DETERMINANTS OF FARM EXIT:

A COMPARISON BETWEEN EUROPE AND THE UNITED STATES

MISHRA A.K. [1] **RAGGI M.**[2] and **VIAGGI D.**[3]
[1] Dept. of Ag. Economics and Agribusiness, Lousiana State University, US
[2] Department of Statistics, University of Bologna, Italy
[3] Department of Agricultural Economics and Engineering, University of Bologna, Italy
Corresponding author: meri.raggi@unibo.it

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ABSTRACT

In the last three decades, European Union (EU) agriculture has been characterized by major exit of farming households from agriculture. In some areas the share of exit has been as high as 40%. Similar pattern has also been observed in the United States (US), where the exit rates are about 9-10 percent per year. Understanding the exit behavior is a key to the future farm structure, management of abandoned land, depopulation of rural areas, and agricultural policy, including government program payments, The main objective of this paper is to review the theoretical background and empirically estiamte the determinants of exit decisions through a comparative econometric analysis in the US and the EU.

Key words: farm exit, logit model, US, EU

1. INTRODUCTION AND BACKGROUND

The issue of farm exit has been a major component of structural change of agriculture in recent years in Europe. According to Eurostat (www.eurostat.eu), the number of farm holdings in EU15 dropped from 7,7 milion in 1995 to 5,7 million in 2007. This trend appears particularly relevant for some countries. For example, in Italy the number of holdings has dropped from 2,6 million in 1990 to about 1,6 million in 2007. Similar pattern has also been observed in the U.S. where the exit rates are about 9-10 percent per year (Hoppe and Korb, 2006). Additionally, Hoppe and Korb (2006) note that exit rates decline with farm size. For example the exit rate is 6-7 percent for large farms sales greater than $250,000). This structural change is a dynamic process over time and a result of adaptation processes of farms to changing economic conditions.

Understanding the exit behavior is a key to the future farm structure, management of abandoned land, depopulation of rural areas, and agricultural policy, including government program payments. Patters of farm exit are politically relevant for their effects on land abandonment, land management and structural effects of remaining active farms, also in view of an increasing competition strategy by the farming sector. Explaining the determinants of exits can also help in understanding more specific issues, such as changes in land property pattern, role of renting, re-location of farm production, and cropping pattern. Finally, knowing which types of farms are most likely to exit might be useful to policymakers interested in the effects of exits on exiting farms, the remaining farms, and farming communities.

Farm exit studies are limited in the agricultural economic literature. In particular, lack of studies on policy effects on farm exit can be due to the types of policy that were generally not expected to have a direct effect on farm exits. For example, Tranter et al. (2007), in analyzing farm reaction to decoupling did not even consider the option of farm exits, while land abandonment had a major role in the survey. The majority of available studies are based on econometric analysis of exit data and the attempt to identify factors affecting exit decision. Two different approaches are available from the literature: one focuses on micro data (farm level) mainly obtained from longitudinal surveys or census (Stokes, 2006; Hoppe and Korb, 2006; Kimhi and Bollman, 1999) and the other on macro data (area/ county level) (Breustedt and Glauben, 2007; Goetz and Debertin, 2001). An alternative classification of the set of studies could be identified: those analyzing ex-post data sets related to actual farm exit and those analyzing stated intention to exit, the latter being more often associated to original surveys of individual farm-households.

Using longitudinal data sets, in particular individual farm data from censusKimhi and Bollmand (1999) studied farm exits in Canada and Israel. The authors calculated real exit rate from 1966 in the Canadian case and from 1971 in Israeli case. A probit model wasconstructed to estimate the exit probability and to seek the determinants of exit behavior. The main finding is that the dependency of exit behavior on farm size differs between the two countries mainly due to institutional differences. Hoppe and Korb (2006) use longitudinal data from the US census (1978 to 1997) to study farm exits in different subgroup of farmers by means of logit models.

Stokes (2006) applies a Markov chain model of farm size to investigate the future structural change (exit and entry) in Pennsylvania's dairy sector. The analysis found that milk prices, price volatility, land values, and dairy termination program have an impact on exit decision. The variables considered are not linked to farm structure and farmer characteristics, except for farm size. In another study Bragg and Dalton (2004) used a two stage approach to investigate farm exits in the State of Maine. In the first step the authors identify the factors affecting the profitability of exits and in second step a logit regression model is performed to determine if and how demographic variables, efficiency, and opportunity costs influence the exit decision. It should be noted that studies by Stokes and Bragg and Dalton (2004) are very small and limited to State dairy farming sector. Finally, Breustedt and Glauben (2007 and

Goetz and Debertin (2001) studied net farm exits, defined as the net change in farm numbers of two different cross section dataset, (). The authors used regression models with regional or area level data, to explain the net change. The authors conclude that exits were influenced by farm and family characteristics.

In the context of those studies analyzing ex-post data, Breustedt and Glauben (2007) examined the exit process in Western EU during the 1990s using a simple model of structural change. Results from their study indicate that exit rates are higher in regions with smaller farms and closely related to production structures. On the contrary, exit rates are lower in regions with more part-time farming, high subsidy payments, and relatively higher prices for agricultural outputs. Findings from Breustedt and Glauben (2007) study indicate that off-farm income and government intervention may have slowed down structural change in European agriculture.

Studies analyzing stated intentions to exit are more directly connect to this paper. They are also often explicitly connected to ex-ante policy analysis. Genius et. al., (2008) present a survey of farmers' intentions facing 2003 CAP reform and in light of three future price scenarios (-10%, ==, +10%). The survey concerns three regions in Greece, the Netherlands and Hungary and is based on a sequential discrete choice approach. Future intentions about input use, labour use, size of business, investment levels, and output diversification were also addressed. About 60% of Greek farmers stated that they would abandon farming activity if the price decreases by 10%. This share reduces to 28% in Hungary and 18% in Holland. The authors also develop an econometric model to explain the choice of abandoning farming, increasing acreage/livestock size or keeping the same mix for the three countries. In the cases of Hungary and Greece, small farms are more likely to abandon, while in the case of Holland the opposite occurs. More specialized farms are more likely to abandon production in Greece and Hungary while in Holland they are less likely to abandon production.

As far as we know, previous literature includes survey-based empirical applications and a few attempt to provide a theoretical interpretation that builds on econometric models based farm household utility function maximization. Secondly, unlike our research and Bragg and Dalton (2004), the surveys did not query the farm operator specifically on their intentions of exiting farming.

The main objective of this paper is to discuss the determinants of farm exits through a comparative econometric analysis in the EU and the US. A logit model is applied to estimate the influence of structural, operator, family, and farm characteristics on decision to exit farming. The model is applied in two different data sets from EU and US, allowing to compare similarities and differences in the two countries.

2. Conceptual Framework

In order to analyse farm exit, two different theoretical approaches can be identified in the literature: a) based on an utility rationale, in which the choice between the two alternatives (exit/no exit) is made seeking the higher utility for the decision maker; b) based on a profit maximizing rationale, in which the choice of exiting the farming sector is the effect of a lower profit compared with staying in farming. Both approaches have some critical aspects and drawbacks. In addition, exit models are forced to represent the exit process in a very simplified way. For example, the choice to exit is a long term decision, but time is not often included explicitly in the approaches presented by the literature. We use the utility maximization approach.

In the context of farm family let us assume that the family seeks to maximize the present value of expected household utility function (Blundell and MaCurdy, 1999). Utility in each period is a function of consumption and leisure. Specifically, in period t the farm household maximizes:

$$HU_t = \sum_{T=t}^{\infty} r_{T|t} U\left(X_T, Z_{fT}, Z_{mT}\right) \qquad (1)$$

Where X_T is the total household consumption of a Hicksian composite commodity, Z_{iT} is *i*'s pure leisure, *i*=spouse(f) and operator(m), and $r_{T|t}$ is the discount rate from period *T* to period *t*. This discount rate includes probability of survival in period *T*. Similar to Blundell and MaCurdy (1999) we consider that all decision about work (farm and off-farm), consumption, exits are made at the beginning of each period. At the beginning of each period the farmer decides if he/she will exit at the end of the period. Further, the household utility is implicitly conditioned on a set of shifter—personal, (health), location, institutional, or policy factors as well. Equation 1 is maximized subject to budget and time constraints as described below:

$$F_{T|t} + \sum_{i} w_{T|i} NF_i + A_t \qquad (2)$$

where $F_{T|t}$ is net farm income, A_t is the value of total assets at the beginning of the planning period, $\sum_i w_{T|i} NF_i$ is the total off-farm income earned by the spouse (f) and operator(m), $w_{T|i}$ is the off-farm wage are for individual (*i*=*f*,*m*). The time constraint is:

$$T_{T|i} = Z_{T|i} + OF_{T|i} + NF_{T|i} \tag{3}$$

Where total time (between farm operator and spouse) is the sum of leisure $Z_{T|i}$, farm work $OF_{T|i}$, and off-farm work $NF_{T|i}$ time at the beginning period. Time allocation decision changes in each period. Off-farm wage rate for individual *i* (*i*=*f*,*m*) is known in advance. This is the wage rate that the operator is expected to receive when exiting farming. Using the above equations one can write the following inter-temporal budget constraint of the following form:

$$\sum_{T=t}^{\infty} \lambda_{T|t} \mid X_T = \sum_{T=t}^{\infty} \lambda_{T|t} \left(w_{Ti} \left(T_{T|i} - OF_{T|i} - NF_{T|i} \right) + F_T \right) + A_t \tag{4}$$

Where $\lambda_{T|t}$ is the market discount rate from period T to period *t*. From the above discussion it is clear that the budget constraint will differ in the exit and nonexit situations. For example, if the farmer decides to exit farming, then the farm income in period *T* will be zero. This in turn will lead to changes in the consumption and leisure choices of the farm household (farm operator and spouse). Further, once the household decides to exit farming it also changes some of the other conditional variables in the utility function, such as location.

Following Mishra and El-Osta, (2008) and Pesquin et al. (1999) we can formulate the exit problem as follows. Let HU_t^E and HU_t^S represent the farm household's present value of expected utility from exits and stay, respectively, evaluated at *t-1* period. Both HU_t^E and HU_t^S are assumed to have a reduced form representation in which each is a function of the conditional variables—those affecting farm income, off-farm income (all in present and future time), and other utility shifters. The farm household decides to exit if $W_t = HU_t^E - HU_t^S > 0$. W_t, a latent variable, can be thought of as the net benefit of exit in *t* period. Finally, W_t is assumed to be a random function of vectors or observed exogenous variables, Y_t, and expressed as:

$$W_t = Y_t \beta + u_t \tag{5}$$

Where β is a vector of unknown coefficients, u_t is error term which is assumed to have a specified probability distribution. Y_t includes a unit vector and all other conditioning variables that are assumed to affect the tendency to exit. The exit decision, W_t, is positively related to variables which increase off-farm utility and present and future on-farm utility. On the other hand, W_t exit negatively related to variables which increase future off-farm utility. The conditioning variables that affect present and future utilities may change with time (like unemployment rate in the country). Some variables affect household utility in all situations and time period (e.g., human capital, and health). Given farm household's decision to exit farming in time period *t* and assuming that u_t is distributed as a standard normal random variable, the simple logit model (Maddala, 2001) for exits is given by:

$$p_i \begin{cases} \Pr\left(W_i = 1 \mid Y_i\right) & \text{if } W_i = 1 \text{ is observed} \\ \Pr\left(W_i = 0 \mid Y_i\right) & \text{if } W_i = 0 \text{ is observed} \end{cases} \tag{6}$$

If the observations are independent, the log likelihood equation is:

$$L\left(\beta \mid W, Y\right) = \prod_{i=1}^{N} p_i \tag{7}$$

Combining equation 6 and 7,

$$L\left(\beta \mid W, Y\right) = \prod_{W=1}^{N} \Pr\left(W_i \mid Y_i\right) \prod_{W=0} \left[1 - \Pr\left(W_i = 1 \mid Y\right)\right] \tag{8}$$

Where the index of multiplication indicates that the product is taken over only those cases where *W*=1 and *W*=0, respectively. Substituting the $\beta's$ and taking the logs yields the following log likelihood function:

$$L\left(\beta \mid W, Y\right) = \prod_{W=1}^{N} \Pr\left(W_i \mid Y_i\right) \prod_{W=0} \left[1 - \Pr\left(W_i = 1 \mid Y\right)\right] \tag{9}$$

In the empirical analysis we use data on the intension of exits as a proxy for the unobserved tendency to exit. The actual exit and the tendency to exit are linked according to:

$$\begin{aligned} &W_t = 1 \quad\quad if \quad W_t > 0 \ \ \text{(farm household decides to exit in period t)} \\ &W_t = 0 \quad\quad otherwise \ \text{(farm household decides not to exit in period t)} \end{aligned} \tag{10}$$

We used data obtained in two different surveys in US and UE. In both surveys, exit rates are based on stated intentions collected through questionnaires and asked with reference to a specified time horizon (in 10 years for the EU and in 5 years for US). In spite of the fact that they are not “real” behavior, stated intentions can be a valuable piece of information in this case, as stopping farming is a large disinvestment that could take some time, so that a decision to exit can lead to an actual exit only after a few years. This would make it difficult to detect it based on the actual event of exit, except at the moment of leaving farming. However the exit decision is still taken given the available information at the time the decision is made.

The logit analysis is applied to data obtained the two different surveys in US and UE. As such the coefficients obtained from the logistics regression in equation 5 contains no information on the magnitude of independent variable on the dependent variable. The magnitude of the marginal effect depends on the values of the other variables and their coefficients. The *marginal effect at the mean* is popular (i.e. compute the marginal effects when all Y’s are at their mean) but other options are possible. In the case of logistic regression, $F(Y) = P(W = 1 | Y)$ and the marginal effect of Y_k (k=1….n) is given by:

$$Y_k = P(W = 1 | Y) * P(W = 0 | Y) * \beta_k \qquad (11)$$

3. RESULTS AND COMPARISONS

3.1. EU data and results

The EU data is from a survey carried out in the CAP-IRE project (Assessing the multiple Impacts of the Common Agricultural Policies (CAP) on Rural Economies, 7fp). The objective of the project CAP-IRE is to develop concepts and tools to support future CAP design, based on an improved understanding of long-term socio-economic mechanisms of change in rural areas. Sample coverage includes 11 case study regions in 9 countries of the EU at the beginning of 2009 (2363 observations) (Table 1). The survey collected data on farm and household characteristics and on the reaction of farm households to CAP reforms under different thematic issue (i.e. farm structural adjustment, investment and innovation, chain interactions, social and environmental sustainability, governance issue).

Table 2 reports the descriptives statistics for the EU sample.

Table 3 reports the parameter estimates of the logit model for the EU sample. Two main variables have a positive and significant effect on the probability of exit: farm rents out land (*land_rent_out*) and the age of the respondent (*age*). The fact that increasing the age of the respondent (to be identified with the farm owner) increase the likelihood of exit is consistent with the idea that the sector is still characterised by an excessive number of operators and that exit would coincide with the retirement of the farmer, rather than happen at an intermediate stage of his/her working life. The positive effect of renting land out seems to be connected to a progressive exit strategy, based on a progressively increasing delegation of farm activities other operators.

A significant number of variables show a negative effect on the probability to exit. These are , the number of male and females in the household, part-time farm work, living on the farm, the size of land owned, having full time employees, selling to private traders, and using advisory services. The role of the intercept in the model, seems to indicate a general prevalence of exit attitude still not explained by the variable used as explanatory variables in the model. The variables related to the number of male and female household members (*hhmale and hh_female*) both hint at the fact that a higher number of household members encourage continuing farming, which may reflect the idea thatfarming is still dependent on labour availability mainly through the farmer's family.

Results show that probability of farm exits decrease when the farm owner is working part time (*hh_partime*) on the farm. Findings here may also suggest that that a number of farm holdings would be sustainable only if the farmer has another source of income. This may suggest that cross subsidisation across sectors and different household activities may be beneficial for decreasing farm exits or reducing the rate of farm exits. On the other hand, the findings also confirms a strengthening category of part time farms as a stable and reinforcing category in farming sector. The coefficient on household lives on the farm (*live_onfarm*) is negative and statistically significant, indicating that the probability of exiting farming decrease if the farm household lives on the farm. This corroborates past knowledge about the positive connections between residential functions of the farm and farming activities and possibly, hints at the potential role of household appreciation of living in the countryside as positive incentive to staying in farming business.The remaining variables negatively correlated to the probability of exiting farming are more related to farms structure and professionality.

Results in table 3 indicate that the probability of farm exit decreases with the amount of land owned *(land_owned_ha*). The amount of land owned can be thought of as a proxy for farm size. Results indicate that economies of scale, large farms. and stronger link to production factors (land) reduces the probability of exit. Findingscould be either interpreted as a higher commitment to farming, a mixed investment strategy that also benefits land ownership as a risk reducing asset. Findings may also suggest higher asset fixity which induce less flexibility in changing economic activity.

Having full time employees (*worker_ftm*) also decouragesexits from farming. It is more likely that large farms have higher number of full-tiem employees. This finding may suggest that larger, more structured farming activities benefit from higher profits.. Resutls in table 3 indicate that selling to private traders (*private*) decreases farm exits by 7.2%, compared to selling to processors processing or cooperatives. The basic message seems to be that collective organization of selling farm output are associated to less active, less profitable farms, or those with a lower entrepreneurial attitude. This finding is in contrast to the current policy emphasis on the aggregation of marketing activities, such a cooperatives . Interestingly other marketing options that are widely discussed in the current policy debate as relevant strengthening strategies, like direct selling to consumers or selling through product contracts, do not seem to affect exit strategy by the farms.

Finally, the use of advisory service (*advisory_service*) reduces the probability of exit. Rather than seeing this as a signal of the advisory service bringing a high contribution to farm profitability, it can be more realistically be seen as a proxy for the professionality of the farm, and their willingness to invest in terms of human capital and knowledge with a sufficient time horizon. Additionally, farms that use advisory services are large farms, driven by profit and always in search of new techniques to bolster their farm income. The overall findings suggest that large farms, more professional and independent farms would stay in farming.

3.2. US data and results

The U.S. data for the analysis are from the 2001 Agricultural Resource Management Survey (ARMS) (22,000 farms). ARMS is conducted annually by the Economic Research Service and the National Agricultural Statistics Service. The survey collects data to measure 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 was also counted. In 2001 ARMS, farmers were also queried about whether the operator has plan to exit farm work. The issue of exits, retirement, and succession is especially pertinent for farmers who are ready to retire in the next five years. Their retirement will have implications for farm wealth, industry structure, and the supply of food and fiber.

Table 4 contains a description of the variables used in the analysis, along with their associated summary statistics. The average age of farm operators is about 53 with 13 years of formal education. Table 4 shows that nearly 14 percent of the farm operators indicated that they plan to exit from farming within next five years. Table 4 also reveals that the average age of the farm operator was about 53, with 13 years of formal education. An interesting finding featured in the table demonstrates that about 22 percent of the farms have children between 13-18 years of age who could potentially take over the farming business. About 60 percent of the farmers and about a third of spouse (31 percent) were raised on a farm. Table 4 reveals that about 73 percent of the farms are individually owned and 67 percent of farm operators reported farming as their main occupation. About, 43 percent of the farm reported gross sales of more than $500,000, and about 21 percent of the farms were located in the Heartland region of the U.S. Further, 25 percent of the farms were rural residential/lifestyle farms (small farms whose operators report a major occupation other than farming).

Along with usual socio-economic factors information on their participation in farm programs and acquisition of debt may affect exit decisions. The 2001 ARMS data collected information on farmer's participation in farm program payments. Specifically, farmers were asked if their participation in farm program has increased, decreased, or remained same in 2001 than in 1996. *M_GOVTPMT* takes a value 1 if participation was more in farm programs in 2001 than in 1996, likewise *L_GOVTPMT* takes a value of 1 if participation was less in farm programs in 2001 than in 1996.[1] Similarly, farm debt could also have potential impact on farm exit decisions. The 2001 ARMS survey asked farm operators about their farm debt. In particular, they were asked if farm debt in 2001 was greater, less, or same as in 1996. A dummy variable, *M_DEBT* and *L_DEBT*, was created and coded as 1 if debt levels were greater and lower, respectively; in 2001 than in 1996 (same debt level was used as the base category).

Finally, following Goodwin and Mishra (2004) this study adopts a bootstrapping approach, which accounts consistently for the stratification inherent in the survey design.[2] The ARMS database contains a population-weighting factor, which indicates the number of farms in the population (i.e., all U.S. farms) represented by each individual observation. We utilize the weighting factor in a probability-weighted bootstrapping procedure. Specifically, the data (selecting N observations from the sample data) are sampled with replacement. We then estimate the models using the pseudo-sample of data. This process is repeated a large number of times and estimates of the parameters and their variances are given by sample means and variance of the replicated estimates. This study utilizes 2,000 replications in the application that follows. Table 5 provides information on the overall fit of the model. Since an R2 does not accurately measure the fit of a logit model, a pseudo- R2, the likelihood ratio, is calculated. The estimated model demonstrated a fairly superior capability as indicated by a McFadden pseudo- R2 value of 0.27.[3] The likelihood ratio is -2142 representing a relatively good fit for a logit model (Hensher and Johnson, 1981).

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1 Same level of farm program participation was used as the reference category.

2 Goodwin, Mishra and Ortalo-Magne (2003) point out that the jackknife procedure may suffer from some limitations and they propose bootstrapping procedure as an alternative.

3 McFadden pseudo-R^2, which is suggested by McFadden (1973, p. 122), can be applied to any model estimated by maximum likelihood methods as in the cases of the *MNL* and Tobit regression models discussed above. As defined, it is a scalar measure which varies between 0 and 1 and is computed as follows:

McFadden pseudo-$R^2 = 1 - \left[\frac{\ln L_A}{\ln L_0}\right]$, 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 take the value 0 (indicating poor fit) if the model predicted

Results in table 5 show a positive and significant coefficient on *OP_AGE*, indicating that an additional year increases the probability of farm exit by 0.6 percent. This finding is consistent with economic theory, indicating that like any rational decision maker, farmers are also willing to retire or make an exit as their age increase. The coefficient of *OP_EDUC* (operator's level of education) is negative and statistically significant at the 1% level of significance (Table 5). The findings may reflect the notion that parents with a higher level of educational attainment may process information, allocate resources, and evaluate new technologies more effectively and thereby increasing the current farm's earning capacity. An additional year of schooling decreases the probability of exits by almost 0.4 (table 5).

A surprise finding in table 5 shows that farm operators and spouses raised on the farm, a proxy for attachment to the land, are more likely to exit farming in the next five years. The coefficient on *F_RAISED* and *S_RAISED* is statistically significant at the 1 percent level of significance. Marginal effects, column 3 (table 5), indicate that operators raised on the farm are about 6 percent more likely to exit farming compared to their counterpart. Similarly, spouses who were raised on the farm are about 2 percent more likely to exit farming compared to their counterpart.

Presence of children in the farm household has an impact on exit decision. This decision is magnified is the children older (in the 13-18 age group). The coefficient on *P_SUCCES* is negative and statistically significant at the 1 percent level. Results indicate that if teenage childe are present in the household then the probability of farm exits decreases by about 2 percent (table 5). A possible explanation is that presence of teenage child may indicate that the farm operator may want to continue farming until the child is ready to take charge of the farming operation. Results in table 5 indicate that farm operators whose main occupation is other than farming (*F_HOBBY*) is 5 percent more likely to exit faming, compared to other small and medium sized farmers. On the other hand, operator of large farm (*F_LARGE*, those operating farms with gross sales of $500,000 or more) is about 2 percent less likely to exit farming. This finding further strengthens the argument that large farms hold out the best prospects of providing a potential successor with reasonable and secure income.

Farms organized as individual sole proprietorships are more likely to exit farming. The coefficient of *F_INDIVD* is positive and statistically significant at the 10 percent level (table

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occurrence of the event no better than a simple flip of a coin, and will equal to 1if the model predicts the event perfectly (see Amemiya, p. 1505; Maddala, p. 39). A rule of thump among practitioners is that the regression model is deemed to have excellent predictive power if the computed value of McFadden Pseudo-R^2 falls between 0.20 and 0.40.

5). Results indicate that the probability of exit increases by approximately 2 percent if the farm is organized as a sole proprietorship, compared to farm organized as partnerships and corporations. This may be because decisions to exit farming may be easily done by one person compared to where the decision to exit may have to be made between partners and corporate board members. 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), based on the value of human time (education), provides the theoretical underpinning of allocating working time between onfarm and off-farm work. A dummy variable that indicates the off-farm work status of the farm family was included in the regression. The coefficient of *SP_OFFOWRK* (spouse working full-time off the farm) is positive and statistically significant at the 5 percent level of significance (table 5). Results indicate that the probability of exit from farming increases by approximately 2 percent if the spouse reported working full-time off the farm (table 5).

The coefficient on *L_GOVTPMT* is positive and significant at the 1 percent level of significance. Results indicate that operators, who decreased their participation in farm programs over the 1996-2001 periods, are more likely to exit farming (about 3.4 percent). This may indicate that farmers may have already been thinking about exits. The coefficients of *M_DEBT* and *L_DEBT* were positive and significant for exit model (Table 5). Results indicate that the probability of exit increases by about 3 percent in both cases. A possible explanation is that farms that have acquired additional debt may not be able to service the debt and eventually willing to exit farming. Further, farmers who have lowered their debt over the 1996-2001 period, perhaps due to lenders choice, also are not able to meet their debt obligations and hence pressured to exit the industry.

Other farm attributes affect exit decisions. Two of the farm attributes that is of interest in this study is whether exits may differ with regional location of the farm and types of farm businesses. Results indicate that farms located in the Northern Great Plains are about 5 times more likely to exit farming, compared to farms located in the Mississippi Portal regions. Farms in this region specialize in wheat, barley, cattle, and sheep. On the other hand, farms located in the Southern Seaboard regions are 2 percent less likely to exit farming. This is consistent with the fact that farms in the Sothern Seaboard region are small farms specializing in beef, general field crops and poultry, whose operators are more likely to work off the farm

(Mishra et al., 2002). Dairy farms (and others such as nursery, green house, etc.) may have more stable and reliable sources of income. Hence, we included dummy variables for various farms types (cash grains, other field crops, cotton, high value crops, beef, hog, poultry and dairy). Results show the probability of exit decreases if farms are specialized in the production of beef. Results in table 5 indicate that the probability of exit for a beef farmer decreases by approximately 2 percent, compared to operators of other livestock farms. Mishra et al., (2002) report that operators of beef farm are more likely to engage in off-farm work, thus increasing their total household income.

4. DISCUSSION

Understanding the farm exit behavior is key to the future of farm structure and agricultural policy. Studying the factors affectingfarm exits could help in understanding more specific issues, such as changes in land property pattern, role of renting, re-location of farm production, and cropping pattern. Finally, knowing which types of farms are most likely to exit might be useful to policymakers interested in designing policies that help reduce farm exits, making farming more profitable, and saving farming communities and rural landsacpe.

A logit model is applied to estimate the influence of structural, operator, family, and farm characteristics on the decision to exit farming in the EU and US. The EU data for the analysis is from a survey of 9 EU countries, in 2009 (2363 observations) while the the US data is from the 2001 ARMS farm-level survey(22,000 farms). Both surveys asked about the farm operator's intention to retire from farming in the next 10 and 5, years for EU and US, respectively.

The results are mostly consistent with previous studies. The key message is that larger, more structured farms and younger farmers are generally less inclined to exit. However the results of the analysis in the two areas show a number of different and sometimes contrasting features. Reasons for these differences can be found in the differences of the survey exercises, which have been performed for different reasons, across different years, and population.Since the surveys were different, based on the questions asked, operators were queried about exit decisions under different time frames. For example, US operators were queried about exit decisions in 5 years, whereas EU farmers were queried about exit decisions in 10 years. Futher, the explanatory variables were different. The US survey had more comprehensive set of explanatory variables.

Being aware of such differences, the comparison of the results in the two cases still yielded potentially interesting results. Farmer's age is the only significant variable in both cases and also has the same sign. Part time farming is the only other significant variable in both cases, but with an opposite sign, hinting at the fact that, while part time is associated to higher exit probability in the US. On the other hand part time farming reduces the probability of exits in the EU. Location and specialization are relevant to farm exits in the US but not in the EU sample. Education and having a successor are the main factors negatively affecting exits, in the US, while structural characteristics of the household,.   farm(including factors depending on connections with outside the farm, such as the kind of commercial partners or advisory services) are likely to redcue exits in the EU case. More "qualitative" issues, such as indebtdness and proprietorship seem to have a higher role in the US. Finally, The comparison and differences in the determinants of farm exits in the EU and the US show a different behavior in the farm dynamics, impact on structural change, and likely different implications for future agricultural policies.

The results suggest that inter-country comparison as the one considered in this paper can paly a major role in the understanding of longer tem trends in agriculture and explaining different reaction towards global market forces. However, this study also raises attention to the need of a more standardized information basis in order to ensure a reasonable comparability of basic data. In addition, both the literature review and the analysis highlight the need for further developments in the theoretical background in farming exit-entry models. In particular there is a need to go beyond a generic use of the household utility framework as a generic cover for simple statistical analysis of the determinants of farm exit.

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Table 1: descriptive about the stated choice to exit in EU dataset by case study area

	Stated choice			Total
Case Study	**Continue**	**Exit**	**Other[1]**	
IT	228	46	26	300
NL	131	107	62	300
GR	264	27	9	300
PL	240	9	0	249
UK	143	11	14	168
ES	145	45	11	201
BG	208	37	28	273
FR1	108	17	15	140
FR2	100	28	27	155
DE1	89	17	11	117
DE2	133	19	8	160
Total	1789	363	211	2363

[1]"Other" includes "don't know and missing value.

Table 2: Summary Statistics and description of variables in EU

Variables	Description	Mean (Std. Dev)	N
education	Max level of educationin the household: 1= None and primary; 2= Lower Secondary; 3= Upper secondary; 4= Post-secondary; 5= Degree;6= PhD	3.61	2346
hh_young	Numb. of hh members younger 18	.81 (2.904)	2345
hh_old	Numb. of hh members older 65	.46 (.751)	2342
hh_male	Numb of hh male members	1.85 (.913)	2357
hh_female	Numb of hh female members	1.67 (.963)	2356
Hh_fulltime	1 if hh members are fulltime in the farm	0.83	2345
hh_fulltime_numb	Numb of hh fulltime	1.48 (.682)	1951
hh_partime	1 if hh members are part time in the farm	.49.	2339
hh_partime_numb	Numb of hh part time	1.41 (.704)	1148
income_from_farm	% of total household gross revenue from farming: 1= less than 10%; 2=10-29%; 3=30-49%; 4=50-69%; 5=70-89%; 6= more than 89%	4.22	2290
sport_group	1 if members of sport group, 0 otherwise	.55	2321
farmers_group	1 if members of farmers group, 0 otherwise	.66	2323
environmental_group	1 if members of environmental group, 0 otherwise	.36	2320
live_onfarm	1 if the hh live on farm, 0 otherwise	.64	2342
Oth_activity	1 if there are other activities different from farming, 0 otherwise	.2	2349
contract_work	1 if there is contract work using farm labour and / or machinery, 0 otherwise	.43	458
food_proc	1 if there is food processing and manufacturing, 0 otherwise	.11	455
retailing	1 if retailing, 0 otherwise	.29	454
recreational_services	1 if there are recreational services, 0 otherwise	.22	454
agri_env_schemes	1 if the farm engaged in agri-environmental schemes, 0 otherwise	.27	2324
organic_prod	1 if the farm produce organic, 0 otherwise	.10	2343
land_owned_ha	Ha of owned land	49.12 (127.98)	2018
land_rent_out	1 if the farm rent out land, 0 otherwise	0.12	2323
land_rent_out_ha	Ha of land rented out	35.89 (303.78)	272
land_rentin	1 if the farm rent out land, 0 otherwise	0.68	2335
land_rentin_ha	Ha of land rented in	80.07 (255.04)	1579
Worker_ftm	1 if there are external workers fulltime, 0 otherwise	0.22	2316
worker_ftm_numb	Numb of fulltime workers	2.76 (3.997)	500
Worker_ptm	1 if there are external workers part time, 0 otherwise	0.27	2311
worker_ptm_numb	Numb of part time workers	3.70 (8.032)	623
share_lab_percentage	%of labour used in other activities	27.05 (23.55)	349
processor	1 if the farm sell products mainly to processor, 0 otherwise	.24	2333
private	1 if the farm sell products mainly to processor, 0 otherwise	.45	2336
cooperative	1 if the farm sell products mainly to cooperative, 0 otherwise	.41	2334
direct_to_final_consumer	1 if the farm sell products mainly to final consumer, 0 otherwise	.13	2331
another_farm	1 if the farm sell products mainly to another farm, 0 otherwise	.11	2335

contract_to_sell	1 if there are contracts to sell, 0 otherwise	.25	2343
internet_to_buy	1 if the farm use internet to buy, 0 otherwise	.17	2346
internet_to_sell	1 if the farm use internet to sell, 0 otherwise	.08	2342
advisory_service	1 if the holding is assisted by a farm advisory, 0 otherwise	.57	2348
age	Age of respondent	48.78	2334
edu	Level of education of the respondent	2.97	2330
Sample			2363

Standard deviation of continuous variables is presented.

Table 3: **Parameter estimates and marginal effects of factors affecting farm exits in EU**

Variables	**Coef.**	**Robust Standard Error.**	**Marginal effect**
intercept	-2.387***	.639	--
hh_male	-.255**	.106	-.023**
hh_female	-.189*	.102	-.017
hh_young	-.014	.123	-.002
hh_fulltime	-.076	.259	-.008
hh_partime	-.283*	.169	-.026*
income_from_farm	.021	.054	.002
live_onfarm	-.444**	.208	-.043**
Oth_activity	.0121	.215	.001
agri_env_schemes	-.122	.195	-.011
organic_prod	-.399	.307	-.033
land_owned_ha	-.008***	.002	-.001***
Land_rent_out	.681***	.211	.078***
Land_rentin	.203	.177	.019
Worker_ftm	-.594**	.245	-.049**
Worker_ptm	-.151	.208	-.014
processor	.177	.207	.017
private	-.787***	.198	-.072***
cooperative	.246	.199	.024
direct_to_final_consumer	.189	.262	.019
another_farm	.196	.256	.019
contract_to_sell	.013	.014	.001
internet_to_buy	.049	.241	.005
internet_to_sell	-.157	.346	-.014
advisory_service	-.751***	.178	-.075***
age	.052***	.006	.005***
edu	-.032	.075	-.003
Pseudo-R^2	0,22		
Wald Chi-Squared	207,10***		
Percent predicted correctly	84,2%		
Log likelihood	-587,189		

[1] For continuous variables marginal effect is calculated at the mean value.

Note: Single, double, and triple asterisks indicate significance at the 10, 5, and 1 percent level of significance.

Table 4: Summary Statistics and description of variables in U.S., 2001

Variable name	Description	Mean (St. Dev)*
OP_AGE	Age of farm operator (years)	53.24 (12.10)
OP_EDUC	Educational attainment of farm operator	13.53 (2.52)
F_RAISED	=1 if the operator was raised on a farm, 0 otherwise	0.60
S_RAISED	=1 if the spouse was raised on a farm, 0 otherwise	0.31
P_SUCCESS	=1 if the farm household has children of ages 13-18, 0 otherwise	0.22
F_HOBBY**	=1 if the farm is classified as a residential/lifestyle farm, 0 otherwise	0.25
F_LARGE	=1 if gross sales from farming is >=$500,000, 0 otherwise	0.43
F_FARMIN	=1 if farming is the main occupation of the farm operator, 0 otherwise	0.67
F_EFFICNCY	Farming efficiency (gross cash income/total variable cost)	2.32 (9.67)
F_CONTRACT	=1 if the farm has a production and/or marketing contract, 0 otherwise	0.10
F_NETINCME	Net farm income ($10,000)	13.26 (117.63)
F_INDIVD	=1 if farm is organized as sole proprietorship, 0 otherwise	0.73
F_PARTNER	=1 if farm is organized as a partnership, 0 otherwise	0.12
SP_OFFOWRK	=1 if the spouse works full time off the farm, 0 otherwise	0.27
M_GOVTPMT	=1 if farm's participation in farm programs increased in 2001 compared to 1996, 0 otherwise	0.12
L_GOVTPMT	=1 if farm's participation in farm programs increased in 2001 compared to 1996, 0 otherwise	0.08
M_DEBT	=1 if farm acquired more debt between 1996 and 2001, 0 otherwise	0.21
L_DEBT	=1 if farm decreased its debt between 1996 and 2001, 0 otherwise	0.24
R_HEART	=1 if the farm is located in the Heartland region, 0 otherwise	0.21
R_NORTHC	=1 if the farm is located in the Northern Crescent region, 0 otherwise	0.14
R_NORTHGP	=1 if the farm is located in the Northern Great Plains region, 0 otherwise	0.07

R_PRGATE	=1 if the farm is located in the Prairie Gateway region, 0 otherwise	0.13
R_EUPLAND	=1 if the farm is located in the Eastern Upland region, 0 otherwise	0.11
R_SEABOARD	=1 if the farm is located in the Southern Seaboard region, 0 otherwise	0.12
R_FRUITRIM	=1 if the farm is located in the Fruitful Rim region, 0 otherwise	0.13
R_BASINRNG	=1 if the farm is located in the Basin and Range region, 0 otherwise	0.04
FT_CASHGRN	=1 if the farm specializes in cash grain, 0 otherwise	0.26
FT_OFIELDCR***	=1 if the farm specializes in other field crops, 0 otherwise	0.13
FT_COTTON	=1 if the farm specializes in cotton, 0 otherwise	0.03
FT_HIGHVAL	=1 if the farm specializes in high value crops (nursery, vegetables, tree nuts), 0 otherwise	0.10
FT_BEEF	=1 if the farm specializes in beef, 0 otherwise	0.23
FT_HOGS	=1 if the farm specializes in hogs, 0 otherwise	0.03
FT_POULTRY	=1 if the farm specializes in poultry, 0 otherwise	0.06
FT_DAIRY	=1 if the farm specializes in dairy, 0 otherwise	0.11
EXIT_PLAN	=1 if the farm operator exiting farming in the next five years, 0 otherwise	0.14
Sample		7,269

* Standard deviation of continuous variables is presented.

*** Small farms whose operators report a major occupation other than farming

*** includes tobacco and field crops

Source: Agricultural Resource Management Survey (ARMS), 2001

Table 5: Parameter estimates and marginal effects of factors affecting farm exits in the U.S., 2001

Variables	Coef.	Robust Standard Error	Marginal effect
Intercept	-8.064***	0.526	--
OP_AGE	0.010***	0.004	‘0.006***
OP_EDUC	-0.059***	0.017	-0.004***
F_RAISED	1.004***	0.177	0.060***
S_RAISED	0.356***	0.088	0.024***
P_SUCCESS	-0.319***	0.126	-0.019***
F_HOBBY	0.711***	0.213	0.054***
F_LARGE	-0.265***	0.123	-0.016***
F_FARMIN	0.094	0.196	0.006
F_EFFICNCY	0.012	0.007	0.001
F_CONTRACT	-0.086	0.253	-0.005
F_NETINCME	-0.001	0.001	-0.000
F_INDIVD	0.263*	0.159	0.016*
F_PARTNER	0.260	0.185	0.018
SP_OFFOWRK	0.264**	0.099	0.018**
M_GOVTPMT	-0.144	0.134	-0.009
L_GOVTPMT	0.445***	0.122	0.034***
M_DEBT	0.418***	0.122	0.029***
L_DEBT	0.424***	0.104	0.030***
R_HEART	-0.249	0.186	-0.015
R_NORTHC	0.056	0.196	0.004
R_NORTHGP	0.586***	0.197	0.047***
R_PRGATE	-0.510***	0.193	-0.028***
R_EUPLAND	-0.277	0.191	-0.016
R_SEABOARD	-0.349**	0.193	-0.020**
R_FRUITRIM	0.246	0.197	0.017
R_BASINRNG	-0.220	0.259	-0.013
FT_CASHGRN	-0.165	0.192	-0.010
FT_OFIELDCR	0.079	0.193	0.005
FT_COTTON	0.297	0.297	0.022
FT_HIGHVAL	0.147	0.220	0.010
FT_BEEF	-0.296*	0.177	-0.018*
FT_HOGS	0.105	0.363	0.007
FT_POULTRY	0.369	0.319	0.027
FT_DAIRY	0.121	0.228	0.008
Pseudo-R^2	0.2728		

Wald Chi-Squared	1092.74***
Percent predicted correctly	72.6
Log likelihood	-2142.4433***

[1] For continuous variables marginal effect is calculated at the mean value.

Note: Single, double, and triple asterisks indicate significance at the 10, 5, and 1 percent level of significance.