# NORTH AMERICAN FARMLAND INVESTMENT PERFORMANCE ASSESSMENT USING E-V ANALYSIS, CAPM AND VALUE AT RISK

Marvin J. Painter

Edwards School of Business, University of Saskatchewan, Canada

## Abstract

*Why is there a strong and growing demand for farmland investment from the non-agricultural sector? Over the study period 1972-2011, North American farmland investment yields have been very competitive with stocks, bonds and real estate. In this study, three methods are used to assess the investment performance of farmland within a diversified portfolio: the Capital Asset Pricing Model (CAPM), the Expected Value-Variance Model (E-V Analysis), and the Value at Risk (VAR) Model. The CAPM analysis suggests that farmland provides an investment yield that is greater than required, given that it adds little or no risk to a diversified portfolio. This also implies that farmland, given its competitive yield, can enhance investment performance in a diversified portfolio. Since CAPM is an equilibrium pricing model, it further suggests that farmland is underpriced and in a liquid, free trading market place, farmland prices would be bid up until the excess return disappears. The E-V analysis found that a North American farmland investment can improve the investment performance of the efficient set of portfolios at low and medium risk levels, but does not provide improvement for higher risk portfolios. Finally, the VAR analysis found that when North American farmland is added to a diversified portfolio, it reduces the maximum expected loss that can occur, thereby reducing the downside risk of the portfolio without reducing the expected yield. In general, all three methods, CAPM, E-V analysis and VAR found consistent results; that North American farmland has a competitive yield and is very good at reducing risk in a diversified portfolio, thereby improving overall investment performance.*

*Keywords: North American Farmland Investment, CAPM, efficient investment*

## 1. Introduction

The demand for North American farmland investment is significant and appears to be growing. This paper will look at Canadian and US farmland investment attributes to assess why the demand for farmland by the non-agricultural sector appears to be strong and growing. Specifically, the assessment will proceed in the following order:

1. North American farmland investment yields will be calculated for the period 1972-2011.
2. The variance-covariance and correlation matrices will be calculated for a set of investment assets including treasury bills (T-bills), government bonds, North American Farmland Trust, US Real Estate Investment Trusts (REITs), gold, oil and stock markets around the world.
3. The Capital Asset Pricing Model (CAPM) will be applied to all assets to assess asset prices and values relative to their levels of systematic risk. The CAPM will be used to assess the investment diversification attributes of farmland and compare farmland valuation relative to other investment assets.
4. The Markowitz E-V model will be used, with the inclusion of the risk-free asset, to determine efficient investment portfolios and the extent to which farmland is included in the 'best' portfolios.

5. Low, medium and high risk portfolios will be chosen from the E-V efficient set and will be compared using the Value at Risk methodology (VAR), to determine whether farmland has significant risk-reducing capabilities when added to an investment portfolio;
6. The CAPM, E-V and VAR results will be compared to make an overall assessment of North American farmland investment performance over the period 1972-2011.

## 2. Background

The idea of efficient investment is usually credited to Markowitz (1959), who developed the expected value-variance (E-V) model, which could combine the right assets in the right proportions to provide a portfolio that dominated all others, in term of return per unit of risk taken. Tobin (1958) and Treynor (1961) extended the E-V model by adding the risk-free asset. Their contribution, called the two-fund separation theorem, produced the Capital Market Line (CML). While E-V analysis and the CML focused on efficient portfolios, Sharpe (1964) developed the Capital Asset Pricing Model (CAPM), which looked at the investment attributes and pricing of individual assets. Value at Risk (VAR) is a risk management tool that was developed by finance and stock market professionals in the late 1980's. It is a model that can estimate for a portfolio the probability of a maximum loss to occur, for a specified period of time.

Peter Barry (1980) applied the CAPM to farmland in eleven different regions in the United States and found that farmland added very little risk to a diversified portfolio of stocks and bonds because most of farmland risk is diversifiable (unsystematic risk). Kaplan (1985) found that farm real estate had two favorable attributes: high total return and low correlation with other assets, which meant that including farmland in a portfolio added a high return asset with very little risk added. Moss, Featherstone and Baker (1987) as well as Lins, Kowalski and Hoffman (1992) and Ruebens and Webb (1995), assessed efficient portfolios using US financial assets and farmland and concluded that the addition of farmland to stock and bond portfolios improved portfolio performance. Brown (1999) showed that farm returns are comparable to returns for stocks and bonds and correlations are low between farmland and financial assets, indicating the potential for efficient diversification by adding farmland to the investment mix. Bigge and Langemeier (2004) found that Kansas farmland's low level of systematic risk meant that farmers could improve overall portfolio performance with investment in the stock market. Libbin, Kohler and Hawkes (2004a and 2004b) suggested that farmers could improve financial performance by investing in financial assets and/or paying down their debt liabilities. Hardin and Cheng (2005) used a Markowitz semi-variance model to evaluate US farmland in a mixed-asset portfolio and found that farmland did not need to be a substantial part of an optimal portfolio; however, they suggested that more studies were needed using additional farmland data to fully assess direct investment in agricultural land. Shadbolt and Gardner (2006) found that returns to farming business investors are highly variable compared to the returns to farmland ownership based on rental agreements. Oltmans (2007) explains that with an appreciating asset like farmland, the capital gain return means that the asset itself need produce less operating income to make it economically desirable. This in part explains why farmers continue to purchase farmland even when it cannot cash flow itself because the operating return is only part of the total return; capital gain (expected growth) is the other part and needs to be addressed in the valuation assessment as well. Painter and Eves (2008) assessed farmland investments in United States, Canada, New Zealand and Australia and found that the low and negative correlation of farmland yields with stocks and bonds made it a good candidate for portfolio diversification. Waggle and Johnson (2009) added farmland and timberland to the choice set of assets. They employed a Markowitz portfolio optimization model and found widely varying allocations with farmland entering the optimal portfolios only at low risk levels and timberland at higher risk levels. Painter (2011) found that a Canadian Farmland Real Estate Investment Trust fared well in an efficient international investment portfolio and provided better diversification performance than gold, in medium risk portfolios. Noland et. al. (2011), used the University of Illinois farmland portfolio and found that it frequently dominated the efficient asset allocation when other financial assets were included in the choice set.

## 3. Calculating income and capital gain yields for a North American FREIT

Farmland ownership yields are calculated annually for the 1972-2011 study period, for the following Canadian provinces and US states: in Canada, Alberta, Saskatchewan, Manitoba, Ontario and Quebec; in US, Iowa, Illinois, Nebraska, Minnesota and Kansas. In each province and state, aggregate farmland data is used to simulate an FREIT (farmland real estate investment trust), assuming that an FREIT will own land that is geographically dispersed for diversification reasons. The total return to an FREIT is divided into two parts; income return and capital gain return. The income return is based on the net lease revenue obtained from renting the farmland in the trust to farm operators. The capital gain return is the change from year to year in the market value of the land. A standard crop share approach is used where the FREIT receives a percentage of the gross revenues produced (17.5% is used for North America to approximate cash rents that are usually in the 5-7% of land values range). The FREIT is then responsible for paying property taxes and building depreciation to arrive at a net lease amount or income return to the FREIT. Hence, the annual income return per hectare to farmland ownership in an FREIT is calculated as follows:

$$IR_t = LR_t - PT_t - BD_t \tag{1}$$

Where:
$IR_t$ = \$ income return to farmland per hectare in year t;
$LR_t$ = gross lease revenue per hectare in year t (17.5% of Gross Farm Revenues);
$PT_t$ = property taxes per hectare in year t;
$BD_t$ = building depreciation per hectare in year t;
The annual income and capital gain yields for each FREIT are calculated as follows:

$$IY_t = \frac{R_t}{V_{t-1}} \tag{2}$$

Where:
$IY_t$ = % income yield per hectare in year t;
$IR_t$ = \$ income return to farmland per hectare in year t;
$V_{t-1}$ = average farmland value per hectare in year t-1.

$$CGY_t = \frac{V_t - V_{t-1}}{V_{t-1}} \tag{3}$$

Where:
$CGY_t$ = % capital gain yield per hectare in year t;
$V_t$, $V_{t-1}$ = average farmland values per hectare in years t and t-1, respectively.

Annual income and capital gain yields are calculated for each province and state, for the period 1972-2011. The annual total investment yields for each provincial and state FREIT are the sum of the annual income and capital gain yields, calculated as follows:

$$ROI_t = \frac{R_t}{V_{t-1}} + \frac{V_t - V_{t-1}}{V_{t-1}} \quad (4)$$

The average annual NA FREIT yield for the study period is the arithmetic average of the provincial and state yields for that year, while the average annual NA FREIT yield over the complete study period is the geometric average of the annual NA FREIT yields, which represents the average annual compounded rate of return earned. In both Canada and US, bond interest is taxed differently than dividends and capital gains. To compare average yields, tax adjustments are made to account for these differences. Also, an FREIT requires management so a Management Expense Ratio (MER) must be included to account for management costs. The average tax adjustment factor is calculated as follows:

$$T = \frac{1 - t_{interest}}{1 - t_{Dividend,G}} \quad (5)$$

Where:

$T$ = the tax adjustment factor for average T-bill and Long Bond yields;

$t_{interest}$ = the average personal tax rate on interest income;

$t_{Dividend,CG}$ = the average personal tax rate on dividend and capital gain income.

Using average personal tax rates in Canada and US, the adjustment factor T is 72%. An MER of 4% has been subtracted from the calculated NA FREIT average yield to account for management expenses. Table 1 illustrates the average annual yields for the choice set of investment assets, which include all tax and MER adjustments. The average borrowing rate is based on the average annual prime lending rate plus 2%, adjusted by the interest tax factor. The standard deviation of annual yields over the study period is provided as the measure of total risk and the coefficient of variation (standard deviation divided by average yield) is provided as a comparative measure of risk per unit of yield.

Table 1. Average annual investment yields for T-bills, long bonds, NA FREIT, gold, oil, REITs and stock markets (1972 – 2011)

| Investment asset | Total yield | Standard deviation | Coefficient of variation |
|---|---|---|---|
| T-Bills | 4.8% | 0.0% | N/A |
| Long Bonds | 5.8% | 3.0% | 0.52 |
| Borrowing | 7.4% | 0.0% | N/A |
| NA FREIT | 6.5% | 9.4% | 1.45 |
| REITs | 9.5% | 21.4% | 2.25 |
| Gold | 9.6% | 26.1% | 2.72 |
| Oil | 8.3% | 29.4% | 3.54 |
| Stock markets | | | |
| Canada | 9.2% | 22.5% | 2.44 |
| Australia | 9.3% | 27.1% | 2.91 |
| US | 8.5% | 18.2% | 2.14 |
| Japan | 8.6% | 33.5% | 3.90 |
| Europe | 9.4% | 22.4% | 2.38 |
| World | 8.5% | 18.5% | 2.18 |
| Hong Kong | 13.2% | 46.8% | 3.55 |

## 4. Correlation results

Table 2 provides the correlation coefficients for the set of investment assets. Some important implications for risk diversification are:

- NA FREIT is negatively correlated with REITs and every stock market, making it a good diversifier in a portfolio of REITs and stocks. NA FREIT also has very low correlation with both T-bills and long bonds, which suggests it may be a good diversifier even with fixed-income assets.
- NA FREIT has a positive correlation with inflation, which suggests it is a good hedge against inflation.
- Both gold and oil are also negatively correlated with REITs and stock markets (in general) and may be as good as or better than NA FREIT as risk reducers in a portfolio.

Table 2. Correlation matrix for the investment assets (1972-2011)

| | T-b | LTB | NA F | Gold | Oil | REIT | Can | Aus | US | Japan | Eur. | World | HK | Inflation |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| T-b | 1.0 | .94 | .01 | -.13 | .00 | .02 | -.12 | -.13 | .10 | .07 | .02 | .06 | -.01 | .72 |
| LTB | | 1.0 | -.09 | -.13 | -.10 | .10 | -.13 | -.10 | .13 | .16 | .06 | .12 | .03 | .69 |
| NA FREIT | | | 1.0 | .46 | .57 | -.10 | -.09 | -.14 | -.21 | -.25 | -.33 | -.31 | -.06 | .48 |
| Gold | | | | 1.0 | .51 | -.18 | .10 | .22 | -.25 | .09 | -.13 | -.11 | .11 | .26 |
| Oil | | | | | 1.0 | -.21 | -.03 | -.25 | -.35 | -.29 | -.36 | -.41 | -.14 | .30 |
| REIT | | | | | | 1.0 | .47 | .51 | .57 | .17 | .39 | .51 | .43 | .02 |
| Can | | | | | | | 1.0 | .79 | .66 | .44 | .64 | .74 | .60 | -.13 |
| Aus | | | | | | | | 1.0 | .60 | .45 | .70 | .77 | .64 | -.12 |
| US | | | | | | | | | 1.0 | .35 | .76 | .88 | .53 | -.09 |
| Japan | | | | | | | | | | 1.0 | .47 | .66 | .59 | .07 |
| Europe | | | | | | | | | | | 1.0 | .89 | .53 | -.12 |
| World | | | | | | | | | | | | 1.0 | .64 | -.08 |
| HK | | | | | | | | | | | | | 1.0 | -.03 |

## 5. Capital Asset Pricing Model (CAPM) application

The second step in the analysis is to apply CAPM to the set of investment assets to assess diversification potential and pricing implications for each asset. For each asset, a beta is estimated using ordinary least squares regression, where the dependent variable is the individual asset annual excess yields[1] and the independent variable is the market portfolio annual excess yields, for the study period 1972-2011. The market portfolio chosen for this analysis is meant to represent a reasonable mix of investment assets that an average investor can choose from. The market portfolio proportions are; T-bills 5%, long bonds 20%, NA FREIT 5%, gold 5%, oil 5%, REITs 30%, and world stock market portfolio 30%. For the study period, the market portfolio average yield was 9.1% (average risk premium over the risk-free yield of 4.2%), with a standard deviation of 10%. Table 3 illustrates the resulting betas for each asset. Based on the CAPM results, there are some important considerations for portfolio diversification:

- NA FREIT, gold and oil all have zero or near zero betas implying that they add no risk to a diversified portfolio.

[1] Excess yields are determined by the actual yield minus the risk-free (T-bill) yield for that year.

Table 3. CAPM Betas for investment assets (1972-2011)

| Asset | Beta ($B_1$) | $B_1$ t-value[a] | Intercept ($B_0$) | $B_0$ t-value |
|---|---|---|---|---|
| Long Bonds | 0.03 | 1.75 | 0.8% | 4.41 |
| NA FREIT | 0.00 | 0.03 | 2.1% | 1.21 |
| Gold | 0.26 | 0.61 | 6.1% | 1.31 |
| Oil | -0.31 | -0.66 | 8.7% | 1.68 |
| REITs | 1.85 | 11.08 | -1.8% | -0.99 |
| Stock Markets: | | | | |
| Canada | 1.69 | 6.88 | -1.3% | -0.46 |
| Australia | 2.10 | 7.48 | -2.0% | -0.66 |
| US | 1.36 | 11.09 | -1.8% | -0.99 |
| Japan | 1.42 | 2.93 | 1.4% | 0.26 |
| Europe | 1.48 | 5.53 | -0.2% | -0.05 |
| World | 1.47 | 8.29 | -1.5% | -0.79 |
| Hong Kong | 2.92 | 5.02 | 3.3% | 0.51 |

[a] The critical t-value for 10% error is 1.71.

- Since NA FREIT, gold, and oil add no risk to a diversified portfolio, their yields should be similar to the risk-free yield, however, all have produced greater yields than required by CAPM.
- CAPM is an equilibrium pricing model. It suggests that if an asset is offering a yield greater than its CAPM required yield, it is underpriced. Investors in the market will demand that asset for their portfolios and in the process, bid up the price until the excess yield is gone and it is offering its equilibrium CAPM required yield. The opposite should occur for an asset that is overpriced. The implication is that NA FREIT (as well as gold and oil) is underpriced[2]. This might suggest that if NA FREIT was widely available, liquid and marketable (i.e., trading on a stock exchange), it would be in demand, causing its price to rise, which in turn would cause FREIT managers to seek more farmland, causing farmland prices to rise.

## 6. Application of the Expected Value – Variance (E-V) Model

An E-V model was applied to the choice set of assets to determine optimal portfolios for the following three scenarios:

| Scenario | Description | Asset Choices |
|---|---|---|
| • Scenario 1 | Traditional Farmer Portfolio | Farmland (NA FREIT), bonds, stocks |
| • Scenario 2 | Traditional non-farmer Portfolio | Bonds, stocks, REITs |
| • Scenario 3 | No Restrictions on asset choice | All assets in choice set |

The E-V model estimated optimal portfolios at all levels of risk and yield, for each of the three scenarios. The Capital Market Line for each scenario is illustrated in Figure 1.

[2] It is important to note that CAPM has not been able to fully explain asset pricing, especially when it comes to low or zero beta assets. In fact, there are other low beta exchange-traded assets in different industries that exhibit persistent excess yields so there is no assurance that the farmland excess yields would disappear in a widely-traded market place.

Table 4 shows a comparison of the three scenarios, based on investment performance, at three levels of risk: low (6% yield), medium (8% yield) and high (10% yield). Based on the E-V analysis and results, some important considerations are as follows:

- At every risk level, unrestricted access to all assets (scenario 3) provides the most efficient portfolios.
- A traditional farmer portfolio, where most of the wealth is invested in farmland, appears to be a medium risk portfolio. A 100% farmland portfolio provides reasonably good investment performance but better performance could be achieved with the addition of other assets.
- Non-farmer investors could improve investment performance with the addition of NA FREIT at the low and medium risk levels, but does not appear to be a good choice for investors who want a higher risk portfolio.

Table 4. Three Scenario E-V Investment Performance Results for Low, Medium and High Risk Portfolios

| | Scenario 1 | Scenario 2 | Scenario 3 |
|---|---|---|---|
| Low risk | | | |
| Portfolio Yield | 6.0% | 6.0% | 6.0% |
| Risk (Standard Deviation) | 2.48% | 2.95% | 2.33% |
| Coefficient of Variation | 0.41 | 0.49 | 0.39 |
| Portfolio weights | | | |
| T-bills and Bonds | 76.1% | 90.2% | 78.3% |
| NA FREIT | 16.3% | 0.0% | 9.6% |
| Gold | 0.0% | 0.0% | 2.8% |
| Oil | 0.0% | 0.0% | 1.1% |
| REITs | 0.0% | 3.0% | 3.0% |
| Stocks | 7.6% | 6.8% | 5.2% |
| Medium risk | | | |
| Portfolio Yield | 8.0% | 8.0% | 8.0% |
| Risk (Standard Deviation) | 9.76% | 10.82% | 7.66% |
| Coefficient of Variation | 1.22 | 1.35 | 0.96 |
| Portfolio weights | | | |
| T-bills and Bonds | 0.0% | 44.7% | 24.4% |
| NA FREIT | 57.5% | 0.0% | 14.5% |
| Gold | 0.0% | 0.0% | 13.8% |
| Oil | 0.0% | 0.0% | 7.8% |
| REITs | 0.0% | 25.8% | 17.7% |
| Stocks | 42.5% | 29.5% | 21.8% |
| High risk | | | |
| Portfolio Yield | 10.0% | 10.0% | 10.0% |
| Risk (Standard Deviation) | 21.8% | 20.15% | 15.78% |
| Coefficient of Variation | 2.18 | 2.02 | 1.58 |
| Portfolio weights | | | |
| T-bills and Bonds | 0.0% | 0.0% | 0.0% |
| NA FREIT | 18.5% | 0.0% | 0.0% |
| Gold | 0.0% | 0.0% | 29.9% |
| Oil | 0.0% | 0.0% | 10.6% |
| REITs | 0.0% | 48.5% | 32.5% |
| Stocks | 81.5% | 51.5% | 27.0% |

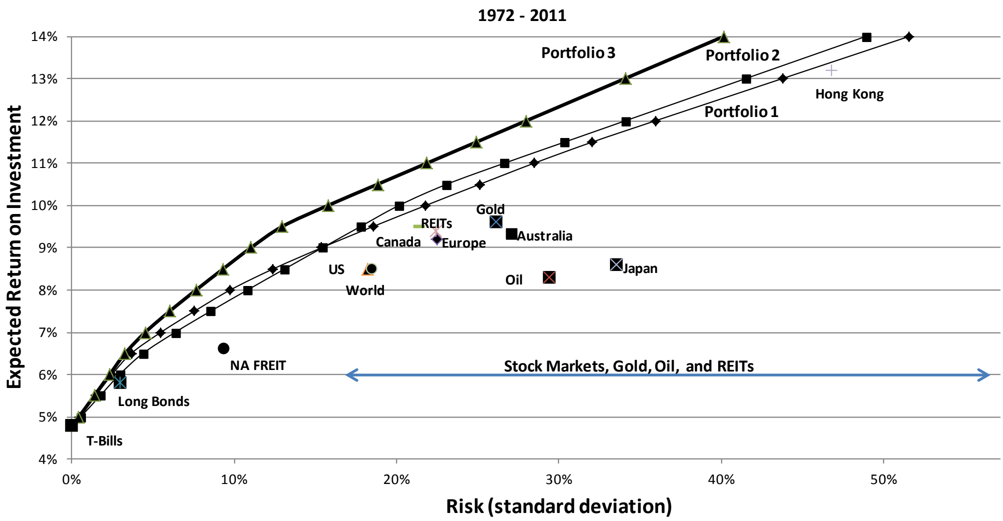


Figure 1. The Efficient Portfolios for Scenarios 1, 2 and 3 (1972-2011)

## 7. Value at Risk (VAR) Assessment

One of the advantages of using VAR to compare portfolios or assets on the basis of investment efficiency is that it need not require, as do both CAPM and E-V Analysis, that asset yields be normally distributed. Two VAR methods are employed: the historical method, where normality is not required, and the variance – covariance method, which assumes that yields are normally distributed.

VAR has three main components: a time period (in this study it is a year as annual yields are used), a confidence level (95%), and a loss amount (to be estimated). For each scenario and portfolio, the largest expected loss over the next year is estimated, given a 95% confidence level. Based on the past 40 years of yield experience, there is a 5% chance that the portfolio loss will be greater than the VAR estimate. For investors, this is meant to represent the lowest yield they can expect for the asset or portfolio, or the extent of the downside risk. Therefore, for a given expected yield, the asset or portfolio with the highest VAR (lowest loss) would be considered to have the lowest risk.

The three scenarios and portfolios from the E-V analysis are used to represent low, medium and high risk choices. For the historical method, the annual yields for each portfolio are calculated over the 40 year study period 1972-2011. The worst 5% of all yields for each portfolio (the left tail of the distribution) are observed and indicate the 95% confidence limit, or the extent to which losses can be expected 95% of the time. For the variance-covariance method, the portfolio yields are assumed to be normally distributed so the expected yield and standard deviation of the portfolio fully describe the distribution of yields. The 95% confidence lower limit is calculated as the average yield on the portfolio minus 1.96 x the standard deviation of the yields. Table 5 illustrates the VAR results for both methods.

In all cases, while the two VAR methods have different maximum loss results, the VAR (Historical) and the VAR (variance-covariance) provide consistent risk rankings amongst the scenarios and portfolios. Also, in the low and medium risk portfolios, the VAR and E-V risk rankings are the same. However, for the high risk portfolios, E-V analysis suggests that the scenario

Table 5. Three Scenario VAR Investment Performance Results for Low, Medium and High Risk Portfolios

| | Scenario 1 | Scenario 2 | Scenario 3 |
|---|---|---|---|
| Low risk | | | |
| Portfolio Yield | 6.0% | 6.0% | 6.0% |
| Risk (Standard Deviation) | 2.48% | 2.95% | 2.33% |
| Coefficient of Variation | 0.41 | 0.49 | 0.39 |
| VAR (Historical) | 1.1% | -0.2% | 1.4% |
| VAR (variance-covariance) | 1.1% | 0.2% | 1.4% |
| Medium risk | | | |
| Portfolio Yield | 8.0% | 8.0% | 8.0% |
| Risk (Standard Deviation) | 9.76% | 10.82% | 7.66% |
| Coefficient of Variation | 1.22 | 1.35 | 0.96 |
| VAR (Historical) | -6.0% | -11.1% | -2.5% |
| VAR (variance-covariance) | -11.1% | -13.2% | -7.0% |
| High risk | | | |
| Portfolio Yield | 10.0% | 10.0% | 10.0% |
| Risk (Standard Deviation) | 21.8% | 20.15% | 15.78% |
| Coefficient of Variation | 2.18 | 2.02 | 1.58 |
| VAR (Historical) | -19.7% | -27.6% | -9.9% |
| VAR (variance-covariance) | -32.7% | -29.5% | -20.9% |

1 portfolio is the least efficient at a 10% yield, as indicated by the coefficients of variation. The VAR (variance-covariance) method confirms that ranking but the VAR (Historical) method has the scenario 2 portfolio as the least efficient of the three in the high risk category. In general, the VAR results are consistent with the E-V results.

## 8. Summary and conclusions

Why is there a strong and growing demand for farmland investment from the non-agricultural sector? Over the study period 1972-2011, North American farmland investment yields have been very competitive with stocks, bonds and real estate. Since all investors hold a variety of assets in a portfolio, farmland is assessed in terms of the yield and risk that it adds to a diversified portfolio. Three methods are used to assess the investment performance of farmland within a diversified portfolio: the Capital Asset Pricing Model (CAPM), the Expected Value-Variance Model (E-V Analysis), and the Value at Risk (VAR) Model. The CAPM analysis suggests that farmland provides an investment yield that is greater than required, given that it adds little or no risk to a diversified portfolio. This also implies that farmland, given its competitive yield, can enhance investment performance in a diversified portfolio. The E-V analysis found that a North American farmland investment can improve investment performance at low and medium risk levels, but does not provide improvement for higher risk portfolios. Finally, the VAR analysis found that when North American farmland is added to a diversified portfolio, it reduces the maximum expected loss that can occur, thereby reducing the downside risk of the portfolio without reducing the expected yield. In general, all three methods, CAPM, E-V analysis and VAR found consistent results; that North American farmland has a competitive yield and is very good at reducing risk in a diversified portfolio, thereby improving overall investment performance.

## 9. References

Barry P.J., 1980. "Capital Asset Pricing and Farm Real Estate" *American Journal of Agricultural Economics*. 62: 549-63

Bigge H.M., Langemeier M.R., 2004. "Relative Profitability and Risk of Kansas Farms and the S&P 500." *Journal of the American Society of Farm Managers and Rural Appraisers*. American Society of Farm Managers and Rural Appraisers (2004 Journal of ASFMRA). 57-63.

Brown B., 1999. "How Do Net Farm Returns Compare with Returns From Stocks Or Bonds?" Proceedings of the 12th International Farm Management Congress, International Farm Management Association, Durban, South Africa.

Hardin W.G., Cheng P., 2005. "Farmland in a Mixed-Asset Portfolio: A Mean-Semivariance Approach." *Journal of Real Estate Portfolio Management*. Vol. 11, No. 2, 187-195.

Kaplan H.M., 1985. "Farmland as a Portfolio Investment." *The Journal of Portfolio Management.* Volume 11: 73-79.

Libbin J.D., Kohler J.D., Hawkes J.M., 2004a. "Financial and Real Estate Investments in Mixed-Asset Agricultural Portfolios". *Journal of the American Society of Farm Managers and Rural Appraisers.* American Society of Farm Managers and Rural Appraisers (2004 Journal of ASFMRA). 97-107.

Libbin J.D., Kohler J.D., Hawkes J.M., 2004b. "Does Modern Portfolio Theory Apply to Agricultural Land Ownership? Concepts for Farmers and Farm Managers". *Journal of the American Society of Farm Managers and Rural Appraisers.* American Society of Farm Managers and Rural Appraisers (2004 Journal of ASFMRA). 85-96.

Lins D., Kowalski A., Hoffman C., 1992. "Institutional Investment Diversification: Foreign Stocks vs U.S. Farmland." In Proceedings of Regional Research Committee NC-161, Department of Agricultural Economics, Kansas State University, Manhatten, Kansas. February.

Markowitz, H.M., 1959. *Portfolio Selection: Efficient Diversification of Investment.* New York: John Wiley and Sons.

Moss C.B., Featherstone A.M., Baker T.G., 1987. "Agricultural Assets in an Efficient Multi-Period Investment Portfolio." *Agricultural Finance Review*. 47: 82-94

Noland K., Norvell J., AFM, Paulson N.D., Schnitkey G.D., 2011. "The Role of Farmland in an Investment Portfolio: Analysis of Illinois Endowment Farms". 2011 journal of the ASFMRA: 149-161

Oltmans A.W., 2007. "A New Approach in Farm Business Analysis to Fit a Changing Farmland Investment Market". *International Farm Management Association Congress 16 Proceedings*, International Farm Management Association, July, 2007 Ireland.

Painter M.J., Eves C., 2008. "The Financial Gains from Adding Farmland to an International Investment Portfolio" *Journal of Real Estate Portfolio Management*, American Real Estate Society, California State University. Vol. 14, Number 1, Pages 63-73. March 2008.

Painter M.J., 2011. "Is Farmland as good as Gold?" *Economics Research International* (ISSN: 2090-2131). Hindawi Publishing Corp., New York, NY. Volume 2011. Pages 1 – 8. December, 2011.

Ross S.A., 1974. "Return, Risk and Arbitrage," in Friend and Bicksler, eds., *Risk and Return in Finance*, Heath Lexington, New York, 1974.

Ross S.A., 1976. "The Arbitrage Theory of Capital Asset Pricing," *Journal of Economic Theory*, December 1976, 343-362.

Ruebens J., Webb J., 1995. Farmland as an Inflation Hedge. *Real Estate Research Issues*. No. 2, 129-134.

Shadbolt N., Gardner J., 2006. "Farm Investments: Alternative Ownership Structures That Address The Liquidity Versus Profitability Conundrum." *Journal of International Farm Management*, Vol. 3, No. 3, July 2006.

Sharpe W.F., 1964. "Capital Asset Prices: A Theory of Market Equilibrium under Conditions of Risk." *Journal of Finance*. September 1964, 425-442.

Tobin J., 1958. "Liquidity Preference as Behavior Toward Risk." *Review of Economic Studies*, XXVI, February, 65-86.

Treynor J., 1961. "Towards a Theory of the Market Value of Risky Assets." unpublished manuscript

Waggle D., Johnson D.T., 2009. "An Analysis of the impact of timberland, farmland and commercial real estate in the asset allocation decisions of institutional investors." *Review of Financial Economics*, 18 (2009) 90-96.