Health Insurance Coverage and Labor Allocation of Beginning Farm Operator Households

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Abstract

According to a recent Young Farmers Coalition Report (2017), affordable health care can be an important factor to beginning farmers' livelihoods. In order to assess the extent to which access to health care coverage presents a barrier to entry, this study investigates the impact of health insurance coverage on the off-farm labor allocation decisions of beginning farm-operator households in the United States. We use farm household-level data from the Agricultural Resource Management Survey (2011 and 2015) and two-stage residual inclusion (2SRI) estimation method to estimate our empirical model. Results show that beginning farm-operator households with health insurance coverage from off-farm jobs are more likely to work off the farm. Our analysis also depicts the regional variability in off-farm work pattern of beginning farm-operator households.

Keywords: Agricultural Resource Management Survey, beginning farm-operator household, health insurance coverage, off-farm labor supply, two-stage residual inclusion model (2SRI).

JEL codes*:* C34, I13, J22, J38, J43, Q12, Q18

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Introduction

The principal source of health insurance for US citizens under age 65 is employer-sponsored programs. Economic studies have extensively examined the impact of health insurance coverage on labor market outcomes and consequently its implications on the functioning of the workforce. For example, the high and variable level of health care costs have been shown to impact wage, employment, retirement, welfare receipt, as well as job turnover and relocation decisions.[1] Studies also emphasize the high cost of acquiring health insurance as a key driver of employees' decision to receive health coverage through employer-sponsored programs (e.g., Jensen and Morrisey, 2001; Garthwaite *et al.*, 2014). . Furthermore, US farmers can purchase health insurance through the individual, non-group market, and the small group market (Sundaram-Stukel and Deller, 2009). In that category, we find mostly farmers and ranchers who operate large farms reporting sales of $250,000 or more (Ahearn *et al.,* 2013). Eligible for public health insurance programs (e.g., the Affordable Care Act) are the physically challenged, low-income parents and people over age 65. An alternative for American farmers would be to receive fringe benefits directly through off-farm employment or indirectly as a dependent of a household member.[2] Off-farm employment[3] helps in increasing and stabilizing family income—risk management strategy (Bubela, 2016; Mishra and Goodwin, 1997) and

[1] For a comprehensive and extensive examination of the relation between health insurance and the labor market, we refer the reader to the study of Currie and Madrian (1999).
[2] There are occasions where not all family members in the household have health insurance coverage. Studies have documented cases where farm households are more likely to be uninsured than the average US household (e.g., Jensen, 1983; Zheng and Zimmer, 2008). In addition, farmers can be denied coverage (Sundaram-Stukel and Deller, 2009).
[3] Bubela (2016) notes that agricultural lender still view off-farm income as a financial strength when making loan decisions.

providing much needed fringe benefits—both health insurance coverage and retirement income (Mishra et al. 2002). Note that two-thirds of farm families either the principal operator or the spouse is employed off-farm (Ahearn *et al.,* 2013).

Data from the US, 2007–2015, reveals that the number of farmers in the United States fell by 6.2%, while the average age of principal farm operators rose by 5.2% (the average age in 2007 was about 57). The continuance of traditional production agriculture relies on developing the next generation of farmers as well. However, the number of beginning farmers decreased by 20% over the same period. Policymakers have responded to the perceived needs of beginning farmers and ranchers by designing programs targeted to them. The 2014 Farm Bill dictates provisions for beginning, socially disadvantaged and limited-resource[4] farmers and ranchers and consistently provides enhanced support across most of the titles in the legislation (see 2014 Farm Bill, USDA-ERS, 2014[5]). Compared to earlier generations of farm households, off-farm income has shifted from an additional income source to an important risk management tool for beginning farm operator households (Bubela, 2016). The increasing reliance on off-farm income extends to young and beginning farmers as well. Further, Bubela (2016) notes that with increased technical, financial, operational, and managerial skill set needed for farming operations often translates into

[4] Based on their low farm sales and household income.

[5] Specifically, the 2014 Farm Act reduces the premiums on buy-up level coverage by 50 percent for new farmers and waives the application fee. The USDA's Farm Service Agency's (FSA) Beginning Farmers and Ranchers Loans provides subsidy on loan rates for small-scale ranchers or farmers whose operations are less than ten years old. The 2014 Farm Bill expands assistance to beginning farmers and ranchers seeking to purchase real property by increasing the maximum loan made under the program to $300,000. Beginning farmers and ranchers who produce value-added products will be given priority consideration for grants. The Value-Added Agricultural Product Market Development Grants was increased from $15 million to $63 million (available until expended) during 2014-18 period. The Conservation Reserve Program Transition Incentives Program (Title II) under the 2014 Farm Bill increased from $25 million to $33 million to facilitate transfers of CRP land enrolled in an expiring contract from retired or retiring famers to beginning or socially disadvantaged farmers and ranchers who plan to return the land to production. In addition the 2014 Farm Bill provided funds (about $100 million, during 2014-2018) for training, education, outreach, and technical assistance to beginning farmers and ranchers, with priority given to partnerships and collaborations led by or including non-governmental and community-based organizations.

skills demanded off the farm. Finally, beginning farm-operator households[6], a focus group of this study, Ahearn and Newton (2009) note that beginning farm-operator households are much more likely to hold off-farm jobs, and they are somewhat less likely to have health insurance coverage than established farm-operator households. Moreover, the aging of the farmer population has led to questions about a shortage of beginning farmers and ranchers. New farmers, including beginning farmers, often bring skill sets to complement and enhance traditional management and production technologies. Finally, the National Young Farmers Coalition (Ackoff et al., 2017) in their report noted capital and health insurance as two major obstacles for beginning farmers.

Therefore, the objective of this study is to examine the impact of fringe benefits (health insurance coverage) on beginning farm-operator households' off-farm labor allocation decisions. The studies mentioned above consider the US farm population as a whole but disregard beginning farmers in accessing affordable health insurance and its implications on labor allocation. We hypothesize that beginning farmers, with less than ten consecutive years of experience, are likely to buy expensive health insurance in the private market and may turn to off-farm job opportunities. We use two-stage residual inclusion (2SRI) method to estimate our empirical model. We use 2011 and 2015 farm-level data from the Agricultural Resource Management Survey (ARMS). Recall that 2011 marks the beginning of Affordable Care Act (ACA) and a slow uptick in the nonfarm economy. Further, the 2015 period marks the fifth year after the ACA was enacted into law[7]. Our estimates suggest that beginning farm-operator

[6] According to USDA's definition, "*a beginning farmer or rancher is an individual or entity who has not operated a farm or a ranch for more than 10 consecutive years. This requirement applies to all members of an entity*". In our paper, we use the word farmers for either farmers or ranchers.

[7] The ACA provides changes to the health insurance market, including new protections and benefits for everyone. Health Insurance Marketplace provides a new option for farm families shopping for health insurance. Just as consumers now have the option of seeking coverage in the Health Insurance Marketplace.

households with health insurance coverage from off-farm work are about 1.7% more likely to work off the farm.

The remainder of the paper is organized as follows. Section 2 provides the background and Section 3 presents the conceptual framework. Section 4 presents data and main observations from the 2015 ARMS, the latest year of our dataset. Section 5 shows the estimation framework and Section 6 discusses the results. The last section summarizes and concludes.

Background

Despite to the predominant role of employer-sponsored programs, few agricultural economics studies have examined the importance of health insurance (e.g., McNamara and Ranney, 2002; Zheng and Zimmer, 2008). McNamara and Ranney (2002) study the trends of health insurance coverage of US hired farm labor using Current Population Survey data from 1995 to 1999. In their paper, they measure the levels of health insurance coverage and examine parameters that may affect the decision to purchase health insurance. They report that hired farm workers are more likely to be without health insurance coverage after controlling for socioeconomic and demographic characteristics including income, education levels, as well as ethnicity. Zheng and Zimmer (2008) analyze US farmers' health consumption[8] taking into consideration their insurance status. Using 1996 to 2001 waves of the Medical Expenditure Panel Survey, they document that approximately 19% of farmers between ages 18 and 64 are uninsured in addition to 29% of self-employed individuals in the same age bracket.

Moreover, the link between health insurance and labor allocation of farm households has not received adequate attention. Papers that examine that relationship include Jensen and Salant (1986), Ahearn *et al.,* (2013) and D'Antoni *et al.,* (2014). The Jensen and Salant (1986) study is

[8] Consumption measures include utilization of health insurance captured by the total number of visits to health providers and expenditures account for total health care expenditures.

one of the first to demonstrate the positive correlation between fringe benefits and the number of hours farmers work off-farm. In a recent study, Ahearn *et al.,* (2013) investigate the role of health insurance coverage and the decision to work off the farm by farm families in the US. Their study is larger in scope using data from the 2010 ARMS. They attribute the high rate of health insurance coverage of farm households to the multiple job holdings of farm family members. Particularly, farm operators and spouses who report off-farm labor are 3.2 percentage points more likely to report health insurance coverage. Also, they state that receipt of fringe benefits is an important reason for participation in the off-farm labor market. Using copulas and 2006-2008 ARMS data D'Antoni *et al.,* (2014) estimate the effect of health insurance coverage on labor allocation. Treating health insurance as a component of (off-farm) income—endogenous variable--they found that greater fringe benefits tend to increase the primary operators and spouses hours worked off the farm.

Another strand of literature focuses on the influence of decoupled payments on and off-farm labor supply decisions. Similar to fringe benefits, receipts of decoupled payments can be considered as additional income providing incentives to decrease off-farm labor supply (Ahearn, El-Osta, and Dewbre, 2006; D'Antoni and Mishra, 2013). For example, Ahearn *et al.*, (2006) use ARMS data for 1996 and 1999 on production flexibility contract (PFC), loan deficiency payments (LDP), and market loan assistance (MLA) payments, individually and in aggregate reduce the probability of the farmer to work off the farm. The estimation results for the spouse are more ambiguous. Finally, D'Antoni and Mishra (2013) analyzed the welfare implications of decoupled payments. They find that the marginal effect of decoupled payments on hours worked off-farm will decrease in magnitude when accounting for fringe benefits, *ceteris paribus*.

However, the studies above fail to discuss the impact of health insurance coverage on off-farm labor allocation of beginning farm-operator households.

Conceptual Framework

We employ a unitary labor supply model where the family is considered as a single decision-agent. The beginning farm-operator household comprises of the farm operator (O) and spouse (S). By doing so we are able to acknowledge the contributions of on-farm labor supply of other household members, in this case the spouse of the principal operator. Consider a household that maximizes a single period, joint utility (U) over income (I) and leisure of each family member (L^0) and (L^S) (Singh, Squire, and Strauss, 1986; Ahearn, El-Osta, and Dewbre, 2006).[9] We assume that $U(.)$ is twice differentiable, (quasi) concave utility function that has positive first order derivatives in terms of its arguments. Each member is assumed to allocate time (T) to on-farm activities (F), off-farm work (E), and leisure (L). Income can originate from three main sources; income from off-farm labor I_E, income from self-employment, on-farm activities, I_F, and unearned income, V.

For such a household the utility maximization problem takes the form

$$Max\ U_{E^0,F^o} = U(I, L^o, L^s) \tag{1}$$

subject to:

$$L^o + F^o + E^o = T^o \tag{2}$$

$$L^s + F^s + E^s = T^s \tag{3}$$

$$w_E^o E^o + w_E^s E^s + \pi_F + V = I \tag{4}$$

$$L^o, F^o, E^o \geq 0 \qquad L^s, F^s, E^s \geq 0 \tag{5}$$

[9] Farm household and beginning farm-operator household is used interchangeably in the modeling section.

Equations (2) and (3) are the time constraint expressions for farm operator and spouse, respectively. The budget constraint is given by (equation 4), and non-negativity constraints are depicted in (expression 5). The full income is defined as the sum of revenues from the operator's off-farm labor ($I_E^0 = w_E^o E^o$), spouse's off-farm labor ($I_E^S = w_E^s E^s$), farm profits (π_F), and other sources of non-labor income (including employer-sponsored health insurance) minus the total income (I).

We define farm profits (π_F) as the value of farm production, $P_f f(.)$, minus the input costs, vX_f, where H is human capital, and R denotes location-specific attributes. Therefore,

$$\pi_F = P_f f\left(F^o, F^s, X_f, H^o, H^s, R\right) - vX_f \quad (6)$$

The production function is assumed to be concave, continuous, and twice differentiable. We consider a fixed human capital factor of production for both members of the household for the short term period we examine (e.g. Knight, 1957; Jovanovic, 1982; Wydick, 1999). We expect that factor to positively affect (managerial) decision-making at the farm and the household level. In addition, human capital is positively related to off-farm labor prospects and can influence the off-farm wage. We consider the household to be a price taker in the labor market wages and are determined exogenously, $w_E^o(H^0) = w_E^o$ and $w_E^s(H^s) = w_E^s$.

Here we should note that full off-farm wage is a function of both the hourly wage, w, and fringe benefits, f_b (which includes health insurance and retirement savings). Therefore, w_E^o, and w_E^s, can be further defined as $Fw_E^o(w_E^o, f_b)$ and $Fw_E^s(w_E^s, f_b)$. Since we do not observe individual wages and we are investigating off-farm work (if operator, spouse or both work off the farm) or as noted above unitary labor supply, we assume that the beginning farm-operator household faces one full wage rate that includes fringe benefits. We solve the above equations to derive the first order conditions of the model; provide the optimality conditions where the

marginal product of each output equals its price. For each household, the marginal rate of substitution between consumption and leisure to its market wage equals the marginal product of self-employment in farming. Finally, note that off-farm wage is non-decreasing in wages and fringe benefits. For instance, an increase in health insurance benefits received off-farm will increase f_b. Therefore, in our case increasing fringe benefits (health insurance) will increase off-farm labor supply of the beginning farm-operator household.

Data

We use farm-level 2011 and 2015 ARMS data to estimate the empirical model. The ARMS, which is representative of all farm households, is conducted annually by the Economic Research Service (ERS) and the National Agricultural Statistics Service (NASS).[10] The survey collects data on farm financial indicators (e.g., farm income, expenses, assets, and debt) and operating characteristics of agricultural businesses, the cost of producing agricultural commodities, and the well-being of farm operator households. The target population of the survey is farm operators representing agricultural production in the 48 contiguous states. Each survey collects information from a single, senior farm operator who makes most of the day-to-day management decisions.

Figure 1 shows the age distribution and farm size of beginning farmers. Note that the left chart depicts the share (%) of beginning farmers in various age groups (X-axis); the right chart represents the average farm size by age group within the beginning farmers' category. Focusing on the age distribution of primary beginning operators and the size of their farm operation, our calculations show that in 2011 14% of the beginning farmers were under the age of 35. In 2015, the percentage of the beginning farm operators increased slightly to 17% in the same age category. Similarly, figure 1 also reveals a slight increase in the share of beginning farm

[10] For more detail, see http://www.ers.usda.gov/Briefing/ARMS/

operators who are 65 and over. Interestingly, we see a 24% decrease in the share of middle aged (35-49) beginning farm operators, during the 2011-2015 period. Beginning farmers (less than 35 years old) are more likely to operate large farms compared to older beginning farm operators (50 years old and older). Figure 1 also shows that the average size of beginning farms less than 35 years increased from 255 acres to about 387 acres (52% increase) during the 2011-2015 period. Finally, figure 1 reveals a 10% and 52% decrease in the average farm size for beginning farmers in the 50-64 and 65 and above age groups, respectively.

Regarding the financial health of beginning farms in 2015, beginning farmers under 35, have a net worth of $403,899 compared to older beginning farmers (50 or older), who tend to have about $486,848 in wealth. This is surprising since Ahearn *et al.*, (2013) report that beginning farmers less than 35 years old tend to have a profitable farming business (average net farm income of $26,271 in 2015) compared to older beginning farmers (50 or older). Older beginning farmers tend to report lower income (average net farm income was $4,370 in 2015).[11]

Looking at a snapshot of our data, the 2011 and 2015 ARMS, and focusing on sources of insurance, we notice the prevalence of employment-based health insurance coverage for farm-operator households (about 57%) followed by government provided and direct purchases (Figure 2). Note that the share of farm-operator household members receiving health insurance coverage through the government increased from about 26% in 2011 to about 28% in 2015. Farm-operator household members are more likely to receive insurance coverage through off-farm employment. Interestingly, during the 2011-15 the share of farm household members receiving health insurance coverage through employment remained steady at 57%. We compare our findings to the US population and we observe that farm families are more likely than the general population

[11] These figures are calculated by the authors employing 2015 ARMS data.

to directly purchase their health insurance from an insurance company (18% versus 16%). There are two distinct patterns that we observe from Figure 2 as it relates to health insurance coverage through private insurance. First, the share of farm-operator household members receiving health insurance coverage through private-directly purchased insurance increased slightly from about 17% in 2011 to about 18% in 2015. Secondly, figure 2 shows a significant jump in the share of U.S household members receiving health insurance coverage through private directly purchased insurance, from about 10% in 2011 to about 16% in 2015. Third, farm-operator household members are less likely to receive health insurance coverage from a government-sponsored program on average compared to the US population (28% versus 37%). Finally, during the 2011-2015 period the share of farm-operator household members that have no form of health insurance is increased from about 9% to 11%. However, the share of overall US population that have no form of health insurance decreased from about 16% to about 9% (see Figure 2).

Looking more closely at 2011 health insurance costs, farm-operator households spent on average $4,925 for both health insurance premiums and out-of-pocket health costs. However, in 2015 the average total insurance costs for farm-operator households increased by slightly about $5,019. For the 40% of farm operators for whom farming is their primary occupation, health insurance expenses are even higher averaging at nearly $6,762. For the farm operators that rely solely on direct purchase to access health insurance coverage, total premiums and out-of-pocket expenses averaged about $8,562 in 2011.[12, 13] Direct-purchase of private health insurance

[12] These figures are calculated by the authors employing 2011 ARMS data.
[13] Studies have reported that US farm households experience higher health insurance costs due to their reliance on private-direct purchase of health insurance (Jones *et al.*, 2009). Other report that US farmers have to pay higher health insurance premiums for lower coverage relative to comparable individuals (e.g., Zheng and Zimmer, 2008; Sundaram-Stukel and Deller, 2009).

contracts is underwritten based on the attributes of the farmer, spouse, and the characteristics of the farm operation.

We exclude farm households where either the beginning farm operator or spouse is 65 years of age or older since Medicare covers these individuals. That results in a sample size of 3,396 beginning farm-operator households. The list of variables with individual summary statistics used in our labor supply model and econometric estimation is shown in Table 1. For our off-farm labor supply latent variable, we use as indicators, the hours per week worked off-farm by the operator and spouse, respectively. Household characteristics include age, age squared, education, family size, and whether they obtain health insurance from an off-farm source. The particular ARMS survey question asks respondents, under the age of 65, whether they have insurance coverage from an off-farm job—56% of beginning farm-operator household reported health insurance coverage through off-farm employment.

In addition to operator and spouse specific variables in our analysis, we account for the farm, location, and year specific variables. Farm-specific variables include an indicator for dairy farms (labor-intensive nature of these holdings), farm efficiency, decoupled and coupled government payments, and total farm sales as well as an indicator for a young beginning farm operator. Location-specific variables include ERS farm resource regions (for more detail see Figure 3). This variable is used as a proxy for local labor market conditions, growing crops, as well as production and marketing cycles that can impact labor allocation decisions. The Mississippi Portal is used as a reference region in our study. Because we utilize a pooled sample, indicator variables to specify year are also included. The reference year is 2011.

The ARMS has a complex, stratified, multi-frame design, therefore, each observation in the ARMS represents similar farms, the particular number being the survey expansion factor (or

the inverse of the probability of the surveyed farm being selected for surveying, Dubman, 2000). The expansion factors are most useful and recommended when the full survey is used, generalizations about the entire population of farms are made based on the results, or a simple univariate analysis is conducted. Following other data researchers we use a Jackknife variance estimation method to adjust for standard errors.

Econometric Framework

We examine the effect of health insurance coverage on off-farm work by beginning farm-operator operators and spouses. Perry and Rosen (2001) examine the effect of self-employment on the probability of health service utilization; they find that self-employed can finance access to health care from sources other than insurance. Finally, using a two stage instrumental variable approach, Olson (2002) study the effect of health insurance on labor-market participation. He finds that wives with owner-employer health insurance would accept a 20% wage discount in the presence of health insurance benefits.

Two-stage instrumental variables approaches have been widely used in empirical health economics research to address endogeneity: two-stage predictor substitution (2SPS); and two-stage residual inclusion (2SRI). Although the latter has not been used in health economics, it has been employed in other studies. These include Shea *et al*. (2007); Shin and Moon (2007); and Lindrooth and Weisbrod (2007), however, the first study by Terza, Basu, and Rathouz (2008) used it in the context of health economics. They showed that the 2SRI estimator is generally consistent while the 2SPS estimator is not. We will follow their methodology in this study. Note that both 2SPS and 2SRI methods entail estimating an equation in which the endogenous regressor, in our case health insurance coverage (coverage from off-farm work), is the dependent variable. For example, in the 2SPS, the predicted values from the first-stage regression replace the endogenous regressor in the second-stage. However, with the 2SRI method, the first-stage

residuals, rather than the first-stage fitted values, are included in the second-stage along with the observed values of the endogenous regressor. Adopting a two-stage least squares method in our study means that we first estimate a health coverage equation:

$$Y_{hci} = \beta_{hc} X_{hci} + \mu_{hci} \quad (7)$$

where Y_{hci} is a health coverage indicator variable (=1 if the beginning farm-operator household has health insurance coverage through off-farm employment), X_{hci} is a vector of explanatory variables that affect health insurance coverage, β_{hc} are unknown parameters to be estimated and μ_{hci} is the error term. Angrist and Krueger (2001) argue that it is preferable to treat the dichotomous dependent variable as a linear probability and estimate Equation (7) using ordinary least squares. Using the predicted probability from a non-linear model as an instrument for health insurance coverage in the second stage is not recommended because the first-stage functional form must be correctly specified in order to generate consistent estimates in the second stage. The first-stage of the 2SRI estimator is identical to that of the 2SPS. We first estimate Equation (7) as a linear model using OLS. The second-stage off-farm work by beginning farm operator household outcome equation under 2SRI is:

$$Y_{OFWi} = \alpha Y_{hci} + \beta_{hc} X_{OFWi} + \delta \widehat{Y_{\mu}} + \gamma_{hci} \quad (8)$$

where Y_{OFWi} is a binary off-farm work indicator variable, X_{OFWi} is a vector of explanatory variables that affect health insurance coverage, $\widehat{Y_{\mu}}$ are the residuals obtained from estimation of Equation 7, α, β_{hc} and γ are unknown parameters to be estimated and γ_{hci} is the error term. Note that Smith and Blundell (1986) show that the *t*-statistic for the estimate of δ is an asymptotically efficient test for the exogeneity of health insurance coverage with off-farm jobs in the health outcome equations. If δ is not statistically significant then health insurance coverage is exogenous. Terza, Basu, and Rathouz, (2008) argue in favor of using the 2SRI method over the

2SPS method to estimate nonlinear models with endogenous regressors. Finally, in order for the parameters of the off-farm work equation (Equation 8) to be consistently estimated, a variable must be included in the first-stage health insurance coverage equation (Equation 7) that is not included in Equation (8). This variable should explain variation in health coverage but be uncorrelated with off-farm work. Our instrumental variable (exclusion restriction) is based on the number of household members with health insurance, and professional services expenditures. We posit the existence of a relationship between the number of family members covered by health insurance and professional services expenditures and health insurance coverage. We found this instrument set is theoretically valid and first-stage *F*-statistics is around 29.4, suggesting that the instrument set is strong. The primary determinant examined in this study is the impact of health insurance coverage on the off-farm work decisions of beginning farm-operator households. The explanatory variables of these regress ions included a vector of all the exogenous variables in Equations (7) and (8).

Results and Discussion

Table 3 shows the parameter estimates of first-stage OLS estimates of factors affecting health insurance coverage from off-farm employment. Note that the estimated model demonstrated reasonable predictive capabilities as indicated by R^2 values of 0.22. The explanatory variables of this regression includes a vector of all the exogenous variables in equation (7) and equation (8). Table 3 reveals that several factors have significant association with health insurance coverage from off-farm work.[14] For instance, the coefficient on the number of family members with health insurance increases the likelihood of health insurance coverage through off-farm work. Our results are consistent with D'Antoni, Mishra, and Khanal (2014).

[14] Note parameters estimates do not reflect elasticity or probability. Here we are simply discussing factors that have significant association with health insurance coverage from off-farm work.

Variables operator age and operator age squared, for example, are found to be of the expected opposite signs, indicating an inverted U-shaped relationship between age of the operator and the likelihood of having health insurance coverage through off-farm work by beginning farm-operator households. Large farms, as indicated by the total real value of sales, has a negative and significant association with having health insurance coverage through off-farm work by beginning farm-operator households. A plausible explanation is that large farms concentrate on production agriculture, spend more hours on the farm and more likely to receive government payments. Therefore, operators and spouses of large farms tend not to or work very few hours off the farm. This relationship has been established in the literature on the off-farm participation decision (Chang and Mishra, 2008; Ahearn, El-Osta, and Dewbre, 2006; El-Osta, Mishra, and Ahearn, 2004). Finally, the estimates in Table 3 show that beginning farm-operator households specializing in dairy production are less likely to have health insurance coverage through off-farm work because operators and spouses who are less likely to work off the farm. This result is as expected, note that dairy farming is more labor-intensive than many other farming operations. These findings are consistent with Ahearn, El-Osta and Dewbre (2006) and Mishra and Goodwin (1997).

Table 4 reports parameter estimates and marginal effects for the 2SRI model[15] of health insurance coverage and off-farm work, using maximum likelihood and robust variance

[15] Using Greene (2008, p 775) one can derive the marginal effect in the binary model in equation (8) is a measure of the instantaneous effect that a change in the k^{th} explanatory variable has on the predicted probability $\Pr(Y=1)$ when the remaining explanatory variables are held constant. Such an effect is computed as the derivative of the conditional mean function with respect to x given by $\frac{\partial E(Y \mid x_j)}{\partial x_k} = \frac{\partial \Phi(\xi' x_k)}{\partial x_k}\xi_k = \phi(\xi' x_k)\xi_k$ where $\phi(.)$ is the standard normal density of the cumulative standard normal function $\Phi(.)$.

[15] For more detail, see http://www.ers.usda.gov/Briefing/ARMS/

estimation methods. Recall that the residuals from the first-stage, along with health insurance coverage variable are used in the estimation of Equation 8. Note that coefficient on the residuals is significant and supports the hypothesis of selectivity into the treatment model (off-farm work). As expected, health insurance coverage has a positive and significant impact on off-farm employment of beginning farm-operators households (operator and/or spouses). The marginal effect of health insurance coverage variable (Table 4) on off-farm work indicates that health insurance coverage from off-farm work increases the likelihood of off-farm work by about 1.7% among beginning farm-operator households. Our results support the positive association between health insurance coverage and increased wages by inducing beginning farm-operator household members to supply labor to off-farm work. In this case, it is evident that off-farm work provides workers with employer-sponsored health insurance as part of a compensation package. Our finding is consistent with Ahearn, El-Osta, and Mishra (2013) but the impact in our study is much smaller. Note that Ahearn, El-Osta, and Mishra (2013), using data from 2010 ARMS and the 2SPS method, investigated all U.S. farm-operator households and found that health insurance coverage increased off-farm work by about 19%. However, in contrast to their study, our sample is only for beginning married farm-operator households under 65, using 2SRI method, and recent data from 2011 and 2015 ARMS—a period when ACA was enacted and self-employed could buy health insurance through exchanges in their states and eligible to receive government subsidy to buy private health insurance.

Variables operator age and operator age squared, for example, are found to be of the expected opposite signs, indicating an inverted U-shaped relationship between age of the operator and the likelihood of off-farm work by beginning farm-operator households.[16] On the

[16] Because of collinearity between age of the operator and educational attainment of the operator, we dropped spouse age from the regression.

one hand, younger beginning farm operators are likely to work less off the farm. On the other hand, operator age squared variable has a positive and significant effect on off-farm work by beginning farm-operator households. Specifically, *ceteris paribus*, the likelihood that the beginning farm-operator working off farm alone decreases throughout the life of the operator until it reaches a maximum at 33 years of age based on point estimates[17], then declines as the operator grows older. The findings about the nonlinear effect of age on participation in off-farm work are consistent with other studies (e.g., Gould and Saupe, 1989; Huffman and El-Osta, 1997; El-Osta, Mishra, and Morehart, 2008).

Regional location (see Figure 4) of the farm is also an important factor in determining off-farm work by beginning farm-operator households. Findings in Table 4 reveal that, compared to the Mississippi Portal region, beginning farm-operator households located in five ERS regions (Northern Crescent, Northern Great Plains, Prairie Gateway, Eastern Uplands, Southern Seaboard, and Basin and Range regions) are more likely to work off the farm. Farmers in the above areas tend to specialize in, wheat, sorghum, poultry, hog, other livestock, and cotton; these farming enterprises are suitable for off-farm work (Mishra *et al.,* 2002). On the other hand, farmers in the Mississippi Portal region tend to have small farms specializing in livestock and mixed grains. Finally, the dummy variable on year 2015 has a negative and significant effect on the probability of off-farm work by beginning farm-operator households. This result is surprising. However, Bubela (2016) finds that the ratio of off-farm income to total household income for all farms fell from 2010 to 2015. Recently established beginning farmer programs offered by USDA and other parts of government could also be driving this decline.

[17] El-Osta, Mishra, and Morehart (2008) in their study report peak age of 44 for all farm operators.

Summary and Conclusions

Health insurance coverage is a significant concern for U.S. beginning farm-operator households (Ackoff et al., 2017), In this study, we estimate the impact of health insurance coverage on off-farm labor supply decisions for beginning farm-operator households using farm-level data from the 2011 and 2015 ARMS and the two-stage residual inclusion (2SRI) estimation method. Our goal is to gain insight into the use of off-farm employment to obtain health insurance coverage. We posit that health insurance provided by off farm employment or wages to purchase coverage can meet a critical need for beginning farm households.

We find a positive relationship between working off-farm and health insurance coverage for beginning farm household members. The probit results indicate, at the margin, that the probability of off-farm work increases by 1.7 percent for addition of the coverage of one family *member*.

The above study provides insights into a possible barrier to entering beginning farmers, there may be some limitations, mostly due to data limitations, that needs to be highlighted. First, in this study, we only considered off-farm work by a family unit (spouse and farm operators). Second, we do not include information on farm risk management strategies (such as crop insurance, etc.). Future research could focus on addressing the above issues, including barriers to entry into farming (land costs) for beginning farmers.

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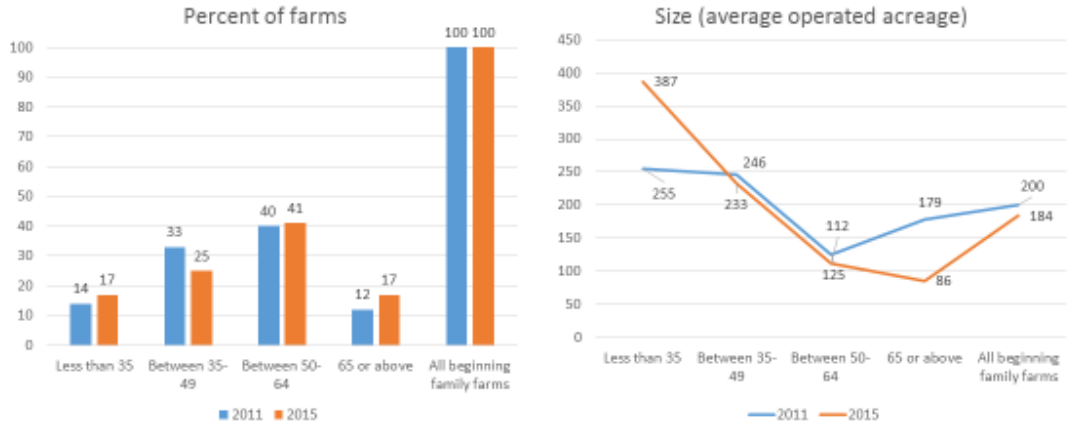
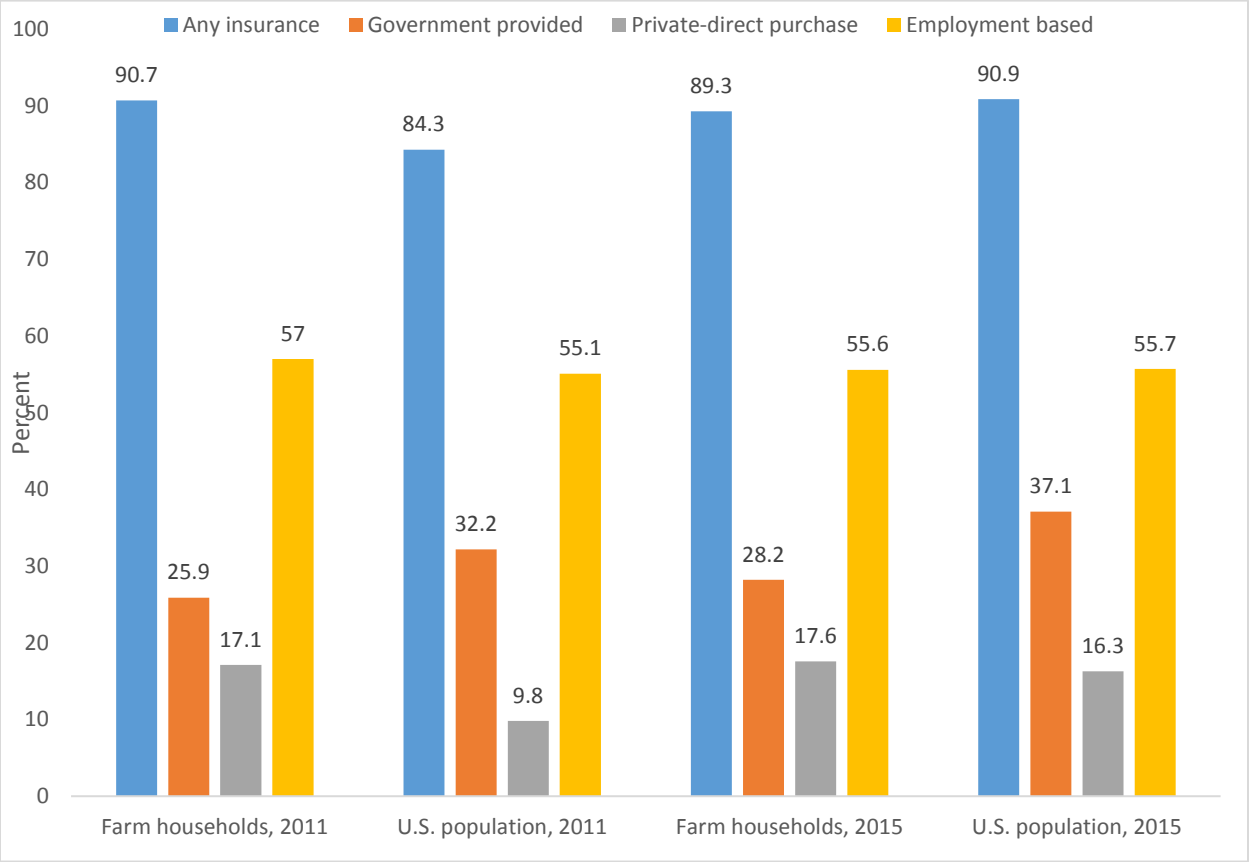
Figure 1. Distribution of beginning farmers by age group and by farm size



Source: Authors, using data from USDA's 2011 and 2015 Agricultural Resource Management Survey.

Figure 2: Sources of health insurance coverage for farming and U.S persons, 2011 and 2015



Source: Authors, using data from USDA's 2011 and 2015 Agricultural Resource Management Survey; 2011 and 2015 Current Population Survey, U.S. Census Bureau.

Figure 3: Economic Research Service (ERS) Resource Regions

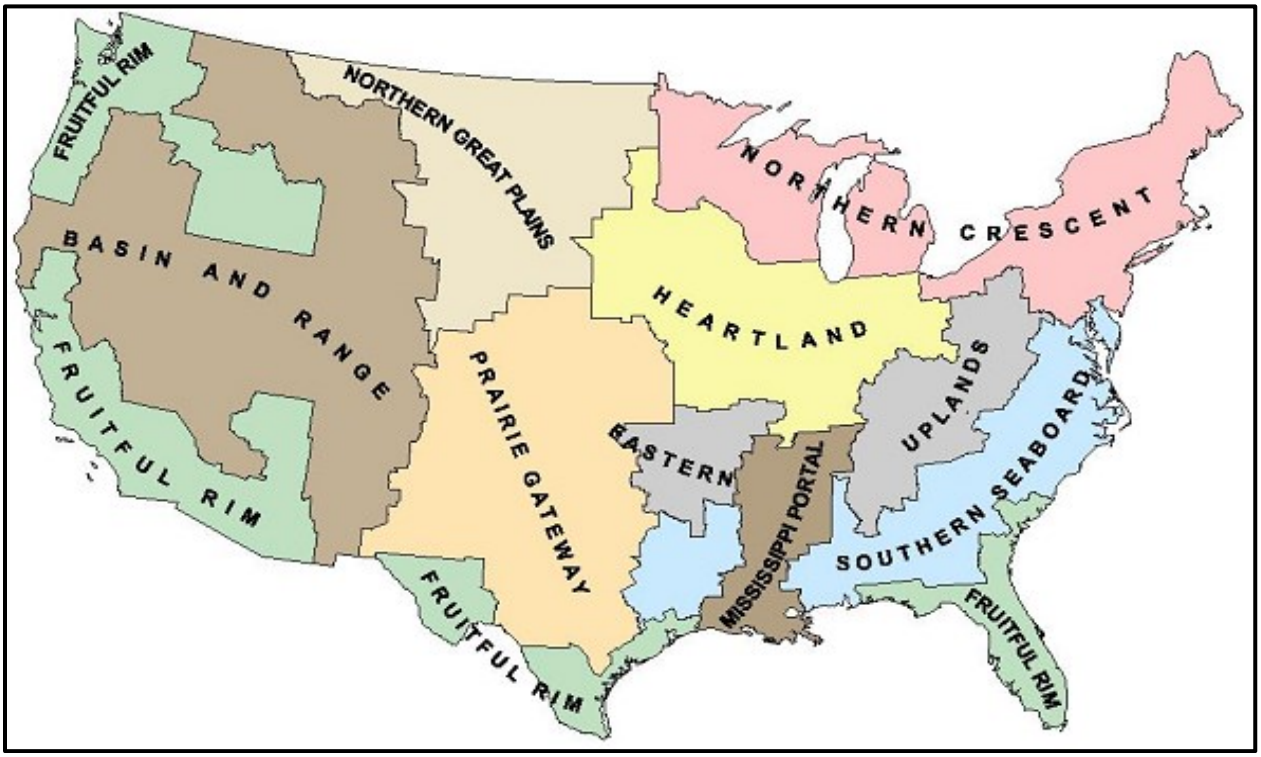


Table 1: Summary Statistics and Description of Variables, US Beginning Farmers, 2015

Variables	Description	Mean	Std. Dev
Household Characteristics			
Operator age (years)	Age of the operator	44.16	11.45
Operator education (years)	Maximum years of schooling attained	15.04	2.93
Covered members (number)	Number of household members with health insurance coverage	2.23	1.89
Health insurance coverage from off-farm employment	(=1; 0 otherwise)	0.54	0.50
Farm Characteristics			
Dairy farm	(= 1; 0 otherwise)	0.54	0.23
Total government payments	Annual payments in $1,000	5.75	20.54
Farm sales	Total value of farm sales in $1,000	498	1,366
Region: Heartland	(= 1; 0 otherwise)	0.26	0.44
Region: Northern Crescent	(= 1; 0 otherwise)	0.11	0.32
Region: Northern Great Plains	(= 1; 0 otherwise)	0.04	0.19
Region: Prairie Gateway	(= 1; 0 otherwise)	0.12	0.33
Region: Eastern Uplands	(= 1; 0 otherwise)	0.08	0.28
Region: Southern Seaboard	(= 1; 0 otherwise)	0.14	0.35
Region: Fruitful Rim	(= 1; 0 otherwise)	0.15	0.36
Region: Basin and Range	(= 1; 0 otherwise)	0.04	0.20
Region: Mississippi Portal	(= 1; 0 otherwise)	0.05	0.22
Year dummy			
Y2015	(= 1 if data from year 2015)	0.47	NA

Source: Agricultural Resource Management Survey (ARMS) 2015.

Table 2: Summary Statistics and Description of Variables, US Beginning Farmers, 2011

Variables	Description	Mean	Std. Dev
Household Characteristics			
Operator age (years)	Age of the operator	45.02	10.84
Operator education (years)	Maximum years of schooling attained	14.78	2.91
Covered members (number)	Number of household members with health insurance coverage	1.41	1.86
Health insurance coverage from off-farm employment	(=1; 0 otherwise)	0.27	0.44
Farm Characteristics			
Dairy farm	(= 1; 0 otherwise)	0.04	0.20
Total government payments (2015 dollars)	Annual payments in $1,000	5.80	26.50
Farm sales (2015 dollars)	Total value of farm sales in $1,000	635	1,625
Region: Heartland	(= 1; 0 otherwise)	0.19	0.39
Region: Northern Crescent	(= 1; 0 otherwise)	0.00	0.00
Region: Northern Great Plains	(= 1; 0 otherwise)	0.04	0.19
Region: Prairie Gateway	(= 1; 0 otherwise)	0.10	0.30
Region: Eastern Uplands	(= 1; 0 otherwise)	0.13	0.34
Region: Southern Seaboard	(= 1; 0 otherwise)	0.16	0.40
Region: Fruitful Rim	(= 1; 0 otherwise)	0.15	0.36
Region: Basin and Range	(= 1; 0 otherwise)	0.04	0.21
Region: Mississippi Portal	(= 1; 0 otherwise)	0.05	0.21
Year dummy			
Y2015	(= 0 if data from year 2011)	0.53	NA)

Source: Agricultural Resource Management Survey (ARMS) 2011.

Table 3: Estimated Coefficients of the Two-State Residual Inclusion (2SRI) OLS Auxiliary Regression, Beginning Farm-Operator Households, US, 2011 and 2015

Variables	**Health Insurance coverage from off-farm employment** *(=1; 0 otherwise)*	
	Coefficient	**St. Dev.**
Constant	-1.790	0.434
Number of household members with health insurance coverage	0.088***	0.008
Operator age	0.021***	0.009
Operator age squared	-0.0002***	0.0001
Operator education	0.197	0.057
Operator education squared	-0.006***	0.002
Total government payments	-0.0004	0.0007
Total farm sales	-0.0001***	0.000
Dairy farm	-0.176***	0.058
Total expenditures on professional services[a]	0.004	0.049
Farm location in Heartland[b] region	0.018	0.076
Farm location in Northern Crescent region	-0.075	0.081
Farm location in Northern Great Plains region	-0.046	0.056
Farm location in Prairie Gateway region	0.029	0.061
Farm location in Eastern Uplands region	0.036	0.065
Farm location in Southern Seaboard region	-0.035	0.057
Farm location in Fruitful Rim region	-0.090	0.075
Farm location in Basin and Range region	-0.007	0.055
Year 2015 dummy	0.148	NA
N	3,396	
R^2	0.22	

Notes: Single, double, and triple asterisks (*, **, ***) indicate significance at the 10%, 5%, and 1% level.

[a] Instrumental variable (exclusion restriction) in the first-stage estiamtion.

[b] Excluded Farm Resource Region: 'Mississippi Portal'

Table 4: Estimated Parameters and Predicted Marginal Effects of Factors in 2SRI Model: Health Insurance Coverage and Off-Farm Work Status of Beginning Farm-Operator Households

Variables	Off-farm work by operator, spouse or both	
	Coefficient (St. Dev.)	**Marginal Effect**
Constant	2.55	NA
	(0.841)	
Health insurance coverage	0.092***	0.017***
	(0.027)	(0.004)
Operator age	-0.077**	-0.014**
	(0.036)	(0.006)
Operator age squared	0.0007*	0.001*
	(0.0004)	(0.000)
Operator education	0.014	0.002
	(0.016)	(0.003)
Total government payments	0.002	0.034
	(0.002)	(0.0005)
Total farm sales	0.000	0.000
	(0.000)	(0.000)
Dairy farm	0.188	0.034
	(0.299)	(0.055)
Farm location in Heartland[a] region	0.267	0.049
	(0.205)	(0.038)
Farm location in Northern Crescent region	0.218	0.040
	(0.289)	(0.053)
Farm location in Northern Great Plains region	0.721***	0.132***
	(0.285)	(0.054)
Farm location in Prairie Gateway region	0.629**	0.116**
	(0.225)	(0.042)
Farm location in Eastern Uplands region	0.531**	0.098**
	(0.177)	(0.043)
Farm location in Southern Seaboard region	0.712***	0.131***
	(0.222)	(0.042)
Farm location in Fruitful Rim region	-0.026	0.005
	(0.221)	(0.040)
Farm location in Basin and Range region	0.541***	0.099***
	(0.267)	(0.050)
First-stage residual	0.232***	0.043***
	(0.107)	(0.019)
Year 2015 dummy	-0.382***	NA
N	3,396	
Log-likelihood function	413.40***	
Log-likelihood ratio	5.6 (*p=0.001*)	

Notes: Single, double, and triple asterisks (*, **, ***) indicate significance at the 10%, 5%, and 1% level. The significance of an estimated parameter is based on robust asymptotic standard error measurement of the corresponding coefficient. The computation of the marginal effect of a continuous variable is done based on footnote (4) with the remaining explanatory variables held fixed at their weighted mean levels.

For a dummy variable, the marginal effect is computed as the difference in the probability of purchasing health insurance coverage or of working off the farm when the value of the binary variable is 1 and when it is 0 with all other explanatory variables in the respective models held at their weighted means (see Greene, 2008, p. 775).

[a] Excluded Farm Resource Region: 'Mississippi Portal'.