farm and views it as being successful). Because of the use of cross-sectional data, we assume the parent has made a decision about whether to pass on the farm to the next generation. The parent's utility level is conditional on having a successor. The utility obtained by parents from each alternative (family succession plan versus no such plan) is assumed to have a deterministic component in a set of explanatory variables. The indirect utility of each alternative is not observable; however, the farm operator succession decision is known in our data set.

Empirical Framework

The econometric representation of the impact of accumulated farm household wealth (W), among other farm and farm operator characteristics, on the latent farm succession decision variables t^* as described in (10), can be specified as follows:

$$t^* = f(\mathbf{X}', W; \boldsymbol{\alpha}) + \varepsilon_i = f(\dot{\mathbf{X}}'; \boldsymbol{\alpha}) + \varepsilon_i, \tag{12}$$

where $\mathbf{X}'$ is a vector of explanatory variables, $\boldsymbol{\alpha}$ is a vector of coefficients to be estimated, and ε is a random error term. Empirically, let the decision to have a succession plan ($t = 1$ if $t^* > 0$; $t = 0$ if $t^* \leq 0$) be represented by the following logistic regression model:

$$E[t \mid \dot{\mathbf{X}}] = P(t = 1) = \frac{e^{\dot{\mathbf{X}}\boldsymbol{\alpha}}}{1 + e^{\dot{\mathbf{X}}'\boldsymbol{\alpha}}} = \delta(\dot{\mathbf{X}}'\boldsymbol{\alpha}), \tag{13}$$

where $P(\cdot)$ is the probability of having a farm succession plan by the farm operator and $\delta(\dot{\mathbf{X}}'\boldsymbol{\alpha})$ is the logistic cumulative distribution function.[5]

Estimation of equation (13) is problematic due to endogeneity concerns resulting from the possibility that unobserved factors (e.g., health of the farm operator, education level of children, macroeconomic conditions, and opportunities and labor market conditions in the local community) might be correlated with both the wealth variable (W) and succession decisions. If left unattended, such concerns could potentially lead to biased and inconsistent parameter estimates. Endogeneity of wealth in farm succession decisions can be tested using the procedure outlined in Wooldridge (2003). This involves a two-stage process by which accumulated wealth is first estimated using ordinary least squares regression and the instrumental variable approach as follows:

$$W = f(\mathbf{X}', \mathbf{w}; \beta) + \mathbf{u}_i, \tag{14}$$

where $\mathbf{X}'$ is a vector of exogenous variables similar to those in (12) that affect both the succession decision as depicted in (13) and the endogenous wealth variable (W), and $\mathbf{w}$ is a vector of instruments correlated with W but not with the succession indicator (t). For the second stage, the vector of residuals ($\mathbf{u}_i$) from the wealth model in (14) is included as an

[4] The alternative is that the parent sells the farm and finds a place for retirement, and the child finds an alternative source of income.

[5] The marginal effects denoting a unit change of a particular explanatory continuous variable on the probability of a farm household having a succession plan is measured as (see Greene, 1997, p. 668): $\partial E[t \mid X] / \partial X = \delta(\mathbf{X}'\boldsymbol{\alpha})[1 - \delta(\mathbf{X}'\boldsymbol{\alpha})]\boldsymbol{\alpha}$. For a kth dummy variable x_k, the marginal change in probability for the ith farm household is computed alternatively as (see Greene, p. 676): $\Delta_{ik} = P_{ik}(x_k = 1) - P_{ik}(x_k = 0)$.

explanatory variable in the farm succession decision equation and is tested for significance. A significant coefficient of the residual vector would indicate the wealth variable is endogenous, and hence warrants the use of predicted rather than observed values of wealth in the model depicting farm succession decisions.

Farm households are unique in the ways they accumulate wealth (Mishra et al., 2002). Farm households have land, buildings and other facilities, machinery, and other equipment that are part of farm net worth. On the other hand, farm households accumulate nonfarm wealth (such as savings, investments, and real estate property) which adds to the net worth of the household (Mishra et al.). As described earlier, the intergenerational transfer of wealth has been an important aspect of farm transfers. In this study, household net worth is a measure of financial well-being of the farm family. Mishra et al. note that at least 70% of farm household wealth comes from the farm and is directly related to farm size. One would expect that passing of wealth to the next generation is in the best interest of the aging head of the household.

Earlier research by Nelson (1985), Welch (1970), Khaldi (1975), and Wozniak (1989) uses education as a measure of human capital to reflect the ability to adopt innovation and technical efficiency. Further, Huffman (1974) contends that schooling augments skills and contributes to efficient decision making. In this study, we use four dummy variables—less than high school (*LTHSSCH*), high school (*HSSCH*), some college (*SCOLL*), and college and beyond (*COLLGRAD*)—to estimate the impact of education on the probability of having a succession plan. The first category, those with less than a high school education, is used as the benchmark group.

There is no standard model for how farm households earn a livelihood. Instead, farm households use a variety of labor allocation decisions to generate income for consumption, savings, and investment. The *Census of Agriculture* has, for several decades, documented the trend toward off-farm work by farm operators, reporting that three of 10 operators worked off-farm by the 1930s, and over half of operators had moved into nonfarm labor markets by the 1960s. Not only has the share of operators working off-farm grown, but the amount of time, as measured in days worked off-farm, has increased as well. Operators and spouses make decisions about whether one, both, or neither work off-farm, and whether to hire someone to work or manage the farm operation. If the marginal value of time from off-farm work exceeds the marginal value of time from on-farm work or leisure, farm operators and spouses may find off-farm jobs more rewarding. Huffman (1976) provides the theoretical underpinning of allocating working time between on-farm and off-farm work by farmers and spouses in Iowa, North Carolina, and Oklahoma based on the value of human time (education). Therefore, in this study, we use three dummy variables to estimate the impact of off-farm work on the probability of having a succession plan. Specifically, the dummy variables depict a labor allocation decision when: (*a*) only the operator works off the farm (*OPOFFONLY*), (*b*) only the spouse works off the farm (*SPOFFONLY*), and (*c*) both operator and spouse work off the farm (*OPSPOFF*). Neither the spouse nor the operator works off the farm (*NONEOFF*) is the benchmark group.

Farm succession literature points out that farm size impacts succession decisions. Using two measures of farm size (acres under cultivation and number of livestock), Stiglbauer and Weiss (2000) found a positive and significant relationship between farm size and succession decisions. On the other hand, using panel data from Israel, Kimhi, Kislev, and Arbel (1995) found the succession decision had a significant effect on farm expansion. This study uses the value of agricultural output as a measure of farm size to assess its impact on the likelihood of succession. Because simultaneity (i.e., when the explanatory variable is jointly determined with the dependent variable) and concerns related to farm size and succession plan caused by unobserved heterogeneity (e.g., risk tolerance, leisure preferences, farming experience, etc.) affect both of these variables, this study will test and correct for these problems using the same procedure outlined above for the likely endogenous wealth variable. Failure to control for simultaneity and unobserved heterogeneity will generate biased coefficient estimates of the "value of production" variable.

Data

A comprehensive succession plan should address the needs of a family, the desires of an owner, and the demands of a farm business. Such plans are considered by many to be a healthy progression in the life of a viable family farm enterprise by connecting current owners to the past and the future. As itemized by Kohl and White (2009), succession planning in the United States consists of five steps. First, a dynamic business model must maximize profit and equity returns, including retirement needs. The succession plan also specifies goals and action plans. Second, the most advantageous method of ownership transfer must be decided. Third, there must be a focus on wealth creation and capital management. This step will build a reservoir of financial resources for uncertainties and turbulent times in transition. Fourth, retirement options must be designed. This promotes preparedness and permits retirement without putting business stability at risk. Fifth, estate planning is used to minimize estate taxes and transfer obligations while planning for an equitable distribution.

Data for the analysis are taken from the 2001 Agricultural Resource Management Survey (ARMS). The ARMS is conducted annually by the Economic Research Service and the National Agricultural Statistics Service. The survey collects measures of the financial condition (farm income, expenses, assets, and debts) and operating characteristics of farm businesses, the cost of producing agricultural commodities, and the well-being of farm operator households.

The target population of the survey is operators associated with farm businesses representing agricultural production in the 48 contiguous states. A farm is defined as an establishment that sold or normally would have sold at least $1,000 of agricultural products during the year. Farms can be organized as proprietorships, partnerships, family corporations, nonfamily corporations, or cooperatives. Data are collected from one operator per farm—the senior farm operator. A senior farm operator is the operator who makes most of the day-to-day management decisions. For the purpose of this study, operator households organized as nonfamily corporations or cooperatives and farms run by hired managers were excluded.

The 2001 ARMS collected information on farm households in addition to farm economic data collected through the regular survey. It also collected detailed information on off-farm hours worked by spouses and farm operators, the amount of income received from off-farm work, net cash income from operating another farm/ranch, net cash income from operating another business, and net income from share renting. Furthermore, income received from other sources, such as disability, social security, and unemployment payments, and gross income from interest and dividends were also counted. Specifically, our analysis focuses on a 2001 ARMS subsample of 3,471 observations selected from over one million married farm-couple households with operators older than 45 years. The issue of succession is central to the family decision-making process, and the literature points to the fact that a majority of farms are passed on directly to children of farm operators and owners. The altruistic motive of parents (farm family in this case) is basic to the theory of intergenerational transfers.

In the 2001 ARMS, farmers were also queried about whether they had developed a succession plan for their farming operation. The issue of succession is especially pertinent for farmers who are ready to retire in the next five years. Using the 2001 ARMS, we classified farm operators into two groups: those with a succession plan and those without. All summary statistics of the variables used in the farm succession model estimated using logistic regression are presented in table 1.

Results and Discussion

A primary concern to be addressed in the modeling of succession decisions by farm operators is the potential endogeneity of the wealth variable (*W*). Finding valid variables that are correlated with *W* but not with the structural errors, ε_i, in (12) and strong instruments for the wealth variable in the 2001 ARMS data set is problematic. A study by Bound, Jaeger, and Baker (1995), for example, demonstrates problems associated with using weak instruments (i.e., when the relationship between the instrument and the endogenous variable is trivial) in that the predictors based on such instruments will be biased. In another study, Angrist and Krueger (2001) point out that the extent of this bias will be reduced when fewer instruments are used. When the number of instruments is equal to the number of endogenous variables, the bias due to the use of weak instruments is approximately zero.

In this paper, a discrete variable depicting the possible adoption of any one of 17 progressive management practices by the farm operator (*PROG_INDEX*) is used as an instrument for *W*.[6] Accordingly, the vector of instruments **w** in (14) reduces to only one variable, which remains sufficient to satisfy the "exclusion restrictions" requirement [i.e., variables correlated with *W* which are present in (14) but not in (13)] when using the 2SLS approach to correct problems associated with endogeneity (for more detail, see Angrist and Krueger, 2001; Bound, Jaeger, and Baker, 1995; Mallar, 1977; Wooldridge, 2003, p. 212).

The choice of valid instruments was based on the distribution of farmers who used progressive management practices that represent substantial population characteristics. The upper chart in figure 1, which shows the weighted scatter plot of the sample, demonstrates visually the extent of association between having a succession decision [coded as 1; 0 otherwise, as in (13)] and the adoption of any one of the possible 17 progressive management practices. Specifically, just over one-fifth (22.2%) of the weighted sample of farm operators

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[6] The *PROG_INDEX* has a mean value of 1.72. The index, which ranges between 0 and 14, is constructed based on the summation of 17 dummy variables with each reflecting whether the farm operator had used (= 1; 0 otherwise) a specific management practice in 2001: (1) forward purchase of input to lock in prices; (2) use farm management services for advice on input or commodity markets; (3) participate in buying clubs, alliances, etc., to purchase inputs; (4) participate in collaborative marketing or networking to sell commodities; (5) use options or futures; (6) use contract shipping to have products hauled to the buyer or market; (7) use on-farm storage of crops; (8) produce certified organic crops; (9) engage in practices that could be used to differentiate livestock products through labeling (e.g., antibiotic-free or range-fed livestock); (10) have taken steps to reduce costs through reduction of used inputs; (11) have taken steps to reduce costs through negotiating lower input prices for inputs; (12) have taken steps to reduce costs through changing production practices (e.g., land preparation, tillage, etc.); (13) have taken steps to reduce costs through change in enterprise mix; (14) have taken steps to reduce overhead costs through renegotiating rental agreements; (15) have taken steps to reduce overhead costs through refinancing existing farm loans; (16) prepare income and net worth statements for own operation from own records; and (17) estimate a rate of return on assets as part of own business analysis.

Table 1. Definitions and Weighted Means of Variables Used in the Farm Succession Plan Model, 2001

		Weighted Means [a]		
Variable Name	Definition	No Succession Plan	Succession Plan	Total ARMS Sample
OPAGE	Age of operator (years)	60*	62	60
HSSCH	Operator education:[b] =1 if high school; 0 otherwise	0.45	0.32	0.41
SCOLL	Operator education: =1 if less than college; 0 otherwise	0.20	0.25	0.22
COLLGRAD	Operator education: =1 if college degree or beyond; 0 otherwise	0.20	0.26	0.22
CHILD6	Presence of children in household: =1 if under age 6; 0 otherwise	0.02	0.02	0.02
CHILD13_18	Presence of children in household: =1 if age between 13 and 18; 0 otherwise	0.16	0.15	0.16
OPOFFONLY	=1 if only the operator worked off-farm; 0 otherwise	0.18	0.17	0.18
SPOFFONLY	=1 if only the spouse worked off-farm; 0 otherwise	0.15	0.16	0.15
OPSPOFF	=1 if both operator and spouse worked off-farm; 0 otherwise	0.34	0.28	0.32
EXPHHNW	Expected household net worth ($10,000s)	59.82*	75.69	64.55
SOLE	Farm organization: =1 if sole proprietorship; 0 otherwise	0.94	0.91	0.93
EXPVALP	Expected value of production ($10,000s)	14.37*	15.96	14.85
PRODINDEX	Productivity index: 0 = least productive; 100 = most productive	72.87	72.52	72.76
FULLOWN	Farm tenure: =1 if farm was fully owned; 0 otherwise	0.62	0.56	0.60
INCOME_01	Income stream: =1 if 2001 household income was below 1996 income; 0 otherwise	0.18	0.19	0.18
ACRES_01	Farm growth: =1 if household operated more acres in 2001 than in 1996; 0 otherwise	0.14	0.22	0.16
GOVP	Expected government support: =1 if support was expected regardless of prices over next 4 years; 0 otherwise	0.28	0.33	0.29
HEARTLND	Farm location:[c] =1 if in Heartland region; 0 otherwise	0.19	0.20	0.19
NRTHCRST	Farm location: =1 if in Northern Crescent region; 0 otherwise	0.14	0.08	0.12
NRTHPLAN	Farm location: =1 if in Northern Great Plains region; 0 otherwise	0.05	0.05	0.05
PRGATEWY	Farm location: =1 if in Prairie Gateway region; 0 otherwise	0.15	0.17	0.16
EASTUPLN	Farm location: =1 if in Eastern Uplands region; 0 otherwise	0.15	0.16	0.16
STHSEABD	Farm location: =1 if in Seaboard region; 0 otherwise	0.10	0.10	0.10
FRUITRIM	Farm location: =1 if in Fruitful Rim region; 0 otherwise	0.10	0.16	0.12
BASINRNG	Farm location: =1 if in Basin and Range region; 0 otherwise	0.04	0.05	0.04
Sample		2,235	1,236	3,471
Population		871,719	370,878	1,242,597

* Differences in the means of non-binary estimates across succession plan, based on linearized standard errors, are statistically different at 1%.

[a] The coefficients of variation (CVs) of all non-binary estimates are below 75%.

[b] The base education category is less than high school (*LTHSSCH*).

[c] The base region is the Mississippi Portal.

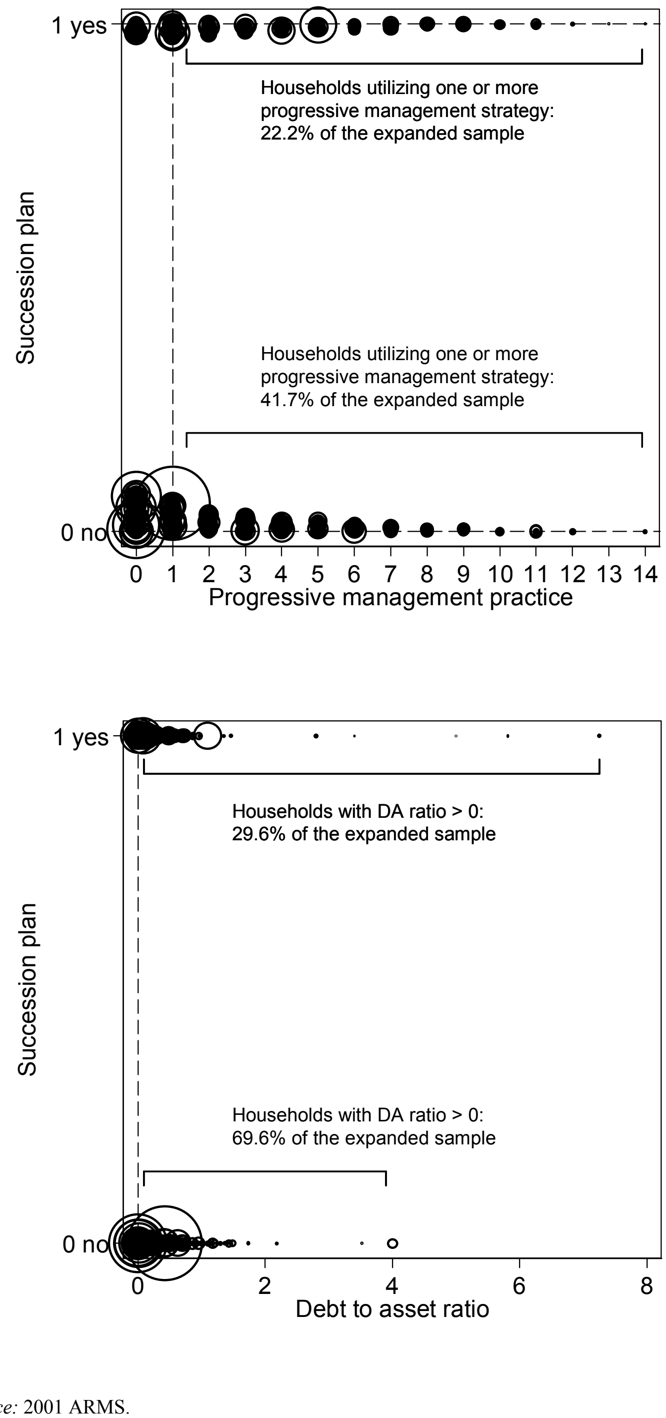
have reported the concurrent presence of a succession plan and the utilization of a progressive management practice, which alludes to a weak correlation between the wealth instrument and the indicator depicting the succession decision. At the same time, the average household wealth held by those operators who used one or more of the progressive management practices in 2001 was $748,838, which is significantly higher than the $464,009 in average wealth held by nonusers of these practices, reflecting a high correlation between the wealth instrument itself (i.e., *PROG_INDEX*) and the wealth variable (*W*).

The lower chart of figure 1, which uses a weighted scatter plot of farm operator households, demonstrates the presence of a weak correlation between the instrument used as a proxy for the value of production variable (i.e., debt-to-asset ratio) and the decision to have a succession plan. For example, nearly 30% of the selected population of farm households with a reported succession plan are found to have a nonzero debt-to-asset ratio. A strong correlation between the debt-to-asset ratio variable and the value of production variable exists. The figure shows a significantly higher amount of farm output ($149,082), on average, for households with any level of indebtedness (i.e., *DA_RATIO* > 0) when compared to the households without any debt (i.e., *DA_RATIO* = 0), with an average of $66,706 in farm sales.

The first column in table 2 reports the results of the first stage of addressing the possible endogeneity of the wealth variable (*W*). Based on the statistical significance of the parameter of *PROG_INDEX*, findings show this variable is a good instrument [i.e., $\text{Cov}(\mathbf{w}, W) \neq 0$; equation (14)] for the level of wealth held by the farm household.[7] While the results of an intermediate step are not shown for the sake of brevity, the significance of the coefficient of the vector of residuals from the first stage, when used as a regressor in the farm succession decision model, demonstrates that wealth indeed is an endogenous variable. Hence, the use of predicted values on household wealth is warranted. In particular, predicted values of wealth are used in the second stage of modeling farm succession decisions.

Similarly, the third column in table 2 shows a statistically significant coefficient of *DA_RATIO*, which justifies its use as an instrument for the “value of farm output” variable. An ensuing test from an intermediate step, however, failed to show that the coefficient of the vector of residuals, when used as a regressor in the farm succession decision model, was statistically significant, thus casting doubt on the endogeneity concern as it relates to the value of farm output. Since a joint test of the null hypothesis that the coefficients of the vectors of residuals of these variables are zero was rejected ($\chi^2_{[2]} = 21.43$; *p*-value = 0.00), predicted values of household wealth and farm output (proxy for farm size) were used in the farm succession decision model.

[7] The fact that the ARMS data have a complex survey design and are cross-sectional raises the possibility that the error terms are heteroskedastic. A Breusch-Pagan/Cook-Weisberg test for the presence of heteroskedasticity in (14), which was performed using Stata, Version 11.0 (StataCorp LP, 2009), confirmed its occurrence (for more detail, see Judge, 1985, p. 446). Specifically, the null hypothesis of constant variance of residuals was rejected based on $\chi^2_{[1]} = 642{,}263$ (*p*-value = 0.00). Accordingly, all standard errors were adjusted for heteroskedasticity using the Huber-White sandwich robust variance estimator based on algorithms contained in Stata (see Huber, 1967; White, 1980). This type of adjustment for standard errors was used in all the regression models in lieu of the jackknife variance estimation method, which is a method suitable for estimation of standard errors when the data set has a complex survey design (for further detail in the context of the ARMS, see Kott, 1997; Dubman, 2000), and when the data set also is used in full rather than as a subset as in this paper.



Source: 2001 ARMS.

Note: The size of the bubble represents the corresponding value of the expansion factor, or weight.

Figure 1. Weighted scatter plot of the decision to have a succession plan in relation to the use of a progressive management practice and the level of indebtedness, 2001

Table 2. Weighted OLS Estimates of Factors Affecting Wealth Accumulation and Farm Output by Farm Operator Households, 2001

	Farm Household Wealth		Value of Production	
Variable	β	Robust Std. Error	β	Robust Std. Error
Intercept	44.808*	25.872	61.063***	10.973
OPAGE	0.400	0.266	−0.408***	0.099
HSSCH	14.298***	4.676	−1.326	2.217
SCOLL	15.992***	5.423	0.854	2.350
COLLGRAD	34.903***	5.317	3.681	2.396
CHILD6	−4.891	8.379	4.690	7.081
CHILD13_18	−0.388	6.882	−3.274*	1.866
OPOFFONLY	−17.421**	7.393	−9.649***	2.499
SPOFFONLY	−17.277***	5.833	−5.261*	2.818
OPSPOFF	−25.312***	6.026	−10.225***	2.327
SOLE	−39.356***	8.763	−26.321***	3.630
PRODINDEX	−0.085	0.195	0.100	0.067
FULLOWN	−2.594	4.714	1.915	1.583
INCOME_01	−5.385	5.627	−5.128***	1.449
ACRES_01	20.224***	6.364	5.539***	1.852
GOVP	7.231	4.830	6.730***	2.213
HEARTLND	12.856***	4.367	−7.545	6.191
NRTHCRST	9.063	5.990	−4.708	7.073
NRTHPLAN	3.841	6.996	−0.664	6.885
PRGATEWY	11.653*	6.204	−4.532	6.180
EASTUPLN	21.563***	6.307	−7.953	5.786
STHSEABD	17.285**	6.880	−0.087	6.282
FRUITRIM	52.629***	9.477	3.777	6.112
BASINRNG	48.905***	13.970	−2.676	6.285
PROG_INDEX	7.894***	1.242		
DA_RATIO			21.976***	6.766
R^2	0.0799		0.0352	
Adjusted R^2	0.0734		0.0284	

Note: Single, double, and triple asterisks (*,**,***) denote statistical significance at the 10%, 5%, and 1% levels, respectively.

The results of the logit model and corresponding marginal effects are presented in table 3. First, the result of the Wald test shows that the coefficients of the succession regression model, when considered jointly, are all significantly different from zero. Another indicator of the model's overall fit is the estimated value of the McFadden pseudo-R^2 (0.07), which, considering the cross-sectional nature of the data, points to the model's fair predictive capability.[8] Yet a third indicator of the model's overall fit is the value of the percent concordant.

[8] McFadden's pseudo-R^2 (see McFadden, 1973, p. 122) is a scalar measure which varies between 0 and 1 and is computed as follows: McFadden's pseudo-$R^2 = 1 - [\ln(L_A)/\ln(L_0)]$, where $\ln(L_A)$ is the value of the log-likelihood function when all the regressors are included in the estimation, and $\ln(L_0)$ is the value of the log-likelihood function when regression is performed on the intercept only. This R^2 will equal 0 (indicating poor fit) if the model predicted the event's occurrence no better than a simple flip of a coin, and will equal 1 if the model predicted the event perfectly (see Amemiya, 1981, p. 1505; Maddala, 1983, p. 39).

Table 3. Weighted Logistic Regression Estimates and Marginal Effects of Factors Affecting Succession Decisions of Farm Operators, 2001

	Estimates		Marginal Effects[a]	
Variable	β	Standard Error	$\partial\beta / \partial X$	Standard Error
Intercept	−5.7548***	1.5603		
OPAGE	0.0343***	0.0133	0.0069***	0.0026
HSSCH	−0.5459***	0.2003	−0.1075***	0.0379
SCOLL	−0.1257	0.2288	−0.0249	0.0446
COLLGRAD	−0.5469**	0.2662	−0.1024**	0.0455
CHILD6	0.1291	0.4612	0.0267	0.0979
CHILD13_18	0.1253	0.2128	0.0257	0.0444
OPOFFONLY	0.5463*	0.3052	0.1179*	0.0699
SPOFFONLY	0.3312	0.2169	0.0700	0.0480
OPSPOFF	0.6024**	0.2860	0.1266**	0.0619
EXPHHNW	0.0189***	0.0039	0.0038***	0.0007
SOLE	0.6527	0.5421	0.1145	0.0809
EXPVALP	0.0007	0.0193	0.0001	0.0039
PRODINDEX	0.0035	0.0072	0.0007	0.0014
FULLOWN	−0.0350	0.1439	−0.0070	0.0291
INCOME_01	−0.0311	0.2152	−0.0062	0.0430
ACRES_01	0.0129	0.2384	0.0026	0.0483
GOVP	0.0336	0.2261	0.0068	0.0459
HEARTLND	0.7385*	0.3888	0.1618*	0.0902
NRTHCRST	0.3729	0.4728	0.0795	0.1065
NRTHPLAN	0.9261**	0.4057	0.2132**	0.1000
PRGATEWY	0.8689**	0.3919	0.1940**	0.0935
EASTUPLN	0.8273**	0.3933	0.1841**	0.0931
STHSEABD	0.8630**	0.4288	0.1952**	0.1040
FRUITRIM	0.4956	0.4638	0.1075	0.1069
BASINRNG	0.5192	0.4571	0.1144	0.1080

Wald χ^2 = 103.45 ($p < 0.001$)
Pseudo-R^2 = 0.069

Association of predicted probabilities of succession and observed responses:
% concordant = 63.8, % discordant = 35.9, % tied = 0.4

Note: Single, double, and triple asterisks (*,**,***) denote statistical significance at the 10%, 5%, and 1% levels, respectively.

[a] The computation of the marginal effects is done following Greene (1997, p. 668)—i.e., $\partial E[\,t\,|\,X\,] / \partial X = \delta(\mathbf{X'\alpha})[1 - \delta(\mathbf{X'\alpha})]\boldsymbol{\alpha}$. For a *k*th dummy variable x_k, the marginal change in probability for the *i*th farm household is computed alternatively as (see Greene, p. 676): $\Delta_{ik} = P_{ik}(x_k = 1) - P_{ik}(x_k = 0)$. Note: For discrete change of dummy variable, the marginal effect is for "from 0 to 1."

This measure, which provides an indication of the model's overall quality by considering the association between predictive probabilities and observed succession responses, is fairly large (64%). Thus, the logistic regression model of succession decisions has reasonable predictive power.

The coefficient of expected household net worth (*EXPHHNW*) is positive and statistically different from zero. A $10,000 increase in expected household wealth increases the probability of having a succession plan by 0.38%.[9] According to the upper chart of figure 2, the probability of having a farm succession plan increases substantially as expected farm household wealth exceeds $75,000.[10] The lower chart shows that the relationship between the probability of a farm succession plan and expected wealth strengthens at each successive level of expected household wealth as the contribution of the other covariates to the probability of succession is allowed to increase from their first quartile levels, to their second and third quartile levels.[11] In contrast to the positive and significant impact of household wealth on the likelihood of farm succession, farm size, as proxied here by expected value of farm output (*EXPVALP*), appears to have no such effect.

Results in table 3 show that the probability of having a succession plan is significantly influenced by an operator's age and education. The signs and the statistical significance of the *OPAGE* terms indicate that the likelihood of a farm operator having a succession plan increases with age of the farm operator. Specifically, an additional year increases the probability of having a succession plan by 0.7%. The literature (see Tweeten, 1984; Goddard et al., 1993) provides evidence that operator's educational level is an important factor in determining structural change in the farm sector. In contrast, the probability of having a succession plan decreases with the educational level of the farm operator. Results reported in table 3 show that, compared to operators with less than high school education, operators with high school (*HSSCH*) and college education (*COLLGRAD*) are less likely to have a succession plan, with the likelihood of having a succession plan by operators with high school and college education decreasing, respectively, by approximately 11% and 10%. These findings reflect the notion that parents with a higher level of educational attainment may process information, allocate resources, and evaluate new technologies more effectively, thereby increasing the farm's current earning capacity. Kimhi (1995) points out that educated farm operators can negotiate a later succession time with their potential successors, and in the process gain additional time to make informed decisions on the choice of a successor. Another plausible explanation for this finding could be that educated farm operators send their children to schools for higher education and many of these children may not return to the farm because they secure higher paying jobs in the nonfarm market.

A dummy variable representing the off-farm work status of the farm family was included in the regression. The coefficients of *OPOFFONLY* (only the operator works off-farm) and *OPSPOFF* (both operator and spouse work off-farm) are positive and statistically significant. The probability of having a succession plan increases by nearly 12% if only the operator reported working off the farm, and by about 13% if both farm operator and spouse work off the farm. An explanation may be that households where the operator either works alone or with the spouse off the farm may choose to live in rural areas and operate a business that qualifies as a farm, but their main job is off the farm. Mishra et al. (2002) report many instances in U.S. farming where such employment patterns are observed. Further, they note that many farm operators may have come into farming after beginning their off-farm job, while many others may have moved from farming to off-farm work. The households of these

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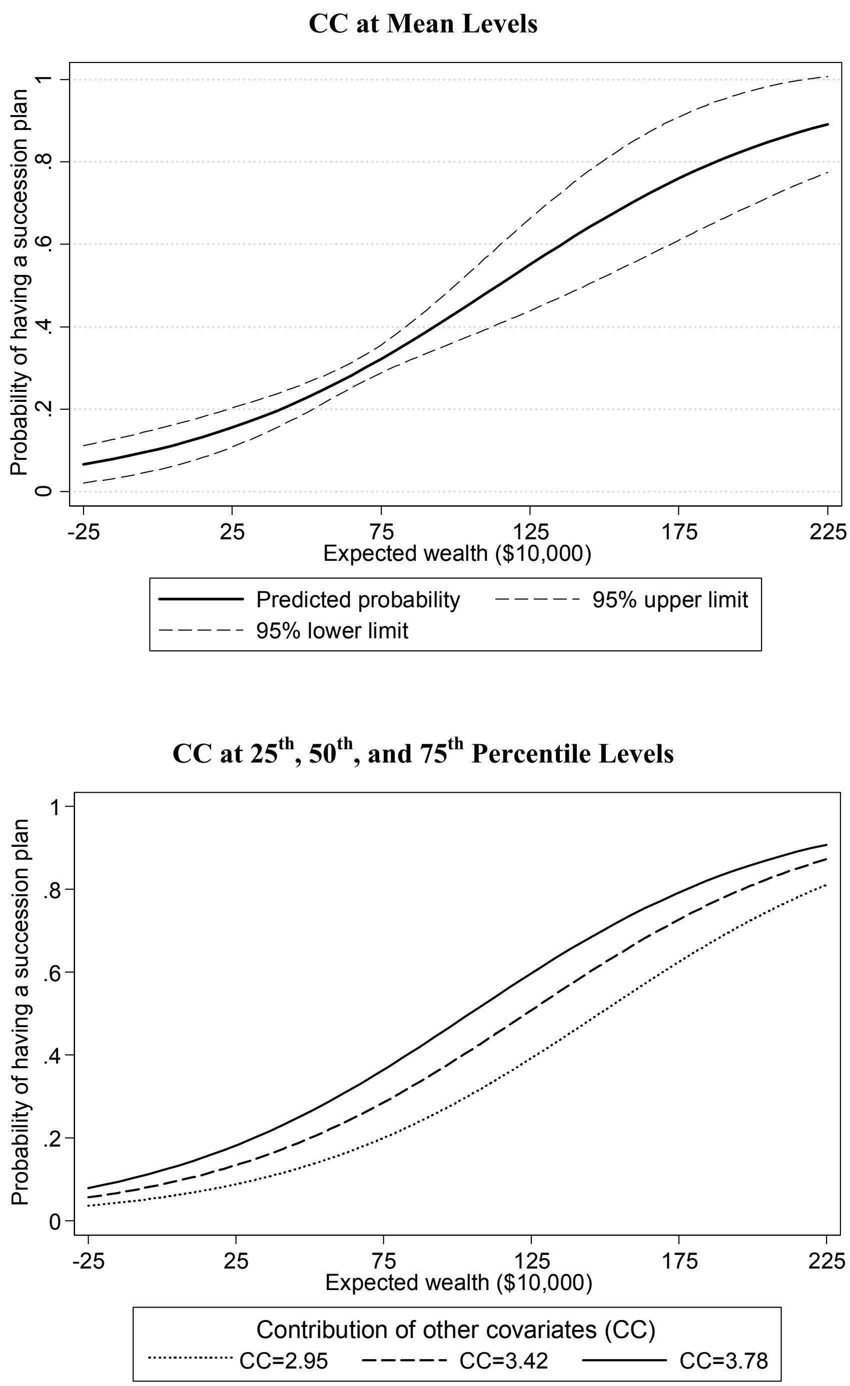
[9] The marginal effects, which capture the impact of changes in the explanatory variables on the probability of the farm household having a succession plan, along with their standard errors are computed using Stata, Version 11.0 (StataCorp LP, 2009).

[10] The simulated probabilities of a household having a succession plan along with their associated confidence intervals are computed with other explanatory variables being held at their means using the Spost package for Stata (see Long and Freese, 2006; Xu and Long, 2005).

[11] The simulated probabilities of a household having a succession plan are computed with the values of the other explanatory variables being held at their 25th, 50th, and 75th percentile levels using the Stata program *viblmgraph* (see Mitchell and Chen, 2005).



Sources: Authors' calculations and 2001 ARMS.

Figure 2. Simulated probabilities of farm succession based on various levels of farm household wealth with contribution of other covariates (CC) held at mean and at selected percentile levels, 2001

operators might be expected to have a weaker tie to their farm than households who are actively engaged in farming.

One of the farm attributes of interest in this study is whether succession may differ by the location of the farm business, which in many ways also proxies for the type of commodities grown on the farm (Mishra et al., 2002). Hence, we included dummy variables reflecting the production region where the farming operation is located. Results show the probability of having a succession plan increases if the farm is located in the Heartland (*HEARTLND*), Northern Great Plains (*NRTHPLN*), Prairie Gateway (*PRGATEWAY*), Eastern Upland (*EASTUPLN*), and Southern Seaboard (*STHSEABD*) regions, compared to the benchmark Mississippi Portal region. Results in table 3 show that farm operators in the Northern Great Plains region are 21% more likely to have a succession plan, followed by the Southern Seaboard region (20%), Prairie Gateway region (19%), Eastern Upland region (18%), and Heartland region (16%), compared to farm operators in the Mississippi Portal region. With the exception of the Southern Seaboard region, farms in most regions specialize in the production of cash grains, cotton, rice, barley, and oats, among others (e.g., wheat, cattle, and sheep). One factor that stands out here is that production of each of the commodities requires large capital investments in land and machinery, which may explain the positive association between these regions and the likelihood of the farm operator having a succession plan.

Summary and Conclusions

Farm succession planning is a part of the development of a complete business plan for a farm operation. Succession plans specify when, how, and under what circumstances management of the business will pass from the current operator to another individual. In one sense, succession plans serve as a road map for managing a business as households enter the retirement or transfer stages of a family life cycle or incur an unexpected circumstance such as the incapacitation or death of an operator. Succession and retirement are inter-linked and are reflective of the life cycles of the farm household and the farm business. Growth, consolidation, and exit phases of a business may overlap with the retirement and succession phases of a household. Despite the important role that succession (family and nonfamily) may play in the continuity of farm businesses, little theoretical or empirical work has been devoted to this issue.

The present study includes a direct measure of succession decision based on information that was collected in a survey of farmers in the United States. Further, the study also treats wealth as an endogenous variable in the farm succession decision of family farm businesses. This study examines farm and family characteristics that affect the likelihood of a household having a succession plan for its farm business. A binomial logit model, along with 2001 ARMS farm-level data, is used to identify factors affecting the succession decision of farm operator households. Factors found to significantly influence the decision to have a succession plan include age of the farm operator, educational attainment of farm operators, off-farm work by either the operator alone or the operator and spouse, expected household wealth, and regional location of the farm business. In particular, farms located in the Heartland, Northern Great Plains, Prairie Gateway, Eastern Upland, and Southern Seaboard regions are more likely to have a succession plan.

This study has highlighted the most significant factors affecting farm succession decisions. The agricultural economics literature indicates farm subsidies tend to become capitalized into land values, and land is a significant part of the farm balance sheet and the main component in farm household wealth. Some farmers depend on government subsidies to augment household income and usually approach retirement slowly. However, wealth, and indirectly government subsidies, may be influential in farm transfers to family members.

Finally, extension agents/economists and financial counselors who provide advice to family farm businesses need to take into consideration the unique challenges facing each business and perhaps identify how family farm business owners have developed the types of succession planning they have or are considering. In addition, these service providers often assist family farm business owners in solving business problems or other issues inherent in the family business. Finally, it is important that economists, financial planners, and business consultants facilitate the process to enable family farm business owners to gain access to their services, thereby fostering their ability to make better succession decisions.

To assist family farm businesses with formal succession plans, the following strategies can be used:

- Develop and conduct educational sessions regarding succession planning for family farm business owners and their families.
- Develop procedures that clearly identify the steps that need to be taken to successfully complete the succession planning process.
- Provide helpful examples of the types of succession plans other family farm business owners have implemented.

[*Received June 2009; final revision received January 2010.*]

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