Farm Entry and Exit from U.S. Agriculture

Ani L. Katchova (The Ohio State University)

Mary Clare Ahearn (ERS-USDA)

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Ani Katchova is associate professor and Farm Income Enhancement Chair at the Department of Agricultural, Environmental, and Development Economics at The Ohio State University. Mary Ahearn is a senior economist, retired, at the Economic Research Service at USDA. The work was performed while Katchova was AAAS Science & Technology Policy Fellow and Visiting Scholar at the Economic Research Service at USDA. The views expressed are the authors' and do not necessarily represent those of the Economic Research Service or the USDA.

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Abstract

This study uses a linked-farm approach (linking farms over time) and a cohort approach (farms that started operating in the same year) to determine exit rates conditional on the number of years a farm has been operating. Linear forecasting, moving-average forecasting, and using data from a later Census are used to re-estimate the number of new farms in their first year of operating. Using the linked-farm approach, an average annual entry rate of 7.5% and exit rate of 8.5% is estimated for 2007 to 2012, which vary based on the farmer's lifecycle. The cohort approach shows that exit rates are lower than 4% for the first 40 years of operating a farm business and then exit rates gradually increase. Revised estimates of approximately 70-80,000 new farms entering each year are calculated, which are considerably higher numbers than the 30-40,000 new farm entrants participating in the Census of Agriculture. The linked-farm and cohort approaches are used to provide updated estimates for farm entry and exit using new Census data and to make comparisons with previous years. To our knowledge, this is the first study to provide revised estimates for new farm entrants into U.S. agriculture.

Keywords: farm exits, farm entry, beginning farmers.

JEL: Q12, Q15, Q18

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Introduction

Concerns about structural change in the farming sector have been a longstanding focus of policymakers. In the late 1940s, Secretary of Agriculture Brannan focused on farm structure with statements regarding the urgency to save the family farm. Secretary of Agriculture Bob Bergland focused attention on structure issues by leading a multi-year project that resulted in 13 public forums around the country during 1979-1980 and the publication of "A Time to Choose" in 1981 (USDA, 1981). The farm financial crisis of the mid-1980s led to a greater focus on farm exits, especially due to bankruptcies (Stam and Dixon, 2004). The weakening of the farm economy since 2012-13 in terms of sector income and asset values is sparking new questions about the potential for involuntary exits from farming and lack of entry opportunities.

As major farm legislation is revised approximately every 5 years, through the Farm Bill, structural change issues are regularly referenced by policymakers. However, very few policies are targeted to address agricultural structure issues.[1] The exception to this are the relatively small programs for addressing farm structural change issues through support and special considerations for young and beginning farmers. While there have always been barriers to entry into farming—through high land prices, access to credit, and the cost of machinery and equipment—the number and proportion of young operators in farming continues to decline.

The current Secretary of Agriculture Thomas Vilsack, speaking at the 2013 Agricultural Outlook Forum in Washington, D.C., indicated farm transitions as an issue of major concern to policymakers. The well-known challenges of the aging farmer population (with an average age

[1]However, there is a growing literature indicating that traditional farm policies are one of the factors indirectly encouraging farm consolidation (Key and Roberts, 2007).

of 58 years old according to the 2012 Census of Agriculture) as well as the concentration of ownership and control of farmland by senior owners has led to concerns about the large share of farmland that is likely to change hands in the near future and the need to train beginning farmers to start their businesses.

Though there are many dimensions to agricultural structure, the number and size distribution are the most basic indicators. The rates of entry and exit, and the ensuing farm consolidation all contribute to the changes in the number and size distribution of farms. While cross-sectional analysis typically provides indicators of the number and size distribution of farms, it does not provide an understanding of the underlying dynamics.

The goal of this research is to identify the dynamics of farm transitions by measuring the exits and entry in U.S. agriculture during 1997-2012 and compare it with results from previous studies. More specifically, using a linked-farm approach of following the same farms over time, entry and exit rates are calculated using the 1997 through 2012 Censuses. Exit rates are also calculated using a cohort approach of following cohorts of farms that have started operating their businesses in a given year from one Census to the next. Finally, by comparing different cohorts of farms in adjacent Censuses, it is shown that not all new farms operating in their first few years are appropriately accounted for, and therefore, revised estimates are provided for the number of new farms entering in agriculture. Given the aging of the farm population, a question that may arise is whether more farmers are needed to enter U.S. agriculture and if so, whether new policies are needed to encourage new and beginning farmers to start their businesses.

Literature Review

Following the farm financial crisis of the mid-1980s, there was a renewed interest in providing a better understanding of farm entry and exits, and two empirical approaches to measure the dynamics of the farm sector emerged in the literature. The first approach is based on the response to a standard question regarding when the principal operator began farming this operation.[2] This approach will be referred as a cohort approach. The linked-farm approach is based on the linking of individual farms across various Censuses of Agriculture based on a farm record identifier.

Gale and Henderson (1991) used the cohort approach to examine entry and exits during 1978-1987. They reported an annual exit rate of 4.7% during the two Census subperiods for 1978-1982 and 1982-1987. Gale (2003) later extended this analysis through the 1997 period, again using the cohort approach to measuring entries and exits, and considered differential rates based on age group.

Gale (1994) employed the linked-farm approach in considering sector dynamics during 1978-1987 for 3 subgroups of farms, defined based on their commodity specialization and region. Hoppe and Korb (2006) also employed the linked-farm approach in considering farm exits for all U.S. farms from 1978 to 1997. They reported exit rates of 9-10% during the period. They considered the probability of farm exits as farm and personal characteristics varied and found that the probability of exits was higher for recent entrants than for older, more established farmers. They also reported significant differences in exit rates based on the farm's commodity specialization.

[2]Various statistical techniques have also been used to estimate the number and size distribution of farms, based on grouped cross-sectional data, e.g., Peterson (1990) and U.S. Congress (1986).

Similarly, Ahearn, Korb, and Yee (2009) considered entry and exit rates based on the linked-farm approach during 1978-1997 and found variations in both rates over time. Of the farms that existed in 1978, 23% were estimated to have survived by 1997. They show a somewhat higher rate of entry and exit for farm businesses than the entry-exit rates for other industries. By farm size, they concluded that, although farms enter and exit at all farm sizes, rates are higher for small farms. They also found that among the cohort of surviving farms, small farms were less likely to expand, compared to large farms. This is consistent with the longstanding trend of greater production concentration on large farms and the relative importance of the farm as a family residence, as much as a family business, for the many small farms. In contrast, among nonfarm industries where the firm does not provide the dual role of residence and business, the growth rate of large surviving firms is less than that for small surviving firms.

Several studies have examined various aspects of the role of life cycle effects on the entry, exit and financial decisions of farm businesses (Boehlje, 1973 and Whittaker and Ahearn, 1991). Mishra, El-Osta, and Shaik (2010) and Mishra, Fannin, and Joo (2014) showed that both farm succession decisions and farm exits are significantly influenced by farmer's age. In addition, Katchova and Ahearn (2016) show that after entry in agriculture, beginning farmers and especially young farmers rapidly increase the size of their farming operation in the first decade of operating their businesses.

While concerns about farm exits in the U.S. mirror those in other countries, several studies show important differences. Kimhi and Bollman (1999) show that farmers over a certain age are more likely to exit when they become older. They also show that understanding behavioral aspects and institutional setting is important when making comparisons about exit

trends in Canada and Israel. Kazukauskas et al. (2013) consider farm exits in a European context and show that the subsidy decoupling has resulted in "gradual" farm exits via disinvesting in farm assets and farmland reduction changes over time. Their study indicates that farm exits may be anticipated and planned over a period of time before an exit actually occurs.

Drivers of Structural Change Affecting Farm Entry and Exits

The number of U.S. farms has been remarkably stable since 1997, varying from 2.2 to 2.1 million. The current definition of a farm—a place with, or the potential for, $1,000 in sales—was adopted in the mid-1970s. It is a very inclusive definition and embraces farms operated by households that are retired or attracted to farming for reasons not primarily related to production, such as the rural lifestyle or investment opportunities. In addition, since the definition is dollar-based but not adjusted for changing price levels, it becomes more inclusive with each passing year as price levels change.

Aside from the stability in the number of farms, there have been significant structural changes over the recent decades. There are many indicators of structural change for the agricultural sector and many references documenting these trends. Armbruster and Ahearn (2014) provide a recent summary of trends and the drivers behind those trends. Here we consider the number and size distribution of firms. Figure 1 shows the number and percent of farms in different constant dollar sales classes for Census of Agriculture years 1997 through 2012 (Ahearn and Harris, 2014). During the 1997-2012 period, both the number and the share of farms increased for those farms with less than $10,000 in gross sales, but most of that came from the very smallest farms without sales, but classified as having the potential for at least $1,000 in sales. Most users of farm structure data are surprised to find that a large and growing share of

U.S. farms have no sales, about 25% in a typical year. These and other households operating small farms rely on their off-farm sources of income.

The largest class, here identified as those with sales of $1 million or more, also experienced increases in their numbers and share, while the next largest class ($500,000 to $1 million) was relatively stable, with only minor declines. The largest declines were in the mid-sizes of $10,000 to $499,999 in sales, which went from 48% of all farms in 1997 to 36% of all farms in 2012.[3] This evidence of a declining middle is a continuation of an ongoing trend. Recently, there has been a renewed emphasis on Agriculture of the Middle research, extension, and policy activities directed towards the farms "of the middle," especially with respect to local food farms (Kirschenmann, et al., 2014). The Agriculture of the Middle research and extension collaboration defines the middle as $50,000 to $500,000 in sales, but there is no consensus regarding what constitutes the middle among various data users. [4]

As the size distribution of farms has evolved over time, increasingly more production has come from large-scale family farms and a relatively few nonfamily farms. In 1997, 2.4% of farms, or 46,068 produced half of all the value of agricultural product, while in 2012, 1.6%, or 33,330 farms produced half of the value. This evolution toward a farm sector in which production is concentrated on fewer large farms seemingly continues unabated. Two key drivers of this changing structure and organization of farms are technology adoption and globalization of agricultural markets. Increasing size of farms tends to reduce cost of production because of efficiencies in production and marketing. Larger size farms are often the early adopters of

[3] If changes in price levels were ignored as is done in the publicly available trend data from NASS, it would appear as if there was an increase in the number of farms between $250,000-$499,999, and especially $500,000-$1 million.
[4] In the original ERS typology a midsized group of farms was not defined; with the 2013 revision a midsized group is defined as $350,000 to $999,999 in gross sales (Hoppe and MacDonald, 2013).

technology derived from research and development, either public or private, leading to increases in productivity. R&D leads to technology adoption that often replaces labor, and generally reduces costs and/or increases yields. The globalization of markets for agricultural and food products, furthermore, fosters efficiency in farm production to hold down costs of exports and to keep lower-cost imports from replacing U.S. production. Other important drivers of structural change in U.S. agriculture include consumer preferences, agricultural and tax policies, markets for inputs, and risk management practices.

Federal Policies Directed at Farm Entry

Historically, U.S. Department of Agriculture (USDA) farm programs provided benefits, such as direct payments or subsidized crop insurance, to farmers and landlords which have generally targeted specific crops (corn, cotton, grain sorghum, rice, soybeans, spring barley, spring wheat, and winter wheat), conservation goals, and disaster relief. Consistent with their production choices, new entrants into farming are less likely than established farms to participate in government direct-payment programs, many of which are focused on cash grain production.

USDA also has a history of providing operating and real estate loans (both direct and guaranteed) to producers as well. Loan programs are critical to agricultural producers given that its capital-intensive nature can pose barriers to entry for the majority of operators who do not inherit their land. While USDA has a long history of providing loans—which served new, young entrants at a disproportionately higher rate —it was not until the 1992 Agricultural Credit Act that USDA was authorized to explicitly target support to new entrants through loan programs. Subsequent farm legislation has continued to target loan programs to new and beginning entrants. In fiscal year 2012 (October 1, 2011 to September 30, 2012), USDA's Farm Service

Agency allocated almost two-thirds of its total direct loan obligations to entering farmers. Their guaranteed loans were also disproportionately allocated to new farmers. In January 2013, FSA announced a microloan program for new and small farmers to allow them to borrow small amounts, up to $35,000, for operating loans. The Farm Credit System, an independent system of cooperative lenders, also targets new and young entrants into farming. Loans to new and young farmers represented 19% of total FCS farm loans and 14% of total new FCS farm loan volume that were made in 2011 (Ahearn, 2013).

In addition to continuing its loan programs, the government's approaches to addressing the needs of new entrants expanded with the 2008 Farm Bill. Provisions which targeted new entrants were also included in the Conservation Title, the Rural Development Title, the Research Title, the Crop Insurance Title, as well as miscellaneous other programs. Funds were authorized to establish a Transition Incentive Program to encourage enrolled Conservation Reserve Program participants to transfer land coming back into production to beginning (and socially disadvantaged) farmers and ranchers engaged in sustainable practices. The 2008 Farm Bill also provided for management training programs that target beginning farmers and ranchers, through the Beginning Farmer and Rancher Development Program. Interest among policymakers in supporting new entrants into farming continued after the passage of the 2008 Farm Bill. As part of his testimony to the Senate Agriculture Committee on June 30, 2010 about progress on the implementation of the 2008 Farm Bill, Secretary of Agriculture Vilsack suggested that Congress consider setting a goal of 100,000 new farmers per year.

The programs of the 2008 Farm Bill were continued and expanded with the latest 2014 Farm Bill. In addition, the acreage limit for eligibility in the Direct Farm Ownership loan program was increased, thereby increasing the eligibility pool of new entrants. Under the 2014

Farm Bill, eligible farmers will be able to own a farm that has 30 percent or less of the acreage of an average county farm, whereas the previous limit was based on median acreage. (In 2013, the national average farm size was 418 acres, while the median acreage was only 80 acres.) The greatest budgetary impact for new entrant programs in the 2014 Farm Bill was due to several favorable provisions in the crop insurance programs, by providing a reduction in their insurance premium, waiving the administrative fee, and provides more favorable calculations of normal yields.

As is clear from a brief review, there are many, sometimes opposing, drivers of structural change. Historically, statements of concern about the loss of family farming and the aging of the farm population have been expressed by policy makers, but explicit programs to foster new and beginning farmers were not introduced into the agricultural policy mix until the 1992 Agricultural Credit Act. Given the continuation of favorable credit terms and other policy interventions to provide knowledge and incentives for beginning farmers to enter and survive in agriculture, we would expect to see entry rates increase or at least stabilize during the 1997-2012 period. On the other hand, the existing tax code discourages farmers who own the relatively fixed supply of farmland from selling their land to new entrants and others. Moreover, aside from the long-term drivers of structural change and relevant policy interventions, the 1997-2012 period overall, but especially the latter part of the period, saw very favorable financial trends. Favorable financial conditions are expected to attract new entrants and decrease exits, but new entrants also face increasing barriers due to rising land values.

Approach and Methodology

Two different methodologies are utilized to calculate entry and exit rates for U.S. farms using the Census of Agriculture data. The linked-farm methodology uses unique farm ID numbers assigned by USDA that identify the farm and allow farm records to be linked over time in the Census data. The goal is to track whether a farm continues to operate, exits, or enters between two Census surveys. If the farm was found in a later survey but not in an earlier survey, this is defined as a farm entry. Exiting farms would be found in an earlier survey but not in a later survey. The percentages of farms that continue, enter, and exit farming define the farm transition matrices. Here only the percent of farms entering and exiting is reported; the percent of farms staying can be directly calculated from the reported entry and exit rates.

Following the approach used by Gale (1994), Hoppe and Korb (2006), and Ahearn, Korb, and Yee (2009), entry rates are calculated as the number of farms that entered between a particular Census survey and the next Census $n_{t,t+5}^{entering}$ divided by the number of entering farms plus continuing farms. Specifically,

$$entry\ rate_{t,t+5} = \frac{n_{t,t+5}^{entering}}{n_{t,t+5}^{entering} + n_{t,t+5}^{staying}} \quad (1)$$

Similarly, exit rates are defined as the number of exiting farms $n_{t,t+5}^{exiting}$ divided by the number of exiting farms plus farms continuing operations. The exit rate between one Census and the next is given by

$$exit\ rate_{t,t+5} = \frac{n_{t,t+5}^{exiting}}{n_{t,t+5}^{exiting} + n_{t,t+5}^{staying}} \quad (2)$$

These entry and exit rates are calculated for all farms and also for groups of beginning farms (with 10 years or less of farming experience) and for established farms (with more than 10 years of experience). Rates were also calculated for farmer groups that are young (less than 35 years old), mid-age (between 35 and 65 years old) and older (more than 65 years old).

The second methodology is a cohort approach that uses farmer's responses to the Census question for "the year they started farming this farm business" (Gale and Henderson, 1991 and Gale, 2003). When considering cohorts of farms that started farming in a particular year, it is expected to find the highest number of farms from a cohort in their first Census, and then to see fewer farms remaining from the cohort in subsequent Census years due to farm exits. Farm exits are defined as the difference in the number of farms that started operating in a given year *j* between two Censuses for years *t and t*+5. Exit rates for a cohort are defined as the number of farms that exit between two Censuses $n_t^j - n_{t+5}^j$ divided by the number of farms in the earlier of the two Censuses n_t^j. Specifically, the exit rate for farms that started to operate in year *j* from Census *t* to *t*+5 is

$$exit\ rate_{t,t+5}^{j} = \frac{n_t^j - n_{t+5}^j}{n_t^j} \quad (3)$$

Note that because the cohort approach does not use linking of farms between Censuses *t* and *t*+5, the number of farms are only taken from a single Census, either *t* or *t*+5. An advantage of the cohort methodology is that individual farms do not need to be identified and linked (as in the linked-farm approach) but only a cohort of farms that started in a given year needs to be followed over time. Therefore, there are no confidentiality requirements when applying this approach. A disadvantage of both approaches is that new and beginning farmers that have recently started their farm operations may be less likely to be known to USDA as there is no requirement that new farmers report their farmer status to USDA. This is an ongoing challenge to make sure every farmer and farm operation is counted.

One of the challenges in farm entry and exit research is the ability to disentangle the effect of tracking the principal operator (with a unique name and farm operator ID) and the farm businesses (with a unique business name and farm ID), and non-principal operators who may

have self-identified as principal operators in later years. USDA collects information for up to three operators of the farm business, but the term "principal operator" can be loosely defined and inconsistently applied in Census forms over time. In these few cases where the principal and nonprincipal operators may have switched over the years, the linked-farm methodology that tracks unique principal operators over time may overestimate entry and exit rates.

The cohort methodology uses the question about operating "this farm" which may not necessarily mean that the farmer was identified as the principal operator at the time they started farming or that he/she may have previously operated a different farm business. The cohort methodology may introduce a potential bias of an uncertain direction when nonprincipal operators at earlier censuses were later classified as principal operators in subsequent Censuses. Therefore, the cohort methodology reduces but does not eliminate the problem of correctly tracking the principal operator in a simple data collection approach, especially when complex farms are managed by multiple operators.

Another disadvantage of the cohort analysis is that the analysis is limited to exit/entry/survival rates because the same farms are not tracked over time to observe farm-level characteristics from multiple periods. For example, market shares of cohorts over time cannot be considered to determine large-scale reallocation of outputs and inputs in agriculture, as reported by Ahearn, Korb, and Yee (2009).

Results

Linked-farm methodology results

The linked-farm methodology is used to calculate farm entry and exit rates using the Census of Agriculture data and the results showing annual entry and exit rates from farming for 1997 to

2012 are presented in table 1. The annual entry rate was 7.5% from 2007 to 2012. The entry rate for 1997-2002 was 7.3% and for 2002-2007 it was 8.7%. The higher entry rate during 2002-07 may be due to the run up in farm income, after the agricultural sector experienced relatively stable (nominal) incomes during 1997-2002. On the other hand, farm exits rates are more comparable over the three subperiods – 8.7% for 1997-2002, 8.2% for 2002-2007, and 8.5% for 2007-2012. Perhaps the slowdown in exit rates during 2002-2007 is due to the relatively rapid rise in land prices. Although per acre (nominal) land prices increased over the whole period, they increased at more than 13% per year from 2007 to 2012. Operators considering exiting may have chosen to delay retirement in the hopes of continued capital gains.

The estimated exit and entry rates since 1997 in this study are somewhat lower than the rates reported in Ahearn, Korb, and Yee (2009). They found that the annual entry rate was 11 percent for 1978-82, 9 percent for 1982-87, 8 percent for 1987-92, and 10 percent for 1992-97. The exit rates were 10 percent for 1978-82, 1982-87 and 1987-92 and 9 percent for 1992-97. These differences of about 2-3% for the entry rates and 1-2% for the exit rates, showing lower entry and exit rates since 1997 than in previous decades may be attributed to strong conditions in the agricultural sector as compared to the 1980s. Still, it is surprising that throughout the last three decades, farm entry and exit rates were relatively stable in magnitude, even during the farm crisis of the 1980s and the Great Recession, commencing in 2008, negatively affecting nonfarm income opportunities.

Headd, Nucci, and Boden (2010) use the Business Dynamic Statistics released by the U.S. Census Bureau's Center for Economic Studies to look at business entry and exit rates. They find that entry and exit rates have decreased since the late 1970s to early 1990s, but have been relatively flat between 1990 and 2005 at 10-12% for firm exit rates and 11-13% for firm entry

rates. Therefore, entry and exit rates for firms in all sectors of the economy are somewhat higher than the estimated entry and exit rates for farm businesses for 1997 to 2007. On the other hand, Ahearn, Korb, and Yee (2009) concluded that entry and exit rates for farm businesses were somewhat higher when compared with entry and exit rates for only manufacturing firms as reported in Dunne, Roberts, and Samuelson (1988).

Both entry and exit rates are higher for beginning farmers with 10 years or less of farming experience (table 1). Annual entry rates for beginning farmers are estimated to be 12.4% and exit rates are estimated to be 9.7% during 2007-2012. For established farmers, entry rates are lower at 5.6% and exit rates are at 8.0% for 2007-2012.

Entry and exit rates from farming differ based on the lifecycle for young, mid-age, and older farmers. Table 2 shows that not surprisingly, entry rates are higher for young farmers (under 35 years old) at 14.1% and lower for older farmers (over 65 years old) at 5.6% during 2007 to 2012. The exit rate for young farmers of 9.3% from 2007 to 2012 is comparable to the exit rate for older farmers of 9.6% but are higher than the exit rates of 7.9% for mid-age farmers.

Caution should be used when interpreting these farm entry and rates as they depend on the USDA's ability to identify, link, and track farms over time. These rates reflect an upper bound for the entry and exit rates due to the challenge of linking farms over time and getting high response rates to USDA surveys. Since the Census of Agriculture was transferred to the USDA for the 1997 and later Censuses, it is likely that the transfer led to improved tracking and linking of the farm businesses, which may partially explain the relatively lower entry and exit rates in more recent periods.

Cohort methodology results

Exit rates are also estimated using the cohort methodology, which relies on a self-reported answer for the year the farmer started operating their business. The number of farms that started farming in a given year should be the highest in the Census for that particular year. Subsequently, fewer farms should remain in the following Censuses because of farm exits. The three most recent Censuses (2002, 2007, and 2012) are included to simplify the graphical and table representation since cohorts are followed over time; similar qualitative results are found when the 1997 Census data are included. Table 3 shows the number of farms that started in a given year using data from the 2002, 2007, and 2012 Censuses. The number of farms that started farming in 2002 were 29,660 in the 2002 Census, 63,719 in the 2007 Census and 51,415 in the 2012 Census. These statistics serve as evidence that not all new and beginning farmers were appropriately counted and included in the Census in the first few years of operating their businesses, as the number of farms that started in 2002 should have been higher in the 2002 Census than in the 2007 Census. Comparing the number of farms in the same cohort that started their businesses in a given year, it is evident that it takes USDA about 3 years and even perhaps up to six years to identify and include beginning farmers in their survey databases.

Figure 2 graphically shows data from table 3, where the lines represent the cohorts of farms that started operating in a given year in the three most recent Censuses. The lines for earlier Censuses need to be strictly above the lines for subsequent Censuses, with the difference between the lines showing farm exits from one Census to the next for each cohort. From the graph, it is also evident that in the first three years of operating a business, farms are not appropriately accounted for because more farms are found in the subsequent Census. Later in this section, several methods are used to re-estimate the number of farms that enter in a Census year.

There are noticeable spikes in figure 2, showing higher number of farms that started farming in round years (e.g. 1960, 1970, 1980, etc.); we hypothesize that some farmers may recall round numbers. Not surprisingly, there are more farmers remaining in business from more recent cohorts (say 1990s) than older cohorts (say 1970s). If a linear trend is plotted on the figure then there would be fewer than a linear trend would predict for the expected number of farms remaining in later Censuses that have started operating in the 1980s and more farms than a linear trend would predict for farms that started operating in the 1970s.

Figure 3 shows the number of farms that exited from one Census to the next, based on when they started operating their businesses. More farms that started operating more recently (figure 2), but also more farms exited from these more recent cohorts (figure 3). The annual exit rates are calculated using the cohort methodology and are shown in figure 4 and table 4. Exit rates for farmers operating in the first 1-3 years cannot be calculated and for years 4-6 they are likely to be underestimated because new farmers are less likely to be captured in USDA databases. Exit rates are 4% for farmers who have operated 3-5 years. Exit rates of 2.5% are the lowest for farmers who have operated 10-29 years and then exit rates gradually increase for farmers who have farmed for at least 40 years to reach over 8.2% for farmers with over 50 years of experience. These results show a u-shaped curve with lowest exit rates and therefore highest survival rates for operators after they move from a beginning status to an established status, at 10 years of farming experience. These findings can also be interpreted that beginning farmers (with 10 years or less of farming experience) are more vulnerable to farm failure and exits than their established (10-40 years of experience) counterparts.

Comparison of results

Comparing the results in table 1 and 4, exit rates calculated using the cohort methodology are estimated to be at or below 4% for farmers with less than 40 years of experience, which are lower when compared to the exit rates of 8.5% using the linked-farm approach. For beginning farmers, exit rates are calculated as 9.7% using the linked-farm approach and between 3.2% and 4.0% using the cohort approach. This is likely due to the fact that imperfect linking and tracking of farms with the linked-farm approach may have resulted in overestimating the exit rates. However, since our results are also showing that farms are less likely to be captured by USDA databases, both the entry and exit rates for beginning farmers may be underestimated using the cohort approach. For established farms, exit rates are estimated to be 8.0% using the linked-farm approach. Exit rates are estimated to be much lower in the range of 2.5% to 5.8% throughout the first 50 years of operating the farm. Exit rate rise to 8.2% only for farmers with over 50 years of farming experience.

To our knowledge, this is the first study that shows that the number of farms entering agriculture is higher than what is recorded in the Census data and statistics. The number of farms operating in their first three years needs to be adjusted as it takes time for new farmers to be "discovered" by USDA. Figure 5 shows the actual number of farms in the 2007 Census based on the years of farming experience and three estimates for the predicted number of farms during their first three years of operating. The first method is a simple linear prediction or forecast based on the rest of the series. The second method uses three-year moving average series to forecast the values for the first three years. The final method uses the cohort approach and assumes a 5% exit rate to estimate the predicted number of farms that started businesses in 2005-2007 in the 2007 Census data as 1.05 times the number of farms that started in 2005-2007 in the

2012 Census. Note that to re-estimate the number of entering farms in the 2007 Census, the 2012 Census data needs to be used.

Recall that the number of farms that started in 2007 according to the 2007 Census was 27,773. Our results show that the number of farms that started in 2007 was re-estimated to be 78,895 using the linear forecast, 75,478 using the moving average forecast, and 70,254 using data from the 2012 Census. Therefore, these estimates show that there were about 42,481-51,122 additional farms that entered in 2007 than what was recorded in the 2007 Census. Using the cohort approach, data from the later 2012 Census was used to re-estimate the number of farms that entered in the previous Census but were not "discovered" by USDA until the following Census.

Conclusions

This study examines entry and exit rates for U.S. farms using two methodologies – a linked-farm and a cohort approach. Transition matrices of farms entering and exiting agriculture are calculated, showing an average annual entry rate of 7.5% and exit rate of 8.5% from 2007 to 2012. On the other hand, the cohort approach shows that exit rates are lower than 4% for the first 40 years of operating a farm business and then the exit rates gradually increase. Therefore, exit rates are shown to be lower using the cohort approach than using the linked-farm approach.

Our goal was to forecast the number of farms that started their businesses during the first few years of operating their farms based on Census data. Using several approaches, including a linear forecast, moving average forecast, and a cohort approach with data from a later Census, we estimate that roughly 70-80,000 new farm businesses are started every year, which is about 40-50,000 more farms than what was reported in the Census of Agriculture. These new and

revised estimates for the number of farms that potentially start operating every year are still lower than Secretary Vilsack's goal of 100,000 new farmers.

This study has provided an important methodological discussion for the linked-farm vs. the cohort approach. When comparing the two approaches for estimating exit and entry rates, both approaches are shown to have advantages and disadvantages and neither one is assumed to be superior to the other approach. Both approaches rely on proper identification of the primary operator and, in the case of the linked-farm approach, on the proper tracking of the primary operator over time. However, in the cohort approach, a further examination of the entry and exit in terms of market shares of the inputs and outputs in agriculture is not possible since the cohorts that start farming in a given year are not individual farms that are identified and linked over time.

Our findings show that (1) exit rates are not as high using the cohort approach as the linked-farm approach and (2) exit rate comparisons between agriculture and other industries (e.g., manufacturing and all other sectors of the economy) should ensure that the underlying methods for measuring the rates are compatible (linked or cohort). Regarding comparisons to other industries, survival rates in agriculture maybe higher due to the closer links between family businesses and family residences and government safety net programs (Ahearn, Korb, and Yee, 2009).

Exit and entry rates vary over time due to market conditions, policies and other factors. Surprisingly, there is little variation in the aggregate exit rates over the long term, even during the farm financial crisis of the 1980s or the 2007-2008 period of lower commodity prices. In particular, the aggregate rates showed no evidence of an effect from the policies directed at the needs of beginning farmers in 1992 and subsequent years. This is not too surprising given that the programs and incentives are limited in scale.

An earlier examination by farm commodity specialization showed the effects of the 1980s crisis (Ahearn, Korb, and Yee, 2009). A possible extension of this study would be to examine exit rates through 2012 by commodity specialization due to the sharp increase and subsequent decline in grain prices which affected grain producers vs. livestock producers differently. The declines in farm incomes and farmland values and rents since 2013 have increased concerns about potential farm bankruptcies and increased exit rates from agriculture. Understanding of the long-term farm entry and exit trends in agriculture can provide important insights for U.S. agricultural policy.

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Table 1. Annual Entry and Exit Rates from Farming 1997-2012

	All farmers		Beginning Farmers <= 10 years of experience		Established Farmers >10 years of experience	
Annual rates	Entry rates	Exit rates	Entry rates	Exit rates	Entry rates	Exit rates
1997 to 2002	7.3%	8.7%	11.6%	9.1%	5.2%	7.9%
2002 to 2007	8.7%	8.2%	14.0%	9.0%	6.1%	7.7%
2007 to 2012	7.5%	8.5%	12.4%	9.7%	5.6%	8.0%

Table 2. Annual Entry and Exit Rates from Farming by Farmer Age, 1997-2012

	Young farmers less than 35 years		Mid-age farmers between 35 and 64 years		Old farmers more than 65 years	
Annual rates	Entry rates	Exit rates	Entry rates	Exit rates	Entry rates	Exit rates
1997 to 2002	12.5%	9.0%	7.6%	7.9%	5.5%	10.5%
2002 to 2007	14.5%	8.9%	9.1%	7.6%	6.7%	9.4%
2007 to 2012	14.1%	9.3%	7.9%	8.0%	5.6%	9.6%

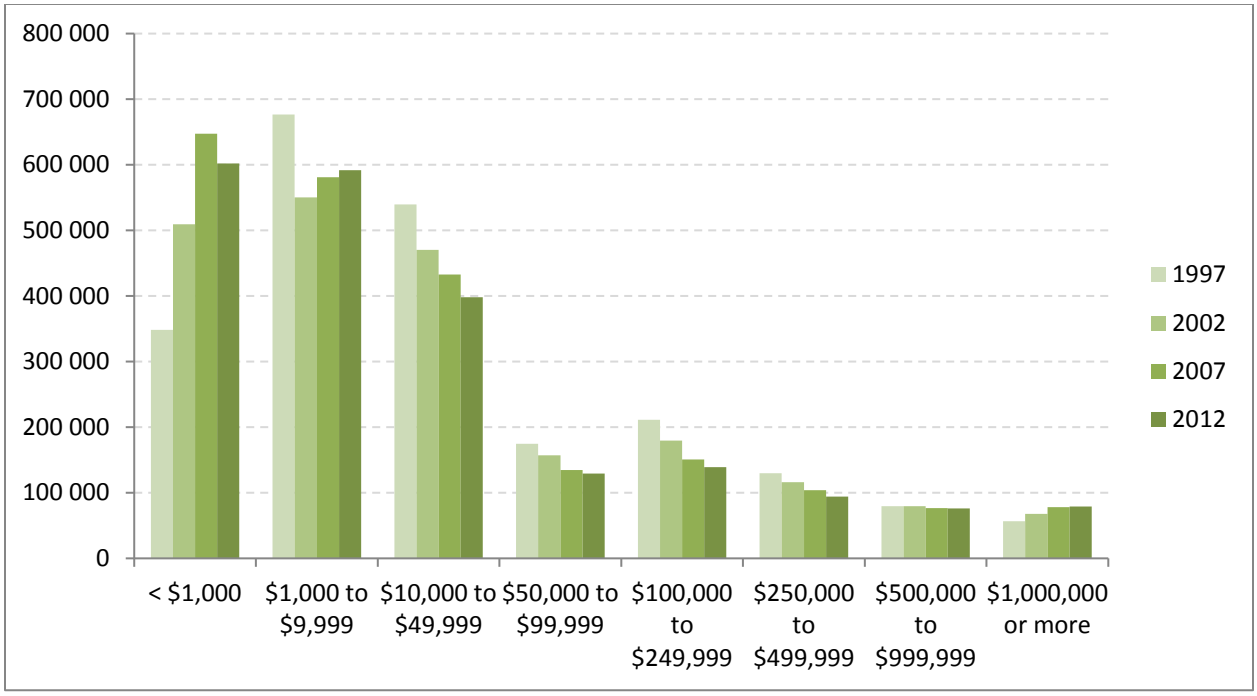
Table 3. Number of Farms by Year Started Business in the 2002-2012 Censuses

Reported year started this business	2002 Census	2007 Census	2012 Census
1995	83,236	68,889	61,827
1996	77,813	62,318	53,690
1997	70,602	62,516	51,657
1998	78,093	69,534	59,297
1999	75,216	66,875	53,990
2000	68,383	95,636	86,433
2001	45,094	65,727	51,817
2002	29,660	63,719	51,415
2003		67,588	52,965
2004		68,876	56,048
2005		69,982	67,782
2006		57,110	62,418
2007		27,773	56,203
2008			55,125
2009			49,979
2010			53,399
2011			41,218
2012			26,968

Table 4. Annual Exit Rates from Farming using the Cohort Methodology

Number of years farming	Annual exit rates 2007-2012
3-5	4.0%
6-9	3.2%
10-19	2.5%
20-29	2.5%
30-39	3.4%
40-49	5.8%
50-59	8.2%

Figure 1. Number of farms, 1997-2012



Source: Ahearn and Harris, 2014, calculations based on USDA, NASS, Census of Agriculture, various years. Sales adjusted by the Producer Price Index for farm products.

Figure 2. Number of Farms Based on the Year They Started Their Business in 2002, 2007, and 2012 Censuses

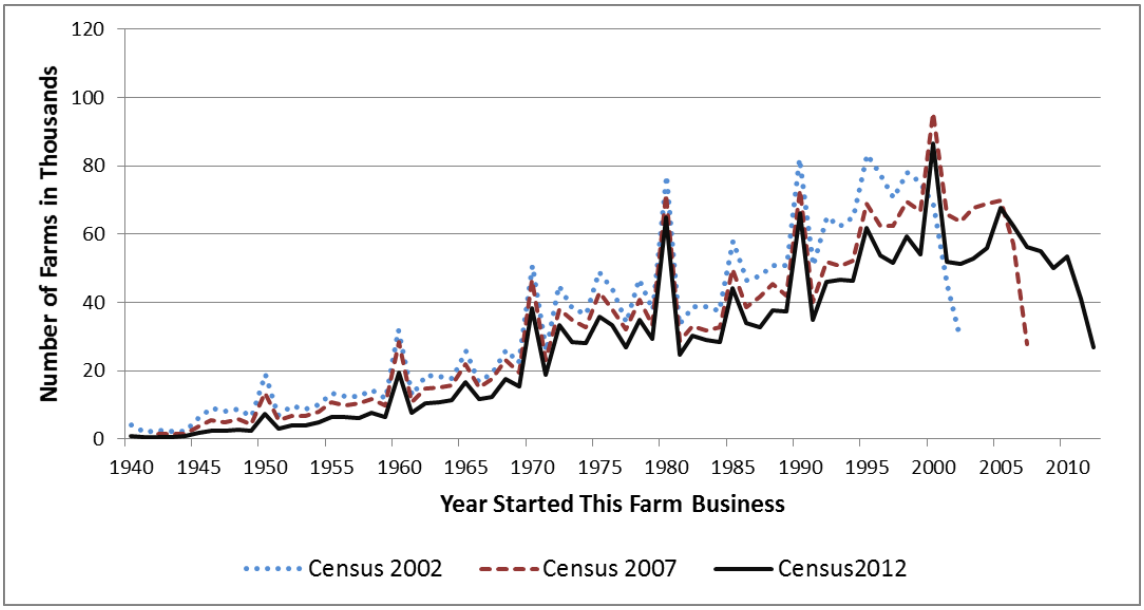


Figure 3. Number of Farms Exiting Based on the Year They Started Their Business

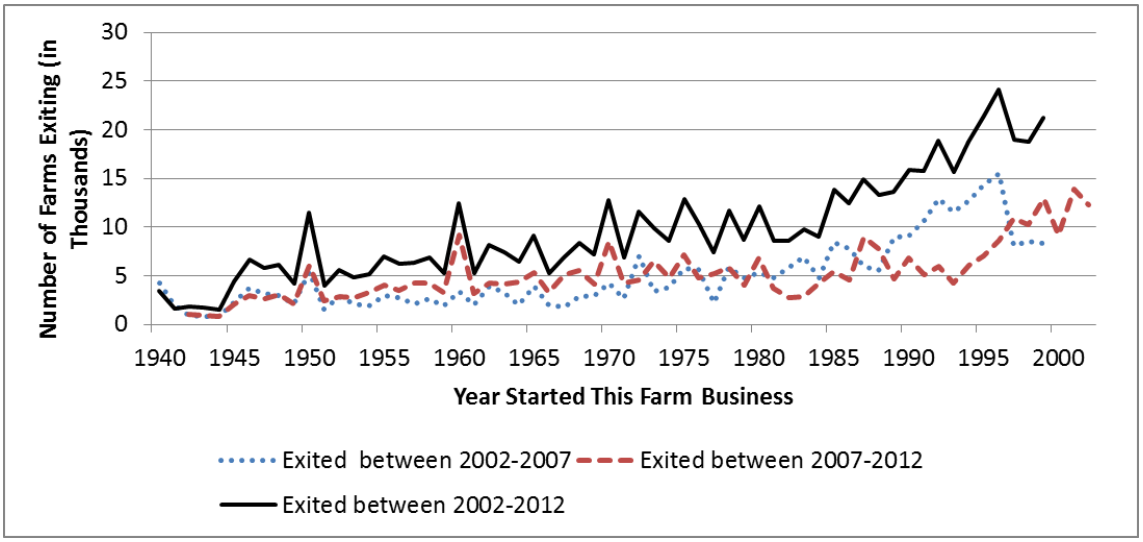


Figure 4. Annual Exit Rates of Farms Based on the Year They Started Their Business

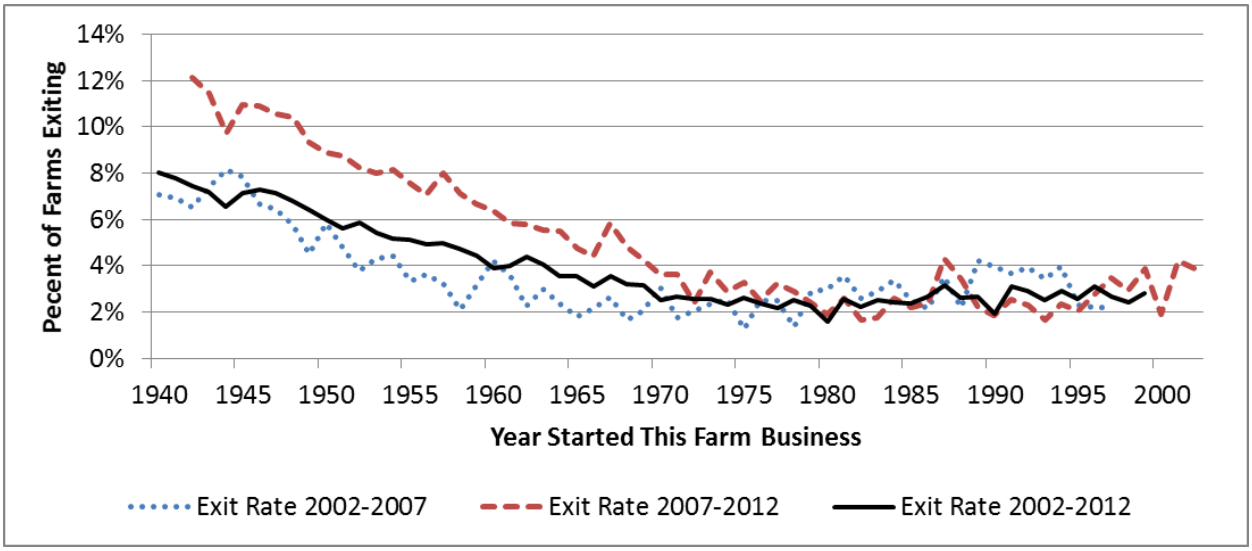


Figure 5. Actual and Forecasted Number of Farms Entering Farming