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Entry and Exit from Farming: Insights from 5 Rounds of Agricultural Census Data

By Bretford Griffin, Valentina Hartarska, and Denis Nadolnyak

Invited presentation at the 2018 Southern Agricultural Economics Association Annual Meeting, February 2-6, 2018, Jacksonville, Florida

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Entry and Exit from Farming: Insights from 5 Rounds of Agricultural Census Data

A major demographic trend is underway in the US farming population. Recent data show that half of the US farmers are older than 58, over half of the landlords are older than 65, and these landlords are planning to transfer 91 million acres, or 10 percent of all agricultural land by 2020 (Agricultural Resources Management Survey, 2014). The aging of farm operators suggests that they may soon disinvest or exit farming. The aging of the landowners is likely to affect the supply of agricultural assets. These trends have implications for prices of land and other assets, availability of agricultural credit, the speed of technological innovation, rural areas depopulation and the rural economy overall. In this paper, we evaluate what factors affect farmers' exit and disinvestment from farming using Agricultural Census farm-level data for retirement age operators for the period 1992-2012.

The demographic pressures are coinciding with economic pressures on farmers' profits and incomes. Since 2012, agricultural commodity markets have experienced significant price volatility which is unlikely to subside and, as a consequence, the pressure on farmers to retire may be accelerating (Newman and McGroarty, 2017). The important questions are how farm profitability, together with other factors, affects operators' tendency to retire and whether farmers are more likely to exit or to rescale/disinvest and wait out the bad times to get better income from their assets if prices improve in the future. We explore these issues by identifying the extent to which various economic and demographic factors affect retirement age farmers' exit, as well as their disinvestment in preparation for retirement.

We contribute to the literature in several ways. First, to explain exit and disinvestment we use high quality and recent Census of Agriculture data from 1992-2012. Previous work on farm

business survival and farmer exit is dated, spanning the 1987-1997 period, or uses a single ARMS survey from 2001 (Goetz and Debertin, 2001, Mishra et al., 2010, Mishra et al., 2014; Key and Roberts, 2006). Recently, Katchova and Ahearn (2017) estimate aggregate exit rates for the period 1997-2012, which compare well to those in the present work. Our interest is not in the exit rates themselves but instead in identifying the economic and demographic factors that affect exit and disinvestment by individual farmers. Another contribution to the literature is the focus on the entire population of retirement age farmers. The existing literature on farmer retirement usually focuses on a single industry (e.g., dairy), state (e.g., Pennsylvania), or region, and thus lacks the breadth of analysis that may be more helpful for broader policy purposes to address issues stemming from the demographic transition presently underway.

In this paper, we frame the exit and disinvestment decisions as retiring farmers' intertemporal utility maximizing choices. In the empirical part, we first summarize the characteristics of exiting and disinvesting farmers using the Census data. Next, we specify a probit model for exit and disinvestment as a function of the variables suggested by the theory and by empirical evidence. Our results show that exit is unrelated to flow variables such as return on assets or to government payments. Farms with larger assets, family farms, and those in livestock production are less likely to exit and disinvest while farms with sales of more than $250,000 are less likely to exit but more likely to disinvest possibly targeting a smaller production scale at retirement age. We find that demographic variables matter. Retirement age minority farmers are 11 percent more likely to exit, female farmers are slightly more likely to exit (retire) but slightly less likely to disinvest, while age affects the retirement decision in a non-linear fashion. Finally, farmers working off-farm have a statistically significant but only slightly smaller exit probability perhaps because, at retirement age, alternative job opportunities are not an important reason for

exiting. The relative size of the regional non-agricultural economy that captures the tradeoffs between farming and other occupations reduces the probability of exit.

The following section summarizes the relevant literature, Section 3 develops the conceptual model, Section 4 describes the data, Section 5 discusses the results, and Section 6 concludes.

Review of the Relevant Literature

The present paper is related to work on evaluating what factors affect farmers' exit, including scaling back and through retirement, as well as to the broader literature on firm exit.

The most recent exit rates estimates for retirement age farmers are provided in Katchova and Ahearn (2017) who compute exit rates for various categories including farmers older than 65. They use Census Data, linked-farm and cohort approach (which better captures exit rates) and reported exit rates that compare well with the present study. Specifically, the results show exit rates of 10.5% for 65 years and older for the period of 1997-2002, 9.4% for 2002-2007, and 9.6% for 2007-2012. Estimates for the prior period of 1978-1997 by Hoppe and Korb (2006) show peak exit rates of 12-13 % for farmers older than 65, with larger farms less likely to exit. These results are somewhat different from Gale (2003) who reports that the exit rate among farmers older than 65 dropped from 8.4 to 6.2 percent between 1978 and 1997. The explanation offered was that improved farmer health and use of new technology, as well as possibly fewer younger generation heirs interested in farming, was behind the exit rates drop. However, while these studies show that exit rates vary in time, they do not provide evidence on how economic and demographic factors correlate with and affect farm exit, and our work fills in this gap.

Research outside the field of agricultural economics looks at the challenges and tradeoffs of selling or exiting the farm business and describes how farmer demographic characteristics,

social constructs, family expectations, successor identity, early childhood socialization, etc., all combine to affect farm exit (Kuehne 2012; Fisher and Burton, 2014). This work is typically case studies or studies based on survey data and thus faces the challenges of obtaining reliable data on sensitive financial and family circumstances. In the economic literature, there are very few nationally representative studies on the topic and work is often focused on the economic aspects of transferring ownership and retirement planning in the context of a smaller group of farmers within a commodity, region, etc. Examples include several studies of Pennsylvania and Maryland and dairy farms (Stokes, 2006; Tauer, 2006; Kimhi and Lopez, 1999).

Earlier research on farm succession by agricultural economists was done mostly in the context of how decisions are affected by tax considerations (Boehlje and Eisgruber, 1972; Tauer, 1985; 1989; Harlin, 1992) or of succession in the context of entering farmers trying to overcome borrowing constraints, at least in commercial farms (Tweeten and Zulauf, 1994). Further studies evaluated the impact on exit, retirement related scaling back, and management transfer decisions of government policies and support payments and alternatives for maximizing retirement benefits, as well as profitability and availability of off-farm work. For example, Kimhi (1994) highlighted the role of demographic factors and found that the optimal time of the farm business transfer is decreasing in parental age and depends on parents' productivity decline, while operators' off-farm job increases the likelihood of the transfer. A transfer at an optimal time can also serve as insurance and secure the parents' retirement income (Pesquin, Kimhi, and Kislev, 1999).

The literature on the management transfer decisions and exit has paid particular attention to the role of farmer demographics, farm and non-farm assets, and government payments and off-farm work. Mishra, El-Osta, and Shaik (2010) found that farm operator age, education, off-

farm work by operator or spouse, as well as expected household wealth, geographic location, and government policy were all significant indicators in the choice of a successor. This role of demographics and government policies in the choice of family or non-family successor is also explored in Mishra and El-Osta (2008) who found impacts of polices, family wealth, and diversification of retirement savings. Government payments and their decoupling from production decisions also influence farm rescaling choices and exit. For example, Key and Roberts (2006) show that increase in direct government payments had a small but statistically significant negative impact on failure and that the magnitude increased with farm size. At the same time, larger debt to asset ratio was associated with an increased hazard rate. Similar results are reported in Mishra et al. (2014) and Pietola et al. (2003). Kazukauskuas et al. (2013) found that decoupling government payments from production decreased the overall exit rates but led to an increase in disinvestment in land and machines suggesting that government policies could allow an optimal rescaling of production, while also facilitating the exit of failing or aging farms.

Research on farmer exit outside of the US shows that the drivers of retirement and exit differ by country. Kimhi and Bollman (1999) compare exit patterns of farmers in Canada and Israel and find that country specific institutional differences affect the speed of exit of retirement age farmers (larger in Canada) and that farm size impact on exit depends on institutional structure. Van Asseldonk et al. (2010) show significant differences in the Dutch farmers' long-term retirement investment, as well as lack of impact of some structural and objective parameters on retirement option choices.

In a study of the financial vulnerability of firms in the US, Gutter and Saleem (2005) find that farmers rely too much on farming as a source of income and wealth and, relative to other business owners, are the most financially vulnerable and least likely to meet long-term objectives

for retirement. The paper highlights how idiosyncratic risks, such as weather or commodity price fluctuations, can affect farmers' short-term finances and retirement goals. This is exactly what aging farmers could be experiencing currently. Thus, understanding what affects farmers' retirement and scaling back using national level data and a relatively longer time period is very important.

This work is also related to the farm exit in general and not only of retirement age farmers. Goetz and Debertin (2001) find that, while off farm labor and government payments do not seem to affect exit overall, if counties are grouped by whether they are losing or gaining farmers, off farm work and government payments matter. In particular, the speed of exit in counties that lose farmers is higher the more dependent these counties are on government assistance.

Finally, the present paper is related to the literature on the relationship between off-farm work and capital accumulation for which there is evidence of a negative association (Ahituv and Kimhi, 2002). Farm households' needs, consumption, and investment, can drive decisions to pursue off-farm employment, regardless of how the money is to be spent (on farm or not) Huffman (1980) also finds that the volume of farm output and farmer demographic characteristics affect off-farm labor.

Methodology

The theoretical basis for the empirical model is grounded in a constrained inter-temporal maximization problem that results in a value function of not exiting (Pietola et al., 2003; Blundell and MacCurdy, 1999; Kimhi and Bollman, 1999). The farmer maximizes the present value of current and future utility of consumption and leisure,

$$V_t = \sum_{\tau=t} \gamma_{\tau|t}\, U(C_\tau, L_\tau) \quad (1)$$

where C_τ and L_τ are consumption and leisure at a future time τ and $\gamma_{\tau|t}$ is the discount factor from τ to t. The end of period exit decision is assumed to be made at the beginning of the period so that $\gamma_{t|t} = 1$. The general form of the intertemporal budget constraint is

$$\sum r_{\tau|t}\, C_\tau = \sum r_{\tau|t}(\, w_\tau(1 - L_\tau) + F_\tau) + A_t \quad (2)$$

where A_t is the net value of assets at time t, w_τ is the off-farm wage rate, per period time endowment is assumed to be 1, F_τ is gross farm income equal to w times time worked on the farm as an opportunity cost, and $r_{\tau|t}$ is the market discount rate from τ to t which is different from $\gamma_{\tau|t}$. The specific form of the budget constraint depends on the exit choice (no on-farm income in case of exit, which changes the optimal labor-leisure allocation). Assuming that the exit decision is irreversible, V_t^E is the value of exiting defined as (1) maximized with respect to (2) excluding F_τ which, in a reduced form, is a function of the variables affecting on- and off-farm income and utility that include individual farmer attributes as well as institutional and locational factors. The present value of utility from not exiting (staying) at the end of current period t is

$$V_t^S = U(C_t, L_t) + \gamma_{t+1} \max(V_{t+1}^S, V_{t+1}^E) \quad (3)$$

This setup can also accommodate descaling or disinvestment by the sale of assets that may be optimal before exiting, depending on consumption and leisure preferences and their changes in time. The difference between the values of staying and exiting , $W_t = V_t^E - V_t^S$, can be called a tendency to exit and is determined by the same variables that determine V_t^E and V_t^S. Equation (3) suggests that W_t increases with variables that positively impact the current off-farm utility and decreases with variables that positively impact on-farm utility and future off-farm utility. It is

important that this formulation does not posit definitive a priori impacts on the exit choices. The ambiguity arises from the conflicting direct and indirect effects of the variables. Examples include changes in off-farm labor market conditions that affect both current and future off-farm utility, personal characteristics such as age and education that affect all states, and farm incomes that increase the on-farm utility but, in time, may lead to changes in labor-leisure allocation favoring exit. The tendency to exit specifies the exit decision rule as an index function:

$$E_t = \begin{cases} 1 \ if \ W_t > 0 \ (farmer \ decides \ to \ exit \ in \ period \ t) \\ 0 \ otherwise \ (farmer \ decides \ not \ to \ exit \ in \ t) \end{cases}$$

The first order approximation of the tendency is

$$W_t = \beta X_t + \varepsilon_i \quad (4)$$

where X_t is the vector of the variables that directly affect current and future on- and off-farm utility as well as shifters such as personal and location-specific attributes and institutional factors and ε_i is the approximation error. If ε_i is assumed to be standard normal, the parameter coefficients in β can be estimated using standard probit with the cumulative in the log-likelihood being standard normal over (-∞, βX_t). In this paper, the probability of observing exit/disinvestment is modeled as:

$$E^* = \boldsymbol{X}_i'\beta + \varepsilon_i, \ E = 1 \text{ if } E^* > 0, \text{ otherwise } 0 \quad (5)$$

where E is a measure of exit, either outright exit or scaling back from farming by disinvestment. The variables in X are determined by the relevant empirical findings and include measures of profitability, on-farm income, as well as off-farm income and demographic variables, agricultural subsidies, and macroeconomic and regional factors. Specifically, we include farm financial variables such as return on assets (ROA), size as total assets (LnAssets), a family farm

dummy (FAMILY), and a dummy for livestock type farm (LIVESTOCK). Farmer demographic characteristics include age (AGE), gender (FEMALE) and race (WHITE) dummies. The specifications also control for institutional factors such as government payment (GPAYMNT), as well as state-specific controls such as nonagricultural share of GDP (NONAGSHARE). The variable definitions are in Table 1 in the Appendix.

Data

We use farm-level Census of Agriculture data from years 1992, 1997, 2002, 2007, and 2012. State GDP data come from the Bureau of Economic Analysis. The data contain retirement age farmers and ranchers whom we define as principal farm operators 60 years or older with more than $50,000 in total annual production. The primary reason for exit from farming for this demographic group is assumed to be retirement, whereas disinvestment is assumed to be in preparation for retirement.[1]

The dependent variables are exit from farming and disinvestment. The exit variable takes the value of 1 if, in the following Census data, there is no record of that individual farmer ID, and zero otherwise. While Completion of the Census questionnaire is mandatory, a measurement error is possible if a working operator does not fill in their Census questionnaire for some years prior to the end of our sample period (2012). We adjust for this by taking the final year of the operator reports, allowing for reporting gaps between 1992 and 2012. Thus, we do not code farmers as exiting if they skipped a participation in one round but participated in the following

[1] While farmers like everybody else are eligible for social security at 65 is they have paid into it, we include farmers a few years younger than 65 and define the age group as 60 years. This helps capturing possible disinvestment in preparation to retirement and can help understand whether farmers plan their retirement by taking advantage of favorable market conditions and sell land before they exit at 65 or later.

Census. Even in the presence of some random measurement errors, exit is the dependent variable, so the relatively large number of observations should help overcome the measurement error issue assuming that survey completion omission is not systematic.

The disinvestment from farming variable is also a dummy that takes the value of one if the land owned at Census year *t* and is less than 80% of the land owned in the previous Census year. This benchmark is selected because the average percentage of the land sold was above 20 percent in all periods so we assume that sales higher than average represent intentional scaling back attributed to preparation for retirement and less than that is used to cover normal obligations or to take advantage of temporary market opportunities. Finally, scaling back at the age of over 60 may be due to optimizing size given farmers' overall health and physical strength.[2] The disinvestment variable may also have measurement issues similar to the exit variable resulting from farmer's failure to complete the mandatory Census questionnaire and therefore with this variable too we skip gaps to find farmers who disinvested from the last time they reported. As before, we assume that the possible measurement error is not systematic and, thus, can be overcome by a large number of observations.

We start the data description by examining how close our exit data are to other published data. Table 1 and 2 in the Appendix show that experienced farmers (older than 60 years of age in our sample, and older than 65 in the comparison group) are very similar for all available years, with the differences attributable to different computational methodologies. While Katchova and Ahearn (2017) use an aggregate cohort methodology to compute exit rates for all farmers, we use

[2] The goal of this disinvestment benchmark is to capture the retirement intent and we have used several alternative values with the precise average of disinvested land or slightly higher percentages, but the results did not change substantially. While it is also possible to simply run a pooled OLS on the actual land disinvested (we did not do this, because we do not have access to the Census data at this point to do that) our interest is to capture the retirement intent and anticipation of retirement not on determinants what factors affect the sale of land.

regression analysis of thus individual farmer data. The aggregate exit rates for farmers with sales larger than $50,000 are also very similar to previously published data. Table 3 in the Appendix summarizes the characteristics of the farmers who sold and those who did not sell land.

Next, we look at the aggregate trends in agricultural GDP by region and in time. The production regions that we analyze and control for in the regressions are Southeast, Appalachia, Corn Belt, Delta, Lake States, Mountains, Northeast, Northern Plains, Pacific, and Southern Plains. Figures 1 and 2 show that the regional level GDP and the share of agricultural GDP in total GDP generally moved in the same direction preserving existing regional differences throughout the study period. The actual values are in Table 1, which shows all key variables' means and the patterns of change for retirement age farmers by Census year. The table shows a decline in the profitability as measured by ROA of retirement age farmers, from 5.6% in 1992 Census to about 0% percent in 2012. The retirement age farmers' assets varied between $500,000 and $800,000 over the study period. Interestingly, we find that in this age group, a large share of farmers seem to receive government payments (about double the national average in 2007 for example) and this number has not changed much in time. The average age of this group is about 70 years and it is stable over time, suggesting that many farmers retire as they become eligible for retirement. The data show that retirement age farmers own on average about 350 acres which is smaller than the 398 acre average for all farms.

Table 2 shows the average values for the variables for farmers who disinvested, presumably in preparation for retirement, and those who did not, while Table 3 highlights the statistically significant differences between these two groups. The data show that farmers who disinvested were about a year older than those who did not, and owned on average 100 fewer acres the year after disinvestment. A slightly larger proportion of the low sales farmers did not

sell land, which might reflect the retirement decision to keep the farm as a residence. Within the Southeast, the Mountains, and the Lake States production regions, higher proportion of farmers were disinvesting in each Census year. There is evidence that disinvesting farmers were less likely to be family farms and the principal operators were less likely to have worked off farm but the differences are very small.

We also observe that about 90% of the retirement age operators run family farms (as opposed to national average of 84%), between 20% and 25% are in crop farming and that share is relatively stable, and 50% are in livestock production with their share decreasing over time possibly at the expense of mixed or other specialized production units.[3] We find that only 1% to 3% of the farmers fall in the category of high sales (over $250,000) but the share of retirement age farmers in that category has been increasing.

Further analyzing the statistically significant differences among the two groups shows no difference in ROA except for the year 2002 when those who disinvested had about 5.8% higher ROA than those who did not disinvest. We do not see systematic differences in assets size. For example, the assets value (farm size) was the same for farmers who disinvested as for those who did not between Census year 1997 and 2002 and between 2007 and 2012, but assets size was $80,300 less for those who disinvested between 1992 and 1997 and $18,400 less between Census years 2002 and 2007. Our data do not show differences in terms of government payments received except for farmers disinvesting between 2002 and 2007 when a much smaller proportion of them received government payments relative to those who did not disinvest. Disinvesting farmers are located in regions with a higher share of agricultural GDP up to 2002 and in regions with a smaller share of agricultural GDP between 2002 and 2012. We find that, in

[3] Livestock is a dummy indicating that farm received the majority of its revenue from Hogs, Dairy products, Cattle, Sheep and Goat Products, Equine, or Poultry and Eggs.

general, disinvesting farmers were less likely to work off farm but the difference between the two groups was very small and decreasing over time. We also see that disinvesting farmers were more likely to be family farms up to 1997 but less likely to be family farms after that. Up to 2002, disinvesting farmers were more likely to be in mostly crop or mostly livestock production but, while this trend continued for mostly crop producing farms, the proportion of disinvesting farmers in mostly livestock production decreased after 2007.

Estimation Results

Table 4 presents the results from the probit estimation for exit and disinvestment, with the first columns containing the estimated coefficients and their significance and next column containing the marginal impacts at the mean. The regression diagnostics values show satisfactory values and acceptable data fit.

We first note that the profitability of the farming operation (ROA) in our sample does not affect exit or disinvestment. This is in line with previous studies on non-retirement age farmers' exit (Mishra et al., 2014). At the same time, farm size (LnAssets) has a large and statistically significant impact on exit with the marginal impact indicating that one percent increase in assets is associated with 0.67 lower percent probability of exit. Similarly, one percent positive change in assets is associated with 0.084 lower probability of disinvestment at the mean. Unlike other studies of exit by all farmers (e.g., Mishra, El-Osta, and Shaik, 2010 and Mishra et al 2014 who use 2001 ARMS data) finding that government payment intensity slowed down the exit of (all) family farms, we do not find that these payments affected either exit or disinvestment of retirement age farmers. Related work by Key and Roberts (2006) which, like us, uses the Census data but for the 1987-1997 period to study farm business survival report very small statistically significant impact of government payments on farm business survival. Like us, Goetz and Debertin (2001) found that,

with national level county data, off-farm work and government payments do not affect exit. However, within the group of counties that had lost farmers, the speed of exit was higher the more reliant farmers were on these payments.

Several other variables influence exit and scaling back but in different direction or size. For example, operators with sales more than $250,000 are 4.3 percent less likely to exit farming than smaller scale operators which is in line with Mishra et al. (2014) who report that larger farms (sales over $500,000 in 2001) have 1.6 percent lower probability of exit. At the same time, operators with larger sales are also 7.9 percent more likely to scale back, which, for our sample, may suggest reluctance to expand or propensity to maintain a certain production scale. Similar to the sales category, the opportunity cost of farming as measured by the strength and size of the non-agricultural economy's share of GDP have strong and divergent impacts on exit and disinvestment. We find that a one percent increase in the share of the non-agricultural sector was associated with 3.77 times lower probability of exit from farming which may suggest positive feedbacks from local non-agricultural economies.[4] At the same time, a similar increase in the non-ag sector is associated with 6 times increase in disinvestment (or land sales) which is a more intuitive result possibly due to farmers wanting to take advantage of favorable market conditions, presumably before retirement.

We also find that, compared to male farm operators, female operators are 1.3 percent less likely to exit farming but are 2.4 percent point more likely to scale back. Thus, since female operators are less likely to exit immediately rather than gradually disinvest from farming, it is

[4] The actual change between 1997 and 2007 was 0.1 percent

possible that at least some of them are widows and perhaps full sale could be restricted by inheritance arrangements. In either case, these effects are small.

There are statistically significant differences in exit rates by race and age. During the study period, white farmers were 10.7 percent less likely to exit farming relative to minority farmers, which is a large difference but there is no difference between these groups in terms of disinvestment. This warrants further study and could be related to entry by young and beginning farmers, differences in family dynamics, or some other factors that need to be identified. The age variable enters non-linearly since farmers in the sample are 60 or older. Since the retirement age is either 65 or 70 as defined by the social security eligibility for farmers who have paid in the system, these farmers are less likely to exit before, and more likely after, the retirement age. At the same time, farmers before the retirement age could be more likely to disinvest in preparation for retirement and less likely to disinvest after that once they decide to retire not to retire. The coefficient estimates and the marginal estimates do not have a direct interpretation (nonlinear specification in a nonlinear model) but support the idea that, indeed, farmers are less likely to exit at first (possibly until 70) but more likely to exit once they reach the social security retirement benchmark.[5] However, age is unrelated to disinvesting for retirement age farmers.

As expected, off-farm work is associated with increased probability of both exit and disinvestment. Specifically, we find that families that work off-farm are close to one percent more likely to exit farming than those who work full time on the farm and they also are about one percent more likely to disinvest in preparation for retirement. This effect is small, possibly due to the categorical nature of the off farm work variable. It is also different from previous work that finds

[5] The marginal effect at the mean can technically be computed but at this point our access to the Census Data has been terminated.

that operators and spouses with operators with off-farm work have a negative association with exit while spouses with off-farm work have a positive association (Mishra et al. 2014). Since our data do not distinguish between the two, it is possible that those two opposite effects neutralize each other and result in no impact.

We find exit rate differences by the farm type. Family farmers have 6.9 percent lower probability of exiting and 4.8 percent lower probability of scaling back relative to non-family farms, highlighting their stronger commitment to staying in the farming business. During the study period, operators who are primarily livestock producers are 5.6 percent less likely to exit farming and 3.1 percent less likely to scale back relative to farmers who are in other types of agricultural production. In addition, consistent with work by Mishra et al. (2014), we find significant regional differences. Farmers from the Corn Belt, the Lake States, and the Northeast are less likely to disinvest, and the Northeastern farmers are more likely to exit relative to the base (Appalachia). The Delta States' farmers are more likely to disinvest and to exit, while the Mountain States and the Southeast are more likely only to disinvest (values are suppressed for formatting sake).

Conclusions

Understanding what factors affect exit and disinvestment of retirement age farmers provides insights into the issues of agricultural land use, rural development and depopulation, and can be helpful in designing agricultural policies. Farming in the US is undergoing significant demographic transition driven by the age dynamics of the farmer population. Latest data from the Census of Agriculture show that half of the farmers nationwide are 58 years or older, and half of the landowners are 65 years or older. Data on farmers' intentions to exit farming and transfer land (presumably to retire) from the 2014 ARMS show that, by 2020, about 10 percent of agricultural land will likely change hands (ACH, 2015). In this paper, we estimate the probability of retirement age farmers' exit within the framework of an accepted concept of the tendency to exit driven by intertemporal utility maximization (Kimhi and Bollman, 1999; Mishra, Fannin, and Joo, 2014). We contribute to the literature by using individual farmer data from the most recent five Census rounds over 1992-2012, which is a longer and more recent interval relative to previously published research on the topic.

Building on previous empirical work, we evaluate the impacts on two exit measures: actual exit and disinvestment (scaling back). A separate analysis of the likelihood of disinvestment allows us to learn about what farm operators do in preparation for retirement. We identify several factors associated with exit from farming, with the main differences in the tendency to exit coming from differences in the demographic and farm characteristics, as well as regional attributes. Our results are consistent with previous findings that farmers with larger operations are less likely to exit or disinvest with mean marginal impacts of size (log of assets) being -0.67 and -0.084. Farms with higher sales (more than $250,000) are also more likely to disinvest than the rest. In addition, farms in economies with proportionally larger nonfarm sector

are more likely to take advantage of market conditions by staying in farming but preparing for exit by disinvestment. Similar but smaller differences are found for demographic characteristics. For example, female farmers are one percent more likely to exit but two percent less likely to disinvest than male farmers. White farmers are 10 percent less likely to exit than minority farmers.

The most surprising result is that, with the exception of farm size, the economic factors measured by the available individual farmer data such as return on assets and government payments are not associated with exit or disinvestment. For retirement age farmers, off-farm work has a minimal, although statistically significant, economic impact with operators with off-farm jobs only 1 percent less likely to exit than those who do not work off-farm. Only indirect economic factors seem to matter in that the relative size of the regional non-agricultural sector speeds up disinvestment, possibly indicating land conversion for non-agricultural uses.

The lack of impact of flow economic indicators such as return on assets, government payments, and the very limited impact of off-farm work suggest that farm transition during the study period was mostly determined by the demographic factors. This has important policy implications as the recent drop in farming profitability may be less of a catalyst to older farmers' exit than expected. While the interpretation that farmers' decisions to exit are driven mainly by demographics and not by direct economic performance indicators is plausible, it warrants further investigation.[6] The new Census of Agriculture 2017 is underway and the new data will be available in only in 2019. In order to address pressing and important policy issues related to farm exit and retirement, future research will also need to identify the factors that affect entry of new

[6] For example, working papers within ERS show that traditional measures of farm profitability such as ROA significantly underestimate farm incomes and thus are not a good proxy of incomes.

and beginning farmers, as well as the expansion of existing farms or farm entry and exit in general.

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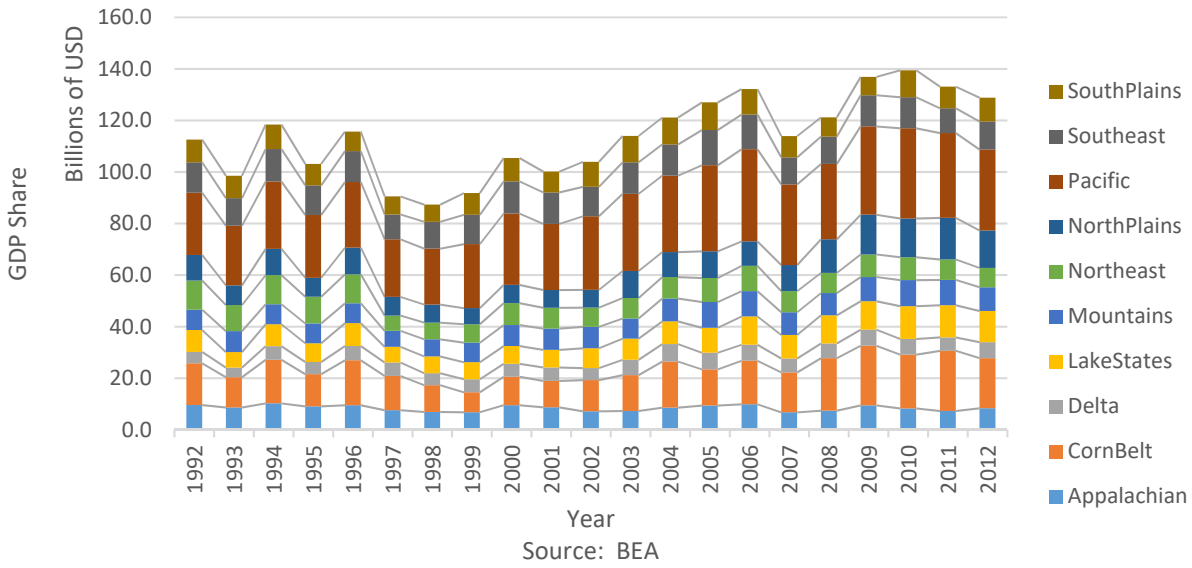
Figure 1 Regional contribution to GDP in Agriculture



Source: BEA

Fugure 2 Agriculture Share of GDP

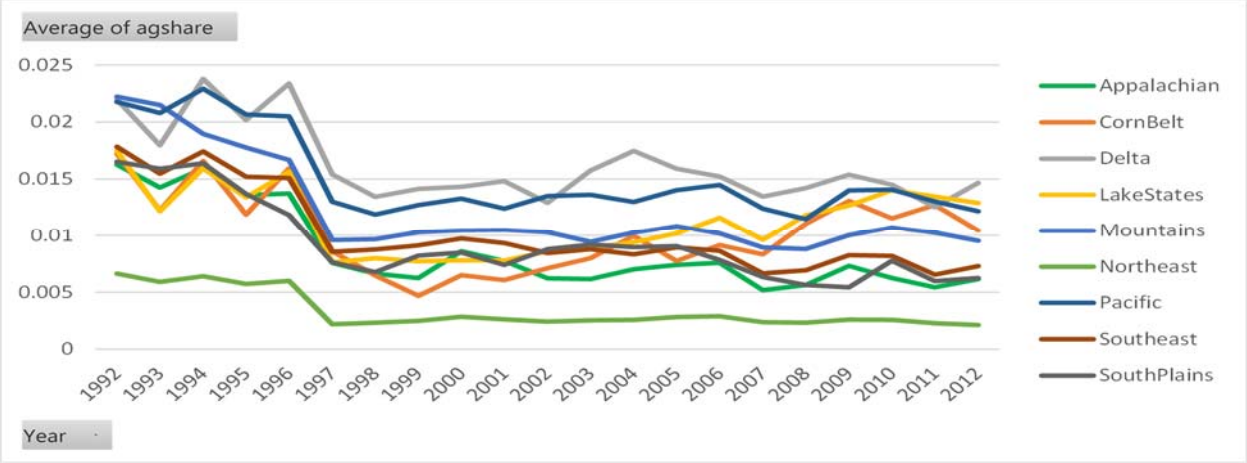


Table 1. Variables Mean by Census Year (Retirement Age Farmers with sales more than $50,000)

	1997	**2002**	**2007**	**2012**
ROA (%)	5.6	4.4	2.1	0.01
Assets ($'000)	663	807	540	649
LnAssets	5.534	5.674	5.427	5.464
GovPayment	0.709	0.777	0.751	0.818
Age (years)	69.7	69.7	69.8	69.9
AgeSquared	4904	4909	4929	4939
OwnAcres	356	351	343	342
NonAgShare (of GDP)	0.987	0.988	0.988	0.986
WrkOffFarm (PO worked off farm)	0.400	0.296	0.479	0.456
Family (farm)	0.869	0.899	0.860	0.866
Crop (main production)	0.234	0.235	0.218	0.231
Livestock (main production)	0.524	0.506	0.460	0.449
HighSales (>$250,000)	0.016	0.016	0.023	0.033
Appalachian	0.148	0.146	0.136	0.130
Corn Belt	0.184	0.187	0.175	0.175
Delta Region	0.055	0.058	0.057	0.056
Lake States	0.081	0.084	0.084	0.082
Mountains	0.061	0.059	0.074	0.083
Northeast	0.064	0.061	0.066	0.067
North Plains	0.081	0.080	0.076	0.075
Pacific	0.075	0.073	0.074	0.078
Southeast	0.085	0.085	0.083	0.082
South Plains	0.163	0.165	0.170	0.169

Table 2. Means, by Disinvestment Class. (Disinvested is defined as sold at least 20percent of its land in Census year t-1).

	Disinvested (Sold Land)				**Did not sell land**			
	1997	2002	2007	2012	1997	2002	2007	2012
ROA	0.051	0.064	0.019	0.000	0.058	0.038	0.022	0.000
Assets	661	838	589	685	664	798	526	638
lnAssets	5.64	5.77	5.53	5.55	5.51	5.65	5.39	5.44
GovPayment	0.666	0.711	1.045	0.619	0.720	0.797	0.641	0.889
Age	70.4	70.4	70.6	70.7	69.5	69.5	69.6	69.6
OwnAcres	341	322	358	343	360	359	338	342
NonAgShare	0.987	0.988	0.988	0.986	0.987	0.987	0.988	0.986
WrkOffFarm	0.376	0.269	0.455	0.432	0.405	0.303	0.486	0.464
Family	0.885	0.898	0.860	0.858	0.865	0.899	0.860	0.868
Crop	0.235	0.234	0.228	0.238	0.234	0.236	0.214	0.229
Livestock	0.551	0.536	0.465	0.451	0.517	0.498	0.459	0.448
LowSales	0.900	0.907	0.887	0.868	0.908	0.919	0.908	0.890
MidSales	0.085	0.076	0.087	0.096	0.075	0.065	0.070	0.077
HighSales	0.015	0.017	0.026	0.036	0.016	0.015	0.022	0.032
Appalachian	0.173	0.168	0.150	0.143	0.142	0.140	0.132	0.126
Corn Belt	0.184	0.177	0.178	0.175	0.184	0.189	0.175	0.175
Delta Region	0.052	0.060	0.054	0.060	0.055	0.057	0.058	0.055
Lake States	0.085	0.087	0.092	0.083	0.080	0.083	0.082	0.081
Mountains	0.063	0.059	0.068	0.082	0.060	0.059	0.076	0.083
Northeast	0.076	0.065	0.072	0.070	0.062	0.060	0.064	0.066
North Plains	0.075	0.071	0.080	0.079	0.083	0.083	0.075	0.074
Pacific	0.062	0.060	0.063	0.060	0.078	0.076	0.077	0.083
Southeast	0.084	0.088	0.083	0.083	0.085	0.084	0.083	0.082
South Plains	0.144	0.162	0.156	0.162	0.168	0.165	0.175	0.171

Table 3. Statistically significant mean difference between farmers who disinvested (sold more than 20% of their land in Census Year t-1) and those that did not.

	1997	2002	2007	2012
ROA	0.003	0.058*	-0.002	0.000
Assets	-80.3*	5.20	18.4*	-3.80
lnAssets	-0.045*	-0.025*	-0.04*	-0.118*
GovPayment	0.372	0.046	-0.369*	-0.141
Age	0.97*	0.93*	0.93*	0.97*
OwnAcres	-133.3*	-153.2*	-128*	-116.6*
NonAgShare	0.0002*	0.0002*	-0.0005*	-0.0007*
WrkOffFarm	-0.001	-0.023*	-0.007*	-0.010*
Family	0.016*	-0.010*	-0.012*	-0.021*
Crop	0.012*	0.004*	0.022*	0.019*
Livestock	0.014*	0.013*	-0.008*	-0.006*
LowSales	0.006*	-0.007*	-0.013*	-0.012*
HighSales	-0.002*	0.004*	0.007*	0.006*
Appalachian	0.014*	0.007*	0.003*	-0.004*
Corn Belt	-0.013*	-0.028*	-0.009*	-0.011*
Delta Region	-0.001*	0.005*	-0.002*	0.004*
Lake States	0.009*	0.004*	0.002*	-0.002*
Mountains	0.014*	0.007*	0.006*	0.018*
Northeast	0.003*	-0.003*	-0.002*	-0.005*
North Plains	-0.004*	-0.002*	0.009*	0.009*
Pacific	-0.002*	0.000	0.003*	-0.006*
Southeast	0.004*	0.006*	0.004*	0.002*
South Plains	-0.022*	0.004*	-0.014*	-0.007*

**Indicates significant at p=.05.*
Positive values indicates Disinvestment > No disinvestment;
Negative values indicated Disinvestment < No disinvestment.

Table 4. Probit regression of exit and disinvestment for retirement age farmers

Variable	RETIRE		DISINVEST	
	Coefficient Estimate	Marginal Effect (at the mean)	Coefficient Estimate	Marginal Effect (at the mean)
Intercept	6.266***		-109.3***	
	(0.311)		(1.699)	
ROA	0.008	0.000	-0.012	0.000
	(0.007)		(0.014)	
lnAssets	-0.123***	-0.671	-0.015**	-0.084
	(0.004)		(0.005)	
GovPayment	0.002	0.002	-0.047	-0.038
	(0.030)		(0.044)	
NonAgShare	-3.822***	-3.77	6.94***	6.84
	(0.179)		(0.339)	
WrkOffFarm	0.016**	0.007	0.019*	0.009
	(0.007)		(0.009)	
Family	-0.079***	-0.069	-0.055***	-0.048
	(0.007)		(0.009)	
Livestock	-0.125***	-0.056	-0.068***	-0.031
	(0.007)		(0.009)	
HighSales	-0.049***	-0.043	0.089***	0.079
	(0.010)		(0.013)	
Female	0.2406***	-0.013	-0.132***	0.024
	(0.014)		(0.021)	
White	-0.189***	-0.107	-0.107	-0.189
	(0.048)		(0.078)	
Age	-0.070***		0.017	
	(0.007)		(0.010)	
Age Squared	0.001***		-.000	
	(0.000)		(0.000)	
Census Year	YES		YES	
Region	YES		YES	
N	184,155		184,155	
Sum of Weights	205,912		205,912	
Likelihood Ratio	5,776		5,848	
(P value)	(.0001)		(.0001)	
Wald	5,658		5,013	
(P value)	(.0001)		(0001)	
Pseudo Chi2	0.26		0.25	

Appendix

Table 1 Description of Variables

Variable	**Description**
Disnivest	Dummy 1 if disinvestment >20% (approximately the average rate)
Exit	Dummy: 1 if respondent exits farming
ROA	GROSSINC(value of production –expense) /ASSETS
GovPayment	Government payment dummy
Assets	Sum of VLAB and MACHVAL ($1,000)
LnASSETS	Natural log of assets
High Sales	Dummy: 1 if > $250K
NonAhShare	1- Agriculture's share of State GDP
WrkOffFarm	Dummy: 1 if any days worked off-farm
Age	Age of principal operator
Livestock	Dummy: 1 if operation's sales is primarily livestock
White	Dummy: 1 if operator is a white
Family	Dummy: 1 if operation is owned and operated by family
Census Year	Census Year of observation
Female	Dummy 1 if PO is Female
Region	AP = Appalachian, CB = Corn Belt, DLT = Delta, LS = Lake States, MTN = Mountain, NTE = Northeast, NP = North Plains, PAC = Pacific, SE = Southeast, SP = South Plains

Table 2 Appendix: Exit rates comparisons compared to published studies

Census Period		Exit	
		Current study	Kathcova & Ahearn (2017)
All Farmers	1992-1997	8.5%	.
	1997-2002	7.2%	8.7%
	2002-2007	7.0%	8.2%
	2007-2012	8.5%	8.5%
		Farmers older than 60	Farmers older than 65
Experienced Farmers	1992-1997	8.0%	.
	1997-2002	7.0%	10.5%
	2002-2007	6.6%	9.4%
	2007-2012	8.0%	9.6%

Table 3. Retirement Age Farmers Overview (Age >60 years, sales over $50,000)

	1992	**1997**	**2002**	**2007**	**2012**
Percent of total farmers	36.1	35.7	37.5	42.6	47.6
Exit Rate (%)	9.4	8.8	8	9	
Disinvested (sold land, % of total)		19	22	22.8	22.5
Average % land sold		24	28.4	28.1	27.5