Food for thought

IN THIS EDITION

Farmland opportunities beyond the U.S.

Following an analysis of the emerging bubble in the U.S. farm land market in our last edition, we take a closer look at the investment opportunity outside the U.S., focusing on Brazil as an alternative.

We observe that agricultural land in the U.S., comparable on a productivity basis, is priced a multiple of 3.4 times that of land in Brazil.

With similar yields and marginal differences in input and transportation costs, we conclude that the price differential is difficult to justify. An analysis of relative returns showing a healthy premium in Brazil supports our conclusion. Further, we identify potential upside in Brazil from improvements in transportation infrastructure and the downside risk in U.S. farm values from changes to farm subsidies and rising interest rates.

The role of agricultural investment in uncertain times

It has been an eventful few years for investors. For some, the diversification offered by traditional investments and even many alternative assets, has been less than expected or has been in decline. This has left a dwindling pool of asset categories available to portfolio managers seeking diversification from equity risk.

We investigate the diversifying properties of agriculture and apply an equity beta analysis to farm land in Australia, the U.S. and Brazil. The conclusion is that farm land has displayed low correlation to the broader equity market. In further analysis on Brazilian agricultural land and hedge funds for a comparison, we see the persistently low equity beta component of its total return.

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Global agriculture’s super trend: soybean exports to China

A strong long-term trend has emerged in global agriculture over the last 15 years: the rapid growth in protein consumption in emerging markets. The trend has been particularly evident in China where the appetite for pork and other meats has been growing strongly. The production of meat has become increasingly reliant on imported animal feed ingredients- the most important of these is soybean. The pace of this growth has meant that China has gone from being self-sufficient in soybean consumption to the world’s largest importer, now accounting for half of all soybeans traded globally.

We find that most of this growth has been met by a rapid rise in soybean land area in Brazil and Argentina, where production has increased by more than 70 per cent during the last decade. Overtaking the U.S. recently, Brazil is now the major supplier to China with 35 per cent market share.
We invest in an inescapable fact.

People need to eat and changing demographics are driving higher food prices. We take a unique approach to investing in food production, by bringing both investment management and farming expertise in-house and under one roof.
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In our last edition, we looked at the U.S. farmland market and examined why some observers believe it is heading into bubble territory. In this piece, we take a closer look at the investment opportunity outside the U.S., focusing on Brazil as an alternative. We outline an approach for evaluating the productive capacity of farmland by looking at how transport and marketing costs determine the price for goods received at the farm gate and how these costs flow through to land price. We make a comparison of those costs in the U.S. and Brazil, which tells us a great deal about relative farm income and values.

Evaluating opportunities across borders
There are wide variations in price and numerous factors to consider when evaluating agricultural assets, so it is critical to focus on the specific variables that will contribute the most to underwriting long-term returns.

Put simply, there are four factors that can drive the investment return potential of a farm, wherever it is in the world:

I) how much you can produce from the land
II) the cost to get products to market
III) product prices
IV) the cost of production

Once we know these numbers, we can make a like-for-like comparison of land prices using the capital cost per unit of production as a common measure.

How much can you produce from the land?
The agronomic output potential of the land is based on intrinsic factors such as soil, climate and topography; these factors can be used to evaluate the yield potential when the data is available. In the absence of this data, historical yields are an indication of productivity.

Soybean yields in both the U.S. and Brazil have averaged 2.7 tons/ha since 1996. Brazilian yield growth of 3.63% p.a. is outperforming the U.S. of 2.64% p.a.¹.

Soybean yields in the U.S., Brazil and Argentina

In addition, the dispersion of rainfall throughout the year in parts of Brazil, including areas in Mato Grosso and Goias, allows for rain-fed “double cropping,” meaning soybeans and another crop can be produced in the same year, which boosts productivity. In summary, soybean yields achieved in the U.S. and Brazil are similar.
The cost to get products to market
Marketing costs are a function of the transport, storage and handling infrastructure required to get products to market, as well as any tariffs or local taxes that are levied.

Agricultural products are commodities, for the most part, freely traded around the world before they reach consumers. As such, prices are set with a reference to the major commodity exchanges. When farmers sell their products at the farm gate, the price they get is derived from these exchanges, adjusted for the cost to get the product to market and any local factors influencing price. This means the price a consumer of soybeans in Shanghai is prepared to pay is transferred along the supply chain to the farmer in Illinois or Mato Grosso.

Domestic factors are also supporting prices in Brazil. In Western Bahia and Mato Grosso, animals are now fed using intensive feeding systems because of an abundant supply of grains, oilseeds, and cottonseed meal. Producers also want to avoid the high transportation costs to ports and meat processing facilities in the south. Producing closer to the source of feed and shipping high-value poultry and beef products to export or population centres is flowing through to higher grain prices. Meat exports grew from less than 2 million tons in 2000 to just over 6 million tons in 2011, and are conservatively forecast by the Brazilian Ministry of Agriculture to reach 8.5 million tons by 2020.

The paving of the BR-163
A major infrastructure project underway in Brazil is the paving of the BR-163, which will connect the centre-west region with the Amazon port of Santarem. Along with reducing internal trucking costs for grains, the road is expected to make sea shipping costs to markets such as the European Union cheaper compared to ports in southern Brazil. The Brazilian Soybean Producers Association estimates that this will save at least $30 per ton in transport costs.


An analysis of these costs from recent data collected by the USDA shows the average marketing costs for 2011 soybeans shipments to Shanghai, China.

In summary, freight costs to Shanghai from the farm gate in the U.S. are less than from Brazil, however, due to Brazil’s ocean freight advantage the difference is slight.
Product prices
Farmers in countries with open trade such as Brazil and the U.S. are exposed to the same world markets for their agricultural products, like soybean, corn, wheat, sugar and canola. Farm gate prices are linked to those international markets, with the difference in marketing costs and trading tariffs reflected in the price farmers receive. Even for those products where there is limited international trade, local prices are still highly correlated to the world market because of the substitutability of agricultural products and the ability of farmers to switch production to more profitable products.

Cost of production
Approximately 70 per cent of the cost of production is from inputs, which have a high correlation to product prices. As product prices fluctuate, farmers are faced with correlated movements in their key input prices. Labour and fixed costs are influenced by location-specific factors and are lower in Brazil than in the U.S. There is a relatively high correlation between grains and fertiliser, as demonstrated by the below chart.

Fertiliser makes up the largest proportion of total U.S. corn production costs

Fertiliser makes up approx. 30-40% of total production costs for corn & soybeans in Brazil

Fertiliser is one of the largest costs of producing grains in the U.S. In Brazil they represent a lower proportion of total production costs, so along with the actual grains price fertiliser costs will be a significant influencer on profitability.

In summary, while input costs in Brazil and the U.S. are similar, the break down differs; non-correlated costs like wages, are lower in Brazil.
Comparing apples with apples - the price of farm land per unit of production

Operating returns – margins squeezed in U.S. farms at current values

Because of the high underlying capital value of farm land in the U.S., operating returns continue to be squeezed. A proxy for operating returns is the price operators are prepared to pay in rent. The ratio of rent to value has been in decline in the U.S. for an extended period.

Cropland rent-to-value, 1967-2011

As demonstrated in the chart located top right, an operating margin premium of approximately 1.5 to 4.4 per cent exists in Mato Grosso operations versus that of U.S. In the areas of Brazil such as Mato Grosso and Goias where a second crop of corn or cotton follows soybean each year returns are at the top of this range of 5.4 to 8.0 per cent.

Soybean farmland operating returns - 3-year cash margin per ton / Current land cost per ton

There is also a contrast in the efficiency of the capitalization of returns. The chart below shows the trend for real estate values to be supported by cash flow in the U.S. We know from the operating returns and land prices in Brazil that the returns are not priced into land values to the same extent.

Current value of farm real estate versus maximum affordable value

Sources: USDA-NASS Quickstats (http://quickstats.nass.usda.gov/) 2012 and USDA-ERS cash rent and Agricultural Land Values Survey data.

This trend is due to the U.S. being a more mature and efficiently priced market, with better access to capital. Debt levels have been between 10 and 15 per cent since the 1990s, and there is a high participation of absentee owners, currently estimated to be 29 to 40 per cent of all farm land.

Leverage on farmland in Brazil is lower, as credit is generally more difficult to obtain. There is a higher proportion of owner/operators and with the more recent development of arable land over the last 40 years it is a relatively less mature farm land market. These factors culminate in a less efficient market and in a greater investment return opportunity.

The UN's Food and Agriculture Organisation have projected strong growth in Brazilian soybean production, estimating that Brazil will produce 27 per cent of global production by 2020.

Conclusion

Land prices – farmland in the U.S. is three to four times more costly than in Brazil

The critical question is whether with similar yields and marginal differences in input and transportation costs, the price multiple of 3.4 is justified. Further, an analysis of relative returns shows that in Mato Grosso, one of the most distant soybean production areas in Brazil, returns are more attractive than those generated in Illinois. Given the potential upside in Brazil from improvements in transport infrastructure and the downside in U.S. farm values from changes to farm subsidies and rising interest rates, the prospects for generating investment returns from Brazilian farmland are compelling.

“For those willing to stomach that risk and take into account the productivity potential evident in areas such as South America, their investment dollars will likely go further there than within the U.S.”

U.S. crop land investors at risk of overpaying
Gavin Maguire - Reuters, 23 August 2011

1 USDA, Foreign Agriculture Service, 2012
6 USDA, FAS, March 2012
7 USDA Soybean production cost data, 2011
8 USDA, FAS, March 2012
9 Brian Briggeman, Federal Reserve of Bank of Kansas City, 2011
One of the most revealing market movements of 2011 was the reaction to Standard & Poor’s downgrade of the United States’ sovereign credit rating. Instead of it becoming more expensive to insure against U.S. default, after the downgrade the cost of doing so actually fell. This reaction is not as perverse as it initially seems, when you consider what investors were seeking in times of uncertainty:

- Secure Income – setting aside the machinations of the current political environment, the ‘Full Faith and Credit’ in the U.S. Government is backed by the world’s richest economy, rule of law and ability to tax the population to meet its obligations.
- Liquidity – the status of the U.S. Dollar, as the global reserve currency, means it is the most deeply liquid and easily exchangeable. At times of stress, you know that you’ll have less trouble exchanging it than almost anything else.

This was just one moment in an eventful few years, which have posed new challenges to investors. While securing income and liquidity are important, they are insufficient to address one of the key risks facing investors today: equity market risk, which now dominates portfolios to a greater degree than many expected. To solve this problem, we refocus our search for diversifying investments, and we find agricultural investments to be amongst those worth considering.

An increasingly limited toolbox
Over the past decade the diversification offered by traditional investments, and even many alternative assets, has either declined, or been revealed as illusory. This has reduced the set of diversifiers available to portfolio managers.

Less effective diversification
The phrase ‘risk-on, risk-off’ provided useful shorthand for the volatile and undiversified behaviour of markets. In a sign that the concept has ‘made it’ in the investing world, a pair of risk-on / risk-off ETFs were launched in 2011.

- Looking deeper, we can see that the diversification of equity markets has eroded and has been doing so for some time. Chart 1 shows the diversification ratio for the Australian equity market. While volatile, this measure has been in decline over the past decade, a similar path to global equity markets. This illustrates a decline in the number of independent risk factors offered by a broad equity index.
- More broadly than equities, we see a rise in cross-correlation amongst all asset classes (Chart 2).

Spurious diversification
- Even amongst alternative asset classes, claims of diversification have turned out to be limited at best. Chart 3 looks at the performance of a broad hedge fund index in equity market crises, exhibiting more negative ‘crisis-alpha’ than many would have liked.
These conditions make portfolio construction more challenging and the search for truly uncorrelated investments even more important.

1. Index Diversification is Down

We calculated the Diversification Ratio for the Australian equity market index (S&P/ASX 200). This is a ratio of the weighted average volatility of index constituents (individual securities) divided by the volatility of the index.

2. Cross-Correlation is Up

We took all major asset class indices, both traditional and alternative, and measured their correlation over rolling four-year periods, starting in the late '90s. We summarised this extensive dataset by taking the average of all cross correlations.

3. Crisis Correlation

We took a hedge fund index and compared its performance in equity crises (largest 10 draw-downs) to the hypothetical performance had the index sat out the crisis in cash (dotted line). The 'crisis alpha' was -5% pa.

4. Risk dominance of equities across portfolio allocations

The impact of recent market volatility on portfolio values surprised many investors. Even those employing advanced diversification discovered an uncomfortably high level of connectedness to the equity markets (Chart 4, portfolio C).

This highlights a key problem facing many investors today: equity risk dominates their portfolio. By focussing on equity risk we can approach a solution. Looking at various asset classes through the lens of equity market beta is revealing.

- Chart 5 shows 10 year returns of major asset classes in relation to equity market beta (S&P500).
- Chart 6 expands on this analysis for hedge funds to reveal the evolving nature of equity beta (red). While the build-up of returns explained by equity markets over the early to mid 2000's may have gone unnoticed, the financial crisis provided painful clarity on its pitfalls.
Applying the equity beta analysis to farmland in Australia, the U.S. and Brazil reveals an asset with little to do with the broader equity market (chart 7). Conducting deeper analysis on Brazilian agricultural land, as we did with hedge funds, shows the persistently low equity beta component of its total return (chart 8).

**Why is this?**

**Income:** agricultural assets produce products with inelastic demand curves, an especially valuable characteristic in times of inflation. Therefore, the income produced has a low correlation to income from assets such as bonds and equities. Bhardwaj and Dunsby⁹ have analysed commodity prices going back to the 1970s under a variety of market conditions, finding that grains are relatively insensitive to the state of the economy. This makes sense when you consider their role in delivering the most basic of human needs – food. Conversely, commodities at a different stage of the economic cycle, such as industrial metals, were found to be highly sensitive to the state of the economy, earning poor returns during recessions and good returns during expansions.

**Land price appreciation:** several long-term global trends have influenced the significant appreciation in agricultural land values. Some of these include: the declining stock of arable land; rising demand for agriculture commodities driven by factors like the growing emerging market middle class, largely moving to cities and demanding processed food and food higher in protein; and new sources of demand from biofuels and other industrial uses.

**Liquidity:** the liquidity profile of an investment is an important consideration. Relatively illiquid assets have the benefit of being less volatile than liquid equivalents. Another perspective on liquidity is to look at how readily the asset’s output can be sold. Food and its inputs have a growing global market with relatively inelastic demand. Put simply, this is the last purchase people cut back on.

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To reduce a portfolio’s exposure to equity beta, selecting assets with return sources independent from equity markets is recommended. One such asset is agriculture.
7. Long term returns vs. equity market beta

To learn the lessons of recent times requires more than the further employment of traditional diversification techniques. A clear analysis of how much equity risk a portfolio actually carries can appropriately specify the problem. The identification of low-equity beta assets such as agriculture will help re-stock the tool-kit of portfolio construction.

Armed with truly diversifying assets, investors have the opportunity to prepare their portfolios for times of further uncertainty.

Author – James Freeman, CFA

4 Analysis: Macquarie, March 2012. Data: Equity market (MSCI World), Fund of hedge funds (Barclay Fund of Funds Index).
5, 7 Analysis: Macquarie, March 2012. Data: Equity market (S&P500), Fund of hedge funds (Barclay Fund of Funds Index).
6 Analysis: Macquarie, March 2012. Data: Equity market (S&P500), Fund of hedge funds (Barclay Fund of Funds Index).
9 Geetesh Bhardwaj and Adam Dunsby, “How many commodity sectors are there, and how do they behave?”, SummerHaven Investment Management, 16/12/2011.
Global agriculture’s super trend: Soybean exports to China

While there is broad recognition that population growth has increased demand for agricultural products, one trend has been an aggressive agent for change in the global agricultural goods market: the rapid growth in protein consumption in emerging markets. Nowhere is this “super trend” more pronounced than in China. The story of China’s rise has been well told; an urbanizing population that is enjoying higher incomes and a corresponding appetite for more nourishing, higher-protein food. However, a confluence of factors has sent this trend rippling all the way to the interior of Brazil. Here, we examine these contributors and look at why this trend represents a major secular shift in diets in China and beyond.
The twelfth Five-Year Plan of the Communist Party of China (2011-2015) carries important implications for agriculture around the world. Amongst the Plan’s key themes are “ameliorating social inequality”. This focus on addressing income equality in this and previous plans has far-reaching consequences for food demand.

Firstly, the “rising tide” of income will stimulate demand from the bottom-third of wage earners for staples such as cereals and pork. At this end of the wage spectrum, demand elasticity for pork is 0.151, so as income increases there is strongly correlated demand for pork. Higher wage earners diversify their meat consumption and have spiked demand for poultry and beef at 4 per cent each year of the last decade.

Other principles and targets of the Five-Year Plan will shape this demand, including mandates like “increasing farm size and production efficiency in pig production and encouraging higher-efficiency poultry and dairy production” – all of which flow through to increased demand for imported soybeans.

Pork production driving demand for soybean meal

Long before Chairman Mao embarked on the first Five-Year Plan, there was a culture of eating pork in China dating back 10,000 years. While other meat types such as poultry and beef are growing in both total and per capita consumption, pork still accounts for approximately 50 per cent of all meat eaten in China.
Demand for beef and chicken is driven by rising incomes at the middle and top third of the wage spectrum. During the next decade, annual consumption growth is expected to track 7.5 per cent and 5.2 per cent respectively. As Government policy and market-based factors impact the economics of farming in China, the adoption of intensive livestock production systems is driving demand for high-protein feed ingredients, which in turn creates a heavy dependence on imports of soy.

**Why has this trend been so pronounced in China?**

While not isolated to China, the super trend of a growing reliance on soybeans from the Americas has emerged because of a confluence of economic, cultural and agricultural factors:

- **Pork and chicken are traditional foods for the Chinese.** Pigs were domesticated in China some 10,000 years ago, and for millennia, virtually every rural household in China raised at least one or two pigs each year.
- **Whereas grazing animals such as sheep, goats and cattle require large amounts of land, pigs and chickens are omnivores that eat feed with a concentration of nutrients. This makes it practical to raise them alongside high-density populations.**
- **Income growth distribution has driven demand for pork as a protein staple.** Government-enforced minimum wages have helped distribute the nation’s wealth. As the wages of more workers at the bottom end of the income spectrum have increased, so too has the demand for more nourishing foods like meat and dairy products. The tide of income amongst the working class is rising and it is lifting the demand for meat products with it.

**Soybeans are the ideal feed for pigs and chickens**

The diets of pigs and chickens require mostly energy and protein. The energy component is met by a range of highly-substitutable grains such as rice, wheat or corn, depending on their respective price.

The protein component is more reliant on the nutritional quality of the ingredients. Fish meal and meat and bone meal were once the preferred source of protein for these omnivorous animals. The supply of fish meal was tightly constrained and once several fisheries collapsed it became uneconomic. The ‘mad cow’ disease outbreak in Europe precipitated restrictions on the use of meat and bone meal since 2000 in the E.U. and in other jurisdictions.

The solution to the shortfall was to specially prepare soybeans to enable better digestion by these animals. With the oil removed, the remaining oilcake contains a combination of amino acids essential for growth in a more suitable combination than any other plant-based feedstock. The emergence of industrially produced soybean meal resulted in a lower-cost protein source in the feed rations of pigs and chickens, enabling widespread low-cost production.

**The soybean supply dilemma for China**

Around the turn of the last century, China was hovering around self-sufficiency for soybean consumption and had import restrictions in place to protect local producers. In order to overcome domestic shortages, authorities enacted a series of measures to liberalize China’s soy trade, including those required by World Trade Organization (WTO) accession protocols, starting in the early 1990s.

Imports quickly overtook production, and today, China is the world’s leading soybean importer\textsuperscript{11}. In 2011, more than 50 million metric tons of soybeans came into China, mostly from the United States, Argentina and Brazil. These imported beans accounted for 82 per cent of soy consumption in China in 2011\textsuperscript{12}, and were used exclusively in the production of soybean meal for livestock feed and soy oil for cooking.

**Super trend or major secular shift**

An interesting feature of China’s meat demand projections is that, under a range of economic development scenarios, demand for soybean feed ingredients is likely to remain strong. With poultry and beef gaining market share with higher income per capita, there is a diversified source of demand. As a consequence the demand for imported feed protein is robust. Based on projections, per capita pork consumption in 2015 is estimated to be 48.6kg (107 lbs), according to a study from Purdue University\textsuperscript{13}. Using a predicted population figure of 1.40 billion, projected total Chinese pork demand for the year 2015 is estimated to be 68 million metric tons. This is a large increase from 2003, when pork consumption was 45 million metric tons, and a 32 per cent increase from 2010 levels\textsuperscript{14}.

“While China is limited to 140 million hectares of agricultural cultivation, Brazil is using 80 million hectares now, has another 200 million hectares of pasture for cattle, and can insert another 140 million hectares into production without encroaching on ecologically protected areas.”

Charles Tang, President of the Brazil-China Chamber of Commerce, 2011
Increased reliance on corn

The combination of strong growth in consumption, reduced stock levels and production problems forced China to import significant quantities of corn in the 2009/10 crop year — the first time since 1996. To meet immediate needs, the shift to higher imports has continued, forecast this year to top 13 million tons. The inability for yields to rise in pace with consumption is expected to put continued strain on corn reserves as well as production in coming years. Similar to the significant growth in soybean imports that started more than a decade ago, a trend is emerging as China moves from a net corn exporter to an importer in the years ahead.

Conclusion

With the greatest scope for both land area expansion and yield growth amongst the top three producers, Brazil is well placed to increase its share of soybean exports to China. With a record 19.8 million metric tons in 2011, which is forecast to increase further, there is a growing reliance in China on Brazilian soybeans.

Chinese Soybean import market share 2011

Source: USDA, FAS March 2012. (2012 Forecast from INTL FCStone Inc)

Source: USDA Projections to 2021, February 2012

2, 3 APCO Worldwide, December 2010: China’s 12th Five-Year Plan
5, 7 USDA, Foreign Agricultural Service (FAS) 2011.
6 China Animal Agriculture Association, March 2011.
9 Or Bovine spongiform encephalopathy (BSE).
10 OIT Agriculture Plant/Crop-Based Renewable Resources 2020
11 USDA Long-term Projections, February 2011-2012
12 USDA, FAS 2011
14 www.meatpoultry.com
15 Forecasts from 2009
17 INTL FCStone Inc
18 China Daily – Asia Pacific, March 2012
Macquarie Agricultural Funds Management (MAFM) recently launched a website, designed to be a single source of information that offers material on the agricultural thematic as well as the business itself. The website contains a number of features including:

- End of day agricultural commodity prices
- Links to relevant news articles
- White papers
- Insights from the MAFM management team and agricultural specialists
- The MAFM Food for Thought newsletter

To find out more, or to download a copy of previous editions of food for thought visit macquarie.com/mafm
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