Precautionary Wealth among U.S Farm Households

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Abstract

Using a cross sectional farm-level data we find that farm households who face higher income uncertainty save more and accumulate more wealth. Precautionary savings is about 6 percent of the total farm household wealth. In addition to precautionary saving, and consistent with theory we found that the age, education, occupation, and the number of acres operated are all important factors that influence wealth accumulation by U.S farm households.

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1. Introduction

Precautionary saving is considered to be one of the most important factors that motivate individuals to accumulate wealth. The main hypothesis of precautionary savings is that individuals who face high level of income uncertainty accumulate more wealth in order to smooth their future consumptions (Lusardi, 1997). The empirical studies investigating the importance of precautionary saving are still inconclusive. For example, some studies find that precautionary saving accounts for a large percentage of wealth accumulation by households (Dardanoni ,1991; Kazarosian,1997; Carroll and Samwick,1998). Others find that precautionary savings account only for a small fraction of wealth accumulation by households (Guiso et al.,1992; Arrondel, 2002; Jensen and Pope, 2004; Kennickell and Lusardi, 2005). Because of the difficulty associated with obtaining good measures of permanent income and income uncertainty using cross sectional data, only few studies have tried to quantify the importance of precautionary saving using cross sectional data (Skinner,1988; Dardanoni,1991; Guiso et al., 1992; Lusardi, 1997; Arrondel, 2002). To the best of our knowledge, this is the first study that quantifies the importance of precautionary savings of U.S. farm households. Quantifying precautionary savings is very important because it has strong policy implications (Paxson,1992). For example, the strength of precautionary savings should be taken into account when government design new farm policies that reduce income risks that farm households face. Precautionary savings could be used as a tool to self-insure against income risk, thereby reducing government's expenditures on farm program payments. Finally, The main objective of this paper is to investigate the presence of precautionary savings among farm households in the United States. The rest of the paper is organized as follows: in section 2, we present a literature review of the past empirical studies on precautionary savings. The economic model is presented in section 3. Section 4 describes the empirical model and estimation procedure. A summary of the data is presented in the next section. In section 6, we present the results -of our analysis. Finally, section 7 presents the conclusion of our main finding.

2. Literature review

The literature has plenty of studies that investigate the presence of precautionary savings. Empirical findings of these papers can be grouped into two sets: the first set of empirical studies found that precautionary savings accounts for a zero or very little proportion of households' wealth accumulation. Skinner (1988) investigated the presence of precautionary savings using data from 1972-73 consumer expenditure survey (CES). The author used occupation as proxy for income uncertainty. The study finds no evidence that households in riskier occupations (farmers, self-employed non-farmers, and salespersons) save more than households in less risky occupations. On the other hand, Guiso et al. (1992) test presence of precautionary savings in Italian households using 1989 Italian household income and wealth survey. The authors measure income uncertainty using the subjective variance of the household's next year income. The study found that households have precautionary savings but it only accounts for 2% of the household total net wealth. Similarly, Lusardi (1997, 1998) found that precautionary savings accounted for about 3 to 5% of the total wealth accumulation. In more recent paper, Arrondel (2002) used subjective earning variance to explain wealth accumulation by French households. He found that precautionary savings is important reason for savings but it account for only 5% of the accumulated wealth accumulation.

The second set of papers found that precautionary savings accounts for a large percentage of wealth accumulation by individuals and households. For example, Kazarosian (1997) found a strong evidence of precautionary savings using panel data from National longitudinal Survey. In addition, he found that farm households exhibit high precautionary saving motives compared to households in other occupation groups. Dardanoni (1991) analyzed precautionary savings using cross sectional data for British households and found that approximately 60% of total savings of individuals can be explained by precautionary savings. Carroll and Samwick (1998) estimated that up to 50% of wealth accumulation of a household can be explained by precautionary savings. Using a approach similar to Dardanoni (1991) Zhou (2003) analyzed precautionary saving of Japanese households. The study found that precautionary savings attribute approximately 64% of the wealth accumulation for agricultural, forestry, fisheries and self-employed households. Even though, the results of all of these studies are mixed regarding the magnitudes of precautionary savings, majority of them point out that precautionary savings represent a large percentage of wealth accumulation among farmers and self employed households. To best of our knowledge, only one study by Jensen and Pope (2004) measure precautionary savings by farmers. Using panel data (1973-1999) from Kansas, the authors test for the presence of precautionary saving motive among Kansas farm households. They found clear evidence of precautionary saving hypothesis. However, the magnitude of this savings is very small. One drawback of Jensen and Pope (2004) is that farms and farm families in their study were from a limited area (Kansas) and the majority of them specialized in wheat farming. Further, farm families faced limited off-farm job opportunities compared to farms in other regions of the U.S. Unlike previous studies, the analysis here is conducted on a national farm-level data with the unique feature of a larger sample than previously reported, comprising farms of different economic sizes and in different regions of the United States.

3. The Economic Model

The precautionary saving model used in this paper is grounded on the buffer-stock model developed by Deaton (1989) and Carroll (1992, 1996). This model assumes that individuals who face important income uncertainty may engage in buffer stock saving behavior in order to smooth their future consumption needs. In other words, the model assumes that individuals have a target wealth to permanent income ratio so that when wealth is above the target, consumption will exceed permanent income causing a drop in wealth level; however, if wealth is below the target, permanent income will exceed consumption leading to a net increase in the wealth level. Carroll (1996) demonstrated that in the presence of future income uncertainty, individuals solve the following optimization problem:

$$\max_{C_t} E \sum_{t=1}^{\infty} B^{t-1} u(C_t)$$

$$\text{s.t.} \quad W_{t+1} = R[W_t + Y_t - C_t]$$

$$Y_t = Y_t^P v_t \qquad (1)$$

Where E denotes expectation, C_t denotes consumption at time t, $B = \frac{1}{1+\delta}$ is the discount factor where δ is discount rate. W_t is total assets (nonhuman wealth) at time t, u is the expected utility function, Y_t is total labor income of the farm household at time t, and $R = 1 + r$ is the gross interest rate, and Y_t^P is the permanent income of the farm household at time t, and v_t is a multiplicative error term.

With wealth data being relatively more readily available and more accurate than say saving data, the majority of studies on precautionary saving have used wealth as response variable. Solving the optimization problem (1) for wealth and simplifying the solution, the following reduced form equation is estimated by several authors (Guiso et al. (1992); Kazarosian(1997); Lusardi (1997, 1998); Arrondel (2002)):

$$ln\left(\frac{W}{Y_p}\right) = f(OpAGE, X, \sigma^2) + \varepsilon \qquad (2)$$

Where W is the total household wealth, Y_P is permanent income, $OpAGE$ is the age of the operator, X is a vector of other control variables that influences the wealth-age profile such as education, occupation, number of children, family size. It should be pointed out that X should include permanent income Y_P if the preferences are non-homothetic (King and Dicks-Mireaux (1982)), σ^2 is a measure of the income uncertainty, and ε is the error term.

4. Model Specification and Estimation Procedure

Carroll and Samwick (1997, 1998) used a slight modification of equation 2 to estimate the impact of precautionary saving on wealth accumulation. We followed their model specification in this study. The equation used to estimate the impact of precautionary saving on wealth accumulation for the U.S farm household is specified as follow:

$$ln(W_i) = \alpha_0 + \alpha_1 OpAGE_i + \alpha_2 \ln(y_i^P) + \alpha_3 \sigma_i^2 + Z_i\beta + \varepsilon_i \qquad (3)$$

Where $ln(W_i)$ is the natural logarithm of the measure of the total wealth (net worth) for the i^{th} farm household $\ln(y_i^P)$ is the natural logarithm of the permanent income for the i^{th} farm household, Z_i is a vector of all other variables that influence the wealth-age profile for the i^{th}

household, σ_i^2 is a measure of the income uncertainty for the i[th] farm household. Finally ε_i denotes the error term. The literature of precautionary saving reported three measures of income uncertainty: (1) subjective variance of the future income uncertainty (Guiso et al., 1992; Lusardi, 1997; Arrondel, 2002); (2) variance of the consumption (Dynan,1993); and (3) variance of the income using panel or cross sectional data analysis (Kazarosian,1997; Carroll and Samwick, 1998). In this study, we estimate income uncertainty using the later approach. Equation 3 will be estimated in two steps: in the first stage, we estimate the permanent income and the income uncertainty; then, the estimated permanent income and income uncertainty are used in the second stage to estimate the wealth accumulation equation.

4.1. Estimation of the permanent income and the income uncertainty

In order to estimate the precautionary saving model given by equation (3), we need estimates of permanent income and income uncertainty for each individual farm household in the sample. As Carroll and Samwick (1997) illustrated, the permanent income can be expressed using the following dynamic process:

$$y_{it}^{p} = y_{it-1}^{p} + \vartheta_{it} \qquad (4)$$

Where y_{it}^{p} is the permanent income in logarithm term at time t, and the y_{it-1}^{p} is the log of permanent income at time t-1, and ϑ_{it} is the shock to permanent income at time t. Jensen and Pope (2004) used the same specification to estimate the permanent income in their study. So using the same specification function, the permanent income in this study is estimated using the following dynamic equation:

$$ln(y_{it}) = Z_t\beta + g(A_{it}) + R_t\delta + \ln(y_{it-1}) + \varepsilon_{it} \qquad (5)$$

Where $\ln(y_{it})$ is the natural log of the observed annual household income at time t, Z_i is a vector of observable characteristics of an individual operator such as education and occupation,

β is a vector of parameter estimates, $g(A_{it})$ is the age-income profile(quadratic age function), and R_i is a vector of dummy variables to capture the impact of region-specific characteristics on the permanent income of the farm household. $\ln(y_{it-1})$ is the natural log of the observed household income in the previous year. Finally ε_{it} denotes the error term at time t. The estimated permanent income for individual i is the predicted value of the current income from equation 5 for that individual, and the income uncertainty that this individual faces is approximated by squaring the estimated residuals from equation 5.

5. Data

Data for the analysis were taken from the 2005 Agricultural Resource Management Study (ARMS). The ARMS is conducted annually by the Economic Research Service and the National Agricultural Statistics Service. The survey collects data to measure the financial condition (farm income, expenses, assets, and debts) and operating characteristics of farm businesses, the cost of producing agricultural commodities, and the well-being of farm operator households.

The target population of the survey is operators associated with farm businesses representing agricultural production in the 48 contiguous states. A farm is defined as an establishment that sold or normally would have sold at least $1,000 of agricultural products during the year. Farms can be organized as proprietorships, partnerships, family corporations, nonfamily corporations, or cooperatives. Data are collected from one operator per farm, the senior farm operator. A senior farm operator is the operator who makes most of the day-to-day management decisions. For the purpose of this study, operator households organized as nonfamily corporations or cooperatives and farms run by hired managers were excluded.

The 2005 ARMS collected information on farm households in addition to farm economic data collected through the regular survey. It also collected detailed information on off-farm hours worked by spouses and farm operators, the amount of income received from off-farm work, net cash income from operating another farm/ranch, net cash income from operating another business, and net income from share renting. Furthermore, income received from other sources, such as disability, social security, and unemployment payments, and gross income from interest and dividends was also counted. In this study we only include farm operators between ages 20 and 65. The age limitation is consistent with other studies (Lusardi, 1997; Kazarosian,1997; Guiso et al., 1992) that estimate permanent income and precautionary savings of households. Summary statistics and description of the variables used in analysis is presented in Table 1. Finally, wealth (or net worth) of the farm household is defined as the sum of farm wealth (farm assets-farm debt) and nonfarm wealth (total nonfarm assets-nonfarm debt).

6. Results

The empirical estimates of the precautionary saving model are reported in table 3[2]. The coefficient of income uncertainty is positive and statistically significant at the 1% level of significance. This result is consistent with theory that states that individual households who face higher income uncertainty, such as farm household, save more and accumulate more wealth in order to smooth their future consumption needs. However, the share of precautionary savings in total farm household's wealth is small evaluated at the sample mean, precautionary saving accounted for only 6% percentage of the total wealth accumulation of U.S farm households. This finding is consistent with findings in the literature (Guiso et al., 1992; Lusardi, 1998). The impact of permanent income of wealth accumulation is positive and significant at the 1 percent level of significance. Results indicate that, on average, farm households with more permanent

[2] In the first stage we estimated permanent income of farm households and variance of permanent income. Results of the analysis can be obtained from the authors. Variance of the permanent income by farm operator occupation is presented in table 2.

income accumulate more wealth. Findings here show that 1 percent increase in permanent income increases wealth accumulation by 0.6 percent. Our findings are consistent with those obtained by Lusardi (1997); Arrondel (2002); Carroll and Samwick (1997 and 1998) and Jensen and Pope (2004).

The impact of education on wealth accumulation is positive and significant, suggesting that higher levels of education would result in higher levels of farm household wealth. Results indicate that an additional year of schooling increases farm household wealth by 3 percent. Our finding is consistent with Lusardi (1998) and Arrondel (2002). The results also show that age is an important factor when it comes to individuals' decisions to accumulate wealth. The coefficients of age and age squared have the expected signs but only the coefficient of age is statistically significant at the 1 percent level of significance. The result of the model, however, does not support a quadratic relationship between age and wealth accumulation. Jensen and Pope (2004) did not find quadratic relationship between wealth and age in their study. They attributed this to the fact that the majority of the farm households stay active in farming beyond the retirement time. Furthermore, since our sample is restricted to farm households between 20 and 65 in age, it is not expected to observe a negative and significant relationship between wealth and age within this period. Our results suggest that an additional year in operator age increases farm household wealth by 4 percent. Our findings are consistent with Guiso et al., (1992).

The coefficient of the occupation dummy variable (if farming is the main occupation) is positive and significant at the1 percent level, indicating that farm households where operator's main job is farming, accumulate more wealth on average than farm operator households whose main job is not farming. More specifically, households with farming as their main occupations accumulate about 41.2% more wealth than other households. This is consistent with the fact that operators who have faming as their main job are traditionally operate large farms and farm income is the main source of total household income. Finally, the size of farm has a positive impact on farm household wealth accumulation. The coefficient of numbers of acres (proxy for size) variable is positive and highly significant in the model. Findings suggest that a 10 percent increase in total operated acres increases accumulated wealth by 0.5 percent.

Finally, majority of the regional location of the farm (dummy variables) has a positive impact on wealth accumulation. The coefficients of regional dummy variables are positive and statistically significant at the 1 percent level. Results show that farm households in all other regions (with the exception of Great Plains and Gateway regions) accumulate more wealth than the farm households in the Mississippi Portal region (benchmark region). This is consistent with the fact that farmland comprises 70 percent of the total wealth and farmland values differ by region. Farmland is more valuable, as government farm program payments are capitalized into farmland, in farming regions like Heartland and Northern Great Plains. On the other hand, urban pressures have increased farmland values in Northern Crescent and Fruitful regions that have increased farm household wealth.

7. Conclusion

The main contribution of this paper is to provide an empirical evidence of precautionary saving in the U.S agricultural sector. Using a cross sectional data from the Agricultural Resource Management Study (ARMS), we found that farm households who face higher income uncertainty save more and accumulate more wealth than other farm households. However, the percentage of total farm household wealth accumulated as a result of precautionary motive is only 6 percent. Even though, precautionary saving is not large among U.S farm households, it is important to take this factor into consideration when implementing new farm policy that lowers the income uncertainty of farm households in the United States. In addition to precautionary saving, and consistent with theory we found that the age, education, occupation, and the number of acres operated are all important factors that influence wealth accumulation by U.S farm households.

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Table1: Definitions and summary statistics of variables used in the analysis

Variable	Descriptions	Mean	Std Dev
VAR_INCOME	Estimated income variance	0.828	1.372
P_INCOME	Estimated permanent income($)	97,207	76,736
HH_NETW	net worth of farm operator household (includes both farm and nonfarm net worth, $)	1,401,918	2,612,978
FARMING	=1 if a operator's job is farming; 0 otherwise	0.683	0.465
OP_EDUC	Operator education level	12.391	1.201
HH_SIZE	Farm household size	3.098	1.609
N_CHILD	Number of children under 18	0.799	1.541
OP_AGE	Age of farm operator	50.509	9.157
T_ACRES	Total acres owned	1,155	3,521
FR_HEART	=1 if farm is located in the Heartland region; 0 otherwise	0.141	0.348
FR_NORTHC	=1 if farm is located in the North Crescent region; 0 otherwise	0.168	0.374
FR_NORTHGP	=1 if farm is located in the North Great Plains region; 0 otherwise	0.049	0.215
FR_PGATE	=1 if farm is located in the Prairie Gateway region; 0 otherwise	0.116	0.320
FR_EUPLAND	=1 if farm is located in the Eastern Uplands region; 0 otherwise	0.108	0.311
FR_SSBOARD	=1 if farm is located in the Southern Seaboard region; 0 otherwise	0.134	0.340
FR_FRIM	=1 if farm is located in the Fruitful Rim region, 0 otherwise	0.157	0.364
FR_BASINR	=1 if farm is located in the Basin and Range region, 0 otherwise	0.053	0.225
FR_MPORTAL	=1 if farm is located in the Mississippi Portal region, 0 otherwise	0.075	0.263

Source: 2005 Agricultural Resource Management Survey (ARMS).

Table 2: Estimated variance of permanent income by principal occupation of the farm operator

Variable	N	Mean	Std Dev
Total sample	4428	0.828	1.372
Nonfarmers	1402	0.434	0.964
Farmers	3026	1.011	1.489

Source: Authors calculations

Table 3: Parameter estimates of wealth equation
Dependent variable = ln(wealth)

Variable	**Parameter Estimate**
Intercept	3.942*
	(0.385)
Income variance	0.073*
	(0.010)
Permanent income	0.611*
	(0.026)
Farming	0.416*
	(0.031)
Operator Education	0.030*
	(0.012)
House hold size	0.018
	(0.015)
Number of cchildren	0.005
	(0.016)
Operator Age/10	0.412*
	(0.131)
Operator age squared/100	-0.017
	(0.014)
Total acres operated/1000	0.043*
	(0.004)
Farming region Heartland	0.231*
	(0.061)
Farming region Northern Crescent	0.350*
	(0.060)
Farming region Northern Great Plain	0.091
	(0.080)
Farming region Prairie Gateway	-0.022
	(0.064)
Farming region Eastern Upland	0.253*
	(0.065)
Farming region Southern Seaboard	0.283*
	(0.062)
Farming region Fruitful Rim	0.416*
	(0.060)
Farming region Basing and Range	0.376*
	(0.077)
Adj. R^2	0.33
No.of observation	4428

Note: Standard errors are reported in parentheses.
* denotes that the parameter is significant at the 1% level of significance
Source: Authors calculations