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Theme Overview: China as the Leading U.S. Agricultural Export Market

Holly Wang

JEL Classification: F1, F52, P2, Q13
Keywords: Agricultural Trade, China, Food Security, Food Safety

China is the largest agricultural export destination country for the United States, receiving 18% of total agricultural export value in 2013. The Chinese agricultural importing market is broad, extending from bio and ag-inputs such as seeds, farm chemicals, animal genes, and veterinary supplies, all the way to ready-to-eat (or drink) food in the retail or food sectors, with the majority being crop commodities. The market is also rather complicated—with trade barriers, strong domestic production supported by the Chinese government, fierce competition within the processing industry causing food safety fears, and consumers' concerns regarding biotechnology caused by confusing and incomplete information. Amid these complexities, the articles in this theme will address the Chinese food market with an emphasis on the U.S. trade perspective. Taken together, the articles will provide information, knowledge, and outlook for stakeholders to vision the roles each can play in domestic and the world markets.

China remains the world's fastest growing large economy, even with its annual gross domestic product (GDP) growth rate dropping to 7.5% from the double digit number it had half a decade ago. The 1.36 billion people's growing appetite for food from animal proteins supported by their increasing income provides an ample demand for grains, livestock, and other food stuff. China's newly much relaxed "one-child policy" will soon bring millions of additional people to its population. With the limitation on the quantity and quality of its land, soil, and water resources, such a demand will have to be satisfied by a strong domestic production and supplemented by imports from the world market, a good opportunity for the U.S. agricultural sector.

Articles in this Theme:

Three new issues emerged recently in the Chinese agricultural sector that affect its performance in the global market. First, the Chinese government has increased its support over time to the agricultural production sector. Second, Chinese companies have started to acquire agricultural assets overseas, including farmland, bulk commodity storage and transportation facilities such as railroads or ports, and meat processing firms. Third, Chinese consumers are very concerned about food safety scandals that are repeatedly reported in their meat, poultry, dairy, and other animal protein products. As described in this theme, their combined effect on trade is mixed.

The first paper, by Bryan Lohmar, discusses the perspective of China's corn import. China has dominated the world soybeans import, and most of it is from the United States to feed its livestock industry. More corn, or other

energy grains, are needed to balance its feed and improve the efficiency of its livestock industry. Lohmar explores whether China will be able to produce more energy grains itself, discover new exporting sources from the world, or import more from the United States.

The second paper, by David L. Ortega, H. Holly Wang and Maolong Chen, discusses the market potential for U.S. meat in China. The authors base their analysis on their previous studies of Chinese preferences for pork, beef, dairy, and poultry for food safety and quality attributes, in the presence of biological based trade barriers.

The third paper by Fred Gale considers the trade barriers. The Chinese government strongly influences, if not controls, its food import in quantity, variety, timing, as well as the importers. This articles calls for a closer observation of China's changing importing behavior, instead of basing expectations solely on past trading patterns.

In the final article Elizabeth Gooch and Fred Gale draws our attention to a new phenomenon—China's worldwide investment in agricultural resources in production, processing, and logistic and marketing channels. The authors consider the potential impacts that these investments will have on China's agricultural commodity import pattern.

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Will China Import More Corn?

Bryan Lohmar

JEL Classification: F1, Q1
Keywords: Agricultural Trade, Meat Demand, Agricultural Statistics, China

The growth and modernization of China's livestock industry has rocked global soybean markets in recent years and many expect a similar impact on world corn markets in coming years. Despite the importance, there is a dearth of verifiable information of the underlying supply and demand of meat and feed ingredients in China to make such forecasts. Moreover, China seeks the conflicting goals of maintaining high prices for corn to encourage production and developing a competitive and modern livestock industry, all the while embracing market mechanisms. How China addresses these conflicting objectives will impact the feed and livestock industry in China and around the world.

Information available to construct a rough supply and demand framework for meat and feed ingredients in China indicate that there is still room for animal product consumption to grow in China. However, whether the additional demand will be met by increasing domestic production or by importing meat and other animal products will depend, partially on whether China can improve production efficiency and if it can effectively address the environmental consequences of greater animal production in large, modern, and more efficient operations. If so, China will likely turn to global markets to procure sufficient feed grains to meet the growing demand as corn production is expected to grow more slowly than feed grain consumption.

China's Elusive Livestock Statistics

There is no question that China's feed and livestock industry has undergone enormous transformation since economic reforms were established in the late 1970s. In the 1980s, nearly all livestock production took place on small farms, termed "backyard" production, and livestock feed was locally procured without much thought about feed efficiency. The development of the feed and livestock industry was targeted by policy makers early on, and according to official statistics, China today is the world's largest commercial livestock feed producer and has become the world's largest producer of pork, eggs, and aquaculture products, second largest producer of poultry meat, and a growing producer of other livestock products. Moreover, a significant and growing share of China's feed and livestock production occurs in large, modern operations.

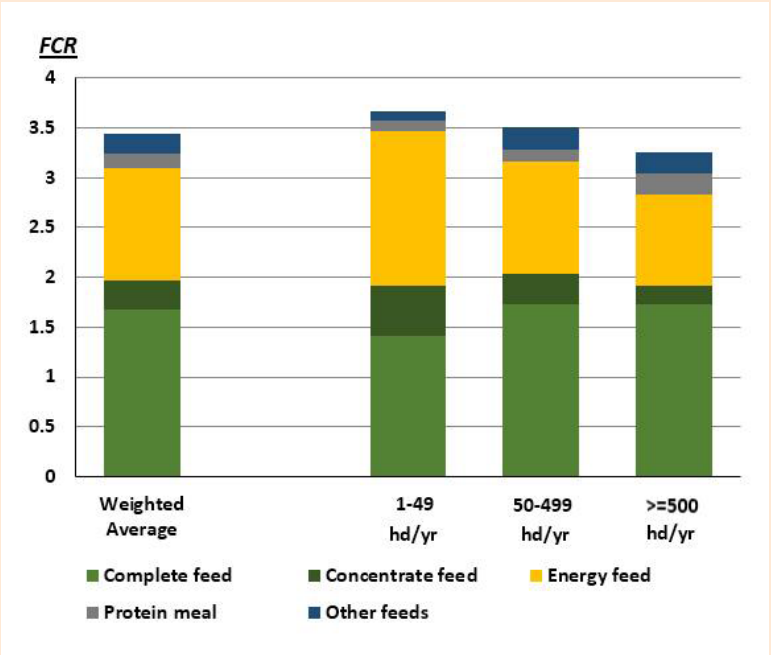
Aside from this general sense of the big picture, a more careful understanding of the underlying supply and demand of feed and livestock products is elusive. Taking pork as a primary example, official production statistics report that China produces more than half of all the pork in the world in recent years, slaughtering 715.6 million hogs to produce 54.9 million metric tons (mmt) of pork in 2013, or about 40.7 kg/capita (assuming population is 1.35 billion). Other official figures, however, suggest that actual pork production in China is much lower than this. For example, official consumption estimates report that urban residents consumed 21.2 kg/year of pork in 2012—the last year consumption statistics are available—and their rural counterparts consumed 14.4 kg that year. Since China is roughly half rural and half urban, these estimates imply consumption of only 17.8 kg/year per capita consumption, or a total of 24 mmt of pork, over 30 mmt below the official production number for 2013. The discrepancy between official consumption and production estimates also

holds true for other livestock products, such as eggs and dairy.

One well-known issue with China's official consumption statistics is that they do not include food consumed away from home, and are also believed to under report at home food consumption. Recent independent surveys of urban households conclude that excluding meat consumed away from home and underreporting results in estimates as much as 40% below actual levels (Bai et al., 2013), so the true urban number could be as high as 35 kg/capita. While consumption away from home is likely lower for rural households, the household survey estimate very plausibly is 30% below actual consumption, indicating rural consumption could be roughly 20 kg/capita. This results in average per capita pork consumption of 27.5 kg, or total pork consumption of 37.1 mmt, which is still far below the official production number of 54.9 mmt in 2013.

Other evidence corroborates the finding from consumption statistics that China is actually producing far less pork than official production statistics indicate. Beginning in 2009, China's Ministry of Commerce began collecting monthly statistics on hog slaughter and they indicate far lower slaughter levels than official statistics. In 2013, the monthly slaughter numbers—the responsibility for which transitioned to the Ministry of Agriculture that year—summed to 233 million head, and although these estimates do not include the thousands of smaller slaughter facilities, even if they represent just half the total slaughter, that would sum to 466 million head or around 36 mmt of pork production. Using farm household production data from China's Research Center for Rural Economy, under the Ministry of Agriculture, Yu and Abler (2013) also estimate China's pork production in 2009 at 35.4 mmt.

Figure 1: FCR and Feed Composition



Source: Center for Chinese Agricultural Policy

China's total pork, and other animal product, production has obvious implications for feed demand. However, the key link to this is the feed conversion ratio (FCR), a measure of efficiency that relates live weight gain to total feed consumed, but there is little information on how efficient China's swine producers are. A recent survey of village-level swine producers by the Center for Chinese Agricultural Policy (CCAP) indicates that larger producers are more efficient than smaller producers, and the weighted average FCR in their sample of village-level producers is 3.49, or 3.49 kg feed for one kg weight gain (Figure 1). If we assume the village level operations represent 80% of production and larger, more modern operations outside villages achieve an FCR of 3, then this suggests the China-wide FCR is about 3.4 Add to this the feed for the sows that produce the piglets, say 0.65/marketed hog, and this raises the total feed per kg of a market hog to 4.05. Then say 75% of market hog weight is actually meat, and the feed-to-meat conversion rises to 5.4. If it takes 5.4 kg of feed to produce one kg of pork, and China's total pork production is 35 mmt, then that suggests total pork feed is 189 mmt.

This estimate of swine feed consumption is based on many assumptions, particularly that China's actual pork production is well below the official production number. However, as argued below, it is difficult to see how pork production and feed demand could be any more than this.

China's Feed Production Estimates and Demand for Specific Ingredients

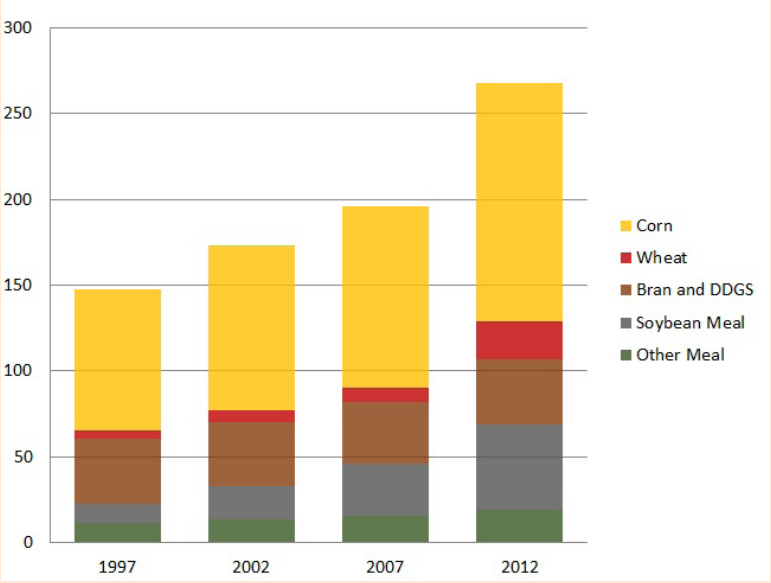
How does this number fit with estimates of China's total feed supply? The China Feed Industry Association (CFIA) reports estimates of commercial production of complete feed (also called compound feed), concentrate feed, and feed premix for swine, layers, broilers, aquaculture products,

ruminants, and other. Again, taking swine as an example, for 2013 these estimates are 66.3 mmt of complete feed, 14.1 mmt of concentrate feed, and 3.75 mmt of pre-mix feed, for a total of 84.1 mmt of commercial swine feed production.

These estimates, however, understate implied total feed produced and used. While complete feed is used as is, concentrate feed is mixed with grains and feed premix is combined with grains and protein meals to generate final feed formulations. Concentrate feed is typically mixed at a ratio of 1 part concentrate to 3 parts grain for swine rations—concentrate feed comprising 25% of total feed—while feed premixes typically comprise around 5% of total feed. Some of the feed premix produced is sold to other feed mills and included in their complete and concentrate feed so is double-counted, and we assume the share of premix double-counted is 20%. Using these relationships, we can estimate the total implied swine feed from the CFIA commercial feed production estimates at 182.6 mmt in 2013, or 6.4 mmt below the estimate reached (by multiplying the 35 mmt production estimate by a 5.4 feed-to-meat conversion). Similar analysis of commercial layer and broiler feed production estimates indicate each sector uses just above 60 mmt of feed, with aqua and ruminants using around 20 mmt each, and "other," such as, rabbits and mink, around 5 mmt, for a total implied feed supply estimate of just below 350 mmt. Since many large livestock operations procure their own feed ingredients and mix their own feed rations, therefore do not purchase commercially-produced feed, the actual total feed production estimate is likely higher than the 350 mmt estimate above.

Dig down deeper to understand what ingredients are used in this feed and it becomes very difficult to determine where all this feed is coming from. Animal feed is comprised primarily of protein meals and energy feed. Figure 2 shows estimates of the feed demand for the following ingredients from 1997-2012: Soybean meal, other protein meals—primarily rapeseed, cotton seed, and fish meal, adjusted for 44% protein equivalence —distillers grains with solubles (DDGS)—wheat bran, rice bran, wheat, and corn. These estimates are based on the U.S. Department of Agriculture (USDA) Foreign Agricultural Service's Production, Supply and Distribution (PSD) online database for corn, derived from USDA PSD milling estimates for wheat and rice bran and USDA PSD rapeseed and cotton production estimates for rapeseed and cottonseed meals, and the author's own DDGS, fishmeal, and wheat feed use estimates. These estimates are very much in line with estimates used by industry and government analysts inside and outside of China.

Figure 2: Estimates of Feed Ingredient Use in China: 1997-2012



Source: USDA PSD and author's own estimates

The estimates in Figure 2 indicate that total feed use in China in 2012 was only 267.7 mmt, far below the 350 mmt estimated by looking at commercial feed production. Under these estimates, feed use grew at a cumulative annual rate of 4% over the period 1997-2012, with protein meal growing faster at 7.8% annually, mostly from soybeans, soybean meal use grew by over 10% a year. The more rapid growth in protein meal resulted in protein meal inclusion in animal feed rations expanding from 15% of all feed in 1997, to over 25% in 2012. Energy feed grew more slowly, only 3.1% annual rate, with corn growing at a somewhat faster rate of 3.5%. Despite a 4% growth rate; however, the 267.7 mmt estimate seems to be well below what would be required to feed all the pigs, chickens, cows, sheep, and all the various aquaculture critters in China.

Many argue that food waste comprises a large share of animal feed in China. While that may have been true when animal production was predominantly backyard, there is little evidence that it is true today. For example, very few of the producers,

even the very small ones, in the CCAP survey reported using recycled food for feed. One reason is that consumers in China do not waste as much as people might think, particularly in households, although more waste occurs in restaurants. Another reason is that China's increasingly modern animal production practices seek out feed ingredients with relatively consistent levels of energy, protein, and other nutrients, and this is difficult to achieve with food waste. The third reason is that there is simply not that much food to go around. Food waste, by dry weight, is almost entirely spent rice and wheat products–fruit, vegetables, and meat are far less likely to be disposed of and, when calculated by dry weight, do not add up to much. China consumes about 140 mmt of milled rice and 70 mmt of milled wheat annually, resulting in about 210 mmt of food grain consumed in a year. If 20% of this is disposed of and recycled as animal feed, then that would imply around 40 mmt of feed. This estimate is fairly liberal, yet it still falls short of making up the gap between the estimates of individual feed ingredient use, and total feed use implied by commercial feed production and animal feed demand.

The point of all this is that China's official production and consumption estimates for livestock products are far apart and one must go through substantial gymnastics to arrive at estimates that are reasonable in themselves and reasonably close to each other. Moreover, even an estimate that assumes meat production is much lower than official production estimates is well beyond the individual estimates of feed use for specific ingredients such as corn and soybean meal. For a country that puts such emphasis on not only development of the livestock industry but also on maintaining feed grain production growth to meet domestic demand, it is somewhat surprising that there are no real reliable estimates of livestock production, feed demand or demand for important feed ingredients such as corn. Or at least the estimates that do exist, do not seem to match each other.

But there are two key conclusions that we can draw from the above analysis thus far. One is that meat consumption in China is very likely well below the official production numbers and there is substantial room for continued expansion of meat consumption in China. The other is that as protein meal inclusion rises to levels that optimize efficiency, then the trend of protein meal growth outstripping energy feed growth that has been in place over the past 15 years will slow and growth in both energy feed and protein meal will converge to the growth rate of total feed. For energy feed, this means an acceleration of growth vis-à-vis total feed demand growth. Since production of bran is based on food grain consumption, which is not growing in China, nor is production of DDGS, we can assume that nearly all of any future increases in energy feed consumption will come from corn and other feed grains.

Corn Production and Self-Sufficiency

China's soybean imports skyrocketed over the last two decades not only because consumption of livestock products grew and livestock producers increased the share of protein meal in their rations, but also because policymakers in China adopted a policy of 95% self-sufficiency for grains in 1995. At that time, policymakers debated whether corn and soybeans should be included in the definition of grains or whether the policy should apply only to "food grains," namely rice and wheat. In the end, corn was included in the 95% self-sufficiency policy, but soybeans, formerly considered a grain as well, were not.

This decision had significant implications for food consumers in China as well as world commodity markets. In the ensuing two decades, a large oilseed crushing industry developed along China's coast supplied entirely by imported soybeans. Soybean imports rose from nothing in the first half of the 1990s to 70 mmt of soybeans in 2014, or more than half of all soybeans traded on global markets. Livestock producers and food consumers in China benefitted significantly by the decision to procure soybeans from global markets. The protein meal from imported soybeans helped facilitate the modernization of livestock production in China, including greater protein meal inclusion in livestock diets which led to more rapid animal growth rates and improved production efficiency. The policy also resulted in more abundant supplies of, and therefore lower prices for, edible oil in China. More abundant and lower-priced supplies of these staples of China's diet, pork, poultry, eggs, and edible oil, allowed far more low-income consumers to improve their diet than would have occurred if soybeans had been kept under a self-sufficiency policy.

The other significant effect of this policy was the growth in China's domestic corn production, over 70% of which was due to expanded sown area rather than yield growth. According to official statistics, China's corn production rose from 99 mmt in 1993 to 213 mmt in 2013, a cumulative annual average growth rate of 3.9% (Table 1). Production growth came from increasing area sown to corn, from 21million hectares (mha) to over 36 mha over the 1993-2013 period, and also from rising corn yields, from 4.73 to 5.9 metric tons per hectare(MT/ha) over the period. Calculating cumulative annual growth rates (CAGR) for area and yield reveals that of the 3.9% growth in corn production over the period, 2.8% of that was from expanded sown area while only 1.1% was from yield growth. Thus, by China's official estimates, 71.8% of the growth in corn production over that period came from expanded corn area.

Table 1: Corn Production and Production Growth in China: 1993-2013

				Cummulative Annual Growth Rates (percent)		
	1993	2003	2013	1994-2004	2004-2014	1994-2014
Area (mha)	21.0	24.7	36.1	1.7%	3.9%	2.8%
Yield (mt/ha)	4.73	4.95	5.9	0.5%	1.8%	1.1%
Production (mmt)	99.1	122.4	213.2	2.1%	5.7%	3.9%
Area growth share of production growth				81.0%	68.4%	71.8%

Source: China Statistical Yearbook. Estimates are based on 3-year averages including the year before and after the reported years

The 15 mha expansion in corn sown area over the period 1993-2013 is not only significant, but it is not clear where this land came from. Over the period 1993-2013, China's official statistics report that sown area in China for soybeans, millet, sorghum, and cotton—all major competing crops for corn—declined by a total of 5.3 mha over the period, while peanut area, also competing with corn, grew by 1.3 mha. Therefore, the total decline is only 4 mha, which is well below the 15 mha expansion in corn sown area. Also over the period, wheat sown area fell by 6.4 mha. However, this reflects a decline of 8.2 mha between 1993 and 2003, when corn area rose by only 3.7 mha, but then wheat area actually expanded by 2.1 mha in the subsequent decade 2003-2013, while corn area also expanded by 11.4 mha. Moreover, while some of the reduced wheat area was due to spring wheat production in Northeast China switching to corn, most wheat area is winter wheat in North China which is double-cropped with corn sown after the wheat harvest in June, thereby does not directly compete with corn for land. There has been a few million hectares in grassland reduction, and also some crops, such as cotton, have seen acreage reduced on the North China Plain, where it competes for corn, and expand into western China (also onto former grassland). Given that urbanization and rising incomes have increased demand for fruit and vegetables, it is not likely that additional land for corn came from declining sown area of these products, and urbanization also directly competes with agriculture for land.

Because China already exploits nearly all the land available for agricultural production, and competition for land by higher-valuing non-agricultural uses is fierce, it is reasonable to expect that future corn production growth in China will most likely come more from yield growth than from continued expansion of sown area, but achieving this yield growth may prove more difficult than it appears at first glance.

Many observers point out that the corn yields in China are around 60% of the yields in the United States and therefore conclude that there is significant room for yield growth and higher yields can be easily achieved. Unpublished estimates of corn yields in China by the U.S. Grains Council over the last several years, however, indicate that corn yields could be as high as 7.5 to 8 MT/ha, or more than 25% higher than China's official estimate in 2013. In addition, a large share of the yield difference comes from lower plant populations, which hover around 22 thousand plants per acre in China, compared to 30 thousand or greater in the United States, or more than 25% higher than in China. Despite the lower plant density, corn ears in China often show signs of "tip back", where the last few rows of kernels at the very tip of the ear do not develop. Tip back is an indication that the plant population is maximized to fully utilize the nutrient availability in the soil. Under these circumstances, it will be difficult to increase the plant population to boost yields without changing agricultural practices and improving the underlying soil productivity.

China's unique land tenure system, which results in very fragmented land holdings, will slow the adoption of agricultural practices that improve the soil. Recent research on soil fertility in China indicate that China's soil suffers from fertility issues such as salinity, acidity, low levels of organic matter, and—in some areas—heavy metal contamination. This can all be reversed, but restoring soil fertility will take time and investment. Farmers in China till such small plots, however, that the incentives to make these investments are weak. Farm households are much better off allocating time and energy to non-farm employment or more lucrative farm activities such as cash crops or livestock production, than activities that may improve corn yields somewhat in future years. China seeks to increase farm size and this is occurring, but the extent of fragmentation is so extreme that it will take many years before a significant amount of land is cultivated in tracts large enough for farmers to face sufficient incentives to make the long-term investment in soil fertility improvement.

Given that the expansion of corn sown area will likely slow, and yield growth will not likely increase appreciably, it seems that corn production growth in China will slow in coming years. Meanwhile, as protein meal inclusion growth begins to slow and converge with overall feed growth, demand for energy feeds will do the

opposite. Energy feed growth can be expected to rise to converge to overall feed demand growth, and the additional energy feed will likely come from corn or other feed grains. Together, these two trends will cause corn import demand to grow, especially if demand growth for animal products remains robust.

China's Import Dilemma

China is currently undergoing a transition to a new model of economic growth and development. The new model emphasizes domestic consumption, so while overall gross domestic product (GDP) growth will slow, consumption growth is expected to remain robust. In particular, the new model seeks to boost income growth and economic stability for the lower tiers of the income distribution and these consumers that have the highest marginal propensity for increasing animal protein consumption as their incomes increase. Thus while China's GDP growth is expected to slow, growth in the consumption of animal proteins is expected to not slow by nearly as much, and as argued above, there appears to be much room to expand animal consumption growth.

China's new development model also puts more emphasis on markets to determine resource allocation. Indeed, China's food security strategy unveiled in late 2013 specifically excludes corn from the 95% self-sufficiency that has guided corn policy for the last two decades, but the new policy will take time to implement. In 2008, China sought to support corn prices by purchasing corn at a minimum price in the northeast, China's largest corn producing region, and increased the minimum price in 2010, 2011, 2012, and 2013. However, with the bumper U.S. corn crops in 2013 and 2014, after 3 years of drought, global corn prices have fallen significantly. China's price support policy results in high domestic corn prices vis-à-vis global markets, and the prices are additionally protected by a tariff-rate quota (TRQ) on corn allowing only 7.2 mmt of imports before prohibitively high tariffs kick in, and only 2.88 mmt of that is allocated to private users, the rest is controlled by state-owned enterprises who may or may not use it. These high prices not only make it more difficult for livestock producers in China to compete with producers in other countries that enjoy the low global prices, but are also causing corn production to continue expanding while demand for corn slows as livestock producers seek alternatives to high-priced corn to include in feed rations. Thus, China's government is holding onto increasingly large, high-priced corn stocks while world corn supplies are also increasing and prices are low. China is experimenting with liberalizing similar policies for soybeans and cotton in 2014, and while this will help resolve distortions in those markets, maintaining high-price policies for corn may cause corn area to expand even further as cotton and soybean prices soften.

Whether China decides to import corn to support domestic livestock production rather than import the livestock products directly, will depend in part on how China resolves the current situation of large, expensive stocks and transitions to a policy that allows corn prices to converge closer to import parity. However, it will also depend on whether China's producers can improve efficiency and also whether they can reduce some of the environmental impacts of large livestock operations. Livestock producers in China are increasingly efficient, but the industries, in aggregate, are still not as efficient as more developed industries in many of China's trading partners, who also currently have the additional advantage of low corn prices.

The most critical threat to the continued expansion and modernization of livestock production in China, however, may turn out to be the environmental consequences of large, modern operations. An environmental census carried out in the last decade concluded that nearly half of the water pollution in China—on a chemical oxygen demand (COD) basis—was due to emissions from livestock production. This led to a series of environmental regulations that recommend treating these emissions rather than using them as a substitute for chemical fertilizer. These policies further raise the costs of livestock production in China. The findings led several prominent specialists to argue that China should procure additional livestock products from other countries that have more land and water resources to support production. Indeed, other Asian neighbors that have higher incomes but also have high population densities and limited land and water resources tend to import a far higher share of livestock products than does China, yet also import grains to support domestic production.

China has made enormous achievements in building a robust and modern livestock industry and can be expected to continue supporting the development of this industry. This will likely, ultimately, lead to policies that liberalize corn imports and cause corn prices to converge toward import parity levels, which in turn will increase corn demand as livestock producers switch back to corn. But the continued consolidation of the industry into larger and more modern operations that can compete with producers in other countries will be slowed as they learn to adjust to the external costs of handling livestock emissions in ways that reduce environmental degradation. Thus, as demand for animal products continues to grow, and the industry continues to modernize and adjust to new realities, we will likely see imports of both feed products and animal products rise, with corn being a key component of these trends.

For More Information

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Emerging Markets for U.S. Meat and Poultry In China

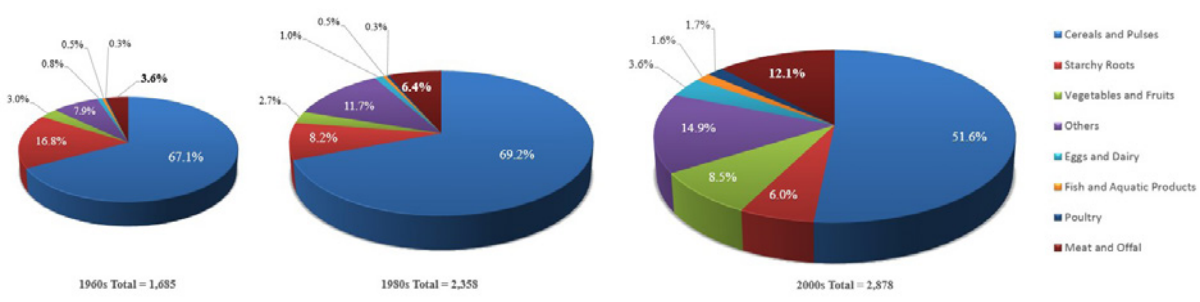
David. L. Ortega, H. Holly Wang, and Maolong Chen

JEL Classification: Q13, Q18, Q27
Keywords: Agricultural Exports, China, Meat Consumption

Rising Demand for Meat in China

As the most populous country, China is also the world's largest food consumer. Rising incomes in China are leading to a shift in the consumption of higher quality food products. This trend is represented by an increase in the consumption of animal protein, mostly meat, poultry, dairy, and aquaculture products. Meat consumption in China grew rapidly in the past three decades and has become the most important category of food consumption in recent years. Data from the Food and Agriculture Organization of the United Nations (FAO), presented in Figure 1, reveals how the typical Chinese dinner plate has changed in the past half a century. In the 1960s, cereals, pulses, and starchy roots provided 84% of total calories for Chinese people, while meat, including poultry and offal, contributed only 4%. As a result of economic development in the last 34 years, when annual GDP grew from $309 Billion in 1980 to $10,355 Billion in 2014 (IMF, 2014), meat, poultry, fish, eggs, and dairy products became a key source of calories and provided 19% of total calories in the 2000s. Among all kinds of meat, pork is the most favored animal protein; its consumption increased by more than 8% annually during this period. Data from the U.S. Department of Agriculture (USDA) shows that annual pork consumption increased from 16 million metric tons in 1985 to 52 million metric tons in 2012, and annual consumption of all chicken, beef, and pork combined increased from 17 to 71 million metric tons. This rising trend in meat consumption is highlighted in Figure 2.

Figure 1: The Evolution of The Chinese Dinner Plate: Food Consumption by Category (KCal/Day/Capita).



Source: Food and Agriculture Organization of the United Nations.

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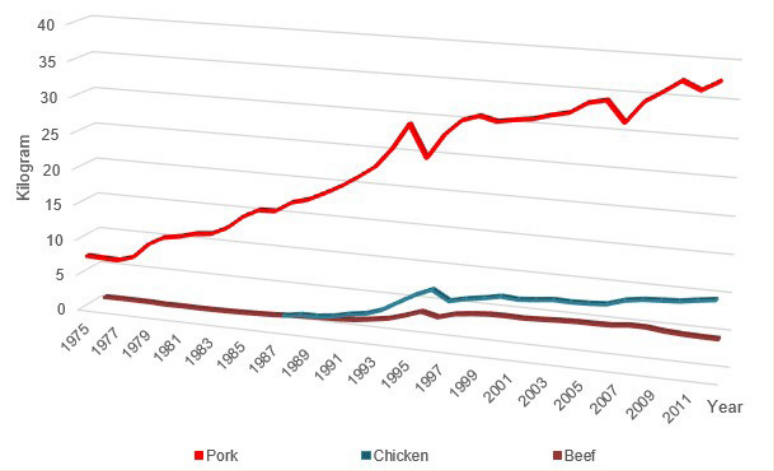
Figure 2: Annual Per Capita Consumption of Meat in China from 1975 to 2012.



Source: U.S. Department of Agriculture, Foreign Agricultural Service.

Table 1: Top 5 Pork Exporters to China (Values in Thousands of Dollars).

	Rank in 2013	2008	2009	2010	2011	2012	2013
United States	1	439,708	82,213	236,233	1,234,857	1,068,791	762,609
Denmark	2	259,858	196,369	357,902	316,367	364,439	413,756
Germany	3	69	176	42,949	78,547	287,514	410,449
Canada	4	111,381	129,121	222,532	204,677	237,720	296,250
Spain	5	234	41,426	54,633	124,313	186,198	217,737

Source: United Nations Statistics Division.

Constraints to Chinese Domestic Meat Production

While China has imported a significant amount of feedstuff to fuel its animal protein production, several constraints prevent Chinese producers from supplying necessary quantity and demanded quality. Limited agricultural space, urban sprawl, and industrialization have made it difficult to prevent the spread of animal diseases, and have lead to food safety problems in domestic animal production. These spatial constraints tend to either raise the cost of food products or compromise their safety and quality, and will likely remain in the presence of government regulations and as livestock industries modernize.

Large swine and poultry operations are densely concentrated around China's urban areas on the east coast of the country (Gerber et al., 2005), where there is also an extremely high density of human population. This provides an environment for animal diseases to spread, and can even result in situations where viruses are passed from animals to human, such as avian and swine influenza (H5N1 and H1N1, respectively). These operations also generate tremendous waste and dead animals, which unless properly handled can pollute surface and ground water. The presence of nitrogen and phosphorus in the water causes an over growth of bacteria, phytoplankton, zooplankton, and other pathogens which in turn affect aquaculture, water fowl, poultry, and swine production. As a result, antibiotics have been liberally administered in livestock operations, and there are serious concerns about the effects of antibiotic residuals in meat and other animal protein products for human consumption (Qi et al., 2009).

Food Safety and Demand for Imported Products

With the appetite for meat rising, Chinese consumers are no longer solely focusing on domestic products. China has been a net pork importer since 2008, with net imports of swine meat increasing to 535 thousand metric tons in 2014 (USDA). Information about China's main pork suppliers can be found in Table 1. As the largest pork exporter to China, U.S. pork suppliers increased the value of their sales in China from $439 million in 2008 to over $1 billion in 2012. This number is expected to increase over the next few years as a result of higher feed prices in China, natural constraints to production, domestic food safety events, and changing consumer preferences and lifestyles.

Because of constantly occurring food safety events, such as the melamine adulterated milk scandal that occurred in 2008, urban Chinese consumers are becoming increasingly concerned about the safety and quality of their food. Their revealed demand for food safety is evidenced by the flourishing of high end food retail stores carrying imported food and drink products from the United States, European Union, Australia and other developed countries. The high transportation cost for items such as meat and fluid milk are reflected in the high price for these products. While a growing minority of affluent consumers mostly patronizes these high-end supermarkets, imported products are making their way into supermarkets frequented by the average urban consumer. Moreover, the supermarket revolution in China

is driving changes in shopping behavior as consumers have experienced an accelerated change towards the procurement of food from modern retail channels, where branding and labeling allow consumers to differentiate the quality image of products (Hu et al., 2004). In the last two years, Internet food sales in China have grown rapidly surpassing $300 billion in 2013 with the largest online retailer, Taobao Marketplace, surpassing U.S. sales from Amazon.com, Inc. and eBay Inc. combined. As a result, online food sales for premium grocery products in China have also boomed, cashing in on food safety scares affecting traditional outlets (Patton, 2013). Same-day delivery of imported meat, poultry and dairy products have started to make an appearance in large cities in China.

In the wake of these Chinese food system transformations, various consumer preference studies have looked at consumer valuation of credence attributes, especially food safety (Wang, Mao, and Gale, 2008; Zhang, Bai, and Wahl, 2012; Bai, Zhang, and Jiang, 2013). Empirical results across studies of pork, beef, poultry, and fluid milk shows that urban consumers are willing to pay a price premium for products with greater food safety credibility, including reliance on certified brands, traceability, antibiotic-free products, and other indicators of premium quality. A series of recent studies have found evidence of effective urban consumer demand for products that can display government food safety certification, third party certification, and product traceability in domestic pork and milk (Ortega et al., 2011; Ortega et al., 2012). While consumers are willing to pay more for government certification of food safety in domestic products as compared to products without certification, there is evidence of emerging consumer preferences for imported food products. This is a result of persistent domestic food safety concerns, rising incomes and changing consumer lifestyles.

On the other hand, Chinese consumers seem to prefer domestic food to imports for less commonly consumed specialty products such as duck; this is mostly a result of local tastes and preferences. Our study conducted in 2013 on duck dishes consumed in restaurants in four major cities reveals that consumers perceive domestic duck meat to have superior flavor than imported duck—when controlling for other quality and safety attributes. Preliminary results from another study conducted in late 2013 indicate that while consumers in Beijing have a strong preference for domestic beef products, they perceive U.S. beef (not legally available in China) to be a safer alternative. Similar results were found in a series of consumer interviews conducted in the summer of 2014 regarding demand for U.S. pork. The strong preference for domestic products is due to perceived taste differences and cultural factors. However, U.S. meat products in China currently enjoy a reputation of being safe and of high quality.

Implications for U.S. Meat Industries

While Chinese concerns over food safety present an opportunity for U.S. products, it also poses a threat for foreign products, especially in the wake of the new Chinese Food Safety Law. Imported products are facing higher barriers to trade due to tightening food safety standards, which are easier to enforce for imported products than for the domestic market. As a result, U.S. meat exports to China have been at the center of controversial trade restrictions and political disputes in recent years. China has banned the importation of U.S. pork that is raised with the use of ractopamine—a feed additive that promotes lean meat production and is readily used in the U.S. swine sector. It is worth noting that despite this trade restriction, U.S. pork is known to have made its way to the Chinese mainland through a "grey channel" originating in Hong Kong where there are minimal trade barriers for imports (Gale, Marti, and Hu, 2012). China also remains the only major market that has not officially reopened to American beef after the first case of U.S. Bovine Spongiform Encephalopathy (BSE) in 2003.

Despite these setbacks and challenges, there is renewed optimism over the future of American meat exports in China. In 2014, Smithfield Foods Inc., the U.S.'s largest pork producer was acquired by China's WH Group (formerly known as Shuanghui International)—the biggest Chinese purchase of a U.S. company to date. Over most of the past decade, Smithfield has been the major U.S. pork exporter to China though these shipments have been largely unnoticed by consumers, as they have been comprised of frozen pork that ends up in meat processing and food service channels. This recent merger provides opportunities for U.S. pork to enter China's profitable chilled/processed pork market that is mainly sold in supermarket stores (Xia, 2014).

In the beef sector, recent talks between trade officials point to an official restoration of the United States-China beef trade in the near future. China is the world's fastest-growing beef market and a significant buyer of imported beef by volume, mostly sourcing from Australia, New Zealand, Canada, Uruguay, and Argentina. Booming domestic demand, coupled with tight domestic supply and favorable U.S. pricing is putting increased pressure on the Chinese to open up the market for U.S. beef. While not as popular as pork, the United States needs to maintain and expand its promotional strategy surrounding beef in China to increase consumer awareness and capture maximum market share once official trade is reestablished.

Starting from 2010, China levied a substantial anti-dumping duty on U.S. chicken—which has ranged from

46% to 105%. In addition, a 2015 ban on poultry from the U.S. to China due to high pathogenic avian influenza (HPAI) detections is currently dampening poultry exports, pointing to the continued existence of business risk on the export of meat products. Nevertheless, the United States has been a significant source of broiler imports in the Chinese market and is expected to recover its market share once official trade is reestablished.

To penetrate and expand into the Chinese market for meat, poultry, and other animal protein, U.S. industries need to recognize Chinese consumers' food culture and preferences with regards to taste, texture, cuts, and emphasize the established safety and quality reputation of U.S. products. Furthermore, as excess demand for animal protein continues to increase under natural and spatial domestic production constraints, the U.S. meat industry is well positioned to capitalize on the growing potential of the Chinese market.

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Get Ready for Chinese Overseas Investment in Agriculture

Elizabeth Gooch and Fred Gale

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In November 2014, a corn shipment from Bulgaria arrived at the Port of Shenzhen, China. The corn was grown on leased land in Bulgaria by a Chinese company that had invested close to $80 million in Bulgaria, to grow and process grains, and oils for export to China. The company set up a Bulgarian subsidiary in 2011, leased 28,700 hectare (ha) of land, and purchased processing plants and storage facilities in the country. The Chinese embassy in Bulgaria identified the country as a favorable target for Chinese agricultural investment in Europe, and the project was endorsed by Chinese dignitaries (Luo, 2014).

As China becomes a large importer, its food security strategy calls for gaining control over imports from their source. To achieve this, a growing number of Chinese companies are making investments abroad that resemble the Bulgarian project. U.S. leaders in agriculture, business, and government should be aware of this new development in agricultural markets.

Whole Supply Chain Control

China has a long history of investing in agriculture overseas with a mix of foreign aid and commercial objectives (Chen, Zhang, and Wang, 2009). As China's imports rise, investment is growing rapidly as Chinese companies pursue profit-making opportunities with encouragement from the Chinese government (*The Paulson Institute*, 2013; Han, Jin, and Wu, 2014). Chinese President Xi Jinping has advocated agricultural investment as a national food security and diplomatic strategy, and officials say outward foreign direct investment in agriculture (OFDI-A) is in its early stages (*Xinhua News Service*, 2014; *Global Entrepreneur*, 2014; Smaller, Wei, and Liu, 2012).

China's OFDI-A is diverse, ranging from small farms cultivating rice across the Russian border, to massive oil palm plantations and processing facilities in Indonesia. In August 2014, China's Ministry of Commerce announced that over 300 Chinese companies were investing in agricultural, forestry, and fishing projects in 46 countries *(Farmer's Daily*, 2014). The Ministry of Agriculture reported that Chinese businesses and state-owned enterprises had cultivated over 230,000 ha of foreign land by the end of 2013.

Chinese OFDI-A is aimed at gaining greater control in the global marketplace. The strategy encompasses mergers and acquisitions of firms from developed economies, while also laying out a clustered investment strategy to access under-utilized agricultural resources with an emphasis on Africa (*Ministry of Commerce*, 2015; *GRAIN,* 2012). The strategy has evolved from the traditional focus on land acquisitions to encompass investments in the entire supply chain, including processing, logistics, ports, and trading. The strategy is influenced by the widespread belief among Chinese government and industry leaders that multinational trading companies will gain large profits and influence prices by controlling the supply chain for Chinese imports of soybeans and other commodities (Dan, 2014; Irwin and Gallagher, 2014; Niu and Wong, 2014; Schneider and Sharma, 2014).

The OFDI-A strategy is a distinctly Chinese approach that aims to meld commercial opportunities with the achievement of national food security objectives. Recent

statements of the strategy emphasize that companies will be the main investors. OFDI-A decisions are made primarily on the basis of profit opportunities, but consultation with authorities and various support seeks to steer investment to achieve national objectives (Liang, Renneboog, and Sun, 2013). Government support includes subsidized and earmarked loans, information services and training, as well as less visible coordination by officials and diplomats (Chen, Zhang, and Wang, 2009).

Mergers and Acquisitions

China wants to take a more assertive role in the global agricultural marketplace, acquiring assets at all stages of the supply chain from cultivation to processing to distribution (Dan, 2014; Irwin and Gallagher, 2014; Schneider and Sharma, 2014). An increasingly important part of China's strategy is to gain control over supply chains plus access to production technology, management techniques and resources in major agricultural-producing countries through mergers and acquisitions.

An example is the recent purchase by China's State-owned agriculture and foodstuff giant, COFCO, for a majority share of Dutch grain trader Nidera for an estimated $1.6 million. The acquisition gives COFCO access to Nidera's Brazilian assets and helps COFCO compete with multinational grain traders. State-backed enterprises like COFCO, Chongqing Grain Group Co., Ltd, and Beidahuang have been the central actors in China's procurement of a large portion of the agricultural marketplace (Hu, 2013), but private companies like WH Group and New Hope Group Co., Ltd. also play a major role.

When acquiring established firms, Chinese companies generally lack the advantage in technology or management, so their main advantage is large capital investment (Spigarelli, Mucelli, and Alon, 2013; Quer, Claver, and Rienda, 2010; Milelli and Sindzingre, 2013). Access to the Chinese market is also attractive to firms that want to increase their distribution (Zheng et al., 2015; Edamura et al., 2014). With the lack of Chinese experience in management, many Chinese firms practice a light-touch approach with acquired companies, retaining the purchased firm's management structure, now loyal to the Chinese parent company (Zheng et al., 2015). For example, after acquiring Smithfield Foods, Inc., WH Group retained the company's management and posted only one staff member at Smithfield's headquarters.

The Smithfield acquisition is China's largest OFDI-A thus far and established China as a major player in the global agricultural market. There have been few details about the motivation for the investment, for which there was no explicit government support. However, the size of the deal and WH Group's takeover of a much larger U.S. based company suggests to some observers that Smithfield was a test case for other large scale investments. Smithfield's vertically-integrated business model that includes control of farming, processing, and marketing of branded products fits China's interest in controlling the entire supply chain. Smithfield's model is also consistent with WH Group's strategy of vertical integration to build consumer confidence in the safety and quality of pork products—a sector that has been troubled by food safety concerns in China. WH Group began test-marketing branded Smithfield products in Chinese supermarkets in 2014. It is noteworthy that China's biggest acquisition to date is a pork company. Meat, dairy, and feed investments reflect a new emphasis on securing animal protein supplies (Schneider, 2014).

New Zealand's dairy industry is another prominent target of Chinese OFDI-A, offering Chinese firms access to already-established dairy farms and processing facilities, knowledgeable employees, and a well-developed dairy market. New Zealand is the leading dairy exporter, so it has attracted interest from Chinese companies facing constraints and high costs in acquiring domestic milk supplies to meet China's rapidly-growing demand.

Developing Untapped Resources

Another prong of China's OFDI-A strategy is to develop new sources of supplies by accessing land and resources in less-developed countries (Anderson and Strutt, 2014). Since the regions containing the world's future agricultural resources have poor infrastructure and low levels of agricultural productivity, China is taking on the role of introducing improvements to the most important and underdeveloped food-producing regions (Freeman, Holslag, and Weil, 2008). For example, China is establishing small cooperative demonstration field project to bring improved technology in agriculture to communities in Southeast Asia and Africa (*People's Daily Online*, 2004; Smaller, Wei, and Liu, 2012).

China's success in cultivating new import sources has been mixed. Chen, Zhang, and Wang (2009) observed that most Chinese ventures had failed because companies were too small, lacked financing, or had unrealistic expectations. Chinese investments in Southeast Asia have played a role in its imports of tropical crops like palm oil, rubber, and cassava, but it is unclear how large. The Bulgarian project described earlier and the commitment to import from Ukraine appears to be part of a strategy to develop new sources for corn imports. Ukraine and Bulgaria became significant corn-exporters to China for the first time during 2014, although the volumes exported were less than promised when the projects were initiated. In 2012, there were protests in Kazakhstan against a plan to lease land to Chinese investors,

but Kazakhstan, nevertheless, became a sunflower seed exporter to China in 2014.

China's investments appear to have an overstated role in the country's imports. Han, Jin, and Wu (2014) reported that the Heilongjiang Province State Farm system produced 800,000 metric tons of grain in Russia during 2011, but the China Customs Statistics reported soybean imports from Russia of 60,000-90,000 metric tons annually during 2012-2014 (China considers soybeans a "grain") and no imports of cereal grains. China has a long history of setting up rice projects in Africa and is now the world's leading rice importer, yet it does not import any rice or other grains from Africa. China Customs Statistics show that the imports of African sesame seeds doubled during 2012-2014 to over $1 billion USD. However, it is not clear that Chinese companies had a role in production (Levitt, 2013).

Several prominent ventures involving land acquisitions in Argentina, Brazil, and Indonesia collapsed or were put on hold after encountering opposition from local governments and legal action by environmental groups (*Global Entrepreneur*, 2014; Myers, 2013; Rosen and Hanemann, 2009). In Brazil, land-ownership laws were changed to forestall a Chinese investment, prompting some Chinese commentators to urge a shift away from land-acquisition in the OFDI-A strategy (*Economic Observer*, 2011).

Implications for the U.S.

U.S. agricultural producers, industry, and government leaders need to be aware of the rising trend of Chinese agricultural investment. Much of the investment—including the Bulgarian case—is intended to create competition for U.S. suppliers. An increasing share of U.S. exports to China may be made by companies under Chinese control.

Chinese agricultural trade opportunities may tilt towards specific countries or regions that are most receptive to Chinese investment. In recent trips abroad, both President Xi Jinping and Premier Li Keqiang have emphasized agricultural investment as well as arranged investment-trade deals. A number of state government agencies in the United States court Chinese agricultural investors, but the U.S. Federal Government has no source of information on U.S. laws, regulations, or assistance for Chinese companies exploring investment opportunities. In addition, there is no mechanism to track Chinese investments in the United States.

A question arises of whether Chinese control will be an important factor determining access to the China market for U.S. products. According to Chinese news media, the Bulgarian corn was expedited through inspection and quarantine at the Chinese port while most other grain shipments have to wait for days or weeks while inspection and quarantine procedures are completed. In the pork sector, U.S. suppliers that use ractopamine are being banned from the Chinese market while those that certify their pork as free of ractopamine have smoother access. With differing requirements for the U.S. and Chinese markets and increasingly strict Chinese enforcement, this raises the possibility that exporters to China may need dedicated production and supply channels geared to produce to Chinese standards.

While Chinese investment will grow and become more important, it is unlikely to play a dominant role in agricultural markets. China's agricultural imports exceed $100 billion USD annually and are growing. China's Development Research Center estimates that the country's imports of edible oils and oilseeds use 50 million hectares of land overseas—the 350,000 hectares currently cultivated overseas by Chinese companies is less than 1% of that total.

Chinese discussions of OFDI-A strategy seem to presume that pure size is the key to creating a profitable trading company, when in fact the multinational companies they aspire to compete with began as family-owned firms and became large because they were well-managed. Shambaugh (2013) suggests that Chinese companies have a lot to learn about doing business overseas, many invest without a well-thought-out business plan, and he reports that as many as 90% of Chinese overseas investment ventures have failed.

While China will try to diversify its imports by investing in seemingly neglected countries, they are likely to find that the costs are higher than they imagined. China's progress in developing overseas supply bases has been slow, and many projects have faltered.

The United States will remain the dominant supplier of China's agricultural imports because it is such a large and efficient supplier. However, U.S. farmers and leaders in industries and governments should be aware of the potential opportunities and competition that may arise from Chinese investment.

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China's Growing Participation in Agricultural Markets: Conflicting Signals

Fred Gale

JEL Classification: Q17, Q18
Keywords: Agricultural imports, China, Food security, Grain, Policy,

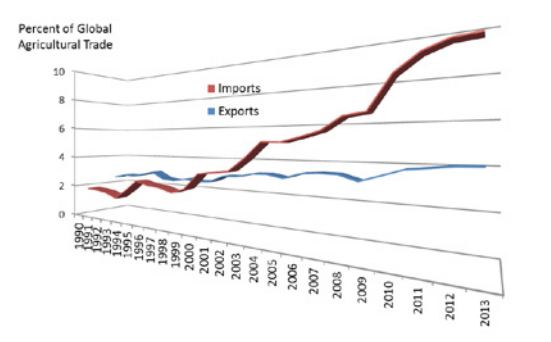
China's imports of agricultural products are growing. Rising living standards and urbanization are creating new demands for food, while environmental and resource constraints limit growth in domestic production. Imports are outpacing agricultural exports, and China is becoming a larger net importer of farm products.

With abundant natural resources and efficient farmers, the United States is the leading supplier of many of China's major agricultural imports. The United States accounted for over 24% of China's agricultural imports by value during 2012-2013 (Gale, Hansen, and Jewison, 2015). U.S. agricultural exports to China grew from $1.9 billion during 2001—the year of China's WTO accession—to $26 billion in 2013. China was the 7th largest market for U.S. agricultural exports in 2001 and is now the top overseas market for U.S. food and fiber. The share of U.S. agricultural exports going to China rose from 2-to-3% during the 1990s to 18% now.

While China's growth creates new potential markets for U.S. agricultural products, it also creates new uncertainty and tensions. As China becomes a bigger customer for U.S. agricultural products, disputes seem to multiply:

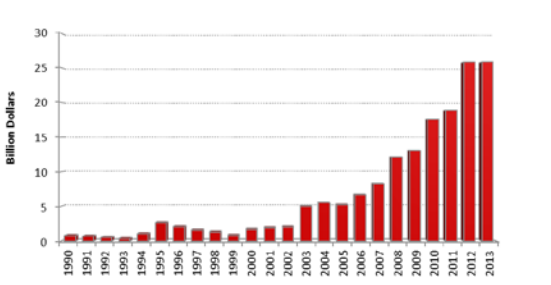
- China was expected to import record volumes of corn during 2013-2014, but shipments dwindled as Chinese authorities rejected over 1.4 million metric tons (mmt) containing an unapproved genetically modified organism (GMO).

Figure 1: China's Share of Global Agricultural Trade, 1990-2013



Source: Analysis of data from World Trade Organization.

Figure 2: U.S. Agricultural Exports to China, 1990-2013



Source: U.S. Department of Agriculture, Global Agricultural Trade System.

- China's imports of distillers' grains, sorghum, and barley soared as Chinese feed mills sought cheaper alternatives to domestic corn. Chinese inspection and quarantine officials announced greater scrutiny of these commodities later in 2014.
- During 2014, Chinese officials began rejecting imports of genetically modified alfalfa.
- Chinese authorities announced suspension of a "sliding scale" augmentation of the cotton import quota during 2015. This is a move that will curb cotton imports.
- Tariff rate quotas (TRQ) for grain were distributed only to potential importers who purchased domestic grain from state reserves during 2015.
- Chinese authorities now require exporters to certify that pork is free of ractopamine (a feed additive banned in China). China banned a number of U.S. pork exporters after detecting ractopamine in their shipments during 2014.
- U.S. beef has not regained access to China's market after being banned over disease concerns in 2003.
- Chinese authorities were slow to comply with a World Trade Organization (WTO) ruling against procedures used to set antidumping and countervailing duties on U.S. chicken.

More Trade, But Controlled Trade

China is sending conflicting signals about its engagement in agricultural markets. There are signs that Chinese officials are moving toward a greater participation in agricultural trade. At the same time, officials also appear determined to exert tight control over imports.

When China joined the WTO in 2001, it committed to relatively low agricultural tariffs, elimination of import quotas for most commodities, science-based standards for imported commodities, and limits on domestic support programs. Chinese leaders say WTO accession was beneficial for agriculture, since it opened the sector to outside investment and technology, boosted agricultural exports, helped alleviate rural underemployment, and renewed momentum on market reforms (Han, 2011; Niu, 2011). Officials endorse participation in multilateral trade organizations like WTO where they hope to promote the interests of China and other developing countries (Agricultural Trade Promotion Center, 2014; Caixin Net, 2015). China has negotiated free trade agreements with a number of agricultural exporters, including U.S. competitors like Australia and New Zealand, which will cut tariffs on imports of dairy, beef, and sorghum from those countries. Some measures, like a cut in tariffs on pistachios and almonds in 2015, reflect consumer demand for new products that are not widely produced in China. President Xi Jinping's farm visits and discussions of agriculture in trips abroad are described by official media as a "farm diplomacy" strategy that reflects his endorsement of international cooperation in agriculture (*Peoples Daily*, 2014). Speeches and articles by agricultural officials endorse a "two markets, two kinds of resources" strategy that advocates meeting China's growing demand for food with both domestic and international commodities. A reflection of the increasing role of trade is the inclusion of agricultural trade and foreign investment policy recommendations in the communist party's annual "Number one documents" during 2014-2015.

China's commitment to free trade in agricultural markets is tempered by perceived threats to food security and domestic stability. A new food security strategy introduced in 2013 acknowledges a necessary role for imported commodities in China's food supply, but it also calls for ensuring that domestic supplies retain a dominant role while imports are limited to a supplementary role (Han, 2012; Han, 2014; Han and Jin, 2014). Officials worry that imports and foreign investment threaten the development of domestic industries and reduce the government's ability to control production and prices (Niu, 2011). Moreover, officials are concerned that agricultural imports could restrain rural income growth and spread discontent in the countryside. Ancillary objectives—all represented in the 2014 "Number one document"—include diversifying import sources, stabilizing domestic prices, and ensuring "industry security", that neither imports nor foreign companies undermine the dominant position of Chinese producers and processors in any particular sub-sector.

With so many objectives, Chinese officials frequently see reasons to intervene in markets. Most of the intervention is in the domestic market through buying and selling commodity reserves and by subsidizing production, transportation, storage, and processing of commodities. China's Minister of Agriculture cited policy support as the most important factor contributing to eleven straight increases in grain production from 2004 to 2014 (Han, 2014). Officials reported that "policy purchases" equaled about 20% of the 2014 grain harvest. More than half of China's cotton is produced with subsidies in the northwest region and requires additional transportation subsidies for the long journey to textile mills in eastern provinces (MacDonald, Gale, and Hansen, 2015). Similar transportation subsidies were given for corn produced in northeastern provinces during 2013, and starch and alcohol processors were given subsidies for each ton of domestic corn they processed during 2014.

Interventions at the border can vary with market conditions. The Minister of Agriculture advised

officials to "keep a good grip on the volume and timing of imports to prevent large concentrated imports of any commodity from pressuring domestic production or having unfavorable impacts on farmers' incomes" (Han, 2014). Similar language about regulating the flow of imports to stabilize domestic markets has appeared in documents since the 1990s and was included in the 2014 and 2015 "Number one documents." Interventions to slow imports include the withdrawal of "sliding scale" cotton import quotas and tighter control over distribution of grain TRQs. Increased attention to inspections and enforcement of bans on feed additives and genetically modified crops tend to occur during periods of excess supply in the Chinese market.

Suspicions that inspection and quarantine measures are manipulated to manage the flow of trade are supported by official documents that endorse such practices.

- A pork industry stabilization policy introduced in 2009 included "adjustment of imports and exports" as a measure for adjusting supply to stabilize prices (National Development and Reform Commission, 2009).
- A Ministry of Agriculture article recommended regulating the flow of imports by using the approval process for genetically modified organisms (Xi and Li, 2013).
- Local news media revealed that a municipal office distributes TRQ to companies based on its assessment of global market conditions (*Weihai Evening News*, 2014).
- A document instructing inspection and quarantine officials to scrutinize imported sorghum and barley for a wide variety of potential disease and contamination problems was interpreted by many market participants as a measure to curb imports (AQSIQ, 2014; Niu and Patton, 2014).

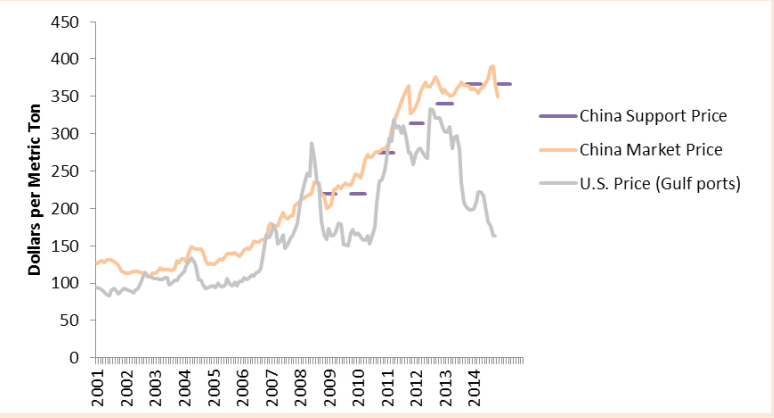
Domestic Intervention Raises Trade Tensions

China's rising level of domestic support for agriculture has raised trade tensions. Chinese officials are pursuing numerous intervention programs modeled on policies used by countries in North America and Europe during the last century. And like those 20th century programs, China's interventions have led to confusion and disruptions in international markets.

When China joined the WTO, its domestic support for farmers was minimal. A package of small subsidies and tax cuts introduced during 2004-2006 was popular with farmers, but the benefits were eroded by rising production costs. After 2008, authorities began to raise price supports annually to maintain production incentives and rural income growth (Gale, 2013). Now China's farm prices exceed global prices for nearly all major commodities, and authorities have accumulated large stockpiles of cotton, grains, edible oil, and sugar.

- China's cotton price-support program distorted global cotton markets (MacDonald, Gale, and Hansen, 2015). U.S. Department of Agriculture "production, supply and distribution" estimates indicate that China's cotton inventories increased by 52 million bales from 2011 to 2014, as domestic cotton was purchased at a high support price. Over the same period, Chinese textile manufacturers imported a cumulative total of 59 million bales of cheaper cotton from the international market. Global prices and demand for cotton began to plunge after China ended the price support program and began to dispose of its cotton stockpile.
- During 2014, China imported 19 mmt of cereal grains, suggesting that the country had a deficit, yet China actually had a surplus of grain. Chinese authorities reported purchasing 124 mmt of domestic grain to support prices that year.
- During 2012, central and local officials launched an initiative to subsidize early-season rice seedling suppliers and mechanized transplanting services to prevent a decline in double-cropping of rice. The following year, authorities reported purchasing 5.7 mmt of early-season rice—about one-sixth of the crop—to support

Figure 3: China and U.S. Corn Prices, 2001-2014



Note: China prices converted to U.S. dollars at the official exchange rate.

Source: China National Development and Reform Commission, China National Grain and Oils Information Center, and U.S. Department of Agriculture.

prices. The high price encouraged rice mills to use cheaper imported rice, and China became the world's top rice importer.

- China imported at least 3.5 mmt of corn to replenish reserves during calendar years 2011-2012, creating an impression that China's corn reserves were nearly exhausted. Yet, China's corn reserves swelled beyond storage capacity by 2014. That year, officials held an auction to sell the U.S. corn they held in reserves for three years.
- In 2009, China introduced a program to stabilize the hog market by stockpiling frozen pork and subsidizing sows in order to prevent cyclical fluctuations in production and prices. Cycles nevertheless continued. Ministry of Agriculture data reported that sow inventories dropped 13% during 2014 after a sustained expansion during 2011-2012. The pork program could not alleviate depressed hog prices during 2014, and some industry reports even said freezers were already filled with carcasses.

China's commitment to free trade in agriculture may be tested as officials find themselves hemmed in by downward pressure on domestic prices, excessive stockpiles, and relatively low barriers to imports. In 2015, Chinese officials say their policy support for agriculture faces "two ceilings and one floor" (*Economic Daily*, 2015). The "floor" is rising production costs which reduce net margins for producers. Domestic prices cannot be raised further above the "ceiling" of international prices—support prices were held steady during 2014, after five years of increases. Soybean and cotton price supports were abandoned, and authorities are experimenting with direct subsidies for these commodities to replace price supports. This policy change is constrained by a second "ceiling": officials say the country's farm subsidies have already reached the 8.5% limit on "amber box" measures prescribed by WTO commitments. As of 2014, China had only notified its domestic support to WTO through 2008, but support has increased rapidly since then (Gale, 2013).

Prepare For Multiple Future Scenarios

Chinese officials say that they take their WTO commitments seriously and aspire to influence the rules for international trade through participation in such international organizations (Niu, 2011; Caixin Net, 2015). They designed their domestic support policies to conform to WTO requirements, and Chinese authorities have refused some demands from soybean, sugar, and distilling industries for antidumping and countervailing duties. However, practices like tight controls over TRQ distribution, opaque and lengthy approval processes for genetically modified crops, and uneven application of inspection and quarantine regulations seem to skirt the rules and add uncertainty to trade. China's future paths for domestic support, food safety regulation, and its approach to producing and importing genetically modified crops are also uncertain.

China's engagement with the global market is related to a wide range of domestic institutional reforms now underway to reduce barriers to rural-urban migration, improve banking services for agriculture, promote rural land markets, and strengthen mechanisms for innovation in agricultural science and technology. The need for such reforms has been recognized for many years (Lohmar et al., 2009), and the decision to finally move forward on such reforms appears to have been spurred by food security concerns and eroding international competitiveness. Chinese officials say new initiatives to increase the scale of farms are intended to raise productivity in order to improve the competitiveness of farms (Caixin Net, 2015). The reform push suggests that Chinese leaders do not intend to shelter uncompetitive small-scale farms behind a barrier of protection as several other East Asian countries have done (Otsuka, 2013).

China is pursuing free trade agreements and encouraging outbound investment in agricultural processing, logistics, and farming to secure supply chains for imported commodities. The outcome of these initiatives and their impacts are all uncertain. Moreover, a financial crisis or the onset of deflation could reverse the rapid growth in rural wages, land rents, and nominal currency appreciation that contributed to rapid growth in Chinese commodity prices in recent years. Just as an unanticipated decline in global agricultural prices created China's "two ceilings and one floor" quandary, a rebound in global prices could improve China's competitive position.

Farmers and leaders in business and government worldwide are trying to anticipate China's future role in agricultural trade. While extrapolating past trends is the easiest way to forecast the future, observers should prepare for a variety of possible scenarios. China is in a critical period where extrapolation of past trends may no longer be valid. China's agricultural imports could continue growing (or even accelerate) if economic growth is sustained and officials reduce their intervention. Conversely, permanently slower economic growth or reversal of reforms could slow agricultural imports. Therefore, monitoring production, consumption, trade, and policy in China may be more important than ever.

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