The Australian Journal of Agricultural and Resource Economics

Journal of the Australian Agricultural and Resource Economics Society

The Australian Journal of Agricultural and Resource Economics, 55, pp. 411–428

Off-farm employment and reasons for entering farming as determinants of production enterprise selection in US agriculture

Jeffrey Gillespie and Ashok Mishra[†]

In today's agriculture, farmers consider off-farm employment and lifestyle goals in complex ways to select production enterprises. Data from USDA's Agricultural Resource Management Survey were used to examine how off-farm employment and 'reasons for entering farming' influence production enterprise selection in US agriculture. A two-stage analysis with a multivariate tobit model was used to examine the impact of off-farm employment as influenced by government farm programme payments, reasons for entering farming, demographics and location on production enterprise selection. Results underscore the impacts of reasons for entering farming and off-farm employment on production enterprise choice and provide implications for policy development. The study highlights the importance of government farm programme payments in production enterprise selection by US farmers.

Key words: diversification, goals, government payments, off-farm employment, production enterprise, tobit.

1. Introduction

The aim of agricultural research and extension has traditionally been to help farmers achieve efficient, profitable production. In accordance with this goal, national agricultural policies have historically focused primarily on increasing farm profitability, usually assuming the farm was the sole or primary income source. Although this focus may generally be appropriate, a myopic view of the profit maximization goal and full-time farming as driving farm decisions ignores what may be dominant drivers; hence, the actual production enterprise selection process is misrepresented. Some farmers farm for reasons other than just maximizing profit, their production enterprise selection decisions reflecting those motivations (Basarir and Gillespie 2006). Furthermore, when a farmer opts to hold an off-farm job, the reduction in management resources available for the farm may further alter farm decisions (Fernandez-Cornejo *et al*. 2005), including production enterprise selection. New landowners often ask about production enterprise options for land given constraints such as

[†] Jeffrey Gillespie (email: jmgille@lsu.edu) is Martin D. Woodin Endowed Professor, Department of Agricultural Economics and Agribusiness, Louisiana State University Agricultural Center, 101 Ag Admin Building, Baton Rouge, Louisiana, USA. Ashok Mishra, is Professor, Department of Agricultural Economics and Agribusiness, Louisiana State University Agricultural Center, 101 Ag Admin Building, Baton Rouge, Louisiana, USA.

doi: 10.1111/j.1467-8489.2011.00542.x

off-farm careers and lifestyle goals, spurning our interest in the determinants of production enterprise selection.

For this study, we distinguish between 'enterprise' and 'production enterprise'. Boehlje and Eidman (1984, p. 79), define enterprise as 'any portion of the farm business that can be separated from the others by accounting procedures according to its receipts and expenses' and production enterprises as 'those enterprises that actually produce a marketable product'. In our case, production enterprise refers to the portion of the farm business that is devoted to the production of a particular commodity, i.e., broilers or hogs.

We use a national farm-level dataset to meet the study objective: to determine how both economic and noneconomic factors influence production enterprise selection. We focus on the roles of off-farm employment, which is influenced by government payments, and alternative reasons for entering farming.

To understand the role of off-farm employment on farm decisions, we consider the factors influencing off-farm labour decisions. Off-farm income has played a critical role in stabilizing farm household income (Mishra and Goodwin 1997), with the average US farm household receiving 85% of its income from off-farm sources (Mishra *et al.* 2002). In the Australian context, Lim-Applegate *et al.* (2002) further examined off-farm employment by farmers. Government payments tend to decrease farmers' off-farm employment (Ahearn *et al.* 2006; Dewbre and Mishra 2007). Likewise, researchers have examined impacts of government policy on farm production enterprise selection (e.g., Gillespie *et al.* 1990). However, less research has investigated the link between off-farm employment and production enterprise selection. Assuming that farmers choose a production enterprise based on labour availability and requirements (and other farm resources), the farmer with off-farm employment is expected to choose production enterprises that are more seasonal and/or where capital investment and economies of scale do not dictate large-scale, management- and labour-intensive operations.

Motivations for entering farming may also influence the production enterprise selection. Although reasons for entering farming have not been extensively considered, the multidimensionality of farmer goals, likely closely associated with motivations for entering farming, have been examined. Economic goals are only part of a goal set including self-reliance and connection to land and community (Thompson 1986). Gasson *et al.* (1988) assert that farmers make decisions leading to family life enhancement and natural resource conservation. The maximum profit goal, for example, may not explain the retired individual's purchase of land to run a small, low-input cow-calf enterprise.

If reasons for entering farming and off-farm work, as influenced by government programmes, were shown to influence production enterprise selection, this would bolster the understanding of industry evolution and land-use patterns. Working in the farm management area, we are commonly asked why estimated production enterprise revenue does not cover estimated cost,

particularly for production enterprises that are less capital and labour-intensive but more land-intensive. Two explanations centre on discussions of farmer goals and off-farm employment, but we have not tested these hypotheses. Our results show these to be important factors in production enterprise selection.

1.1. Reasons for farming, off-farm employment and production enterprise selection

1.1.1. Multi-dimensional decision-making

The economic foundation of production enterprise selection is the production possibilities curve (PPC) and isorevenue line (IR), which provides the framework for production enterprise selection linear programming studies, such as Gillespie *et al*. (1990). This framework is useful in determining how farmers utilize scarce resources to maximize profit. Consideration of alternative farmer motivations, however, provides insight as to why the profit-maximizing production enterprise combination is not always chosen.[1] Although a few studies have examined reasons for entering farming, several have examined farmer goals, postulated to be closely related to reasons for entering farming (Gasson 1973; Harper and Eastman 1980; Patrick *et al*. 1983; Coughenour and Swanson 1988; Fairweather and Keating 1994; Willock *et al*. 1999; Bergevoet *et al*. 2004; Basarir and Gillespie 2006), many showing family and/or environmental goals as highly important to farmers. Goals considered have varied, ranging from maximizing profit, having leisure time, providing family farm experiences, maintaining land, minimizing debt, etc. Australian economists have been particularly interested in characterizing farmer goal structure (Kerridge 1978; Cary and Holmes 1982; Frost 2000; Kuehne *et al*. 2007).

Farmer goals have influenced decision-making. Willock *et al*. (1999) showed that attitudes and objectives were determinants of Scottish farmer behaviour. Bergevoet *et al*. (2004) found that, among Dutch farmers, goal structure influenced farm size. Willock *et al*. (1999) incorporated elements of the Theory of Reasoned Action (Fishbein and Ajzen 1975), which explores the roles of attitudes and goals on behaviour. Bergevoet *et al*. (2004) incorporated elements of the Theory of Planned Behaviour, also developed by Fishbein and Ajzen (1975) and extended by Azjen and Madden (1986). These theories have been used to explain decisions such as adoption of environmentally friendly practices (Pample and van Es 1977).

Previous studies linking goal structure with production enterprise choice include Gillmor (1986) and Basarir and Gillespie (2006). Gillmor (1986) compared Irish farmers' goals with those of English farmers and recommended 'investigations into the links between motivation and overt behaviour in terms of farm enterprise practices and land-use patterns'. Basarir and

[1] Credit and information constraints may also explain why the profit-maximizing farmer does not select what analysts without full information would select as the profit-maximizing enterprise combination.

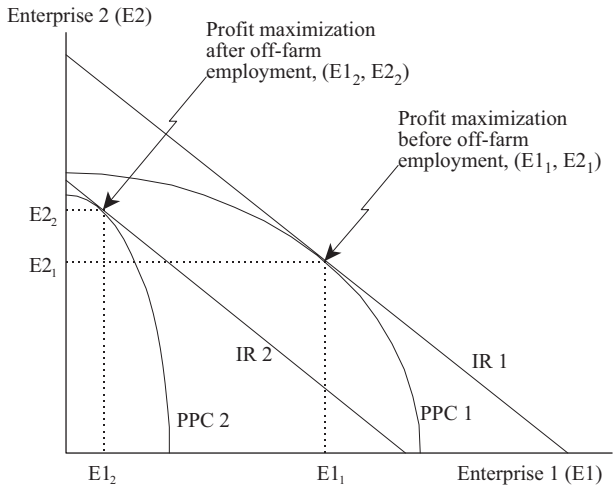

Figure 1 Production possibilities curves (PPC) and isorevenue lines (IR) depicting the profit maximizing combinations of output levels of enterprises E1 and E2 before and after off-farm employment.

Gillespie (2006) found that, among Louisiana beef and dairy farmers, goal structure differed by demographics and production enterprise, with beef farmers indicating greater concern for maintaining and conserving land and dairy farmers indicating greater concern for maximizing profit and avoiding risk.

1.1.2. The role of off-farm employment in production enterprise choice

Referring to Figure 1, assume E1 and E2 refer to output produced from production enterprises 1 and 2, respectively. Off-farm employment would shift the farm's PPC inward from PPC1 to PPC2 as operator labour and management become more constrained. The shift inward is not expected to be proportionate, as the two production enterprises are likely to have different operator and labour requirements. As illustrated, E1 has greater labour and management requirements, so after off-farm employment is taken, the inward shift in the PPC is more extensive for E1 than for E2. Once the farm's IR shifts inward accordingly from IR1 to IR2, the profit-maximizing production enterprise combination changes, with E1 production decreasing and E2 production increasing. This illustrates how the resulting production enterprise combination could change after off-farm employment. The depicted situation assumes risk neutrality, but relaxing that assumption could result in further adjustments, with the off-farm job altering the risk environment as discussed in Mishra and Goodwin (1997). This model admittedly simplifies a complex issue, as off-farm work by any family member could serve to increase operating capital, allowing for hiring additional labour or adoption of technology.

Consider production enterprise cost and returns estimates and labour requirements provided by Paxton (2008) and Boucher and Gillespie (2008). Labour per acre among production enterprises varies greatly, with dairy

requiring the greatest. The fixed-resource farmer wishing to maximize profit would likely choose dairy and/or crop enterprises. The farmer employed off-farm, however, with limited labour and management resources, may choose the less labour-intensive beef enterprise.

The role of off-farm employment and farmer decision-making has been examined. Examples include studies addressing its impact on food expenditures (Chang and Mishra 2008) and farm size and specialization (Davis and Gillespie 2007). Damianos and Skuras (1996) examined the impact of off-farm employment on enterprise choice in Greece. 'Enterprise' in their study did not refer simply to the production enterprise of our study, so it does not fully address our focus.

2. Material and methods

The data used in this study are from the 2003 Agricultural Resource Management Survey (ARMS) household version, conducted by the National Agricultural Statistics Service of the US Department of Agriculture[2] (US Department of Agriculture, Economic Research Service (USDA-ERS). http://www.ers.usda.gov/Briefing/ARMS/WhatisArms.htm, accessed 27 October 2010). The ARMS, conducted annually, includes a large set of observations with a wide range of operation types. A multiphase survey, the ARMS collects information about production practices, land-use, and structural and economic characteristics of farms and farm households.

2.1. Econometric specification

The model utilized in this study is estimated using a two-stage framework. In the first stage, the farmer's off-farm employment decision is estimated using a tobit model, with dependent variable *Off-farm Hours*, the total hours the farmer worked off the farm in 2003. Independent variables are farm and farmer characteristics (See Hallberg *et al*. 1991). As shown by Greene (2000), the tobit index function is given as follows:

$$\begin{aligned} y_i^* &= \beta' x_i + \varepsilon_i, \\ y_i &= 0 \text{ if } y_i^* \leq 0, \\ y_i &= y_i^* \text{ if } y_i^* > 0. \end{aligned} \tag{1}$$

where y_i^* is the latent variable, β is the estimate, x_i is the independent variable, and ε_i the independently, normally distributed error term with zero mean and common variance σ^2 (Maddala 1983, p. 151). As *Off-farm Hours* is truncated at 0, the tobit model is used to reduce bias relative to ordinary least squares

[2] Although some studies have included off-farm wage in the off-farm work equation, the ARMS does not include information on off-farm wage.

regression. With the first-stage tobit model being used to estimate *Off-farm Hours*, predicted values can be used as independent variables in a multivariate tobit model (Lee 1993) explaining production enterprise choice.

The problem with including actual values of *Off-farm Hours* as independent variables in the second stage is the issue of endogeneity: *Off-farm Hours* is correlated with the error term in the second-stage production enterprise choice equations, as found using the Hausman test ($P < 0.04$; Wooldridge 2006), the likely result of off-farm employment and production enterprise selection being simultaneously determined. The solution is to use predicted first-stage estimates of *Off-farm Hours* as an instrumental variable in second-stage equations.

In the second-stage multivariate tobit equations, the five dependent variables (one per equation) are portions of farm value produced from the enterprise of interest: beef, dairy, crops, hogs and broilers. For Farm k, this is calculated as:

$$Valueportion_{jk} = \frac{Value_{jk}}{\sum_{i=1}^{n} Value_{ik}} \tag{2}$$

where $Valueportion_j$ is the portion of total farm value from production enterprise j, $Value_j$ is value from production enterprise j, and there are n production enterprises on the farm. This variable measures the portion of total farm value from the production enterprise, but also the economic importance of other enterprises. A positive $Valueportion_j$ indicates the production enterprise was chosen, with greater value indicating more concentration in that production enterprise. 'Zero' values are found for each $Valueportion_j$ equation, as most farms would not be producing a particular production enterprise. The tobit specification is appropriate because of the truncation of $Valueportion_j$ at 0.

The multivariate tobit is a simultaneous equation model that accounts for correlation of the error terms; ρ is a vector of parameters capturing the contemporaneous dependence among error terms in the system. Because each dependent variable is the portion of value for a specific production enterprise, it is expected that the error terms are correlated. An equation for every potential production enterprise is not included, so the sum total of the five dependent variables is not one. The QLIM procedure in SAS is used to estimate the model (SAS Institute 2010).

2.2. Independent variables

In the first-stage tobit model for *Off-farm Hours*, explanatory variables fall into three categories: demographic, farm and financial, and government payments (Table 1). Demographic variables include operator *Age* and squared

Table 1 Dependent and independent variable means, all models, $n = 5594$

Variable	Mean	Standard deviation
% Value production, beef	28.82	41.16
% Value production, dairy	11.61	29.95
% Value production, crops	43.64	46.52
% Value production, hogs	1.93	12.09
% Value production, broilers	7.03	25.18
Takeover family farm, % yes	44.24	49.67
Invest in real estate, % yes	1.79	13.25
Live in rural area, % yes	10.51	30.67
Retirement activity, % yes	2.09	14.31
Outdoor activity, % yes	11.53	31.94
Other reason, % yes	13.37	34.04
Generate additional income, % yes	14.18	34.88
Age, years	54.28	12.60
College, % yes	23.67	42.51
Education index, 1–4	2.69	2.69
Farm-raised, % yes	80.26	39.80
Household size, number	2.91	1.51
Off-farm hours	511.69	918.50
Miles to town	23.14	24.21
Net worth/10,000	140.62	318.94
Insurance/expenses	0.05	0.06
Government payments/1000	19.96	54.20
Acres/1000	1.34	4.76
Large farm, %	27.46	44.63
Crop farm, % yes	0.44	49.68
North-east, %	9.22	28.94
Appalachia, %	12.37	32.93
South-east, %	10.78	31.01
Delta, %	9.89	29.85
Southern plains, %	9.53	29.36
Northern plains, %	6.86	25.29
Corn belt, %	10.27	30.35
Lake states, %	9.85	29.80
West, %	9.56	29.41
Pacific, %	11.67	32.11
Metro, %	50.75	50.00

term, *Age Squared*, for consideration of nonlinearities. Operator *Education* is coded as 1: < high school; 2: high school diploma; 3: some college; and 4: ≥4-year college degree. *Household Size* is the number of persons living in the farm household. Consistent with Chang and Mishra (2008), *Education*, *Household Size* and *Age* are expected to have positive, negative and nonlinear relationships, respectively, with *Off-farm Hours*.

Farm and financial variables include household net worth (*Net Worth*), farm acres (*Acres*), total insurance expenses divided by total farm expenses (*Insurance*/*Expenses*), a dummy variable indicating whether > 50% of receipts are from crops (*Crop Farm*) and distance of the farm from a town with population ≥10,000 (*Miles to Town*). Larger farms are expected to less likely enter the off-farm labour force (Chang and Mishra 2008). Risk averse farmers, measured by *Insurance*/*Expenses*, are expected to more likely enter the

off-farm labour force, as off-farm labour diversifies the financial portfolio. With greater off-farm employment opportunities, farmers living closer to urban areas are expected to more likely enter the off-farm labour force. *Net Worth* and *Crop Farm*, scaled by dividing by 10,000 and 1000, respectively for computational purposes, are included to examine their relationships with *Off-farm Hours*.

Govt Payments is total payments received from government farm programmes. The sign is expected to be negative (Goodwin and Mishra 2004; Ahearn *et al*. 2006). *Govt Payments* is scaled, dividing by 1000 for computational purposes.

Some studies have considered jointness of off-farm work decisions by operator and spouse. Results have been mixed, with some showing no evidence of jointness (e.g., Mishra and Goodwin 1997; El-Osta *et al*. 2004; Ahearn *et al*. 2006). Considering the mixed results and our modelling of the decision of the operator (only operator goals are included), we do not consider jointness in our model.

In the second-stage multivariate tobit model, variables are classified as those indicating off-farm work, reasons for entering farming, demographic and size, and location. It is expected that farmers working greater hours in off-farm jobs would more likely select beef relative to other production enterprises. This is because of the lower labour and management requirements per acre. Likewise, the seasonal nature of crop production is conducive to more extensive off-farm work during seasons when crops are not grown.

In the ARMS household survey, respondents were asked to indicate 'What was the primary reason for becoming a farm operator?' Respondents were to indicate one of the following motivations for entering farming:[3] (i) take over operation of the farm from a family member or another person, (ii) develop a business to generate additional income, (iii) investment in real estate, (iv) live in a rural area, (v) retirement residence/activity, (vi) growing crops and/or livestock that provide outdoor activity and (vii) other reason (list).

Of the responses, (ii) most closely approximates the profit maximization goal. Farmers indicating (iii) are likely to have entered farming in part for speculative reasons. Reasons (iv–vi) approximate lifestyle goals, with (iv) appealing to the advantages of rural life, (v) concerning the provision of postretirement employment and (vi) pertaining to the advantages associated with outdoor work. We expect that farmers selecting any of these reasons, especially (v), would select production enterprises that provide greater flexibility and leisure time, while avoiding production enterprises requiring more extensive management.

[3] In contrast to simple pair-wise comparisons (Thurstone 1959), the analytic hierarchy process (Saaty 1990), fuzzy pair-wise comparisons (Van Kooten *et al*. 1986) and magnitude estimation (Stevens 1957), our responses do not provide full rankings or ratings of reasons for each individual, but rather the highest ranked. Alternative elicitation methods providing full rankings or ratings require extensive questioning, making them unlikely to be feasible for lengthy surveys such as the ARMS.

Reasons for entering farming dummy variables include *Takeover Family Farm*, those answering (i) in the aforementioned list; *Invest in Real Estate*, those responding (iii); *Live in Rural Area*, those responding (iv); *Retirement Activity*, those responding (v); *Outdoor Activity*, those responding (vi); and *Other*, those responding (vii). The base is 'Develop a business to generate additional income'. Thus, estimates for each of these variables indicate whether the reason is more or less likely to have been chosen relative to the base. Although the questions are framed in terms of reasons for entering farming, we expect these reasons to be related to motivations for continuing farming, with some differences, such as additional motivations of transferring the farm to future generations and environmental stewardship.

Although previous research provides little insight into expected signs on reasons for entering farming variables, Basarir and Gillespie's (2006) results suggest goals other than developing a business to generate additional income to be more important to beef than dairy farmers. Given the extensive investments associated with hog and broiler operations, it is expected that generating additional income would be among the most important reasons for entering those production enterprises.

Demographic and size variables include *Age*, *College*, *Farm-raised* and *Large Farm*, the latter three dummy variables indicating the farmer held a 4-year college degree, was raised on a farm and had gross farm income $>$ \$500,000, respectively.

Location variables include *North-east*, *Appalachia*, *South-east*, *Delta*, *Southern Plains*, *Northern Plains*, *Lake States*, *West*, and *Pacific*, with the base region, *Corn Belt*.[4] These variables account for different suitability of land and resources for production enterprises, representing 10 US crop production regions as used in the Regional Environment and Agriculture Programming Model (Johannson *et al*. 2007). These variables serve as proxies in considering profit-maximizing production enterprise combinations by region: the PPC shape is influenced by region because of soil, climate, etc. Likewise, the IR slope is influenced by regional price differences. *Metro* is a dummy variable indicating the county where the farm is located is in a metropolitan area. Although 6326 farmers answered the reason for entering farming question, with missing data for other variables, sample size was reduced to 5594. Listwise deletion was used to deal with missing data (Allison 2002, p. 6).

3. Results

Means of independent and dependent variables are presented in Table 1. To study the impact of off-farm labour on farm production enterprise selection,

[4] Regions include *North-east*: CT, DE, ME, MD, MA, NH, NJ, NY, PA, RI and VT; *Appalachia*: KY, NC, TN, VA and WV; *South-east*: AL, FL, GA and SC; *Delta*: AR, LA and MS; *Southern Plains*: OK and TX; *Corn Belt*: IL, IN, IA, MO and OH; *Lake States*: MI, MN and WI; *Northern Plains*: KS, NE, ND and SD; *West*: AZ, CO, ID, MT, NV, NM, UT and WY; *Pacific*: CA, OR and WA.

Table 2 Tobit results of number of off-farm hours worked every year by the operator, $n = 5533$

Variable	Estimate β	Standard error
Intercept	−2975.18**	55.47
Demographic		
Age	129.64**	20.43
Age squared	−1.67**	0.19
Education	276.58**	34.93
Household size	−6.96	25.37
Farm and financial		
Net worth/10,000	−3.26**	0.33
Miles to town	1.15	1.57
Acres/1000	−17.43	13.16
Insurance/expenses	3762.42**	614.04
Crop farm	−381.57**	74.33
Government payments		
Govt payments/1000	−21.09**	1.52
Sigma	2067.02**	41.47
Log likelihood	−16,948	
AIC	33,919	

Note: **Significance at the 0.01 level.

we first report the parameter estimates of the *Off-farm Hours* equation and then the impact of off-farm work on production enterprise selection, considering endogeneity of off-farm hours.

3.1. Factors influencing the off-farm work decision

Table 2 presents tobit results for estimating the *Off-farm Hours* instrument. *Age* and *Age Squared* are significant, suggesting increased hours of off-farm work until age 39 and decreased hours afterwards. Farmers with lower net worth and more education worked more off-farm hours. These results are consistent in sign with earlier research (Huffman 1980; Hallberg *et al*. 1991).

Farmers who were more risk averse (measured by *Insurance*/*Expenses*) or received $< 50\%$ of farm receipts from crops were likely to work more hours off-farm, consistent with Mishra and Goodwin (1997). The *Govt Payments*[5] coefficient is negative and significant at the 1% level. As payments increased, annual hours worked off-farm decreased, consistent with Goodwin and Mishra (2004) and Dewbre and Mishra (2007). For the tobit, *Sigma* is equivalent to the standard error of the estimate in ordinary least squares regression.

3.2. Off-farm employment and production enterprise selection

Multivariate tobit results for production enterprise choice show that off-farm work, reasons for entering farming, demographic and size, and location

[5] *Govt Payments* includes coupled and decoupled payments. When coupled payments increase, so generally do decoupled payments, and vice versa.

variables influence production enterprise selection (Table 3). Discussion of results is simplified by indicating only whether a variable influences percentage of farm production value from the referenced production enterprise, recognizing that it also influences whether the enterprise was chosen. Significance of the ρ estimates suggests correlated error terms among the equations (Table 4), with two implications: (i) the multivariate tobit increases efficiency of the estimates, compared with estimating each tobit equation separately, and (ii) negative signs suggest that, holding all else constant, the production enterprises substitute for one another.

Farmers working more off-farm hours were more likely to realize higher percentages of farm production value from beef or broilers and lower percentages from dairy or crops, indicated by coefficient signs for instrumental variable, *Pr_Off-farm Hours*. This reflects the relative flexibility of cow-calf or stocker production on pasture and limited economies of size that lends the enterprise to small-scale, part-time farming. From a policy perspective, of interest is that, from the first-stage equation, greater government payments were associated with less off-farm work, and lower off-farm work in turn increased the selection of dairy or crop enterprises.

3.3. Reasons for entering farming and enterprise selection

Reasons for entering farming significantly influenced production enterprise selection. Farmers indicating the primary reason for becoming a farm operator was to 'Take over operation of the farm from a family member or another person', relative to 'Develop a business to generate additional income', were likely to produce higher percentages of farm value from dairy or crop production and lower percentages from broiler production (Table 3), as indicated by coefficient signs for *Takeover Family Farm*. This suggests the important role of farm succession in dairy and crop production, contrasted with a lesser role in broilers (Mishra and El-Osta 2008). In the broiler industry, state-of-the-art facilities evolve rapidly, accelerating their rate of obsolescence and perhaps reducing their relative values in farm succession.

Farmers indicating their primary reason for becoming a farm operator was 'Investment in real estate', relative to 'Develop a business to generate additional income', were more likely to produce higher percentages of farm value from dairy and lower percentages from broilers (Table 3). Dairy production frequently occurs relatively close to urban areas, generally areas of increasing land values: i.e., southern California and eastern Pennsylvania. Capital investment in enterprise-specific broiler facilities that must produce income streams over extensive periods to repay a loan plus interest is unlikely to be consistent with farming for real estate investment purposes.

Three lifestyle goals were as follows: 'Live in a rural area', 'Retirement residence/activity' and 'Growing crops and/or livestock that provide outdoor activity'. Farmers indicating the primary reason for becoming a farm operator was to 'Live in a rural area', relative to 'Develop a business to generate

Table 3 Multivariate tobit results of percentage value of livestock or crop enterprise on the farm, $n = 5594$

Variable	Beef		Dairy		Crop		Hog		Broiler	
	β	SE	β	SE	β	SE	β	SE	β	SE
Intercept	−0.0181	0.0319	0.0457	0.0236	0.8168**	0.0374	0.0628**	0.0102	−0.0163	0.0191
Off-farm work										
Pr_Off-farm hours	0.0003**	0.0000	−0.0001**	0.0000	−0.0005**	0.0000	0.0000	0.0000	0.0001**	0.0000
Reasons for entering farming										
Takeover family farm	0.0039	0.0146	0.0610**	0.0108	0.0543**	0.0172	−0.0053	0.0047	−0.0733**	0.0087
Invest in real estate	0.0283	0.0390	0.0778**	0.0288	−0.0502	0.0458	−0.0127	0.0125	−0.0542*	0.0233
Live in rural area	0.0519**	0.0196	0.0173	0.0145	−0.0688**	0.0231	0.0018	0.0063	−0.0220	0.0118
Retirement activity	0.0679	0.0366	0.0050	0.0271	−0.0348	0.0430	−0.0020	0.0117	−0.0243	0.0219
Outdoor activity	0.0710**	0.0191	0.0314*	0.0141	−0.0159	0.0224	−0.0097	0.0061	−0.0624**	0.0114
Other	−0.0321	0.0185	0.0503**	0.0137	0.0642**	0.0217	−0.0030	0.0059	−0.0726**	0.0111
Demographic and size										
Age/10	0.0044**	0.0004	−0.0019**	0.0003	−0.0028**	0.0005	−0.0004**	0.0001	0.0004	0.0002
College	−0.0323**	0.0121	−0.0512**	0.0090	0.1277**	0.0142	0.0058	0.0039	−0.0387**	0.0072
Farm-raised	0.0166	0.0130	0.0532**	0.0096	−0.0158	0.0153	0.0093*	0.0042	−0.0072	0.0078
Large farm	−0.2179**	0.0116	0.0756**	0.0086	−0.0620**	0.0137	0.0312**	0.0037	0.1834**	0.0070
Location										
North-east	−0.0787**	0.0226	0.3480**	0.0167	−0.2415**	0.0266	−0.0411**	0.0073	0.0195	0.0135
Appalachia	0.1000**	0.0209	0.0325*	0.0155	−0.2098**	0.0246	−0.0144*	0.0067	0.0829**	0.0125
South-east	0.0809**	0.0219	−0.0156	0.0162	−0.2444**	0.0257	−0.0444**	0.0070	0.2247**	0.0131
Delta	0.0892**	0.0221	−0.0051	0.0163	−0.1967**	0.0259	−0.0551**	0.0071	0.1524**	0.0132
Southern plains	0.2894**	0.0225	0.0221	0.0167	−0.3342**	0.0265	−0.0504**	0.0072	0.0766**	0.0135
Northern plains	0.1292**	0.0245	−0.0293	0.0181	−0.0301	0.0287	−0.0423**	0.0078	0.0124	0.0146
Lake states	−0.0621**	0.0220	0.1836**	0.0163	−0.0828**	0.0259	−0.0131	0.0071	−0.0084	0.0132
West	0.2350**	0.0224	0.0258	0.0165	−0.2447**	0.0263	−0.0514**	0.0072	0.0078	0.0134
Pacific	0.0248	0.0220	0.1286**	0.0163	−0.0752**	0.0259	−0.0596**	0.0071	−0.0097	0.0132
Metro	0.0337**	0.0104	0.0333**	0.0077	−0.1131**	0.0122	−0.0016	0.0033	0.0420**	0.0062
Sigma	0.3681**	0.0035	0.2723**	0.0026	0.4324**	0.0041	0.1180**	0.0011	0.2203**	0.0021
Number > 0	3029		774		3194		205		408	

Note: Significance at the **0.01 and *0.05 levels, respectively. Log likelihood = 2259. AIC = −4267. Number > 0 is the number of observations for which the dependent variable > 0.

Table 4 Multivariate tobit model ρ values

Interaction	ρ Estimate	Standard error
% Value beef × % value dairy	−0.1108**	0.0133
% Value beef × % value crops	−0.5579**	0.0093
% Value beef × % value hogs	−0.0430**	0.0134
% Value beef × % value broilers	−0.1723**	0.0130
% Value dairy × % value crops	−0.4189**	0.0111
% Value dairy × % value hogs	−0.0822**	0.0134
% Value dairy × % value broilers	−0.1012**	0.0133
% Value crops × % value hogs	−0.1267**	0.0132
% Value crops × % value broilers	−0.2131**	0.0128
% Value hogs × % value broilers	−0.0801**	0.0134

Note: **Significance at the 0.01 level.

additional income' were more likely to generate higher percentages of farm production value from beef and lower percentages from crops (Table 3). 'Retirement residence/activity' was not significant at the 0.05 level for any enterprise. Farmers indicating their primary reason for becoming a farm operator was 'Growing crops and/or livestock that provide outdoor activity', relative to 'Develop a business to generate additional income', were more likely to generate higher percentages of farm production value from beef or dairy and lower percentages from broilers. These results show the prevalence of farmers with lifestyle goals producing beef and their lesser tendency to enter the other production enterprises, particularly broilers, the result partially explained by smaller economies of size associated with cow-calf production.

Other nonincluded goals (*Other* in Table 3) positively influenced the percentage of farm production value received from dairy and crops and negatively influenced the percentage received from broilers. Beef farmers placed the least and broiler farmers the greatest emphasis on 'Develop a Business to Generate Additional Income'.

3.4. Demographic, size and location variables

Older farmers were more likely to realize greater percentages of farm production value from beef and lower percentages from dairy, crops or hogs (Table 3). College graduates were more likely to realize greater percentages of farm production value from crops and lower percentages from beef, dairy or broilers. Farm-reared farmers were more likely to realize higher percentages of production value from dairy or hogs. These results suggest significant influences of demographics on production enterprise choice.

Large-scale farmers were more likely to realize higher percentages of production value from dairy, hogs or broilers and lower percentages from beef or crops. These results are partially explained by relative economies of size associated with these enterprises.

Location influenced production enterprise choice, with expected regional signs. Farmers in metropolitan counties were likely to realize greater percentages of production value from beef, dairy, and broiler production and lower percentages from crops.

4. Discussion and conclusions

Study results underscore the role of reasons for entering farming and off-farm employment in farm production enterprise selection decisions. Motivations for farming other than profit maximization have significant, if not dominant, influences on farm decision-making for a significant portion of farmers. Despite rapidly increasing farm sizes and the importance of financial management in farm survival, traditional lifestyle motivations associated with farming continue to be important, particularly in certain segments of agriculture. Related is the role of off-farm employment – some production enterprises lend themselves more readily to success alongside off-farm employment than others. Brief breakdown summaries by production enterprise follow.

Beef Farming. Entering farming for lifestyle reasons of living in a rural area or outdoor activity are associated with greater concentration in beef farming, consistent with Basarir and Gillespie (2006), who found that goals other than maximizing profit were more important to beef than dairy farmers. Furthermore, farmers working more extensively in off-farm jobs are more likely to choose beef relative to some other production enterprises. Most beef farmers are relatively low-input cow-calf or stocker farmers, so the importance of these reasons relative to generating additional income is as expected, and relatively lower economies of scale and capital and labour requirements in this production enterprise are attractive to those employed off-farm.

Dairy Farming. Entering farming for reasons of taking over the family farm, investing in real estate, outdoor activity or another unspecified reason are associated with greater concentration in dairy. Basarir and Gillespie (2006) found dairy farmers more likely than beef farmers to heavily weight the goals, 'maximize profit' and 'avoid years of loss/low profit'. Off-farm work had the expected negative impact on choosing to engage in extensive dairying. Many dairy farms are operated by traditional, full-time farmers who are involved in farming for a variety of reasons, including income generation and family tradition. The real estate investment result is initially surprising given the extent of operator labour typically required. Many US dairy farms, however, are located in urbanizing areas with relatively high and increasing land values, examples including Sacramento, Washington, Philadelphia and New Orleans.

Crop Farming. Entering farming for reasons of taking over the operation from a family member is likely to be associated with greater specialization in crops. However, entering farming to live in a rural area is likely to be associated with lower specialization in crops. Furthermore, off-farm work does not appear to be complementary with crop farming. Overall, crop farmers were

among the more highly educated, full-time farmers whose primary reasons for entering farming included generating additional income, although other reasons were also important.

Hog Farming. Reasons for entering farming were not found to influence specialization in hog farming, nor was off-farm work. However, farm-rearing, being younger and farm size were associated with increased specialization in hog production.

Broiler Farming. Entering farming for taking over the family farm, investing in real estate, outdoor activity and other reasons are likely to be associated with lower concentration in broiler production. Moreover, broiler production appears to be more attractive to farmers holding off-farm employment. Income generation appears to be a particularly important goal for these farmers.

Extending these results to developed countries other than the United States, it is recognized that agricultural policies differ, in some cases impacting farm production enterprise scale. However, the impacts of reasons for entering farming and off-farm employment would likely be consistent if production technologies and scale are similar. In Australia, dairy, hog and broiler farms tend to be more capital and labour-intensive than beef farms, so off-farm employment, as characterized by Lim-Applegate *et al*. (2002), and reasons for entering farming would be expected to be similar to US results.

4.1. General observations

From a policy perspective, several observations are made from these results. First, dairy production and production of many field crops, such as grains, soybeans, cotton and others, have had extensive government programmes providing payments directly to farmers. Farmers of these production enterprises have reasons for entering farming that are significantly more important than generating additional income, and the production enterprises do not appear to be complementary with off-farm employment. Provision of payments in these production enterprises is consistent with an ideal of American farming, as discussed in Paarlberg (1964): 'Farming is not only a business, but a way of life'. Furthermore, those receiving higher government payments worked fewer hours off-farm and were dairy and crop farmers, rather than beef and broiler farmers. Thus, the significant relationship between government payments, off-farm work and production enterprise choice is noted.

The production enterprise that can be argued to have the highest degree of vertical coordination, broilers, has farmers with the greatest concern for developing a business to generate additional income. On the other hand, the production enterprise associated with an industry that is less vertically coordinated relative to other livestock enterprises, beef, has farmers who are more likely to choose goals other than the income generation goal. Thus, limited evidence of a potential linkage between vertical coordination and reasons for entering farming is seen, an issue that could bear further research considering

recent legislation at both state and national levels to deal with packer ownership of livestock.

Future research could further delve into interactions among reasons for entering farming, farmer demographics, etc. For example, Molnar (1985) showed older farmers to have higher subjective measures of well-being than younger ones; we show age to be positively associated with beef production. The point is there may be further interactions among demographics, goal structure and enterprise choice that could be fruitful areas for further study.

References

Ahearn, M., El-Osta, H. and Dewbre, J. (2006). The impact of coupled and decoupled government subsidies on off-farm labor participation of US farm operators, *American Journal of Agricultural Economics* 88, 393–408.

Allison, P.D. (2002). *Missing Data*. Sage Publications, Thousand Oaks, CA.

Azjen, I. and Madden, J. (1986). Prediction of goal-related behavior: attitudes, intentions, and perceived behavioral control, *Journal of Experimental Psychology* 22, 453–474.

Basarir, A. and Gillespie, J. (2006). Goals of beef cattle and dairy producers in a multidimensional framework, *Agricultural Economics* 35, 103–114.

Bergevoet, R., Ondersteijn, C., Sattkamp, H., van Woerkum, C. and Huirne, R. (2004). Entrepreneurial behavior of Dutch dairy farmers under a milk quota system: goals, objectives and attitudes, *Agricultural Systems* 80, 1–21.

Boehlje, M.D. and Eidman, V.R. (1984). *Farm Management*. Wiley and Sons, New York, NY.

Boucher, R. and Gillespie, J. (2008). *Projected Costs and Returns for Beef Cattle, Dairy, and Forage Crop Production in Louisiana, 2008*. A.E.A. Information Series 256, Louisiana State University Agricultural Center, Baton Rouge, LA.

Cary, J.W. and Holmes, W.E. (1982). Relationships among farmers' goals and farm adjustment strategies: some empirics of a multidimensional approach, *The Australian Journal of Agricultural Economics* 26, 114–130.

Chang, H.H. and Mishra, A. (2008). Impact of off-farm labor supply on food expenditures of the farm household, *Food Policy* 33, 657–664.

Coughenour, C. and Swanson, L. (1988). Rewards, values, and satisfaction with farm work, *Rural Sociology* 53, 442–459.

Damianos, D. and Skuras, D. (1996). Farm business and the development of alternative farm enterprises: an empirical analysis in Greece, *Journal of Rural Studies* 12, 273–283.

Davis, C. and Gillespie, J. (2007). Factors affecting the selection of business arrangements by US hog farmers, *Review of Agricultural Economics* 29, 331–348.

Dewbre, J. and Mishra, A. (2007). Impact of program payments on time allocation and farm household income, *Journal of Agricultural and Applied Economics* 39, 489–505.

El-Osta, H., Mishra, A. and Ahearn, M. (2004). Labor supply by farm operators under 'decoupled' farm program payments, *Review of Economics of the Households* 2, 367–385.

Fairweather, J. and Keating, N. (1994). Goals and management styles of New Zealand farmers, *Agricultural Systems* 44, 181–200.

Fernandez-Cornejo, J., Hendricks, C. and Mishra, A. (2005). Technology adoption and off-farm household income: the case of herbicide-tolerant soybeans, *Journal of Agricultural and Applied Economics* 37, 549–563.

Fishbein, M. and Ajzen, I. (1975). *Belief, Attitude, Intention, and Behaviour. Introduction to Theory and Research*. Addison-Wiley, Reading, MA.

Frost, F.M. (2000). Value orientations: impact and implications in the extension of complex farming systems, *Australian Journal of Experimental Agriculture*, 40, 511–517.

Gasson, R. (1973). Goals and values of farmers, *Journal of Agricultural Economics* 24, 521–542.
Gasson, R., Crow, G., Errington, A., Hutson, J., Marsden, T. and Winter, D. (1988). The farm as a family business, *Journal of Agricultural Economics* 39, 1–41.
Gillespie, J.M., Hatch, U. and Duffy, P.A. (1990). Effect of the 1985 Farm Bill provisions on farmers' soil conservation decisions, *Southern Journal of Agricultural Economics* 22, 179–189.
Gillmor, D.A. (1986). Behavioural studies in agriculture: goals, values and enterprise choice, *Irish Journal of Agricultural Economics and Rural Sociology* 11, 19–33.
Goodwin, B.K. and Mishra, A.K. (2004). Farming efficiency and the determinants of multiple job holding by farm operators, *American Journal of Agricultural Economics* 86, 722–729.
Greene, W.H. (2000). *Econometric Analysis*, 4th edn. Prentice-Hall, Upper Saddle River, NJ.
Hallberg, M., Findeis, J. and Lass, D. (eds.) (1991). *Multiple Job-holding Among Farm Families*. Iowa State University Press, Ames, IA.
Harper, W. and Eastman, C. (1980). An evaluation of goal hierarchies for small farm operators, *American Journal of Agricultural Economics* 62, 742–747.
Huffman, W. (1980). Farm and off-farm work decisions: the role of human capital, *Review of Economic Statistics* 62, 14–23.
Johannson, R., Peters, M. and House, R. (2007). *Regional Environment and Agriculture Programming Model*. USDA-Economic Research Service Technical Bulletin 1916.
Kerridge, K. (1978). Value orientations and farmer behaviour: an exploratory study, *Quarterly Review of Agricultural Economics* 31, 61–72.
Kuehne, G., Bjornlund, H. and Cheers, B. (2007). There's more than one type of farmer; Acknowledging farmers' diversity – an Australian perspective, *International Journal of Interdisciplinary Social Sciences* 2, 179–186.
Lee, L.F. (1993). Chapter 6: multivariate tobit models in econometrics, in Maddala, G.S., Rao, C.R. and Vinod, H.D. (eds), *Handbook of Statistics*, Vol. 11. Elsevier, Amsterdam, pp. 145–173.
Lim-Applegate, H., Rodriguez, G. and Olfert, R. (2002). Determinants of non-farm labor participation rates among farmers in Australia, *The Australian Journal of Agricultural and Resource Economics* 46, 85–98.
Maddala, G.S. (1983). *Limited-Dependent and Qualitative Variables in Economics*. Cambridge University Press, Cambridge.
Mishra, A. and El-Osta, H. (2008). Effect of agricultural policy on succession decisions of farm households, *Review of Economics of the Households* 6, 285–307.
Mishra, A. and Goodwin, B. (1997). Farm income variability and the supply of off-farm labor, *American Journal of Agricultural Economics* 79, 880–887.
Mishra, A., Morehart, M., El-Osta, H., Johnson, J. and Hopkins, J. (2002). *Income, Wealth, and Well-being of Farm Operator Households*. Agricultural Economics Report # 812, Economic Research Service, US Department of Agriculture, Washington, DC.
Molnar, J.J. (1985). Determinants of subjective well-being among farm operators: characteristics of the individual and the firm, *Rural Sociology* 50, 141–162.
Paarlberg, D. (1964). *American Farm Policy*. John Wiley & Sons, New York, NY.
Pample, F. and van Es, J. (1977). Environmental quality and issues of adoption research, *Rural Sociology* 42, 57–71.
Patrick, G., Blake, B. and Whitaker, S. (1983). Farmers' goals: uni- or multidimensional?, *American Journal of Agricultural Economics* 65, 315–319.
Paxton, K. (2008). *Projected Costs and Returns: Cotton, Soybeans, Corn, Milo, and Wheat, Northeast Louisiana, 2008*. A.E.A. Information Series 254, Louisiana State University Agricultural Center, Baton Rouge, LA.
Saaty, T. (1990). How to make a decision: the analytic hierarchy process, *European Journal of Operational Research* 48, 9–26.
SAS Institute (2010). *9.2 Software*. SAS Institute, Cary, NC.

Stevens, S. (1957). On the psychophysical law, *Psychological Review* 64, 153–181.
Thompson, P. (1986). The social goals of agriculture, *Agriculture and Human Values* 3, 32–42.
Thurstone, L.L. (1959). *The Measurement of Values*. University of Chicago Press, Chicago, IL.
Van Kooten, G., Schoney, R. and Hayward, K. (1986). An alternative approach to the evaluation of goal hierarchies among farmers, *Western Journal of Agricultural Economics* 11, 40–49.
Willock, J., Deary, I., Edwards-Jones, G., Gibson, G., McGregor, M., Sutherland, A., Dent, J., Morgan, O. and Grieve, R. (1999). The role of attitudes and objectives in farmer decision making: business and environmentally-oriented behaviour in Scotland, *Journal of Agricultural Economics* 50, 286–303.
Wooldridge, J.M. (2006). *Introductory Econometrics: A Modern Approach*. Thomson South-Western, Thomson Learning, Inc, Mason, Ohio.