Risk Balancing Using Farm Level Data: An Econometric Analysis

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Abstract:

In the paper, an econometric model is proposed to test the risk balancing hypothesis using farm level data. For the purpose, a constraint on expected utility maximization with respect to farm financial structure is given. Cluster method is applied to pick out the farms on the efficient frontier under expected utility maximization given risk attitude and actual interest rate. Regression results are given and compared to previous findings. Farm characteristics associated with the risk behaviors of farms with optimal utility are identified and compared with other farms.

Keyword: Risk Balancing, Farm, Econometric Model

Risk Balancing Using Farm Level Data: An Econometric Analysis

Under the framework of expected utility maximization, risk balancing hypothesis states that change in business risk might produce opposite movement in financial risk (Barry and Robinson, Collins, Gabriel and Baker). Generally, business risk is measured as the volatility of rate of return on farm asset while financial risk refers to debt to equity ratio. Past studies on risk balancing have shown that risk balancing might lead to failure of government policy in reducing farm risk (Featherstone, et al), and change in risk attitude or interest rate would lead to different adjustment in financial structure (Barry and Robison).

Recent studies focused on the effects of risk management strategies on farmers' risk balancing behaviors. For example, Escalante and Barry (2001) employed a risk programming model to illustrate risk balancing behavior of a typical farm. Their study showed that the greater appeal of the risk benefits on diversity in farm risk management might downplay the role of risk balancing, which implies that risk balancing is conditional in practice. By studying the correlation coefficient between business and financial risks in a longitudinal farm level data, Escalante and Barry (2003) found that over 50% out of 82 farms in the study had risk balancing behavior. The following analysis based on two periods cross-sectional data showed that the coefficients react significantly to crop insurance coverage, tenure position, and crop diversification index in the late 1990s.

In the study, we investigate the implication of the expected utility maximization with respect to farm financial structure, so as to put the empirical analysis under the framework of optimal utility. An econometric model is then proposed to test the risk balancing hypothesis directly with farm level data. Based on the regression results, farm characteristics associated with the risk balancing behavior are identified.

Model

The equilibrium analysis approach assumes that individual farm maximize expected utility of wealth. Under the mean-variance framework (Barry and Robison, Collins), the objective function can be expressed as:

$$MaxEV(R_E) = E(R_E) - \frac{1}{2} r s_E^2 \quad (1)$$

where $E(R_E)$ and s_E^2 are mean and variance of rate of return on equity, r is the risk aversion parameter.

Collins (1985) showed that if we write return on equity as a function of debt to equity ratio d, expected rate of return on asset $\bar{r}$ and its variance s_r^2, and interest rate i, that is

$$\begin{aligned} E(R_E) &= (1+d)\bar{r} - id \\ s_E^2 &= (1+d)^2 s_r^2 \end{aligned} \quad (2)$$

the maximization problem becomes

$$\underset{d}{Max} EV(d) = \bar{r}(1+d) - id - \frac{1}{2} r s_r^2 (1+d)^2 \quad (3)$$

Solving the problem with respect to d gives

$$d^* = \frac{\bar{r} - i}{r s_r^2} - 1 \quad (4)$$

The second-order condition is met by risk-averse proprietors.

Equation (4) captures the relationship between business risk s_r^2 and financial risk d under the framework of expected utility maximization. In equilibrium, risk balancing implies

$$\frac{dd^*}{ds_r^2} = -\frac{\bar{r} - i}{r s_r^3} < 0 \quad (5)$$

when $\bar{r} - i$ is greater than zero, and given the definition of s_r^2 and d .

Optimal utility level of a farm is required for equation (5), i.e. risk balancing to be held. Past empirical studies generally either assume that the results, derived from the aggregate data, would describe the behavior of "aggregate decision makers" if hard to obtain adequate farm level data (Gabriel and Baker), or apply risk programming model to a representative farm under different level of risk aversion parameters (Escalante and Barry 2001) to obtain the level.

In this study, however, we assume that, in practice, some of farms are optimally operated while others are not, and thus there is an efficient frontier of optimal utility formed by those optimally operated farms. The expected utility maximization model of equation (3) has an implied requirement for optimizing $\frac{\bar{r}-i}{s_r}$ given d^* (Appendix A). Suppose optimal level of $\frac{\bar{r}-i}{s_r}$ is *m*, a constraint utility maximization problem based on equation (3) could be constructed as

$$(6) \qquad \begin{aligned} &\underset{d}{Max} EV(d) = \bar{r}(1+d) - id - \frac{1}{2} r s_r^2 (1+d)^2 \\ &s.t. \quad \frac{\bar{r}-i}{s_r} \le m \end{aligned}$$

Define $\bar{r}-i$ as the net rate of return, then m is the maximum net rate of return per unit of risk taken. If r and i are given as constant, it can be proved that optimal utility level $E(d^*)$ satisfying the following inequality

$$(7) \qquad EV(d^*) \le i + \frac{m^2}{2r}$$

Under the condition, value of m determines the optimal utility level for the farm. In other words, the underlying efficient frontier is a function of m. The relationship between optimal utility and *m* is illustrated in Figure 1. For the farms (denoted as *) on the curve, they have the highest $\frac{\bar{r}-i}{s_r}$ for any given d. In other word, if value of $\frac{\bar{r}-i}{s_r}$ for a given farm equals to m, then from inequality (7), the farm must be on the efficient frontier, and thus has the optimal expected utility $EV(d^*)$. Given this, an efficient frontier could be found by comparing actual value of $\frac{\bar{r}-i}{s_r}$ from the farms with the same value of d if we know the risk aversion parameter r and interest rate i for each farm in the dataset.

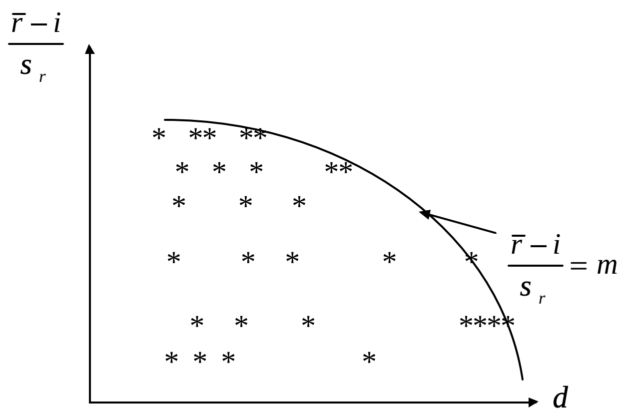

Figure1 Farms on the Efficient Frontier

In practice, interest rate i, defined as ratio of interest payment to total debt, can be calculated using farm level data. As for the risk aversion parameter r, no direct data is available. When programming method is applied, it is usually given as a constant (McCarl and Spreen). However, the method would not tell us what exactly the parameter is for the underlying farm. On the other hand, inaccurate estimate of the parameter might lead to overestimate or underestimate of the optimal utility level for a given farm (Appendix B).

Consider this, we assume that risk aversion of a farm is a function of some variables available from the data. In the study, two variables are assumed to affect farmer's risk attitude, ratio of variance of rate of return on asset to insurance expense per acre tillable land (RVI), and Tenure. RVI gives the risk taken by per unit of insurance expense on per acre tillable land. Generally, given the risk level, the higher insurance expense per unit land, the more risk aversion the farmer is, and vise verse. Tenure position distinguishes landowner from manager. Theoretically, landowner is more risk aversion than manager in farm operation.

Farms with similar r and i are then grouped together by cluster method based on RVI, tenure and i. Moreover, for comparison with similar research, farm size is also included in the variables, and is defined as ratio of farm tillable acres to total tillable acres in the dataset (Size).

Of farms with similar r and i, farms on the efficient frontier could be formed by those with the biggest value of $\frac{\bar{r}-i}{s_r}$ among those with the same or similar debt to equity ratio d (Figure 1). For the reason, cluster method is applied again to the partitioned groups obtained above respectively, and some subgroups will be produced based on the value of debt to equity ratio d. Farms with the highest values of $\frac{\bar{r}-i}{s_r}$ within each subgroup are picked out as those on the efficient frontier.

Since risk balancing is an equilibrium result under the definition of equation (4), it should occur among the farms on the efficient frontier rather than out of it. From equation (4), we have $s_r^2 = \frac{\bar{r}-i}{r(1+d^*)}$. Using first order Taylor series approximation, s_r^2 can be expressed as a linear regression model of $\bar{r}-i$ and d around the optimal values, which is

(8) $$s_r^2 = a + b_1(\bar{r}-i) + b_2 d + u$$

where $s_r^2, \bar{r}$, i and d are defined the same as above.

Applying the model to the farms on the efficient frontier provide an equilibrium testing of the hypothesis. The estimated coefficients b_1 and b_2 are the marginal contributes of the independent variables to s_r^2 respectively. Risk balancing implies estimated coefficient b_2 should be negative.

Empirical Analysis

Farm level data from IFBFM (Illinois Farm Business Farm Management) during the period of 1996 to 2002 are used in the study. The farms should be in the dataset for at least four years during the period, and total 1964 farms are included. Table1 gives the summary statistics of the data.

These farms are partitioned into four groups based on four variables defined above, including ratio of variance of rate of return on asset to insurance expense per acre tillable land (RVI), ratio of farm interest payment to total debt (i), Tenure, and ratio of farm tillable acres to total tillable acres (Size). A nonhierarchical clustering technique Kmeans from Stata is applied. The method breaks the farms into distinct non-overlapping groups based on the selected variables. As a result, values of the selected variables within each partitioned group are similar, but different among the groups. The four partitioned groups consist of 268, 463,689 and 544 farms respectively.

On the basis, Kmeans method by debt to equity ratio d is applied again to pick out farms on the efficient frontier within each partitioned group. In the process, the average distance of d for each subgroup is controlled to be 1%, 3%, 5% and 8% respectively. The average distance is defined as mean of the difference of maximum and minimum values of d divided by the minimum value of d within each subgroup. Table 2 illustrates the percentile of farms on the efficient frontier within each partitioned group. On average, around 25% of the farms within each group are on the efficient frontier.

The regression model is then applied to the cross sectional of data from the farms on the efficient frontier within each group respectively. The results are listed in Table 3. For comparison, regression results without considering efficient frontier are given in Table 4.

From Table 3, of the farms on the efficient frontier, farms in the fourth group demonstrate consistently strong risk balancing behavior, while those in the third group have no such behavior. Compared to farms in the fourth group, those in the second group have relatively weak risk balancing behavior. As the average distance of d increase, the behavior is less obvious. Behavior of farms in the first group is uncertain, and it seems that other factors might affect the dependent variable other than the debt to equity ration d. Moreover, the contradictory results of the third group in Table 3 and Table 4 proved the value of considering efficient frontier. Overall, farms demonstrated risk balancing behaviors are around 43% of the average 471 farms on the efficient frontier. The percentage is close to the finding of Escalante and Barry (2003).

Table 5 provides the summary statistics for the farms on the efficient frontier for the 3% case(1). Comparing the result reveals some interesting farm characteristics for the underlying farms, especially those with risk balancing behavior. For example, the fourth group that illustrates consistent risk behavior consists of relatively younger farmers with the lowest average age (46) and smallest farm size (0.0503%). These farms mainly operate on the leasing land and depend on external fund. As a result, they have the lowest tenure position (0.25%) and highest debt to equity ratio (1.13). These farms also have the highest RVI (0.96%). Together with the lowest tenure position, we could say that these farms are relatively less risk aversion. Their net rate of return measured as $\bar{r} - i$ is also the highest.

By contrast, the second group consists of farmers of moderate age (49). They have a medium tenure position (16.6%), but the largest farm size (6.07%). These farms do not borrow much with an average debt to equity level (0.76). Values of the interest rate paid (6.17%), RVI (0.60%), and $\bar{r} - i$ (20%) for the group are all at a moderate level.

The third group consists of mainly old farmers who operate largely on owned land. Their average age is 54. On average, they own 46.6 percent of land, but land quality is the lowest one, an average soil rating of 77. Moreover, these farms have the lowest debt level (0.49) and thus lowest interest rate paid (4.8%). RVI value is also the lowest (0.56%). As a result, farmers in this group are highly risk aversion. The lowest net rate of return (17.5%) could be another proof.

Farm characteristics for the first group are a little confusing. Although their debt to equity level is not the highest (0.84), they paid the highest interest rate on average (6.4%). These farms also lease most of their land as those in the fourth group, while their farm size is somewhat closer to that of group 2.

In summary, younger leasing farmer is more prone to take risk and thus obtain a relatively higher rate of return. Older farmers are more risk aversion, and own considerable share of land. Moreover, most of farms are clustered either in the third or in the fourth groups. There are 1333 farms belong to the two groups, taking up nearly 70% of the total farms in the data set.

Summary and Discussion

In the paper, an econometric model is proposed to test the risk balancing hypothesis using farm level data. Under the expected utility mean variance framework, a constrained utility maximization is proposed to construct the efficient frontier under the optimal utility. Cluster method is applied to pick out the farms on the efficient frontier under expected utility maximization given risk attitude and actual interest rate. For the farms on the efficient frontier, an econometric model is used to test the hypothesis.

Two important implications are obtained from the results. First, even with farm level data, risk balancing is showed to be conditional. On average, around 43% of the average 471 farms on the efficient frontier demonstrated risk behaviors. The results support strongly the finding of Escalante and Barry (2003). Second, farm characteristics affect the risk balancing behaviors. Generally, farms with lower risk averse and relatively higher return tend to demonstrate risk balancing behaviors. They usually have higher debt level.

The econometric model is on the assumption that s_r^2 is a homogenous function of degree 1 of $\bar{r} - i$ and d, that is, variable $\bar{r} - i$ is independent of d (Modigliani and Miller Proposition, Collins) given r and i. The assumption of independence might be violated in practice and lead to bias of estimates for d. For example, for the case of 3% average distance of d, a simple regression of $\bar{r} - i$ on d for the third group reveals a significantly positive coefficient for d. For the regression adjusted R^2 is only 6%, the bias is not considered in the study.

Theoretically, risk aversion parameters r reflect the magnitude of risk aversion. The classification applied gives an approximate measurement of the parameter. Although the results could be rough, it is still an effective approach in maintaining similarity of the parameters within each group. In addition, the varied average distances of debt to equity ratio d within the partitioned groups are applied to differentiate farms on the efficient frontier. According to inequality (7), too fine a classification might overestimate the frontier, and vise versa. The problem might be solved by further considering confidence level in clustering.

Note

(1) Summary statistics for the case of 1%, 5% and 8% are similar to that of the 3% case. The Tables for the other three cases are available from the authors upon request.

Reference:

Barry, J.P, Ellinger P., Hopkin J.A. and Baker, B.C. Financial Management in Agriculture. Interstate Publishers, Danville, Illinois, Sixth Edition, 2001

Barry, P.J., Escalante C. L. and Bard, S. K. "Economic Risk and the Structural Characteristics of Farm Business", Agricultural Finance Review, (Spring 2001): 73-86

Barry, P.J. and Robison L.J. " Portfolio Theory and Financial Structure: An Application of Equilibrium Analysis", Agricultural Finance Review, 47(1987): 142-51

Collins R. A " Expected Utility, Debt-Equity Structure, and Risk Balancing", American Journal of Agricultural Economics, 67(1985): 627-29

Eicheberger, J. and Harper I.R., Financial Economics, Oxford University Press, 1997

Escalante, C.L. and Barry, P. J., "Farm-Level Evidence on the Risk Balancing Hypothesis from Illinois Grain Farms." Selected Paper to be presented at 2001 AAEA Annual Meeting, 2001

Escalante, C.L. and Barry, P. J., "Risk Balancing in an Integrated Farm Risk Management Plan" Journal of Agricultural and Applied Economics, 33.3 (December 2001): 413-429

Featherstone, A.M. Moss, C. B. Baker, T. G. and Preckel, P. V., "The Theoretical Effects of Farm Polices on Optimal Leverage and the Probability of Equity Losses" American Journal of Agricultural Economics 70(1988): 572-79

Gabriel, S. C. and Baker, C. B. "Concepts of Business Risk and Financial Risk" American Journal of Agricultural Economics: 62 (1980): 560-64

McCarl B.A and Spreen H. T., Applied Mathematical Programming: Using Algebraic Systems, Department of Agricultural Economics, Texas A&M University 1997

Mas-Colell, A. Whinston M.D. and Green J.R. Microeconomic Theory, Oxford University Press, 1995

Sydsaeter, K. Strøm, A. Berck P. Economists' Mathematical Manual, 3rd, Springer-Verlag Berlin. Heidelberg 1999

Appendix A

For the constrained maximization problem,

$$\underset{d}{Max} EV(d) = \bar{r}(1+d) - id - \frac{1}{2} r s_r^2$$
$$s.t. \quad \frac{\bar{r}-i}{s_r} \le m$$

If we substitute the optimal debt to equity ratio d^* back in equation (2), the optimal utility level be

$$\begin{aligned} EV(d^*) &= \bar{r}(1+d^*) - id^* - \frac{1}{2} r s_r^2 (1+d^*)^2 \\ &= \bar{r}\left(\frac{\bar{r}-i}{r s_r^2}\right) - i\left(\frac{\bar{r}-i}{r s_r^2} - 1\right) - \frac{1}{2}\frac{(\bar{r}-i)^2}{r s_r^2} \\ &= i + \frac{1}{2r}\left(\frac{\bar{r}-i}{s_r}\right)^2 \\ &\le i + \frac{m^2}{2r} \end{aligned}$$

Appendix B

From inequality (5), suppose a farmer has a risk aversion parameter r_1 and a constant i and objective m, his/her optimal utility can be written as

$$EV(d^*) \le i + \frac{m^2}{2r_1}$$

Suppose it holds in equality for the farm. Now, if we take the farmer's risk attitude as r_2, and $r_2 < r_1$, we will overestimate the farmer's optimal utility level for

$$EV(d') = i + \frac{m^2}{2r_2} > i + \frac{m^2}{2r_1} = EV(d^*)$$

Similarly, if $r_2 > r_1$, we will underestimate the farm's optimal utility level.

Table 1 Summary Statistics of Selected Variables of the Total Farm Data

Variable	Definition	Farms	Mean	Standard Deviation	Minimum	Maximum
Tenure	Ratio of owned land acres to tillable acres (%)	1964	21.66	24.69	0.00	100.00
RVI	Ratio of variance of rate of return on asset to insurance expense per acre tillable land (%)	1964	0.96	2.18	0.01	71. 63
Size	Ratio of farm tillable acres to total tillable acres (%)	1964	0.05	0.03	0.00	0.31
i	Ratio of farm interest payment to total debt (%)	1964	5.66	2.64	-0.10	76.74
Cropshare	Ratio of crop sale to total gross farm return	1964	0.93	0.12	0.03	1.14
Soil Rating	Soil rating index	1964	80	12	44	100
Age	Age	1850	51	11	6	84
d	Debt to Equity Ratio	1964	0.69	0.94	0.00	12.96
$\bar{r} - i$	Rate of return on assets minus interest payment to total debt (%)	1964	19.48	23.68	-62.54	433.22
s_r^2	Variance of Return on Total Assets (%)	1964	1.19	11.23	0.00	310.76

Table 2 Farms on the Efficient Frontier

Average Distance of	Group	1	2	3	4
d	Farms in Each Group	268	463	689	544
1%	Farms	110	180	250	205
	Percentage	41%	39%	36%	38%
3%	Farms	65	115	170	135
	Percentage	24%	25%	25%	25%
5%	Farms	58	76	130	110
	Percentage	22%	16%	19%	20%
8%	Farms	52	60	95	71
	Percentage	19%	13%	14%	13%

Percentage is calculated as farms on efficient frontier within each group to the number of farms in the same group

Table 3 Regression Results for the Farms on the Efficient Frontier within Each Group with Average Distance of 1%, 3%, 5% and 8% respectively [(a)]

Results for Average Distance of d = 1%

Variables \ Group	1		2		3		4	
	Estimates	t-ratio	Estimates	t-ratio	Estimates	t-ratio	Estimates	t-ratio
d	0.00021	0.56	-0.0013	-2.2**	0.0012	1.03	-0.0014	-1.72***
$\bar{r}-i$	0.01678	4.63*	0.0706	32.46*	0.0807	27.05*	0.0905	12.28*
Constant	-0.00004	-0.04	-0.0086	-11.18*	-0.0096	-8.28*	-0.0173	-6.67*
Adjusted R^2	0.15		0.86		0.76		0.42	
Farms	110		180		250		205	

Results for Average Distance of d = 3%

Variables \ Group	1		2		3		4	
	Estimates	t-ratio	Estimates	t-ratio	Estimates	t-ratio	Estimates	t-ratio
d	-0.00003	-0.07	-0.0017	-2.14**	0.0032	4.46*	-0.0019	-1.88***
$\bar{r}-i$	0.00617	1.47	0.0749	30.81*	0.0414	13.65*	0.0977	12.38*
Constant	0.00159	1.47	-0.0099	-9.58*	-0.0050	5.83*	-0.0205	-6.84*
Adjusted R^2	0.00		0.89		0.59		0.53	
Farms	65		115		170		135	

Results for Average Distance of d = 5%

Variables \ Group	1		2		3		4	
	Estimates	t-ratio	Estimates	t-ratio	Estimates	t-ratio	Estimates	t-ratio
d	0.00051	2.4*	-0.0004	-1.17	0.0037	4.75*	-0.0018	-1.58
$\bar{r}-i$	0.00447	1.62	0.0139	5.8*	0.0373	10.8*	0.1017	11.44*
Constant	0.00093	1.32	-0.0001	-0.17	-0.0051	-4.9*	-0.0221	-6.16*
Adjusted R^2	0.10		0.30		0.57		0.54	
Farms	58		76		130		110	

Results for Average Distance of d = 8%

Variables \ Group	1		2		3		4	
	Estimates	t-ratio	Estimates	t-ratio	Estimates	t-ratio	Estimates	t-ratio
d	-0.00028	-0.89	-0.0004	-1.09	0.0040	4.42*	-0.0035	-2.38*
$\bar{r}-i$	0.00413	1.46	0.0149	5.88*	0.0386	9.48*	0.1308	14.95*
Constant	0.00175	2.31*	-0.0003	-0.58	-0.0061	-4.35*	-0.0311	-8.7*
Adjusted R^2	0.02 s_r^2		0.36		0.59*		0.91	
Farms	52		60		95		71	

Note:(1) Dependent Variable is s_r^2

(2) *,**, and *** denote significance at 1%,5% and 10% percent level re spectively

Table 4 Regression Results without Considering Efficient Frontier [(a)]

Variables \ Group	1		2		3		4	
	Estimates	t-ratio	Estimates	t-ratio	Estimates	t-ratio	Estimates	t-ratio
d	0.0005	1.27	-0.0015	-3.92*	-0.0224	-2.91*	-0.0111	-4.5*
$\bar{r} - i$	0.026	7.63*	0.0650	41.86*	0.3721	23.51*	0.3464	21.95*
Constant	-0.001	-1.01	-0.0057	-13.87*	-0.0268	-4.59*	-0.0716	-12.46*
Adjusted R^2	0.19		0.79		0.45		0.47	
Farms	268		463		689		544	
Percentage	14%		24%		35%		28%	

a. Percentage is calculated as farms in each group to total 1964 farms

Table 5 Summary Statistics of Selected Variables for Farms on the Efficient Frontier within Each Group (Average Distance of d is 3%)

Group 1						Group 3					
Variable	Obs	Mean	Std. Dev.	Min	Max	Variable	Obs	Mean	Std. Dev.	Min	Max
Tenure	65	6.72	3.36	1.99	23.17	Tenure	170	45.63	22.87	0.68	100.00
RVI	65	0.74	0.59	0.08	3.85	RVI	170	0.56	0.82	0.01	6.57
Size	65	0.059	0.025	0.017	0.118	Size	170	0.053	0.043	0.004	0.271
i	65	6.40	2.03	3.13	16.32	i	170	4.85	2.47	0.00	8.92
Cropshare	65	0.92	0.13	0.33	1.04	Cropshare	170	0.87	0.18	0.20	1.02
Soil Rating	65	82	13	50	100	Soil Rating	170	78	13	50	100
Age	58	51	9	37	75	Age	158	54	12	30	84
d	65	0.840	0.915	0.006	6.087	d	170	0.49	0.93	0.00	9.02
$\bar{r}-i$	65	21.96	9.51	9.21	62.87	$\bar{r}-i$	170	17.47	22.22	-0.74	161.52
s_r^2	65	0.29	0.32	0.02	1.83	s_r^2	170	0.38	1.34	0.00	13.90
Group 2						**Group 4**					
Variable	Obs	Mean	Std. Dev.	Min	Max	Variable	Obs	Mean	Std. Dev.	Min	Max
Tenure	115	16.60	6.71	5.66	47.14	Tenure	135	0.33	1.58	0.00	16.72
RVI	115	0.60	0.63	0.04	5.09	RVI	135	0.96	1.05	0.10	8.95
Size	115	0.061	0.017	0.021	0.173	Size	135	0.050	0.026	0.011	0.173
i	115	6.17	3.36	1.34	18.86	i	135	5.69	6.56	0.00	76.74
Cropshare	115	0.93	0.10	0.37	1.14	Cropshare	135	0.94	0.12	0.32	1.03
Soil Rating	115	82	11	52	98	Soil Rating	135	83	11	55	100
Age	110	49	10	26	74	Age	129	46	10	6	74
d	115	0.76	0.90	0.00	6.25	d	135	1.13	1.68	0.00	12.96
$\bar{r}-i$	115	20.90	28.93	-5.03	302.59	$\bar{r}-i$	135	30.30	21.02	-62.54	198.20
s_r^2	115	0.45	2.29	0.00	24.49	s_r^2	135	0.70	2.78	0.01	31.44