Food for thought

IN THIS EDITION

The Arab Spring and the role of food prices

The recent events in the Middle East and North Africa (MENA) region have had their genesis in a range of complex political and social causes.

The role of rising food prices in these events and in political unrest and revolution more broadly is not widely recognised.

The connection between price volatility, hunger and civic unrest is logical; the evidence is less straightforward.

Continued page 4

Is a bubble emerging in US farm land?

On the back of high commodity prices United States (US) agricultural land owners have recently enjoyed fierce competition for their farm land.

The boom in US farm land prices has been spectacular as a result.

But there are alarm bells ringing. Some of those who experienced the farm land bubble of the mid 1980s are warning caution. There have been parallels drawn with the residential property market of the mid 2000s.

A closer analysis uncovers several reasons for concern, some of these include: historically low income returns; the influence of speculators; the distorting effect of government subsidies; and the role of low interest rates.

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Reaping what you sow: Can sustainability in agriculture make good business sense?

There is a clear link between sustainability and agriculture. Examples of detrimental environmental and social impacts that have resulted when sustainability is neglected in agriculture will be familiar to many.

With advances in science and technology farmers have made a leap forward in improving the sustainability of agricultural operations. Meaningful gains have been made that have allowed for the better application of water, nutrients and pesticides at more precise rates and in a timelier manner, thereby optimizing the use of inputs.

Making agricultural operations more sustainable can do more than prevent negative impacts; it can also make them much more profitable.

Continued page 8

Managing climate volatility in agriculture

Most of us like to monitor the weather as it has some effect on the things that we do every day.

For farmers, the climate is more critical; it contributes directly to their businesses bottom line. This means that investing in agriculture places an increased importance on understanding weather patterns.

Modern day meteorology has given us valuable insight into the climate trends that impact agriculture. It can explain the climate anomalies that link the heavy rains and consequent flooding in Sri Lanka and Pakistan in 2010 and the related dry weather in Southern United States.

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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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The Arab Spring and the role of food prices

“There are only seven meals between civilization and anarchy.”
Josette Sheeran (UN World Food Program)

Share of food spending as percentage of total expenditures

The important role of rising food prices is one of the more notable trends to emerge from recent instances of political unrest and revolution.

When the global price of staple foods doubles, the impact in absolute terms does not differ across geographies. However, in relative terms, the impact differs greatly. Americans spend less than 10 per cent of their income in the supermarket. The poorest two billion people in the world spend 50-70 per cent of their income on food. For these people, soaring prices may be a calamity.

United Nations World Food Program (UN WFP) shows that heightened global food prices translate to negative coping strategies for the most vulnerable. For those:
- living on less than $US2 a day, education and health are being sacrificed and livestock are sold off
- living on less than $US1 a day, consumption of milk, protein, fruits and vegetables dramatically reduces
- for those living on 50 cents a day, whole meals are forgone, or whole days are spent without food.

Beyond the humanitarian impacts of food price volatility, the political effects have been highlighted by recent events in the Middle East and North Africa (MENA) region.

From malnutrition to revolution

“Cart after cart [of produce] was overturned and the pavements were covered with trampled goods. . . . Onions, potatoes, cabbages flew through the air, and in each instance the target was a ducking, wailing peddler, whose stock had been ruined beyond hope of recovery.”

This was the reaction to a 30 per cent rise in food prices over a few weeks. The food riots lasted two months bringing commerce to a standstill.

The city being described? New York 1917.

Finding evidence of the causal link between price volatility, hunger and civic unrest is challenging. There are many more instances of price volatility that do not result in riots than those that do. Lamentably, millions of the world’s hungry have suffered in silence. So how can we understand the food riots that followed the spike in prices in 2008 and ‘Arab Spring’ revolutions in the context of global food prices?

History shows that a sense of injustice and moral outrage are two themes common to food riots. Marie Ganz, leader of the New York food riots of 1917, emphasised the perception of wrongdoing as a cause; “The day of the profiteer had come”5. Similarly, historian E.P. Thompson cited the “ethical wrongdoing of profiteering” as the object of demonstrator anger in the large-scale unrest in England and France of the early 1700s.

The 2008 food riots in Egypt and Cameroon provide contemporary examples within the MENA region. In Cameroon, the focus of unrest was merchants, accused of stockpiling grain in hopes of further price increases. The riots abated before prices fell, because the government intervened and forced the auction of illicit surpluses. The restoration of a sense of justice proved more powerful than price.
Why MENA?

While the Middle East and North Africa (MENA) region is not alone in experiencing economic malaise and social discontent, it is notable for one major factor: most food is imported and there is limited capacity to respond to food price rises through a local supply response. Given inadequate water resources and poor irrigation infrastructure in many parts, it is more difficult to stimulate the production of locally produced substitutes when food prices rise. The solution from some governments has been to keep downward pressure on prices by supporting domestic, albeit costly, production or subsidising imports.

Saudi Arabian officials attempted to bolster its food supply base through the support of its domestic food production program. With government subsidies of $US1.87 billion (1993 dollars) wheat production peaked at 4.5 million metric tonnes in 1993 - a subsidy of $US415/metric tonnes or three times the cost of wheat on the international market at the time. However, environmental constraints and budget pressures led to this program being cut and the Food and Agriculture Organisation (FAO) project in Saudi Arabia will import 1.7 million metric tonnes of wheat in 2011 which will rise to three million metric tonnes by 2016.

Top 20 wheat importing countries
MENA countries (red) (2011 estimate)

<table>
<thead>
<tr>
<th>Country</th>
<th>Import (MT)</th>
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<tbody>
<tr>
<td>Egypt</td>
<td>5,000</td>
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<tr>
<td>Brazil</td>
<td>5,000</td>
</tr>
<tr>
<td>Indonesia</td>
<td>4,000</td>
</tr>
<tr>
<td>Japan</td>
<td>4,000</td>
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<tr>
<td>Algeria</td>
<td>4,000</td>
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<tr>
<td>Korea</td>
<td>3,000</td>
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<tr>
<td>Nigeria</td>
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<tr>
<td>Iraq</td>
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<tr>
<td>Mexico</td>
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<tr>
<td>Afghanistan</td>
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<tr>
<td>Turkey</td>
<td>3,000</td>
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<tr>
<td>Philippines</td>
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<tr>
<td>United States</td>
<td>3,000</td>
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<tr>
<td>Bangladesh</td>
<td>3,000</td>
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<tr>
<td>Yemen</td>
<td>3,000</td>
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<tr>
<td>Viet Nam</td>
<td>3,000</td>
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<tr>
<td>Morocco</td>
<td>3,000</td>
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<tr>
<td>Saudi Arabia</td>
<td>3,000</td>
</tr>
<tr>
<td>Sudan</td>
<td>3,000</td>
</tr>
<tr>
<td>Israel</td>
<td>3,000</td>
</tr>
</tbody>
</table>

Source: USDA estimate, 2011.

UN FAO Food Price Index

Global government reaction

- Food subsidies – designed to provide domestic stability, these subsidies hollow out local production and increase dependence on imports and therefore sensitivity to global price volatility
- Export bans – designed to protect local supplies, the ‘tragedy of the commons’ is inflicted on the global market as prices continue to rise as supply is reduced. It is estimated that up to 20 per cent of the 2008 price rise of agricultural commodities was due to global export bans.
- Land acquisitions – countries such as China and Korea have sought to secure supply by purchasing or leasing farmland as far afield as Africa. The World Bank reported in 2010 that nearly 140 million acres were targeted. That is an area that exceeds the cropland devoted to corn and wheat in the United States.

Prospects of further food price volatility

Each night, 219,000 additional people join the global dinner table.

In years past, single factors such as adverse weather caused agricultural commodity price spikes. Now trends on both sides of the demand and supply equation are driving prices:

1. China: is starting to consume more beef, which in turn requires grain which would otherwise have been earmarked for human consumption
2. USA: is turning grain, which would otherwise have been used for human consumption, into ethanol
3. EU: is banning genetically modified crops, which could help increase productivity in places like Africa, improving self-sufficiency
4. Global: while policymakers may desire to support small farmers, demand drivers indicate Brazil-style high-technology large-scale agriculture is required.

So where do the governments in the MENA region that face issues of food security turn to, given moves to shore up strategic food production partnerships in Africa face an uncertain future? The more fertile areas of the Horn of Africa have long been the food bowl of the Mahgreb and Arabian Peninsula. Yet, this region faces its own challenges of increased climatic and political volatility and more recently drought leading to widespread famine. At the same time, there is also stiff competition from countries outside of the MENA region that are facing their own issues of food security.

Increasing competition for land, political risk in those countries that have been favoured for land acquisition to date, and the prospect of further price volatility will heighten the risks of political instability. It is possible that events during the ‘Arab Spring’ may spread beyond the MENA region in years to come.

1-2 “The New Geopolitics of Food”, Foreign Policy, June 2011
4-6 “The Psychology of Food Riots”, E. Fraser and A. Rimas, Foreign Affairs, January 2011.
7 http://www1.american.edu/TED/SAUDI.HTM
15 “The New Geopolitics of Food”, Foreign Policy, June 2011
16 Macquarie Analysis, 2011
17 “The New Geopolitics of Food”, Foreign Policy, June 2011
Initially the benefits of sustainability seemed difficult to quantify, indeed much of the early sustainability thinking implied that there was an unavoidable trade-off between social or environmental criteria and financial returns.

In more recent years sustainability has gained greater traction in the business world and more attention has been applied to measuring its impact. Due to an increasing number of investors demanding greater accountability and transparency in the sustainability of investments there has been a proliferation of corporate reporting and tracking around sustainability through measures such as the Dow Jones Sustainability indexes and the KLD Broad Market Social Indexes. These indices track financial performance of the leading sustainability-driven and socially responsible companies worldwide.

There has also been a growth in the application of external standards, such as the United Nations Principles for Responsible Investment (UNPRI), a set of voluntary guidelines for investment entities wishing to address environmental, social and corporate governance issues. Since 2006, the UNPRI has attracted more than 900 signatories globally.

Looking specifically at agriculture, GLOBAL G.A.P. (Good Agricultural Practice) is one of the leading organizations to develop a set of voluntary standards for the certification of agricultural products around the world. It has amongst its membership agricultural producers and food retailers including McDonald’s, Walmart, Tesco, ALDI and Cargill. Most recently, a group of UNPRI signatories have released the United Nations Principles for Responsible Investment in Farmland.

Sustainability and agriculture are inextricably linked. There are numerous well-known examples of detrimental environmental and social impacts that have resulted when sustainability is neglected in agriculture, including the dramatic loss of biodiversity-rich rainforest in Borneo to make way for palm plantations. Another example of the catastrophic effects of ignoring sustainability in agriculture is the ‘dead zone’ in the Gulf of Mexico. This was caused by an excess of nutrients in the Gulf due to outflows from the Mississippi and other rivers that contained excessive amounts of fertiliser, this toxically decreased the amount of oxygen in the water degrading the marine ecosystem.

The effects of neglecting sustainability in agriculture can also be social. This was evident in Madagascar in 2008 when social upheaval sparked from plans by Korean company Daewoo Logistics to lease some 3.2 million acres, nearly half of Madagascar’s arable land for the production of corn, directly contributed to the fall of the Madagascan Prime Minister.

Events such as these have led to sustainability in agriculture being associated with the need to manage negative social and environmental consequences. However, making agricultural operations more sustainable can also make them much more profitable.
**What is agricultural sustainability?**

The United Nations Food and Agricultural Organisation definition of sustainable agricultural development is:

“The management and conservation of the natural resource base, and the orientation of technological and institutional change in such a manner as to ensure the attainment and continued satisfaction of human needs for present and future generations. Such development... conserves land, water, plant and animal genetic resources, is environmentally non-degrading, technically appropriate, economically viable and socially acceptable.”

To identify how sustainability impacts the profitability of farming it is important to understand the components of agricultural sustainability.

The framing of sustainability can be directed with a wide lens at a global level and at the most micro level, down to the complex biological processes in the soil. Analyses of agricultural sustainability may be expected to focus on the impact of the farming practices on the environment and the reduced reliance on non-renewable resources. However, sustainable agriculture in fact requires optimisation of economic, environmental and social performance – the three pillars of sustainability.

The pillars of sustainability and examples of how they can relate to agriculture are:

<table>
<thead>
<tr>
<th>Sustainability pillars</th>
<th>Impact</th>
<th>Example of issues</th>
</tr>
</thead>
<tbody>
<tr>
<td>Economic</td>
<td>Major</td>
<td>Financial returns prospects for future growth</td>
</tr>
<tr>
<td>Environmental/ecological</td>
<td>Major</td>
<td>Resource use, ecological impact, biodiversity</td>
</tr>
<tr>
<td>Social/ethical</td>
<td>Moderate</td>
<td>Health impacts of foods, genetic engineering, animal rights</td>
</tr>
</tbody>
</table>

So what are the core sustainability factors that impact profitability and the future value of the land?

The answer in agriculture is the use of resources, their limitations and the ecological impact of farming practices. The most important resources in agriculture are soil, water, energy from the sun and access to land itself.

Proper management of soil is absolutely essential to all major agricultural systems in both the short and long term. Soil is directly responsible for the production of crops and for producing feed to be used as an input for other systems.

For irrigated farming systems the availability and quality of water is critical, however irrigation water contributes only 10 per cent of the water needed for agriculture. For regions with severe water shortages – such as the Middle East, central Asia and North Africa - security of water for agriculture is a major cause for social conflict.

Ecological impacts of agriculture can occur when there are inputs like fertiliser and chemicals used in excess or improperly, they may be caused by production that is too intensive for the local environment or when production leads to unwanted by-products.

**Agriculture and climate change**

There is little doubt that climate change is also a major sustainability challenge for agriculture, presenting both the need to adapt to a changing climate and to address agricultural practices that generate greenhouse gas emissions. The Intergovernmental Panel on Climate Change (IPCC) reports that in 2007 agriculture accounted for 12-14 per cent of total man-made emissions of greenhouse gases[1].

Each industry within agriculture has varying climatic impacts. One of the primary sources of methane emissions is rice paddy cultivation[1], however changing the nature of some long established rice cultivation practices continues to be a challenging task, particularly in developing nations.

Land clearing has also been a major contributor of greenhouse gases, however significant steps are being taken to prevent or control land use changes through better regulation. Regulatory approaches include programs such as those in Australia and Brazil where farmers are required to maintain a prescribed amount of their land as native vegetation.

Better management of cropping has also been identified as a source of significant savings in emissions. Two areas where potential gains may be made are the highly productive areas of the United States (U.S.) Midwest and the Cerado of Brazil. Some 61 per cent of all US agricultural emissions are from crop land management, mostly where excess fertiliser leads to emissions of nitrous oxide or the loss of organic matter leads to a net release of carbon dioxide. In the case of these examples more sustainable farming practices could also lead to cost reductions and higher productivity, resulting in more profitable farming systems.
How have farming practices become more sustainable?

We have seen that the management of the soil and the proper use of agricultural inputs, such as chemicals and fertiliser, are important sustainability factors in agriculture. This is particularly relevant to the production of crops in rain-fed systems. Crop production practices evolved rapidly from the 1950's. This period featured the advent of more affordable fertilisers and chemicals for pest and weed control, the lower cost in real terms of farm machinery and diesel and improved plant breeding, these contributed to a boom in agriculture known as the green revolution.

The rapid increase in productivity was at times accompanied by the excessive use of chemicals and fertilisers and a high frequency of cultivating the soil. The resulting impact on the soil and surrounding ecosystems was something that was not fully understood. However, over time and with more research, a better understanding of the impact of resource and input use was developed.

In recent years there has been an evolution of more sustainable farming strategies that commonly have both environmental and economic benefits. These include practices such as: zero or reduced tillage — no or less cultivating of the soil; contour farming where mounds of soil are made to increase the absorption of rainfall; and stubble retention and the use of mulches and cover crops to reduce evaporation and the loss of soil from wind and rain. Another breakthrough leading to a reduction in the use of pest and disease control stemmed from changing the patterns of crops that were grown within a cropping cycle or rotation, including legumes — a broad leaved plant — which assisted with adding the important plant nutrient, nitrogen, to the soil. This underpinned the common modern crop rotation of alternating soybeans, a legume, and maize.

Technological solutions for better farming practices

The benefits of zero tillage and crop stubble retention: (top) conserved soil moisture (dark patches) due to the moisture conserving effect of the previous season’s crop remnants; (bottom) the new crop is planted in rows between the previous crop’s stubble.

With technological advances in the use of satellites to track and guide the movement of farm machinery, a leap forward was made that allowed for the more accurate application of water, nutrients and pesticides to specific areas and at the times they are required, thereby optimizing the use of inputs. This is part of the practice known as precision agriculture which is one of the most important examples of using technology to provide a more sustainable and profitable approach to agriculture.

Precision agriculture is a term used to describe an approach to agriculture where crops are managed on a site specific basis, understanding the importance of those variations and changing how the different areas are farmed to maximise production. The five main components of precision agriculture are:

- Monitoring the crop, soil and environment
- Mapping those attributes
- Using decision support systems such as specialised software
- Taking differential action depending on the needs of precise areas (eg variable input application)
- Using geospatial referencing (satellite tracking and guidance) across each of the above components.
Some of the management practices of precision agriculture are described in the table below including an indication of the potential impact on costs, operating efficiency and outputs:

<table>
<thead>
<tr>
<th>Management Practice</th>
<th>Description</th>
<th>Impact</th>
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</table>
| **GPS guidance and swath control**         | Tractors are steered automatically using signals received from a series of Global Positioning Satellites (GPS), swath control ensures it is applied only where it needs to thus reducing the use of diesel, chemicals and fertiliser. | • Input costs reduced by 1.0 per cent  
• Increased operator efficiency by 1.0 per cent |
| **Zero tillage and stubble retention farming** | A technique where no tilling or turning of soil is required. Stubble retention is conserving the remnants of the previous season’s crop. The result is reduced diesel use and soil erosion and improved water use efficiency and greater bio-diversity of the soil. | • Operator efficiency increased by 0.5 per cent  
• Increased plant available water by 1 per cent |
| **Controlled traffic**                     | Equipment runs over the same tyre marks reducing crop damage and horse power required to propel machinery. | • Input costs reduced by 1.5 per cent from reduced crossover  
• Operator efficiency increased by 0.5 per cent  
• Increased plant available water by 1 per cent |
| **Enterprise resource planning**           | Involved mapping crop yields and varying the rate of application of inputs on a precise basis, to the square metre, rather than universal application rate to entire fields. This improves yields and decreases chemical and fertiliser use. | • Input costs are reduced by 15 per cent as application of inputs is matched to lands productive potential  
• Crop yields are increased by 3 per cent due to the optimisation of fertiliser use |
**Precision agriculture and profitability**

**Example from Matto Grosso, Brazil**

![Precision agriculture and profitability chart](Source: NASA/Goddard Space Flight Center Scientific Visualization Studio)

**What is the impact on profitability?**

The integrated use of precision agriculture can lead to a potential increase in overall profitability. An example demonstrated in the chart below from a farming system in the Matto Grosso in Brazil shows that through the use of precision agriculture techniques, profitability can be 63 per cent higher than using industry standard practices.

**Conclusion**

In the examples of the clearing of the Borneo rainforest and the nutrient overload of the Gulf of Mexico from excess fertiliser use we saw that poor agricultural practices can lead to environmental damage. We have also seen that by addressing the very same issues that farming can be both more sustainable and more profitable.

In countries that adopt leading sustainability policies such as Australia and Brazil there are now laws that require a proportion of a farmers’ land to be maintained with native trees. In the crop producing areas of Brazil the Brazilian Forestry Code legislates the native vegetation areas must be at least 20 to 35 per cent, plus buffer areas around waterways. In the regions closer to the Amazon biome it is much higher at 80 per cent, achieving both environmental conservation and some strictly controlled economic activity for the local community. These are examples of optimising social, environmental and economic outcomes.

The use of precision agriculture has led to more efficient use of fertiliser and pest and disease control chemicals. Farmers now conduct deep soil testing and other monitoring that demonstrates the correct use of these inputs. These more sustainable practices are attempting to achieve lower costs, higher yields and as a result greater profits.

It is clear that more sustainable agriculture adds value, generates returns, and increases the overall economic stability of the business and meets social responsibility targets.

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2. [http://www.time.com/time/world/article/0,8599,1861145,00.html#ixzz1W5WOdHL8](http://www.time.com/time/world/article/0,8599,1861145,00.html#ixzz1W5WOdHL8)
4. [FAO, Water in agriculture](http://www.unwater.org/downloads/media/scarcity/factsheet_wwf_eng.pdf)
Managing climate volatility in agriculture

One of the major risks for most agricultural businesses is climate volatility, specifically, when there is too little or too much rainfall. When a drought or a flood occurs it has a much broader impact than on agriculture alone, it affects the broader community through water shortages or it can be a cause of disruption to peoples’ day-to-day lives.

While most people follow the weather on a daily basis, to determine what to wear or what activities will be possible, a vast majority do not really understand the science of meteorology.

In agriculture the climate is critical almost all of the time. It is not only the catastrophic events that can shape the fortunes of a season, it is also the more subtle water shortages and excesses and temperature extremes that will have dramatic impacts on agricultural output. This, in turn, is a driver of agricultural prices in the short term. This means that investing in agriculture places among other things an increased importance on understanding weather patterns.

Understanding climate variability

The first step in managing climate risk is to understand the climate in your operating area. In the charts below we look at two locations as examples of farming in dramatically varying climates, Durham, Yorkshire in the United Kingdom (UK) and Walgett, New South Wales in Australia. Both locations are prolific producers of wheat, in the order of seven tons per hectare in Durham and four tons per hectare on average, with much warmer temperatures and a shorter growing season, in Walgett.

What is striking about the two locations is the disparity between their annual rainfall variations. You can see from the chart that Durham enjoys more consistent rainfall, averaging over the 120 years recorded 647mm with a standard deviation of 101mm, compared to Walgett with an average of 475mm and a standard deviation of 160mm. The Walgett area is a prized grain growing region, producing valuable high grades of wheat. However, managing crops under the more variable rainfall conditions requires the manager to adopt a range of strategies.

Durham, U.K
Rainfall 1890 to 2010

Walgett, Australia
Rainfall 1890 to 2010
Strategies to manage climate risk

One method that can be used to reduce climate risk early in the investment process is to strategically select the operating location, selecting areas where there is adequate to above adequate rainfall for the chosen agricultural operation.

To mitigate the risk of variability across operations, farmed areas are diversified geographically, with operations spread over multiple areas where the probability of similar weather patterns is decreased. The challenge with this strategy is that to diversify effectively and still maintain the scale to operate efficiently you need to be operating over a relatively large area of land.

A further strategy is to manage for a longer time period, over multiple years rather than only one year at a time, thus smoothing the year on year volatility caused by anomalous climatic events. This requires patience and the capacity to manage cash flow from the years of plenty to the leaner years. This then raises the question of what is an effective time horizon to enable the averaging of one-off weather events? Also, how can you know if there will be both good seasons and bad seasons for your agricultural operations?

To answer these questions and to develop a better understanding of the geographic spread of weather events that impact agriculture, it is useful to look at what we do know about climatic events. Predicting the weather is difficult, but the science of meteorology has increased our understanding of what drives the weather systems that impact agriculture. Here we will focus on the Pacific basin as it encompasses the major production areas of the Americas, Australia and Asia. Within this region there are two related events that are responsible for most of the abnormalities—these events are described as the El Niño and La Niña effects.

The El Niño and La Niña effects

It was sardine fishermen from the Andes region in South America who gave the name to a phenomenon that had a dramatic impact on their catch and hence their livelihoods. These strange events were very poor catches in the typically cold waters of the Eastern Pacific, caused by unusually warm water, low in nutrients, where fish were much less plentiful than in normal years. They were probably unaware that this would also be related to the fortunes of those relying on rainfall in the east of Australia, South East Asia and in India, and impacting the climate around many parts of the Pacific.

El Niño, or the boy child, is an event which sees warm water appear in the Pacific Ocean off South America around the Christmas period. Meteorologists define the effect as abnormally warm water in the central Tropical Pacific. This abnormally warm water is an indicator of a broader change to the flow of ocean currents in the Pacific, with areas of cool and warm water in places where they are usually not. The evaporation of ocean water near land masses differs as does air temperature. The result is a greater variation of rainfall and temperature than normally observed.

The role of sea surface temperature is climate volatility. Variation of the sea surface temperature from average for April 2011, the warm area (red) in the South Eastern Pacific is indicative of a La Niña event.

Source: QLD DPI www.longpaddock.qld.gov.au
There are two main indicators of the presence of El Niño or La Niña, the Southern Oscillation Index (SOI) and the Oceanic Niño Index (ONI). SOI is a pressure differential calculated from the monthly or seasonal fluctuations in the air pressure difference between Tahiti and Darwin. ONI is a three month running mean of sea-surface temperature anomalies in the Niño reference location three based on the 1971-2000 base period.

Sustained positive values of the ONI often indicate El Niño episodes and negative values are associated with La Niña episodes, vice versa for the SOI.

The impact of these changes is affected by the strength or weakness of the El Niño event. For strong events the impact can be tremendous- severe droughts, heat waves or floods.

These impacts are regional and there is a correlation between El Niño events and the time of year they are observed.

The anti-El Niño, La Niña or girl child describes the abnormally cool waters of the Tropical Pacific. The results of La Niña are mostly the opposite of those of El Niño. For example, El Niño would cause a wet period in Southern United States (U.S.) while La Niña would typically cause a dry period in that area. In the tropical western Pacific La Niña can cause heavy rains.

The La Niña that appeared in the Pacific in 2010 contributed to the deluge in Australia, which resulted in one of the country’s worst natural disasters with large parts either under water from floods of unusual proportions, or being battered by tropical cyclones. It wreaked similar havoc in south-eastern Brazil and played a part in the heavy rains and consequent flooding in Sri Lanka, Pakistan.

The table on the next page is an illustrative summary of the various impacts on each region for the summer and winter periods.
El Niño
Northern Summer — Southern Winter (June to August)

El Niño
Northern Winter — Southern Summer (December to February)

Source: Macquarie Research, September 2011
The impact on agricultural investments

The impact on profitability from climate variability is twofold. Firstly, as we have seen with changes in weather patterns or extreme weather events, there is an impact on output. Secondly, with changes that impact across a significant agriculturally-productive area, there will be an impact on supply that will lead to changes in agricultural commodity prices.

We can see from the charts above that the impacts of the El Niño and La Niña systems vary around the Pacific. An example of the impact on agriculture production can be seen below. US production of corn tends to be below average in La Niña and above in El Niño, while in Brazil soybean production is higher in La Niña seasons and lower in El Niños.

It is important to note the intensity of the weather event. During a moderate La Niña in Brazil crops tend to have above average yields and better production because of wetter conditions, while a strong El Niño tend to generate slightly lower yields but still above the five year average. A weak El Niño tends to produce poor yields. During a La Niña, strong, weak or moderate cool and wet conditions tend to generate higher than average yields in Brazil.

Investing in agriculture invariably requires an understanding of weather patterns beyond whether or not it will rain today and what the temperature will be. While certain agricultural regions do face patterns of variability that are different to other regions, there are a range of strategies that can be deployed to manage climate risk.

El Niño/La Niña and US corn yield

![Chart showing the correlation between El Niño/La Niña and US corn yield.]

Source: USDA, Macquarie Research, September 2011

El Niño/La Niña and Brazilian soybean yield

![Chart showing the correlation between El Niño/La Niña and Brazilian soybean yield.]

Source: Conab, Macquarie Research, September 2011
Is a bubble emerging in US farm land?

Section 1 —
The US farm land bubble... A cautionary tale

“Soaring U.S. farm land values in the past year are causing worries among agricultural bankers that a farm land “bubble” may be brewing similar to one that triggered the farm crisis of the 1980s”

Reuters, July 2011

The US is endowed with some of the most productive agricultural land in the world. The navigable waterways of the greater Mississippi basin and well-developed infrastructure enables product to reach markets at a relatively low cost. It is clear to see why US farm output has historically been among the most competitive globally and why agriculture has been a key feature of the nation’s economic development.

The boom in US farm land has been unprecedented. The near unabated price appreciation of farm land in Indiana, a prime grain-belt state, has been underway since 1987. In the five years from 2005 to 2010 land prices in the most productive Midwest states have risen by a staggering 40 to 70 per cent. The trend is continuing and in the 12 months to 1 July this year there was an increase of 17 per cent on average across Indiana, Illinois, Iowa, Michigan and Wisconsin. This is the biggest year-over-year increase since 1977.

The question is, how sustainable is this trend?
A cautionary tale of US farm prices

The rush for US farm land is being fuelled by some compelling fundamental factors some of which could include: strong agricultural commodity prices, the limited scope to increase arable land and growing export demand from emerging markets.

There are other factors affecting farm land prices that, on closer analysis, may be cause for some caution. These include historically low income returns, the influence of speculators, the distorting effect of government subsidies and the role of low interest rates.

US farm land: Cause for caution

- **Low net income return**: As farm land prices are being driven higher, the net return on investment is being squeezed.
- **Speculators**: Speculation of future land prices, rather than current returns, is driving land prices.
- **Government subsidies**: Farm subsidies being capitalised into land values is likely to have a negative impact when government spending is reduced as part of deficit reduction measures.
- **Interest rates**: Historically low interest rates are driving investment flows into farm land and providing cheap debt.
Diminishing net income returns

As a function of the stream of expected future income, there is a direct link between the income derived from farm land and its value. Commodity price rises in recent years have not translated directly to profits for US farm owners because input costs have also increased. Productivity gains have been only a modest contributor, with the United States Department of Agriculture (USDA) reporting that in the 30 years to 2010 the yield increase for corn (maize) has averaged 1.9 per cent per annum. The growth in land values has fallen out of step with the growth in net incomes, with the result being that US farm land is now generating income returns of below two per cent, amongst the lowest income yields from farm land globally.

The historically low income returns are also evident in the cash rent multiple, which is a description of the number of times current cash rent - an indicator of farm land income - must be multiplied to equal the current price of farm land. A proxy for a Price-to-Earnings ratio, the cash rent multiple is a commonly tracked measure of farm land value. A recent study revealed the current cash rent multiple for Indiana farm land is 27 times, which is its highest point for the period from 1975 to 2010 and a trend that can be witnessed across the grain-belt states.

Increased speculation in farm land

The market for farm land in the US is sophisticated by global standards. In addition to owner-operators, there is a well developed leasehold market and a proportion of owners who employ managers to conduct farm operations. It is reported that 40 to 50 per cent of farm land in the US is now managed by someone other than the owner and that figure is increasing.

18 per cent of farm operators rent more than 75 per cent of their total land. Farm ownership is undergoing a major shift as financial investors increasingly enter the market and traditional owner-operators exit.

The impact is more than just greater volatility or overheating in the market. The change increases the risk to productivity of farms where the management passes from the owner, to that of a tenant or employed manager. With an increase in third-party operators there is a raised likelihood of a misalignment of interests between the manager and the owner of the land, as managers seek to maximise returns to their own time horizon. Without proper long-term investment in farm infrastructure, the health of soil and proper control of pests and diseases, then long-term productivity could be affected.

The role of subsidies in inflating land prices

US farm incomes have historically contained a significant proportion of government subsidies delivered through direct and indirect support measures. Many of these measures are included in the Farm Bills and incorporate a range of direct payments, export subsidies, farm loans, insurance, disaster aid, countercyclical payments, conservation subsidies, product price support mechanisms and other measures.

The Organization for Economic Cooperation and Development (OECD) reported that in 2009 US farmers received $US40 billion in direct support and $US89 billion in farm gate price support, of which $US119 billion came from tax payer revenue. The 2008 Farm Bill provides in excess of $US284 billion in financial support to US agriculture over the 2008-2012 period with commodity program payments accounting for $US43.3 billion of this total.

So why may this be a contributing factor to a bubble in farm land prices? Farm income subsidies are capitalised in the value of agricultural land in the US. A 2011 report concluded that each additional dollar of government subsidies increase the value of land by $US13.14 per acre. This suggests that, with a wind back of subsidies, the impact on farm values would be dramatic. With the current administration pledging aggressive budget cuts, pressure is mounting for a reduction to agriculture and biofuel support measures. The senate vote in June this year in favour of removing $US6 billion a year in ethanol subsidies is seen by some as a willingness by both parties to address agriculture spending to rein in the Government’s deficit.
There are two key impacts of low interest rates on farm land values. As the returns from “risk-free” government debt have become less attractive investors have looked to alternatives, including farmland. More concerning is the impact of cheap debt fuelling buyers with bullish future growth expectations. Operating farm land is a business where value is driven by the land's ability to produce a commodity with certain costs of production with a financial return as the result. A low cost capital structure is a risky driver of growth for farm land values.

In an example of the potential impact of a rise in interest rates, a recent study models interest rates increasing from 3.25 per cent to 4.5 per cent, and concludes that for farm values to stay at parity the cash rent on farm land would have to rise from an average of $US161 per acre to $US220 per acre. The corollary is that, should incomes not rise, there would be downward pressure on prices.
The farming opportunity outside the US

With signs the US farm land market may be running out of steam investors have turned their attention to other potential production powerhouses.

There has been a fundamental shift in the global commodity markets during the past 40 years as the major producers of South America have steadily gained market share. In 1970 the US produced over 71 per cent of global soybean production, the countries of South America, including Brazil, Argentina, Uruguay and Paraguay combined, produced less than one per cent. In the last five years the production from Brazil and Argentina alone eclipsed that from the US. The FAO projects that these countries will produce over half of the global supply by the end of the decade. As grain handling and transport infrastructure has been developed the competitiveness of South American production has improved. This is particularly the case in Brazil.

The cost of land is a fraction of that in the US, with land suitable for soybean production – Illinois in the US, Rio Negro, Uruguay, Santa Fe, Argentina and Mato Grosso, Brazil - compared in the charts below. The chart on the right shows the cost of land on an equivalent soybean yield basis with the cost in Mato Grosso, Brazil, being less than 30 per cent of that in Illinois in the US.

Investors may view the potential downside risk in US farm land with some caution. However, the fundamentals that underpin the global demand for agricultural products remain strong. Importantly, the major drivers of growth for these products are increasingly from outside the US, with other producing countries becoming more competitive. The investment opportunity in farming is global with the case for investment in regions outside the US becoming more compelling.

2. Farm land Values, Current and Future Prospects (2011), Brent Gloy, Chris Hurt, Michael Boehlje, and Craig Dobbins, Purdue University, March 1, 2011
3. USDA Farm land Survey 2010.
4. The Agricultural Newsletter, Federal Reserve Bank of Chicago, Number 1953 August 2011
5. USDA, National Agriculture Statistics Service, 2011.
6. Knight Frank: Farm land index 2011
7. Farm land Values, Current and Future Prospects (2011), Brent Gloy, Chris Hurt, Michael Boehlje, and Craig Dobbins, Purdue University, March 1, 2011.
15. Farm land Values, Current and Future Prospects (2011), Brent Gloy, Chris Hurt, Michael Boehlje, and Craig Dobbins, Purdue University, March 1, 2011.
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