ABSTRACT

In recent years, as North American farmland prices have continued to rise, a number of North American public farmland investment trusts have been formed to offer investors a liquid and marketable farmland investment vehicle. How risky are these farmland REITs? This paper compares the investment risk with other popular investment options such as bonds, stocks, gold, oil and real estate using several well-known and accepted methods of risk analysis, including overall yield variance, CAPM, Value at Risk (VAR), and Drawdown. North American Farmland REIT has less risk than gold, oil, REITs and stock markets.

Assessing the Required Risk Premium for North American Farmland Investment

By Marvin J. Painter

Introduction

In recent years, as North American farmland prices have continued to rise, there has been ever growing interest from the non-agricultural sector in farmland as an investment choice. A number of North American public farmland investment trusts have been formed to offer investors a liquid and marketable farmland investment vehicle. Hancock Agricultural Investment Group[1] is a $1.6 billion farmland investment fund managing 265,000 acres in the United States; 1,000,000 acres in Canada; and over 6,000 acres in Australia. Bonnefield Canadian Farmland Fund[2] located in Ottawa, Ontario launched LPI with a public offering in April, 2010 and holds a diversified Canadian farmland portfolio worth approximately $20 million and recently launched LPII.

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Agcapita[3] is a Canadian farmland fund based in Calgary, Alberta with $100 million in assets under management and has now launched its third fund. Assiniboia Capital Corporation,[4] located in Regina, Saskatchewan, a limited partnership publicly available for investment, was founded in 2005 and now manages approximately 110,000 acres of Canadian farmland. Sprott Resources[5] is a publicly traded Canadian company that is targeting over 2,000,000 acres in western Canada. HCI Ventures[6] and Prairie Merchant Corp,[7] both private, have also been investing in farmland. The United States trust's Specialty Asset Management (SAM) Farm and Ranch Group,[8] part of Bank of America, have been purchasing farmland for investors for the past twenty years. TIAA-CREF Life Insurance Company (TIAA-CREF Life)[9], a wholly owned subsidiary of Teachers Insurance and Annuity Association (TIAA), is one of the largest institutional owners of farmland in the world, with approximately $2.5 billion of investments across the United States, Australia, South America, and Europe as of December 31, 2011. They have been investing in farmland and agriculture related assets since 2007. Ceres Partners LLC,[10] a Granger, Indiana-based investment firm, oversees sixty-one farms valued at $63.3 million in Illinois, Indiana, Michigan and Tennessee.

How risky are these farmland real estate investment trust (REIT) investments for an average investor and what risk premium should they require? This paper compares the investment risk in a North American FREIT (farmland REIT) with other popular investment options such as bonds, stocks, gold, oil, and real estate. The risk comparison uses several well-known and accepted methods of risk analysis, including overall yield variance, Capital Asset Pricing Model (CAPM), Value at Risk (VAR), and Drawdown. Conclusions are drawn about risk exposure for average investors in a North American farmland REIT and a farmland risk premium is estimated using each method. The risk assessment and comparison methodology is as follows:

1. Investment yields are calculated for the period 1972-2013, for a set of investment options including a North American FREIT;
2. The variance-covariance and correlation matrices are calculated for the set of investment options;
3. CAPM is applied to all assets to compare betas and levels of systematic risk;
4. Value at Risk (VAR) is used to compare all investment options;
5. Drawdown is applied to compare risk in all investment options;
6. A table of risk comparison results is provided and an indication of required risk premium is provided for the FREIT, based on the relative investment risk as measured by the comparative variances and correlations, CAPM, VAR and Drawdown.

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. The main contribution from Markowitz is that the risk in a portfolio of assets where returns are not highly correlated can be much less than the sum of the assets' individual risks. Therefore, combining assets with low correlation can provide efficient diversification by lowering risk without lowering expected return. 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). This improved and simplified the investment decision because it showed that all efficient portfolios were some combination of the market portfolio and the risk-free asset. Sharpe (1964) developed the Capital Asset Pricing Model (CAPM), which looked at the investment attributes and pricing of individual assets. If investors held only efficient portfolios, when considering an additional asset for the portfolio they would only be concerned with how much risk that new asset is adding to the overall portfolio risk, called systematic risk, as opposed to that portion of the new asset's risk that would be diversified away once inside the portfolio, called unsystematic risk. Value at Risk (VAR) is a risk management tool that estimates for an asset or portfolio the probability that a maximum loss will occur, for a specified period of time. When comparing assets or portfolios, the greater the maximum loss for a given confidence level, the greater the risk. Drawdown is another risk management tool that measures and compares the magnitude, duration, and frequency of periods where an asset or portfolio's return is lower than a previous high mark.

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 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. 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. Painter and Eves (2008) assessed farmland investments in the 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. Generally, the farmland investment research cited here concluded that farmland adds very little risk to a diversified portfolio and because farmland investment returns have been

comparable to alternative investment returns, generally farmland investments can improve overall portfolio risk and return performance.

Comparator Set of Investment Options

The investment options to be compared include treasury bills (T-bills, considered to be a risk-free asset, with a risk premium of zero percent), long-term government bonds, US Real Estate Investment Trusts (REITs), gold, oil, stock markets around the world, and a North American FREIT. For each investment option, data is collected to calculate annual investment over the study period 1972 to 2013, which provides forty-two annual investment yields for each asset. The data sources for this study are all accessible on-line.[11]

Calculating income and capital gain yields for a North American FREIT

Farmland ownership yields are calculated annually per study period for the following Canadian provinces and US states: provinces of Alberta, Saskatchewan, Manitoba, Ontario, and Quebec; states Iowa, Illinois, Nebraska, Minnesota, and Kansas. In each province and state, aggregate farmland data is used assuming that a FREIT will own land that is geographically dispersed for diversification reasons. The total return to a 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 percent is used for North America to approximate cash rents that are usually in the five to seven percent range of land values). 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 acre to farmland ownership in an FREIT is calculated as follows:

$$(1) \qquad IR_t = LR_t - PT_t - BD_t$$

Where,

IR_t = $ income return to farmland per acre in year t;
LR_t = gross lease revenue per acre in year t (17.5% of Gross Farm Revenues);
PT_t = property taxes per acre in year t;
BD_t = building depreciation per acre in year t;

The annual income and capital gain yields for each FREIT are calculated as follows:

$$(2) \qquad IY_t = \frac{IR_t}{V_{t-1}}$$

Where;

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

$$(3) \qquad CGY_t = \frac{V_t - V_{t-1}}{V_{t-1}}$$

Where;

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

Annual income and capital gain yields are calculated for each province and state for the period 1972 to 2013 (for the United States, 1972 to 2012 is used because 2013 data

is as of yet unavailable. The impact being that United States' farmland returns may be slightly underestimated but the risk assessment should be reasonably accurate). The annual total investment yields for each province and state are the sum of the annual income and capital gain yields, calculated as follows:

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

To calculate each annual NA (North American) FREIT yield, the arithmetic average is calculated with all ten provincial and state yields for that year. 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.

Tax and Management Expense Adjustments to FREIT and Bond Investment Yields

In both Canada and the United States, bond interest is taxed differently than dividends and capital gains. To compare investment option yields, tax adjustments are made to account for these differences. Also, an FREIT requires management so a Management Expense Ratio (MER, similar to mutual funds) is included to account for management costs.

The tax adjustment is made to T-bill and Long Bond yields. In Canada and the United States, the average personal tax rate on interest is significantly higher than on dividends or capital gains, which means that to an average investor, a five percent pre-tax dividend or capital gain yield is significantly better than a five percent pre-tax bond yield. Since the study is using before-tax average yields, a discount must be applied to T-bills and Long Bonds to adjust for the higher rates of taxation. The average tax adjustment factor is calculated as follows:

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

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 the United States, the approximated adjustment factor T is 72 percent. Therefore, average T-bill and Long Bond yields are discounted to 72 percent of their calculated values to adjust for the fact that interest income is taxed higher than dividend and capital gain income.

A MER of four percent has been subtracted from the calculated NA FREIT average yield to account for management expenses. A typical MER for equity funds such as Templeton Franklin, AIM Trimark, Investors Group and others is between two and three percent while segregated funds are up to four percent. Bonnefield states a 1.25 percent MER on their webpage however; it is unclear whether that includes all associated management expenses. For this study, a four percent management fee is used, which is based on a discussion with Assiniboia Capital Corporation president Brad Farquhar in 2011. Their fund had a combination of fees, including a property management fee (based on revenues), asset management fee (based on net asset value, like a mutual fund), plus a fee for operating expenses, all of which combined totaled approximately four percent of the asset value.

Table 1 illustrates the average annual yields for the comparator set of investment options, which include all tax and MER adjustments. 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.

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. T-bills and long bonds have a higher positive correlation with inflation and both gold and oil also have positive correlations with inflation, which means they are also good inflation hedges.
- It is important to note that both gold and oil also display negative correlation with REITs and stock markets (in general) and may be as good as or better than NA FREIT as risk reducers in a portfolio.
- In a world where global communication and movement of financial capital is at every investor's fingertips, simply diversifying across international stock markets is no longer an ideal diversification strategy, as can be seen from the high positive correlations. REITs are also positively correlated with stock markets, which leads investors to search for other assets that can provide risk reduction without reducing expected returns thus efficient investment.

Capital Asset Pricing Model (CAPM) Application

The CAPM assumes that all investors will hold diversified portfolios so as to enhance the rate of return per unit of risk assumed. An asset's unsystematic risk is that which can be eliminated by holding the asset in a well-diversified portfolio and hence will not attract a risk premium in the market. However, an asset's systematic risk, which is characterized by the volatility in the asset's return caused by volatility in the market in general, cannot be diversified away. The asset's risk premium should be a function of its systematic risk only, which may be large or small relative to the total variance. The CAPM equation is as follows:

$$(6) \qquad E(R_i) = r_f + B_i [\, E(R_m) - r_f \,]$$

Where;

$E(R_i)$ = the expected return on asset i

r_f = the risk-free rate of return

$E(R_m)$ = the expected return on the market portfolio

B_i = the beta for asset i (the indicator of the asset's systematic risk)

For each investment option, a beta is estimated using ordinary least squares regression, where the dependent variable is the individual asset annual excess yields (actual yield minus the risk-free T-bill yield for that year) and the independent variable is the market portfolio annual excess yields for the study period 1972 to 2013. 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 chosen to represent a reasonable mix are: T-bills at five percent; long bonds at 20 percent; NA FREIT, gold, and oil at five percent; REITs and world stock market portfolio at 30 percent. For the study period, the market portfolio average yield was 7.6 percent (average risk premium over the risk-free yield of 3.0 percent) with a standard deviation of 9.7 percent and coefficient of variation of 1.28. Table 3 illustrates the resulting betas for each asset.

The CAPM results indicate that long bonds, NA FREIT, gold, and oil all have very low or zero betas (at the 90 percent level of significance, NA FREIT, gold, and oil all have betas that are not significantly different than zero) suggesting that they should provide an average yield close to the average risk-free (T-bills) yield. The CAPM required yield for an individual asset is equal to the risk-free rate plus the asset's beta times the average market portfolio risk premium. Table 4 provides a comparison of the CAPM required yields and the expected yields, where expected yield is the assets past average yield over the period 1972 to 2013.

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. Their total risk is unsystematic (diversifiable) risk and they have no systematic (market) risk. Therefore, they are very good diversifiers.
- Since NA FREIT, gold, and oil add no risk to a diversified portfolio, their yields should be similar to the risk-free yield, meaning, a zero or very low risk premium. 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. 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. In this scenario, there would be an initial bump in yield but as prices stabilized, with no change in farmland operating incomes the average yield would be lower, as predicted by CAPM. This analysis assumes that NA FREIT would be liquid and marketable for investors so that they would not require extra risk premiums for liquidity and marketability.

In summary, according to CAPM, NA FREIT is a low risk asset when added to a diversified portfolio of investment assets and should require a very low risk premium. Because NA FREIT is yielding greater than its CAPM risk-adjusted yield, it (meaning its underlying assets) is undervalued. However, 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.

Value at Risk (VAR) Assessment

While standard volatility measures (such as variance of past returns) measures both upside and downside volatility, VAR is only concerned with the probability of a large loss. VAR has three main components: a time period (can be a day, month, or year), a confidence level (95 percent is very common), and a loss amount. For example, based on past returns, what is the largest expected loss over the next year for an investment asset, given a 95 percent confidence level? That percent or dollar amount is the VAR. There is a five percent chance that the loss will be greater than the VAR estimate, which would be referred to as a VAR break.

There are three common methods of calculating VAR for an asset or portfolio: historical method, variance-covariance method, and the Monte Carlo simulation approach. The historical method plots all the return points in a frequency distribution chart for a past period of time. In this study it would be a frequency plot of annual returns for each investment option being compared, for the period 1972 to 2013. The worst five percent of all returns for each portfolio (the left tail of the distribution) would indicate the 95 percent confidence limit. For example, if for an asset the left tail included annual losses of 10 to 35 percent, we would expect that, with a 95 percent confidence level, our annual loss next year would not exceed 10 percent.

The variance-covariance method assumes that asset returns are normally distributed so we only need to estimate the expected return and standard deviation for an asset to fully describe the distribution of returns. We also know that in a normal distribution a 95 percent confidence lower limit would be the expected return on the asset minus 1.96 times the standard deviation. For example, if the expected return on the asset is eight percent with a standard deviation of 7.36 percent, the 95 percent lower limit would be -6.43 percent (loss). Thus, for this asset, there would be a 95 percent confidence level that the maximum loss next year would be -6.43 percent, with a five percent chance that the loss would be greater.

The third method of calculating VAR uses a Monte Carlo simulation model to generate a probability distribution of expected returns for each asset being compared. Probability distributions would be required for all assets, based on past return experience. The Monte Carlo model is used to generate outcomes of asset returns, based on randomly selected inputs from the individual asset probability distributions. The worst five percent of the Monte Carlo outcomes would provide the 95 percent VAR for the portfolio.

In this study, the VAR is estimated for each investment option using the past forty-two annual investment returns (1972 to 2013), using the historical method. The worst five percent of all yields for each asset (the left tail of the distribution) are observed and indicate the 95 percent confidence limit, or the extent to which losses can be expected 95 percent of the time. Table 5 illustrates the VAR results.

From the VAR results, it can be seen that T-bills and Long Bonds have the lowest risk (highest VAR's), which is to be expected. NA FREIT also has a relatively low risk assessment using VAR, indicating that there is a 95 percent probability that the expected yield next year will not fall below -11.6 percent. This is significantly less risk than gold, oil, REITs, and all of the stock markets, including the most diversified world stock market index.

The Drawdown Model of Risk Assessment

Drawdown is a commonly used measure of risk for investments, commodities and hedge funds. The definition of a drawdown is any period where an asset or portfolio's value is less than a previous high mark. As with VAR, Drawdown is concerned with the downside risk and includes three measurements for each asset during the study period:

a) The magnitude of each drawdown, measured as the percentage decline from peak to trough. This is meant to be a measure of "how bad" the downside risk can be;
b) The duration of each drawdown, measured by the number of years from peak to peak. This is the number of years it takes for the asset to recover in a particular drawdown period. This is a measure of "how long" the downside risk might last;
c) The drawdown frequency during the study period, measured by how many times a drawdown has occurred. This is meant to measure "how often" downside risk can occur in a given time period.

Table 6 illustrates the Drawdown analysis results for the study period 1972 to 2013.

T-bills and bonds exhibit the lowest risk as there were no drawdowns during the study period, which is the nature of debt securities (assuming that they are always held to maturity). The stock markets are somewhat similar in risk, with the exception of the long drawdown period for Japan, which started in 1989 and still has not fully recovered the 1989 peak. REITs are also very similar to stock markets in magnitude, duration and frequency. Gold and oil have high risk as measured by large magnitudes of drawdown (bigger losses) and long durations (takes a long time to recover), although less frequency than REITs or stock markets. During the study period of forty-two years, NA FREIT had only one drawdown, which was smaller than all other assets except T-bills and bonds, but lasted for sixteen years, which is less time than the oil or gold drawdowns but significantly more than stock markets and REITs. This illustrates the long price cycle on farmland and the relative stability of NA FREIT. The Drawdown analysis shows a different aspect of farmland risk (as well as gold and oil), namely duration of drawdown that isn't captured by other models.

Summary and Conclusions

Table 7 provides an overall risk comparison using all of the risk measures. For each risk assessment result, each asset is labelled as low, medium, or high risk. The last column then provides an average assessment of overall risk for each asset.

Based on the risk measures employed in this study, a North American Farmland REIT would be considered a low to medium risk asset, or having less risk than gold, oil, REITs, and stock markets. The implication is that NA FREIT would also attract a lower required risk premium by investors. However, it should be cautioned that an FREIT may attract an additional risk premium for liquidity and marketability, depending on the farmland investment instrument being offered to investors.

Endnotes

[1] Division of Manulife Financial Canada, a publicly traded company; http://www.haig.jhancock.com/

[2] Division of Manulife Financial Canada, a publicly traded company; http://www.haig.jhancock.com/

[3] http://www.farmlandinvestmentpartnership.com/

[4] http://www.assiniboiacapital.com/

[5] http://www.sprottresource.com/

[6] http://www.hciventures.ca/

[7] http://www.wbrettwilson.ca/pmc/contactus.html

[8] http://www.ustrust.com/ust/pages/index.aspx

[9] https://www.tiaa-cref.org/public/index.html

[10] http://www.ceresglobalagcorp.com/

[11] Statistics Canada – Canadian Economic Observer: http://www.statcan.gc.ca/pub/11-210-x/11-210-x2010000-eng.htm. Provides interest rates, inflation rate and other economic data.

Statistics Canada Cansim tables (all with prefix 002-) 0001, 0003, 0005, 0007, 0008, 0009, and 0012. These table provide all the historical Canadian farmland information from average annual farmland values to net farm incomes, by province.

http://www76.statcan.gc.ca/stcsr/query.html?style=emp&qt=002-0003&GO%21=Search&la=en&qm=1&st=1&oq=&rq=0&rf=0

USDA provides all farmland data, by state. http://www.ers.usda.gov/data-products/farm-income-and-wealth-statistics.aspx#27405

Historical gold prices: http://www.nma.org/pdf/gold/his_gold_prices.pdf

Historical oil prices: http://www.fintrend.com/inflation/inflation_rate/Historical_Oil_Prices_Table.asp

Real estate investment trusts historical dividend and price data provided by NAREIT US Real Estate Index Service: http://www.reit.com/investing/index-data/monthly-index-values-returns

Historical stock market data is available at Morgan Stanley: http://www.mscibarra.com/legal/index_data_additional_terms_of_use.html?/products/indices/international_equity_indices/gimi/stdindex/performance.html

References

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

Bigge, Holly M., and Michael R. Langemeier (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.

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

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

Libbin, James D., Jeremy D. Kohler, and Jerry M. Hawkes (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, James D., Jeremy D. Kohler, and Jerry M. Hawkes (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., A. Kowalski, and C. Hoffman (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, Charles B., Allen M. Featherstone, and Timothy G. Baker (1987). "Agricultural Assets in an Efficient Multi-Period Investment Portfolio." *Agricultural Finance Review*. 47: 82-94

Noland, Kevin, Jonathan Norvell, AFM, Nicholas D. Paulson, and Gary D Schnitkey. (2011). "The Role of Farmland in an Investment Portfolio: Analysis of Illinois Endowment Farms". 2011 *Journal of the ASFMRA*: 149-161.

Painter, Marvin J. and Chris Eves (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, Marvin 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.

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

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

Tobin, James (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, Doug, and Don T. Johnson (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.

Table 1. Average annual investment yields and risk premiums for T-bills, long bonds, NA FREIT, gold, oil, REITs, and stock markets (1972-2013)

Investment	Total Yield	Standard Deviation	Risk Premium	Coef of Variation
T-Bills	4.6%	0.0%	0.0%	0.00
Long Bonds	5.6%	2.3%	1.0%	0.42
NA FREIT	6.9%	9.3%	2.3%	1.36
REITs	9.5%	20.9%	5.0%	2.19
Gold	8.4%	26.2%	3.8%	3.12
Oil	8.2%	28.7%	3.6%	3.51
Stock Markets:				
Canada	9.1%	22.0%	4.5%	2.43
Australia	9.4%	26.5%	4.8%	2.83
US	9.1%	18.1%	4.6%	1.98
Japan	8.9%	32.8%	4.3%	3.67
Europe	9.9%	22.0%	5.3%	2.22
World	9.0%	18.2%	4.4%	2.02
Hong Kong	13.4%	45.7%	8.8%	3.40

Table 2. Correlation matrix for the investment assets (1972-2013)

	T-b	LTB	**NA F**	Gold	Oil	REIT	Can	Aus	US	Japan	Eur	World	HK	Inflation
T-b	1.0	.94	**-.03**	-.06	.02	.02	-.10	-.12	.05	.06	-.01	.02	-.01	.73
LTB		1.0	**-.14**	-.05	-.06	.09	-.09	-.08	.06	.14	.02	.06	.03	.70
NA FREIT			**1.0**	**.43**	**.54**	**-.1**	**-.1**	**-.13**	**-.21**	**-.25**	**-.33**	**-.30**	**-.06**	**.43**
Gold				1.0	.50	-.16	.11	.22	-.28	.07	-.15	-.14	.11	.29
Oil					1.0	-.19	.02	-.21	-.33	-.27	-.34	-.38	-.13	.30
REIT						1.0	.47	.52	.55	.16	.38	.50	.44	.02
Can							1.0	.79	.64	.44	.63	.72	.60	-.12
Aus								1.0	.58	.44	.69	.76	.65	-.12
US									1.0	.35	.76	.88	.52	-.12
Japan										1.0	.47	.66	.58	.06
Europe											1.0	.89	.53	-.13
World												1.0	.63	-.10
HK													1.0	-.03

Table 3. CAPM Betas for investment assets (1972-2013)

Asset	Beta (B_1)	B_1 t-value	Intercept (B_0)	B_0 t-value
Long Bonds	0.032	2.00	0.9%	5.12
NA FREIT	0.010	0.06	2.6%	1.61
Gold	0.253	0.61	5.7%	1.31
Oil	-0.176	-0.39	7.7%	1.63
REITs	1.787	10.35	1.5%	0.84
Stock Markets:				
Canada	1.678	7.19	1.4%	0.58
Australia	2.061	7.60	1.5%	0.53
US	1.338	6.97	1.9%	0.97
Japan	1.385	2.98	4.1%	0.84
Europe	1.458	5.58	2.9%	1.08
World	1.441	8.11	1.5%	0.83
Hong Kong	2.827	5.01	8.2%	1.40

The critical t-value for 10% error is 1.71

Table 4. CAPM Required Yields compared to Expected Yields (1972-2013)

Investment Asset	Risk-Free Yield	Asset Beta	Market Portfolio Risk Premium	Required Yield	Expected Yield	Outperform (underperform)
T-bills	4.6%	0.000	2.6%	4.6%	4.6%	0.0%
Long Bonds	4.6%	0.032	2.6%	4.7%	5.6%	0.9%
NA FREIT	4.6%	0.010	2.6%	4.6%	6.9%	2.3%
Gold	4.6%	0.253	2.6%	5.3%	8.4%	3.1%
Oil	4.6%	-0.176	2.6%	4.1%	8.2%	4.1%
REITs	4.6%	1.787	2.6%	9.3%	9.5%	0.2%
Stock Markets:						
Canada	4.6%	1.678	2.6%	9.0%	9.1%	0.1%
Australia	4.6%	2.061	2.6%	10.0%	9.4%	-0.6%
US	4.6%	1.338	2.6%	8.1%	9.1%	1.0%
Japan	4.6%	1.385	2.6%	8.2%	8.9%	0.7%
Europe	4.6%	1.458	2.6%	8.4%	9.9%	1.5%
World	4.6%	1.441	2.6%	8.4%	9.0%	0.6%
Hong Kong	4.6%	2.827	4.2%	12.1%	13.4%	1.3%

Table 5. VAR Comparisons for Investment Options (1972-2013)

	Using annual yields for 1972-2013			95% Conf Level
Investment Asset	Average	Minimum	Maximum	VAR
T-bills	4.6%	0.3%	12.8%	0.4%
Long Bonds	5.6%	1.3%	11.0%	1.6%
NA FREIT	6.9%	-15.7%	29.5%	-11.6%
Gold	9.5%	-27.4%	101.0%	-25.2%
Oil	8.4%	-46.4%	96.9%	-38.1%
REITs	8.2%	-42.2%	49.0%	-37.3%
Stock Markets:				
Canada	9.1%	-47.5%	56.2%	-27.1%
Australia	9.4%	-50.7%	76.4%	-34.5%
United States	9.1%	-37.6%	37.1%	-28.6%
Japan	8.9%	-36.1%	125.8%	-29.4%
Europe	9.9%	-46.4%	78.9%	-24.1%
World	9.0%	-40.7%	41.9%	-25.5%
Hong Kong	13.4%	-57.1%	161.7%	-51.1%

Table 6. Drawdown Risk Comparisons for Investment Options (1972-2013)

Investment Asset	Max Drawdown Magnitude (%) 'How Bad'	Max Drawdown Duration (yrs) 'How Long'	Drawdown Frequency (# times) 'How Often'
T-bills	0%	0	0
Long Bonds	0%	0	0
NA FREIT	39.4%	16	1
Gold	55.9%	26	3
Oil	68.2%	24	2
REITs	58.0%	6	4
Stock Markets:			
Canada	45.5%	6	6
Australia	43.0%	6	8
United States	41.3%	8	5
Japan	58.2%	24	4
Europe	40.1%	6	6
World	42.1%	8	5
Hong Kong	74.0%	8	7

Table 7. Comparison of Risk Measures for Investment Options

	Tot Risk	Inflation	CAPM	VAR	Drawdown			**Overall**
Asset	Std Dev	Corr	Beta	95%	'bad'	'long'	'often'	**Risk**
T-bills	0.0%	.73	0.000	0.4%	0%	0	0	
	low	low	low	low	low	low	low	**Low**
Bonds	2.3%	.70	0.032	1.6%	0%	0	0	
	low	low	low	low	low	low	low	**Low**
FREIT	9.3%	.43	0.010	-11.6%	39.4%	16	1	
	low/med	low	low	med	high	high	low	**Medium**
Gold	20.9%	.29	0.253	-25.2%	55.9%	26	3	
	high	Low/med	med	high	high	high	med	**High**
Oil	26.2%	.30	-0.176	-38.1%	68.2%	24	2	
	high	Low/med	low	high	high	high	low/med	**High**
REITs	28.7%	.02	1.787	-37.3%	58.0%	6	4	
	high	med	high	high	high	med	med/high	**High**
Stock Markets:								
Canada	22.0%	-.12	1.678	-27.1%	45.5%	6	6	
	high	med	high	high	high	med	high	**High**
Australia	26.5%	-.12	2.061	-34.5%	43.0%	6	8	
	high	med	high	high	high	med	high	**High**
US	18.1%	-.12	1.338	-28.6%	41.3%	8	5	
	med/high	med	high	high	high	med	high	**High**
Japan	32.8%	.06	1.385	-29.4%	58.2%	24	4	
	high	med	high	high	high	high	med/high	**High**
Europe	22.0%	-.13	1.458	-24.1%	40.1%	6	6	
	high	med	high	high	high	med	high	**High**
World	18.2%	-.10	1.441	-25.5%	42.1%	8	5	
	high	med	high	high	high	med	high	**High**
HK	45.7%	-.03	2.827	-51.1%	74.0%	8	7	
	high	med	high	high	high	med	high	**High**