Farmland Values, Farmer Equity and Equilibrium in the Agricultural Capital Market

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Abstract

Farm ownership in the United States has remained one of the last bastions of the sole proprietorship. This study examines the econometric evidence that this structure fails to meet the equilibrium with broader equity markets in the United States. In particular, the study focuses on the potential division of farm assets into operating assets and farmland. Finding that neither operating assets nor farmland prices move in equilibrium with the broader stock market index, the study turns to agency theory to explain the possible reasons for this persistent disequilibrium.

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> I hated all my toil in which I toil under the sun, seeing that I must leave it to the man who will come after me, and who knows whether he will be wise or a fool? Yet he will be master of all for which I toiled and used my wisdom under the sun. This also is vanity. So I turned about and gave my heart up to despair over all the toil of my labors under the sun, because

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sometimes a person who has toiled with wisdom and knowledge and skill must leave everything to be enjoyed by someone who did not toil for it. (Ecclesiastes 2:18-21a, ESV)

1 Introduction

A popular folklore in rural communities is that farmers live poor and die rich. The core behind this folk knowledge is that farmers borrow money to buy land and then spend years paying off the farm loans. During this repayment period a significant portion of the farmer's operating income is used to pay the interest and principal on the debt issued to pay for farmland. This gain in equity has historically been magnified by increases in farmland prices. The mechanics of the live poor-die rich scenario hides a more fundamental question that has not been addressed. Specifically, suppose that we envision farming as the combination of two groups (or portfolios) of assets – operating assets (i.e., tractors, combines, cotton harvesters, etc.) and real estate. Given this decomposition, one question is whether there are gains or losses from one individual holding both assets? Put slightly differently, could there be a market for farmland owned by non-farmers who rent land to producers? We recognize that there currently exists a significant amount of off-farm ownership of land. However, these owners are largely retired farmers or heirs of deceased farmers who own land and rent it to the sibling that remains in agriculture. Limited inroads have been made by investment groups such as Prudential and Hancock. However, even when these outside interest groups acquire farmland, they may continue to operate the asset through contracted management. The other point is that an arbitrage action where the farmer sells farmland to buy other assets (i.e., a stock portfolio) could improve the position of both investors.

2 Decomposing the Agricultural Asset Portfolio

As a starting point for our analysis, consider the rate of return on agricultural assets used by Collins (1985) in the derivation of the optimal debt model

$$r_{At} = r_{Pt} + a_t \tag{1}$$

where r_{At} is the rate of return on all agricultural assets at time t, r_{Pt} is the rate of return to agricultural operations, and a_t is the appreciation rate for all agricultural assets. Reversing the basic definition, we multiply by the level of agricultural assets (A_t) to yield

$$R_{At} = R_{Pt} + a_t A_t \tag{2}$$

where R_{At} is the dollar return to agricultural assets, R_{Pt} is the dollar return to operations (i.e., the revenues from farming minus the direct cost of production), and $a_t A_t$ is the dollar value of the appreciation in agricultural assets. Next, we depart from Collins's basic formulation by suggesting that most of the appreciation to agricultural assets accrues to farmland. The market value assets other than farmland typically decline. We call this depreciation or capital consumption in the aggregate system of accounts. Given this insight, we rewrite Equation 2 as

$$R_{At} = R_{Pt} - K_t + \tilde{a}_t L_t \tag{3}$$

where K_t is the level (or dollar value) of capital consumption, $\tilde{a}_t$ is the rate of appreciation for farmland, and L_t is the value of farmland owned by the firm. Given this decomposition, we can redefine the rate of return to agricultural assets as

$$r_{At} = \frac{R_{At}}{A_t} = \left[\frac{R_{Pt} - K_t}{A_t - L_t}\right] \frac{A_t - L_t}{A_t} + \left[\frac{\tilde{a}_t L_t}{L_t}\right] \frac{L_t}{A_t}$$
$$= r_{Pt} (1 - s_t) + \tilde{a}_t s_t \ni: s_t = \frac{L_t}{A_t} \tag{4}$$

where s_t is the share of farmland in total assets.

Hence, the return on agricultural assets can be rewritten as a portfolio of operating assets and farmland. Implicitly, this formulation assumes that the assets are owned and operated by the same individual. To complete the concept of divided ownership, we assume that the farmer pays the landowner for the use of the farmland. Specifically, we assume that

$$r_{At} = \left[\frac{R_{Pt} - K_t - \delta r_{Bt} L_t}{A_t - L_t}\right] (1 - s_t) + (\delta r_{Bt} + \tilde{a}_t) s_t \tag{5}$$

where δr_{Bt} is the effective interest rate used to determine the rental rate on land. In general, we would assume that $0 \leq \delta \leq 1$. Specifically, the rate of return to holding farmland and renting it to the farmer (r_{Ht}) is

$$r_{Ht} (\delta) = \delta r_{Bt} + \tilde{a}_t. \tag{6}$$

First, consider the equilibrium between the holding return on farmland in Equation 6 and simply holding the basic corporate bond. Intuitively, there must be an equilibrium level of δ that exactly compensates for additional risk from the capital gains to farmland. In addition, we can rewrite the rate of return to operating assets as

$$r_{Pt} (\delta) = \frac{R_{Pt} - K_t - \delta r_{Bt} L_t}{A_t - L_t}. \tag{7}$$

Regardless of the division, the overall rate of return to agricultural assets remains unchanged

$$r_{At} = r_{Pt}(\delta)(1 - s_t) + r_{Ht} s_t. \tag{8}$$

The economic question is whether the farmer would be better off by adjusting his portfolio (i.e., selling a portion of their farmland or purchasing additional acreage). We will examine the potential gains to this transaction in two ways: examination of the minimum variance portfolio that yields the same rate of return to assets using portfolio analysis, and capital market models of risk.

3 Data

The rate of return to farm assets used in this study is constructed by merging the older State-Level Farm Sector Income and Balance Sheet Estimates (old state panel) with the fifteen individual Agricultural Resource Management Survey (ARMS). Appendix A provides details on how these two data sets were joined.

Given the set of data available, we turn to the definitions of each return. In general, we want to define the overall returns to agricultural assets as total revenue less the direct cost of production including capital consumption. We do not want to include costs of ownership. Hence, we do not deduct interest paid or payments to non-operator landlords. Given this concept, we define the rate of return to farm assets as

$$R_{At} = NCI_t + I_t + NOLL_t - K_t + \tilde{a}_t L_t \tag{9}$$

where NCI_t is the net cash income, I_t is the interest paid, $NOLL_t$ is the payments to non-operator landlords, and K_t is the level of capital consumption. Basically, both datasets consider interest and payments to non-operator landlords as cash expenses.

Hence, they are subtracted from revenues to produce net cash income. Next, we segment the returns into returns to operation and returns land ownership

$$\begin{array}{c} R_{Pt} = NCI_t + I_t + NOLL_t - K_t - \delta r_t L_t \\ R_{Ht} = \left(\delta r_{Bt} + \tilde{a}_t\right) L_t \end{array} . \tag{10}$$

The question then becomes: What is the appropriate charge for farmland? Specifically, what is the appropriate level of δ? Appendix Tabel B.1 presents the state-level rate of return to agricultural operations and farmland for different levels of δ. Based on these values, the riskiness (measured by the coefficient of variation) of each asset is presented in Table 1. Based on these results, $\delta = 0.50$ appears to be the most likely charge for the use of farmland.

[Table 1 about here.]

4 Comparing Investments in Farmland and Operating Assets

Given the decomposition of the return in Equation 8, one question is whether the sale of farmland to purchase more operating assets would improve the farmer's risk/return portfolio. Looking at the problem in a slightly different way, is the observed s_t optimal? We will examine this question using two approaches. In the first approach we examine whether the optimal portfolio is "close" to the observed portfolio (i.e., is the efficient combination of operating assets and farmland derived from portfolio theory approximately what we observe for each state). The second analysis asks whether the assets are appropriately priced. In this section, we approach the problem in two ways. First, we examine whether farm assets (operating assets, holding farmland, and total farm assets) are in equilibrium with the capital market. In the second application we ask whether the operating assets and holding farmland are appropriately priced when we only consider agricultural assets.

4.1 Portfolio Analysis

As a first step, we derive the optimal portfolio of operating assets and farmland by minimizing variance subject to a given rate of return on assets. Specifically, we use the analytical solution of the portfolio problem

$$\begin{aligned} &\min_x \ \frac{1}{2} x' \Sigma x \\ &\text{s.t. } x' \bar{r} \geq \mu \end{aligned} \tag{11}$$

following the formulation presented in Moss (2010, pp.112-119). To analyze the portfolio we solve for the share of operating assets and farmland for a specific state that minimizes the risk given that the expected rate of return is greater than or equal to the expected rate of return on all agricultural assets. Several aspects of the solution can be compared with the observed data. Specifically, the optimal share of farmland can be compared with the actual share of farmland from the data. In addition, we can compare the level of risk for the optimal solution with the standard deviation of returns observed in the data.

The solutions to the formulation in Equation 11 for each state are presented in Table 2. In general the results are fairly comparable with the observed data with three exceptions. Specifically, there are short-sales of operating assets in three states – Indiana, Minnesota, and Wisconsin. The short-sale (or negative investment in operating assets) suggests that the rate of return from holding farmland is far higher than the operating return after adjusting for relative risk. This suggests that factors outside agriculture (i.e., urban pressure) dominate the land market in those states. Apart from those three states, the largest discrepancy is for Georgia where the portfolio analysis suggests that 67 percent of the asset portfolio is investment in farmland compared with 75 percent of the actual assets being farmland.

[Table 2 about here.]

In addition, apart from the three states with negative investments in operating assets, the standard deviation for the optimal portfolios is fairly close to the historically observed standard deviations. The largest discrepancy appears to be for Florida whose portfolio standard deviation is about 5 percent smaller than the standard deviation from the historical data. Hence, assuming $\delta = 0.50$ yields optimal portfolios that match up with a division of ownership between operating assets and farmland values.

4.2 Market Models of Risk and Return

In this section we examine whether the operating assets and farmland values are appropriately priced using two different market models to account for relative risk. The first market model is the Capital Asset Pricing Model (CAPM). The CAPM model is used to analyze whether agricultural assets (operating assets, holding farmland, and total returns to agricultural assets) are appropriately priced with respect to the general return on equities. For this analysis we use the return on the Standard and Poor's 500 portfolio (henceforth the S & P portfolio). A second analysis then analyzes whether operating returns and holding farmland are priced appropriately with respect to each other and the returns on agricultural assets in other states.

4.2.1 Capital Asset Pricing Model

The market model for risk states that in equilibrium, the price of an investment will compensate for its riskiness. The Capital Asset Pricing Model developed by Lintner (1965), Mossin (1966), and Sharpe (1964) constructs a pricing equilibrium between individual investments and a market rate of return

$$r_{it} = r_f + \beta_i \left(r_{mt} - r_f \right) \tag{12}$$

where the individual investment's β_i measures the relative riskiness of asset i with respect to the market return. This study uses Black's approach to testing for this equilibrium (Campbell et al., 1996, pp.196-203) to test for the market efficiency of each set of returns (i.e., operating returns, holding returns, and total returns).

The first step is to estimate each asset's β using ordinary least squares using the simple linear model

$$r_{it} = \alpha_i + \beta_i r_{mt} + \epsilon_t. \tag{13}$$

This approach departs from other approaches by not specifying a risk-free rate of return. The estimates for each return for the fifteen states in our sample are presented in Appendix Table C.1. Given the vector of estimated βs we then estimate a market return relationship. Specifically, if the Capital Asset Pricing Model holds, differences in the average rates of return must be explained by their relative risk measured by their market βs

$$\bar{r}_i = \gamma_0 + \gamma_1 \beta_i + \nu_i. \tag{14}$$

The returns are explained by the equilibrium if $\gamma_0 = 0$, $\gamma_1 = 1$, and the errors are uncorrelated.

After estimating the βs in Equation 13, we estimate γ_1 as

$$\hat{\gamma}^* = \frac{\left(\iota - \hat{\beta}^*\right) \hat{\Sigma}^{*-1} \left(\bar{r} - \hat{\beta}^* \bar{r}_m\right)}{\left(\iota - \hat{\beta}^*\right)' \hat{\Sigma}^{*-1} \left(\iota - \hat{\beta}^*\right)} \tag{15}$$

where ι is a conformable vector of ones (i.e., 15×1) and $\bar{r}_m$ denotes the average return on the market portfolio. We use our initial βs as initial estimates of $\hat{\beta}^*$ and let $\hat{\Sigma}^*$ equal the identity matrix. While it looks a little convoluted, Equation 15 is actually a weighted least squares estimate of Equation 14. Next, given our current estimate of $\hat{\gamma}^*$, we can re-estimate $\hat{\beta}^*$

$$\hat{\beta}^* = \frac{\sum_{i=1}^{T} \left(r_t - \hat{\gamma}^* \iota\right) \left(r_{mt} - \hat{\gamma}^*\right)}{\sum_{t=1}^{T} \left(r_{mt} - \hat{\gamma}^*\right)^2} \tag{16}$$

where r_t denotes the vector of returns on the assets we are analyzing in each year t and r_{mt} is the return on the market portfolio. Finally, the covariance matrix ($\hat{\Sigma}^*$) can be estimated as

$$\hat{\Sigma}^* = \frac{1}{T} \sum_{t=1}^{T} \left(r_t - \hat{\gamma}^* \left(\iota - \hat{\beta}^*\right) - \hat{\beta}^* r_{mt}\right) \left(r_t - \hat{\gamma}^* \left(\iota - \hat{\beta}^*\right) - \hat{\beta}^* r_{mt}\right)' \tag{17}$$

In this application, we iterate on Equations 15 through 17 twice. The test statistic for capital market efficiency is then

$$J = T \left(\ln \left|\hat{\Sigma}^*\right| - \ln \left|\hat{\Sigma}\right|\right) \overset{a}{\sim} \chi^2_{N-1} \tag{18}$$

where $\hat{\Sigma}$ is the variance matrix for the original regression residuals.

The estimated parameters for the Black CAPM formulation are presented in Table

3. The ordinary least squares results impose no restrictions on Equation 13 while iterated results impose the market clearing conditions on the estimates for Equation 13. The estimated γ^* in Table 3 then imposes the theoretical restrictions on Equation 14. The first important result in Table 3 is that the restriction imposed values of β are much different from the estimates with the theoretical restrictions imposed. In fact, columns 8 and 10 of Table 3 indicate that several of the results switch signs (hence, the tabular value of "a"). However, none of the values of β switch signs for holding farmland. The largest negative discrepancy is for Iowa while the largest positive discrepancy is for Wisconsin. However, the signs of the changes are somewhat misleading as will be further discussed.

[Table 3 about here.]

Following this general pattern of differences between the ordinary least squares and iterated βs, the test statistic for market equilibrium can be rejected for operating returns and total returns, but the market equilibrium is not rejected for holding farmland. Specifically, the J statistic from Equation 18 is 7.7946 which is distributed χ^2_{14}. This value cannot be rejected at any conventional confidence level – hence, we conclude that holding farmland meets the CAPM market equilibrium conditions. However, certain aspects of the results for holding farmland suggest that this equilibrium result is only technical. Specifically, nine of the states (California, Florida, Illinois, Indiana, Iowa, Kansas, Minnesota, Nebraska, and Washington) have negative βs. This implies that these returns are safer than the implicit Black risk-free portfolio. Another result that supports this contention is the estimated value of γ^* in Table 3. In all likelihood, these βs are probably not statistically significant at any reasonable level of confidence. In general, we would expect that the estimated value of γ^* should be close to 1.0. The fact that it is small for all the asset bundles considered suggests that the returns are extremely low risk with respect to the market index (i.e., the return on the S & P portfolio). Thus, even though holding farmland appears to be in CAPM equilibrium, the numerical estimates raise several questions.

4.2.2 Arbitrage Pricing Model

One of the factors driving the failure of the CAPM model in Section 3.2.1 is the fact that the residuals from the ordinary least squares estimations are correlated across assets. Specifically, the CAPM assumes that the market portfolio is sufficient to explain the co-movements in returns (i.e., the correlation between returns after accounting for the relationship with the market return should be low). However, in our application, the S & P returns do not account for a significant amount of the correlation between agricultural returns. One possible solution to this difficulty is the Arbitrage Pricing Theorem developed by Ross (1976) as implemented in the Arbitrage Pricing Model of Roll and Ross (1980). In this framework, we assume that the market price is generated by the effect of a set of common factors

$$r_{it} = \lambda_0 + \lambda_1 F_{1t} + \lambda_2 F_{2t} + \cdots \lambda_k F_{kt} + \epsilon_{it} \tag{19}$$

where the F_{jt} are the common factors and λ_j are constants. Several alternatives have been suggested to estimate the common factors such as deriving the factors from the covariance of the returns using confirmatory factor analysis and specifying the common factors using macroeconomic variables (i.e., growth in money supply, growth in gross domestic product, and changes in unemployment). In this analysis, we use confirmatory factor analysis. As a starting point, assume that the variance matrix for the returns can be expressed as a function of common factors

$$\Sigma(\theta, \Theta) = \theta\theta' + \Theta \tag{20}$$

where θ is a $k \times N$ matrix of factors (where k is the number of common factors and N is the number of assets in the analysis), and Θ is a diagonal matrix of idiosyncratic risk for each asset return. The parameters can be estimated using maximum likelihood based on the logarithm of the likelihood function

$$L = -\frac{T}{2}\left(\ln|\Sigma(\theta, \Theta)| + \mathrm{tr}\left(S\Sigma(\theta, \Theta)^{-1}\right)\right) \tag{21}$$

where tr (.) is the trace operator. Given these estimates, arbitrage equilibrium is then tested using the specification

$$\bar{r}_i = \lambda_0 + \lambda_1\theta_1 + \lambda_2\theta_2 + \cdots \lambda_k\theta_k + \xi_i. \tag{22}$$

For the returns to be in arbitrage equilibrium, the linear expression in Equation 22 must explain the variation in the average returns.

The estimated factor loadings form the variance matrix containing both the returns to operations (RO) and the holding return for farmland (RH) presented in Appendix Table D.1. Eight common factors explain 87.2 percent of the common variation. Further, the hypothesis that more than eight factors are required to model the common variation in returns can be rejected at the 0.10 level of significance. However, eight factors to represent thirty returns seems a little excessive.

The ordinary least squares results for the specification in Equation 22 are presented in Table 4. To test for arbitrage equilibrium, we construct a Wald test of all the factor loading equal to zero (but not the constant which is simply the risk-free rate of return). The Wald test yields a result of 0.00013 which is distributed χ^2_8.

Obviously, the statistic cannot be rejected at any conventional confidence level, so we conclude that the returns are in arbitrage equilibrium. As a secondary test for arbitrage equilibrium, we append a vector that is one if the investment is an investment in farmland and zero if the investment is an investment in operating assets. These secondary regressions are presented in the second column of Table 4. These results indicate that investment in farmland is not a significant determinant of the rate of return. Thus, the returns from holding farmland appear to be in risk/return equilibrium with the operating returns. This result is consistent with the portfolio results in Section 3.1. Specifically, given the covariance matrix and expected returns from the sample, the optimal portfolios mimic the actual portfolio of operating assets and investment in farmland observed in the data. In the Arbitrage Pricing Model results, the value of farmland does not form information that can be used to generate risk free returns. If the coefficient on farmland in Table 4 was statistically significant and positive, investors could make a risk free profit by selling operating assets short and buying farmland. Similarly, if the coefficient on farmland in Table 4 were statistically significant and negative, the investor could make a profit by shorting farmland value and buying agricultural operations. Hence, we are left with the somewhat comforting implication that farm operating assets and holding farmland are in a risk/return equilibrium.

[Table 4 about here.]

This is not to say that the Arbitrage Pricing Model results are completely consistent with expectations. As stated earlier, there appears to be too many common factors. Undoubtedly, some of these factors have to do with different types of agriculture. For example, the USDA has developed several typologies. Before 2000, the Economic Research Service divided the country into ten regions - Northeastern

States, Lake States, Northern Plains, Corn Belt, Appalachia, Southeastern States, Delta States, Southern Plains, Mountain States, and Pacific States. More recently, this state level segmentation has been replaced with regions such as the Northern Crescent, Heartland, Northern Great Plains, Eastern Seaboard, Eastern Uplands, Mississippi Portal, Prairie Gateway, Basin and Range, and the Fruitful Rim. These divisions are intended to recognize that agriculture in the United States varies by region. Different factors affect the returns and risk of the regions differently. From this perspective, eight factors are less than ten, so eight factors may be acceptable. An additional point of concern is that the risk-free rates of return for the portfolio are relatively high (i.e., 0.156). While the average return to agricultural operations for Arkansas (0.130), California (0.243), Florida (0.242), Georgia (0.121), and North Carolina (0.210) are in this range, the other returns to operation and all the returns to holding farmland are less than 1 standard deviation below the estimated risk-free rate of return. Possibly, an iterated estimation process for the λs may provide additional insights into the risk-free rate of return on all agricultural assets.

5 Empirical Model of Optimal Debt

The preceding section of this study focuses primarily on market-based arbitrage between assets. Basically, the question asked was whether it is efficient to hold both farmland and operating assets. The results confirmed that both assets could be held in an efficient portfolio. However, the results of the Capital Asset Pricing Equilibrium Model rejected an equilibrium between the capital market and either operating assets in agriculture or total assets in agriculture. In addition, while the Capital Asset Pricing Model results did not reject the equilibrium between returns to holding farmland and the capital market, the results contained anomalies. Specifically, the estimated

βs appeared to be consistent with extremely low risk investments with returns less than the implied risk-free asset.

The disequilibrium between the capital market and the return for agricultural assets has interesting implications. Most importantly, additional equity enters the sector only through retained earnings or securitized debt (i.e., mortgages or liens against equipment or other assets). Another implication is that we are not in a Modigliani and Miller (1958) world. The valuation of capital assets is dependent on the individual's source of capital.

To investigate the effect of risk on this capital market equilibrium in the sector, we return to the debt-balancing model proposed by Collins (1985). Collins demonstrated that the firm's optimal debt traded the additional utility of expected income against the disutility of additional risk – hence, the individual chooses the level of debt that balances utility. Ramirez et al. (1997) provide a reparameterization of Collins' formulation based on an optimal control formulation

$$\delta_t = 1 - \frac{(1-b)\,\sigma^2_{At}}{\mu_{At} - K_t} \tag{23}$$

where δ_t is the optimal debt-to-asset position at time t, b is the relative risk aversion coefficient, σ^2_{At} is the variance of the rate of return on assets at time t, and μ_{At} is the expected rate of return on assets at time t.

While Equation 23 has been used in theoretical models to demonstrate how various factors such as government policies (Featherstone et al., 1988) or different tax rates on capital gains (Moss et al., 1989), empirical applications of the model have been few. The major problem involves the estimation of a measure of variance that changes either across time or across individuals. Moss et al. (1990) provided empirical confirmation of the risk-balancing model using aggregate U.S. returns and modeling the variance using an Autoregressive Conditional Heteroscedasticity formulation.

In this study, we take a slightly different approach. First estimate the return for each state at each time period using a locally linear weighted regression formulation of time, the real interest rate, the real return on the S & P portfolio and the growth in real personal income. Then we square the residuals and fit another locally linear regression of the squared residual from the first equation as a function of time. The argument is that the estimated variance coefficient by state and year is measured with error, but the measurement error should attenuate. Hence, the larger the measurement error, the more likely the estimated coefficient on variance (or relative riskiness) should be biased toward zero.

Given this formulation, we estimate a linearized form of Equation 23

$$\delta_{it} = \alpha_0 + \alpha_1 \left(r_{At} - K_{Tt} \right) + \alpha_2 \hat{\sigma}^2_{At} \tag{24}$$

where r_{At} is the rate of return to all agricultural assets, K_{Tt} is the cost of capital, and $\hat{\sigma}^2_{At}$ is the estimated variance of the rate of return on agricultural assets. In this analysis we define K_{Tt} from the data by dividing the interest paid by the total level of debt. Additional work is needed on this definition. Specifically, this computed interest rate is more of an average interest rate than a marginal interest rate. As interest rates change, farmers optimally adjust. If the interest rate is increasing, they avoid refinancing old debt. However, as interest rates decline farmers may choose to bundle old debt with new debt in order to reduce their interest rate.

Table 5 presents the results of estimating Equation 24 using a fixed effect estimator across all fifteen states. Note that the fixed effects model removes the constant (e.g., there is a single constant for each state). Overall, the $F\left(2, 740\right) = 77.1533$ which can be rejected at any conventional level of significance. Hence, the risk balancing results are significant. In fact, we have empirical evidence that farmers respond to changes in relative risk when selecting their debt levels. However, the $R^2 = 0.161$, so other factors are important.

[Table 5 about here.]

6 Theories of Firm Structure and Asset Ownership

So what do each of these pieces add up to? Farm operating assets and farmland ownership appear to be in a risk/return equilibrium. However, both sets of agricultural returns (and the return to all farm assets) are not in equilibrium with the overall capital market (measured as the return to the S & P portfolio). In addition, the level of debt is determined by the risk-balancing model. Taken together, the results add up to a conclusion that most in agricultural finance hold as a truism – there is something unique about agriculture that separates agricultural financial markets from the general equity market. Two potential sources of this separation are the institutional arrangement of the farm firm and the possibility of excessive idiosyncratic risk.

It is interesting that neoclassical economics assumes so much about the behavior of the firm without a rigorous model of the firm itself. In fact the firm in the context of the sole-proprietorship is a fiction. The firm is the decision maker. Collins (1985) implicitly makes this assumption by formulating the optimal debt as an expected utility problem. In this section, we develop the firm first within the context of New Institutional Economics and then within Agency Theory (Jensen and Meckling, 1976). Each of these paradigms will put a slightly different spin on the question of whether farmland ownership can be separated from the ownership of other agricultural assets.

6.1 New Institutional Economics

Coases's (1937) article "The Nature of the Firm" is typically considered the cornerstone of New Institutional Economics. Going back to Adam Smith's (1982) original manufacturer where one man cuts the wire, a second attaches a head, and a third sharpens the end into a pin highlights the potential gains to labor specialization. However, the question left unresolved is whether the three individuals could be independent contractors or whether a single entity called a firm must employ the three workers.

In this context, Coase develops a model where the boundaries of the firm are determined by the tradeoff between transaction costs and diseconomies of scope. Transaction costs are the costs of ascertaining the value of the intermediate product used in the production process. For example, in the case of pin production, suppose that the wire is cut and the head is attached by one firm who sells the intermediate product to another firm that sharpens the end and markets the product to the consumer. The derived demand for the intermediate product is determined by the final demand for that certain variety of pins (i.e., long pins) and the marginal cost of sharpening the end of the pin. The transaction cost is the cost of determining this intermediate value. The finishing firm may contend that the demand for long pins is short this year; thus, he is only willing to pay the producer of the intermediate product 3/4 of last year's price. The transaction cost involves the cost of determining if the claim is true.

The counter-force is the possibility of diseconomies of scope. Diseconomies of scope involve the cost of managing an activity that is not part of the firm's core business. In the simple example, the assumption would be that the management of cutting the wire and attaching the head was much different than sharpening the end and marketing the pin. Obviously in this simple example, this claim is far-fetched. However, we can envision the scenario of tire manufacturers where the management of petroleum production to produce rubber for manufacturing tires is much different than the management of manufacturing. Hence, the firm would choose to buy their inputs even given significant transaction costs.

The tradeoff between the two costs then produces different types of transaction governance. If the transaction costs are low and the diseconomies of scope are high, the input is acquired in a market transaction (i.e., market governance). If on the other hand, the transaction costs are high and the diseconomies of scope are low, the input is produced with the firm (i.e., governance by ownership). In the latter case, the firm hires employees to cut the wire and add the head.

What does this theory have to do with farmland markets? The storyline is the same, except instead of dealing with an intermediate form of the product we are dealing with the market of an important input – farmland. We assume that the market for farmland involves establishing the price of an extremely heterogeneous factor of production. This heterogeneity increases the transaction cost for the market for the input to the farmer (i.e., the service flow from farmland). The farmer must choose between two forms of governance – rent the asset or own the asset. From the farmer's vantage point, the diseconomies of scope appear smaller than the transaction cost associated with discerning the quality of the asset. This tips the structure toward ownership even with the diseconomies of scope (i.e., living poor).

From the landowners perspective, the problem is similar. Each year the landlord must specify the rental rate. However, his value is determined by expected yields, input and output prices, and the abilities of the farmer. The transaction costs for the landowner may be quite large. Of course, contracts have been developed to offset some of the transaction costs. For example, share rental agreements may make the agreements incentive compatible.

Williamson (1975, 1985) provides a more rigorous formulation of the transaction cost paradigm. In this formulation, transaction costs are functions of asset specificity, frequency of transactions, and uncertainty. Asset specificity involves the uniqueness of the investment to a particular transaction. In the Adam Smith example, we assumed that the first stage produced a long wire for a particular finisher. That output was not very specific. The producer could cut the end off the product and sell it to a manufacturer making short pins (however the intermediate suppliers of short pins may be more specific). The real-life example would be the scenario where a particular tract of land required specific investment in equipment to farm. For example, assume the land along the Mississippi River in Arkansas tends to be relatively wet. Hence, farming it may require the purchase of track-equipment (i.e., Caterpillar Challenger tractors). Once the farmer invests in this equipment, he has assets specific to that relationship (or at least more costly equipment than required for other farmland). The landlord could then use this asset specificity to increase his rent.

The frequency attribute relates to the number of times the contract is renegotiated. As the number of renegotiations increases, each party has more opportunity to adjust the terms of the contract. This enables the terms to evolve as more is known about the economics of the relationship. For example, a lease that is renegotiated once every five years has a higher transaction cost than leases that are renegotiated every year.

Finally, increases in uncertainty increase the transaction cost. Take for example the introduction of a new cell phone with unique abilities. The final demand for this product is highly uncertain, hence it is difficult to estimate the profitability of the relationship. The cell phone may be a flop in which case the firms will take a loss on their product specific investments.

Farmland fits particular aspects of the Williamson model. In some cases investment in relationship specific assets may be relatively high. For example, cotton pickers are more specific than combines. Alternatively, the specificity may be spatial in the case where a farmer invests in a second set of some equipment because the leased land is distant from his home operation. Secondly, rental arrangements occur fairly frequently. This allows the farmer to get out of a lease agreement when he finds that the land is difficult to farm. Alternatively, the landlord can search for other renters if the farmer's abilities do not match his farmland. In any case, the annual returns to farmland tend to be fairly uncertain. High corn prices that accompanied the drought of 2012 coupled with the increased demand for ethanol have given way to much lower expected corn prices in more recent years with the stagnation in the demand for corn used to produce ethanol.

6.2 Agent Models

Another set of models that explains the anomalies in behavior associated with different ownership forms is the Agent model proposed by Jensen and Meckling (1976). Following the discussion of Moss (2013), we assume that a farmer owns all the farm assets. The farmer does not necessarily maximize profit, but instead maximizes expected utility. In this case, the farmer takes some non-pecuniary benefits such as home consumption (i.e., the farmer kills one steer per year for beef). However, the farmer also has a labor/leisure choice for the last hour of labor (however, it is possible that many farmers actually find farming recreational). Within this context, the farmer's choices are optimal.

Next, we hypothesize that the farmer chooses to sell some of his assets and lease them back. This transaction is the essence of diversifying the ownership of agricultural assets. The farmer could sell farmland and retire debt. Any excess could be invested in other assets (i.e., stocks and bonds). However, the farmer now has less of a commitment from operating income (e.g., at least the farmer does not make principle payments). The question is whether this trade affects the level of economic value created from farmland.

Following the Jensen and Meckling (1976) formulation, the answer is no. The total level of assets did not change, but the income from the assets are now being shared across two individuals. The total amount of income from the farm assets received by the farmer has declined. This decline changes the marginal utility of effort because the farmer receives only a fraction of the income from that effort. Naturally, the level of effort the farmer will expend declines. Hence, the total return to agricultural assets declines.

From an arbitrage perspective, this result suggests that owner/operators may be willing to pay more for farmland than outside investors. Specifically, if the profits from separated ownership are lower because of agency, outside investors will be willing to pay less for farmland if they have the same opportunity cost of capital. However, if the owner/operator's only source of capital is debt capital, his cost of capital may be endogenous. The more money the owner/operator borrows, the higher the financial risk (Gabriel and Baker, 1980). Hence, the banks will charge a higher interest rate. Therefore, there may be an equilibrium between the agency cost and the financial risk.

7 Conclusions and Suggestions for Further Research

This study examines the ownership pattern for farmland based on the agricultural folklore that farmers live poor and die rich. At first glance, the folklore would appear a statement of the farm philosophy. However, it points to a more fundamental financial question – why do farmers make forced savings payments (i.e., principle payments)? By selling assets and leasing them back, farmers could increase consumption in the short term. Alternatively, investment in agriculture could be exchanged for investment in stocks and bonds.

As a starting point, we analyzed whether the returns to agricultural operations and holding farmland formed an efficient risk/return portfolio. Specifically, we found that both farmland and operating assets would be held in an optimal portfolio. Next, we concluded that neither operating assets nor holding farmland were in arbitrage equilibrium with general stock market returns. Finally, our empirical evidence suggested that operating assets are in arbitrage equilibrium with land ownership. Further, the arbitrage equilibrium exists between the fifteen Agricultural Resource Management Survey states. Taking these results together, we conclude that outside investors could gain from diversifying into farmland. Returns from farmland are essentially risk-free with respect to other financial investments. This implies that the cost of capital inside agriculture for the purpose of buying farmland is higher than can be explained by relative risk in the rate of return to land ownership.

The risk/return analysis is not without weaknesses. First, the results for the Capital Asset Pricing Model are suspect because the market portfolio (e.g., the Standard & Poor's 500 index) does not account for all the common variability in agricultural returns. Hence, there are reasons to suspect whether the S & P index provides an appropriate measure of risk. Second, the estimated coefficients are small and sometimes negative in the case of farmland values. This result is consistent with less than risk-free investment. While we accept the conjecture that the risk in investment in farmland is small, one possibility is that by averaging across farms the sample systemically understates the risk to either investment in operating farm assets or holding farmland. Future research should investigate whether the original variability can be recovered from the sample. This recovery may be relatively straightforward for the ARMS sample. However, given that the farm sample really does not exist in the older data, it may be difficult to recover the disaggregated variability before 2003.

Recognizing the possible shortcomings of the risk/return models, we conclude that farmers could gain from the "short-sale" of farmland to non-farm investors. A plethora of reasons have been suggested for the unwillingness of farmers to undertake such transactions. For example, some would suggest that the rural ethic puts a premium on owning the factors of production. Alternatively, there may be an inheritance motivation – I inherited this land from my father and I want to pass it to my son. However, in this study, we develop two different institutional models that suggest that outside ownership may produce lower asset values. The New Institutional Economic paradigm suggests that in some cases transaction costs are higher than diseconomies of scope. Hence, the returns on assets are higher simply because it would be more costly to establish an efficient rental price. Alternatively, the Agency Theory approach suggests that separating the ownership from the production activities reduces the farmer's incentives which reduces the return on assets. This reduction in the rate of return would reduce the maximum bid that outside investors are willing to pay for farmland. The Agency Theory effect may be offset if the opportunity cost of capital for outside investors is significantly lower than the marginal cost of debt capital to farmers.

Given these possibilities, can future research analyze the likelihood of each hypothesis? One approach would be to compare regions where off-farm ownership or rental arrangements are more frequent than areas with less off-farm ownership. One possibility is that some crops reduce the transaction cost (i.e., returns per acre for corn/soybean agriculture throughout the Corn Belt may be similar). Thus, either the share of farmland leased or the lease rate could be regressed on the type of agriculture, the average return and the standard deviation of the return for the county, and other factors such as the share of family-lease arrangements could be formulated to test the transaction cost model. One test for the Agent Theory model would involve regressing the return on agricultural assets as a function of the share of rented land. Of course, this relationship needs to include other factors such as farm size (returns to scale may be significant) and the age of the operator (many younger farmers rent more farmland because they have more binding capital constraints).

Apart form these institutional models, other factors bias the farmer's choice in favor of farmland ownership. Specifically, ownership guarantees access. Farmland changes operators infrequently. Any parcel of farmland may be available for purchase by individuals outside the family once every second generation. In addition, partially due to transaction costs, rental agreements may persist between landlords and farmers for decades. Hence, the decision not to purchase a parcel of farmland may severely reduce the farmer's access to additional farmland for years. Hence, the decision to pass up the opportunity to purchase farmland may be the reverse of the option value for farmland analyzed by Moss et al. (2003). The challenge is forming an empirical model so that institutional behavior could be separated from option pricing behavior.

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A Description of Data

To estimate empirical adjustment factors we start by creating a sample of logarithmic difference ratios

$$z_{ij} = \ln\left[\frac{x_{Aij}}{x_{Oij}}\right] \tag{A.1}$$

where x_{Aij} is the observation of characteristic j for state i in the 2003 ARMS sample (i.e., x_{A11} is the value of total acres for Arkansas in the ARMS financial data for 2003) and x_{Oij} is the comparable value in the old state panel. Thus,z_{11} is the relative logarithmic difference between the reported acreage in Arkansas reported between the two samples. The complete dataset is presented in Table A.1. Also presented in Table A.1 are the simple averages by state and by category. The data indicate some variation between approximations. The average variation is relatively small for California at 0.01056, but this average masks a range of ratios between 0.38432 for acreage to -0.64035 for net cash income. To provide a more systematic adjustment, we propose using the adjustment

[Table 6 about here.]

$$\tilde{z}_{ij}(\delta) = \delta \bar{z}_i + (1 - \delta) \bar{z}_j \tag{A.2}$$

where δ is an estimated parameter, $\bar{z}_i$ is the average logarithmic difference for a particular state and $\bar{z}_j$ is the average logarithmic difference for a particular category. The optimal weight is selected by minimizing the average logarithmic difference

$$Z(\delta) = \sum_{i=1}^{N} \sum_{c=1}^{C} \omega_{ij} \left(z_{ij} - \tilde{z}_{ij}(\delta) \right)^2 \tag{A.3}$$

where ω_{ij} is a matrix of weights.

The final point in the process is then to assign a set of weights to each state/category observation. It is clear that some portion of the weight should be determined by the size of the state. However, as depicted in Table A.2 there are several potential measures of state size (e.g., number of farms, number of acres, total farm assets, and sales). In this study we use a weighted weight defined as

[Table 7 about here.]

$$\tilde{\omega}_i = a_1\omega_i^{(1)} + a_2\omega_i^{(2)} + a_3\omega_i^{(3)} + a_4\omega_i^{(4)} \tag{A.4}$$

where the a_i are personal weights assigned to each measure of size and $\omega_i^{(k)}$ is that state's share of attribute j. Table A.3 presents a similar weighting by attribute ($\tilde{\omega}_j$). As indicated by the tabular values, we have placed more weight on assets and sales at the state level, and total assets, debt, net cash income and farm real estate values for the categories. The sample weight for the estimation of δ is then defined as

[Table 8 about here.]

$$\omega_{ij} = \tilde{\omega}_i\tilde{\omega}_j. \tag{A.5}$$

These values are presented in Table A.4. Given this formulation, the level of δ that minimizes the error of approximation is 0.7838. Hence, most of the weight is placed on state effects. Given this estimated value δ, the state-level adjustments using Equation A.2 are presented in Table A.5. With this adjustment factor, the new adjusted level of each variable can be computed as

[Table 9 about here.]

[Table 10 about here.]

$$\tilde{x}_{Oij} = \exp\left(-\tilde{z}_{ij}\left(\delta^*\right)\right)x_{Aij} \tag{A.6}$$

where $\tilde{x}_{Oij}$ is the value of the old state panel computed from the ARMS data based on the optimal weight δ^*.

The natural question is then: How good are these estimates? To develop a measure of the goodness, consider the projected values for 2003. Table A.6 presents the 2003 data from the old state panel while Table A.7 presents the same data from ARMS. Applying the adjustment in Equation A.6 to the ARMS data in Table A.7 yields the estimated values in the old data set presented in Table A.8. To address the question of how good the approximation is we define an error measure similar to that defined in Equation A.1

[Table 11 about here.]

[Table 12 about here.]

[Table 13 about here.]

$$\tilde{z}_{ij}^{(e)} = ln\left(\frac{x_{Oij}}{\tilde{x}_{Oij}}\right). \tag{A.7}$$

These values are presented in Table A.9. The averages of the geometric differences (weighted by the individual probabilities presented in Tables A.2 and A.3) are presented in Table A.10. Taking the anti-logarithm of each geometric average gives an idea of the "goodness" of each adjustment. The state level averages indicate a fairly small error of adjustment for Georgia, Illinois, Indiana, Iowa, Kansas, Missouri, Nebraska, and Texas. The adjustments for California, Florida, and Washington are somewhat higher. The greatest diversion appears to be for Arkansas and Wisconsin. As a rule, the error in all categories are small. The largest differences are for the acres and capital consumption variables.

[Table 14 about here.]

[Table 15 about here.]

[Table 16 about here.]

[Table 17 about here.]

[Table 18 about here.]

Table 1: Coefficient of Variation for Returns

	100 % Interest		75 % Interest		50 % Interest		25 % Interest		0 % Interest	
State	Operation	Holding	Operation	Holding	Operation	Holding	Operation	Holding	Operation	Holding
Arkansas	0.18718	1.65623	0.69206	1.27404	1.30318	0.92135	1.94596	0.60142	2.51565	0.31496
California	0.48515	1.46226	1.45167	1.15039	2.71744	0.83398	3.97759	0.52157	4.85117	0.22113
Florida	0.23169	1.23171	0.82174	0.99041	1.52917	0.74527	2.28747	0.50025	3.00915	0.25934
Georgia	0.05851	1.34284	0.45107	1.08715	0.94358	0.83413	1.53859	0.58770	2.21553	0.35121
Illinois	-0.39082	1.08586	0.06700	0.84194	0.81741	0.61229	2.03524	0.39818	3.75799	0.20023
Indiana	-0.46785	1.19896	-0.04857	0.92991	0.61047	0.67789	1.63366	0.44437	3.09931	0.22996
Iowa	-0.00175	0.95387	0.47355	0.74280	1.16968	0.54572	2.13651	0.36286	3.28643	0.19411
Kansas	-0.17552	1.29809	0.24603	0.97484	0.83571	0.67729	1.60506	0.40662	2.47855	0.16273
Minnesota	-0.30398	1.09786	0.05473	0.85414	0.50289	0.62621	1.03258	0.41494	1.61142	0.22066
Missouri	-0.81288	1.36432	-0.43534	1.05686	0.14522	0.76917	1.02881	0.50366	2.29509	0.26143
Nebraska	0.12086	1.14322	0.57602	0.89179	1.17970	0.65719	1.92145	0.44009	2.71208	0.24056
North Carolina	0.57998	1.73017	0.86031	1.38146	1.14954	1.03218	1.44182	0.69255	1.73139	0.37115
Texas	-0.86066	1.52596	-0.56350	1.18944	-0.01702	0.85854	0.81110	0.54127	1.75227	0.24395
Washington	0.16356	1.85943	0.76122	1.44024	1.52267	1.02628	2.35309	0.63317	3.07988	0.27186
Wisconsin	-0.06528	1.50347	0.37438	1.18654	0.95614	0.88415	1.72858	0.60081	2.73705	0.33945
Mean	-0.08345	1.36361	0.38549	1.06613	1.02439	0.78011	1.83183	0.50997	2.74220	0.25885
Std.Dev	0.42269	0.25842	0.52298	0.20401	0.64909	0.14908	0.75137	0.09836	0.84380	0.06100

Table 2: Comparison of Expected Value-Variance with Actual Data

	Result of Expected Value-Variance				Values from Sample		Log Ratio (EV/Act)	
	Operating Assets	Farmland	Mean Return	Std. Dev	Share of Land	Std.Dev.	Share of Land	Std. Dev.
Arkansas	0.27602	0.72398	0.07611	0.05623	0.74960	0.05688	-0.03477	-0.01151
California	0.16979	0.83021	0.08051	0.04925	0.84673	0.05067	-0.01971	-0.02834
Florida	0.18022	0.81978	0.08693	0.06178	0.85510	0.06519	-0.04218	-0.05381
Georgia	0.32899	0.67101	0.08085	0.07033	0.75373	0.06996	-0.11625	0.00521
Illinois	0.28858	0.71142	0.05973	0.07725	0.78314	0.07916	-0.09604	-0.02452
Indiana	-0.39879	1.39879	0.05584	0.10543	0.75886	0.07109		0.39407
Iowa	0.32635	0.67365	0.07049	0.08189	0.73111	0.08501	-0.08185	-0.03744
Kansas	0.32799	0.67201	0.05527	0.06048	0.72315	0.05972	-0.07334	0.01267
Minnesota	-0.02771	1.02771	0.05646	0.09200	0.67862	0.06723		0.31370
Missouri	0.20725	0.79275	0.04570	0.06222	0.72991	0.06098	0.08259	0.02020
Nebraska	0.33700	0.66300	0.07143	0.06855	0.70271	0.06990	-0.05817	-0.01961
North Carolina	0.27798	0.72202	0.09825	0.07234	0.74746	0.07144	-0.03462	0.01258
Texas	0.14876	0.85124	0.04157	0.05094	0.80202	0.04978	0.05955	0.02317
Washington	0.25517	0.74483	0.07001	0.04556	0.76613	0.04554	-0.02819	0.00052
Wisconsin	-0.46915	1.46915	0.06100	0.09907	0.62436	0.04942		0.69547

Table 3: Capital Asset Pricing Model Test for Market Equilibrium

State	Operating Returns OLS	Operating Returns Iterated	Holding Returns OLS	Holding Returns Iterated	Total Returns OLS	Total Returns Iterated	Logarithmic Difference Between OLS and Iterated: Operating	Holding	Total
Arkansas	0.0504	0.1219	0.0352	0.0419	0.0484	0.0646	0.8831	0.1749	0.2878
California	-0.2859	0.0446	-0.0346	-0.0360	-0.0405	-0.0233	a	0.0397	-0.5526
Florida	-0.1672	0.1887	-0.0173	-0.0139	-0.0076	0.0212	a	-0.2206	a
Georgia	0.1293	0.1955	0.0184	0.0292	0.0513	0.0748	0.4131	0.4597	0.3757
Illinois	0.0914	0.0079	-0.0294	-0.0256	-0.0157	-0.0280	-2.4424	-0.1360	0.5797
Indiana	0.1342	-0.0088	-0.0271	-0.0223	-0.0065	-0.0241	a	-0.1958	1.3032
Iowa	0.0704	0.0544	-0.0239	-0.0176	-0.0067	-0.0024	-0.2578	-0.3099	-1.0327
Kansas	0.1073	0.0187	-0.0282	-0.0296	0.0003	-0.0177	-1.7477	0.0492	a
Minnesota	0.1720	0.0122	-0.0491	-0.0436	-0.0112	-0.0282	-2.6479	-0.1192	0.9177
Missouri	0.2697	0.0355	0.0201	0.0259	0.0548	0.0259	-2.0282	0.2539	-0.7496
Nebraska	0.1104	0.1038	-0.1034	-0.0978	-0.0460	-0.0427	-0.0616	-0.0561	-0.0742
North Carolina	-0.0812	0.1996	0.0033	0.0091	0.0184	0.0657	a	1.0291	1.2751
Texas	0.3203	0.0617	0.0288	0.0301	0.0697	0.0355	-1.6474	0.0452	-0.6732
Washington	-0.0157	0.0496	-0.0380	-0.0387	-0.0219	-0.0192	a	0.0175	-0.1301
Wisconsin	0.1723	0.0469	0.0012	0.0099	0.0309	0.0234	-1.3021	2.1065	-0.2785
γ^*	0.1104		0.0482		0.0673				
Test	169.4681		7.7946		69.7714				
P[Test]	0.00000		0.89975		0.00000				

a denotes an undefined logarithm – attempting to take the logarithm of a negative value.

Table 4: Arbitrage Pricing Model Ordinary Least Squares Results

Variable	Basic Model	Difference for Farmland
Constant	0.1563	0.1436
	(0.0371)	(0.0671)
Factor 1	-0.0776	-0.0938
	(0.0346)	(0.0795)
Factor 2	0.0373	0.0493
	(0.0363)	(0.0642)
Factor 3	-0.0804	-0.0672
	(0.0329)	(0.0672)
Factor 4	-0.0763	-0.0884
	(0.0382)	(0.0660)
Factor 5	-0.1262	-0.1230
	(0.0363)	(0.0388)
Factor 6	-0.1222	-0.1255
	(0.0434)	(0.0458)
Factor 7	-0.0293	-0.0270
	(0.0495)	(0.0505)
Factor 8	-0.0450	-0.0425
	(0.0796)	(0.0803)
Farmland		0.0266
		(0.1176)

Table 5: Results of the Optimal Debt Formulation

Parameter	Estimate
α_1	0.0873***
	(0.0216)[a]
α_2	-9.4799***
	(0.7986)

[a] Numbers in parentheses denote. standard errors. *** denotes statistical significance at the 0.01 level of confidence.

Table A.1: Logarithmic Ratio – Older Panel Divided by ARMS

Year	Acres	Total Assets	Total Debt	Gross Cash Expenses	Gross Cash Receipts	Interest Paid	Capital Consumption	Net Cash Income	Leases and Rents	Property Taxes	Real Estate	State Average
Arkansas	-0.15743	-0.29306	-0.87438	-0.54642	-0.65250	-0.65090	0.32949	-0.76158	-0.35612	-0.21918	-0.37367	-0.41416
California	0.38432	0.16624	-0.27506	-0.08933	-0.23272	-0.32677	0.49347	-0.64035	0.51712	-0.00842	0.12762	0.01056
Florida	-0.37078	-0.15522	-0.70343	-0.05691	-0.27855	-0.41141	0.47428	-0.92935	4.77404	0.03813	-0.19209	0.19897
Georgia	-0.05666	0.09273	-0.41579	-0.50702	-0.90455	-0.41138	0.36615	-1.42161	0.36929	0.26503	0.12026	-0.22760
Illinois	0.02952	-0.41489	-0.37149	-0.18281	-0.18069	-0.38354	0.23367	0.12119	-0.44783	-0.51802	-0.55600	-0.24281
Indiana	0.00484	-0.29500	-0.45413	-0.21341	-0.39491	-0.46519	0.11681	-0.67175	-0.08250	-0.25256	-0.39561	-0.28213
Iowa	0.05194	-0.32589	-0.48312	-0.17248	-0.14869	-0.35346	0.12331	-0.16296	-0.34507	-0.20186	-0.44472	-0.22391
Kansas	0.11382	-0.23194	-0.59118	-0.63498	-0.55303	-0.46204	0.32616	0.12318	-0.82842	-0.25419	-0.28878	-0.29831
Minnesota	-0.01235	0.01149	-0.22266	-1.00053	-0.03689	-1.12908	0.29240	-1.58186	-0.97109	-0.44982	-0.03945	-0.46726
Missouri	0.01427	-0.13376	-0.53567	-0.04366	-0.36486	-0.45311	0.41182	-1.11901	0.19008	0.00303	-0.15525	-0.19874
Nebraska	0.33121	-0.20724	-0.43626	-0.11047	-0.24092	-0.19110	0.47776	-0.46566	0.23580	-0.23663	-0.34005	-0.10760
North Carolina	-0.09940	-0.13056	-0.74300	-0.97433	-0.87936	-0.57442	0.05322	-0.41795	-1.81547	-0.02356	-0.15800	-0.52389
Texas	-0.04279	0.05099	-0.37421	-0.02166	-0.36500	-0.27179	0.53132	-1.36242	-0.29067	-0.06476	-0.01581	-0.20244
Washington	-0.39965	0.05761	-0.21325	-0.38256	-0.33454	-0.17800	0.16972	0.05776	-0.34874	-0.04964	-0.03535	-0.15060
Wisconsin	-0.00453	-0.00237	-0.21080	-0.05397	-0.24927	-0.26747	0.24612	-0.55639	0.25262	-0.03852	-0.00866	-0.08120
Variable Average	0.03333	0.13333	0.13333	0.06667	0.06667	0.06667	0.06667	0.16667	0.06667	0.03333	0.16667	

Table A.2: State Weights

State	Farms	Acres	Assets	Sales	Aggregate Weight
Arkansas	0.0418	0.0256	0.0264	0.0319	0.0183
California	0.0691	0.0828	0.1553	0.2074	0.1100
Florida	0.0387	0.0146	0.0401	0.0480	0.0258
Georgia	0.0434	0.0212	0.0449	0.0246	0.0180
Illinois	0.0643	0.0590	0.0786	0.0765	0.0461
Indiana	0.0524	0.0314	0.0468	0.0387	0.0245
Iowa	0.0793	0.0696	0.0823	0.1101	0.0604
Kansas	0.0568	0.1101	0.0419	0.0580	0.0372
Minnesota	0.0705	0.0569	0.0773	0.0294	0.0276
Missouri	0.0934	0.0639	0.0644	0.0389	0.0298
Nebraska	0.0428	0.1333	0.0535	0.0891	0.0527
North Carolina	0.0471	0.0172	0.0370	0.0345	0.0203
Texas	0.2019	0.2606	0.1603	0.1230	0.0920
Washington	0.0312	0.0213	0.0321	0.0395	0.0218
Wisconsin	0.0674	0.0324	0.0590	0.0506	0.0310
Weight	1	2	5	5	
Ration	0.0769	0.1538	0.3846	0.3846	

Table A.3: Category Weight

Category	Weight	Share
Acres	1	0.03333
Total Assets	4	0.13333
Debt	4	0.13333
Gross Cash Expenses	2	0.06667
Gross Cash Receipts	2	0.06667
Interest	2	0.06667
Capital Consumption	2	0.06667
Net Cash Income	5	0.16667
Rents and Leases	2	0.06667
Property Tax	1	0.03333
Real Estate	5	0.16667

Table A.4: Aggregated Weight

Year	Acres	Total Assets	Total Debt	Gross Cash Expenses	Gross Cash Receipts	Interest Paid	Capital Consumption	Net Cash Income	Leases and Rents	Property Taxes	Real Estate
Arkansas	0.000610	0.002439	0.002439	0.001219	0.001219	0.001219	0.001219	0.003049	0.001219	0.000610	0.003049
California	0.003668	0.014672	0.014672	0.007336	0.007336	0.007336	0.007336	0.018341	0.007336	0.003668	0.018341
Florida	0.000858	0.003434	0.003434	0.001717	0.001717	0.001717	0.001717	0.004292	0.001717	0.000858	0.004292
Georgia	0.000601	0.002403	0.002403	0.001201	0.001201	0.001201	0.001201	0.003003	0.001201	0.000601	0.003003
Illinois	0.001536	0.006142	0.006142	0.003071	0.003071	0.003071	0.003071	0.007678	0.003071	0.001536	0.007678
Indiana	0.000817	0.003267	0.003267	0.001633	0.001633	0.001633	0.001633	0.004084	0.001633	0.000817	0.004084
Iowa	0.002012	0.008048	0.008048	0.004024	0.004024	0.004024	0.004024	0.010060	0.004024	0.002012	0.010060
Kansas	0.001241	0.004962	0.004962	0.002481	0.002481	0.002481	0.002481	0.006203	0.002481	0.001241	0.006203
Minnesota	0.000919	0.003675	0.003675	0.001838	0.001838	0.001838	0.001838	0.004594	0.001838	0.000919	0.004594
Missouri	0.000992	0.003970	0.003970	0.001985	0.001985	0.001985	0.001985	0.004962	0.001985	0.000992	0.004962
Nebraska	0.001758	0.007032	0.007032	0.003516	0.003516	0.003516	0.003516	0.008789	0.003516	0.001758	0.008789
North Carolina	0.000675	0.002702	0.002702	0.001351	0.001351	0.001351	0.001351	0.003377	0.001351	0.000675	0.003377
Texas	0.003067	0.012267	0.012267	0.006133	0.006133	0.006133	0.006133	0.015333	0.006133	0.003067	0.015333
Washington	0.000725	0.002900	0.002900	0.001450	0.001450	0.001450	0.001450	0.003625	0.001450	0.000725	0.003625
Wisconsin	0.001035	0.004139	0.004139	0.002069	0.002069	0.002069	0.002069	0.005173	0.002069	0.001035	0.005173

Table A.5: Bridge Constants

Year	Acres	Total Assets	Total Debt	Gross Cash Expenses	Gross Cash Receipts	Interest Paid	Capital Consumption	Net Cash Income	Leases and Rents	Property Taxes	Real Estate
Arkansas	-0.1007	-0.1842	-0.4503	-0.3503	-0.3935	-0.4307	0.1532	-0.6010	-0.0450	-0.1946	-0.2335
California	-0.0089	-0.0923	-0.3585	-0.2585	-0.3016	-0.3389	0.2450	-0.5092	0.0469	-0.1028	-0.1417
Florida	0.0319	-0.0516	-0.3177	-0.2177	-0.2609	-0.2981	0.2858	-0.4684	0.0876	-0.0620	-0.1010
Georgia	-0.0604	-0.1438	-0.4100	-0.3100	-0.3531	-0.3904	0.1935	-0.5607	-0.0046	-0.1543	-0.1932
Illinois	-0.0637	-0.1471	-0.4133	-0.3133	-0.3564	-0.3937	0.1902	-0.5640	-0.0079	-0.1576	-0.1965
Indiana	-0.0722	-0.1556	-0.4218	-0.3218	-0.3649	-0.4022	0.1817	-0.5725	-0.0164	-0.1661	-0.2050
Iowa	-0.0596	-0.1430	-0.4092	-0.3092	-0.3523	-0.3896	0.1943	-0.5599	-0.0038	-0.1535	-0.1924
Kansas	-0.0757	-0.1591	-0.4253	-0.3253	-0.3684	-0.4057	0.1782	-0.5760	-0.0199	-0.1696	-0.2085
Minnesota	-0.1122	-0.1957	-0.4618	-0.3618	-0.4050	-0.4422	0.1417	-0.6125	-0.0565	-0.2061	-0.2450
Missouri	-0.0541	-0.1376	-0.4037	-0.3037	-0.3469	-0.3842	0.1998	-0.5544	0.0016	-0.1481	-0.1870
Nebraska	-0.0344	-0.1179	-0.3840	-0.2840	-0.3272	-0.3644	0.2195	-0.5347	0.0213	-0.1283	-0.1672
North Carolina	-0.1245	-0.2079	-0.4740	-0.3740	-0.4172	-0.4545	0.1294	-0.6248	-0.0687	-0.2184	-0.2573
Texas	-0.0549	-0.1384	-0.4045	-0.3045	-0.3477	-0.3850	0.1990	-0.5552	0.0008	-0.1489	-0.1878
Washington	-0.0437	-0.1272	-0.3933	-0.2933	-0.3365	-0.3737	0.2102	-0.5440	0.0120	-0.1376	-0.1765
Wisconsin	-0.0287	-0.1122	-0.3783	-0.2783	-0.3215	-0.3587	0.2252	-0.5290	0.0270	-0.1226	-0.1615

Table A.6: State-Level Farm Sector Income State and Balance Sheet Statistics (Old State Panel) for 2003

Year	Acres	Total Assets	Total Debt	Gross Cash Expenses	Gross Cash Receipts	Interest Paid	Capital Consumption	Net Cash Income	Leases and Rents	Property Taxes	Real Estate
Arkansas	303.158	546.744	102.819	93.558	142.877	6.567	7.188	43.326	5.211	1.582	425.136
California	345.223	1,228.980	254.206	263.206	369.414	16.520	10.508	98.656	11.317	6.231	1,053.270
Florida	231.818	780.374	122.085	108.482	159.632	7.783	5.444	46.458	0.012	2.697	686.441
Georgia	219.067	609.074	83.467	67.599	136.753	5.431	6.520	60.640	1.973	1.756	492.268
Illinois	376.712	1,195.233	143.555	105.141	139.148	9.191	12.273	25.311	17.699	6.646	1,038.720
Indiana	252.773	775.150	107.406	73.407	106.887	6.992	9.903	24.890	10.313	3.498	655.749
Iowa	352.222	929.266	160.373	122.005	157.216	10.344	11.888	38.628	14.677	4.453	746.043
Kansas	731.783	601.027	121.237	142.112	173.002	7.832	9.453	21.395	10.668	3.217	426.813
Minnesota	346.250	700.647	124.779	94.266	124.842	8.041	10.773	29.116	6.774	2.606	532.457
Missouri	284.906	508.935	63.445	36.207	58.543	4.090	6.201	18.328	2.121	1.657	406.482
Nebraska	946.392	993.313	207.944	181.570	258.314	13.474	11.852	64.408	13.236	7.209	755.166
North Carolina	170.093	577.523	79.165	132.941	171.875	5.147	6.985	32.136	21.707	1.766	471.243
Texas	569.869	487.442	58.018	52.935	85.591	3.709	5.516	29.745	2.680	1.998	396.771
Washington	430.986	627.935	106.709	145.692	172.498	6.905	9.633	22.722	6.908	3.871	504.044
Wisconsin	203.922	567.065	87.570	59.895	94.039	5.692	10.539	28.857	3.231	3.323	426.177

Table A.7: Agricultural Resource Management Survey (ARMS) Data (New State Panel) for 2003

Year	Acres	Total Assets	Total Debt	Gross Cash Expenses	Gross Cash Receipts	Interest Paid	Capital Consumption	Net Cash Income	Leases and Rents	Property Taxes	Real Estate
Arkansas	311	754.533	50.631	90.281	136.455	3.198	17.576	46.174	6.820	2.366	530.796
California	507	1,451.254	193.077	240.714	292.716	11.915	17.212	52.002	18.980	6.179	1,196.639
Florida	160	668.179	60.418	102.480	120.822	5.158	8.748	18.342	1.410	2.802	566.475
Georgia	207	668.254	55.073	40.714	55.347	3.599	9.403	14.634	2.855	2.289	555.176
Illinois	388	789.349	99.011	87.574	116.146	6.263	15.504	28.572	11.310	3.959	595.703
Indiana	254	577.126	68.203	59.300	72.014	4.391	11.131	12.714	9.496	2.717	441.494
Iowa	371	670.821	98.927	102.677	135.495	7.264	13.448	32.819	10.394	3.639	478.215
Kansas	820	476.610	67.126	75.312	99.511	4.934	13.099	24.200	4.659	2.495	319.759
Minnesota	342	708.744	99.871	34.660	120.321	2.600	14.432	5.986	2.565	1.662	511.859
Missouri	289	445.216	37.133	34.660	40.646	2.600	9.362	5.986	2.565	1.662	348.029
Nebraska	1,318	807.387	134.425	162.581	203.010	11.130	19.112	40.430	16.756	5.690	537.478
North Carolina	154	506.836	37.658	50.178	71.336	2.898	7.367	21.158	3.533	1.725	402.372
Texas	546	512.943	39.907	51.801	59.417	2.826	9.384	7.616	2.004	1.873	390.546
Washington	289	665.171	86.216	99.378	123.451	5.779	11.415	24.073	4.874	3.684	486.537
Wisconsin	289	665.171	86.216	99.378	123.451	5.779	11.415	24.073	4.874	3.684	486.537

Table A.8: ARMS Data Adjusted to State-Level Farm Sector Income State and Balance Sheet Levels

Year	Acres	Total Assets	Total Debt	Gross Cash Expenses	Gross Cash Receipts	Interest Paid	Capital Consumption	Net Cash Income	Leases and Rents	Property Taxes	Real Estate
Arkansas	343.957	907.123	79.430	128.155	202.243	4.920	15.080	84.221	7.134	2.874	670.429
California	511.522	1591.638	276.321	311.713	395.770	16.721	13.472	86.528	18.111	6.848	1378.800
Florida	154.982	703.556	83.015	127.408	156.837	6.950	6.573	29.301	1.292	2.981	626.648
Georgia	219.884	771.629	82.983	55.509	78.787	5.318	7.748	25.637	2.868	2.671	673.496
Illinois	413.507	914.460	149.679	119.791	165.880	9.284	12.818	50.219	11.400	4.635	725.041
Indiana	273.010	674.309	103.986	81.808	103.729	6.565	9.281	22.537	9.653	3.208	541.939
Iowa	393.777	773.976	148.942	139.877	192.726	10.724	11.073	57.449	10.434	4.243	579.670
Kansas	884.459	558.819	102.703	104.262	143.838	7.403	10.960	43.048	4.753	2.956	393.884
Minnesota	382.610	861.914	158.488	49.769	180.390	4.046	12.525	11.044	2.714	2.042	653.977
Missouri	305.078	510.890	55.603	46.961	57.500	3.818	7.666	10.421	2.561	1.927	419.575
Nebraska	1364.170	908.404	197.360	215.983	281.585	16.024	15.346	69.014	16.403	6.469	635.324
North Carolina	174.410	623.966	60.497	72.939	108.267	4.565	6.472	39.519	3.784	2.146	520.426
Texas	576.836	589.078	59.805	70.242	84.122	4.153	7.691	13.270	2.002	2.174	471.209
Washington	301.919	755.387	127.763	133.254	172.833	8.398	9.251	41.476	4.816	4.228	580.483
Wisconsin	297.421	744.135	125.860	131.269	170.258	8.273	9.113	40.859	4.744	4.165	571.836

Table A.9: Logarithm of the Observed State-Level Farm Sector Income State and Balance Sheet Divided by Adjusted ARMS

Year	Acres	Total Assets	Total Debt	Gross Cash Expenses	Gross Cash Receipts	Interest Paid	Capital Consumption	Net Cash Income	Leases and Rents	Property Taxes	Real Estate
Arkansas	0.12626	0.50630	-0.25809	0.31466	0.34749	-0.28874	0.74098	0.66470	0.31400	0.59685	0.45551
California	0.39320	0.25858	0.08342	0.16914	0.06891	0.01213	0.24844	-0.13117	0.47027	0.09437	0.26931
Florida	-0.40264	-0.10363	-0.38570	0.16082	-0.01767	-0.11326	0.18852	-0.46092	4.68644	0.10017	-0.09114
Georgia	0.00372	0.23656	-0.00582	-0.19705	-0.55142	-0.02098	0.17263	-0.86092	0.37394	0.41932	0.31346
Illinois	0.09319	-0.26776	0.04177	0.13045	0.17573	0.01015	0.04343	0.68516	-0.43990	-0.36044	-0.35952
Indiana	0.07701	-0.13937	-0.03236	0.10836	-0.02999	-0.06301	-0.06492	-0.09928	-0.06606	-0.08648	-0.19063
Iowa	0.11152	-0.18285	-0.07394	0.13670	0.20365	0.03614	-0.07101	0.39692	-0.34122	-0.04837	-0.25232
Kansas	0.18949	-0.07281	-0.16591	-0.30971	-0.18461	-0.05635	0.14793	0.69915	-0.80849	-0.08460	-0.08029
Minnesota	0.09986	0.20715	0.23914	-0.63873	0.36807	-0.68686	0.15070	-0.96935	-0.91461	-0.24370	0.20557
Missouri	0.06841	0.00383	-0.13194	0.26007	-0.01797	-0.06895	0.21206	-0.56457	0.18848	0.15108	0.03170
Nebraska	0.36564	-0.08936	-0.05224	0.17356	0.08626	0.17334	0.25829	0.06907	0.21450	-0.10829	-0.17280
North Carolina	0.02506	0.07735	-0.26895	-0.60028	-0.46216	-0.11995	-0.07623	0.20680	-1.74675	0.19480	0.09927
Texas	0.01215	0.18939	0.03032	0.28287	-0.01731	0.11316	0.33236	-0.80718	-0.29147	0.08409	0.17194
Washington	-0.35592	0.18479	0.18008	-0.08924	0.00194	0.19574	-0.04045	0.60180	-0.36074	0.08800	0.14120
Wisconsin	0.37741	0.27175	0.36274	0.78466	0.59361	0.37394	-0.14534	0.34777	0.38401	0.22590	0.29400

Table A.10: Average Error of Adjustment

State Deviations			Category Deivations		
State	Deviation	Level	Category	Deviation	Level
Arkansas	0.33912	1.40372	Acres	0.13798	1.14795
California	0.14947	1.16122	Total Assets	0.06885	1.07128
Florida	0.15965	1.17311	Debt	-0.00432	0.99569
Georgia	-0.06124	0.94060	Gross Cash Expenses	0.10711	1.11306
Illinois	0.00989	1.00994	Gross Cash Receipts	0.06175	1.06370
Indiana	-0.07924	0.92382	Interest	0.00612	1.00614
Iowa	-0.01042	0.98964	Capital Consumption	0.15961	1.17305
Kansas	-0.00594	0.99408	Net Cash Income	-0.05951	0.94222
Minnesota	-0.18735	0.82915	Rents and Leases	0.07463	1.07749
Missouri	-0.06033	0.94145	Property Tax	0.03140	1.03190
Nebraska	0.03281	1.03335	Real Estate	0.04768	1.04884
North Carolina	-0.16756	0.84572			
Texas	-0.04540	0.95562			
Washington	0.14403	1.15492			
Wisconsin	0.34440	1.41114			

Table B.1: Expected Rates of Returns and Standard Deviations for Operating Returns and Holding Returns

	100 % Interest Rate				75 % Interest Rate				50 % Interest Rate			
	Return to Operation		Return to Holding		Return to Operation		Return to Holding		Return to Operation		Return to Holding	
	Mean	Std.Dev.	Mean	Std.Dev.	Mean	Std.Dev.	Mean	Std.Dev.	Mean	Std.Dev.	Mean	Std.Dev.
Arkansas	0.02580	0.13782	0.08821	0.05326	0.07950	0.11487	0.07210	0.05659	0.12965	0.09949	0.05570	0.06045
California	0.07267	0.14979	0.07971	0.05451	0.16251	0.11195	0.06360	0.05529	0.24339	0.08957	0.04720	0.05659
Florida	0.05328	0.22995	0.08511	0.06910	0.15334	0.18661	0.06910	0.06976	0.24223	0.15841	0.05279	0.07083
Georgia	0.01035	0.17691	0.09326	0.06945	0.06772	0.15014	0.07730	0.07111	0.12121	0.12846	0.06106	0.07320
Illinois	-0.06496	0.16621	0.08619	0.07937	0.00836	0.12476	0.06997	0.08311	0.07522	0.09202	0.05345	0.08729
Indiana	-0.06733	0.14392	0.08740	0.07290	-0.00541	0.11136	0.07122	0.07659	0.05197	0.08512	0.05474	0.08074
Iowa	-0.00024	0.13742	0.08946	0.09379	0.05116	0.10803	0.07318	0.09852	0.09918	0.08479	0.05659	0.10370
Kansas	-0.02300	0.13104	0.07990	0.06155	0.02607	0.10594	0.06361	0.06526	0.07216	0.08634	0.04703	0.06944
Minnesota	-0.03436	0.11305	0.08881	0.08090	0.00536	0.09798	0.07261	0.08501	0.04324	0.08597	0.05610	0.08959
Missouri	-0.09365	0.11520	0.08748	0.06412	-0.03994	0.09175	0.07135	0.06751	0.01049	0.07221	0.05491	0.07138
Nebraska	0.01478	0.12230	0.09014	0.07885	0.05800	0.10069	0.07396	0.08294	0.09888	0.08382	0.05748	0.08746
North Carolina	0.11832	0.20400	0.08765	0.05066	0.16520	0.19202	0.07165	0.05186	0.20966	0.18239	0.05536	0.05363
Texas	-0.17043	0.19802	0.08169	0.05353	-0.08117	0.14405	0.06557	0.05512	-0.00184	0.10800	0.04916	0.05726
Washington	0.02095	0.12808	0.08071	0.04341	0.07934	0.10423	0.06459	0.04485	0.13374	0.08783	0.04818	0.04695
Wisconsin	-0.00514	0.07881	0.09130	0.06073	0.02522	0.06736	0.07527	0.06343	0.05454	0.05705	0.05894	0.06666

	25 % Interest Rate				0 % Interest Rate			
	Return to Operation		Return to Holding		Return to Operation		Return to Holding	
State	Mean	Std.Dev.	Mean	Std.Dev.	Mean	Std.Dev.	Mean	Std.Dev.
Arkansas	0.17681	0.09086	0.03898	0.06482	0.22139	0.08800	0.02195	0.06968
California	0.31724	0.07976	0.03049	0.05846	0.38537	0.07944	0.01347	0.06090
Florida	0.32259	0.14102	0.03618	0.07233	0.39611	0.13164	0.01926	0.07428
Georgia	0.17138	0.11139	0.04452	0.07575	0.21869	0.09871	0.02766	0.07877
Illinois	0.13685	0.06724	0.03661	0.09194	0.19414	0.05166	0.01943	0.09704
Indiana	0.10554	0.06460	0.03793	0.08536	0.15587	0.05029	0.02080	0.09045
Iowa	0.14436	0.06757	0.03967	0.10933	0.18710	0.05693	0.02241	0.11543
Kansas	0.11570	0.07208	0.03012	0.07408	0.15702	0.06335	0.01289	0.07919
Minnesota	0.07945	0.07695	0.03927	0.09465	0.11418	0.07086	0.02211	0.10018
Missouri	0.05808	0.05645	0.03815	0.07575	0.10317	0.04495	0.02107	0.08061
Nebraska	0.13772	0.07168	0.04067	0.09242	0.17477	0.06444	0.02353	0.09782
North Carolina	0.25197	0.17476	0.03876	0.05597	0.29235	0.16885	0.02186	0.05889
Texas	0.07008	0.08640	0.03244	0.05993	0.13613	0.07769	0.01541	0.06315
Washington	0.18475	0.07851	0.03146	0.04969	0.23284	0.07560	0.01442	0.05305
Wisconsin	0.08291	0.04796	0.04230	0.07041	0.11038	0.04033	0.02534	0.07466

Table C.1: Capital Asset Pricing Model State-Level Results

State	Constant	S % P Return	Constant	S & P Return	Constant	S & P Return
Arkansas	0.12653	0.12186	0.05462	0.04193	0.07445	0.06460
	(0.01366)[a]	(0.08085)	(0.00843)	(0.04986)	(0.00783)	(0.04637)
California	0.24225	0.04462	0.04812	-0.03604	0.08111	-0.02331
	(0.01252)	(0.07413)	(0.00790)	(0.04673)	(0.00709)	(0.04196)
Florida	0.23683	0.18874	0.05314	-0.01388	0.08638	0.02121
	(0.02156)	(0.12763)	(0.00993)	(0.05880)	(0.00914)	(0.05407)
Georgia	0.11620	0.19547	0.06031	0.02919	0.07893	0.07476
	(0.01742)	(0.10312)	(0.01025)	(0.06066)	(0.00966)	(0.05716)
Illinois	0.07501	0.00795	0.05411	-0.02564	0.06045	-0.02798
	(0.01291)	(0.07642)	(0.01223)	(0.07241)	(0.01109)	(0.06563)
Indiana	0.05219	-0.00880	0.05531	-0.02230	0.05645	-0.02410
	(0.01194)	(0.07069)	(0.01132)	(0.06699)	(0.00996)	(0.05895)
Iowa	0.09779	0.05439	0.05704	-0.01756	0.07056	-0.00240
	(0.01183)	(0.07001)	(0.01455)	(0.08609)	(0.01193)	(0.07061)
Kansas	0.07168	0.01869	0.04779	-0.02963	0.05572	-0.01768
	(0.01211)	(0.07166)	(0.00972)	(0.05752)	(0.00837)	(0.04954)
Minnesota	0.04292	0.01218	0.05722	-0.04358	0.05718	-0.02816
	(0.01206)	(0.07139)	(0.01253)	(0.07416)	(0.00941)	(0.05570)
Missouri	0.00958	0.03549	0.05424	0.02594	0.04503	0.02588
	(0.01010)	(0.05977)	(0.01000)	(0.05918)	(0.00854)	(0.05051)
Nebraska	0.09622	0.10382	0.05998	-0.09777	0.07252	-0.04267
	(0.01150)	(0.06808)	(0.01205)	(0.07134)	(0.00976)	(0.05775)
North Carolina	0.20454	0.19957	0.05512	0.00914	0.09657	0.06574
	(0.02515)	(0.14888)	(0.00752)	(0.04452)	(0.00990)	(0.05862)
Texas	-0.00342	0.06168	0.04838	0.03012	0.04066	0.03554
	(0.01509)	(0.08928)	(0.00800)	(0.04737)	(0.00693)	(0.04104)
Washington	0.13197	0.04962	0.04917	-0.03870	0.07050	-0.01919
	(0.01216)	(0.07197)	(0.00652)	(0.03861)	(0.00637)	(0.03772)
Wisconsin	0.05334	0.04685	0.05868	0.00993	0.06041	0.02337
	(0.00793)	(0.04692)	(0.00935)	(0.05535)	(0.00691)	(0.04092)

[a] Numbers in parenthesis denote standard errors

Table D.1: Estimated Factor Loadings

	Common Factors							
Return – State	1	2	3	4	5	6	7	8
RO – Arkansas	0.0719	0.9110	0.2625	0.0377	0.1417	-0.0614	0.0377	0.0485
RO – California	0.2408	0.7257	0.3454	-0.1611	0.1805	-0.1616	0.1598	-0.0573
RO – Florida	-0.0582	0.8683	0.0073	-0.0087	0.2627	-0.1438	-0.0798	0.0109
RO – Geogia	-0.0617	0.9380	0.2158	0.0390	0.0220	0.0132	-0.1080	-0.0061
RO – Illinois	0.2316	0.1523	0.9100	0.0433	0.2238	-0.0245	0.0260	0.0393
RO – Indiana	0.2176	0.2973	0.8204	-0.0684	0.3235	0.0377	-0.0082	0.1309
RO – Iowa	0.0435	0.3331	0.8876	0.1208	0.0691	-0.0289	-0.0982	-0.1367
RO – Kansas	0.1936	0.5546	0.7010	0.0988	0.1280	0.0324	-0.0286	0.0871
RO – Minnesota	-0.0352	0.5715	0.3537	0.1174	0.5801	-0.0888	-0.1121	-0.0688
RO – Missouri	0.0838	0.4771	0.4894	0.0667	0.6816	0.0277	-0.0251	0.0358
RO – Nebraska	0.0846	0.4815	0.7937	-0.0516	-0.1560	-0.0706	-0.0592	-0.0958
RO – N. Carolina	-0.0210	0.9050	0.2058	0.1350	-0.1457	0.0535	0.0564	0.0045
RO – Texas	0.1166	0.7882	0.3111	0.0925	0.2568	0.2926	0.0419	-0.0268
RO – Washington	0.2925	0.6988	0.4295	0.0062	0.0958	-0.0930	-0.1240	0.0296
RO – Wisconsin	0.0044	0.5373	0.4859	0.0444	0.6023	0.0084	-0.1005	0.0165
RH – Arkansas	0.6187	0.1381	0.0725	0.2239	0.1837	0.4993	0.2509	-0.0739
RH – California	0.4439	-0.0860	-0.2053	0.3708	-0.1450	0.1126	0.7598	0.0048
RH – Florida	0.3151	-0.1176	0.0273	0.7661	0.0132	-0.0050	0.2075	-0.0086
RH – Georgia	0.2588	0.1449	0.1307	0.8780	0.0894	0.1941	0.0178	-0.0426
RH – Illinois	0.9041	0.0281	0.2339	0.2446	-0.0820	-0.0905	0.0454	0.1475
RH – Indiana	0.9193	0.1482	0.1520	0.1263	-0.0615	0.0289	0.0179	0.1437
RH – Iowa	0.9537	0.0056	0.2325	0.0811	-0.0331	-0.0541	0.0250	-0.1276
RH – Kansas	0.9030	-0.0578	0.1470	0.0690	0.0837	0.0685	0.0733	-0.0111
RH – Minnesota	0.9072	0.0626	0.0441	0.1339	0.0086	0.1153	0.1386	-0.1556
RH – Missouri	0.8151	0.1722	0.0788	0.3778	0.0505	0.0963	-0.0058	0.0686
RH – Nebraska	0.9010	-0.1175	0.1859	0.0391	0.0653	-0.0735	0.0084	-0.0799
RH – N. Carolina	0.4959	0.2536	-0.0512	0.5620	0.0254	0.2252	-0.0003	0.1273
RH – Texas	0.2699	-0.2751	-0.0736	0.3527	-0.0928	0.6877	0.0268	0.0176
RH – Washington	0.6668	0.0370	-0.1312	0.0228	0.0771	0.2801	0.0944	0.1176
RH – Wisconsin	0.6991	0.2103	-0.0801	0.4306	-0.0522	0.2867	-0.0459	-0.0297
SS loadings	8.0110	6.8440	4.8630	2.5300	1.6890	1.1940	0.8260	0.2010
Proportion Var	0.267	0.228	0.162	0.084	0.056	0.04	0.028	0.007
Cumulative Var	0.267	0.495	0.657	0.742	0.798	0.838	0.865	0.872