Leasing and Debt in Agriculture: A Quantile Regression Approach

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Abstract

While traditional finance theory suggests that leasing and debt are substitutes, some papers demonstrated the theoretical possibility of complementarity. Empirical studies indicate that both are possible. In this paper we will use the Tobit model, ordinary least squares and quantile regression techniques to study the relationship between leasing and debt in farm capital structure in Illinois. Our results indicate that leasing and debt are close to perfect substitutes and leased assets are less risky than debt-financed assets in Illinois farms. The results from the quantile regression help us to capture the effects of farm characteristics on the distribution of leased to assets ratio.

Key words: leased to assets ratio, debt to assets ratio, farm characteristics, Tobit, OLS, quantile regression.

Leasing and Debt in Agriculture: A Quantile Regression Approach

The relationship between leases and debt is a controversial issue in the finance literature. While the idea that leasing and debt are substitutes is widely accepted in the finance literature, some papers have provided some evidences against this idea. Myers, Dill and Bautista (1976) argue that lease payments are fixed obligations like other loans and hence they can displace debt and reduce debt capacity. Therefore, an increase in one should lead to a compensating decrease in the other. From a classical view three types of substitutions between leases and debt are possible. Standard finance theory argues that cash flows from lease obligations are equivalent to debt cash flows and hence the tradeoff between leases and debt are one-to-one (Miller and Upton, 1966; Lewellen et al., 1976; Franks and Hodges, 1978; Levay and Sarnat, 1979 and Idol, 1980). Another group, based on the differences in the terms and the nature of lease and debt contracts, believes the tradeoff of leases for debt is less than, but close to, one (Meyer et al., 1976 and McConnell and Schallheim, 1983). The last group argues that the tradeoff between leases and debt is greater than one because of greater moral hazard in lease contracts (Klein et al., 1978).

Ang and Peterson (1984) have provided some evidences against the traditional view. They indicate that the leasing and debt can be complements. Finucane (1988), Marston and Harris (1988), Erickson (1993), Adams and Hardwick (1998), and Deloof and Verschueren (1999) attempt to find a remedy to the Ang and Peterson's puzzle. Andersson (1990) and Bierlen et al. (2000) test the substitutability between leasing and debt in farm capital structure. Bierlen et al. estimations indicate that land leasing and debt are substitutes and the degree of substitution is more than one.

In general, empirical works in this area following Ang and Peterson (1984) have applied Tobit models and simple regression methods based on the least squares approach to test the substitutability between leasing and debt.

Empirical works in this field, however, suffer from one common shortcoming. In general, least squares estimation of mean regression models as well as Tobit models seek to find how the conditional mean of the dependent variable responds to the independent covariates. They simply assume that covariates shift only the location or scale of the conditional distribution. When the whole distribution of the dependent variable can change with the independent covariates the results of simple least squares is misleading. Quantile regression methods enable us to explore potential effects of the independent variables on the shape of the distribution of the dependent variable as well.

In this paper, we will present some arguments and evidences which indicate that the distribution of leasing to assets ratio can be changed with the farm characteristics. Then we will use Tobit model, ordinary least squares method and quantile regression to study the relationship between leasing to asset ratio and debt to asset ratio. In our models we will use farm characteristics to control for debt capacity. In this paper we will use the data which is provided by the Illinois Farm Business Farm Management (FBFM) system for 2000.

The remainder of the paper is organized as follows. First, we will review the theoretical framework behind the empirical works in this area and we will introduce our variables. Second, we will review estimation methods. Third, we will introduce our data set and argue that the distribution of leasing to assets ratio can be changed with the farm characteristics, for example the age of farm's operator. Fourth, we will present our results. The final part is conclusion.

Theoretical Framework

Following the literature we define the debt-to-lease displacement ratio, α, with the following equation.

$$DR_N = DR_L + \alpha LR_L \qquad (1)$$

where:

DR_N = Debt to total asset ratio of a farm which does not lease,

DR_L = Debt to total asset ratio of a similar farm which does lease,

LR_L = Leasing to total asset ratio of a farm which does lease.

If leases and debt are perfect substitutes, then α is equal to one. In this case the tradeoff between leases and debt is one-to-one (Miller and Upton, 1966; Lewellen et al., 1976; Franks and Hodges, 1978; Levay and Sarnat, 1979 and Idol, 1980). If the debt-to-lease displacement ratio is positive but less than one, then leases and debt are substitutes but leased assets are less risky than debt-financed assets (Meyer et al., 1976 and McConnell and Schallheim, 1983). A displacement ratio greater than one indicates that leases and debt are substitutes but leased assets are riskier than debt-financed assets (Klein et al., 1978). Finally, if the displacement ratio is negative then leases and debt are not substitutes but complements (Ang and Peterson, 1984).

In order to control for debt capacity in the applied model we can rewrite equation (1) by the following linear arbitrage form:

$$DR_N = DR_L + \alpha LR_L = \beta' X \qquad (2)$$

where $\beta' X$ is a linear function of farm characteristics and controls for debt capacity. In equation (2), X is a k×1 vector of observable farm characteristics and β is a k×1 vector of testable parameters. Since DR_N is not observable we can use the left hand side of the above arbitrage equation to reach the following testable model:

$$LR_L = -(1/\alpha) DR_L + (1/\alpha)\beta' X \qquad (3)$$

Equation (3) can be rewritten as the following cross-sectional econometric model:

$$LR_{Li} = \gamma_0 + \gamma_1 DR_{Li} + \gamma' X_i + \varepsilon_i \qquad (4)$$

We will use age of farm's operator, net worth of farm, and soil quality as farm characteristics to control for debt capacity. In this paper we will estimate model (4) by ordinary least squares, Tobit model and quantile regression.

Estimation Methods

The Tobit model is a common method of estimation in this field. Since the leasing to total assets ratio is bounded between zero and one and some farms do not lease, the Tobit model potentially can provide an unbiased estimation for model (4). However, this model fails to capture the effect of independent covariates on the distribution of leasing to total asset ratio.

In general, ordinary least squares approach and those methods which are derived from this approach seek to find how the conditional mean of the dependent variable responds to the independent covariates and they simply assume that covariates shift only the location or scale of the conditional distribution. When the distribution of the dependent variable can change with the independent covariates the results of a simple least squares is misleading. Instead, quantile regression methods enable us to explore the potential effects of the independent covariates on the shape of the distribution of the dependent variable as well. Quantile regression methods establish an approach to estimate models for the conditional quantile functions (Koenker and Hallock, 2001).

For a linear regression model such as Y = Xβ + ε, the linear conditional quantile function, $Q_Y(q \mid X = x) = x_i'\beta(q)$ can be estimated by solving:

$$\hat{\beta}(q) = \arg\min\{[\sum_{i\in T} q \mid y_i - x_i\beta \mid] - [\sum_{i\in T'} (1-q) \mid y_i - x_i\beta \mid]\} \quad (5)$$

where $T = \{i \mid y_i \geq x_i\beta\}$ and $T' = \{i \mid y_i \leq x_i\beta\}$. For conditional median quantile function, q = 1/2, the solution is identical to minimizing sum of absolute values of the residuals.

In the next section we will introduce our data set and then we will indicate that the distribution of leasing to assets ratio varies with the change in farm characteristics, say age of operator, and hence we can capture the effect of independent covariates on the leasing to assets ratio by the quantile regression.

Data

In this paper we will use the data which is provided by the Illinois Farm Business Farm Management (FBFM) system for 2000. There were 2369 observations in the original data set. After some investigation we dropped 217 bad and unrelated observations from the original data set. Therefore our final data set includes 2152 observations. The FBFM data set does not include the value of land. This deficiency enforces us to estimate the value of land indirectly. For this estimation we assume that the value of land per acre is equal to the annual rent per acre divided by 5 percent interest rate. Based on this assumption we calculate the value of land for all observations and then we calculate the debt to total assets ratio (including the value of land) and leasing to total assets ratio (including the value of land).

The descriptive statistics of our variables are presented in Table 1. This table indicates that the mean of leasing to assets ratio and the mean of the debt to total assets ratio are equal to 0.53 and 0.10 respectively. The first ratio indicates that leased assets have an important role in the capital structure of Illinois farms and leasing is one of the more common methods of financing among the farmers in this state. The second ratio indicates that debt has relatively a minor role in the capital structure of Illinois farms. The average age of farmers is equal to 51 years and the mean of net worth of farms is equal to $821,000. The mean for the index of soil quality is equal to 80.36 with the minimum and maximum being 40 and 100 respectively.

In order to indicate that the distribution of leasing to assets ratio changes with the change in the farm characteristics we have provided Table 2. This table indicates that while the leasing to assets ratio for 80.6 percent of young farmers (age less than 40 years) is more than 50 percent, only 30.4 percent of old farmers (age greater than 60) have a leasing to assets ratio greater than 50 percent. Also, Graph 1 reveals that the distribution of leasing to assets ratio changes with the change in the age of farmers. This graph clearly indicates that the distribution of leasing to assets ratio for young farmers is negatively skewed but for old farmers is positively skewed. Hence we can argue that quantile regression is an appropriate instrument in this study, because it enables us to capture the potential effects of the independent variables on the shape of the distribution of the dependent variables.

Results

We have estimated model (4) by the ordinary least squares, Tobit Models and quantile regression. For quantile regression we estimated a family of conditional quantile functions, $q \in \{0.1, 0.2, 0.3, ..., 0.9\}$. All estimated parameters are strongly significant at 99% level of confidence with relatively high adjusted coefficient of determination for OLS and Tobit models. We used bootstrap method to construct 95 percent confidence intervals for displacement ratios. In this paper we did not test for heteroskedasticity because quantile regression automatically will do it. The estimated parameters are indicated in tables 3 to 7. These tables indicate that the estimated parameters by OLS and Tobit model are very close. This result is not surprising, given the small percentage, 4.2%, of censored observations. Hence in the rest of this paper we will compare the results from OLS and quantile regression.

- Estimated Intercepts

Table 3 reports the estimated intercepts. This table indicates that while the estimated intercept by OLS is equal to 0.84 the estimated intercepts for our conditional quantile functions raise from 0.60 to 0.97. In graph 2 we present a concise summary of estimated intercepts by the quantile regressions and their 95% confidence intervals. The estimated intercept by the OLS also is superimposed on this graph. This graph clearly indicates that the estimated intercept by the quantile regressions in some quantiles are less than and in some quantiles are more than the estimated intercept by the OLS.

- Estimated Displacement Ratios

Table 4 reports estimated displacement ratios. This table indicates two important points. First, the displacement ratios which are obtained from OLS and quantile regressions are all less than but close to one, supporting the hypothesis that leasing and debt are close to perfect substitutes. This result is consistent with the notion that leased assets are less risky than debt-financed assets. This point reveals that lease contracts are less risky than debt contracts for Illinois farmers. Based on this result we can argue that the landlords in Illinois are faced with a lower level of moral hazard and other types of asymmetry of information than the money lenders. Actually, this result indicates that the landlords are more familiar with the farmers' characteristics than the money lenders in Illinois.

Second, the estimated displacement ratio by the OLS is always in the 95% confidence interval of the estimated displacement ratios by quantile regressions. Hence the debt-to-assets ratio does not affect the distribution of leasing to assets ratio significantly. Graph 3 represents the estimated displacement ratios which are obtained by the quantile regressions and OLS.

- Impact of the Age of farm's operator

Table 5 which reports the estimated coefficients on the age of the farm's operator by the different methods of estimations indicates that this variable has a negative impact on the leasing to assets ratio. This means that older farmers tend to use less leased and more debt-financed assets, which supports the life cycle theory.

Table 5 also indicates that while the estimated coefficient on age by the OLS method is equal to -0.0078 the magnitude of this coefficient for our conditional quantile functions raise from -0.011 to -0.0024. This means that the negative impact of age on the leasing to asset ratio tends to zero as this ratio goes up. Also, we can argue that the leasing to asset ratio is more sensitive at its lower levels and less sensitive at its higher levels to the age. In graph 4 we present a concise summary of estimated coefficients on age by the quantile regressions and their 95% confidence intervals. The estimated coefficient by the OLS also is superimposed on this graph.

- Impact of the net worth of farm

Another control variable in our model is the net worth of farm. Table 6 indicates that this variable also has a negative impact on the leasing to asset ratio. If we consider this variable as a proxy for wealth, then our results indicates that farmers with higher wealth tend to use less leased assets.

Table 6 also indicates that while the estimated coefficient on net worth (measured in million dollars) by the OLS method is equal to -0.136, the magnitude of this coefficient for our conditional quantile functions first decreases from -0.147 in quantile

0.1 to -0.187 in quantile .6 and then increases to -0.130 in the last quantile. In graph 5 we present a concise summary of estimated coefficients on net worth by the quantile regressions and their 95% confidence intervals. The estimated coefficient by the OLS also is superimposed on this graph. This graph reveals that the magnitudes of estimated coefficients on this variable obtained by the quantile regression method are larger than the corresponding coefficient obtained by the OLS method.

- Impact of Soil Quality

Table 7 reports the estimated coefficients on the soil quality. In general, soil quality has a positive impact on the leasing to asset ratio, which indicates an interesting result. We can interpret this result by the asymmetric information hypothesis. Actually the soil quality is less observable for money lenders but more observable for both farmers and landlords. Hence, the better soil quality increases the costs of contracts for money lenders (who provide financial support for land buyers) compare to the landlords. This leads to a higher leasing to assets ratio for better quality.

Table 7 also indicates that while the estimated coefficient by the OLS is equal to 0.00391 the estimated coefficients for conditional quantile functions decrease from 0.0059 to 0.0012. This result reflects the fact that when the leased to asset ratio is low then the soil quality has more impact on the leased to asset ratio. Hence we can argue that the marginal impact of soil quality on the leasing to asset ratio is decreasing. In graph 6 we present a concise summary of estimated coefficients on the soil quality by the quantile regressions and their 95% confidence intervals. The estimated coefficient by the OLS also is superimposed on this graph.

Conclusion

Based on the classical finance theory, three types of substitutions between leases and debt are possible: Perfect substitutes or positive and one-to-one relationship between leases and debt; less than perfect substitutes, which indicates that leases are less risky than the debt-financed assets; and finally more than perfect substitutes, which indicates that leased assets are riskier than the debt-financed assets. New finance theory argues that leases and debt can be complements. In this paper we examine the relationship between leases and debt in farm capital structure in Illinois. We estimate the displacement ratio between the leases and debt by OLS method, Tobit model, and quantile regression. In order to control for debt capacity we use three variables: the age of farm's operator; the net worth of the farm; and soil quality. Our results indicate that all estimated parameters are highly significant. Also, our estimates indicate that displacement ratio in Illinois farms is less than but close to one. Hence leased assets in Illinois are less risky than the debt-financed assets. Our results from quantile regressions indicate that the impacts of farm characteristics on the distribution of leasing to assets ratio is an important issue and it can be captured by the quantile regression.

References

Adams, M. and P. Hardwick. “Determinants of the Leasing Decision In United Kingdom Listed Companies.” *Applied Financial Economics*, 8(1998):487-94.

Andersson, H. “Owner Operated Land, Fixed Rent Leases and Share-Leasing Arrangements: Some Implications for Asset and Debt Restructuring of Minnesota Farms.” *University of Minnesota*, Dissertation (2000).

Ang, J, and P. Peterson. “The Leasing Puzzle.” *The Journal of Finance* 39(1984):1055-65.

Bierlen, R., L. N. Langemeier, B. L. Ahrendsen, and B. L. Dixson. “Land Leasing and Debt on Farms: Substitutes or Complements.” *Quarterly Journal of Business and Economics* 39(2000)18-36.

Deloof, M. and I.Verschueren. “Are Leases and Debt Substitutes? Evidence from Belgian Firms.” *Financial Management* 28(1999):91-5.

Erickson, S. M. “An Empirical Investigation of the Cross Sectional Determinants of Lease Use.” *Journal of Economics and Finance* 17(1993):17-28.

Finucane, T. J. “Some Empirical Evidence on the Use of Financial Leases.” *The Journal of Financial Research.* 11(1988):321-33.

Franks, J. R. and S. D. Hodges. “Valuation of finance Lease Contracts: A Note.” *Journal of Finance* 33(1978), 675-69.

Idol, C. “A Note on Specifying Debt Displacement and Tax Shield Borrowing Opportunities in Financial Lease Valuation Models.” *Financial Management* 9(1980):24-29.

Klein, B., R. Crawford, and A. Alchian. “Vertical Integration, Appropriable Rests, and The Competitive Contracting Process.” *Journal of Law and Economics* 21(1978):279-326.

Koenker, R and K. F. Hallock. “Quantile Regression.” *Journal of Economic Perspective* 15(2001):143-56.

Levy, H., and M. Sarnat. “Leasing, Borrowing, and Financial Risk.” *Financial Management* 8(1979):47-54.

Lewellen, W. G., M. S. Long, and J. J. McConnell. “Asset Leasing in Competitive Capital Markets.” *Journal of Finance* 31(1976):737-98.

Marston, F. and R. S. Harris. “Substitutability of Leases and Debt In Corporate Capital Structures.” *Journal of Accounting, Auditing and Finance* 3(1988):147-64

McConnell, J. And J. S. Schallheim. “Valuation of Asset Leasing Contracts.” *Journal of Finance Economics* 12(1983):237-86.

Miller, M. H. and W. W. Upton. “Leasing, Buying and the Cost of Capital Service.” *Journal of Finance* 21(1966):761-86.

Myers, S. C., D. A. Dill, and A. J. Bautista. “Valuation of Finance Lease Contracts.” *Journal of Finance* 31(1976):799-819.

Table 1: Summary Statistics of Illinois Farm Characteristics in 2000

Statistics	Leasing Ratio	Debt Ratio	Age	Net Worth	Index of Soil quality
Mean	0.53	0.10	51	820822	80.36
Standard Error	0.01	0.00	0	16405	0.26
Median	0.57	0.08	50	624624	83.00
Mode	0.00	0.00	50	425688	90.00
Standard Deviation	0.25	0.08	11	761040	12.25
Range	1.00	0.67	80	7598337	60.00
Minimum	0.00	0.00	21	0	40.00
Maximum	1.00	0.67	101	7598337	100.00
Number of observations	2152.00	2152.00	2152	2152	2152.00

Table 2: Distribution of Leasing Ratio by the Age of Operators

Leasing to asset ratio	*Age Less Than 40 Years*	*Age Between 40 and 50 Years*	*Age Between 50 and 60 Years*	*Age More Than 60 Years*
Less than 10 percent	4.0	3.4	6.5	16.8
10-20 percent	2.7	2.6	6.0	11.1
20-30 percent	2.0	4.9	7.4	12.4
30-40 percent	3.7	5.0	9.4	15.5
40-50 percent	7.0	9.3	13.8	13.8
50-60 percent	13.4	18.2	13.5	11.3
60-70 percent	17.4	17.5	15.7	8.6
70-80 percent	23.1	22.8	17.4	6.5
80-90 percent	23.7	15.5	9.1	3.4
90-100 percent	3.0	0.6	1.2	0.6

Table 3: Estimated Intercepts by the Quantile regression, OLS and Tobit model

Type of Regression		*Parameter*	*t-ratio*	*95% Confidence Interval*	
				Lower Bound	Upper Bound
Quantile Regressions:	10%	0.6040	6.9800	0.4343	0.7736
	20%	0.6548	10.8400	0.5364	0.7733
	30%	0.7798	16.3200	0.6861	0.8735
	40%	0.7952	17.6300	0.7067	0.8836
	50%	0.8723	23.5500	0.7997	0.9449
	60%	0.9066	26.5100	0.8396	0.9737
	70%	0.9129	30.4000	0.8540	0.9718
	80%	0.9809	43.9000	0.9370	1.0247
	90%	0.9694	38.7900	0.9204	1.0184
Ordinary Least Square		0.8339	24.3100	0.7666	0.9012
Tobit Model		0.8087	25.8860		

Table 4: Estimated rate of substitutions by the Quantile regression, OLS and Tobit model

Type of Regression		*Parameter* γ_1	*Parameter* α	*95% Confidence interval of* α*	
				Lower Bound	Upper Bound
Quantile Regression:	10%	-1.2054	0.8296	0.7099	1.0630
	20%	-1.1939	0.8376	0.7095	0.9756
	30%	-1.2291	0.8136	0.7092	0.9503
	40%	-1.1809	0.8468	0.7499	0.9633
	50%	-1.1811	0.8467	0.7428	0.9624
	60%	-1.1893	0.8408	0.7511	0.9398
	70%	-1.1920	0.8389	0.7544	0.9335
	80%	-1.1695	0.8551	0.7877	0.9847
	90%	-1.0536	0.9491	0.8420	1.0736
Ordinary Least Squares		-1.0917	0.9160	0.8267	1.0217
Tobit Model		-1.0020	0.9980		

* Calculated by Bootstrap method

Table 5: Estimated parameters for age by the Quantile regression, OLS and Tobit model

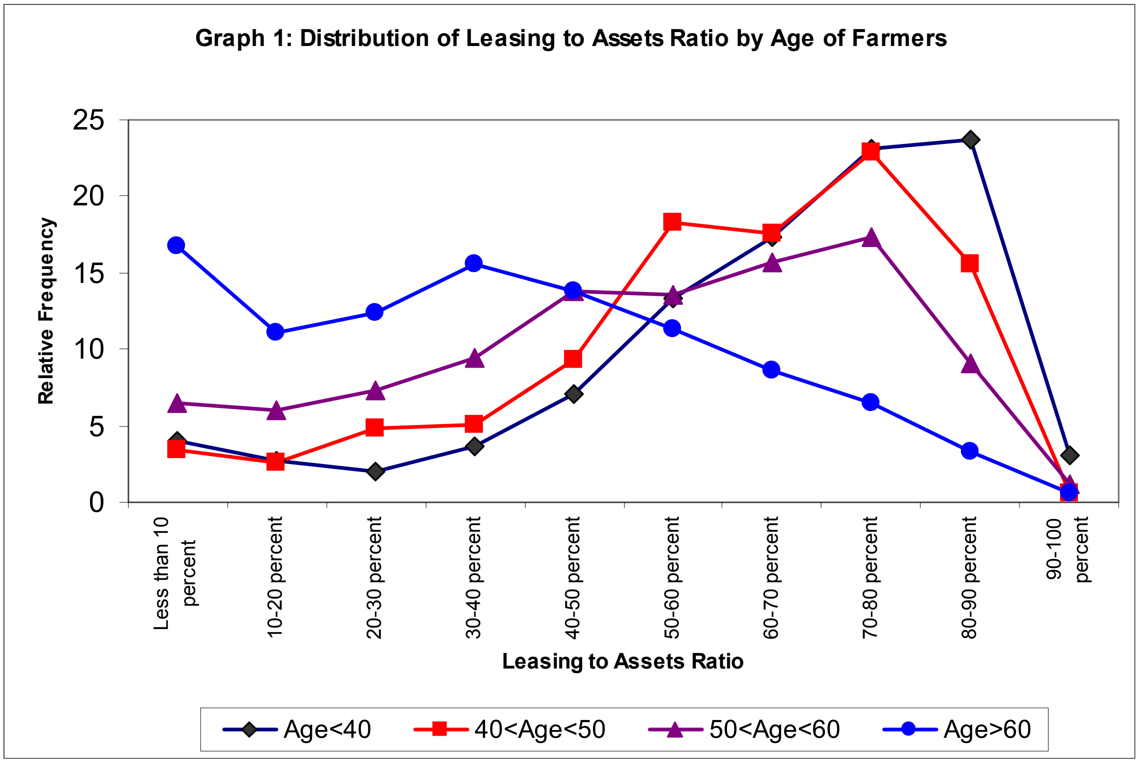
Type of Regression		*Parameter*	*t-ratio*	*95% Confidence Interval*	
				Lower Bound	Upper Bound
Quantile Regression:	10%	-0.01080	-9.95000	-0.01292	-0.00867
	20%	-0.00946	-12.80000	-0.01091	-0.00801
	30%	-0.00878	-15.42000	-0.00990	-0.00766
	40%	-0.00741	-14.06000	-0.00844	-0.00638
	50%	-0.00688	-16.42000	-0.00770	-0.00606
	60%	-0.00582	-15.41000	-0.00656	-0.00508
	70%	-0.00486	-14.77000	-0.00550	-0.00421
	80%	-0.00393	-16.25000	-0.00440	-0.00345
	90%	-0.00238	-8.33000	-0.00293	-0.00182
Ordinary Least Square		-0.00779	-20.04000	-0.00855	-0.00702
Tobit Model		-0.00648	-18.14966		

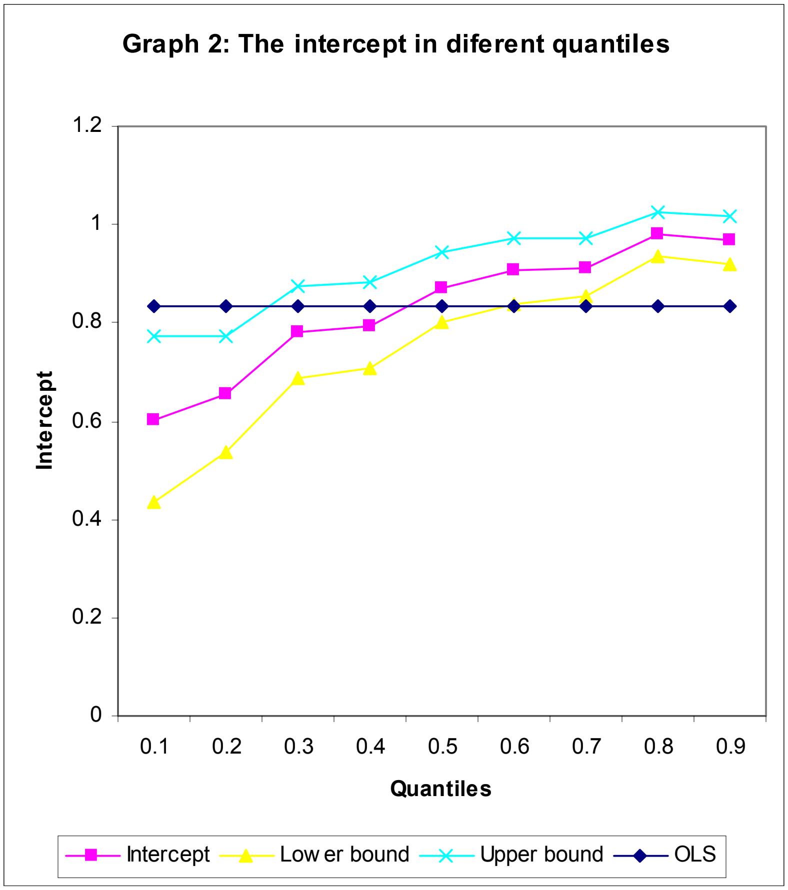
Table 6: Estimated parameters for net worth by the Quantile regression, OLS and Tobit model

Type of Regression		*Parameter*	*t-ratio*	*95% Confidence Interval*	
				Lower Bound	Upper Bound
Quantile Regression:	10%	-0.145	-13.8100	-0.165	-0.124
	20%	-0.174	-23.5600	-0.188	-0.159
	30%	-0.173	-27.9900	-0.186	-0.161
	40%	-0.179	-27.4500	-0.192	-0.166
	50%	-0.178	-30.0800	-0.190	-0.167
	60%	-0.184	-29.8800	-0.196	-0.172
	70%	-0.173	-28.0400	-0.185	-0.161
	80%	-0.156	-29.0000	-0.166	-0.145
	90%	-0.130	-17.2100	-0.144	-0.115
Ordinary Least Square		-0.139	-25.3100	-0.150	-0.128
Tobit Model		-0.145	-29.2501		

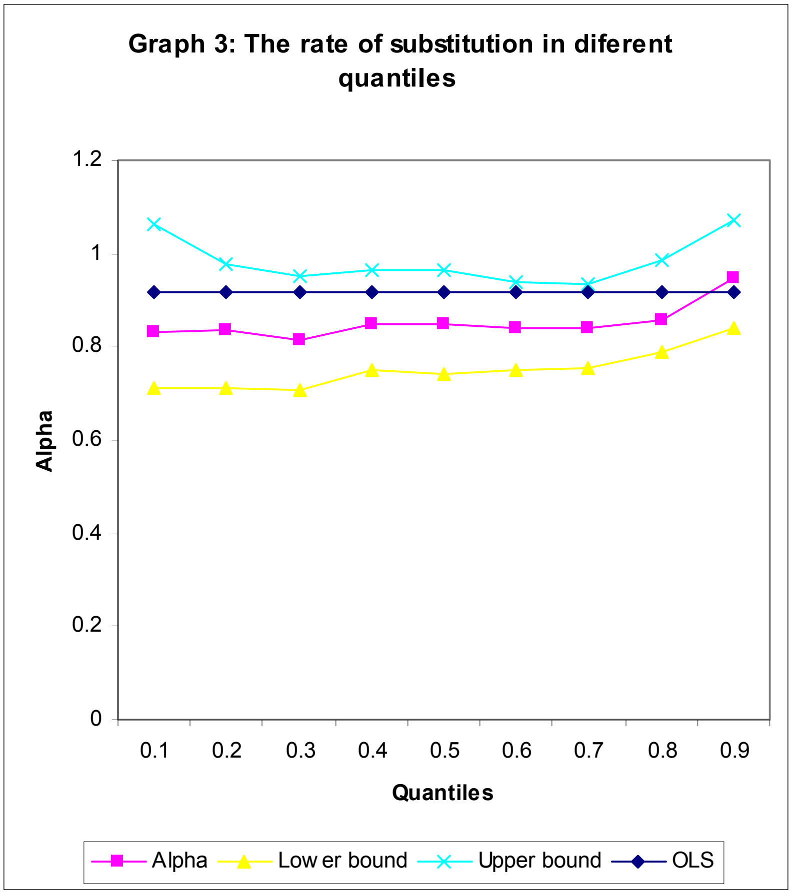
Table 7: Estimated parameters for soil quality by the Quantile regression, OLS and Tobit model

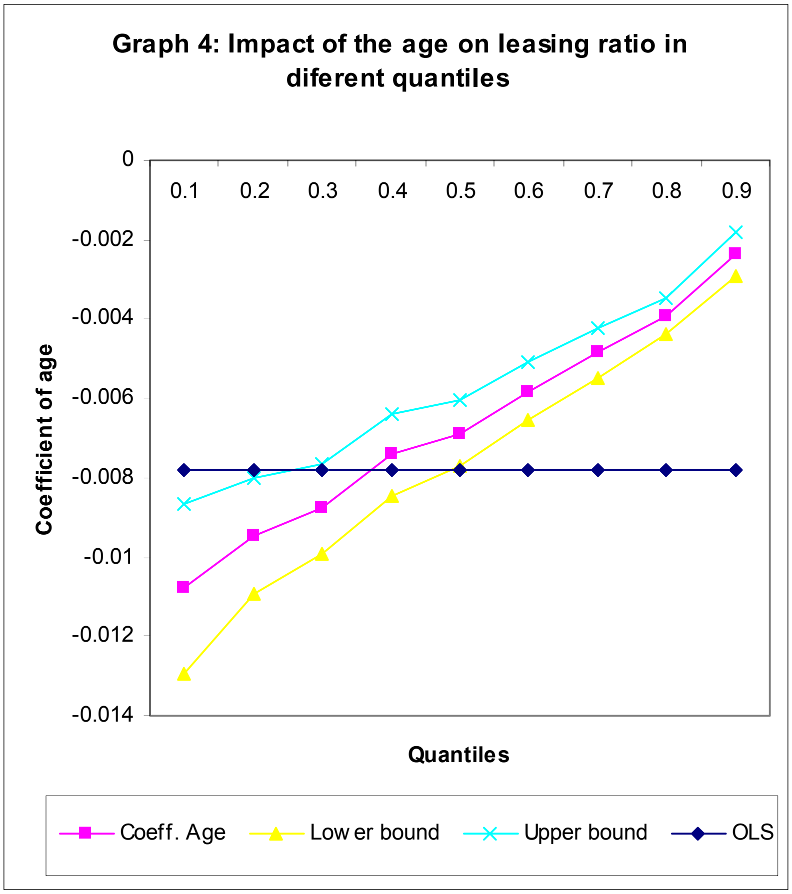
Type of Regression		*Parameter*	*t-ratio*	*95% Confidence Interval*	
				Lower Bound	Upper Bound
Quantile Regression:	10%	0.00590	7.48000	0.00435	0.00745
	20%	0.00597	10.33000	0.00484	0.00711
	30%	0.00491	10.80000	0.00402	0.00580
	40%	0.00449	10.46000	0.00365	0.00533
	50%	0.00374	10.59000	0.00305	0.00444
	60%	0.00319	9.74000	0.00254	0.00383
	70%	0.00288	10.16000	0.00232	0.00344
	80%	0.00176	8.33000	0.00134	0.00217
	90%	0.00115	4.88000	0.00069	0.00162
Ordinary Least Square		0.00391	11.94000	0.00327	0.00456
Tobit Model		0.00357	12.02872		

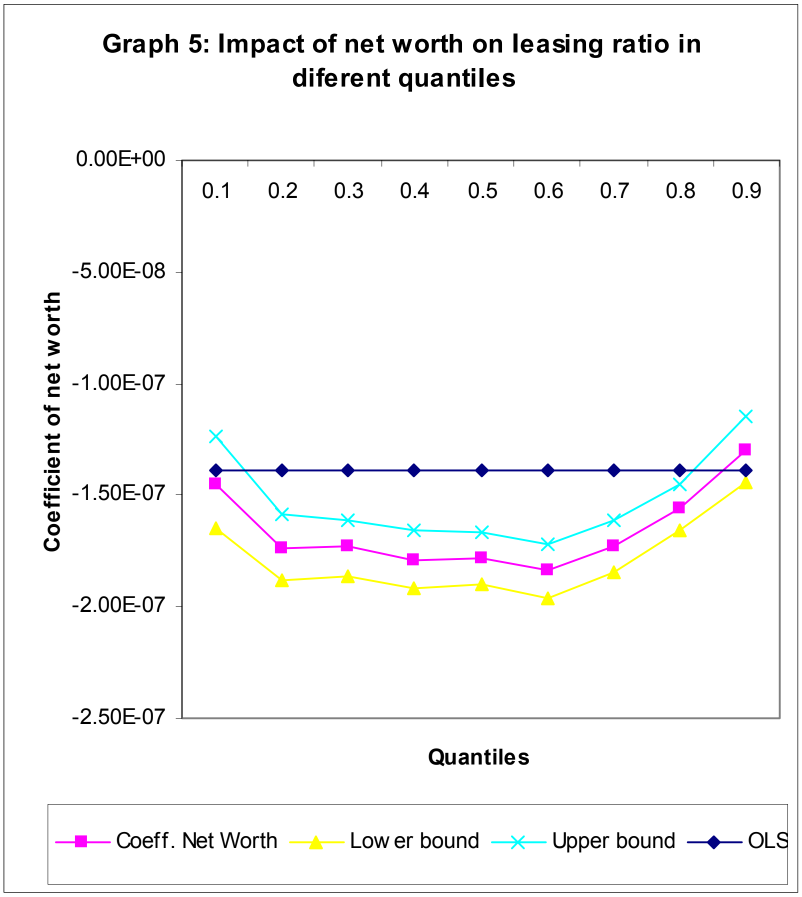

Graph 1: Distribution of Leasing to Assets Ratio by Age of Farmers
25
20
15
10
5
0
Relative Frequency
Less than 10 percent
10-20 percent
20-30 percent
30-40 percent
40-50 percent
50-60 percent
60-70 percent
70-80 percent
80-90 percent
90-100 percent
Leasing to Assets Ratio
Age<40
40<Age<50
50<Age<60
Age>60

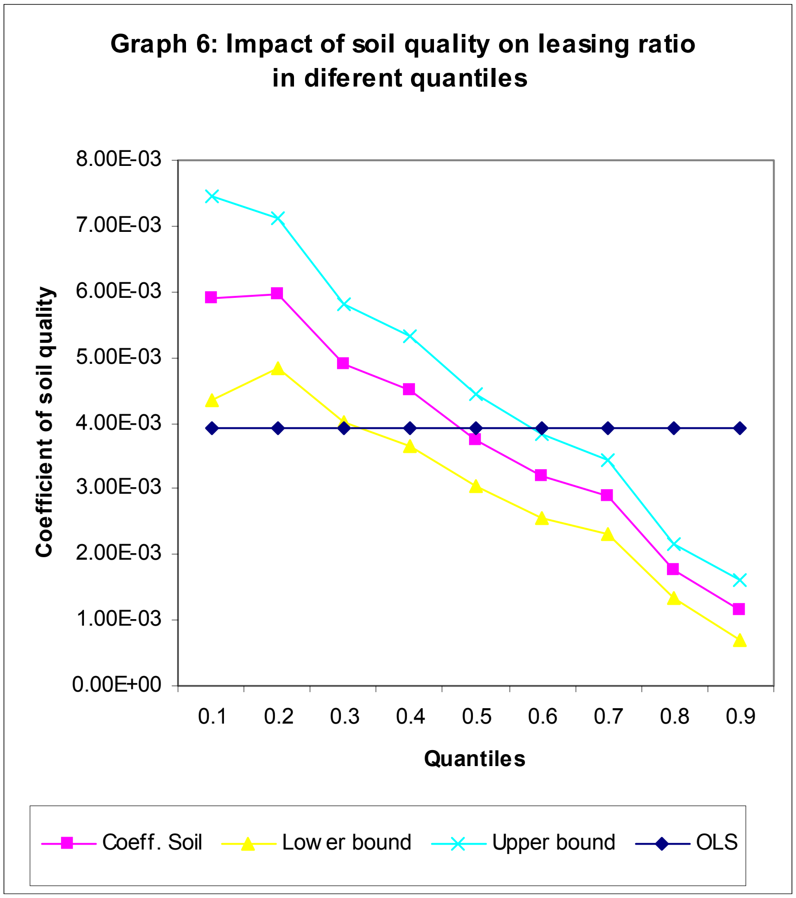


Graph 2: The intercept in diferent quantiles
1.2
1
0.8
0.6
0.4
0.2
0
Intercept
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
Quantiles
Intercept
Low er bound
Upper bound
OLS


Graph 3: The rate of substitution in diferent quantiles
1.2
1
0.8
0.6
0.4
0.2
0
Alpha
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
Quantiles
Alpha
Low er bound
Upper bound
OLS


Graph 4: Impact of the age on leasing ratio in diferent quantiles
0
-0.002
-0.004
-0.006
-0.008
-0.01
-0.012
-0.014
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
Coefficient of age
Quantiles
Coeff. Age
Low er bound
Upper bound
OLS


Graph 5: Impact of net worth on leasing ratio in diferent quantiles
0.00E+00
-5.00E-08
-1.00E-07
-1.50E-07
-2.00E-07
-2.50E-07
Coefficient of net worth
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
Quantiles
Coeff. Net Worth
Low er bound
Upper bound
OLS


Graph 6: Impact of soil quality on leasing ratio in diferent quantiles
8.00E-03
7.00E-03
6.00E-03
5.00E-03
4.00E-03
3.00E-03
2.00E-03
1.00E-03
0.00E+00
Coefficient of soil quality
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
Quantiles
Coeff. Soil
Low er bound
Upper bound
OLS