2013

Investing in Agriculture: Opportunities in Farmland, Futures, and Equities

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Contents

Executive Summary

Agriculture is a $6.4 trillion market globally, yet commitments by institutional investors have been quite small. Interest in institutional agricultural investment is now building, albeit from a very low base.

Institutional agricultural investments can take many forms, including public equities, grain futures contracts, farming of permanent crops including fruits and nuts, and strategies that purchase land to grow annual row crops such as corn and soybeans. This report discusses each of the main agricultural investment strategies, the secular drivers of global food-and-feed demand, the economics of farming across regions, prospective return characteristics, and the risks for farmland investors.

The long-term investment thesis supporting row crop exposure is likely familiar to many investors: the emerging middle class globally is projected to boost global meat consumption by about 75% through 2050 as per capita GDP rises, driving demand for the corn and soybeans that are used extensively as animal feeds. However, if you compare the yield increases necessary to meet expected future grain needs, future yield growth can decelerate sharply from the growth rates achieved over the past 40 years. That said, the low-hanging fruit of yield enhancement may have already been picked (in particular, expanded irrigation and fertilizer use in the developed world), so future growth in yields may require substantial investment capital to further develop and apply new technologies such as drought-resistant seeds to fields across the world.

Families or institutions seeking to invest in agriculture in a liquid fashion have somewhat limited options: grain commodity futures, which tend to suffer from pernicious implementation issues, or listed agricultural equities (such as fertilizer and seed manufacturers).

For those investors not limited to liquid strategies, a wider variety of opportunities may be worth considering:

- The cultivation of **permanent crops** such as fruits and nuts is a long-term strategy (vines or trees may take years to become productive) that can offer high cash yields. However, this strategy possesses considerable risks—the expensive plants may become damaged or diseased, access to cheap water may become limited, and the plants' fruit may fall out of favor with consumers. Certain insurers have been active investors in this field for decades. Diversification by region and crop is the watchword, and operational expertise is critical.
- Similarly, **livestock and dairy** production have thus far seen limited institutional investment participation, perhaps because of their operational complexity. Returns could be attractive; risks to the animals are obvious, but risk of health scares and of rising feedgrain prices must be considered as well.
- **Row crops** including corn and soybeans have been the focus of most institutional investors seeking out agricultural exposure. Investors that find the long-term demographic thesis for grain demand compelling will find grain production appealing. Additionally, investors with limited access to agricultural expertise may be attracted to strategies that focus on buying farmland and lending it out to expert farmers for a cash rent or a blended cash/crop "flex" rent (both are common in the highly productive but exorbitantly priced **U.S. Midwest**). However, do not expect high returns when buying productive Midwest farmland yielding 4%. Also, bear in mind that a rise

in interest rates could prove quite damaging for rich land prices, unless accompanied by rising grain prices. Investors seeking returns more commensurate with illiquidity may pursue row crop strategies focused on **South America**, **Africa**, or **Russia**. Pockets of these areas have good climate and soil conditions, and while land prices have jumped in some cases, they have generally remained cheap relative to the U.S. Corn Belt. In addition to the risks present in the United States, investors in these regions can face considerable political risks that could eventually crimp their ability to buy, sell, or control their land. Additionally, infrastructure to get inputs to the farms and crops to market may be well below developed world standards.

Agriculture is an appealing and varied new frontier for institutional investors. Yet investors must tread carefully. Land prices in some areas appear quite elevated, most of the managers raising money today have more experience in boardrooms than tractor cabs (and few have developed track records with successful exits), and today's rock-bottom interest rates will not persist forever. ■

Agriculture is a $6.4 trillion market globally, employing more than one-third of the world's population[1] and encompassing about one-tenth of global GDP. Yet focused participation in agriculture by institutional investors has been surprisingly small. That is now just beginning to shift, with interest in institutional agricultural investment building quickly, albeit from a very low base.

Institutional agricultural investing can take many forms, including long-only or long/short investing in agriculture-related public equities such as Monsanto; long-only or long/short investing in agricultural commodity futures; private equity agricultural infrastructure plays; livestock production and aquaculture; and farming of permanent crops including fruits and nuts. However, when most institutional investors consider agriculture today, they tend to focus on easily understandable strategies that purchase land for growing annual row crops (particularly corn and soybeans, which are key to livestock production).[2] Land-based agricultural strategies may owe some of their new popularity to a preference for non-financial assets in the post-Lehman investment environment.

In this report, we will incorporate some discussion of each of the main agricultural investment strategies. We discuss the secular drivers of global food-and-feed demand, the economics of farming across regions, return characteristics, and the risks for farmland investors. In particular, we focus on row crop farming in the Americas, Russia, and Africa.[3] We believe that farmland investments in South America, Russia, and Africa offer significantly higher potential returns than those in the richly priced U.S. Corn Belt; however, foreign farm owners in these developing markets face substantial operational and political risks.

Introductory Framework

Readers who possess some familiarity with the basics of agricultural investing may wish to skip this brief introductory discussion.

The Agricultural Value Chain

We divide the agricultural value chain into three components: inputs, outputs, and distribution (Figure 1). **Inputs** include land, labor, seed, fertilizer, crop protection (such as herbicides), and equipment (such as implements and irrigation systems). Land can be further broken down based on how it is used (Figure 2). **Outputs** are the crops or animal products themselves, some of which are investible via futures markets (futures contracts are generally limited to commodity crops and do not exist for crops that are highly differentiated in quality or variety, such as wine grapes). Finally, the **distribution and infrastructure** segments of the agricultural value chain offer both public equity and private investment opportunities. The various segments of the value chain provide investors with a variety of liquidity and potential risk/return profiles.

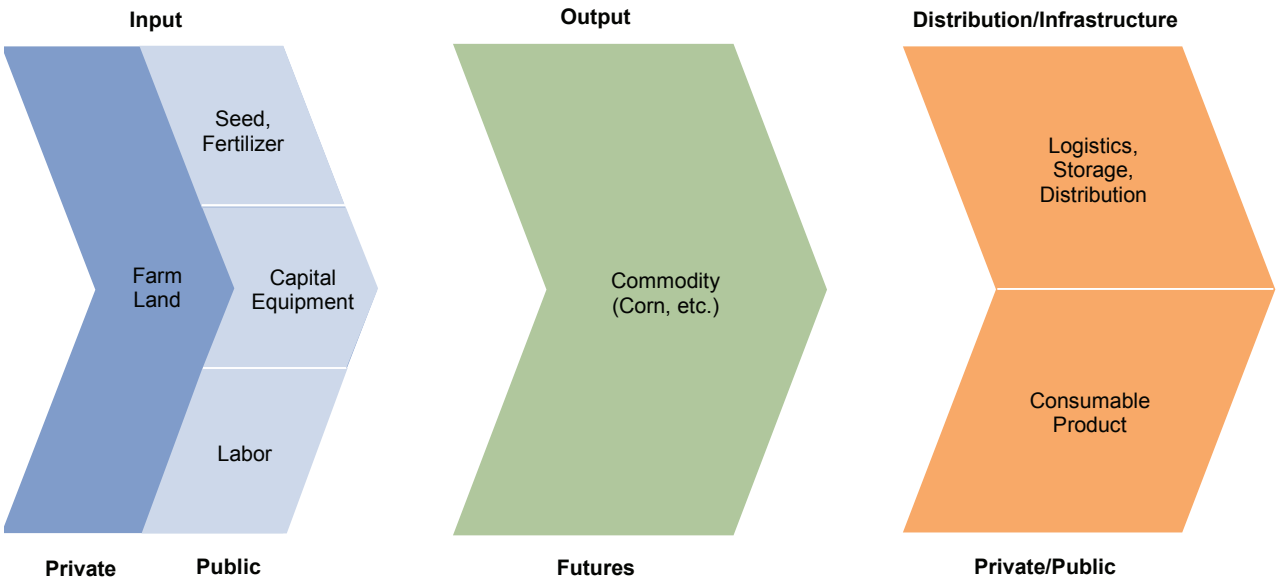
Other contributors to this report include Otso Fristrom, Peter Roney, Patrick Sahm, and Duane Sayre.

[1] Many of these are subsistence farmers or very small-scale commercial growers in the developing world.

[2] As we discuss in more detail later, some funds control the farming operations (either with employees or operating partners), others rent the farmland out for an annual cash or cash plus crop proceeds annual rent, and some are a hybrid of operating and leasing. A handful of funds lease some of their target farmland rather than buy it (sometimes these are very long-term leases that substitute for outright ownership in regions that do not allow foreign or institutional ownership of farmland).

[3] Timberland is of course an agricultural product, but because institutional investors are much more familiar with that asset class and because we cover it periodically in other publications, we will not discuss it in this report.

Figure 1. Agricultural Value Chain



Source: Cambridge Associates LLC.

Agricultural Crop Types

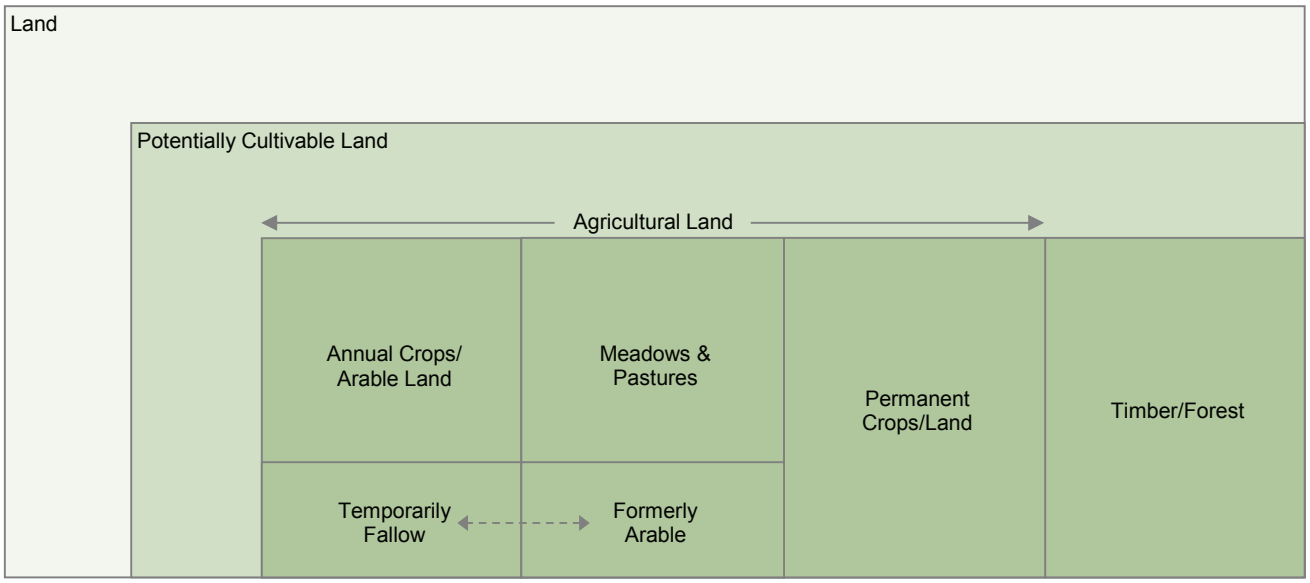
Investors considering an allocation to land-based investment strategies will quickly realize that investment opportunities are often segregated by crop type. Figure 3 shows the dollar value and production quantity of the highest-grossing ten crops globally. Only three crops on this list are in the mainstream of agricultural investment strategies: corn/maize, soybeans, and wheat.

Row crops (also known as annual crops) such as corn and soybeans are predominant in most new private agricultural investment fund launches. Farmers growing crops invest in land and inputs such as seeds and fertilizer, and typically the land begins producing valuable grain within a season or two (although substantial yield improvements that increase land prices can take multiple years). Row crop farmers may have some ability to switch between annual crops as grain prices, climate, or soil conditions warrant.

Permanent crops, on the other hand, tend to be produced in orchards or vineyards. Figure 4 sets out the five top-grossing permanent crops globally. Permanent crops popular for institutional investment include grapes, stonefruits, cranberries, and tree nuts. Investors in permanent crop production tie up substantial value in the trees or vines, so they must be attuned to future shifts in demand for particular fruits and nuts or varieties of same (think of the demand for Merlot versus Pinot Noir wine after the 2004 film *Sideways*),[4] as well as the threat of diseases. **Animal products** including fish and meat, dairy products, and wool currently hold limited shelf space in institutional investment products.

[4] From 2004 to 2007, the annual acreage of newly planted Merlot vines in California decreased 80%, from 787 new acres planted in 2004 to just 157 new acres planted in 2007. Over the same period, annual plantings of Pinot Noir grapes in California increased nearly five-fold, from 676 acres in 2004 to 3,243 acres in 2007.

Figure 2. Agricultural Land Definitions



Land: The total area of all countries excluding area under inland water bodies.

Potentially Cultivable: Land that could potentially be used to raise agricultural crops or livestock. This includes all land currently used for cultivation, but also includes arid land, protected parks, and other areas where meaningful cultivation is limited.

Agricultural Land: The sum of arable land, meadows and pastures, and permanent land.

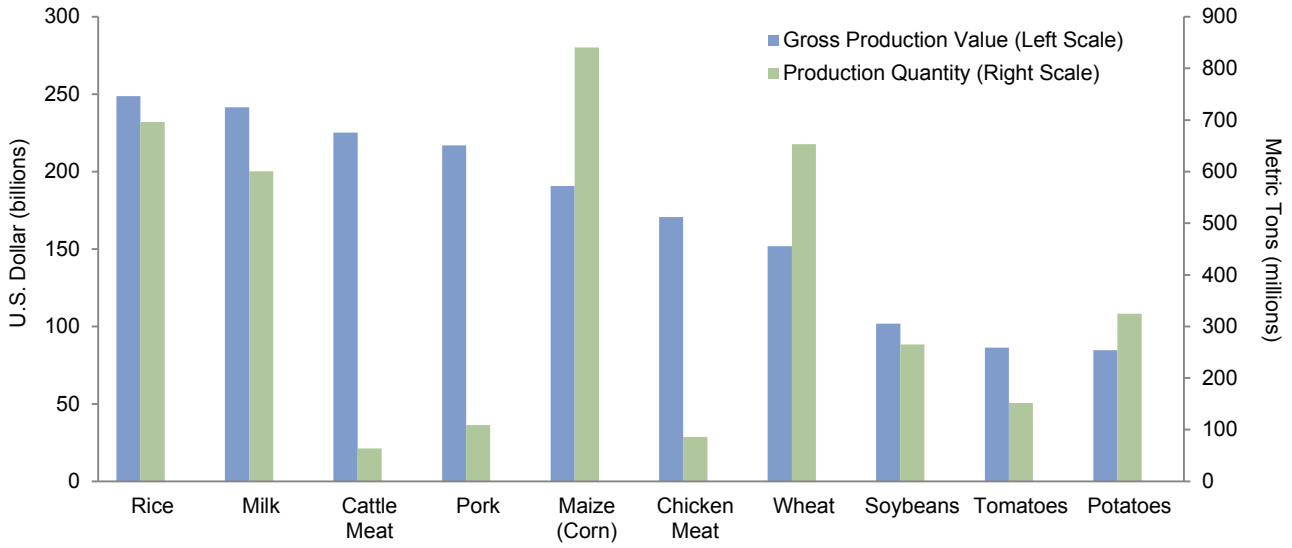
> **Annual Crops/Arable Land:** Land currently cultivated and used for non-permanent farming.
>
> **Temporarily Fallow/Formerly Arable:** Fallow land (temporary) is the cultivated land that is not seeded for one or more growing seasons. The maximum idle period is usually less than five years. Land remaining fallow for too long may acquire characteristics requiring it to be reclassified, such as meadows & pastures (if used for grazing), timber/forest (if overgrown with trees), or potentially cultivable land (if it becomes wasteland).
>
> **Meadows & Pastures:** Land used permanently (five years or more) to grow herbaceous forage crops, either cultivated or growing wild (wild prairie or grazing land).
>
> **Permanent Crops/Land:** Land cultivated with long-term crops that do not have to be replanted for several years (such as cocoa and coffee); land under trees and shrubs producing flowers, such as roses and jasmine; and nurseries (except those for forest trees, which should be classified under timber/forest).

Timber/Forest: Land defined by both the presence of trees and the absence of other predominant land uses. The Food and Agriculture Organization of the United Nations defines this area as land spanning more than 0.5 hectare with trees higher than five meters and a canopy cover of more than 10%, or trees able to reach these thresholds *in situ.*

Source: Food and Agriculture Organization of the United Nations.
Note: Figure is not to scale.

Figure 3. Global Commodity Production

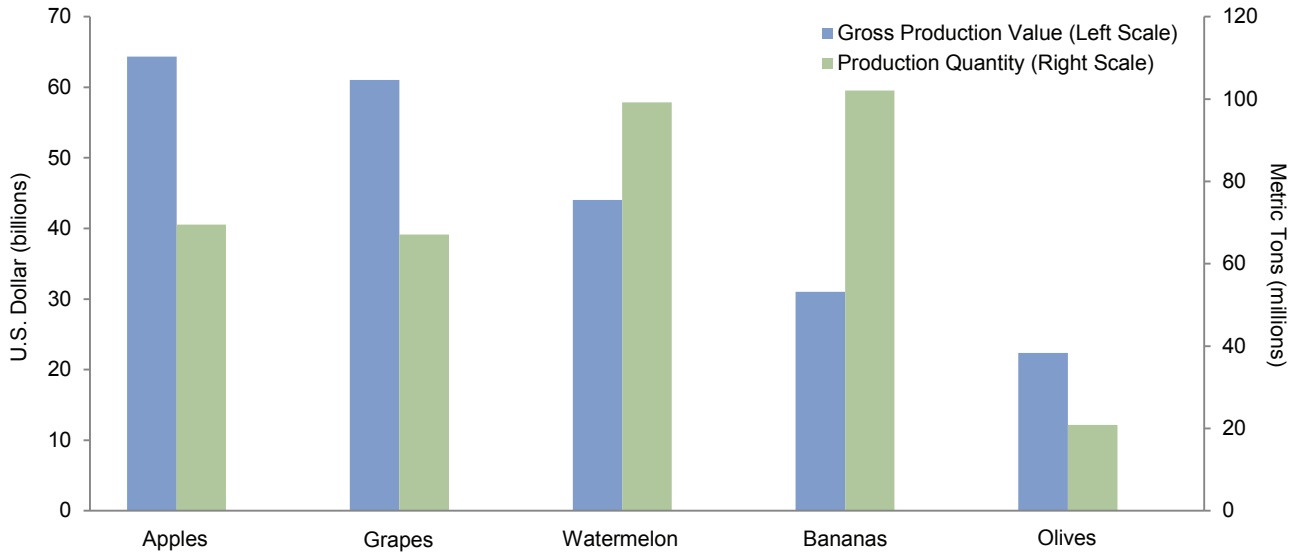
2010



Source: Food and Agriculture Organization of the United Nations.
Note: Graph represents top ten commodities based on gross production values.

Figure 4. Global Permanent Crop Production

2010



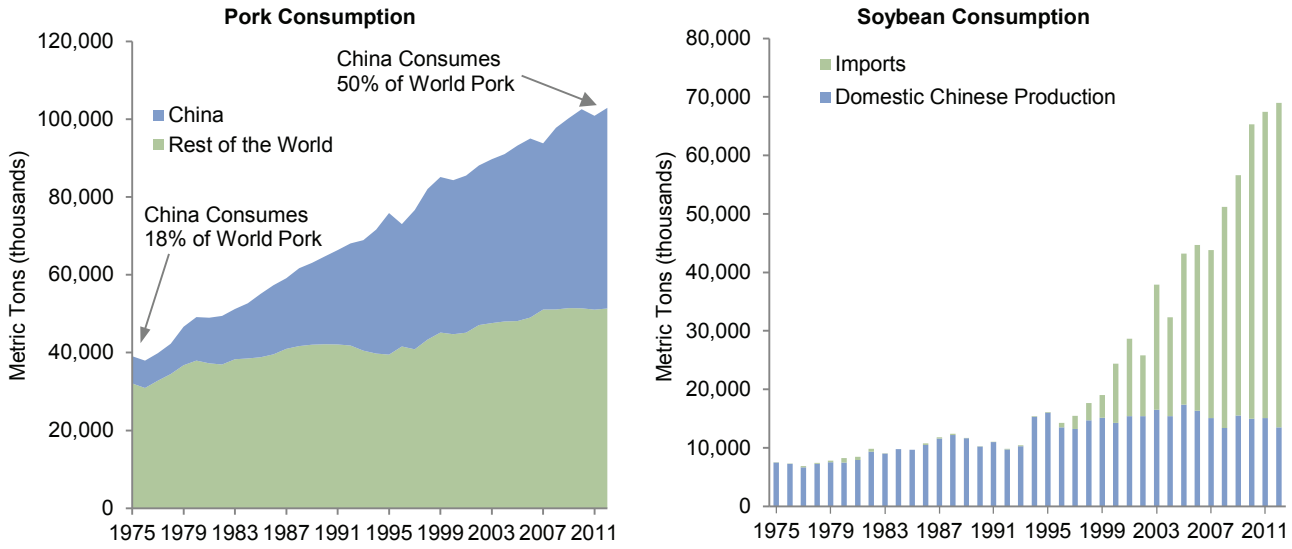
Source: Food and Agriculture Organization of the United Nations.
Note: Graph represents top five permanent crops based on gross production values.

Grain Supply and Demand—Describing and Critiquing the Macro Case

The long-term investment thesis supporting row crop exposure is likely familiar to investors that have met with a few managers. To understand why many investors believe grain and farmland prices will be well supported in coming years and decades, one must look at how grains will be used once harvested.

The vast majority of corn and soybeans (the primary crops grown on institutionally owned investment properties) will not end up directly on dinner plates; instead, the majority of the world's soybean harvest goes to animal feed, and the corn harvest is directed primarily to animal feed and U.S. automobile fuel (ethanol). Demand growth for crops is closely tied to the appetite for, and ability to afford, meat among consumers in emerging markets benefitting from rising incomes and standards of living. Per capita GDP and protein consumption are closely linked (Figure 8); if economic and population growth continues apace in emerging powerhouses Brazil and China, global protein consumption could expand quickly. Expanding appetite for meat among the emerging middle class drives grain demand because producing a kilogram of pork or beef protein requires between three and eight kilos of grain. So when investors think about soybeans, they should probably picture a plate of pork in China, rather than a bowl of edamame in a Los Angeles sushi restaurant (Figure 5). Like soybeans, corn is used extensively to feed livestock; unlike soy, it is also used to feed SUVs in Texas: ethanol consumed 40% of the 2012 U.S. corn crop, up from just 7% in 2002, so global fuel demand and the continued presence of the U.S.

Figure 5. China's Demand for Food
1975–2012



Source: U.S. Department of Agriculture - Foreign Agriculture Service.
Note: Data for 2011 and 2012 reflect official U.S. Department of Agriculture estimates.

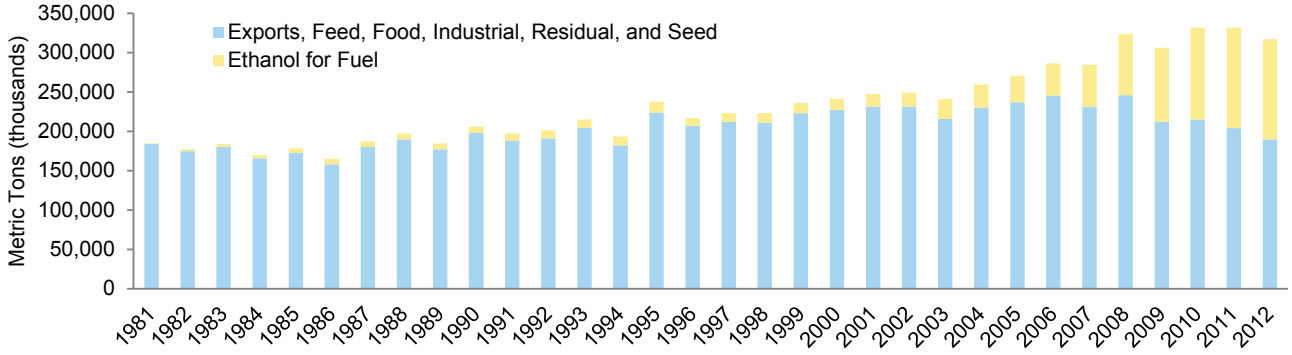
domestic ethanol mandate provide support for corn prices (Figure 6).

Long-Run Demand Is Formidable; Can Farmers and Technologists Rise to the Challenge?

Discussions of the supply/demand dynamic for agriculture should come with a time horizon attached. The investment proposition tends to be couched in the very long term, with demand from population growth and growing wealth in the emerging markets outstripping current food supplies. However, the nearer-term dynamics are also important for investors, even for those investing in strategies based on buying farmland. First, we will discuss the long-term supply/demand dynamic.

The world population topped 7 billion recently, and is estimated to grow to 9 billion by 2050, with the fastest rate of increase in Africa, modest growth in the Americas and Asia, and modest population *shrinkage* in aging Europe (Figure 7). On top of that, per capita meat consumption is anticipated to increase by more than one-quarter over that period, driven by population growth and per capita income growth in less developed countries. Per capita protein consumption in a country tends to be associated with the country's per capita GDP, with a steep curve in the first $3,000 per person or so of GDP (Figure 8), implying that a modest increase in per capita income boosts protein consumption sharply. Put it together, and the world's meat production will need to increase by about 75% by 2050. Grain use is projected to grow by more than 45% over that period. While projections for rice and wheat consumption show a relatively modest increase, corn and soybeans, both of which are used for animal feed, will likely experience a higher growth rate. The diversion of more than 40% of the massive U.S. corn crop to create ethanol,

Figure 6. U.S. Corn Market
1981–2012



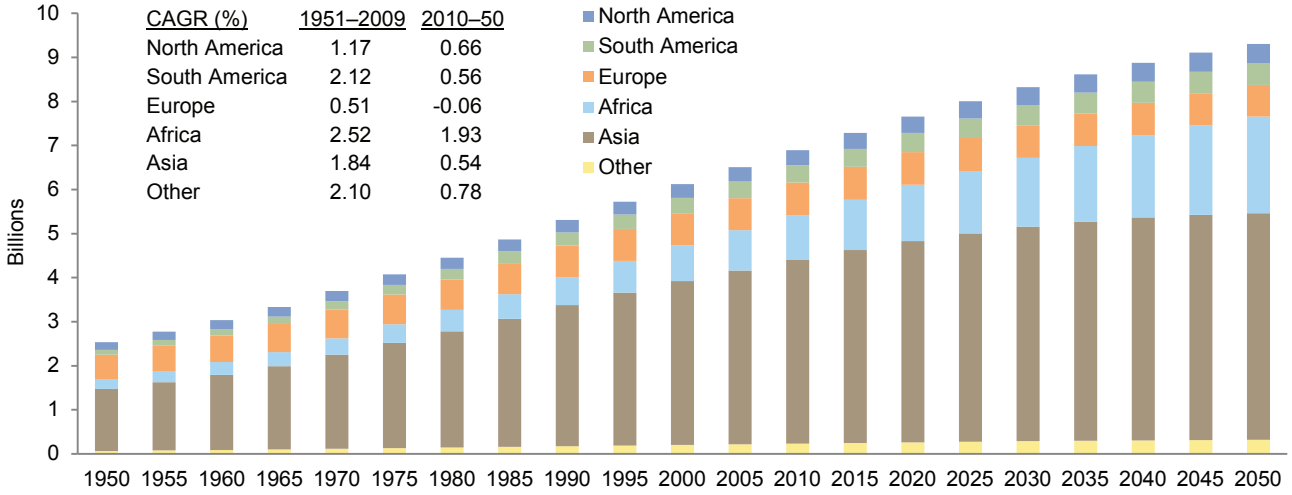
Cum Growth in U.S. Corn Consumption/Exports (2000–12)	
Ethanol-Based:	785.6%
All Other Uses:	-16.4%
Total:	31.3%

Market Share of Ethanol Production Among Uses for Corn	
2002:	7.2%
2012:	40.1%

Sources: U.S. Department of Agriculture - Economic Research Service and U.S. Department of Agriculture - Foreign Agricultural Service.
Note: Data for 2012 are projections.

Figure 7. Regional Population Growth: Historical and Projected

1950–2050

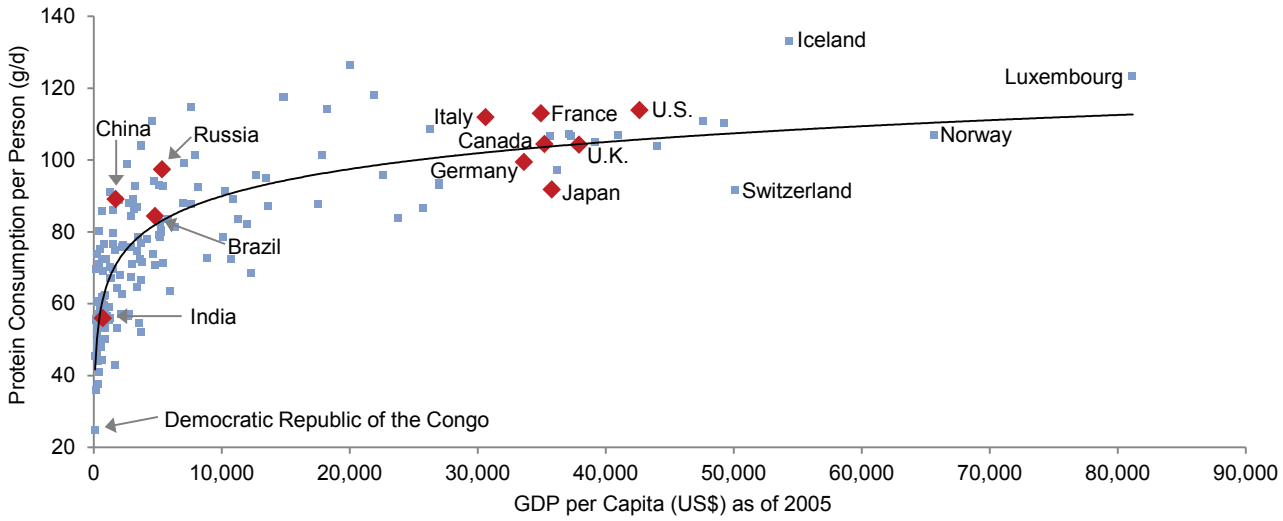


Source: Population Division of the Department of Economic and Social Affairs of the United Nations Secretariat, *World Population Prospects: The 2010 Revision.*

Notes: Data after 2010 represent UN projections. "Other" includes countries in the Caribbean, Central America, and Oceania regions. CAGR is the compound annual growth rate.

Figure 8. Protein Consumption Versus GDP per Capita

2005–07



Sources: Food and Agriculture Organization of the United Nations, *Statistical Yearbook 2009* and International Monetary Fund, World Economic Outlook Database.

Notes: The G-7 and BRIC countries, as well as other major outliers, have been labeled on the graph. GDP data are nominal.

up from less than 10% a decade ago, is another source of demand, and biofuel mandates are not limited to the United States (Table 1).

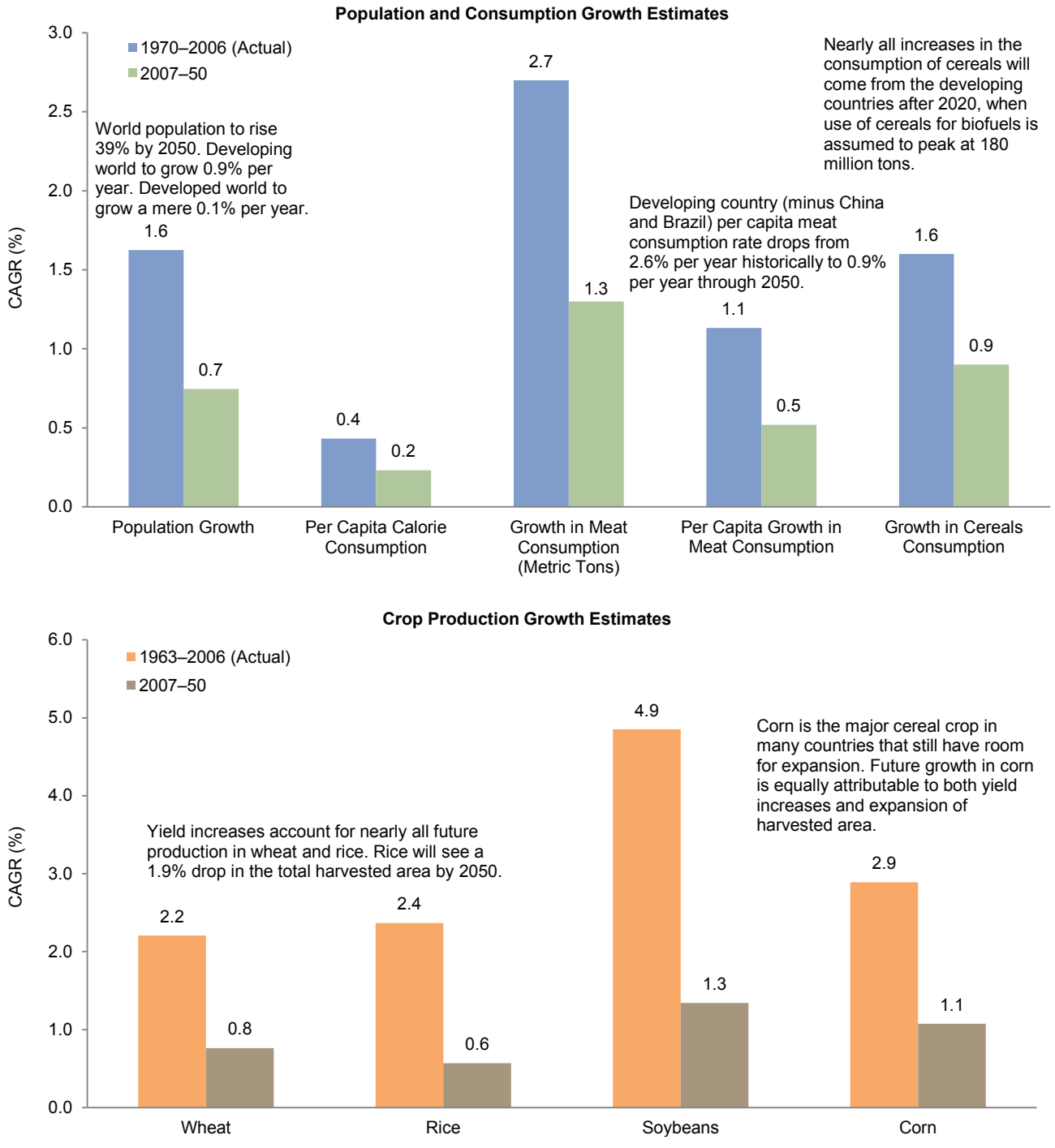
However, if you compare these future increases to their historical precedents (Figure 9), significant *deceleration* is clear. The production of these commodities is growing, but the rate of growth is projected to slow markedly. Soybean and corn yields that grew by nearly 5% and 3% annualized, respectively, over the past four decades now need to grow by a bit more than 1% annualized over the next four decades. Could it be that the food production challenge over the very long run is not so extreme as the dire Malthusian warnings suggest? We believe that long-term grain demand will continue to

Table 1. Biofuel Mandates by Country

Country	Target
Australia	New South Wales ethanol mandate at 6%; Victoria and Western Australia have 5% biofuel targets
Brazil	Minimum ethanol content of 18% to 20%
Canada	5% ethanol blending rate, 2% biodiesel
Colombia	E8 ethanol mandate currently in place, with discussions underway to increase to 10%
China	15% of transport fuels to be met by biofuels by 2020
European Union	Currently 5.75%; minimum 10% blending rate in each member state by 2020
France	Currently 7%, 10% by 2015
Germany	6.25% ethanol in gasoline
India	Current E5 mandate, will move to E10 when production is in place
South Korea	B2 biodiesel mandate
Jamaica	10% ethanol blending rate
Japan	3% biofuel blending rate
South Africa	10% ethanol blending rate
Thailand	B5 biodiesel mandate in place
United Kingdom	5% biofuel blending rate; 10% by 2020
United States	36 billion gallon biofuels target by 2022

Sources: API, Biofuels Association of Australia, Biofuels Digest, European Union, Food and Agriculture Organization of the United Nations, HSGA, Itau Securities, Latin American Energy Organization, Thomson Reuters, Guardian News and Media Limited or its affiliated companies, and U.S. Department of Agriculture - Foreign Agricultural Service.
Note: Data are as of December 31, 2012.

Figure 9. Global Annualized Growth Estimates: Population, Consumption, and Crop Production



Source: Compiled using information from the Food and Agriculture Organization of the United Nations, *World Agriculture Towards 2030/2050*.

grow, but in a decelerating fashion—a contrast with the impression left by marketing materials from some farmland investment managers.

That said, continued yield improvements from better inputs and technology will be necessary to feed a growing world. The amount of net additional farmland likely to come into production is probably modest, and some argue that the low-hanging fruit of yield enhancement has already been picked, so future yield enhancement may require substantial investment capital.[5] Without growth in yields per hectare, feeding a growing world would eventually become impossible.

Sufficient Yield Growth Is Not a Slam Dunk

Use of fertilizer, irrigation, and herbicides and pesticides is already widespread in the world's most productive farm regions. Growth in cereal yields appears to be decreasing over time, with about 3% annual yield growth in the 1960s, 2.3% in the 1970s and 1980s, and 1.3% in the 1990s and 2000s (Figure 10). However, as shown in the figure, only 0.5% annual yield growth is needed for the next four decades to keep up with projected demand.[6] Continued investment in yield-enhancing technologies has the potential to help farmers meet future demand; however, investors should realize that these forecasts mask substantial uncertainty and minimize the very real volatility and instability likely in shorter-horizon snapshots.

Elevated crop prices may well be needed to induce continued investment (on the part of farmers or firms that support farming via seed

[5] Investment must occur at both the research & development lab and the farm.

[6] Projected demand growth is higher for some grains, including 1%+ annual demand growth for corn and soybeans (which are primarily used as feed grains and for biofuel production).

How Does a Slowing China Impact Medium-Term Grain Demand?

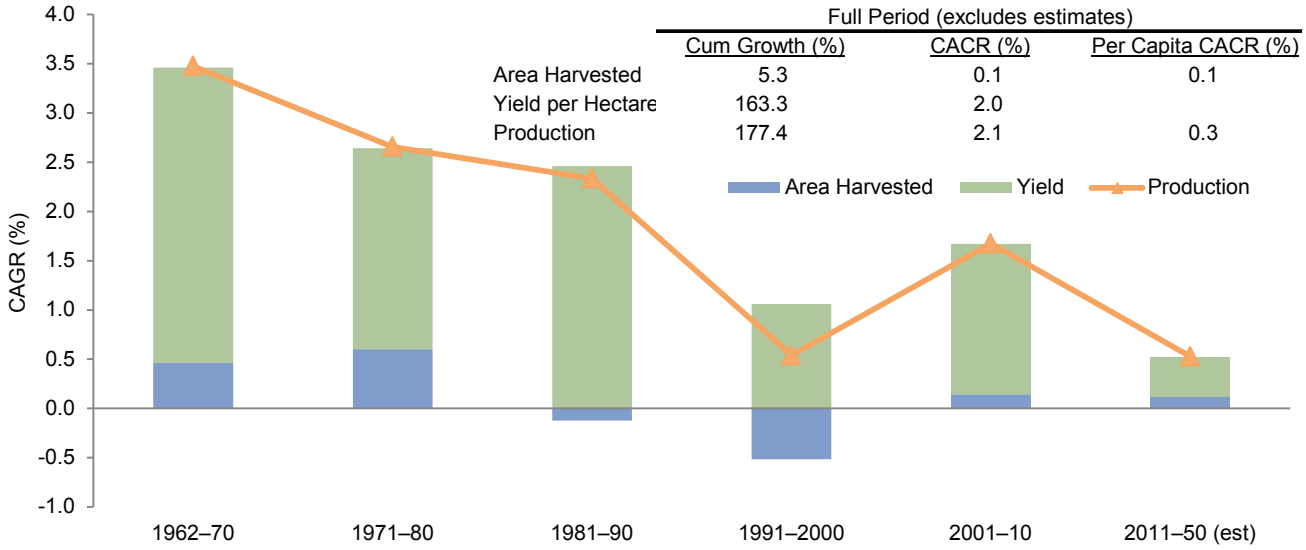
Over the past decade or more, China's strong economic growth and aggressive investment pace have driven demand for many global commodities. Today, Chinese growth appears to be slowing sharply (official GDP growth stats register 7.4% growth—slow by Chinese standards, but still quite heady compared to the rest of the world), and inventories appear to be brimming. Given the government's apparent desire to limit further mal-investment and property bubbles, the pace of investment is likely to shrink, and consumer demand will need to take up the growth baton—not a given, considering that China's demographic dividend is also due for a cutback in the medium term. Population growth of 0.6% over the past decade is just half that of the prior decade, and the ratio of working age persons to retirees is likely to plummet from 8 today to just 6 by 2020.*

Moreover, Chinese diets have already transitioned, such that consumption of protein and calories is similar to that in relatively wealthy Asian nations (the Chinese diet is about 3,000 calories per day, and protein accounts for 12% of calories, versus 3,070 and 11% for Korea, and 2,800 and 13% for Japan). In the 1990s, the Chinese daily caloric intake climbed 13% as per capita GDP tripled to $3,500; however, over the next decade, dietary calories only increased by 2% even as income growth remained strong.** Barclays estimates that China's commodity intensity is falling for agricultural products, and Chinese soybean consumption, which grew at a 9% annual rate from 2007 to 2011, is estimated to grow at only 5% per year from 2011 to 2015 (the growth rate of pork, wheat, and rice consumption through 2015 is estimated at only 1% annually). China's investment-led growth has driven the commodities bus over the past decade, but today that driver is looking fatigued.

* Please see Wang Feng, "Racing Towards the Precipice," China Economic Quarterly, Dragonomics Research and Advisory, June 2012; and Thomas Gatley, "China's Population Challenge," GKDragonomics, August 2012.

** Dietary statistics are from the UN FAO, collected in Kevin Norrish et al., "China's Commodity Intensity," Barclays Commodities Research, April 25, 2012.

Figure 10. Annualized Growth in Global Cereal Production, Yield per Hectare, and Harvested Area
1961–2050



Sources: Food and Agriculture Organization of the United Nations and OECD.
Note: Yield represents harvested production per unit of harvested area for crop products.

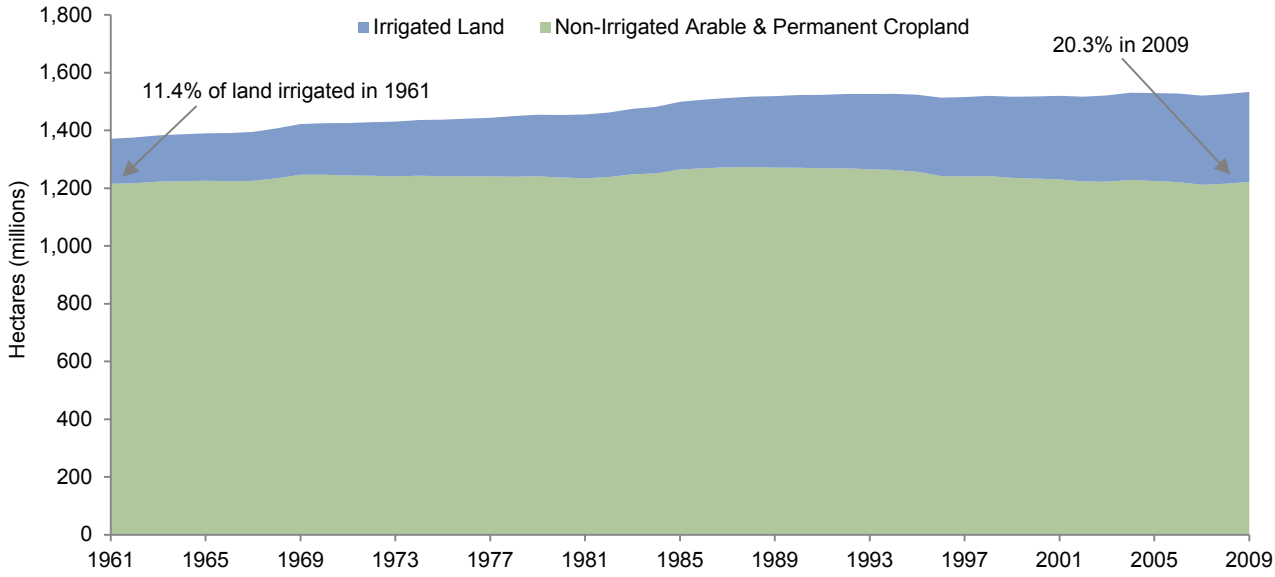
technologies, fertilizer and crop protection, and implements). And with investment, annual yield growth of 0.5% could be within the realm of possibility. If yield growth is inadequate, causing grain supply to persistently fall short of demand, elevated prices for grain and meat would cause some demand destruction: consumers that had recently acquired a taste for meat would probably revert, at least temporarily, to diets skewed toward breads, tubers, or rice if meat prices became unaffordable. Of course, this transition will likely be volatile, given the changing climate and the political instability that can result from food price increases in the developing world (where food tends to make up one-third or more of the consumer spending basket).[7]

What are some of the possible sources of continued yield improvement? We will examine them one by one.

- **Irrigation.** Irrigation has been a huge yield booster over the past several decades, but the availability of fresh water limits future expansion in the amount of irrigated land. The doubling of irrigated land since 1961 has provided a sizable boost to yields (cereal yields of irrigated land are half again as high as rain-fed land). In 1961, 156 million hectares of cropland were irrigated, and now it is about 312 million. Yet the percentage of cropland receiving irrigation is only 20% today (Figure 11).

[7] Some commentators have cited wheat price spikes, caused in part by drought and fires in Russia's wheat belt, as a significant contributor to the initial waves of the Arab Spring.

Figure 11. Irrigation of Global Arable and Permanent Cropland
1961–2009



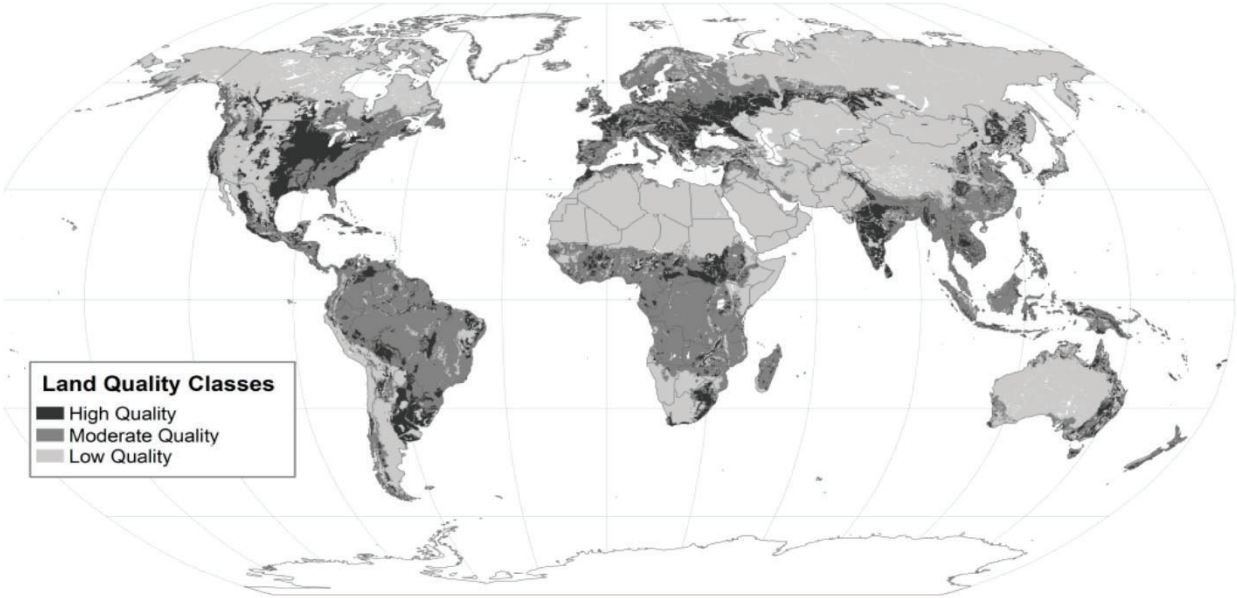
Source: Food and Agriculture Organization of the United Nations.

It is tempting to think that a further doubling in the market share of irrigated land could goose global grain yields. However, that appears unlikely, with numerous constraints including limited investment capital in the developing world, and especially the limited availability of a suitable water supply. Just nine countries possess 60% of the world's available freshwater supply, according to the World Business Council for Sustainable Development, and even in some of those countries, irrigation levels may not be sustainable in some regions where aquifers are becoming depleted. The Food and Agriculture Organization (FAO) of the United Nations predicts modest net increases in irrigated land through 2050 of 0.1% per year annualized, with all of the increase coming in the developing world.

- **Fertilizer.** Most plants require three nutrients to grow, and their initials can be found on bags of fertilizer at the neighborhood garden center: nitrogen, phosphorus, and potash (N, P, and K). The amount of fertilizer applied by U.S. farmers tripled from 1960 to 1980, but subsequently leveled off. GPS-based technology available to farmers today allows application of differing nutrient concentrations in each square meter of farmland.

  Fertilizer is available for use in much but not all of the developing world (in fact, these countries apply 70% of the world's fertilizer); however, scant access to financing limits fertilizer use by farmers in some regions. Soil quality and fertilizer needs vary widely from one region to the next (Figure 12). As of the middle of the past decade, farmers in developing countries applied 127 kilograms of

Figure 12. Inherent Land Quality Map



Source: Reproduced from the U.S. Department of Agriculture - Natural Resources Conservation Service.

fertilizer per hectare, compared with 144 per hectare for the developed world. However, by 2050, the FAO expects per hectare fertilizer use in the developing world to outstrip the developed world (200 kilograms versus 166 kilograms), driven by strong growth in Chinese and Indian farmers' use of fertilizer. At a global level, FAO anticipates that fertilizer use per hectare will increase by 0.9% per year on an annualized basis.

The recent advances in natural gas extraction using fracking and horizontal drilling that have sharply boosted worldwide natural gas reserves will likely help keep a lid on prices of nitrogen-intensive fertilizers because these fertilizers are often manufactured using natural gas. There has been some controversy over the future availability of phosphates: while some observers have expressed concern over dwindling supplies of phosphate and the concentration of phosphate reserves in Morocco, the fertilizer industry notes that global phosphate production continues to expand, and that China has taken Morocco's spot as the top-producing country, with 35% of global production in 2011.

- **Seed and crop protection technology.** The use of so-called Roundup Ready corn and soybean seed, which produces crops that tolerate the non-selective herbicide glyphosate,[8] has become common in the United States and some other markets. These seeds allow farmers to efficiently control weeds, although their use is somewhat controversial and is limited in some regions (especially in Europe and Africa). Some reports indicate glyphosate-resistant weeds are becoming more prevalent, so the crop

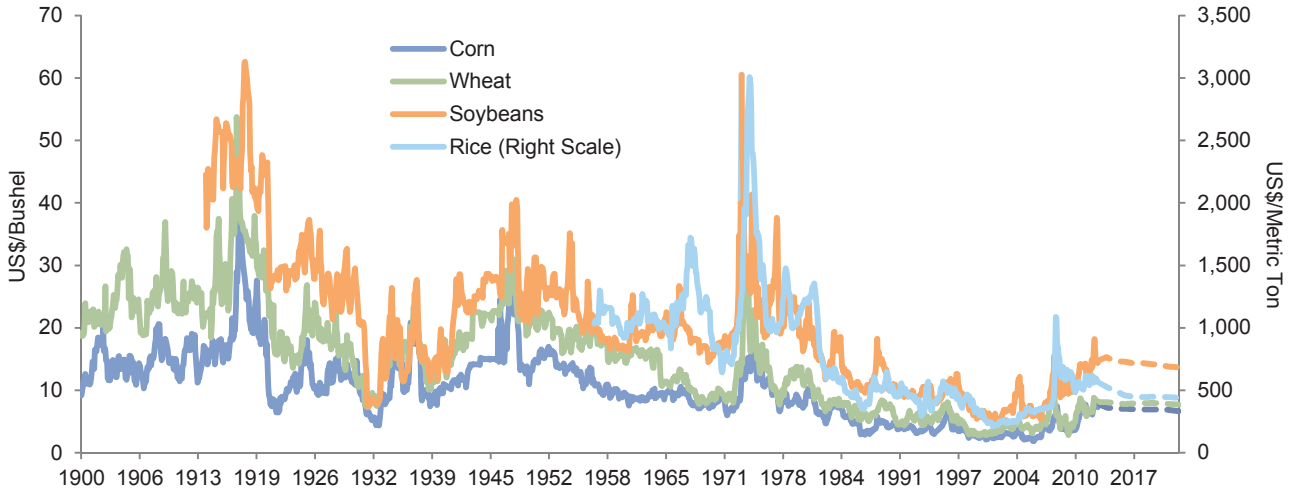
[8] Roundup is Monsanto's trade name for glyphosate.

protection arms race will likely continue. One promising development in the research pipeline of seed producers is drought-resistant crops. These would allow cropping in non-irrigated land that receives insufficient rainfall, and would permit continuing cropping in areas that see their rainfall diminish due to climate change.

Attempts at genetic modifications to decrease the need for certain fertilizers have the potential to improve the economics for certain farmers (particularly those in areas with poor infrastructure where transporting inputs is expensive). From an investment perspective, any game-changing developments in seed technology may be a mixed bag, and would likely benefit farmers in marginal areas at the expense of farmers in core regions. Although technology advancements could boost crop supply and thus lower crop prices, the resulting yield improvements for farmers in marginal areas could boost prices of their landholdings.

Will high prices spur strong investment in existing yield enhancers, as well as the development of future technologies, ensuring adequate grain supplies in the decades to come? Over the past century, and particularly the past 50 years, dramatic advances in agricultural productivity have helped grain production keep up with demand, even amid rapid population growth and increasing demand for meat protein. The Green Revolution helped introduce hybrid seeds, crop protection, and irrigation, spurring yield gains and holding grain prices down as supplies expanded. In nominal terms, a bushel of corn cost about 32 cents in 1900, versus more than $8 during the 2012 drought in the U.S. Midwest. However, Figure 13 illustrates that on an inflation-adjusted basis, grain prices have declined over the very long term (that is to say, prices of other goods and services

Figure 13. Real Crop Prices
January 31, 1900 – December 31, 2021



Sources: Global Financial Data, Inc., OECD, and U.S. Department of Labor - Bureau of Labor Statistics.
Notes: Prices are deflated by the CPI-U, based on the December 31, 2012, level. Soybean data begin November 1, 1913, and rice data begin January 1, 1957. Dotted lines indicate OECD estimates. Soybean estimates are represented by oilseeds. Rice prices are as of December 31, 2012.

have increased more rapidly than grain prices), as yields per hectare increased at an amazing compound rate of 2.0% per year from 1961 to 2010. (Recent grain price increases have been sharp indeed, but we believe that poor weather has been a significant factor, and that prices are unlikely to outstrip inflation over the long term.) Total production growth compounded at 2.1% per year (the remaining 0.1% came from a modest boost in the total amount of cultivated land). Production growth outstripped global population growth by 1.4% per year over that period. The amount of irrigated land doubled from 1961 to 2009, while the amount of non-irrigated arable and permanent cropland was essentially unchanged.

Yield increases over the past five decades have been relatively broad based, with worldwide annualized increases ranging from 1.4% to 2.1% for the four cereal crops shown in Figure 14, and annualized cereal yield increases ranging from 1.5% to 2.1% for the five regions shown in the figure. That said, large yield differentials across regions remain: corn yields per hectare are just 2,000 kg for Africa; range from 4,000 kg to 6,000 kg for South America, Asia, and Europe; and are 10,000 kg for North America (Figure 15).

It is an open question whether future technological breakthroughs will continue to boost yields per hectare in the decades to come. In any case, the newest technologies are unlikely to be adopted quickly in the developing world, where agricultural capital remains limited, and the infrastructure required to transport inputs onto the field and crops to market is spotty at best.

The amount of land cultivated globally has been relatively flat over the past 50 years. High grain prices in the past five years have encouraged the transformation of pastureland to cropland in South America and other regions; however, this process may be constrained over time by water limitations and climate change.

A significant unknown over the very long term is the impact of climate change on the effort to boost crop yields. Warmer average temperatures may lengthen the growing seasons for some regions; increased carbon dioxide in the atmosphere may encourage plant growth; and decreased soil moisture could reduce yields. Even researchers that agree on how the climate will change do not necessarily agree on whether global warming would decrease or increase crop yields.

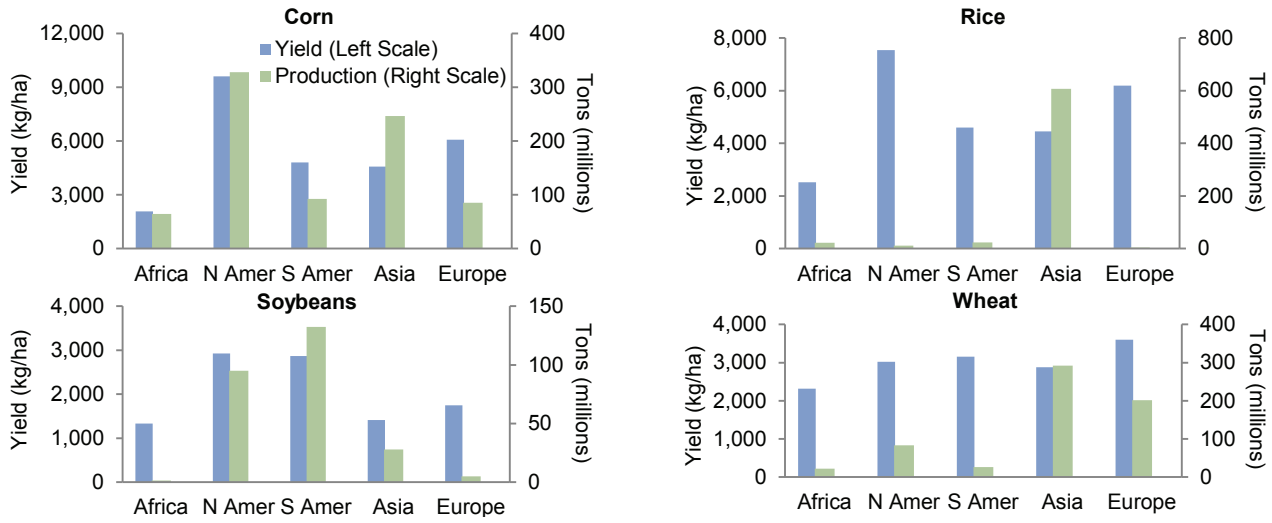
Has the low-hanging fruit of production growth already been picked? We are not certain, although we believe that if grain prices remain high, sustained investment will spur further research & development efforts, again spurring continued increases in global grain yields. To the extent yield enhancements come from technological enhancements, real land prices in some regions where these enhancements are employed may continue to appreciate faster than inflation. However, given the recent price gains, we would be cautious about assuming substantial real price gains for farmland globally in the foreseeable future (particularly for core U.S. Midwest farmland, which already strikes us as being priced for perfection). Further, application of yield-enhancing technologies could boost prices of marginal land if the technology significantly improves the economics of farming those marginal properties.

Figure 14. Historical Crop Yields by Region

1961–2010

Source: Food and Agriculture Organization of the United Nations.
Notes: Crop yield represents the harvested production per hectare of harvested area for crop products. One hectare is equivalent to 2.47 acres.

Figure 15. Crop Yields and Production by Region
2010



Source: Food and Agriculture Organization of the United Nations.
Notes: Crop yield represents the harvested production per unit of harvested area for crop products. One hectare is equivalent to 2.47 acres.

Parsing the Agricultural Investment Landscape

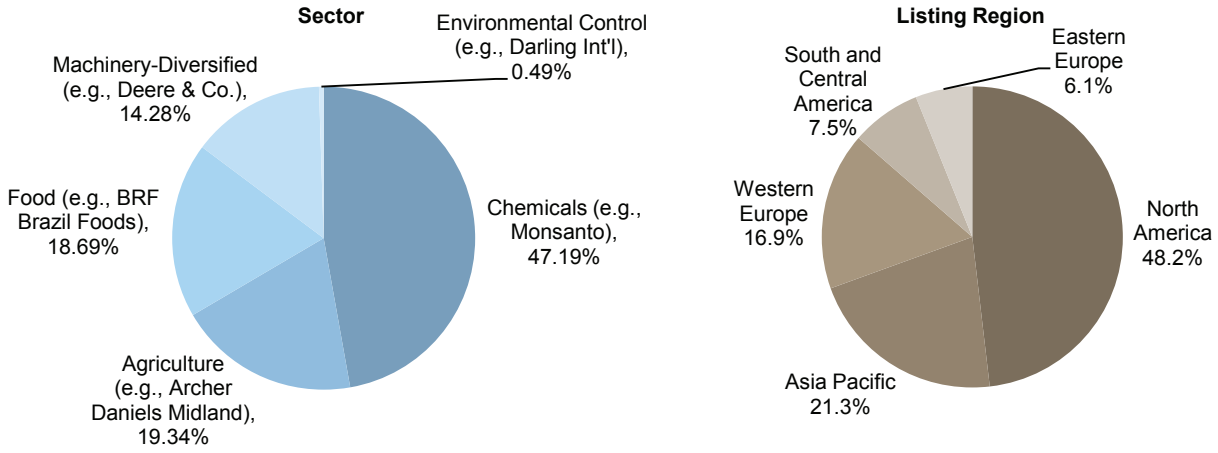
Institutional investment in agriculture can take several forms. Investors can own publicly listed agricultural entities such as fertilizer suppliers, commodity futures, public or private agricultural infrastructure plays, and, most commonly, investments in crop production. In this section, we describe some of these approaches, focusing on land-based row crop strategies in the Americas, Africa, and Russia.

Investments in Listed Agriculture-Related Companies

Investors seeking to invest in agriculture may be more tempted to begin with a liquid strategy. This limits the field to either commodity futures (discussed below) or listed agricultural equities. For the latter, a limited number of active managers troll this pond, and at least one indexed product is available as well. Investors should bear in mind that broad-based equity indices already incorporate agricultural equities, so for most investors considering agricultural equities, the decision is not whether to invest in them, but rather whether to invest in *more* of them.

The decision of what types of companies managers will own is important. For example, a tractor manufacturer may benefit from rising grain prices, while a poultry producer may suffer. Very few listed agriculture-related companies own and operate farms. Figure 16 provides the regional and sector breakdowns of the Market Vectors Agribusiness exchange-traded fund (ETF) (generally known in the industry by its ticker symbol, MOO). The ETF allocates 47% to agricultural chemical companies. The ETF has performed relatively well during its somewhat short history, with

Figure 16. Market Vectors Agribusiness ETF (MOO) Breakdown
As of December 31, 2012



Source: Bloomberg L.P. and Van Eck Global.
Notes: The Agribusiness exchange-traded fund seeks to replicate as closely as possible, before fees and expenses, the price and yield performance of the DAXglobal® Agribusiness Index. The index provides exposure to approximately 50 companies worldwide that derive at least 50% of their revenues from the business of agriculture. Companies listed as examples represent the largest constituents in each sector. Figures may not total due to rounding.

its underlying index returning an annualized 7.2% since inception in September 2007 in US$ terms compared to the MSCI World Index, which returned 0.2%. (However, volatility for the agribusiness index is about 50% higher than for the MSCI World.)

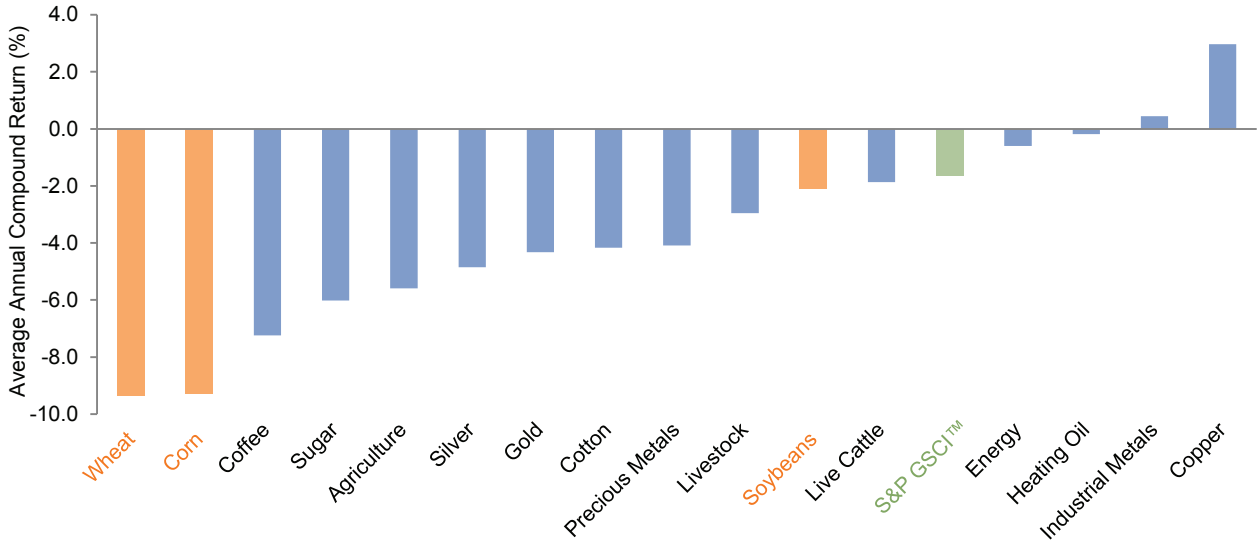
Given the agribusiness index's 81% correlation to the MSCI World and its high volatility, investors should not expect to see their portfolio-level volatility decline because of adding agricultural equities. The performance history is insufficient to determine whether long-term expected returns would be higher for agriculture-related equities than broad equities, in equilibrium (setting aside entry and exit valuations). For investors seeking a liquid agriculture play, agriculture-related equities appear to be a decent fit; whether these investments stand to boost portfolio returns is yet to be seen.

Commodity Futures

Investors can establish long positions in a variety of agricultural commodities via futures contracts. These include grains and oilseeds; so-called softs including coffee and sugar; and livestock. The universe of high-quality managers offering agricultural futures specialist funds is small. That said, commodity futures managers with broad mandates may be willing to establish agriculture-focused separately managed accounts. ETFs and exchange-traded notes (ETNs) are also available, although we would be somewhat cautious because of punitive roll yields across some agricultural commodities and high fees for many products (plus counterparty risks for ETNs).

Roll yields for agricultural commodities have averaged -6% per year since 1983, compared to about -2% for the S&P GSCI™ Index as a whole (Figure 17). Historical returns for agricultural

Figure 17. Roll Returns
January 31, 1983 – January 31, 2013 • U.S. Dollar



Sources: Standard & Poor's and Thomson Reuters Datastream.
Note: Grains are shown in orange.

futures investments have been generally unimpressive, both in absolute terms and relative to broad commodity futures indices (Figure 18). Spot grain prices have essentially matched inflation over the past four decades, and total returns for agricultural futures have been only modestly better than that, despite strong historical collateral returns averaging about 5.6% (in large part because the negative roll yield has partially offset the collateral yield). Today, the collateral yield is not meaningful. Additionally, while agricultural futures have exhibited varied but generally low correlations with equities over the past four decades, monthly return correlations over the past ten years are meaningfully higher (about 46%, versus -2% for the prior three decades).

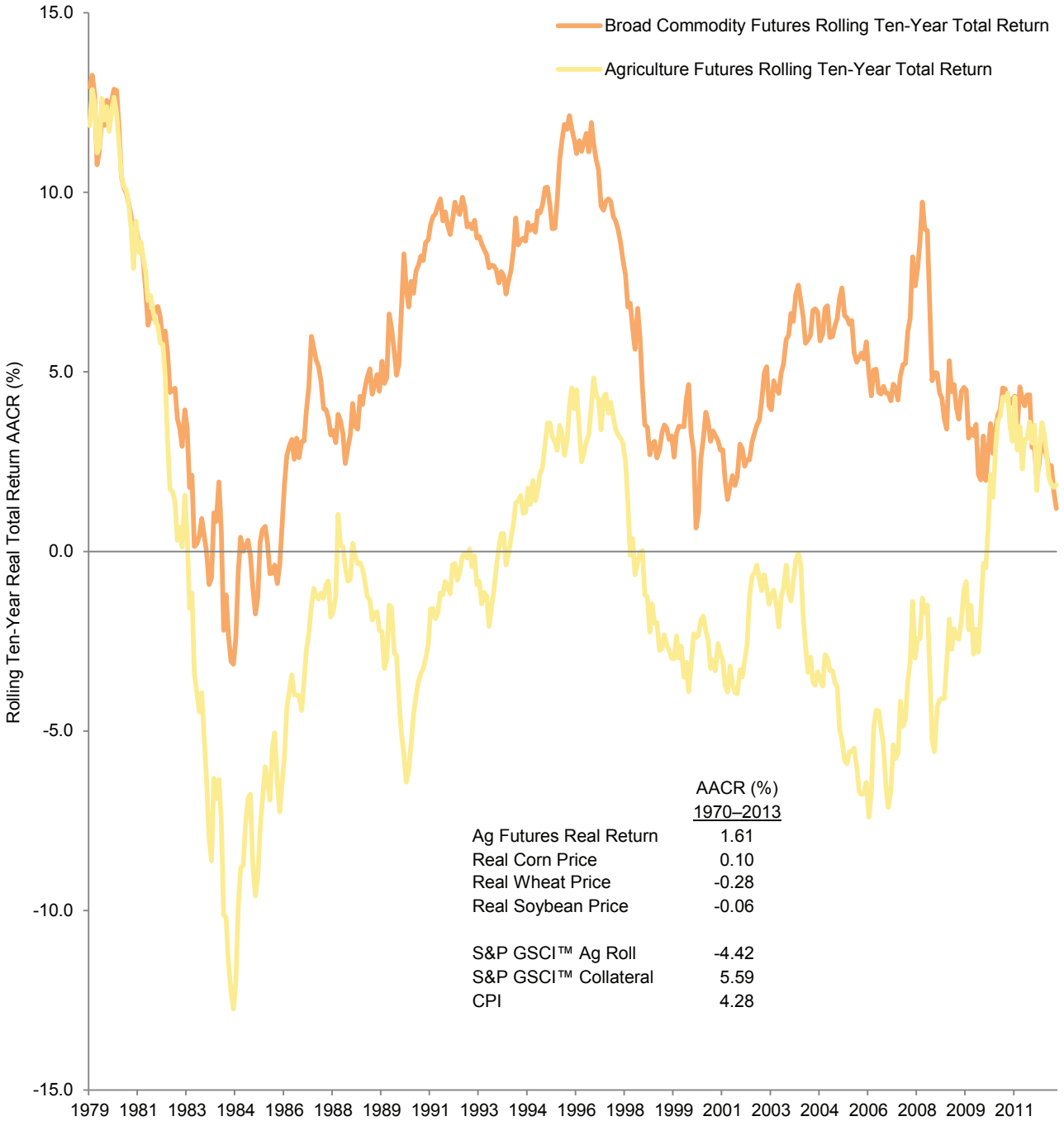
Investors seeking exposure to grain prices tactically could do so quickly and in a relatively pure fashion via agricultural futures, but the appeal for long-term investors is not particularly clear.

Private Investments in Permanent Crop Production

A very small universe of institutional investors (mainly insurance companies) has participated in permanent crop production for decades. These investors may buy raw land and install vines or fruit/nut trees, or they may purchase land from a farmer's estate or a once-enthusiastic housing developer now scaling back. As mentioned previously, permanent crops are characterized by a high level of investment in plants themselves. Permanent crop investors are more likely to produce crops from their orchards or vines directly than to rent their land out, partly because tenants may be harder on the plants than owners.

Permanent crop investment is made at some risk, because demand for that crop variety can shift unpredictably (due to cultural shifts, changing nutrition awareness, or fads), or the trees or vines can be damaged by bad weather, fire, or blight. Also, any diminution in the availability of cheap

Figure 18. Rolling Ten-Year Real Total Return of Agriculture Futures Versus Broad Commodity Futures
December 31, 1979 – January 31, 2013



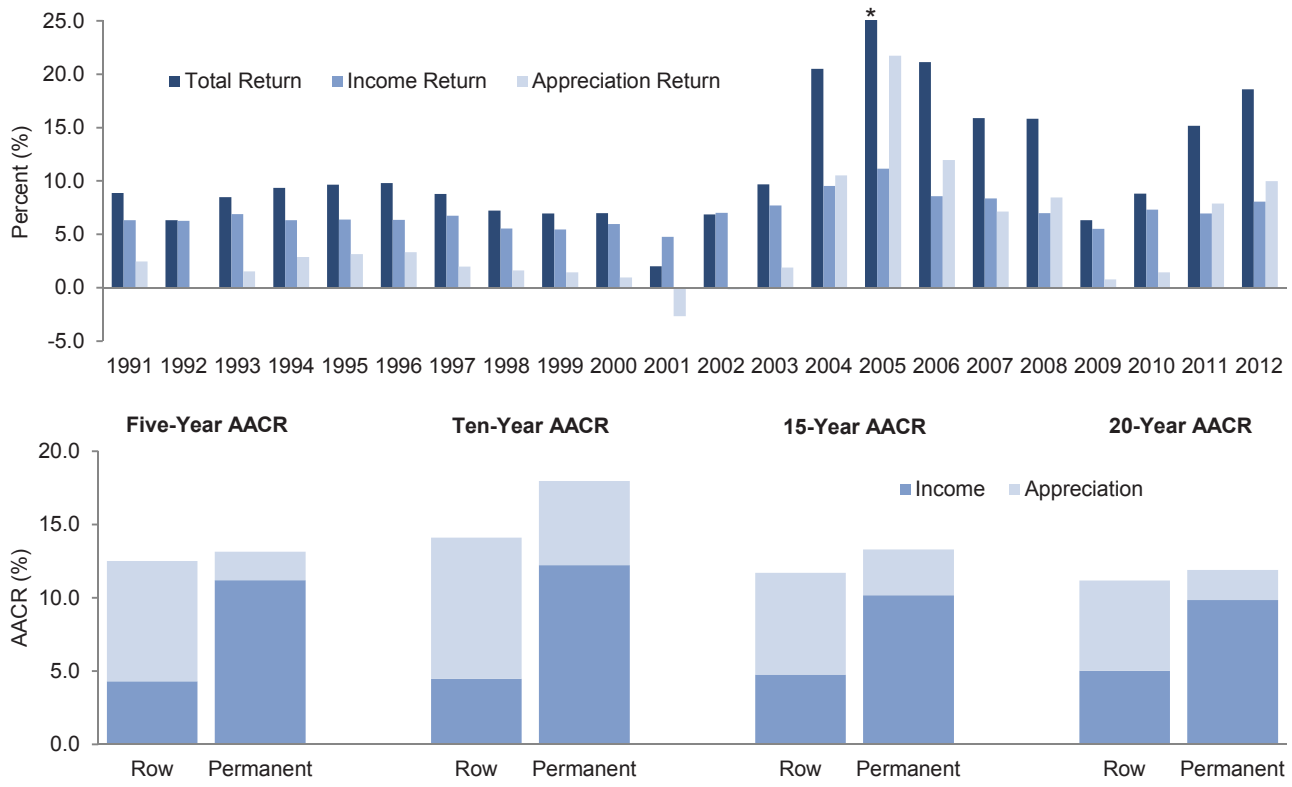
Sources: Dow Jones Indexes, Standard & Poor's, and Thomson Reuters Datastream.
Notes: Broad commodity data represent the S&P GSCI™ Index series from December 1978 to January 1991, and the Dow Jones-UBS Commodity Index series thereafter. CPI-U data are as of December 31, 2012.

water for irrigation can kill the economics of an orchard (or indeed the orchard's trees).

Partly because of the elevated risks, and partly because land used for orchards and vineyards has not historically appreciated as strongly as row crop farmland (where sustainable corn or soybean yield improvements tend to get baked in to the land price), permanent crop producers tend to demand high levels of operating cash flow, so that expected *total* returns in equilibrium should be somewhat higher than those for row crop farming. If expected yields for row crops in a given region are equal to perhaps 4% to 7% of the land value per year, then expected yields for permanent crops are likely to be several percentage points higher. Income-based returns for U.S. permanent crops, for example, have been an annualized 12.2% over the past ten years, versus annualized 4.5% income returns for U.S. row crops (Figure 19).[9]

[9] These return figures are from the NCREIF Farmland Index. The index history goes back to 1991, but until recent years, it included farmland properties from only a small handful of institutional investors. That said, we believe it is representative enough to illustrate the disparate income returns for permanent versus row crop investors.

Figure 19. U.S. Farmland: Annual Income and Appreciation Return
1991–2012



Source: National Council of Real Estate Investment Fiduciaries.
Note: Data are quarterly and represent the NCREIF Farmland Index, which represents a very limited investor universe for most of its history.
* Scale capped at 25.0% for graphing purposes. Actual total return in 2005 was 33.9%.

Investors considering permanent crop production should endeavor to spread their exposure to a variety of fruits and/or nuts, and to a variety of regions with different weather and pest exposure. Additionally, permanent crop investors can dial the potential risk and return up or down depending on whether the investment is in currently producing assets or in orchards or vines that need to be planted. While income can be high from permanent crop strategies, the investor is generally operating rather than renting the property, and is thus dependent on producing sufficient crops and selling them for a reasonable price each year. Regional and crop diversification can help mitigate (but not eliminate) the risks from disease, weather, health scares, tariffs, and changing tastes.

Private Investments in Livestock Production

Analogous to permanent crops, livestock tends to have a relatively high risk profile. Livestock investors are often subject to a variety of risks, including diseases that could decimate a herd or decimate demand for the product (think mad cow disease). The cost of feed is a real variable for many livestock producers as well because the price of meat and dairy products does not always track the price of feed grains. Strategies that focus on pasture-raised stock can mitigate that risk, but they remain exposed to drought, hail, or other adverse weather that can ruin their herd's primary source of feed. Livestock strategies can incorporate meat, dairy, or a combination of the two. We know of few institutional investment funds that offer (or plan to offer) livestock exposure.

Private Investments in Row Crop Production

While institutions contemplating agriculture may begin with liquid vehicles, many are attracted to land-based row crop strategies (recall that row crops are annual crops that are replanted every year, including corn and soybeans, so they offer some flexibility and risk reduction compared with permanent crops). These strategies have clear ties to the long-run global demand case we examined earlier. Row crop operators can often begin generating income more quickly than permanent crop operators (who sometimes must wait several seasons for newly established plants to begin producing).

Row crop land purchased by investors is often rented out to experienced farmers; however, farmland investment managers need to be skilled in assessing tenants and in evaluating the value and desirability of land prior to purchase. Cash rents limit investors' risks to weather, crop disease or pests, and, to some degree, changing consumption patterns, while flex rents (which include some participation in crop price changes) can increase the risk and the return.

Investment funds that purchase assets in emerging markets may be more likely to produce crops directly, taking on some of those risks in the quest for higher returns rather than renting out fields to tenant farmers. In some regions, investors seek to boost yields by employing crop-type specialist operators, applying updated technology, and investing capital in irrigation or other improvements. In some cases, investors target economies of scale, purchasing multiple farms and sharing resources. This consolidation has long been underway in the U.S. Corn Belt—over the past 40 years, the average farm size in Illinois has increased 54%.

Row crops are grown in a wide variety of regions. Institutional investors examining products in the marketplace today are likely to see exposure to the following: the U.S. Midwest and Canada's pricey but fertile Grain Belt; Australia; pockets of Africa that appear (for the moment, at least) to look kindly on foreign

investors; soybean powerhouse South America (particularly Brazil and Uruguay); and the low-priced wheat country of the former Soviet Bloc, including Russia and the Ukraine.

In the remainder of this section, we provide more detailed assessments of U.S., South American, and Russian opportunities. We would stress, however, that the risk and return opportunities even within a small region are likely to vary widely. Investors may be attracted to the "beta" of a region, but the manager's alpha can add or subtract from the underlying opportunity quite significantly, depending on factors such as the manager's skill at buying land at favorable prices, finding an optimal tenant or farming the land productively, and packaging land parcels for high-value sale.

Row crops can be grown on most continents, and with high-quality U.S. Midwest farmland looking rather expensive, institutional investors in the United States are increasingly looking closely at strategies in South America, Africa, the former Soviet Union, and other areas where land remains relatively cheap and prospective returns higher. However, the potential return premium of emerging regions does not stem solely from lack of institutional familiarity: political and operational risks abound in these regions,[10] and infrastructure to import farm implements and inputs (such as seed, fertilizer, diesel fuel for tractors, and herbicide) and to transport crops to market can be substandard. The realization of attractive returns by emerging markets farmland funds may also depend on substantial crop price appreciation, converting pasture land to farmland, aggregating small farms into larger ones, encouraging politicians to develop road or rail infrastructure, or other risky strategies. That said, most investors would view the prospective returns from low-risk U.S. core row crop strategies as inadequate to justify the long lock-ups required.[11] Tables 2 and 3 summarize the opportunities, risks, and key economics for farmland investment in the U.S. Midwest, Brazil, and Russia.

[10] These include the risk of expropriation, as well as grain export controls or domestic price controls, taxes or restrictions on foreign investors that wish to sell assets and move capital out of the country, and other concerns.
[11] In contrast with private real estate strategies, higher levels of leverage are not a common element in higher risk/return farmland strategies.

Table 2. Farmland Prices and Estimated Gross Return Potential

	U.S. Midwest	Brazil	Russia
Cost of 1 Hectare	$16,000	$4,200	$1,100
Land Yielding 1 Metric Ton	$4,300	$1,300	$300
Cost of Land Yielding $1,000 of Grain	$8,600	$2,600	$1,000
Estimated Gross Return Potential*	8% to 10%	12% to 15%	15% to 20%

Sources: Cambridge Associates LLC, CME Group, HighQuest Partners (farmland costs and yields for Brazil and the United States), Thomson Reuters Datastream, and VTB Capital (costs and yields for Russia).
Notes: Costs rounded to nearest $100. Land price per $1,000 yield calculations use U.S. spot price benchmarks rather than farm gate prices. Farmland prices are thought to be representative, but prices vary widely depending on location, topography, soil, and other factors.
* Represents Cambridge Associates' thumbnail estimate of the potential gross internal rate of return for a well-managed fund, in a benign environment of moderate land and crop appreciation and no significant flare-up of interest rates or political risk.

Table 3. Overview of Selected Regional Row Crop Farming Investment Opportunities

	Opportunities	Concerns and Considerations
U.S. Midwest *(Central Illinois Soybean Farming)*	◆ Infrastructure offers relatively easy access to inputs and to crop markets ◆ Productive soil ◆ Strong legal system; land ownership rights clear ◆ Established investment market ◆ Diversity of crop types, soil, and weather ◆ Government subsidies and crop insurance ◆ Access to financing	◆ Prices of prime Midwest farmland appear very rich today ◆ Potential impact when interest rates eventually rise ◆ Subsidies, capitalized into land values, are vulnerable to cuts ◆ High labor costs relative to emerging world ◆ Given high productivity, less potential gain from yield improvements
Brazil *(Mato Grosso Soybean Farming)*	◆ Favorable climate and ample rainfall ◆ High-quality soil and flat topography ◆ Average soybean yield in Brazil exceeds United States ◆ Rising domestic demand for sugarcane from ethanol ◆ Even after tripling from 2001 to 2010, Brazilian farmland cheaper than United States ◆ Labor costs are relatively low ◆ Access to modern agricultural technology and genetics developments	◆ Foreign ownership restrictions for land ◆ Infrastructure and logistics are subpar ◆ Complicated regulatory bureaucracy ◆ Financing may be limited or expensive ◆ Elevated political/expropriation risk in South America; thus far these risks in Brazil appear limited ◆ "High-context" culture: personal and family relationships are important in business dealings ◆ Better to invest in farmland, or in agri-cultural infrastructure (crushing, storage, etc.)?
Russia *(South Stavropol Wheat Farming)*	◆ Excellent soil quality ◆ Inexpensive farmland ◆ Favorable production costs ◆ Proximity to export markets ◆ Government subsidies	◆ Government currently supportive of foreign investment in agriculture, but history of expropriation ◆ Organized crime and corruption increase risk profile and cost of security ◆ Infrastructure and logistics are subpar ◆ Competitive environment: large producers account for 30% of output ◆ Execution has proven to be challenging for some investment funds ◆ Crossover investment in Ukraine is common: land ownership restrictions burdensome

Sources: Bunge Limited, Cambridge Associates LLC, HighQuest Partners (farmland costs and yields for Brazil and the United States), VIAPI Nikonova (Russian State Agricultural Research Institute), and VTB Capital (costs and yields for Russia).

The U.S. Midwest: comfortable, but richly valued starting point. Only a handful of institutional investors in the United States purchased domestic farmland before the recent boom (one long-time manager estimates that less than 2% of U.S. farmland is owned by institutions[12]), and the high prices of U.S. farmland deter most return-seeking investors today. That said, farmland in the U.S. Midwest is some of the most productive land in the world, benefitting from a good climate and quality soil, together with a strong infrastructure and access to capital, allowing farmers to employ advanced technology.

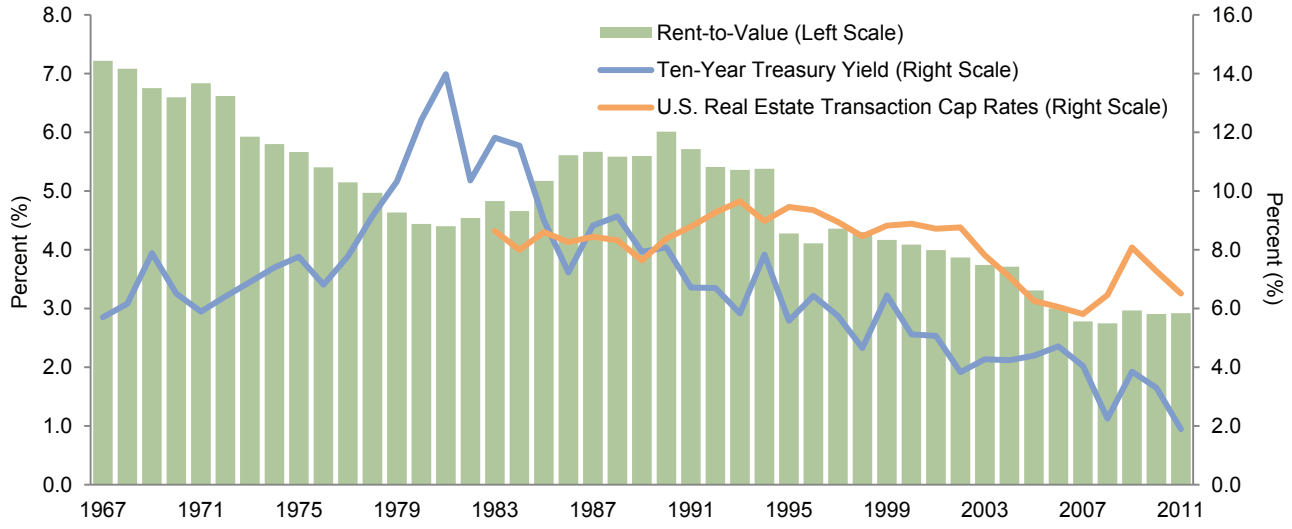
While prospective returns from U.S. Midwest row crop strategies are unappealing when the illiquidity of farmland is taken into account, some institutions may be more comfortable making an "educational" toehold investment where there is good rule of law, an established infrastructure, and access to capital permitting the use of advanced technology. Most strategies purchase land[13] and then quickly rent it out to farmers, who generally pay a cash rent.[14] Rents as a percentage of farmland value (cap rates, essentially) have moved down fairly steadily over the past 40 years, from about 7% in the early 1970s, to 6% in the early 1990s, to about 3% today (Figure 20). Those are averages, and

[12] However, according to the USDA Economic Research Service, non-operating landowners own the majority of farmland in three key farming regions: the U.S. Corn Belt, the Northern Plains, and the Southern Plains. These tend to be individuals or families, rather than institutions. Institutional investment funds targeting farmland are a recent phenomenon.

[13] Typically, ongoing use of leverage is not an important component of U.S. farmland strategies, though temporary borrowing is not uncommon.

[14] Some leases are structured with a lower cash payment and a percentage of the value of the year's harvest. Full crop share leases with no fixed cash payment are not commonly used by institutional farmland managers.

Figure 20. U.S. Cropland Rent-to-Value
1967–2011



Sources: National Council of Real Estate Investment Fiduciaries, Thomson Reuters Datastream, U.S. Department of Agriculture - Economic Research Service, and U.S. Department of Agriculture - National Agricultural Statistics Service.
Note: Transaction capitalization rates represent four-quarter moving averages and begin December 31, 1983.

conditions vary widely from one region and property to the next (Figure 21). Farmland that has the potential to be turned into a housing development, or that offers hunting or other recreational uses, will likely sell at a premium (implying a low cap rate), as will land that abuts growing family farm complexes.[15]

Given today's elevated prices, what kind of returns seem reasonable to assume for high-quality U.S. Midwest farmland? While top-quality, well-located land has been selling at auction for cap rates of 4% or below, some institutional managers claim to still be able to purchase good-quality U.S. Midwest land at cap rates up to 6% by buying directly from selling farmers rather than participating in auctions. If land prices grow at 4% per year over the long term (their average rate of growth since 1991, although it appears to us that some of the very strong *recent* price appreciation may in fact have stolen some *future* price appreciation[16]), that equates to a gross return of just 10% assuming no leverage, before substantial management fees and transaction costs. Even in today's ultra-low interest rate environment, investors are unlikely to salivate at net returns of perhaps 7% from illiquid assets (in an average year, just 50 farmland acres out of every 10,000 in the United States change hands, according to the U.S. Department of Agriculture).

While many U.S.-focused managers buy land in the established Corn Belt of Illinois, Indiana, and Iowa, others venture farther afield, buying cheaper land that may benefit from adding irrigation or other improvements that could boost productivity, crop reliability, and eventual land sales prices. While Illinois farmland is about $16,000 per hectare on average[17] (and some parcels are well above $25,000), average U.S. farmland is less than $6,000 per hectare and is considerably less productive than Illinois land.

Crop insurance and subsidies have been part of the U.S. farm economy for decades, and at least some of their benefits are likely incorporated into land values. Because farming has a wide geographic spread in the United States, those subsidies still enjoy some political support, though rising fiscal deficits make them increasingly less tenable. Substantial cuts in these programs could put some pressure on land values and increase the volatility of annual income for tenants (which could feed through to rents over time). Other political risks related to expropriation or untenable government intrusion, significant in the developing world, are quite low in the United States. Significant debt defaults hammered farmland values in the 1980s, but the risk of a near-term repeat of this seems low; farm debt levels remain low today (Figure 22).

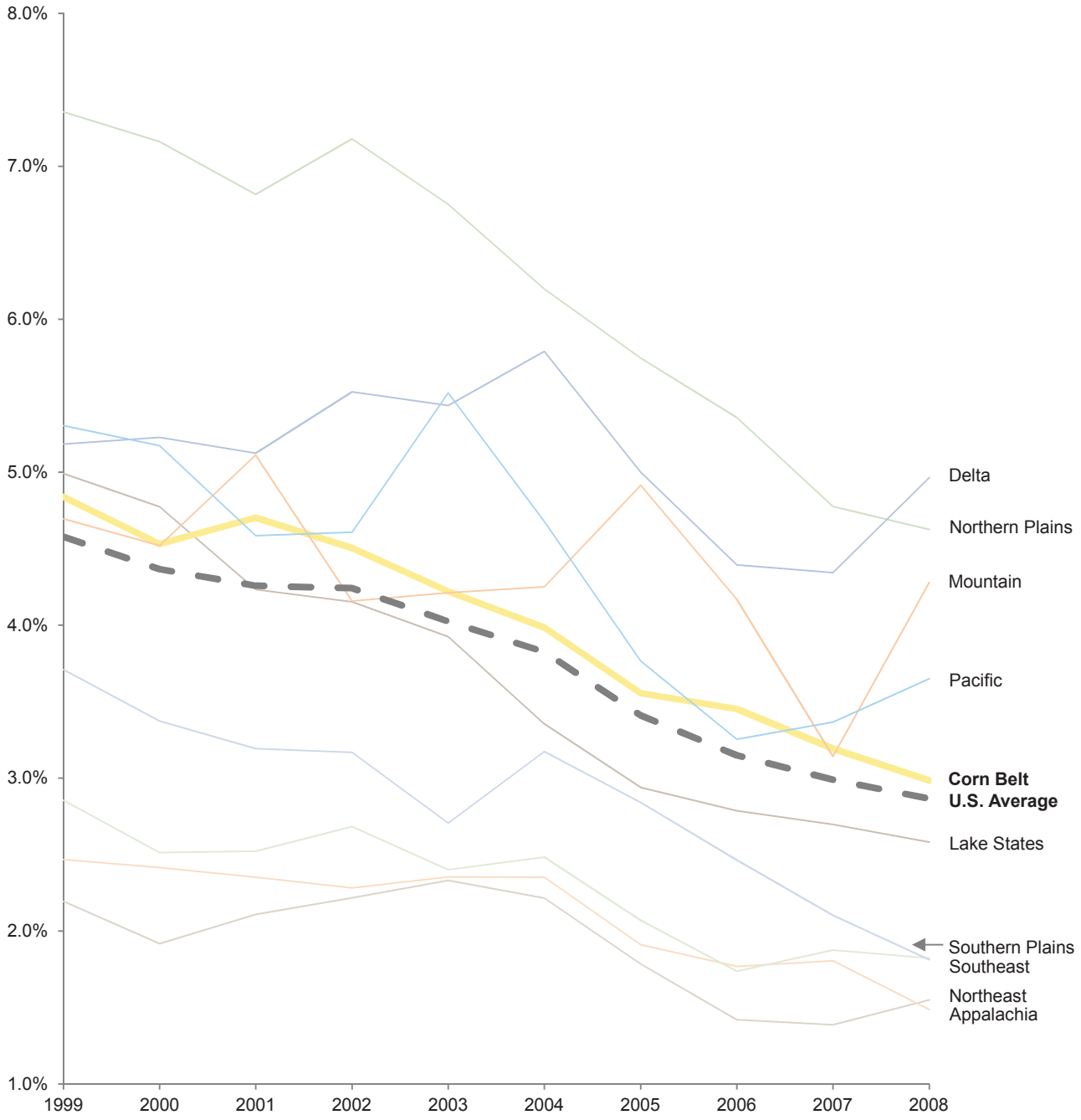
Today's ultra-low interest rates have pushed investors into a variety of steady-income assets including U.S. Midwest farmland, and if interest rates were to rise sharply, land prices and liquidity would likely drop. Many farm buyers employ some leverage, and an increase in the cost of leverage would limit the price that these buyers could pay. Additionally, investors that are content with the cap rate on farmland today (which is low compared to the asset class's history, but high compared to yield alternative investments today) may demand higher yields if bonds or cash began to offer a more compelling yield alternative.

[15] Because operators looking to grow may be willing to pay a premium for land that is adjacent to other holdings.

[16] The appreciation return from 1991 to 2003 was just 1.4% per year, while the appreciation return from 2004 to 2012 was 8.7%.

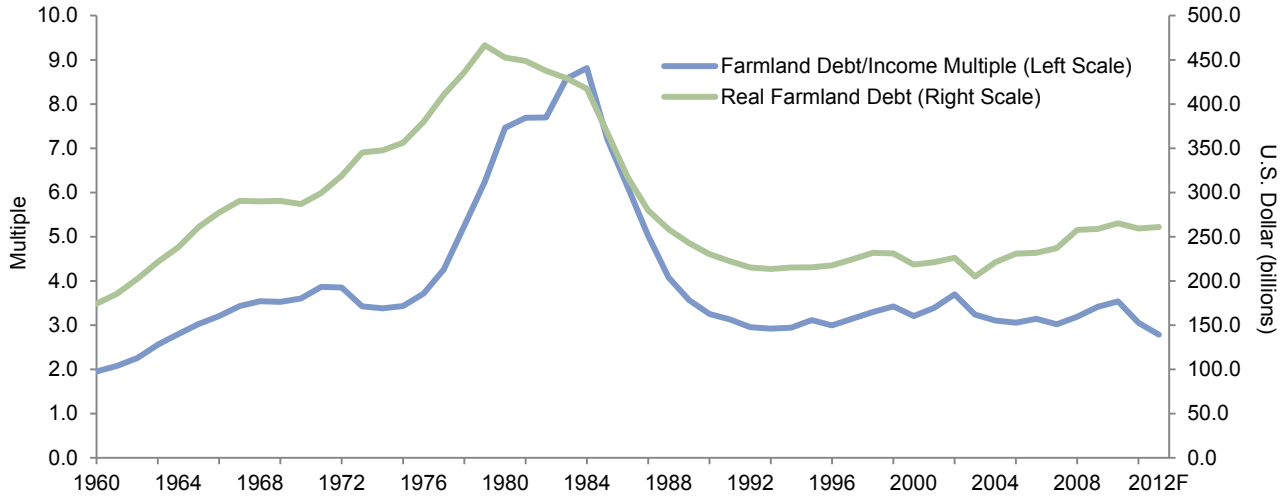
[17] A hectare is roughly 2.47 acres.

Figure 21. U.S. Cropland Rent-to-Value by Region
1999–2008



Sources: U.S. Department of Agriculture - Economic Research Service and U.S. Department of Agriculture - National Agricultural Statistics Service.
Note: The rent-to-value ratio represents the ratio of per acre cash rent for cropland to per acre value of cropland in the June area survey, including both irrigated and non-irrigated cropland.

Figure 22. Total U.S. Farm Sector Debt
1960–2012



Source: U.S. Department of Agriculture - Economic Research Service.
Notes: Data for 2012 are forecasts. The farmland debt/income multiple represents nominal farmland debt divided by the rolling five-year average of net farmland income. Real farmland debt is deflated by the CPI-U, based on the December 31, 2012, level.

After rising four-fold during the 1970s as inflation soared and farmers took on increasingly unsustainable debt levels, sharply rising interest rates crushed Illinois farmland prices, which dropped 37% on average from 1981 to 1985.[18] Because of farmland's interest rate risk, we do not believe that farmland will be a strong inflation hedge (we sing the same tune when it comes to the inflation sensitivity of real estate investments). True, the land and its crops are real assets, but this must be weighed against interest rate risk. Managers often emphasize the correlation of inflation with farmland returns over the past two decades or more, but investors should recall that interest rates declined during that full period. Rising inflation, coupled with rising interest rates, would likely be a sharp negative for farmland returns, unless sharply rising grain prices and thus farm income offset the impact of rising cap rates.

We believe U.S. farmland has significant benefits for investors considering private agricultural opportunities for the first time; however, returns are likely to be low relative to the strategy's illiquidity.

Brazil: excellent farming conditions, but check the entrance and exit. Like the U.S. Midwest, Brazil's expanses of fertile, flat land with plentiful water hold considerable appeal. Unlike prime U.S. farming regions, land costs in Brazil remain reasonable. For this reason, Brazil is a popular destination for farmland investment funds.

Brazil's sugarcane crop is the world's largest, supported in part by the country's domestic demand for low-cost ethanol fuel made from sugarcane (sugarcane is a more efficient source

[18] Price changes described in this example are not inflation adjusted. Please note that farm debt ratios and debt-service burdens were much greater in the early 1980s than today.

of ethanol than the corn used in the United States). Brazil is the world's second-largest producer of soybeans. Advanced farm technology is already in use across Brazil's farming regions, and the country's soybean yields are even higher than those in the United States. Brazil produces one-third of the world's soybeans, satisfying robust domestic demand (Brazil is the second-largest beef producer in the world) and exporting the rest to China and Europe.

Land prices remain relatively attractive as the country's agricultural infrastructure lags behind its crop-growing prowess. However, this is also an investment opportunity. Some investment funds are weighing opportunities in Brazil across the value chain, such as crushing and storage facilities.

Farmland funds targeting the country generally seek gross returns in the neighborhood of 12% to 15%, with little or no structural borrowing.[19] Many of the managers currently targeting Brazil are forming their first institutional fund to do so (they typically have some operating experiences, of course, but that experience may have come primarily from farmland investment in another region, or from a corporate parent involved in grain trading or processing in Brazil). For that reason, it is difficult to assess whether those 12% to 15% gross returns are achievable. They would require some shrinkage of the land price gap with the United States, which appears reasonable but is far from certain (a substantial gap will surely persist, in part mirroring Brazil's infrastructure gap).

The mixed welcome for foreign land buyers is one factor that could hold back land price appreciation. The government certainly benefits from the rush of agricultural capital into the country, but it has established a number of roadblocks to foreign land ownership. Even for managers able to negotiate those roadblocks to acquire land, investors need to recognize that the government's attitude toward foreign ownership in five or ten years when the manager attempts to exit its investments is unknown and could hamper the manager's ability to access the global market, given that selling to another non-Brazilian institutional buyer appears to be the most likely exit. One collection of South American agricultural assets (Adecoagro, backed by hedge fund legend George Soros) floated shares to the public in February 2011, but it has few peers.

Russia and Ukraine: cheap, rich soil, but if government's enthusiasm for foreign investors wanes, watch out. A handful of managers are looking to generate attractive returns from Russia's fertile and very inexpensive farmland. Russian land is much cheaper than U.S. or even Brazilian land, both on a straight dollars-per-hectare basis and adjusted for yield differences.

The land's productivity is well below its potential, offering some scope for increased yields and therefore land values. Although Russia's infrastructure is lacking (e.g., the country has insufficient railcars), access to export markets is generally solid (Egypt, Europe, and Pakistan are key import markets for Russian wheat). Some managers plan roll-up strategies to consolidate small farmland tracts into efficient, large-scale operations, but acquiring large numbers of neighboring parcels can be difficult and politically sensitive. Operating in Russia can be quite challenging and indeed dangerous, due to the influence of organized crime; security is a significant cost for an institutional farmland operation.

[19] Some funds that do not intend to use leverage as a source of returns may still use credit lines temporarily, such as for seasonal cash flow needs.

Some Russia-focused managers are likely to incorporate Ukrainian investments as well. Ukraine's "black earth" soil is justifiably famous, but its productivity withered during the Soviet decades. Ukraine's *farming* potential is excellent, but its investment potential is much less certain, in part because it is currently impossible for foreigners to buy Ukrainian land outright. Inexpensive long-term leases can be attractive, but returns in the country may be limited without the potential for land price gains.

In addition, some managers have struggled to operate profitably in the region. In late September, news reports outlined a Ukrainian government agriculture plan that would offer investors tax and tariff incentives and free land use for 50 years on up to 4 million hectares of large-scale parcels. Participating investors would need $200 million initial investments to qualify, with large future injections as well. Investors will contract with the national government, rather than with local politicians—a big plus. While the program appears encouraging, final implementation has many wildcards.

The Russian government is by far the biggest variable in the success or failure of a Russia-focused farmland investment strategy. The government's desire to boost the anemic but high-potential agricultural sector is apparent, as is a recognition that foreign capital is essential to that effort. The agricultural ministry has made high-profile stops at global investment conferences to pitch the country's opportunities, and new tax credits and subsidies sweeten the already attractive opportunities for investors. Yet anyone familiar with Russia's past treatment of foreign investors and joint venture partners must seriously question whether the current embrace will continue once the government has accomplished its goals, and whether flourishing investments will be allowed to remain in foreign hands.

Investment managers in the country are generally seeking 15% to 20% gross internal rates of return (IRRs). If productivity and land prices make even moderate gains, these returns may well be achievable, without leverage. Of course, fertile Russian farmland is cheap today because of the very real risks.

Africa: high potential for investors that can retain control. The opportunities and risks for farmland investors in Africa are much like those in Russia. Africa has a plethora of farming potential, with cheap farmland and some regions well suited to growing crops. It also has significant operational hassles and a checkered history of political risk. Expected returns are high, and they had better be.

Africa's wide range of climactic zones and elevations allows farmers to grow a variety of crops. Malawi, Tanzania, and Zambia are key target regions for African managers. High yields are possible for well-run irrigated parcels. Labor costs are low, and irrigation can often be added at a moderate cost, significantly improving the harvest's reliability and the potential for double cropping (growing two crops per year).

Africa's infrastructure deficiencies present substantial challenges to farmers. For inland farms, moving inputs such as seed and fertilizer in from the coast, and moving crops to market, is challenging and expensive. Entrenched social problems and periodic unrest impact labor productivity.

Of course, the risk of expropriation looms large in Africa. The presence of successful former Zimbabwean farmers on the management teams of some investment funds is a stark

reminder that land ownership can be fleeting in Africa. Funds may carry insurance against land expropriation, but political risks still loom large.[20] Investors should evaluate the manager's strategy for developing friendly ties with the local communities in which they operate, as well as the manager's ability to keep out of government crosshairs without succumbing to corruption.

Like Russia, managers raising Africa-focused funds generally seek to generate gross IRRs of 15% to 20%. Also like Russia, few managers have raised and deployed capital for prior African funds, let alone generated a successful track record of investments. Investors seeking high returns from African investors must keep their eyes wide open to the considerable risks.

Conclusion

Agriculture is an appealing and varied new frontier for institutional investors. From Monsanto shares, to wheat futures traded on commodity exchanges, to fertile soybean fields in Central Brazil, an enormous variety of agriculture-themed investments exists. The number of institutional-quality agricultural managers is somewhat limited compared to other asset classes. Funds targeting a variety of strategies are available, but many of them have short track records with few "exits," limited farming experience, or other factors that may limit their appeal to institutional investors.

For investors that seek agricultural exposure and are limited to liquid strategies, agriculture-related equities appear more promising than agricultural commodity futures, which currently have punitive roll yields and miniscule collateral returns. However, agricultural equities for the most part represent makers of farming inputs and implements, rather than farm operators, and investors should also expect a volatile ride.

For investors that can tolerate illiquidity and desire land-based farming strategies, we believe row crop strategies in emerging markets offer the prospect of strong returns, albeit with substantial political risks. U.S. row crop strategies may suffer from high land valuations, although political risk is lower. In the United States, of course, the political risk is tied to the continuation of government subsidies, rather than to corruption, foreign investor purchase/sale restrictions, or any fears of expropriation.

Investors should recognize that future land price appreciation is likely to be slower than in the recent past, and could easily go negative if interest rates rise or grain prices step off the "up" escalator. Given today's relatively low cap rates, falling or stagnant farmland prices would be a difficult hurdle for even very skilled managers to overcome.

U.S. farmland today, on average, offers cash rental yields of around 3%; these low yields may still appear to be a promising investment to many farmers, given that ten-year municipal and Treasury bonds yield just 2% and that row crop farmland has appreciated by nearly 50% over the past five years. Yet if interest rates rise, or if grain prices decline and push down rental income possibilities, today's bullish sentiment could reverse. The asset class is promising, but investors should be aware of elevated land valuations in some areas (particularly in the U.S. Midwest) and a plethora of inexperienced managers and hot money.

[20] Is any insurer offering coverage against confiscatory taxation, obligatory local joint venture partners, or mandatory employment of government cronies?

While continued agricultural investment is a necessary step to satisfy long-term food demand, some managers overstate the investment tailwinds stemming from population growth and long-term food supply constraints. Further, the political risks surrounding some agriculture-related investments are considerable (both in established and underdeveloped regions). However, investors with an eye on the risks and operational realities will find a variety of promising, but untested, strategies and managers. ■