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Abstract

The recent financial crisis has renewed interest in alternative asset classes such as farmland. Previous work has shown that farmland may provide expected return premiums while adding little additional risk to a diversified portfolio. However, these studies have been based on relatively short time periods and aggregated data on farmland returns. This analysis contributes to this literature using farm-level data from the University of Illinois endowment farms, providing additional evidence that farmland could play a favorable role within an investment portfolio. The implications of these results extend to the use of farmland within general investment portfolios.

The Role of Farmland in an Investment Portfolio: Analysis of Illinois Endowment Farms

By Kevin Noland, Jonathan Norvell, AFM, Nicholas D. Paulson, and Gary D. Schnitkey

Introduction

The chaos in the financial markets in 2008 and 2009 has led to a renewed interest in asset classes that have been overlooked by most mainstream investors. An example is that of U.S. farmland, which provided stable income streams and reasonable market value stability during the recent period of volatility in the credit markets (Potkewitcz, 2009). There is a great deal of anxiety in many quarters about the future investment performance of traditional asset classes. This has led to unprecedented interest in the return and risk component of farmland and in the short and long term influence it has on investors' portfolios.

A number of academic studies have evaluated farmland and its investment potential (e.g., Kaplan, 1985; Lins, Sherrick, and Venigalla, 1992; Libbin, Kohler, and Hawkes, 2004; Hennings, Sherrick, and Barry, 2005). This paper contributes to the body of literature on this important topic using established methods for comparing financial returns and asset portfolio analysis. The main contributions of this analysis include the use of farm-level, rather than regionally aggregated, data for computing farmland returns and a more recent and broader coverage of time periods relative to previous studies.

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Farmland as an asset class has the necessary characteristics required to evaluate its financial return. Two main sources of income are associated with farmland returns: the income stream associated with the land, and changes in its market value. With these data in place, cash return, appreciation return, and total return can be calculated. The variability in farmland returns can be measured to better understand its risk characteristics. Farmland returns and variability of returns can then be compared with other asset classes and inflation to gauge how they move together over time. Understanding these relationships can assist decision makers who are charged with maximizing portfolio returns while controlling risk exposure. In this study, we use panel data from the University of Illinois (UI) pool of endowment farms to calculate annual farmland returns, compare farmland financial performance with that of other asset classes, and assess the role of farmland within a well-diversified investment portfolio. We address the following important questions:

- What has been the historical return of the UI farmland portfolio?
- How does the UI farmland portfolio interact with other asset classes within a diversified pool of investments to affect the portfolio's risk and return results?
- What percentage of the UI's endowment pool should be invested in farmland?
- What does this result suggest for other institutional investors and individual investors?
- What are the implications of examining a live portfolio of farmland compared to past studies that used aggregate data from different periods and/or widely dispersed geographic areas?

These concerns have a broader impact than just on the UI and its decision makers. Pension fund managers, endowment managers, institutional investment advisors, private investors, farm managers and operators, rural appraisers, agricultural lenders, and academics are among the parties interested in the investment qualities of farmland. Indirectly affected by farmland returns are equipment manufacturers and dealers, grain merchandisers and processors, fertilizer and chemical companies, and the many people who labor in these organizations. If this study reaffirms the favorable impact farmland has on an already diversified portfolio, as past studies have shown, then the potential exists to improve portfolios' capacity to withstand inflation and shocks to the financial markets with less volatility of returns.

Background

Johnson (1970) and Melichar (1979) represent two of the seminal studies on calculating the returns to farmland. Johnson (1970) examined the relationship between farmland market values and current farmland returns, primarily from the perspective of the farm operator, using data from the U.S. Department of Agriculture (USDA) and the U.S. Census of Agriculture. His main findings were that, during the 1960s, farmland returns from income averaged between three and four percent, the average rate of appreciation over the same time period was 5.3 percent, and returns were positively related to farm size as measured by gross sales. Melichar (1979) analyzed the importance and sources of farm asset appreciation from 1954 to 1978 using USDA data on aggregate farmland values and returns for the entire U.S. Using asset-pricing theory, he illustrated the relationship between capital gains and losses and an asset's growth rate, current return, and the discount rate. Melichar found that although the nominal appreciation of farm assets generally exceeded net farm income by a great extent in the 1970s, inflation-adjusted capital gains roughly equaled net income.

A number of studies have analyzed farmland as an investment tool and compared its performance with other asset classes. Barry (1980) applied the Capital Asset Pricing Model (CAPM) to evaluate farmland investment using USDA data on national farmland returns and data on other classes from a variety of sources from 1950-1977. He concluded that farm real estate added little systematic risk to a diversified investment portfolio, and that the inclusion of farm real estate added substantial return premiums compared with alternative asset classes. Irwin, Forster, and Sherrick (1988) expanded on the work of Barry (1980) by thoroughly incorporating the effects of inflation, widening the scope of asset classes considered, and expanding the time period studied to 1947 through 1984. They also found that farmland adds a relatively small amount of systematic risk to a portfolio, but added only a small return premium. Furthermore, they found that farm real estate investment was exposed to significant inflationary risk.

Other authors have used historical data to develop and compare investment portfolios containing varying levels of farmland investment to assess its impact on performance. Kaplan (1985) used regional farmland return data from 1947 through 1980, creating optimized investment portfolios including large cap, small cap, long-term corporate and government bonds, and U.S. Treasury bills as alternative asset classes. Farmland was determined to be an excellent

hedge against inflation. Its returns were not significantly correlated with any asset class examined except for the U.S. Treasury bill index. On a total return basis, farmland performed as well as or better than every asset class except small cap stocks.

Lins, Sherrick, and Venigalla (1992) used returns data from Ibbotson and Associates for common stocks, long-term corporate bonds, and business real estate. Total returns for farmland were calculated from USDA data by combining cash rents and capital gains as percentages of land value and removing real estate taxes as a percentage of market value for 28 U.S. states from 1967-1988. Farmland made up a dominant component of the optimized portfolio across a variety of scenarios defined by the authors. Furthermore, farmland outperformed stocks and bonds, exhibiting a negative correlation to those asset classes and positive correlation to inflation.

Hennings, Sherrick, and Barry (2005) considerably expanded the analysis done by Lins, Sherrick, and Venigalla (1992) by enlarging the universe of possible asset classes and updating the period under evaluation to 1972 through 2003. Return data were gathered for government bonds, U.S. Treasury bills, domestic common stocks, corporate bonds, foreign equities, interest rate indices, real estate investment trusts (REITs), commodity indices, cash rents for cropland, and farmland valuation indices from the National Council of Real Estate Investment Fiduciaries (NCREIF). State-level farmland value and cash rent data was compiled from USDA sources. Their results confirmed those of previous studies by concluding that farmland returns were indeed negatively correlated with stocks and bonds and positively correlated to inflation. The authors concluded that adding farmland to investment portfolios had historically improved risk and return characteristics while providing a hedge against inflation.

Libbin, Kohler, and Hawkes (2004) examined the application of portfolio theory and the CAPM for investment diversification strategies for farm households. Their analysis was based on the observed tendencies of farm operators and farm owners to: 1) make minimal use of financial diversification techniques to manage risk; and 2) lean toward greater specialization in order to more effectively manage expenses and output prices. The article asked if greater diversification might be a better strategy since the goals of most farm operators are to maximize their income and to decrease its variability. The authors briefly described the process for creating efficient portfolios that maximized returns for an acceptable level of risk while noting the "acceptable" level of risk is unique to each investor and may be difficult to quantify. Even though not proven through new empirical evidence, the authors concluded their review of relevant studies with the opinion that CAPM analyses supported the inclusion of financial assets and real assets together in a well-diversified portfolio that enhanced its return and risk characteristics.

University of Illinois Endowment Pool and Farms

The UI operates an endowment pool of financial assets to provide income to the colleges and departments that are the beneficiaries of donors' bequests. The Treasury Operations office is responsible for maintaining a long-term investment horizon for these investment balances. An endowment pool investment policy developed by senior UI business officers, with assistance from an external investment advisor, is reviewed periodically and approved by the investment policy committee of the Board of Trustees. The endowment pool investment policy guides those responsible for its execution in the pursuit of a rational level of return with a prudent level of risk. The policy has typically required a mix of stocks and bonds, with a small private equity allocation being added in the last decade.

The UI has been the beneficiary of an unplanned portfolio of endowment farmland since the first farm was received in 1923. The size of the UI farmland portfolio peaked in 2007 with 21 endowment farm gifts consisting of approximately 11,900 acres under professional in-house management. The entire portfolio is located in central and north-central Illinois, with a listing of farms and their locations in the state depicted in Figure 1. The farms received accounting treatment as separately-invested endowments until January of 2007. Separately-invested endowments stand alone outside of the general UI endowment pool and distribute net income directly to the beneficiary college or department. Endowment pool participants, on the other hand, receive a monthly income stream from the diversified pool of which it owns shares.

In 2007, one of the farms was strategically transitioned from separately-invested endowment to become the cornerstone of a new farmland asset class in the endowment pool. The former recipient of that farm's income began receiving its monthly income distribution from the endowment pool, and the net farm income was paid into the endowment pool. Anecdotal evidence hinted that farmland would have a favorable impact on the endowment pool, and the UI's investment advisors agreed that it would be a prudent decision. This single farm comprised seven percent of the total endowment pool

market value when it was added in January of 2007. The Board of Trustees of the UI granted approval to add farmland up to 15 percent of the total endowment pool value.

Data

Leases for the endowment farms were entirely one-year crop-share leases from 1923 through 2004. The Agricultural Property Services (APS) office, which handles management of the endowment farms, was instructed by UI senior administrators to open a subset of the farms to a competitive bidding process for cash rent leases for the 2005 crop year. This conversion to competitively bid cash rents took four rounds to complete and one group of farms remained to be bid for the first time at the end of 2008. During this conversion, some farms received a resulting one-time boost in net income in cases where part of the crop had been stored and sold in the first year of the cash rent.

Farm Income

Endowment farm data were gathered and retained by APS with oversight from University Accounting and Financial Reporting (UAFR). UAFR meticulously calculates endowment farm net income from APS data using Generally Accepted Accounting Principles (GAAP). These accounting practices are also, with a few exceptions, aligned with the Farm Financial Standards Council (FFSC) guidelines. Slight departures from FFSC guidelines are used for long-term asset depreciation and the deferral of expenses for which GAAP result in more conservative accounting conventions. Revenues include grain sales and inventories, crop insurance proceeds, cash rent, and other miscellaneous sources such as commodity program payments. Expenses include inputs, machine hire, taxes, building and drainage repairs, depreciation, crop and liability insurance, and any other miscellaneous expenses.

Farmland Values

Some endowment farms were professionally appraised at the time the UI received title in order to determine their initial beginning of year asset value. For many years this was the cost value reported by UAFR and attempts to place a current market value on particular farms only occurred as needed. In the early 1990s the UI Treasury Operations staff began seeking benchmarks to which the endowment farms' financial performance could be measured. The Federal Reserve Bank (FRB) of Chicago Farmland Values for Region XI, East Central Illinois was selected as a proxy for changes in the UI endowment farms' values and was used by APS to create an annual index of farm value changes. Upon completion of formal appraisals in the mid-1990s, farm values were adjusted annually using the FRB Index. The APS office has occasionally made further adjustments to the FRB Index value for a particular farm if recent farm sales near the subject farm supported a variance from the index value. APS used the Illinois Land Sales Bulletin, Farm Credit Services publications and other sources to find comparable sales with which to justify any variations from the FRB Index.

In 2008, UAFR informed APS that a new statement from the Governmental Accounting Standards Board (GASB 52) would be enforced by the UI's external auditors. GASB 52 requires that public universities that own endowment real estate to report it at fair value on financial statements and stipulates that fair value should be established via periodic appraisals by certified real estate appraisers. APS elected to hire 1st Farm Credit Services' certified appraisers to obtain these appraisals. The farms were valued as of July 1, 2008 in order to coincide with the UI's fiscal year. For purposes of this analysis, these appraised values are adjusted to 12/31/08 values by applying the third and fourth quarter changes as reported by the FRB Index. Because APS utilized a thorough process for annually valuing the endowment farm portfolio prior to the requirement for external appraisals, the following two sets of data are averaged to reach the end-of-year farm values for this analysis:

1) APS farm valuation data through December 31, 2007 with the adjusted 1st Farm Credit Services appraisal valuation for December 31, 2008.
2) Adjusted 1st Farm Credit Services appraisal valuations for December 31, 2008, with each prior year deflated by the FRB Index value for that year.

Following the practice of the studies cited previously, the Not-Seasonally Adjusted Consumer Price Index (CPI) from the U.S. Bureau of Labor Statistics (BLS) were used to convert nominal income and farmland values to real values in 2008 U.S. dollars.

Current Returns, Capital Gains, and Total Returns

Nominal current returns were calculated on an annual basis as the ratio of net income to farm value at the beginning of the year. Annual capital gains/losses were computed as the change in farm value over the year, divided by the beginning of year value. Annual total returns were computed as the sum of net income and capital gains/losses divided by the beginning of the year farm value. The annualized

return for each annual return series (current returns, capital returns, total returns) was then taken as the geometric return of the series to capture compounding effects over time. The geometric return formula is given by

$$(1)\quad R_j = \sqrt[n]{(1+a_1)(1+a_2)\cdots(1+a_n)}$$

where R_j is the geometric return for asset j and a_i is the nominal return for year i.

Returns and Portfolio Analysis

Individual endowment farm returns were combined into the "UI Farmland Portfolio" using an acre-weighted averaging procedure. Geometric returns were calculated for cash return, land value return and total return for each farm and for the UI Farmland Portfolio for the following periods and sub-periods:

1. 1962-2008 – This is the period for which University Accounting and Financial Reporting (UAFR) and APS files contained complete farm income data.
2. 1962-1970 – A period of high cash returns and moderate increases in land values.
3. 1971-1980 – A decade of high cash returns and large increases in land values.
4. 1981-1990 – A decade of moderate cash returns with large increases in land values early in the period, followed by a severe correction in land values.
5. 1991-2000 – This decade produced moderate levels of cash returns and land value returns.
6. 2001-2008 – A period of moderate cash returns and large increases in land values.
7. 1962-1986 – This sub-period captures the large increases in land values, followed by the severe correction.
8. 1987-2008 – This sub-period includes the current upward trend in cash returns and land values.
9. 1962-2002 – This sub-period excludes the recent years of high net incomes and competitively bid cash rents. All leases in this period are crop share.
10. 1970-2008 – This sub-period starts the first year that USDA returns for Illinois farms are available.

The UI farm portfolio returns and standard deviation of annual returns are compared to large company stocks, small company stocks, long-term corporate bonds, long-term government bonds, intermediate-term government bonds, U.S. Treasury bills, and inflation. The UI farm portfolio was also compared to USDA data for Illinois farms for the years 1970 to 2008 to assess the representative nature of the data. Correlation coefficients among the UI farm portfolio's cash return, land value return and total return, and the same return elements for each asset class stated above were also calculated for use in constructing optimal investment portfolios.

Portfolio selection and performance measures follow Markowitz (1952). Expected returns are a weighted average of total returns for each individual asset class, where the weights are equal to the proportion of total portfolio value invested in each respective asset class. The algebraic expression for total expected portfolio return is given by

$$(2)\quad E[R_p] = \sum_{g=1}^{G} w_g E[R_g]$$

where $E[R_p]$ is the expected portfolio return, $E[R_g]$ is the expected return to each individual asset g and w_g is the portion of total portfolio value assigned to individual asset g.

The standard deviation of returns is used to calculate variances for an asset class and co-variances between asset classes. The optimal combination of assets will minimize the overall risk to the portfolio. Algebraically, the measure of risk for a multiple-asset portfolio is given by

$$(3)\quad Var(R_p) = \sum_{g=1}^{G}\sum_{h=1}^{H} w_g w_h Cov(R_g, R_h)$$

where w_g is the weight assigned individually to each asset g, R_g is the return to each respective asset g, and $Cov(R_g, R_h)$ is the covariance between returns for assets g and h.

The University of Illinois endowment pool is used as a proxy for the asset classes to include in the optimization exercise due to its reasonable and prudent investment goals, and long-term investment horizon. The endowment pool's standard deviation of returns from 2002 through the end of 2009 was approximately 12.5 percent. Investment targets for the UI endowment pool as of the date of this research include allocations across U.S. Equities (51.5%), Non-U.S. Equities (15%), Private Equities (5%), Fixed Income (21.5%), and Endowment Farmland (7%).

The alternative asset classes selected for this analysis include large company stocks, small company stocks, long-term corporate bonds, long-term government bonds, intermediate-term government bonds,

and the UI farmland portfolio. U.S. Treasury bills were excluded due to their relatively short-term time horizon. Private equity and other alternative assets were excluded from this analysis due to the lack of historical performance data for those asset classes. All historical performance data for alternative asset classes was obtained from Ibbotson's 2009 Valuation Yearbook.

Using the means, standard deviations, and correlations among returns for each asset class, constrained optimization was performed using the Microsoft Excel Solver tool to construct maximum return portfolios at varying levels of risk by choosing allocations of total portfolio value across the available asset classes. The two constraints in place for each scenario are that the percentage share from each asset class cannot be a negative number (no short-selling) and the sum of the percentage shares must total 100 percent (full investment). These results were then used to construct the efficient frontier, or E-V frontier, which represents the relationship between the maximum returns an investor can expect for any given level of risk they are willing to bear (Fabozzi and Modigliani, 2009). Portfolios that lie on the E-V frontier have the highest expected return possible for their respective levels of risk. Alternatively, portfolios on the frontier have the minimum level of risk for any given expected level of return.

Efficient portfolios were constructed for the following three scenarios:

1. Optimal portfolio allocation excluding farmland investment
2. Optimal portfolio allocation including farmland investment
3. Optimal portfolio allocation with farmland investment limited to a maximum of 15 percent

The comparison between scenarios 1 and 2 above illustrates how the addition of Illinois farmland to an investment portfolio impacts performance. The third scenario illustrates the effect of the UI endowment pool's current policy limit of 15 percent of total investment allocated to farmland.

Results

Table 1 compares the returns of major asset classes, the UI farmland portfolio, Illinois farmland returns as reported by the USDA, the market portfolio modeled after the UI endowment pool asset allocation, and a measure of inflation given by the BLS CPI index. The comparison demonstrates the competitive return and risk characteristics of the farm portfolio when compared to the other asset classes. It is worth noting that there is surprisingly little variation in farmland returns over the longer time periods.

The 1960s produced solid returns with low variability for the UI farms. Stocks also enjoyed a good decade, although with considerably more volatility relative to farmland. The 1970s saw inflation exceeding the rate of return on U.S. Treasury Bills and was an excellent decade for Illinois farmland returns. The 1980s experienced falling inflation and a farm economy crisis, while other major asset classes experienced an excellent decade. The 1990s generated excellent returns for almost every asset class in the previous table and the UI farmland portfolio continued the modest recovery started in the late 1980s. The first decade of the 2000s is thus far producing excellent returns to the UI farmland portfolio and fixed income funds, while stock performance has been relatively poor. The 1962-1986 period captured in the previous table demonstrates good returns to the UI farmland portfolio but with significant volatility. The 1987-2008 period shows a reasonable return for all asset classes and decreased volatility in farmland returns compared to 1962-1986.

Figure 2 provides correlations between the UI farmland portfolio and the asset classes included in this analysis over the full 1962 to 2008 time period. Farmland in Illinois exhibits a moderate positive correlation with inflation, providing some support for previous findings that farmland may provide a hedge against inflation. The UI farmland portfolio is negatively correlated with large company stocks, long-term corporate bonds, long-term government bonds, intermediate-term government bonds, and the market portfolio. Only slight positive correlation exists between the UI farmland and small company stocks. Not included in Figure 2 due to the differing time period, the UI farmland portfolio shows a high correlation of 0.87 with USDA Illinois farms total return for the 1970-2008 period. Comparison of the similar returns and risk figures for the UI and USDA farmland in Table 1, and the high correlation between the two, suggests that the endowment farm data is fairly representative of Illinois farmland.

Comparison of the risk and return characteristics, and relationship with other asset classes, clearly shows the favorable implications of holding Illinois farmland within a portfolio. The total return is competitive with other asset classes, and Illinois farmland tracks modestly with inflation. The standard deviation of returns for Illinois farmland is reasonable and its negative correlation with the returns of other asset classes over time indicates that it complements a well-

diversified portfolio. We now explore these observations in more detail by examining efficient investment portfolios constructed from these asset classes, specifically examining the impact on expected portfolio performance with the addition of farmland investment.

Efficient Investment Portfolios

Table 2 reports optimized asset allocations for three investment scenarios across varying acceptable risk scenarios. The UI endowment pool's standard deviation of 12.5 percent is highlighted as a point of reference in each of the three sections of Table 2. Risk levels below four percent standard deviation of return were not feasible and risk levels above 21 percent standard deviation of returns produced models that were fully allocated to small company stocks.

The top section of Table 2 displays outcomes where UI farmland is included in the investment portfolio. The middle section reports outcomes when UI farmland is excluded. Finally, the bottom panel reports portfolio allocations when farmland is limited to no more than 15 percent of the total portfolio. In every case, increasing the allocation to UI farmland to the 15 percent maximum limit, or a larger allocation in the unconstrained case, was optimal. Only at high acceptable risk levels exceeding a 21 percent standard deviation of portfolio returns would the efficient allocation to farmland drop below 15 percent of total portfolio value. This is due to the historically low risk of farmland investment relative to its expected return compared with the other asset classes.

For every standard deviation value, the return is higher when UI farmland is included in the asset allocation. Comparing the top two sections of Table 2 shows that when UI farmland is allowed into the investment portfolio, allocations toward small company stocks and government bonds diminish as farmland allocation increases. The conclusion from these observations is that the addition of UI farmland to the investment portfolio can improve expected returns, reduce investment risk, or have both effects.

Figure 3 further illustrates the portfolio results by plotting the E-V frontiers for investment strategies which include farmland and exclude farmland from the portfolio. Each of the asset classes included in the portfolios are also plotted individually with their respective return and risk values. The efficient frontier when farmland is included as an asset class within the portfolio dominates the frontier which excludes farmland investment. For any acceptable level of risk, the investor can achieve higher expected returns when farmland is included in the portfolio.

Conclusion

The UI farmland portfolio provides favorable return, risk and correlation characteristics when compared with alternative asset classes including stocks and bonds. This is true to such an extent that the E-V frontier/portfolio exercises result in farmland frequently dominating the efficient asset allocation. Our results suggest that the UI policy limiting farmland investment allocations to 15 percent of the general endowment fund may be hindering returns and/or exposing the fund to larger amounts of risk than necessary. The implications of our analysis also extend beyond the UI case to general investors whose portfolios may or may not include farmland investment.

Our data also suggests that farmland may provide a moderate inflation hedge, although the correlation between farmland returns and inflations are lower than in some previous studies covering different time periods (e.g., Irwin, Forster, and Sherrick, 1988). This difference may also be attributable to the farm-level data which was available for this analysis, relative to the aggregated data sources used in earlier studies. Finally, our results illustrate the time dependence of the relative performance of farmland investment to alternative assets and farmland's suggested role in diversified investment portfolios, especially when compared with the conclusions made in previous studies.

The UI farmland portfolio likely has higher volatility of returns than would be expected from a diversified farmland portfolio containing properties from widely dispersed geographic regions. The correlation of total returns between the individual farms and the total UI farm portfolio demonstrates that the farm portfolio is highly correlated to itself. This is not necessarily surprising and supports the implication that diversification to other agricultural asset sub-classes and geographic regions within the portfolio may even further improve its overall return and risk characteristics.

This analysis of the UI farmland portfolio holds the advantage of having data from a live portfolio of farms. The results substantiate what previous studies have concluded; Illinois farmland can lower the volatility of an already diversified investment portfolio while providing a return premium above what is required to compensate for its systematic risk. However, these conclusions must be balanced with the recognition that illiquidity and thin markets make buying and selling Illinois farmland more challenging than actively traded asset classes with daily liquidity and ownership changes. These challenges

may make the holding of 50 percent or more of a market portfolio in farmland, as was suggested by the efficient portfolio modeling, impractical for institutional investors who might have immediate requirements for liquidity. Perhaps the future will bring solutions to these limitations to an extent that makes even greater allocations to farmland a viable reality.

These results lead to a number of additional questions that could be topics for future research. First, and related to the challenge of liquidity, is the diversification effect of farmland investment scalable to small investors? Second, can investment returns be further diversified by investment into land used for other crops such as timber, fruits and vegetables, or rangeland used for livestock? Third, are there advantages to investing in managed farmland funds over holding individual farm properties? Fourth, is it possible to construct reasonable estimates of the costs of illiquidity, thin markets, high-transaction costs, and the unique tax obligations associated with farmland investment? Finally, how will these conclusions be affected as the U.S. and global economies emerge from the current recession?

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Figure 1. University of Illinois endowment farms donated by 1976 or earlier

1. Allerton Farm–4 units–Piatt County
   3,844 total acres
   3,379.5 tillable acres
2. Campbell Farm–DeWitt County
   86 total acres
   85.2 tillable acres
3. Carter-Pennell Farm–Vermilion County
   346 total acres
   319.3 tillable acres
4. DeHart Farm–Moultrie County
   120 total acres
   116.2 tillable acres
5. Hackett Farm–Douglas & Moultrie Counties
   416 total acres
   364.6 tillable acres
6. Hubbell Farm–DeWitt County
   160 total acres
   157.2 tillable acres
7. Hunter Ag. Exp. Farm–Champaign County
   280 total acres
   243.9 tillable acres
8. Hunter Ag.Sch.Farms–4 units
   Menard, Macoupin, & Sangamon Counties
   1,256 total acres
   1215.5 tillable acres
9. Warren Farm–Piatt County
   120 total acres
   119 tillable acres
10. Weber Farms–2 units–LaSalle County
    800 total acres
    774 tillable acres
11. Wright Farms–3 units–DeKalb County
    893 total acres
    869.9 tillable acres

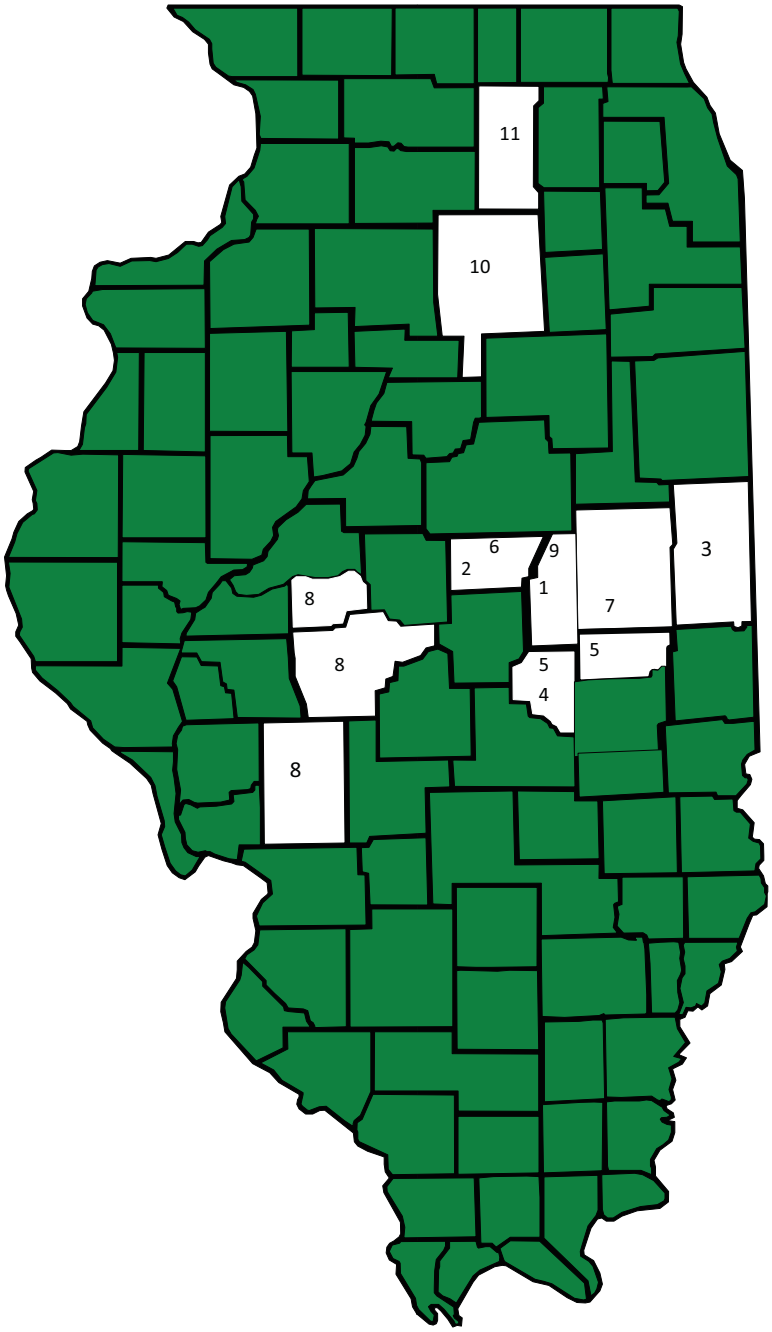
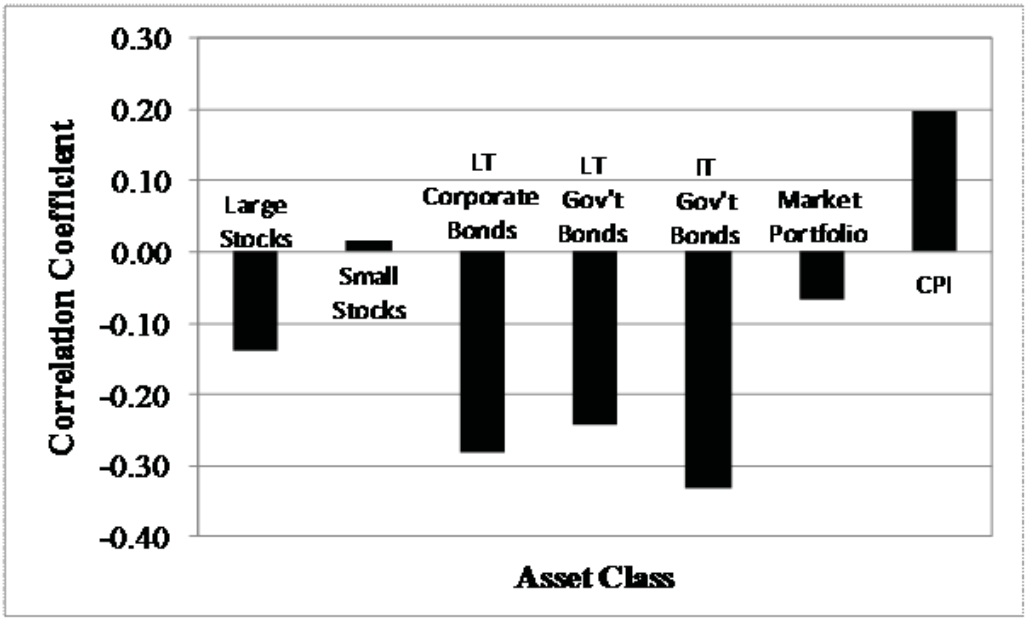


Figure 2. Correlations among total returns for the UI farmland portfolio, alternative asset classes, and inflation 1962-2008



Note: The acronyms LT, IT, and CPI stand for long-term, intermediate-term, and consumer price index, respectively.

Figure 3. E-V frontiers with and without farmland, and individual asset class performance

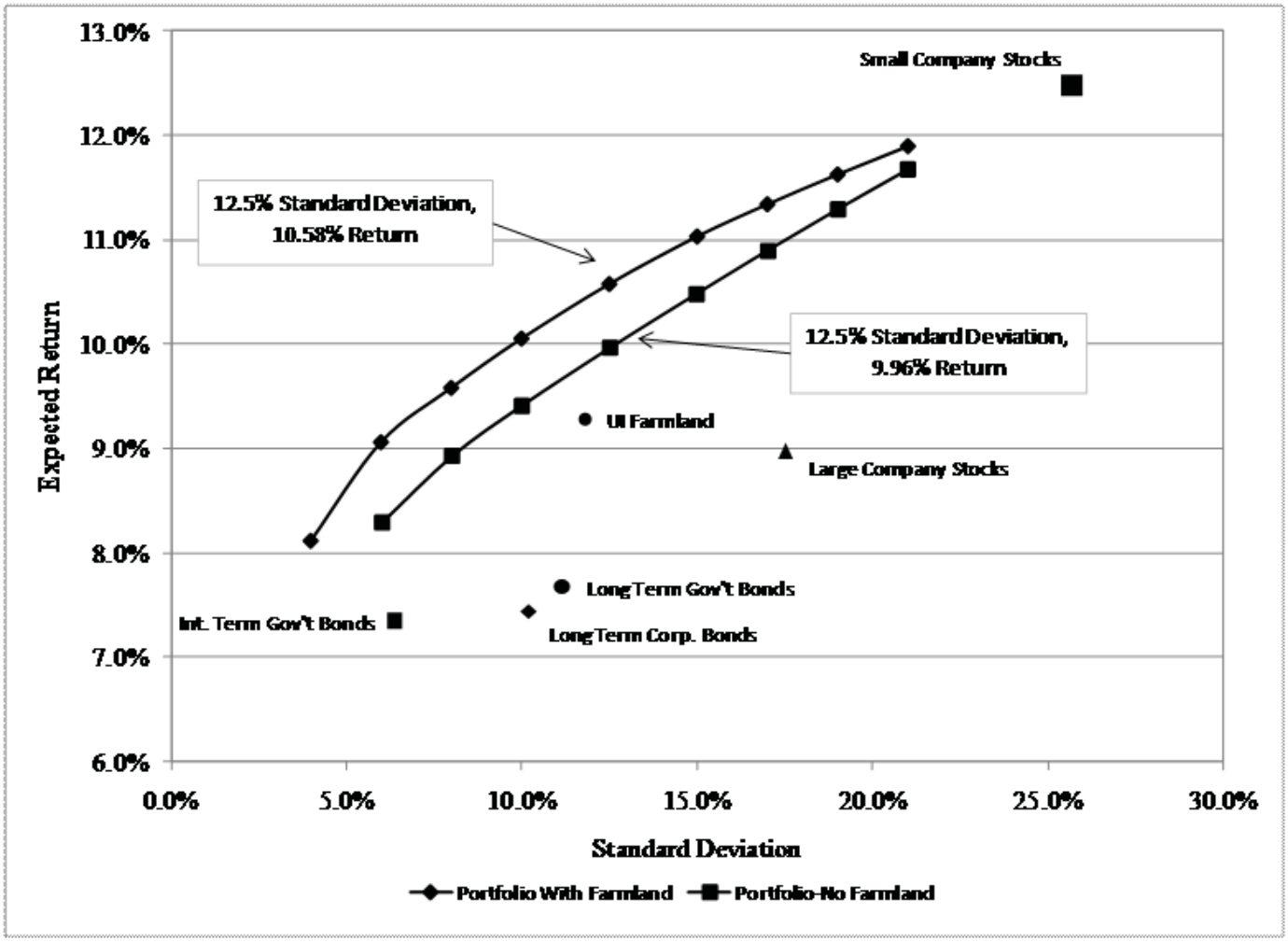


Table 1. Comparison of performance across asset classes for different time periods

Asset Class	1962-2008	1970-2008	1962-1986	1987-2008	1962-2002	1962-1970	1971-1980	1981-1990	1991-2000	2001-2008
Expected Returns										
Large Company Stocks	9.0%	9.5%	9.3%	8.6%	10.0%	6.3%	8.5%	13.9%	17.5%	-2.9%
Small Company Stocks	12.5%	11.7%	15.3%	9.4%	13.5%	11.8%	17.5%	9.3%	17.5%	5.1%
Long-Term Corporate Bonds	7.4%	8.9%	6.7%	8.3%	7.7%	2.3%	4.2%	14.1%	9.0%	7.6%
Long-Term Gov't Bonds	7.7%	9.3%	6.2%	9.4%	7.5%	1.3%	3.9%	13.7%	10.3%	9.3%
Intermediate-Term Gov't Bonds	7.3%	8.3%	7.5%	7.2%	7.7%	4.2%	5.7%	12.5%	7.5%	6.5%
UI Farmland Portfolio	9.3%	9.2%	8.9%	9.7%	8.5%	9.1%	19.7%	-0.2%	7.1%	12.2%
Market Portfolio	10.0%	10.4%	10.6%	9.4%	10.7%	7.4%	10.9%	12.3%	15.2%	2.9%
USDA Illinois Farmland	-	11.9%	-	12.0%	-	-	22.6%	2.9%	10.4%	13.3%
Consumer Price Index	4.2%	4.5%	5.4%	3.0%	4.5%	3.2%	8.1%	4.5%	2.7%	2.4%
Standard Deviation of Returns										
Large Company Stocks	17.5%	18.2%	16.4%	19.1%	16.9%	13.5%	20.7%	13.2%	15.3%	21.5%
Small Company Stocks	25.7%	23.8%	28.3%	22.4%	25.0%	35.1%	29.6%	19.0%	16.7%	28.8%
Long-Term Corporate Bonds	10.2%	10.4%	11.9%	8.0%	10.9%	7.7%	8.0%	13.6%	10.8%	4.5%
Long-Term Gov't Bonds	11.1%	11.4%	11.6%	10.6%	11.5%	6.2%	7.0%	14.1%	13.3%	8.5%
Intermediate-Term Gov't Bonds	6.4%	6.5%	7.0%	5.8%	6.6%	5.2%	3.3%	7.6%	7.2%	4.9%
UI Farmland Portfolio	11.8%	12.6%	15.4%	5.6%	12.4%	6.5%	15.0%	12.4%	5.3%	5.9%
Market Portfolio	13.4%	13.5%	13.7%	13.4%	13.1%	13.1%	16.3%	11.0%	11.0%	15.2%
USDA Illinois Farmland	-	11.2%	-	5.3%	-	-	11.7%	10.9%	3.1%	7.5%
Consumer Price Index	3.0%	3.1%	3.6%	1.3%	3.1%	1.9%	3.7%	2.0%	0.6%	1.3%

Table 2. Individual assets, efficient portfolio allocations, and performance measures at varying levels of risk

Individual Asset Class Performance

	Large Stocks	Small Stocks	LT Corp. Bonds	LT Gov't Bonds	IT Gov't Bonds	UI Farmland Portfolio
Expected Return	8.97%	12.47%	7.44%	7.67%	7.35%	9.28%
Standard Deviation	17.53%	25.67%	10.20%	11.14%	6.39%	11.78%

Efficient Portfolio Allocations - Farmland Included

Portfolio Risk (Standard Deviation)	Asset Allocation						Portfolio Performance Expected Return	C.V.
6%	0.00%	17.95%	0.00%	18.56%	25.49%	38.00%	9.06%	0.66
8%	0.00%	25.40%	0.00%	18.45%	10.89%	45.26%	9.58%	0.83
10%	0.00%	32.72%	0.00%	16.63%	0.00%	50.65%	10.06%	0.99
12.5%	0.00%	42.45%	0.00%	3.37%	0.00%	54.18%	10.58%	1.18
15%	0.00%	55.03%	0.00%	0.00%	0.00%	44.97%	11.04%	1.36
17%	0.00%	64.70%	0.00%	0.00%	0.00%	35.30%	11.35%	1.50
19%	0.00%	73.64%	0.00%	0.00%	0.00%	26.36%	11.63%	1.63
21%	0.00%	82.15%	0.00%	0.00%	0.00%	17.85%	11.90%	1.76

Efficient Portfolio Allocations - No Farmland

6%	0.00%	16.74%	0.00%	23.67%	59.59%	-	8.28%	0.72
8%	0.00%	29.02%	0.00%	26.02%	44.96%	-	8.92%	0.90
10%	0.00%	38.39%	0.00%	27.67%	33.94%	-	9.41%	1.06
12.5%	0.00%	48.97%	0.00%	30.48%	20.56%	-	9.96%	1.26
15%	0.00%	59.09%	0.00%	32.37%	8.54%	-	10.48%	1.43
17%	0.00%	67.05%	0.00%	32.95%	0.00%	-	10.89%	1.56
19%	0.00%	75.27%	0.00%	24.73%	0.00%	-	11.29%	1.68
21%	0.00%	83.20%	0.00%	16.80%	0.00%	-	11.67%	1.80

Efficient Portfolio Allocations - Farmland Limited to 15% of Total Portfolio Value

6%	0.00%	21.15%	0.00%	22.30%	41.55%	15.00%	8.79%	0.68
8%	0.00%	30.64%	0.00%	23.67%	30.69%	15.00%	9.28%	0.86
10%	0.00%	39.04%	0.00%	26.25%	19.71%	15.00%	9.72%	1.03
12.5%	0.00%	49.07%	0.00%	28.55%	7.38%	15.00%	10.25%	1.22
15%	0.00%	59.09%	0.00%	25.91%	0.00%	15.00%	10.75%	1.40
17%	0.00%	67.11%	0.00%	17.89%	0.00%	15.00%	11.14%	1.53
19%	0.00%	74.86%	0.00%	10.14%	0.00%	15.00%	11.51%	1.65
21%	0.00%	82.43%	0.00%	2.57%	0.00%	15.00%	11.87%	1.77

Note: The acronyms LT and IT stand for long-term and intermediate-term, respectively.