BUSINESS GROWTH STRATEGIES OF ILLINOIS FARMS: A QUANTILE REGRESSION APPROACH

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Business Growth Strategies of Illinois Farms: A Quantile Regression Approach

This study examines the business strategies employed by Illinois farms to maintain equity growth using quantile regression analysis. Using data from the Farm Business Farm Management system, this study finds that the effect of different business strategies on equity growth rates differs between quantiles. Financial management strategies have a positive effect for farms situated in the highest quantile of equity growth, while for farms in the lowest quantile the effect on equity growth is negative. Cost reduction, asset management and revenue enhancement strategies all proved to have important effects on the determination of growth equity rates.

Key words: business growth, equity growth, percentile, quantile regression.

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The 1996 Farm Bill dismantled an income support mechanism that U.S. farmers had enjoyed since 1973, resulting in a high income volatility period for the farm sector. The federal government disbursed billons of dollars to stabilize farm income. Farmers received $4.3 billion in direct government payments in 1997, $6.0 billion in 1998, and $8.7 billion in 1999 (ERS-USDA). In 1997, the average large family farm recipient received over $18,000 in benefits. Illinois farmers received federal support above national average; however the government efforts were not enough to stabilize income variability. As a reaction, Illinois farms have adopted several business strategies to avoid the deterioration of their equity positions. Among the strategies that have been adopted by Illinois farms are asset management, financial management, revenue enhancement, and cost reduction strategies.

Previous studies have looked at the effect that these strategies have had on the equity positions of Illinois farms. In particular, Escalante and Barry (2002) identified key strategies employed by Illinois grain farms to prevent deterioration of their equity growth after the 1996 Farm Bill. Using an OLS regression with farm data, they identified that revenue enhancement, cost reduction and capital management strategies were important to maintain equity level. By pooling all farms together and estimating a mean based regression (OLS), Escalante and Barry (2002) overlooked the possibility that farms at different points in the distribution of equity growth may actually face different effects from the same strategies.

The heterogeneity of the sector suggests that not all farms follow the same strategies during a period of low farm income, thus the effects of each different business strategy on the equity growth rate might differ. If this is the case, OLS coefficients will be inefficient. Furthermore, they would not allow the researcher to identify different effects of the management strategies at various points of the distribution of equity growth. A quantile regression approach would identify different effects for alternative points in the equity growth distribution and test whether or not these differences are statistically significant. In addition, quantile estimators are robust to outliers in the distribution and therefore are especially useful for distributions that do not resemble the normal distribution.

Several studies have used quantile regression to account for the effect of covariates on location, scale and shape of the distribution of the response variable. Jayachandram, Blaylock, and Smallwood (2002) showed evidence that quantile regression is effective in estimating conditional function at any part of the distributions. Mata and Machado (1993) as well as Gorg, Strobl and Ruane (2000) employed quantile regression to analyze the determinants of firm start-up size. They showed that a quantile regression estimator can provide more precise information on the determinants of start-up size than OLS regression model.

This paper will extend the previous literature by using a quantile regression approach to analyze the effect of different strategies to maintain equity positions. The quantile regression will potentially provide a different estimator for each quantile. Therefore, the objectives of this paper are: a) to examine the important factors or key strategies used by Illinois farms to maintain their equity positions and b) to asses how different strategies affect farms according to their position on the equity growth distribution. This will allow us to evaluate the relative importance of the strategies at different points of the distribution of farms' equity growth.

The following sections present the methodology and model specifications, the econometric analysis as well as a description of the data and the regression results.

Methodology and Model Specification

This section outlines the methodology employed to construct the variables considered in the study. It includes the description of the theoretical model as well as the econometric models employed during the analysis. Barry et al. (2001) define equity growth according to the following equation:

(1) $$g = \left[r * (A/E) - i * (D/E \right] * \left[(1-t) * (1-c) \right]$$

where *r* is the expected rate of return on assets, *A/E* is the asset to equity ratio, *i* is the cost of debt, *D/E* is the debt to equity ratio, *t* is the net withdrawals for taxation and *c* is the family consumption. Equation (1) shows how the rate of equity growth is influenced by several factors. If the rate of return on assets or the asset to debt ratio were to increase, the rate of equity growth would increase as well. On the other hand, as the rate of interest rate, taxation and consumption increase, the rate of equity growth will decrease. These alternative strategies that influence the rate of equity growth have been classified into four major categories: asset management, financial management, revenue enhancement, and cost reduction (Escalante and Barry, 2002). The following paragraphs describe in detail these strategies.

Asset Management Strategies

The asset management strategy refers to the optimization of rate of return on assets through either revenue enhancement or cost reduction. It indicates whether or not the utilization of farm assets translates to favorable high returns for the farm business. When a farm chooses the adequate level of asset either by selling or buying assets, the productivity ratios can be improved leading to a better equity position.

Financial Management Strategies

Financial management strategies refer primarily to debt and equity management strategies. They may entail the regulation of the debt to equity rate and borrowing costs such as interest paid by the farm. Financial management strategies try to minimize the financial stress of farms therefore the adequate level of debt can stimulate equity growth. If the cost of borrowing exceeds the farm returns, higher level of leverage will translate in a deterioration of the farm's equity position

Revenue Enhancement Strategies

These strategies aim to enhance the net contribution of farm activities and to increase the farm net worth. The revenues of the farm can be enhanced by identifying existing assets that are not generating as much revenue as they might, developing marketing plans backed by thorough financial resources, analysis, and hedging brokerage relations.

Cost Reduction

Cost reduction strategies refer to cost control strategies that improve the operation efficiency. They might include the selection of cost effective technologies and inputs, cost saving production scheduling, and other overhead cost reduction schemes (Escalante and Barry, 2002).

Following Escalante and Barry (2002), ten variables are chosen to represent these four alternative strategies to explain the rate of equity growth. Therefore the equity growth is defined as follow:

> Equity growth $= f$ (asset turnover, tenure, share leasing ratio, leverage, interest expenses ratio, net farm income ratio, off-farm income, operating expenses ratio, family living expenses)

Equity growth is defined as the annual change in farm equity capital. The change in equity reflects the effect of retained earnings, realized capital gains on non-real state assets as well as the unrealized nominal capital gain on farm real state. Since the original purchase value of farmland is difficult to identify from the FBFM data base, the equity growth rate was adjusted by eliminating the contribution from unrealized capital gains on farmland thus obtaining the realized equity growth. This adjustment consists on subtracting to the farm equity capital on year t the acreages own by the farm in the previous year (t-1) multiplied by the change in farmland value.

The asset turn over ratio, the tenure ratio and the share leasing ratio correspond to the asset management strategy. The asset turn over ratio is calculated by dividing the value of farm production by the value of total farm assets and measures how efficiently farm assets are being used to generate revenue. A farm business has two ways to increase profits – either by increasing the profit per unit produced or by increasing the volume of production (if the business is profitable). A relationship exists among the rate of return on farm assets, the asset turnover ratio, and the operating profit margin ratio. The higher the asset turn over ratio, the more efficiently assets are being used to generate revenue. The tenure ratio is estimated by dividing the total number of owned acres by the total number of tillable acres including both leased and owned acres. The rate of equity growth is expected to increase as both the leased and owned acreage increase. Ellinger and Barry (2002) correctly pointed out that capital gains are given up when farmers decide to lease land. The share leasing ratio is estimated by dividing the number of crop shared acres by the total tillable acres. It is used as a proxy for the farmers' intention to expand farm production by controlling more farmland. Share leasing practices as pointed by Escalante and Barry (2002) have favorable risk bearing attributes and have less liquidity constraints than the cash leasing options, thus helps better farmer to maximize the rate of equity growth.

The leverage ratio and the interest expense ratio are identified as financial management strategies. The leverage ratio is the proportion of debt to total assets. This ratio measures the financial position of the farm and expresses the risk exposure of the farm business. The higher the ratio, the higher the risk exposure of the farm business. Equity growth is influenced by this ratio as higher debt levels can stimulate growth when they are well managed and do not lead to financial stress. Successful farms are able to manage higher leverage ratios only when the returns generated from assets exceed the cost of borrowing (Boessen et al., 1990). On the other hand a high leverage ratio may turn into a force against growth if the financial stressed imposed on the farm too high. The interest expense ratio is the ratio of interest expenses to gross revenues. It shows the amount of gross farm income used to pay for borrowed capital and it is used as a proxy measure for a set of strategies intended to minimize the cost of borrowing (Escalante and Barry, 2002). This variable is expected to have a negative effect on equity growth.

The revenue enhancement strategy is represented by the net farm income and the off-farm income. The net farm income ratio is obtained by dividing the net farm income by the gross revenues. This variable is used to measure farmer's actions to increase the farm equity. To enhance farm revenues, Escalante and Barry (2002) point out the fact that farmers can rely on alternative farm revenue enhancement strategies such as federal income subsidy support, effective market strategies, and nontraditional uses of farm products. Another proxy for revenue enhancement strategies is the off farm income. Many farm families already have at least one family member earning supplemental income away from the farm. An off-farm income source may not only generate steady income for family expenses but can also help relieve the pressure of cash withdrawals over the business profitability. Both variables are expected to have a positive impact on equity growth.

The operating expense ratio and family living expenses are used as proxies for the cost reduction strategy. The operating expenses ratio measures how efficiently the farm business controls its operating expenses, and is calculated by dividing total operating expenses by gross revenues. It indicates the proportion of farm income used to pay operating expenses not including principal or interest. The equity growth ratio is expected to be affected negatively as the operating expense ratio increases. The family living expenses are cash withdrawals paid by the business to cover family living expenses. In the context of the farming operation, family living withdrawals can be viewed as compensation for the owner/operator's management and labor. Actual withdrawals in excess of the amount needed to cover family living expenses can affect the equity growth negatively especially for less profitable farms.

Econometric Models

Two econometric models are employed in this study. The first is an ordinary least squares estimation (OLS) and the second is a quantile regression. Koenker and Basssett (1978) introduced quantile regression as a generalization of sample quantiles to conditional quantiles expressed as a function of explanatory variables. The quantile regression is an extension of the OLS regression model that allows the specification of conditional functions at any quantile. The quantile regression allows examining whether the effect of a particular explanatory variable on equity growth differs by the position of the farm business on the equity growth distribution. The quantile regression describes the entire conditional distribution of equity growth given a set of asset management, financial management, revenue enhancement, and cost reduction strategies. OLS regressions impose the constraints that the effect of a particular explanatory variable on equity growth is the same for the different equity growth groups. When the farms are homoskedastic in term of growth on equity, the slope estimates of the conditional quantile functions at each point of the distribution of the dependent variable will be equal to each other and to the slope estimates from the OLS. However, when the farms are hetersokedastic, the slope estimates of the conditional quantile functions will differ from each others as well as from the OLS slope estimates. Therefore, estimating conditional quantiles at various points of the distribution of the dependent variable will allow us to trace out different marginal responses of the dependent variable to changes in the explanatory variables at these points. Moreover, under the assumption of independently and normally distributed errors, the estimator from the quantile regression may be more efficient than the OLS estimators (Koenker and Basssett, 1978). The quantile regression is also robust for outliers.

Buchinsky (1998) describes the general quantile regression model as follows:

(2) $$y_i = x_i'\beta_\theta + u_{\theta i}, \quad i = 1......n,$$

where y_i denotes the equity growth for farm i and the θ^{th} quantile ($0<\theta<100$) of the conditional distribution of y_i is a linear function of a K*1 vector of explanatory variables x_i and an unknown error term, $u_{\theta i.}$; β_θ is the unknown vector of regression parameters associated with the θ^{th} percentile. The conditional quantile function can be expressed as $Q_\theta(y_i|x_i) = x_i'\beta_\theta$. Thus the quantile regression estimator $\hat{\beta}_\theta$ can be found as the solution to the following minimization problem:

(3) $$\underset{\beta_\theta}{Min}\left\{ \sum_{y_i \geq x_i'\beta_\theta} \theta \left| y_i - x_i'\beta_\theta \right| + \sum_{yi < x_i'\beta_\theta} (1-\theta) \left| y_i - x_i'\beta_\theta \right| \right\}$$

The study considers nine quantile regressions at the 10th, 20th, 30th, 40th, 50th, 60th, 70th, 80th and 90th quantiles. To obtain a consistent estimator of the covariance matrix, it is necessary to employ a design matrix bootstrap estimation (Jayachandram, 2002). In the design matrix bootstrap estimation, the quantile regression is estimated with sample of N observations drawn randomly with replacement from the original sample. For this study, the method was repeated 1000 times to obtain bootstrap estimates $\hat{\beta}_\theta$.

Furthermore, to examine the effect of the explanatory variable as one move from one quantile to the other, an inter-quantile regression is conducted. Consider a quantile regression for the k^{th} and m^{th} quantiles. Then we have the following equation:

$$Q_k = \alpha_k + \beta_{1k}x_1 + \beta_{2k}x_2 + ...\beta_{jk}x_j + \mu_k \tag{4}$$

$$Q_m = \alpha_m + \beta_{1m}x_1 + \beta_{2m}x_2 + ...\beta_{j,m}x_j + \mu_m \tag{5}$$

Then the inter-quantile regression can be expressed as follow:

$$Q_k - Q_m = (\alpha_k - \alpha_m) + (\beta_{1k} - \beta_{1m})x_1 + (\beta_{2k} - \beta_{2m})x_2 + ...(.\beta_{jk} - \beta_{jm})x_j + (\mu_k - \mu_m) \tag{6}$$

where the estimated coefficients denote the inter-quantile differences in farmers' strategies. The covariance matrix is obtained again by bootstrapping with 1000 replications. The OLS regression, the quantile regression and the inter-quantile regressions were estimated with STATA using the reg, sqreg and iqreg procedures respectively.

Data

The data used for this study corresponds to the Farm Business Farm Management (FBFM) system data base for the years of 1995 to 2003. This study includes only grain farms that have at least $40,000 in total assets as well as in gross farm returns. The data were carefully screened to comply with all the FBFM data certification such as FMV Balance Shit Certification and Family living/Sources and Uses Certification. The screening was done to eliminate any inconsistency that could be present in the data. Values of both dependent and independent variables those that were greater than the mean plus three standard deviations or lower than the mean minus three standard deviations were considered outliers, and consequently were eliminated from the sample. These elimination procedures resulted in a sample of 3,212 farm observations for the year 1995 to 2003.

Table 1 shows the descriptive statistics of the variables employed in this study by quantile of equity growth. The number of observations for each quantile varies between 321 and 322. The distribution of the observations among all quantiles is uniform within the range mentioned above, as expected. Farms that experience the largest equity growth are logically in the 90th quantile and have a 16% of equity growth on average. On the other hand, farms that belong to the 10th quantile have a negative equity growth of 14%.

The asset turnover, debt to asset ratio, and interest expenses variables present a U-shape relationship with the equity growth rate, as shown in Figure 1. The highest and lowest quantiles are associated with the highest values of the ratios mentioned above. For example, the mean for the asset turnover ratio is 37% for the 10th quantile and 34% for the 90th quantile; middle quantiles such as 50th and 60th quantiles have on average an asset turnover ratio of 27% and 28% respectively. This figure shows evidence that the relationship between independent variables and equity growth may not be linear. The same type of association is observed for the leverage variable. Similar to Escalante and Barry (2002) findings, higher leverage ratios are observed for the highest and lowest quantiles suggesting a dual nature of the leverage effect on equity growth.

Conversely, the tenure ratio presents an inverted U shape relationship with equity growth; the higher and lower quantiles of farm equity growth are associated with lower tenure ratio while middle quantiles show higher levels of the same ratios. The means of tenure ratio for the 10^{th}, 60^{th} and 90^{th} quantiles are 15%, 20% and 15% respectively.

The other variables used in this study do not have a single type of relationship with the rate of equity growth. It is interesting to note that the family living expenses variable as well as the operating expenses ratio decreases as moving up on the growth quantile; higher equity growth rates are associated with low levels of family and operating expenses. The mean value of family living expenditure for the 10^{th} quantile is $48,519 and for the 90^{th} quantile is $48,022 whereas the mean of operating expenses ratio for the 10^{th} quantile is 71% and for the 90^{th} quantile is 59%. The share leasing, the net farm income and the off farm income ratios show a different behavior than the previous group; the higher quantiles are related with the higher value of these ratios as expected.

Regression Results

The results of the OLS regression as well as the results from the quantile regression are shown in Table 2. Estimated coefficients for the asset turnover ratio, net farm income ratio and off-farm income show a positive and significant impact of these variables on equity growth ratio while tenure, share leasing ratio, operating expenses ratio and family expenses have significantly negative effects on equity growth. The debt to asset and interest expense ratios estimated coefficients are not significant. However, a Breusch-Pagan test for heteroskedasticity indicates that heteroskedasticity is present in the data.[1] The conditional variance of the equity growth distribution is not constant across different levels of equity growth ratios. The presence of heteroskedasticity violates one of the

[1] To test for heteroskedasticity, the hettest command on STATA was employed. The hettest performs a score (Lagrange multiplier) test for H: b=0 against multiplicative heteroskedasticity (Breusch & Pagan 1979; Cook & Weisberg 1983)

main assumptions of OLS: spherical errors. This leads to OLS estimates being inefficient. Furthermore, quantile regression has the advantage that it does not assume normally distributed errors for the estimation of the coefficients, as OLS does and allows coefficients to change for different sub-sets of the sample. Pooling together all the data may obscure interesting patterns in the behavior of farms with different equity growth ratios. Quantile estimates improve the efficiency of the estimators compared to OLS and allow analyzing independently heterogeneous farms. They may allow detecting significant effects from variables whose coefficients may have been dismissed for not appearing to be statistically different from zero in a mean based model such as OLS.

The low R^2 of the OLS could be interpreted as evidence of bias due to omitted variables; quantile method is also a good alternative when this type of bias is suspected (Jayachandram, 2002). Nevertheless, the pseudo R^2 which is the relevant goodness of fit measure in quantile regression does not seem to show an improvement on the fit of the model compared to OLS. Furthermore, the model appears to explain better the equity growth for the lower two quantiles than for higher quantiles.

Table 2 shows that there exists a disparity in the behavior of farms which would not be observed if we had looked only at the results from the OLS regression. Specifically, two interesting cases are observed in the sign changes of the coefficients of asset turnover ratio and debt to asset ratio. The asset turnover ratio has a positive impact on equity growth for all quantiles except for the lowest one. As the percentile increase, the magnitude of the coefficients also increases. This indicates that the effect of the asset turnover ratio is more important for farms that have higher equity growth than for those with low equity growth. Similarly for the lowest and highest quantiles, the estimated coefficients are significantly different from the OLS coefficients. This can be seen on Figure 2a where the 95% confidence interval for the quantile regression estimates for the 10th and 20th quartiles are below the OLS estimate. On the other hand, the confidence interval for the quantile estimators for the 80th and 90th quantiles, is above the OLS estimate. This result indicates that high equity growth farms make better use of its assets to generate revenues than low equity growth farms.

The tenure ratio affects negatively the rate of equity growth for all quantiles contrary to what was expected. These coefficients are significantly different from zero at 95% confidence. However only the 90th percentile estimated coefficient is significantly different from the OLS estimator. Figure 2b shows that the OLS estimator for the tenure ratio rest within the 95% confidence interval at each quantile except for the last one.

The share leasing ratio also has a negative effect on equity growth and is significantly different from zero for all quantiles except for the 90th one. The 10th and 90th quantile coefficients are significantly different from the OLS coefficient as well. These results indicate that greater reliance on owned and shared leased acres affect negatively the rate of equity growth. This contradicts results from previous studies where share leasing rate and tenure ratio showed a positive effect on equity. This change in sign might be explained by the fact that cash rent arraignment appears to dominate the leasing arraignment.

It is very interesting to observe that the leverage ratio is significantly different from zero for all quantiles except for the middle one. The impact of leverage is negative for farms that are in lower quantiles; however, for farms in the higher quantiles the effect is reversed. Figure 2d shows this relationship as well as the fact that all quantile estimates are significantly different from the OLS estimators. These results suggest that a higher leverage position is an important determinant for those farms that already have a high rate of equity growth. For farms in the opposite extreme of the distribution, high levels of leverage have negative effects on equity growth; high leverage positions can be associated with financially stressed farms that are not able to generate enough returns to surpass the cost of borrowing resulting in a further deterioration in the farm equity position. Financial strategies used by farms have different effects for each level of equity growth. The interest expense ratio, on the other hand, is positive and significant only for the low quantiles with the magnitude of the effect decreasing as the percentiles increases. This indicates that the interest expense ratio is not detrimental for slow growing farms.

The revenue enhancement strategies represented by net farm income ratio and by off farm income positively affect the equity growth of the farm. The net farm income ratio as well as off-farm income coefficient estimates are significantly different from zero for all quantiles. Nevertheless, whereas for net farm income none of the coefficients estimated are statistically different from the OLS estimates, for the case of off-farm income, Table 2 shows that the 10^{th} quantile coefficient is in fact statistically different from OLS. Figure 1f confirms the result expressed in Table 2 as it shows that OLS estimates for this variable's lie within the 95% confidence interval for quantile estimates. Similarly Figure 1g shows that the OLS coefficient is outside the confidence interval only for the 10^{th} quantile as expressed above. These results indicate that even though the revenue enhancement strategies are important determinants of net farm worth, in general they are not affected by the position of the farm on the equity growth distribution.

The OLS estimator on the operating expense ratio variable confirms its expected negative effect on equity growth. The coefficients on this variable are generally higher in absolute value for higher quantiles than for the lower ones, suggesting that this variable becomes more important for slower growing farms. In other words, the operating expense ratio seems to be more of a negative factor for slower growing farm. Even though the coefficients for all quantiles but the highest one are statistically different from zero they are not statistically different from the OLS estimator.

The family living expenditure withdrawals negatively affect the equity growth of farms. As it occurred for the operating expense ratio coefficients for all quantiles are statistically different from zero but not from the OLS estimator. The highest effect in absolute value is seen for the 40^{th} percentile.

The results reported in Table 2 suggest that the magnitude of the coefficients differ among quantiles for some of the variables included in the regressions. Inter-quantile regressions are used to test this more rigorously by comparing the coefficients across quantiles and determining whether or not they are statistically different from each other. In particular, if the estimator of the interquantile regression for a certain variable is significant then one can conclude that the slope parameters from the quantile regression of such variable for the quantiles being compared are statistically different from each other. Inter-quantile regression is a good way of further inspecting how farmers' strategies change as one moves along the return on equity distribution. This allows to test whether the effect of different business strategies is the same at two different quantiles. Table 3 presents the results from the inter-quantile regressions, comparing only contiguous quantiles. The effects of the asset turnover ratio appear to be different between the 10^{th} and the 20^{th} quantile, the 40^{th} and the 50^{th}, and the 70^{th} and the 80^{th}. The estimates of the coefficients of tenure ratio, off-farm income, operating expense ratio, and family living expenditure does not appear to be statistically different across quintiles. For the leverage ratio, it is clear that the effect is different for adjacent quantiles confirming the conclusions expressed above. The larger differences are observed between the lowest and highest interquantile ranges.

The interest expense ratio and net farm income effect appears to be different only between the 30^{th} to 40^{th} quantile, while the share leasing ratio shows a difference only between the 10^{th} and 20^{th} quantiles.

Summary and Conclusions

The empirical analysis takes into account the heterogeneity of the farm equity growth using the quantile regressions approach, showing that OLS estimation is not always an appropriate method to analyze equity growth. All the independent variables have been found to have an influence on the net worth of the farm. However the importance of each one of the strategies is not the same for all farms. All four strategies complement each other to allow farms to maintain equity growth and to avoid its deterioration. The study found that asset management strategies are an important determinant of the equity growth for all farms; financial management strategies are relevant as well. Minimizing borrowing costs or regulating the interest expenses through refinancing strategies and on time loan payment, influence equity growth; however it is important to recognize that the effect of these strategies depends on the location of the farm on the equity growth distribution. This is the case in particular of the Financial Management strategy, measured through the debt to asset ratio. Financially stressed farms use financial strategies differently than farms that are well performed. Furthermore, the cost reduction strategies are also important determinants of farm net worth. The regulation of family living withdrawals and use of cost efficient technologies prevent the potential deterioration of farm equity. By employing quantile a regression method, the findings of our study provide important insights on the way farms use different business strategies to enhance farm net worth, controlling for the unrealized nominal capital gains on farmland.

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Table 1: Descriptive Statistics by Quantiles

		Quantiles								
Variables	Mean	10 th	20 th	30 th	40 th	50 th	60 th	70 th	80 th	90 th
Equity growth	0.05	-0.14	-0.04	-0.01	0.01	0.03	0.05	0.08	0.11	0.16
Asset turnover ratio	0.31	0.37	0.28	0.25	0.27	0.27	0.28	0.30	0.31	0.34
Tenure ratio	0.18	0.15	0.21	0.26	0.24	0.20	0.19	0.16	0.16	0.15
Share leasing ratio	0.55	0.54	0.55	0.50	0.52	0.56	0.55	0.57	0.57	0.58
Debt to asset ratio	0.31	0.45	0.31	0.26	0.28	0.27	0.26	0.28	0.30	0.32
Interest expense ratio	0.02	0.03	0.03	0.02	0.02	0.03	0.02	0.02	0.02	0.02
Net farm income ratio	0.20	0.09	0.15	0.18	0.19	0.22	0.22	0.23	0.24	0.24
Off farm income	20582	16228	17528	18790	21807	20457	21259	22670	21938	22301
Operating expense ratio	0.63	0.71	0.67	0.65	0.64	0.61	0.62	0.61	0.59	0.59
Family living expenses	48519	50546	49471	49427	48507	49056	46892	46399	48004	48022
Observations	321	322	321	321	322	321	321	322	321	321

Table 2: OLS and Quantiles regression results

E. Growth [a]	OLS	Quantiles 10th	20th	30th	40th	50th	60th	70th	80th	90th
Asset turnover ratio	0.046	-0.048	0.007	0.025	0.023	0.043	0.047	0.063	0.086	0.100
	(4.72)*	(-2.06)* †	(0.52) †	(2.02)*	(1.77)	(3.77)*	(4.49)*	(4.82)*	(5.75)* †	(5.94)* †
Tenure ratio	-0.106	-0.123	-0.102	-0.101	-0.098	-0.100	-0.102	-0.095	-0.081	-0.053
	(-8.65)*	(-5.82)*	(-8.47)*	(-8.85)*	(-8.30)*	(-9.27)*	(-9.31)*	(-6.99)*	(-4.61)*	(-2.19)* †
Share leasing ratio	-0.056	-0.078	-0.053	-0.055	-0.058	-0.056	-0.052	-0.045	-0.035	-0.017
	(-7.36)*	(-6.99)* †	(-6.73)*	(-7.1)*	(-7.36)*	(-8.15)*	(-6.78)*	(-4.85)*	(-2.61)*	(-0.98) †
Debt to asset ratio	-0.015	-0.156	-0.094	-0.065	-0.019	0.012	0.038	0.073	0.121	0.188
	(-1.22)	(-6.73)* †	(-6.17)* †	(-4.03)* †	(-1.27)	(0.94) †	(2.43)* †	(3.42)* †	(5.42)* †	(7.46)* †
Interest expense ratio	0.098	0.263	0.174	0.149	0.042	0.076	0.035	0.073	0.016	0.058
	(1.41)	(2.29)*	(2.37)*	(2.19)*	(0.62)	(1.16)	(0.44)	(0.60)	(0.12)	(0.39)
Net farm income ratio	0.119	0.082	0.104	0.098	0.131	0.138	0.137	0.148	0.139	0.180
	(5.37)*	(2.71)*	(5.14)*	(4.61)*	(6.18)*	(7.45)*	(6.53)*	(5.11)*	(3.52)*	(3.65)*
Off farm income	1.12E-06	8.13E-07	1.05E-06	9.92E-07	1.02E-06	9.64E-07	0.000001	1.1E-06	1.3E-06	1.27E-06
	(11.37)*	(4.80)* †	(9.17)*	(10.72)*	(11.62)*	(11.27)*	(10.4)*	(7.43)*	(7.94)*	(6.97)*
Operating expense ratio	-0.224	-0.236	-0.200	-0.207	-0.187	-0.195	-0.198	-0.184	-0.176	-0.099
	(-8.04)*	(-6.41)*	(-6.85)*	(-7.30)*	(-7.43)*	(-9.58)*	(-8.16)*	(-5.00)*	(-3.50)*	(-1.47)
Family living expenses	-5.1E-07	-5.1E-07	-5.8E-07	-6E-07	-6.3E-07	-6.2E-07	-5.8E-07	-5.5E-07	-6.4E-07	-4E-07
	(-5.26)	(-3.32)*	(-6.09)*	(-5.61)*	(-6.64)*	(-7.12)*	(-6.68)*	(-3.89)*	(-3.93)*	(-2.47)*
Constant	0.208	0.204	0.161	0.179	0.171	0.179	0.187	0.175	0.178	0.125
	(8.09)*	(5.72)*	(6.05)*	(6.94)*	(6.93)*	(9.14)*	(7.87)*	(5.36)*	(3.60)*	(2.03)*
Observations	3212	3212	3212	3212	3212	3212	3212	3212	3212	3212
R-squared/ Pseudo R2	0.149	0.149	0.117	0.105	0.100	0.100	0.098	0.092	0.095	0.101

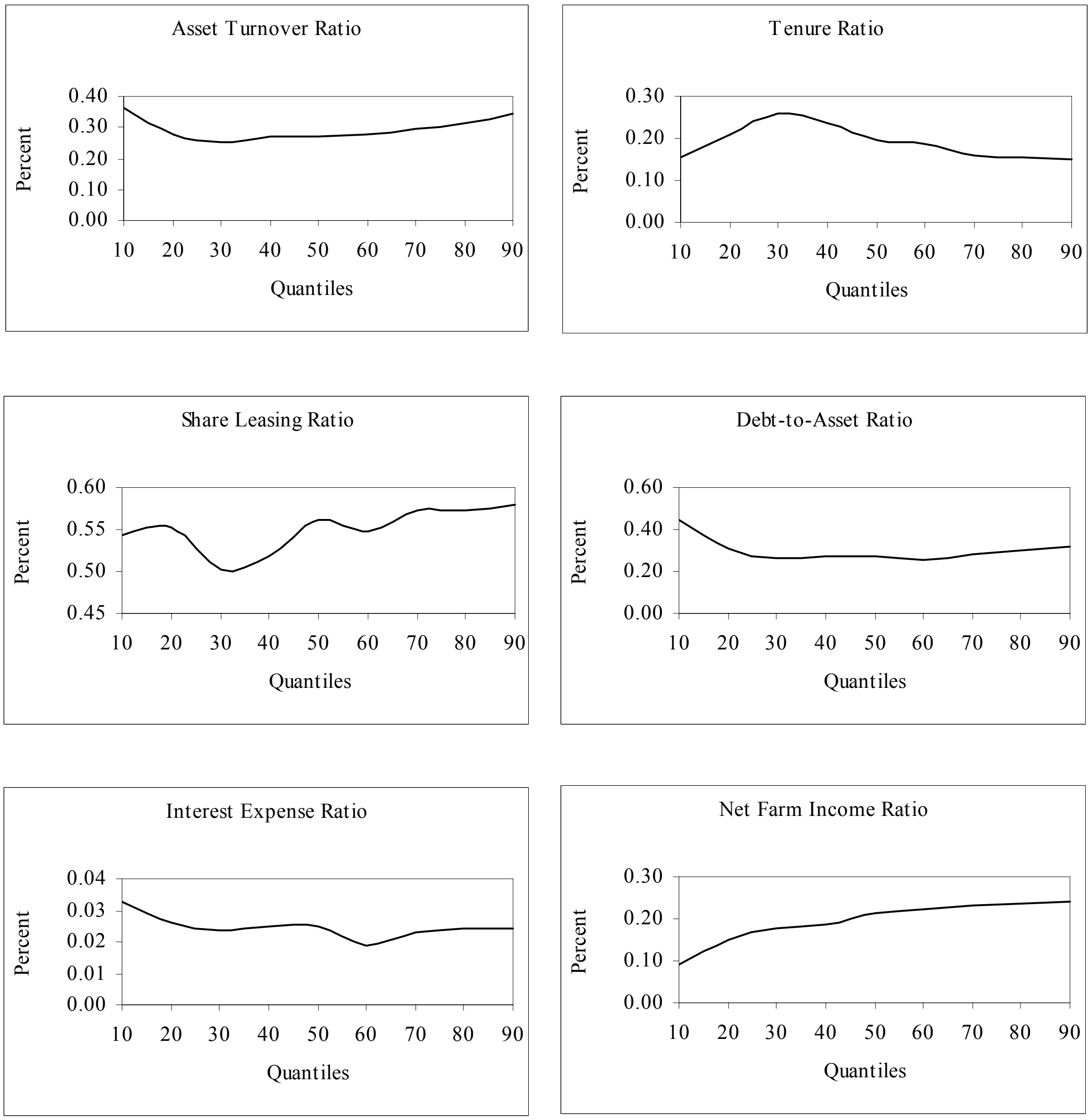
Absolute value of t-statistics (OLS) and Bootstrap t-statistics (quantile regression) in parentheses.
Coefficients that are significantly different from than the OLS coefficient at 95% confidence level are denoted with †.
Coefficients that are significantly different from zero at 95% confidence level are denoted with *.
[a] The dependent variable is equity growth

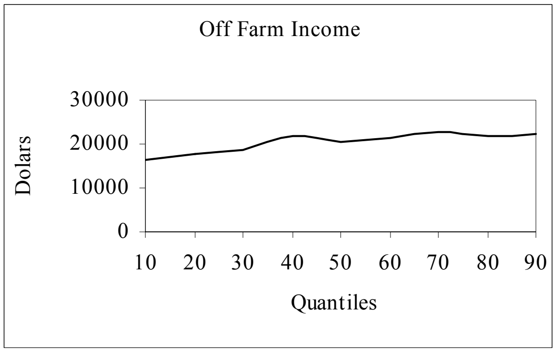
Table 3: Inter-Quantile regression results

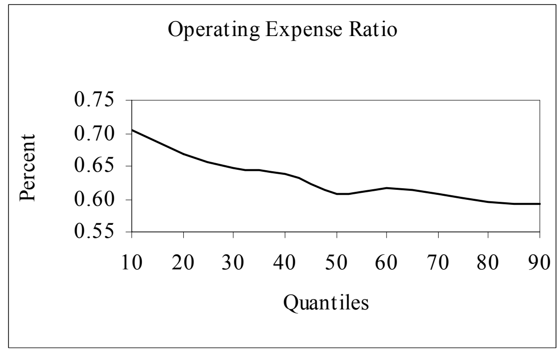
	Inter-Quantiles							
	10^{th} –20^{th}	20^{th} –30^{th}	30^{th} –40^{th}	40^{th} –50^{th}	50^{th} –60^{th}	60^{th} –70^{th}	70^{th} –80^{th}	80^{th} – 90^{th}
Asset turnover ratio	0.055	0.018	-0.003	0.021	0.004	0.016	0.023	0.014
	(3.26)*	(1.83)	(-0.32)	(2.67)*	(0.55)	(1.80	(2.16)*	(1.01)
Tenure ratio	0.021	0.001	0.003	-0.002	-0.002	0.007	0.014	0.028
	(1.38)	(0.10)	(0.32)	(-0.3)	(-0.26)	(0.83)	(1.07)	(1.45)
Share leasing ratio	0.025	-0.003	-0.002	0.002	0.004	0.007	0.010	0.018
	(2.94)*	(-0.46)	(-0.48)	(0.35)	(0.87)	(1.07)	(1.02)	(1.32)
Debt to asset ratio	0.061	0.029	0.047	0.031	0.025	0.036	0.047	0.067
	(3.29)*	(2.72)*	(4.50)*	(3.55)*	(2.84)*	(2.71)*	(3.00)*	(3.18)*
Interest expense ratio	-0.089	-0.026	-0.106	0.033	-0.040	0.038	-0.058	0.042
	(-0.97)	(-0.51)	(-2.20)*	(0.76)	(-0.79)	(0.51)	(-0.67)	(0.33)
Net farm income ratio	0.022	-0.006	0.033	0.007	-0.001	0.011	-0.009	0.041
	(0.99)	(-0.37)	(2.34)*	(0.49)	(-0.1)	(0.60)	(-0.30)	(1.11)
Off farm income	2.38E-07	-5.9E-08	2.77E-08	-5.5E-08	3.75E-08	9.52E-08	2.05E-07	-3.1E-08
	(1.70)	(-0.81)	(0.44)	(-0.95)	(0.58)	(0.99)	(1.81)	(-0.20)
Operating expense ratio	0.036	-0.007	0.020	-0.008	-0.003	0.014	0.008	0.076
	(1.26)	(-0.35)	(1.18)	(-0.48)	(-0.18)	(0.59)	(0.22)	(1.58)
Family living expenditure	-6.9E-08	-2.3E-08	-3E-08	1.22E-08	4.11E-08	3.24E-08	-9.1E-08	2.33E-07
	(-0.55)	(-0.30)	(-0.44)	(0.2)	(0.67)	(0.36)	(-0.79)	(1.65)
Constant	-0.042	0.017	-0.007	0.008	0.008	-0.012	0.003	-0.053
	(-1.60)	(0.92)	(-0.46)	(0.51)	(0.51)	(-0.55)	(0.09)	(-1.22)
Observations	3212	3212	3212	3212	3212	3212	3212	3212
Pseudo R^2	0.149	0.1172	0.1046	0.0996	0.0996	0.0977	0.092	0.1007

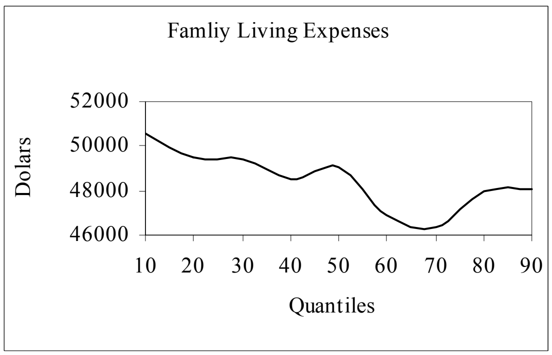
Bootstrap t-statistics values in parentheses.
Coefficients that are significantly different from zero at 95% confidence level are denoted with *

Figure 1: Mean values of Selected Variables by Quantiles of Equity Growth




Off Farm Income
Dolars
30000
20000
10000
0
10 20 30 40 50 60 70 80 90
Quantiles


Operating Expense Ratio
Percent
0.75
0.70
0.65
0.60
0.55
10 20 30 40 50 60 70 80 90
Quantiles


Famliy Living Expenses
Dolars
52000
50000
48000
46000
10 20 30 40 50 60 70 80 90
Quantiles

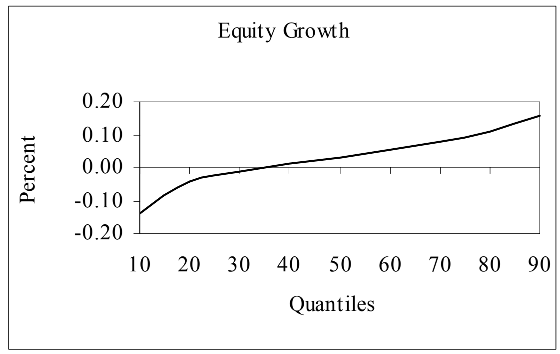
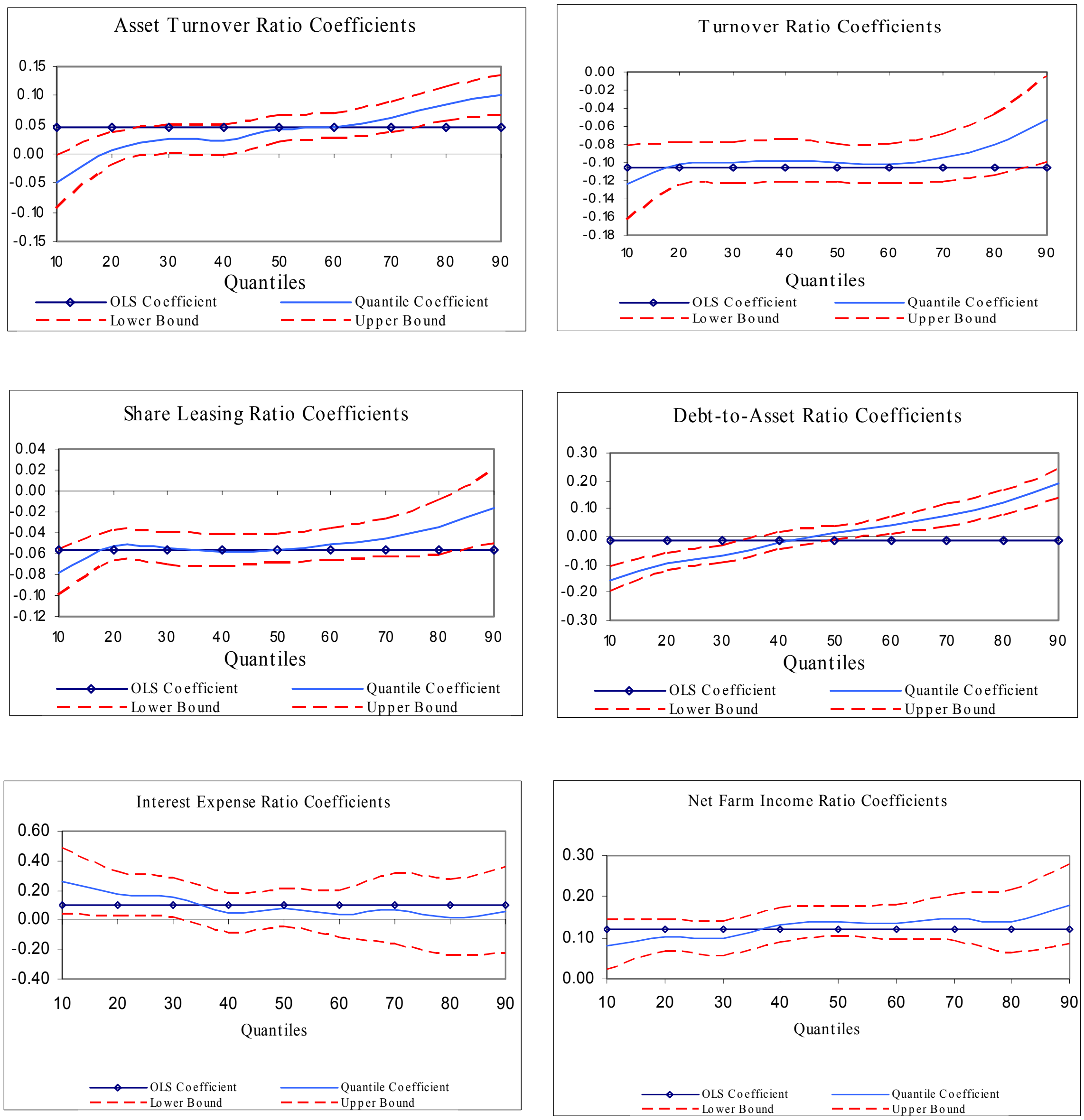
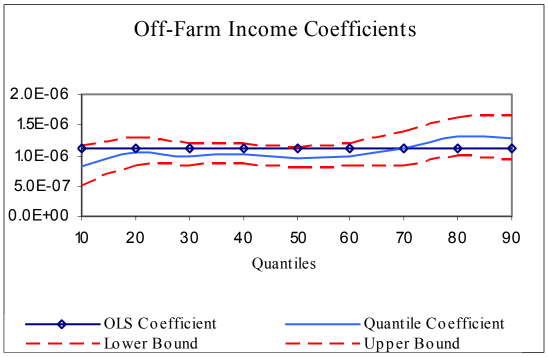
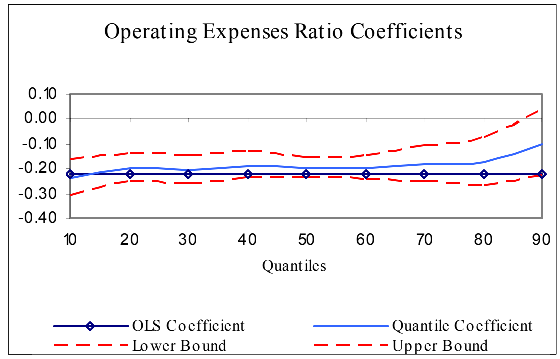
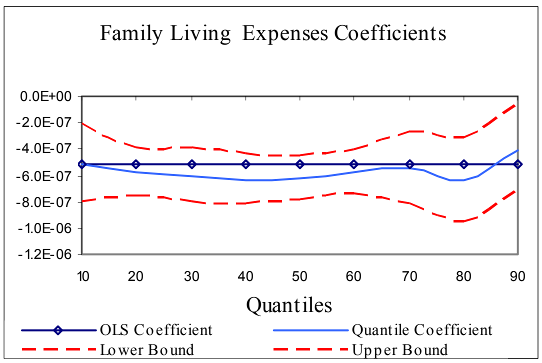

Equity Growth
Percent
0.20
0.10
0.00
-0.10
-0.20
10 20 30 40 50 60 70 80 90
Quantiles

Figure 2: Quantile Regression Results




Off-Farm Income Coefficients
2.0E-06
1.5E-06
1.0E-06
5.0E-07
0.0E+00
10 20 30 40 50 60 70 80 90
Quantiles
OLS Coefficient
Quantile Coefficient
Lower Bound
Upper Bound


Operating Expenses Ratio Coefficients
0.10
0.00
-0.10
-0.20
-0.30
-0.40
10 20 30 40 50 60 70 80 90
Quantiles
OLS Coefficient
Quantile Coefficient
Lower Bound
Upper Bound


Family Living Expenses Coefficients
0.0E+00
-2.0E-07
-4.0E-07
-6.0E-07
-8.0E-07
-1.0E-06
-1.2E-06
10 20 30 40 50 60 70 80 90
Quantiles
OLS Coefficient
Quantile Coefficient
Lower Bound
Upper Bound