ECONOMETRIC ANALYSIS OF FARMER PARTICIPATION IN THE DAIRY TERMINATION PROGRAM IN NORTH CAROLINA AND VIRGINIA

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Abstract

Farm-level data are used to estimate equations explaining the probability of bidding and the level of the bid for the 1986 Dairy Termination Program. Participation was attractive to older farmers, to those who were not planning to transfer the farm to a family member, to less experienced farmers, and to those using less sophisticated management techniques. Schooling, off-farm work, and nonfarm experience did not have significant effects. The participation pattern suggests that the long-term effects of the program on milk supply are small.

Key words: Dairy Termination Program, human capital, life cycle, farm commodity programs, participation.

The Dairy Termination Program (DTP), introduced as part of the 1985 Food Security Act in an effort to curb surplus milk production, offered cash payments to dairy operators who agreed to cease milk production for five years. In contrast to the earlier Milk Diversion Program, which required participants to make temporary partial cutbacks in production, the DTP required participants to cease milk production for five years and to liquidate the entire dairy herd. This amounted to permanent exit from dairying for most participants; the majority of DTP participants in three separate surveys reported that they would probably not return to dairying (Carley *et al.*; USGAO 1988; Simler *et al.*). Given the persistent excess capacity in U.S. farming (Dvoskin), additional programs that pay farmers to leave farming are likely to receive consideration from policymakers in future farm legislation.

The research reported here attempts to identify characteristics of farm operators that are associated with greater willingness to participate in the DTP. This is accomplished by estimating models that explain the probability of submitting a bid to participate in the DTP and the level of the bid using various measures of human capital and demographic characteristics. The results of this study should prove useful by providing an indication of what types of farmers found the DTP attractive and by adding to our knowledge of how human capital and other demographic characteristics influence farm management decisions.

Several other studies have examined participation in voluntary government programs, including grain marketing programs (Chambers and Foster; Kramer and Pope), the role of participation in supply control programs in determining aggregate supply (Lee and Helmberger), and the 1983 Milk Diversion Program (Lee and Boisvert; Gauthier; USGAO 1985). Study of DTP participation is warranted because of the unique features of the program and because policymakers need information about the program to aid them in deciding whether to implement this type of program again in the future.

Several studies have examined participation in the DTP. Carley *et al.*, Kirkland and Smith, Simler *et al.*, and USGAO (1988) presented descriptive statistics from surveys of DTP participants, but nonbidders were not included. Only the studies by Simler *et al.* and USGAO (1985, 1988) included rejected bidders. Gauthier *et al.* used the Carley *et al.* data to conduct a discriminant analysis between DTP participants and Milk Diversion Program participants, but they did not compare DTP participants to nonparticipants. Kaiser and Lee Examined DTP participation and sign-up rates using grouped state-level data and found a number of variables significantly affected participation, including the ratio of actual marketings to contract base, average age of farmers, profitability, and other variables.

The farm-level data used in the current study contain more detailed information on farm and operator characteristics than the data employed in previous studies of DTP participation. These data allow ex-

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amination of the influences of some human capital and demographic variables that have not been considered in earlier studies. This is also the first study of participation in the DTP that has utilized farm-level data on accepted bidders, rejected bidders, and nonbidders.

This study focuses on the role of human capital and life cycle variables on a farmer's willingness to quit dairying. It has been shown elsewhere that human capital can aid farmer decisions with respect to efficient input use (Huffman; Pingali and Carlson), technology adoption (Rahm and Huffman), and farm size and growth (Sumner and Leiby). This study shows how different types of human capital influence the farmer's DTP participation decision.

There has been limited formal study of life cycle influences on farm management decisions, but recent work has indicated that farmer age is an important influence on entry, exit, and growth of farms (Smith; Peterson). An important demographic influence on farming decisions is the presence or absence of a family member willing to take over management of the farm when the current operator quits. Norris and Batie found that a kin-transfer variable was positively associated with use of conservation tillage in a recent study of Virginia farmers. The current study considers the effects of farmer age and family transfer on DTP participation.

A MODEL OF DTP BIDDING

DTP participants were required to sell all dairy cattle for slaughter or export during one of three separate disposal periods between April 1986 and August 1987 and to have no interest in a dairy operation for a period of five years. Provisions of the program also prohibited sale of the facilities and land of the dairy for dairy use. The DTP called for interested producers to submit payment bids instead of signing up for a predetermined payment. The bid was determined by dividing the desired payment by hundredweight of base milk marketings during one of two historical periods during 1984 and 1985. Each farmer could submit as many as three bids: one for each of the three disposal periods.

The bidding took place during February and March of 1986, just a few months after the program had been announced. After all bids had been submitted, USDA announced that all bids at or below $22.50 had been accepted. Producers who had submitted more than one bid below $22.50 had the lowest bid accepted. Once accepted, the producer could not legally decline to participate.[1]

The determination of the optimum bid was a complex calculation that had to be done in a short time with limited information. This complexity is borne out in a comparison of seven different extension aids for DTP bid calculation that found substantial differences in analytical approaches and in numerical results obtained from the different procedures (Knight and Kubiak). While a variety of different factors might be expected to influence the participation decision, this study focuses on characteristics of the farm operator and considers selected physical characteristics of the dairy.[2]

The participating producer needed to be compensated with a cash payment for (1) a capital loss on his dairy-specific assets that could not be used for milk production, (2) the loss of net returns from the dairy enterprise, which may be partially offset by net returns from an alternative enterprise of from reallocation of labor to an off-farm activity over the five years of the program, (3) possible start-up costs to re-enter dairying after the program, plus (4) a premium added on by the producer.[3] The present value of the payment required by the ith producer is expressed here using an equation similar to those found in Knight and Kubiak:

$$(1)\quad \text{PAYMENT}_i = CL_i + \sum_{t=1}^{5}(1+r)^{-t}(NR_{it}^{d} - NR_{it}^{a}) + (1+r)^{-5}\text{ENTER}_i + P_i,$$

where PAYMENT_i is the present value of the cash payment desired by potential participant i, CL_i is the capital loss anticipated by the ith individual, r is a discount rate ($0 \leq r < 1$), NR_{it}^{d} is expected net returns from dairy enterprise i in year t, NR_{it}^{a} is expected returns from an alternative nondairy activity in year by individual i, ENTER_i is expected costs of re-entering dairying at the end of the five year program, and P_i is the premium.[4] The capital loss is assumed to be proportional to the size of the dairy enterprise, while the difference in net returns and inclination to

[1] A number of individuals were allowed to move to a later disposal period in a few isolated cases.

[2] Selected physical characteristics of the farm are included in the empirical model. Financial characteristics are not given much consideration because no information on financial variables was contained in the data used in this study.

[3] The premium is intended to reflect strategic bidding behavior by the producer, while the other components reflect a "breakeven" payment level. The premium is assumed to vary with influences that are unobserved, such as access to information or subjective beliefs about the cutoff bid level.

[4] The choice of the timing of the payments and income tax considerations are ignored here to maintain simplicity.

re-enter after five years may differ across individuals.

The actual bid is obtained by dividing equation 1 by hundredweight of base marketings. The bid is then expressed as equation 2:

$$(2)\quad BID_i = \left(\frac{CL_i}{B_i}\right) + \sum_{t=1}^{5}(1+r)^{-t}\left[\left(\frac{NR_{it}^{d}}{B_i}\right) - \left(\frac{NR_{it}^{a}}{B_i}\right)\right] + (1+r)^{-5}\left(\frac{ENTER_i}{B_i}\right) + \left(\frac{P_i}{B_i}\right),$$

where BID_i is the bid submitted by individual i, and B_i is hundredweight of milk production during a historical base period. If both the capital loss and base production are proportional to current size of the dairy enterprise, the first term on the right-hand side of (2) becomes a constant. The premium is believed to depend on unobserved factors. The discussion that follows is concerned with the effects of farm operator characteristics on the remaining terms: the difference between dairy and alternative net returns per unit of base period production, and the costs of re-entering.

Differences in human capital and farm specialization are expected to affect the difference between dairy and alternative net returns. Studies of nonagricultural wage growth and job mobility often distinguish between general and specific human capital (Mincer; Mincer and Jovanovic; Shaw). General human capital is capital that may produce returns in any work activity, while specific human capital is useful only in a specific work activity or firm.

Dairy-specific human capital—dairy experience and use of management practices—is expected to raise NR_{it}^{d}, but not NR_{it}^{a}, thus being associated with a higher bid. Nonfarm-specific human capital is expected to reduce the bid by increasing prospective returns in nondairy (nonfarm) activities (NR_{it}^{a}), while not affecting dairy returns. General human capital can be expected to raise net returns in both dairy and alternative activities; thus it has an ambiguous effect, or possibly a zero effect if it raises returns in dairy and the alternative activity equally.

It is important to consider the decision in the context of the farmer operator's life cycle. The farmer's age, given the level of experience, could affect the decision in a number of ways. Age could be associated with lower net returns from dairying if members of older age cohorts tend to use outmoded management techniques.[5] Studies of nonfarm workers have found that the likelihood of changing jobs or migrating declines with age (Mincer and Jovanovic; Goss and Paul) since the older worker has a shorter time horizon over which to recoup the costs of a job change or move. If this is true for farmers who switch from dairying to an alternative enterprise or activity, there will be a positive association between the bid and the age of the farmer. Older farmers who are near retirement age or who are already planning to retire may find DTP participation attractive. Such individuals will be less concerned about reduced returns and will not want to re-enter dairying after the program. This would lead to lower bids for older farmers. In summary, two of the effects of age on the bid discussed here are negative, while the other is positive. The net effect of age is therefore *a priori* ambiguous.

While many farmers do not retire in the usual sense of the word, most farmers either scale back the size of their operations or gradually pass day-to-day management activities to a family member or associate as they reach advanced age. The presence of a family member to take over the farm is expected to have a negative effect on the farmer's inclination to quit dairying and consequently a positive effect on the bid.

Off-farm work may be expected to influence a farmer's willingness to quit dairying, but the direction of the effect, as with age, is not clear. Off-farm work, on the one hand, can be a transition stage for farmers getting out of farming, and it may be associated with greater nondairy human capital. Off-farm work, however, is also a common strategy for young farmers who are building up their farm operations and for part-time, "hobby" farmers (Findeis *et al.*). Off-farm work may be associated with less willingness to quit farming if it contributes to the financial health of the farm. The net effect of off-farm work is therefore ambiguous.

EMPIRICAL MODEL

An initial assumption is that the bid can be expressed as a linear function of characteristics of the farm operator and physical characteristics of the farm:

$$(3)\quad BID_i = X_i\beta + e_i,$$

[5] The effects of age are discussed here under the assumption that experience (as well as all other characteristics) is held constant. The effects of age and experience are likely to offset each other, at least partially. This has been an issue in studies of the migration decision (which is similar to the DTP participation decision), where Goss and Paul showed that it is important to hold experience constant when measuring the effect of age on the probability of migrating.

where X_i is a vector of characteristics for individual i, β is a vector of coefficients, and e_i is a random disturbance term. This equation can be estimated using least squares.

Another interesting consideration is the effects of these characteristics on the discrete event of submitting a bid. Every individual is assumed to have a bid level at which he would be willing to participate, but bids are not observed for all individuals because there are costs of submitting a bit that must be weighed against the expected benefit of submitting a bid. The likelihood that an individual will submit a bid is assumed to decrease as the size of the bid increases because the expected benefit of submitting a high bid will be small due to a low probability that the bid will be accepted.

Presumably the same characteristics that affect the bid affect the probability of bidding. Let the variable SUB_i take on a value of 1 if a bid is submitted and 0 otherwise. Then:

$$(4) \quad Pr(SUB_i = 1) = F(X_i\delta),$$

where F() is a cumulative probability density function and δ is a vector of parameters to be estimated. Assume the logistic distribution for F() leads to estimation of a logit equation (Amemiya; Maddala), yielding estimates of δ. The estimates of δ can be used to compute the effects of the characteristics X_i on the probability of bidding.

DATA AND VARIABLE SPECIFICATION

Farm and operator characteristics and DTP bids were obtained for a sample of accepted bidders, rejected bidders, and nonbidders in North Carolina and Virginia by means of a mail survey. It was desired that observations representing all three classes of producers be present in the sample, but a simple random sample of the population of dairymen would have included too few bidding producers because only 24 percent of producers in these two states submitted bids.

Accepted producers were identified on a list of all North Carolina and Virginia producers using milk commission and ASCS records, but it was not possible to identify rejected bidders. All 377 accepted bidders and a randomly selected group of 400 (14.7%) other producers were mailed a questionnaire in September of 1987 with a follow-up letter ten days later. Of the 777 mailings, 237 usable responses were received from 88 accepted producers, 32 rejected bidders, and 117 nonbidders (see Table 1).

Table 1. Dairy Termination Program Participation Of Dairy Farms In North Carolina And Virginia

	No Bid	Bid Rejected	Bid Accepted
	Number of Farms		
Total NC and VA Dairy Farms	2350 (76%)[a]	367 (12%)	377 (12%)
In Sample	117 (49%)	32 (14%)	88 (37%)
Samples as Percentage of Total	5%	9%	23%

[a]Numbers in parentheses are row percentages

The stratification of the survey design resulted in an overrepresentation of accepted bidders in the final sample.

The right-hand tail of the sample distribution of bids therefore has less weight than would the distribution from a completely random sample. Comparison of the sample with other data sources (Carley *et al.*; Kaiser and Lee) suggests that the sample is reasonably representative of the region but may not be comparable with regions outside the Southeast.

The level of the bid is represented by the variable BID, the lowest bid submitted to participate in the DTP. Bids are observed for 117 individuals in the sample, and the bids ranged from about five dollars to seventy dollars per hundredweight.

SCHOOLING represents general human capital, believed to be useful in promoting dairy productivity as well as productivity in an alternative activity. The expected effect of SCHOOLING on the bid is ambiguous, but SCHOOLING may aid the processing of information about the program (reducing costs of preparing a bid) and may be expected to result in greater probability of submitting a bid.

DAIRYEXP and MANAGEMENT are variables representing dairy-specific human capital, which is believed to generate greater returns to the operator in dairying than in an alternative activity, resulting in higher bids and lower probability of bidding. DAIRYEXP is number of years of experience in dairying, and MANAGEMENT is an index running from 0 to 6 representing use of advanced management techniques.[6]

Nonfarm work experience (NONFARMEXP) represents human capital specific to nonfarm work that

[6] MANAGEMENT is the number of following practices used: DHIA participation, regular use of artificial insemination, forage quality testing, feed ration formulation, grouping cows by production levels, and keeping individual animal records. A similar index was used by Sumner and Leiby.

is expected to be associated with greater ease of adjustment out of full-time dairying and consequently also associated with lower bids and greater likelihood of bidding. OFF-FARM is average weekly hours of off-farm work and has an ambiguous expected effect, as does the age of the principal operator of the farm (AGE).

FAMILY is a dummy variable equal to one if the operator reported that he or she had been planning (prior to DTP) to transfer the dairy to a family member upon leaving dairying, zero otherwise. A value of one for FAMILY is expected to be associated with higher bids and lower probability of bidding.

Selected physical characteristics of the farm representing size, efficiency, diversification, and location are also included as explanatory variables. HERDSIZE is the average number of cows in the dairy herd before the DTP, and represents the size of the dairy enterprise. HERDSIZE is included to pick up any scale effects on participation. Such an effect could occur if, for example, the payment in equation 1 is independent of scale. Dividing through by base production to obtain the bid would lead to lower bids for larger farms.

MILK PER COW is average annual milk production per cow as estimated by the operator. This variable is an important measure of production efficiency and should be associated with greater dairy returns. Consequently, greater milk per cow is expected to be associated with less likelihood of bidding and greater bids.

DAIRY90 is a discrete measure of specialization of the farm, equal to one if the dairy enterprise accounted for 90 percent or more of farm income, zero otherwise.[7] More specialized dairies are expected to submit higher bids and be less likely to bid, because more diversified farms should find it easier to switch to an alternative enterprise in place of the dairy enterprise.

To allow for regional differences in participation, six regional dummy variables are also included, with the excluded region being southeastern Virginia. The regions were defined to represent differing topography and dairying conditions.

RESULTS

Table 2 compares the means of variables for accepted producers and "continuing" producers in the sample.[8] There are no significant differences in SCHOOLING or DAIRYEXP, but the value of MANAGEMENT was greater for continuing producers, indicating that they were more likely to use advanced management techniques. There is no difference in off-farm work, but accepted producers had more experience in nonfarm work, were older, and were less likely to be planning a family transfer of the dairy. Continuing producers were more likely to have a specialized dairy farm. Although there was no difference in herd size between accepted and continuing producers, milk per cow was greater for continuing producers. These comparisons suggest that the program was attractive to older farmers and to those using less-sophisticated management techniques. The program also tended to attract more diversified farms and those with less productive cows.

Table 2. Mean Values Of Farm And Operator Characteristics For Farms Accepted Into The Dairy Termination Program And Continuing Farms

Variable	Accepted	Continuing
SCHOOLING	12.51	12.30
DAIRYEXP	30.71	30.24
MANAGEMENT	3.23[a]	3.96[a]
NONFARMEXP	7.27[a]	5.38[a]
OFF-FARM	4.84	4.82
AGE	55.39[a]	49.59[a]
FAMILY	0.33[a]	0.66[a]
DAIRY90	0.61[a]	0.77[a]
HERD SIZE	94.24	96.50
MILK PER COW	14,680[a]	16,605a
Observations	88	

[a] Denotes a significant difference at the .05 level between means of accepted and non-accepted producers.

Table 3 presents the results of estimating the probability of bidding equation by the logit procedure over all 237 observations in the sample. Maximum likelihood estimates of the δ parameters for the probability of bidding equation are shown in Table 3 with asymptotic standard errors and derivatives

[7] A continuous measure of diversification was not available.

[8] Comparisons between bidders and nonbidders and between accepted and rejected bidders tell a similar story and are therefore not shown here.

Table 3. Effects Of Farmer Characteristics On The Probability Of Bidding For Dairy Termination Program

Explanatory Variable	Estimated Coefficient[a]	Standard Error	Derivative
SCHOOLING	0.029	0.064	0.006
DAIRYEXP	-0.076***	0.022	-0.016
MANAGEMENT	0.006	0.129	0.001
NONFARMEXP	0.0001	0.022	0.000
OFF-FARM WORK	-0.015	0.016	-0.003
AGE	0.112***	0.025	0.024
FAMILY	-1.136***	0.343	-0.240
DAIRY90	-0.119	0.427	-0.060
HERD SIZE	0.0019	0.0028	0.0004
MILK PER COW	-0.00026***	0.00009	-5.5×10^{-5}
Regional Dummies:			
Southwest VA	0.740	0.542	0.13
Northern VA	0.713	0.674	0.12
Northwest VA	-0.792	0.634	-0.18
Western NC	-0.983*	0.641	-0.18
Piedmont NC	0.035	0.479	0.01
Eastern NC	1.773**	1.030	0.23
Percent Correct Predictions			74
McFadden R^2			.23

[a]This column presents maximum likelihood estimates obtained with the logit estimation procedure. The intercept estimate is not shown.

*** = significantly different from zero at .05,
** = significantly different from zero at .10,
* = significantly different from zero at .15.

Table 4. Effects Of Farmer Characteristics On Bids Submitted For The Dairy Termination Program

Explanatory Variable	Estimated Coefficient[a]	Standard Error	Elasticity
SCHOOLING	0.087	0.386	0.06
DAIRYEXP	0.273**	0.153	0.46
MANAGEMENT	1.63***	0.74	0.34
NONFARMEXP	0.002	0.147	0.001
OFF-FARM WORK	0.105	0.092	0.03
AGE	-0.233*	0.146	-.67
FAMILY	6.76***	2.00	dummy
DAIRY90	4.55***	1.98	dummy
HERD SIZE	-0.005	0.014	0.03
MILK PER COW	-0.0007**	0.0004	-.60
Regional Dummies:			
Southwest VA	-5.85**	3.04	dummy
Northern VA	-10.88***	3.53	dummy
Northwest VA	-6.24**	3.66	dummy
Western NC	-7.66**	4.15	dummy
Piedmont NC	-8.83***	2.81	dummy
Eastern NC	-12.52***	5.08	dummy
R^2			.34

[a]This column presents estimates obtained by least square estimation with weighting of observations to correct for possible bias due to the sample design. The intercept estimate is not shown.

*** = significantly different from zero at .05,
** = significantly different from zero at .10,
* = significantly different from zero at .15.

computed from the δs. The derivatives are the approximate change in the probability of bidding resulting from a unit change in the explanatory variable, holding all other variables constant at their mean values. In Table 4 the estimated bid equation coefficients are shown, with standard errors, and elasticities computed at the means. The bid level equation was estimated using least squares over the 117 producers who had submitted bids.[9]

The results indicate that human capital specific to dairying is associated with less willingness to participate, while other types of human capital have no effect. There is strong evidence that life cycle influences are important to the decision, and milk per cow, specialization, and location also have significant effects.

SCHOOLING does not have a significant effect for either the probability of bidding or the bid level. This is consistent with the proposition that SCHOOLING is general human capital. Its effect would be zero if greater schooling is associated with equally high prospective returns in a nondairy activity and in dairying. Apparently, schooling does not reduce the cost of submitting a bid enough to increase the probability of bidding.

Dairy experience (DAIRYEXP) and use of management techniques (MANAGEMENT), measures of dairy-specific human capital, both raise the bid. This is consistent with the expectation that these variables would be associated with higher returns in dairying but would not have a payoff in an alternative activity. An additional year of dairy experience

[9]In the sample design accepted bidders had a greater likelihood of being sampled than did rejected bidders or nonbidders. Correction for bias resulting from stratification on an endogenous variable requires that the observations be weighted. The weights presented in Maddala (pp. 170-174) are used: $w_j=n_j/N_j$, where n_j is the number of individuals from group j in the sample, N_j the number in the population, and the groups j=1,2 are accepted bidders and nonaccepted individuals.

Preliminary estimation also corrected for possible bias in equation (3) resulting from censoring of the observed bid data due to self-selection in the bid decision (see Kennedy, pp. 192-194). This involved using the Heckman two-stage procedure. Comparisons with simple weighted least squares estimates revealed no bias, however, so the Heckman procedure was not used to obtain the final results shown here.

decreases the probability of bidding by 1.6 percentage points and increases the bid by $0.27.[10] Use of an additional management technique raises the bid by $1.63. MANAGEMENT does not significantly effect the probability of bidding. The negative effect on probability of bidding posited for MANAGEMENT could have been confounded by an opposite positive effect if operators who adopt new management practices are also more aware of and more inclined to participate in government programs.

The negative association of dairy experience and use of management techniques with participation suggests that the program attracted less productive farmers. This conclusion is supported by the comparison of means that showed no difference in dairy experience despite the fact that participants were significantly older.[11] The comparison of means also showed that accepted producers used fewer management techniques and had lower milk per cow.

The variables representing human capital associated with nonfarm work, NONFARMEXP and OFFFARM, are nonsignificant in both equations. No evidence is found that attachment to the nonfarm labor market affects the inclination of a farmer to quit dairying through DTP participation.

The results indicate that life cycle influences are important to the DTP bidding decision. AGE has a strong positive effect on the likelihood of bidding and a negative effect on the bid. This is consistent with the comparison of means, further indicating that the program was attractive to older farmers. An additional year of farmer age is estimated to increase probability of bidding by .024, and decrease the bid by $0.23. These effects hold experience constant; note that the effects of age and experience offset one another. The negative effect of age, holding experience constant, implies that the program may have been attractive to retiring farmers. It may also indicate that, while the experience of older farmers is valuable (implied by the positive coefficient on DAIRYEXP), members of older age cohorts may be at a competitive disadvantage in dairying relative to younger farmers.

The association of advanced age with participation differs from results found in previous studies of other programs where older farmers showed less inclination to participate in government programs (Chambers and Foster; Lee and Boisvert).[12] This finding is consistent, however, with those of Smith and of Peterson who found that the probability of exiting farming is strongly associated with age. Apparently the DTP was attractive enough as an early retirement program to overcome the apparent distaste of older farmers for government programs.

The presence or absence of a family member to take over the dairy when the current operator quits is clearly an important influence on the decision. A family transfer is associated with a 0.24 lower probability of bidding, and a $6.76 higher bid, *ceteris paribus*. This factor is probably of particular importance to farmers who are near retirement age. Plans for a family transfer probably affect many other farm management decisions, especially those that involve a long time horizon. Norris and Batie found that this variable influenced use of conservation tillage in a study of Virginia farmers, but the author is not aware of other studies that have considered this variable. Family transfers should be considered in future studies of farm management decisions, especially the exit decision.

The attractiveness of the DTP to older farmers and to those not planning a family transfer implies that the program attracted farms that might have been preparing to exit dairying without the program through retirement. The Simler *et al.* and Kirkland and Smith studies of DTP participants reached a similar conclusion. The finding that the program attracted farms that may have been planning to exit anyway is similar to the findings of Lee and Boisvert and of Gauthier that the Milk Diversion Program attracted dairy farms that were already reducing their marketings, implying that the program paid for reductions that would have occurred without the program.

DAIRY90 has a significant positive effect on the bid, indicating that specialized dairies submitted higher bids, consistent with expectations. Specialized dairies are associated with bids that are $4.55 higher. Specialization did not have a significant effect on the probability of bidding.

HERDSIZE is not significant in either equation, suggesting that there was no scale bias in participation. MILK PER COW is significant in both equations. The negative effect on the probability of bidding suggests that farms with more productive cows were less inclined to participate, but a negative effect is also found in the bid equation, implying that those with more productive cows were willing to participate for a lower payment. These two effects

[10] Note that the estimated partial effect holds age constant, as well as all other explanatory variables.

[11] The same result was found in the USGAO (1988) study.

[12] Kaiser and Lee found a negative effect of age on DTP participation using state-level data. The Carley *et al.*, USGAO (1988), and Simler *et al.* surveys, however, found that participants tended to be older, as did this survey.

appear to contradict each other, and the negative effect on the bid is surprising.

It is possible that the negative effect on the bid represents a scale effect not captured by herd size. This could come about if, for a given capital loss (CL in Equation 2), higher milk per cow translates to greater base marketings (B), reducing the bid. Alternatively, more productive cows might be associated with a lower capital loss due to relatively high value on the export market, or high-producing herds might have been financed with an excessive debt load, motivating producers to participate in the DTP to relieve financial stress.[13] It should be noted that the net effect shown by the comparison of means was that DTP participants had lower milk per cow, so the negative effect of MILK PER COW on submitting a bid appears to dominate the negative effect on the bid level.

The regional dummy variables show that farms in eastern North Carolina were the most likely to bid, probably an indication of relatively good nondairy farming alternatives in the region. The least likely to bid were farmers in western North Carolina and northwestern Virginia, probably an indication of poor alternatives and poor information in the mountainous western North Carolina region, and the relatively good conditions for dairying in northwestern Virginia. Farmers in all regions tended to have lower bids than those in southeastern Virginia, but none of the other regions was significantly different from each other. The author is not aware of any reason why farmers in southeast Virginia would bid lower than others.

CONCLUSIONS

This paper has identified characteristics influencing willingness to quit dairying by examining the influences of farm and operator characteristics on the decision to participate in the Dairy Termination Program using a sample of dairymen from North Carolina and Virginia. The results provide some understanding of the role human capital plays in influencing the mobility of farmers and extend our knowledge about participation in voluntary farm programs.

The DTP appears to have attracted older and less efficient dairy farmers. Many of the farms that participated in the DTP probably would have left the dairy business in the near future without the program. This pattern of participation implies that the program paid for reductions that would have occurred anyway without the program. The finding that younger, more productive farmers were not attracted to the program suggests that the DTP will have limited long-term effects, and it is mainly a short-term solution to the problem of surplus milk production. Future programs should be targeted at younger dairymen and farms with more productive herds to achieve a more long-term reduction in milk production.

The DTP appears to have operated as a type of "golden handshake" program (Teigen), paying marginal farmers to leave the industry. Though removing marginal farmers was not a stated goal of the DTP, the program probably performed a valuable function by doing so. Industries such as dairying, which are already experiencing surplus production and face the prospect of substantial productivity gains from biotechnology while demand for output remains static, will need to make further structural adjustments toward fewer (and larger) farms. Programs that facilitate the exit of farmers can ease the pain of inevitable adjustments, and Teigen argues that such programs have lower budgetary costs than price support programs. The DTP seems to have functioned as such a program, and, as such, was an improvement over the earlier Milk Diversion Program, but it was still aimed primarily at removing cows. In the future, policymakers should consider implementing programs that are specifically targeted at buying out farmers instead of cows.

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