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# Development of China's Feed Industry and Demand for Imported Commodities

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## Abstract

China's commercial feed industry plays a critical role in supporting growth of the country's livestock sector and creating export opportunities for other countries. The feed industry's need for raw materials has been key to lowering China's barriers to agricultural imports. China is now the world's leading importer of soybeans, rapeseed, distillers' grains, sorghum, barley, and fish meal. The feed industry drives demand for each of these commodities, all of which are quota-free with low tariffs. China's feed industry was launched in the 1970s with strong government support and foreign investment, but it is now composed mainly of private companies, including some of the largest in the world. As the industry matures and consolidates, Chinese companies will become more active in international markets by procuring raw materials, setting up feed mills overseas, and even producing meat and dairy products in other countries. This trend creates more demand for U.S. commodities and relieves pressure on China's scarce land and water resources.

**Keywords:** China, feed industry, corn, soybean meal, imports, trade policy

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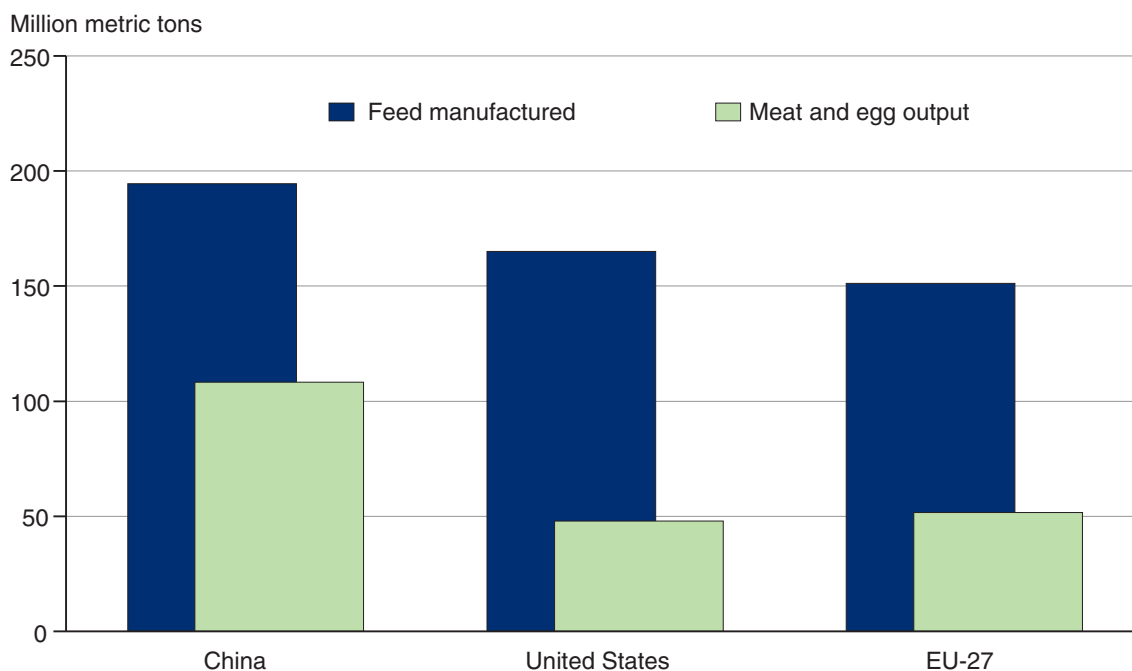
# Development of China's Feed Industry and Demand for Imported Commodities

## Introduction

China's demand for feed ingredients to support its growing production and consumption of animal protein has several consequences for global agricultural markets. During 2014/15, China was the world's leading importer of soybeans, rapeseed, distillers' grains, sorghum, barley, and fish meal, all of which are used directly or indirectly as animal feed. Corn—also used predominantly for animal feed—has surpassed wheat and rice to become China's largest single crop. China is also a top producer and consumer of feed additives like lysine.

After nearly four decades of transitioning from a largely plant-based diet toward greater meat consumption, China is now the world's largest producer of livestock products and has also emerged as the largest manufacturer of animal feed (fig. 1). Although government officials played an important role in launching China's feed industry, the country's emergence as the world's largest feed producer reflects the expansion of privately owned companies.

Figure 1  
**Manufactured feed output, 2012**



Source: USDA, Economic Research Service analysis of data from China, U.S., and European Union (EU) feed industry associations, and United Nations Food and Agriculture Organization.

China's growing demand for animal feed in the 1980s and 1990s signaled export opportunities for other countries (Crook, 1988; Crook and Colby, 1996). China's demand for feeds, meat, and dairy remains attractive for U.S. and other exporters (Hansen and Gale, 2014; Lohmar, 2015; Gale et al., 2015). China's commercial feed-milling industry serves as an intermediary, matching the demands of livestock producers with feed supplies.

This report reviews the growth of China's feed industry since its inception in the 1970s, its demand for raw materials, and its influence on lowering barriers to agricultural imports. As the feed industry grows and matures along with China's broader economy, it continues to help identify new sources of feed and to influence foreign trade policies.

# Overview of China's Feed Industry Growth

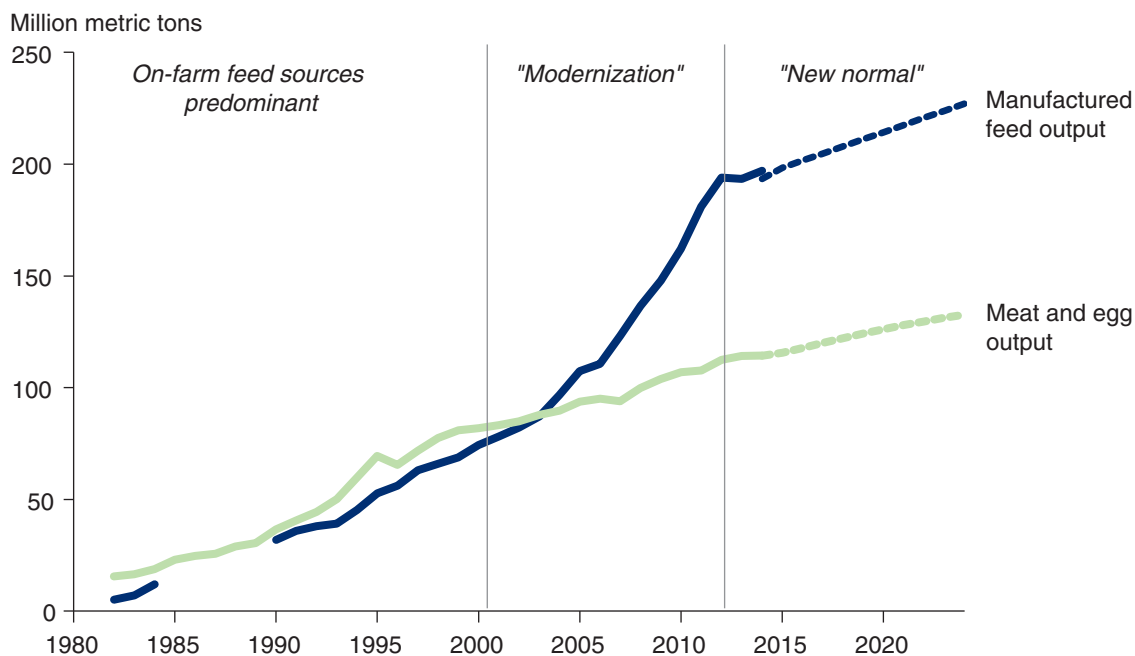
According to the United Nations Food and Agriculture Organization (2014), China is the world's largest consumer of feed ingredients, accounting for one-fifth of the total. China's commercial feed output of 194 million metric tons (mmt) in 2012 outpaced U.S. and EU feed industries. A private industry survey also estimated that China's feed output was the world's largest (Allaboutfeed.net, 2012).

China's manufactured feed output grew from just 5 mmt in 1982 to 198 mmt in 2014 (fig. 2). The industry's growth paralleled that of meat and egg production, which grew from about 15 mmt annually in the early 1980s to 114 mmt in 2014. Commercial feed output grew especially fast during the 2000s as it displaced traditional onfarm feed sources. Projections by China's Ministry of Agriculture anticipate that feed industry output and animal protein production will grow more moderately (1.5 percent annually) during 2014-24 (China Ministry of Agriculture, 2015c).

## 1970s-80s: Government Launches Feed Industry

China's use of animal feed has grown and evolved over four decades in parallel with the country's development and reform (table 1). The Chinese Government constructed the country's first modern feed mills during the 1970s by importing equipment from Eastern Europe. At that time, China's economy was under strict central planning. Feed production was limited to a few mills until broader economic reforms began in 1978. That year, China's central leadership first endorsed livestock production as a priority at a meeting where broader market-oriented reforms were announced.

Figure 2  
**China's feed, meat, and egg output, 1982-2024**



Note: There is no feed data for 1984-1989. Data for 2015-24 are projections by China's Ministry of Agriculture.  
Source: USDA, Economic Research Service analysis of data from China National Bureau of Statistics, China Feed Industry Association, and Ministry of Agriculture (2015).

Table 1 <b>Highlights of China's feed industry development</b>	
1974-75	First modern feed mills were constructed in Beijing and Shanghai.
1978	The Commerce Ministry set up a Feed Bureau and built 143 mills by 1980. Agricultural departments, industry bureaus, and rural townships built mills as well.
1979	Feed-milling and livestock ventures by Charoen Pokphand (known in China as Zhengda) and Continental Grain were the first foreign companies permitted to operate in China.
1982	Leader Deng Xiaoping endorsed feed-milling as a key industry.
1984	The Government drafted a plan to expand feed industry production capacity to 100 mmt by 2000. Support measures included exemptions from value added tax and business tax, earmarked bank loans, reduced tariffs on raw materials, imports of equipment, and subsidies. Authorities budgeted 1.5 billion yuan for feed industry support during the seventh Five-Year Plan.
1989	The Government's "vegetable basket project" initiative charged municipal authorities with developing meat and feed production to supply cities.
1990s	Privately owned feed mills expanded as the domestic grain market was liberalized.
1995	Tariffs were cut for imports of soybean meal, fish meal, and distillers dried grains, and imports were exempted from quotas and value added tax.
2001	WTO accession stimulated a wave of feed industry investment and lowered import barriers and restrictions on interregional trade and investment. Soybean tariffs were set at 3 percent with no import quota, while grains had tariff rate quotas.
2005	New Hope Group acquired a controlling interest in Liuhe Group, the most prominent in a wave of mergers and acquisitions.
2006-10	A renewed push for livestock industry modernization under the 11th Five-Year Plan prompted greater use of manufactured feed.
2007-14	A surge in pork prices and disease prompted more government support and private investment in swine production projects that included plans to supply feed to producers.
2011-12	Abuse of feed additives and hormones on swine and poultry farms alleged by Chinese news media increased pressure to increase vertical integration and coordination of livestock and feed production.
2013-14	Feed industry growth stalled with slower economic growth, H7N9 outbreaks, stricter regulations, and an anticorruption campaign.
2014	The Ministry of Agriculture reported closing 30 percent of feed enterprises after a re-licensing campaign.
Source: Compiled by USDA, Economic Research Service from Hsu and Crook (2000), "China's Feed Manufacturing Industry is Booming," <i>China Situation and Outlook Series</i> , WRS-99-4, USDA, Economic Research Service, and Chinese documents.	

Support for launching the feed industry was driven by a perceived conflict between dietary change and food security. On one hand, government leaders anticipated greater consumption of animal protein, exemplified by Premier Hu Yaobang's long-term strategy to alter the nation's diet by producing and consuming more meat and milk (China Ministry of Agriculture, 1985). At the same time, officials worried that using grain for animal feed would draw resources away from production of staple foods, thus threatening food security. Leaders believed feed mills would help address this problem by transforming raw materials into animal protein more efficiently.

In 1979, two feed companies became the first foreign ventures allowed in China, a reflection of the priority placed on the feed industry by China's political leaders. In 1980, a meeting of technical experts was convened to develop strategies for expanding the livestock industry (China Ministry of Agriculture, 1980). In 1982, Deng Xiaoping—China's preeminent leader at the time—endorsed feed-milling as a priority industry. In 1984, China's State Council formulated a strategic plan for the feed industry's growth through 2000.

Government support was instrumental to the industry's launch during the 1980s (Hsu and Crook, 2000). Government ministries and bureaus were ordered to set up feed mills. The 1984 plan called for tax waivers, low tariffs, and special allocations of foreign exchange to encourage imports of feed-milling machinery and equipment. The plan called for utilizing nongrain feed resources, pasture, and marginal lands to support livestock, but it also recommended lowering tariffs on imports of feed ingredients with high protein content, which were scarce in China.

## 1980s-90s: Backyard Producers Use Local Feedstuffs

The first feed mills served mainly state-owned farms on the outskirts of cities, a relatively narrow segment of China's livestock production. During the 1980s, village-based mills multiplied as small-scale family-based livestock production became the main driver of growth in livestock production after production, prices, and sales of meat and eggs were liberalized.

Until the 1990s, "backyard" livestock producers used surplus labor to gather and prepare feed materials and food scraps with minimal cash outlay. Animals were widely dispersed in small pens and sheds. China's 1996 agricultural census found that 70 percent of all agricultural households raised swine, with an average of two animals per household (China National Bureau of Statistics, 2000). Livestock output outpaced commercial feed production, as backyard producers used mainly onfarm feed materials.

In 1995, China liberalized imports of nongrain feed materials by cutting tariffs, waiving value-added taxes, and eliminating import quotas for soybean meal, meal from other oilseeds, fish meal, distillers dried grains, bone meal, brans and husks of grains, byproducts of sugar and starch processing, and pulp or dregs from winemaking. These measures were followed up with a tariff cut and elimination of import quotas on soybean imports in 1998/99.<sup>1</sup> These steps were critical to increasing the supply of raw materials for the feed industry.

The Government's role in the industry declined as a liberalization of China's domestic grain market during the 1990s led to privatization of many feed mills. The number of feed mills rose from 9,000 to over 13,000 during 1991-96 as rural collectives and entrepreneurs started small mills using crude equipment and locally available raw materials (Hsu and Crook, 2000). The government continued to issue Five-Year Plans for the industry, but direct government involvement and support measures were curtailed.

## 2000s: Livestock "Modernization" Accelerates

In the 2000s, the development of the feed industry helped transform livestock production into a more commercialized and specialized activity. Commercial livestock producers prioritize rapid

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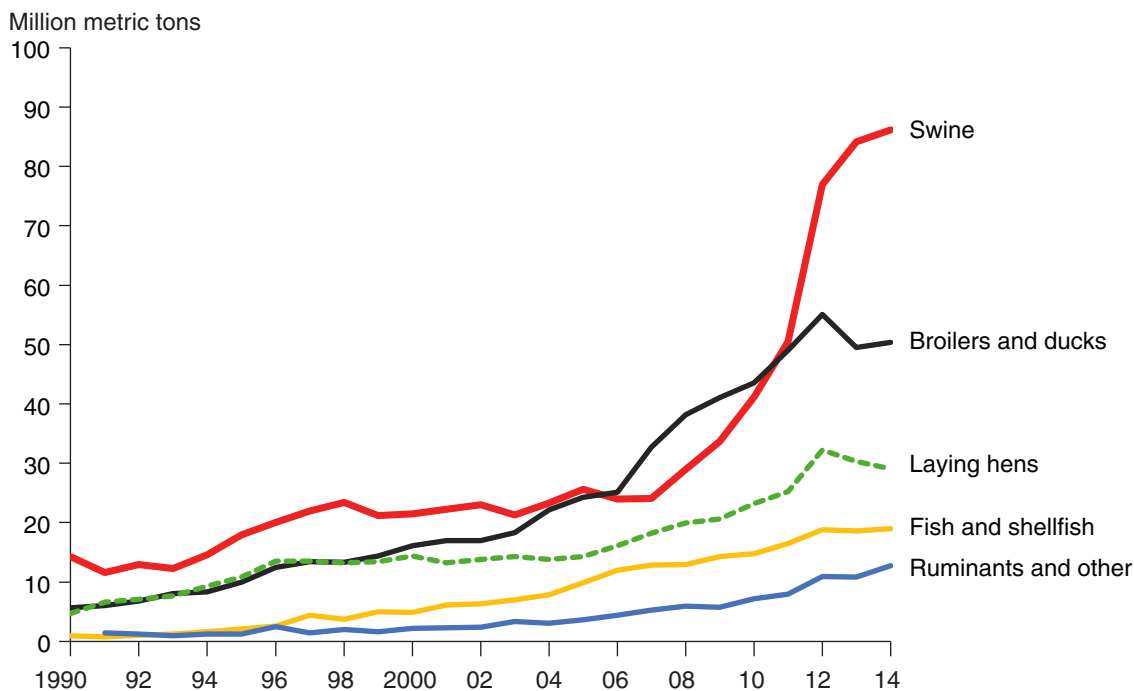
<sup>1</sup>The VAT exemption for soybean meal imports was withdrawn in 1998 to increase the incentive to import unprocessed soybeans.

weight gain of animals more than backyard producers do and are more willing to pay for commercially mixed feeds. With this transformation, feed companies expanded regionally and nationally. Large feed companies offered services and advice to farmers, and some experimented with a “company + household” model that recruited livestock growers, supplied them with feed and piglets or chicks, and promised to buy the mature animals.

China’s 2005-10 Five-Year Plan accelerated “modernization” of the livestock sector. Prompted by ongoing concerns about animal disease, food safety, and uneven quality of meat and dairy products, the “modernization” campaign introduced subsidies for constructing larger scale farms; acquiring improved breeding stock; and establishing breeding farms, artificial insemination, and mandatory vaccinations. Many county and provincial officials coordinated livestock industry investment projects by encouraging processors of feed, meat, and other agricultural products to use the “company + household” model, which included backyard producers as well as large-scale breeding farms, feed mills, and slaughter plants.

A surge in complete, formulated feed output for swine after 2007 reflects the emphasis of the livestock modernization campaign on hog production and substitution of commercial feed for locally procured materials (fig. 3). Feed produced for poultry grew more steadily from 1990 to 2012 as feed companies promoted vertical coordination in poultry production beginning in the 1990s. Feed production for egg-laying poultry, aquaculture, cattle, and sheep also grew rapidly during 2004-2012.

Figure 3  
**China's complete, formulated feed produced for each type of livestock**



Source: USDA, Economic Research Service analysis of data from China Feed Industry Association.

## 2013-15: “New Normal” of Slower Growth, Consolidation

During 2013-15, China’s rapid growth in feed production slowed abruptly, mirroring the slower growth in the Chinese economy. Anticipating the slowdown, some feed industry assessments had suggested that feed industry growth would slow as demand grew saturated (Fang, 2011). Feed manufacturing output declined for the first time ever in 2013, marking a new phase in the industry, characterized by slower growth and consolidation.

During 2013-15, growth in consumption of meat and other products—having already fallen with the slow economy—declined further amid a campaign to curb banquets, travel, and wasteful consumption by government officials. The campaign led to the closure or downsizing of foodservice establishments and special dining rooms for officials. Avian influenza outbreaks during 2013 and 2014 temporarily reduced consumption of poultry and eggs. Poultry feed was the main component of the decline in overall feed output during 2013. During 2015, a decline in pork output slowed the demand for feed. China’s National Bureau of Statistics reported a 4.9-percent contraction in pork output during the first half of 2015.

Another feature of the “new normal” involved stricter and more standardized enforcement of regulations on food and feed safety, environmental protection, and control of animal disease. China’s Ministry of Agriculture (2015a) reported withdrawing the business licenses of 30 percent of feed mills during a 2014 relicensing campaign prompted by concerns about feed safety and quality. A widely publicized incidence of pig carcasses in Shanghai’s Huangpu River during 2013 prompted officials to enforce regulations banning swine farms near human settlements, roads, waterways, and markets. Food safety concerns prompted some meat and feed companies to adopt vertically integrated business models to gain more control over supply chains and bolster consumer confidence in their products.

## Future Growth

China’s feed industry is expected to resume a more moderate pace of growth in coming years. Urbanization, which raises living standards, will propel growth in consumption of animal protein. Growth and modernization of the livestock and aquaculture sectors will support use of commercial feeds. China’s Minister of Agriculture predicted further growth in meat output from 2016 to 2020 and called for an accelerated transition from backyard to “above-scale” farms with closer ties to processing companies (China Ministry of Agriculture, 2015b).<sup>2</sup> The Minister noted that above-scale farms are already predominant in the egg industry and called for raising the hog sector’s share of above-scale farm production to 52 percent by 2020 (fig. 4). The share of dairy production attributed to above-scale farms rose from just 11 percent of dairy production in 2005 to 45 percent in 2014 and is expected to rise further to 60 percent by 2020. China’s use of commercial feed for cattle and sheep is relatively modest, but it may grow rapidly as these subsectors adopt more commercial modes of production.

Assessments of growth in feed demand moderated as current market conditions changed. Studies by Chinese research institutes during 2011-2012 predicted rapid growth in demand for corn that would result in rising imports (Xi and Yang, 2013; Ni, 2013; Han, 2014).<sup>3</sup> However, feed

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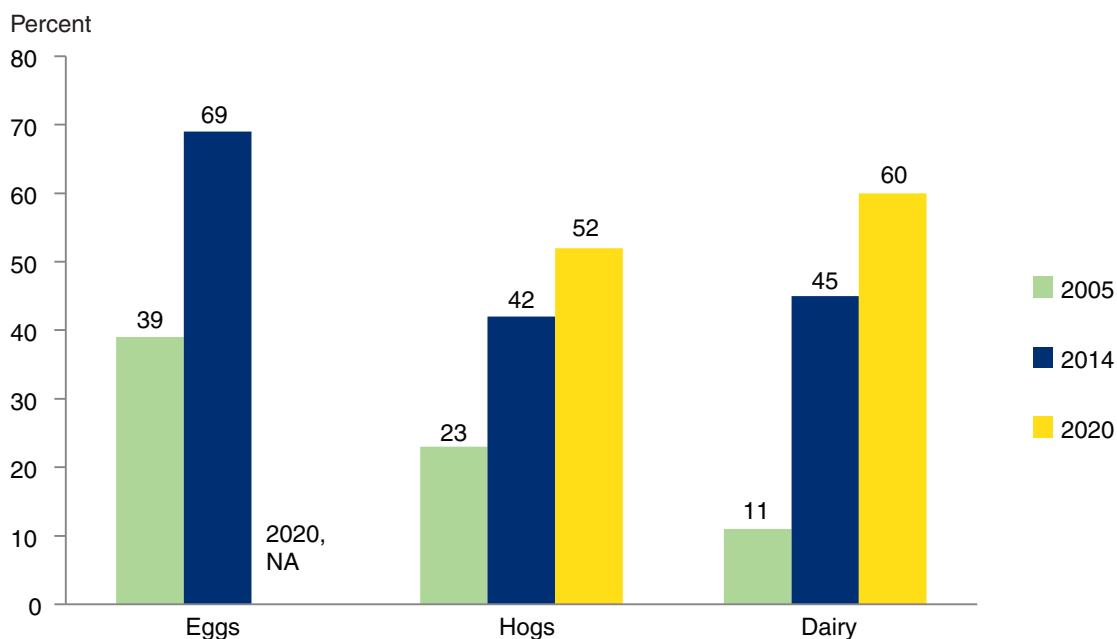
<sup>2</sup>“Above-scale” is defined by the Ministry of Agriculture as farms slaughtering 500 hogs annually, or those with an inventory of 100 dairy cows or 10,000 laying hens.

<sup>3</sup>These studies were conducted during 2011-12 although they were published in 2013-14.



production slowed abruptly soon after these reports were written. Recent projections by the China Ministry of Agriculture (2015c) projected 1.5-percent annual growth in the country’s feed industry output for 2014-24, much slower than the 8- to 10-percent growth during the previous decade. As output growth slows, the feed industry may consolidate into fewer, larger companies with more vertical integration, increased collaboration among companies, improved products, and better customer service.

Figure 4  
**Livestock share of production from "above-scale" farms**



Note: "Above-scale" refers to farms raising 10,000 laying hens or 100 head of dairy cattle or slaughtering 500 or more hogs per year. China Ministry of Agriculture estimated the 2020 share.  
 Source: China Ministry of Agriculture, 2015b.

## Competition and Consolidation

While government ministries and foreign investment were key in the early development of China's feed industry, the industry has become more diverse as other sources of financing became available. Data on feed companies from China's economic censuses for 2004, 2008, and 2013 show that the role of state investment and foreign capital has declined, feed companies have gradually increased their reliance on debt, and most equity comes from individual or company investment.

The number of above-scale feed enterprises (with annual sales of 5 million yuan or more—about \$800,000) counted by the censuses increased and their combined value of assets grew (in nominal terms) from 57 billion yuan to 337 billion yuan from 2004 to 2013. The economic census data indicate that debt financed about two-thirds of assets in 2004 and 2008, and the debt share rose to over 70 percent in 2013 (fig. 5). In 2004, individual investment, company investment, and foreign capital accounted for roughly equal shares of equity. Most equity investment over the following decade came from retained earnings and other company investment—their shares of investment increased while foreign capital's share declined.<sup>4</sup> State investment accounted for a small share of feed industry financing in 2004, and its share fell further by 2013. (The government's share of investment in the feed industry was far below the average for all sectors reported by the economic census.<sup>5</sup>)

In recent years, Chinese feed companies grew to become some of the world's largest. A compilation of data by *Feed International* listed 23 Chinese companies among the top 101 in the world (Roembke, 2015). Large companies are building modern mills, aggressively expanding the scale and geographic scope of their operations, and experimenting with new products, raw materials, and sales channels.

As large companies expanded, many small mills remained in the industry. According to China Feed Industry Association statistics, China still had 10,113 feed-milling enterprises in 2013, nearly three times the 3,804 “above scale” feed industry enterprises reported by the economic census that year. The top 10 companies accounted for just 36 percent of output.<sup>6</sup> China Feed Industry Association (2014a) estimated that five of the largest companies utilized roughly half their capacity that year. Commentators have long cited chronic problems of excess capacity, crude equipment, and low-quality products in the feed industry overall, that reflect the large number of small mills (Zhang, 2006; Fang, 2011).

The Chinese Government's 2011-15 Five-Year Plan for the feed industry called for transforming China from a “big feed country” to a “strong feed country” by reducing the number of small mills with outmoded facilities. The Ministry of Agriculture's feed mill relicensing campaign during 2014 was ostensibly aimed at improving the safety and quality of feed, but it meshed with the objective

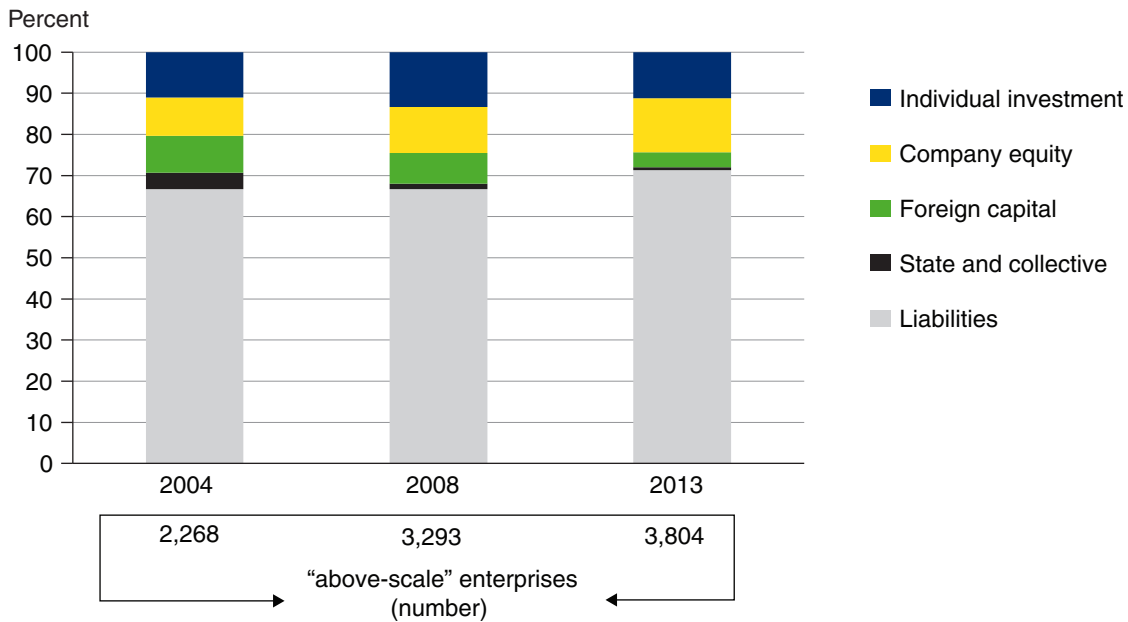
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<sup>4</sup>The chart understates the share of investment from individuals. The data represent 3,293 above-scale enterprises; they exclude over 8,000 small enterprises, which are predominantly financed by individuals.

<sup>5</sup>Despite the small share of state investment, the feed industry includes one prominent state-owned company. COFCO, China's largest agribusiness conglomerate, accounts for a large share of China's imports of feed ingredients, and it has a large feed-milling division.

<sup>6</sup>The 2008 economic census counted nearly 12,000 feed enterprises, but only 10 percent said they had been established before 1996.

Figure 5  
**China feed industry sources of financing, 2004-13**



Note: Chart shows proportions of aggregate paid-in capital and total liabilities for “above-scale” feed enterprises—that is, with sales of 5 million yuan or more. “Foreign” includes Taiwan, Hong Kong, and Macau.  
 Source: USDA, Economic Research Service analysis of data from China National Bureau of Statistics, Economic Censuses 2004, 2008, and 2013.

of eliminating excess capacity by closing mills that lack modern equipment, quality control, and testing capacity.

In the “new normal” era of slower overall growth in the market, companies are using various strategies to gain market share. Feed producers seek to gain larger, more stable profits by forward-integrating into livestock production (Fang, 2011). Food safety, animal disease concerns, and demands for traceability add impetus to the vertical-integration strategy. Some companies seek to transform themselves from “feed companies” to “food companies” by supplying branded meat products to supermarkets and company-operated specialty shops (China Feed Industry Association, 2014b). The largest companies are experimenting with business models that include selling feed online and providing technical advice and credit to farmers (China Securities News, 2015).

## Corn and Soybean Meal Are Chief Raw Materials

The supply of raw materials has long been a critical concern for the feed and livestock industries in China. During the 1980s, Chinese handbooks for raising swine recommended a variety of grains, brans, hulls, beans, vines, vegetables, silkworm cocoons, and the byproducts of distilleries for feed. These feeds require minimal cash outlay, but animals grow slowly, and their health and productivity depend on local availability of feedstuffs.

In the early 1980s, Chinese officials estimated that commercial feed accounted for just 10 percent of feed consumed by livestock. (See box, “Three Main Commercial Feed Products in China.”) Sichuan Province officials told Crook (1994) that 20 percent of their Province’s feed came from complete, formulated feed while 80 percent was mixed on-farm using corn, sweet potatoes, and other ingredients. Surveys of swine farms in four Provinces during 2000-01 found that the proportion of commercially mixed feed varied widely from 7 percent in Sichuan Province to 50 percent in Zhejiang Province (Zhou et al., 2003a). Several years later, Zhang (2006) estimated that commercial feed constituted 30 percent of feed consumed. One recent survey of villages found that 30 percent of hog producers used complete feed (Wang and Zhang, 2012). A survey by the Center for Chinese Agricultural Policy found that complete and concentrate feed accounted for more than half of feed used by hog producers (Lohmar, 2015).<sup>7</sup>

The rising use of commercial feed in China has contributed to growth in use of corn and protein meals for livestock production, a trend observed worldwide (UN FAO, 2014). Commercial feed includes a variety of raw materials that can be altered depending on market conditions, but the predominant ingredients in China are corn and soybean meal. A statistical report compiled by China’s feed industry association indicated that the country’s feed mills consumed 187 mmt of raw materials during 2013. Corn accounted for more than half of the volume of materials used by feed mills (fig. 6). The feed mills reported using 34.7 mmt of soybean meal and 20 mmt of other high-protein meals from cottonseed, rapeseed, fish and other beans. The 12.9 mmt of “other” raw materials includes distillers dried grains and other byproducts of industrial processing.

### Three Main Commercial Feed Products in China

China’s feed industry association reports statistics on three broad categories of feed products (Hsu and Crook, 2000):

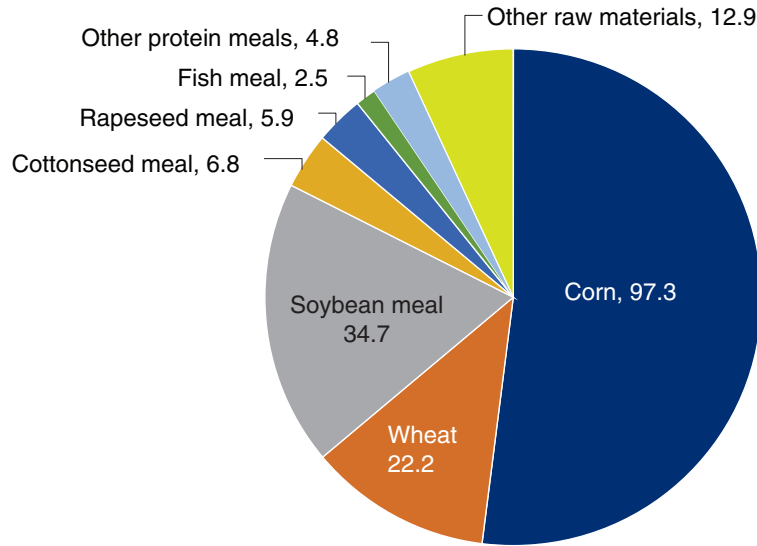
- Complete or compound feed (peihe siliao, output of 169 mmt in 2014) contains all the energy, protein, and other nutrients needed by animals.
- Premix feed and additives (yuhunhe siliao, tianjiaji, 6.4 mmt in 2014), comparable to premix feeds in the United States, contains vitamins, trace elements, and pharmaceuticals for mixing with grains and protein meals by small mills or farmers.
- Concentrate feed (nongsuo siliao, 21.5 mmt in 2014) is made by adding protein meals to premixes. It is often mixed on-farm with grain or other energy-type feeds.

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<sup>7</sup>Wang and Zhang’s sample was composed almost entirely of small farms selling fewer than 50 pigs annually. Farms included in the survey cited by Lohmar were somewhat larger in scale, but large company-operated farms seem to be under-represented in both surveys.

Figure 6

**Raw materials used by Chinese feed mills, 2013 (million metric tons)**



Source: Compiled by USDA, Economic Research Service from 2013 China Feed Industry Association statistical report, [www.chinafeed.org.cn](http://www.chinafeed.org.cn).

Most—but not all—feed grains and oilseed meals used in China appear to be consumed as products of commercial feed mills. A significant volume of grain is mixed and fed to livestock on-farm without passing through commercial mills, and an increasing number of large farms have their own milling facilities.<sup>8</sup> Estimates of the total volume of corn consumed as feed in China by various organizations for 2013/14 varied widely from 114 mmt to 150 mmt, but all exceeded the 97 mmt reported used by feed mills. Similarly, estimates of soybean meal consumption were over 50 mmt for 2013/14, significantly larger than the 34.7 mmt used by feed mills.<sup>9</sup>

### Policies Influence Use of Raw Materials

Official support for creation of a modern feed industry in the 1970s was motivated by concern about the adequacy of China’s raw material supplies to support the livestock industry. The possibility that a growing livestock industry would outstrip China’s grain supplies prompted Chinese officials to devise strategies to use byproducts and nongrain crops, to grow feeds on marginal lands, and to encourage farmers to use oilseed meals as feed instead of spreading them on fields as fertilizer (Yu and Liang, 1987). Government support for the feed industry in the 1980s aimed to increase the efficiency of producing animal protein from grain (China Ministry of Agriculture, 1991).

<sup>8</sup>The Center for Chinese Agricultural Policy survey found that complete feed and concentrate feed accounted for more than half of the feed used by hog producers, while grain, other energy feeds, and protein meals accounted for an additional 40 percent (Lohmar, 2015; fig. 1).

<sup>9</sup>Consumption of grains as feed is not directly measured by statistical surveys in any major country. Analysts estimate disappearance by constructing supply-demand balances using data on production, imports, exports, inventories, and statistics on industrial processing.

Other strategies to increase feed efficiency included importing more efficient livestock breeds and diversifying meat production to include more poultry.

Chinese officials told Crook (1996) that they became concerned about food security as grain production declined in some areas during 1993-94, prices rose sharply, and officials became alarmed by Lester Brown's book *Who Will Feed China?* The effect of feed demand on food security was a theme of a China State Council (1996) "white paper" that called for measures to maintain 95-percent self-sufficiency in grain as production of meat increased demand for feed grains. The paper called for curbing growth in feed use of grains by shifting meat production from pork to less grain-intensive animals like poultry, beef, and mutton and by using grasslands and crop byproducts to feed animals. The paper also recommended many measures to increase grain production by reclaiming land, boosting productivity, and intervening in markets to control grain prices.

The concerns about grain supplies spurred the mid-1990s lowering of import barriers for oilseed meals, fish meal, distillers dried grains, bone meal, brans and husks of grains, byproducts of sugar and starch processing, and pulp or dregs from winemaking. The targeted items were byproducts of grain processing, had high protein content, and supplemented domestic feed grains like corn that primarily supplied energy to livestock feeds. During 1995-96, tariffs were lowered to 5 percent; import quotas were eliminated; and imports were exempted from value-added tax (VAT) for this group of feed raw materials. Officials told Crook and colleagues (1998) that the VAT exemption for soybean meal imports was intended to support livestock farmers and feed mills.

The surge in soybean meal imports after the liberalization reduced profit margins for soybean processors in China. Smuggling of soybean oil—which had a higher tariff and was still assessed a VAT—also surged. In 1999, to address these problems, officials moved to encourage imports of soybeans for processing in China by restoring the VAT on imported soybean meal, eliminating quotas on imported soybeans, and cutting the soybean tariff to 3 percent (Hsu, 2001). After that, China's imports of soybeans grew from under 1 mmt in 1996/97 to over 70 mmt in 2013/14. Soybeans became China's largest agricultural import item.

Soybean meal represents about 70 percent of the unprocessed soybeans (by volume) that remain after extracting edible oil from them, and nearly all of that meal is consumed domestically as animal feed. The soybean meal content of China's soybean imports grew from 2.5 mmt in 1996 to over 50 mmt in 2014 (fig. 7).<sup>10</sup> The accelerated growth in soybean imports beginning in 2002 corresponds to the period of accelerated growth in feed output during 2002-12 (fig. 2). In contrast, China was a net exporter of corn until 2007. It became a net importer of corn in 2009, but imports have never exceeded 5 mmt annually. In the 2000s, China also began to import distillers dried grains, sorghum, and barley. (See box, "China Begins Importing Distillers Dried Grains," on page 15.)

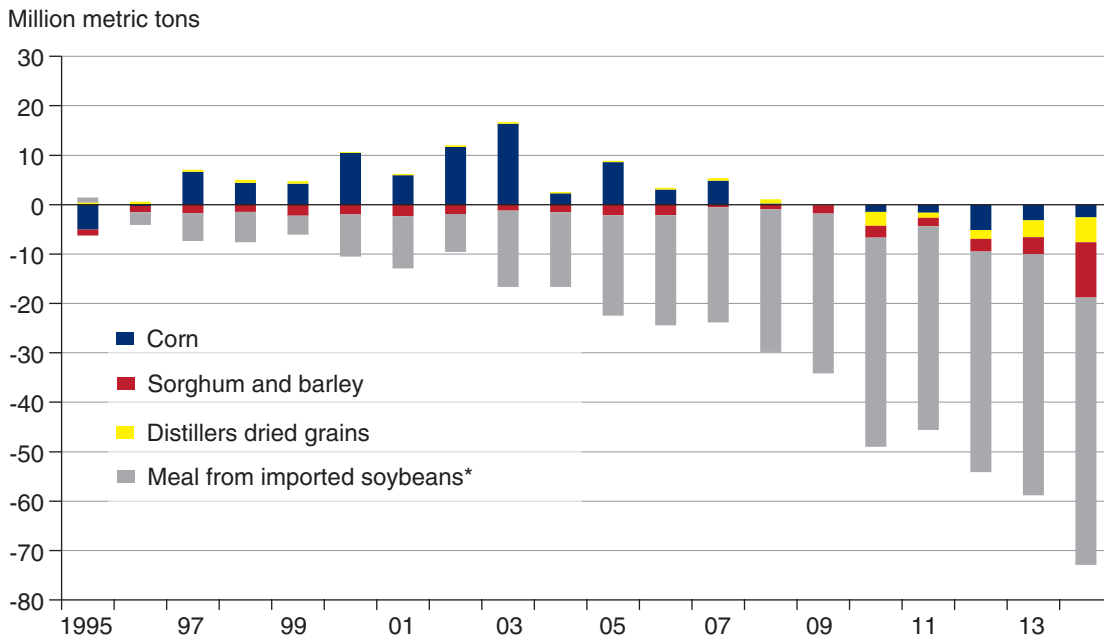
Prompted by the objective of self-sufficiency in grains, China's supply of corn for animal feed came almost entirely from domestic production. After joining the World Trade Organization in 2001, China retained quotas to limit corn imports and focused domestic policy support on corn and other cereal grains. An annual 7.2-mmt tariff rate quota for corn imports was established, but 60 percent of the quota was reserved for state trading companies. The remaining quota of 2.8 mmt was divided

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<sup>10</sup>This includes meal derived from imported soybeans plus imported soybean meal. China exports approximately 1 mmt of soybean meal in most years, but exports increased to 2 mmt in 2014. Note that China also has a smaller supply of soybean meal derived from domestic soybeans, but imported soybeans have accounted for all of the growth in soybean meal supply.

Figure 7

**China net trade in feed raw materials, 1995-2014**



\*Includes estimated meal derived from imported soybeans plus imported soybean meal.  
 Note: Net trade = exports – imports. Data are for calendar years.  
 Source: USDA, Economic Research Service analysis of Chinese Customs Statistics.

among thousands of private-sector applicants. Producers of corn and other grains received subsidy payments, and a price support program shielded producers from declines in corn price.

With consumption of feed growing faster than consumption of food grains, China’s corn output doubled from 2000 to 2013 (fig. 8). Production of corn surpassed that of wheat and rice, making it the country’s leading crop in 2012. In contrast, China’s domestic soybean output declined to under 12 mmt in 2013.

**Feed Mills Find Substitutes for Costly Domestic Corn**

During the “new normal” of 2013-15, China had surpluses of corn with downward pressure on prices, the opposite of what was predicted in earlier years. Despite the domestic surplus, Chinese feed mills encountering narrow profit margins imported significant volumes of feed ingredients that were cheaper than Chinese corn.

During 2008/09, Chinese authorities began to rely on price supports as the main policy to boost farmer income and bolster production incentives (Gale, 2013). That year, China introduced “temporary reserve” programs for corn, soybeans, and rapeseed to prevent sharp declines in prices by stockpiling the commodities when the market price fell below a floor price established by authorities.<sup>11</sup> During 2008/09, Chinese authorities stockpiled corn and soybeans to insulate farmers from steep drops in global prices. From 2009 to 2013, officials increased the support price each year to

<sup>11</sup>China introduced minimum price programs to stabilize rice and wheat prices in 2004 and 2006, respectively. Additionally, temporary reserve programs for these grains were initiated during 2008/09, but they were used sparingly except for wheat in Xinjiang Autonomous Region, which was not covered by the minimum price program.

## China Begins Importing Distillers Dried Grains

As U.S. production of corn-based ethanol expanded during the 2000s, Chinese feed companies began exploring the potential for importing its residual co-product—distillers dried grain with solubles (DDGS)—for use as a raw material.

A study evaluating potential demand for U.S. DDGS in China reported that a few feed processors and research institutes were experimenting with its use in duck and fish feed (Fabiosa et al., 2009). China has a long history of using co-products from distilleries as animal feed, but the U.S. product is reportedly of better, more consistent quality. Moreover, domestic DDGS—produced mainly in northeastern Provinces—are costly to transport to feed mills along China’s southern coast.

The Fabiosa study estimated that feed mills could reduce their costs 6 percent by substituting U.S. DDGS for part of the corn and soybean meal used in feed products. At the time, imports of DDGS were small, but the study estimated that China’s potential demand for imported U.S. DDGS was at least 3 million metric tons (mmt) annually.

During 2009, China began importing U.S. DDGS in significant volumes. Imports grew as rising prices for corn and other feed ingredients in China prompted Chinese millers and livestock producers to seek cheaper ingredients (Jewison and Gale, 2012). U.S. sales to China increased to 2.5 mmt in 2010, close to the potential demand estimated by Fabiosa et al. (2009). That year, China surpassed Mexico and Canada to become the leading U.S. export market for DDGS.

Sales of U.S. DDGS to China were curtailed during 2011 after China’s Commerce Ministry launched an anti-dumping investigation of the product that threatened to impose high duties. However, U.S. exports rebounded after the investigation was abandoned—partly in response to opposition from China’s feed industry (Jewison and Gale, 2012). U.S. DDGS exports rose to 4.4 mmt during 2013/14 as U.S. DDGS prices fell, and most shipments of U.S. corn were rejected by Chinese inspection and quarantine authorities after detecting an unapproved genetically modified variety.

assure farmers that they would be able to cover rising production costs. However, the stockpiling program was not used extensively during those years because market prices generally exceeded the support price.

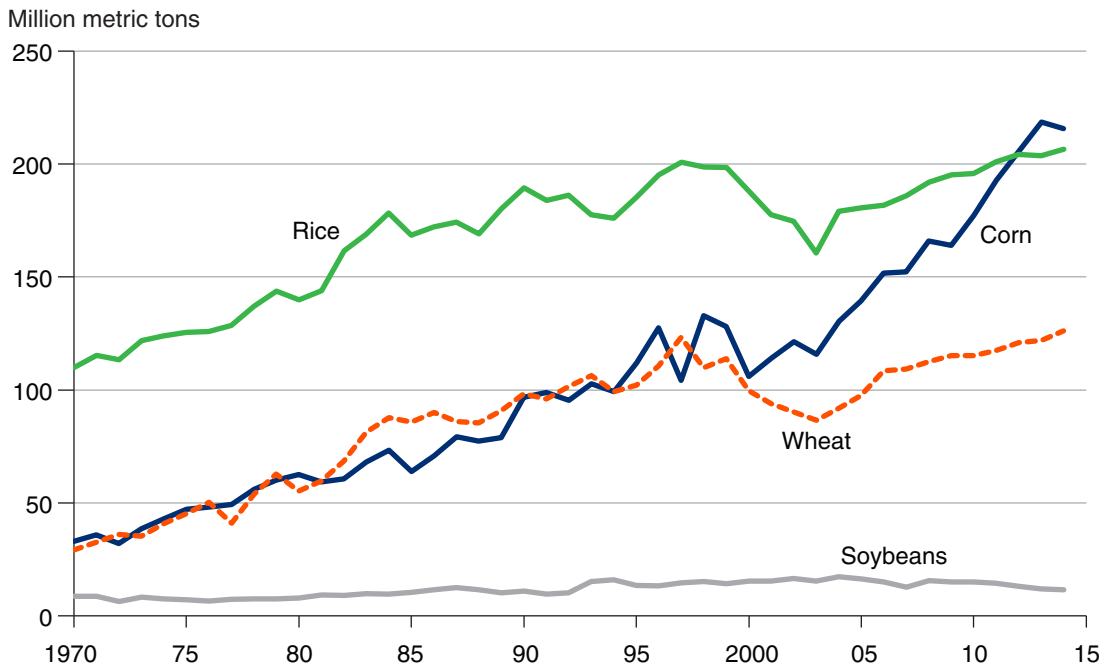
During 2013, global corn prices fell after both China and the United States had record corn harvests (fig. 9). U.S. corn prices fell sharply, but Chinese officials purchased 69 mmt from their corn harvest—about 30 percent of that year’s output—to prevent Chinese prices from falling below the support price. According to estimates by China’s Ministry of Agriculture, the price of imported corn fell 20 percent below the price of Chinese corn in August 2013, and a price gap of 15 to 35 percent persisted through mid 2015. The price difference gave feed mills and other corn users in China strong incentive to import corn, but imports were limited by the tariff-rate quota for corn. Officials further restricted imports beginning in November 2013, when inspection and quarantine officials began rejecting all corn shipments containing a genetically modified variety they had not approved.<sup>12</sup>

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<sup>12</sup>China’s inspection and quarantine authority reported that a combined 1.4 mmt of U.S. corn and DDGS were rejected during 2014.

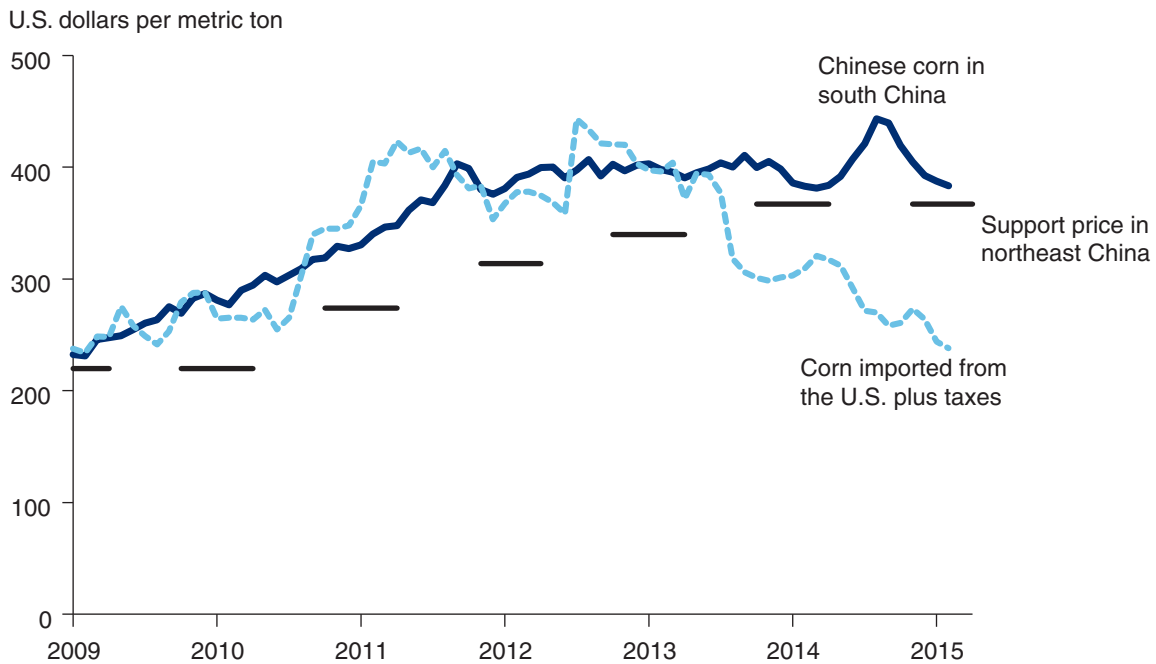


Figure 8  
**Corn became China's leading crop in 2012**



Note: Rice produced is unmilled.  
 Source: USDA, Economic Research Service analysis of data from China National Bureau of Statistics.

Figure 9  
**Monthly Chinese and U.S. corn prices, 2009-14**



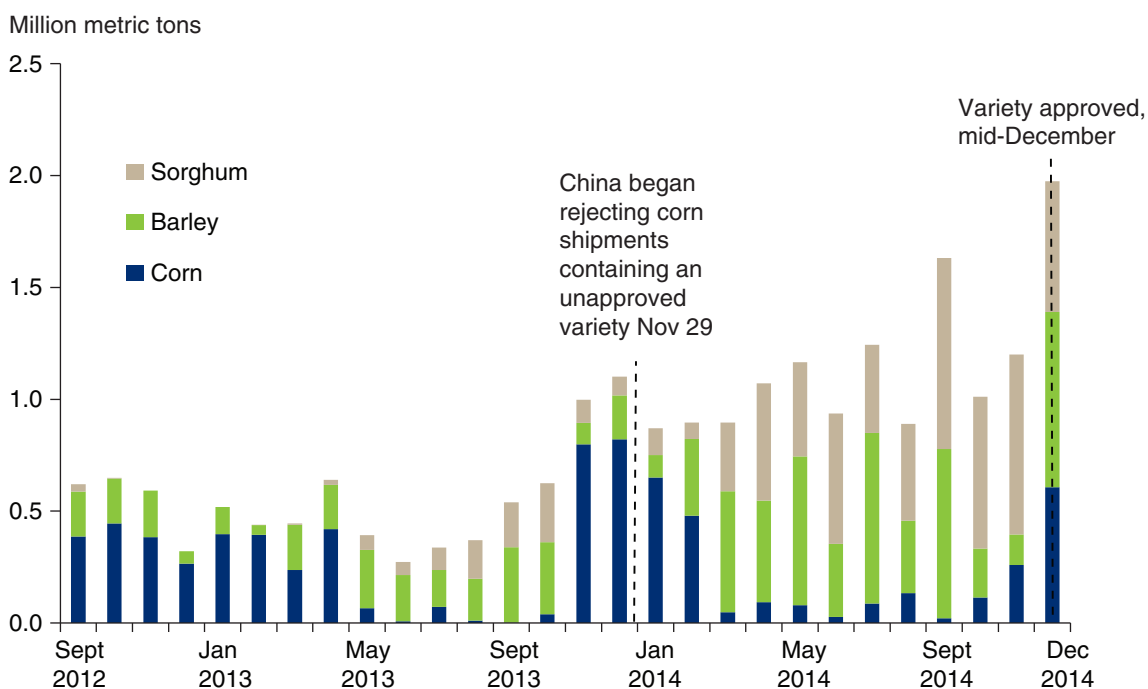
Source: USDA, Economic Research Service analysis of data from China National Grain and Oils Information Center, National Development and Reform Commission, and U.S. Grains Council.

When feed mills were unable to import sufficient corn during 2014, they increased their purchases of sorghum and barley as cheaper alternatives to domestic corn (fig. 10). After surging to 800,000 metric tons per month during November and December 2013, China’s corn imports fell to under 100,000 metric tons each month from March to October 2014. However, imports of sorghum and barley combined increased to an average of about 1 million metric tons monthly from March to December, 2014 as feed mills imported these grains to replace corn in their products. DDGS imports also increased during 2014, although some of those shipments were rejected as well.

The surge in imports of sorghum, barley, and DDGS reflects the ability of feed mills to find cheaper substitutes for Chinese corn in animal feed. (See box, “High Chinese Corn Prices Prompt Feed Mills To Import Sorghum.”) These imported feed ingredients were more than \$100 cheaper per metric ton than Chinese corn, and no quota restricted imports. The genetically modified corn variety was approved in December 2014, but imports of sorghum and barley remained robust in the early months of 2015.<sup>13</sup>

The substitution of imported materials further weakened demand for Chinese corn. With a record corn harvest in 2013 and a near-record output in 2014, China had a large surplus. The price support program purchased an even larger volume from the 2014/15 crop than it had purchased during 2013/14. Some observers estimated that corn reserves exceeded 150 mmt during 2015. (China does not reveal the size of its grain reserves.)

Figure 10  
**China's monthly imports of corn, sorghum, and barley**



Source: USDA, Economic Research Service analysis of China customs statistics.

<sup>13</sup>Although China’s corn imports rebounded during November-December 2014, most of the corn China imported in those months was non-genetically-modified corn from Ukraine.

## High Chinese Corn Prices Prompt Feed Mills To Import Sorghum

During early 2015, a group of Chinese futures market analysts visited dozens of feed mills and livestock producers in China's Guangdong Province to gauge market conditions (Meng and Chen, 2015). Their report described how companies and farmers responded to a price support policy that elevated the price of domestic ingredients.

The group reported that imported energy-type feed ingredients such as corn and sorghum were 12 to 15 percent cheaper than domestic corn after paying freight and duties. Feed mills reported cutting back on their use of domestic corn and wheat bran by substituting cheaper imported ingredients. One trader estimated that the volume of corn arriving in Guangdong from domestic production regions was down 50 percent from the previous year. As world corn prices fell below Chinese corn prices during the 2013/14 marketing year, feed mills in Guangdong sought to procure imported corn, but nearly all shipments of U.S. corn were rejected for containing unapproved genetically modified varieties during 2014.

Mills began using imported sorghum when imported corn was not available. At first, millers expressed concern that the sorghum might affect quality of the final feed product. They initially used sorghum to replace about 10 to 20 percent of domestic corn in their formulations. By 2015, some concerns remained about the effect of sorghum on the color of feed, but feed mills expressed stronger concerns about the quality of Chinese corn. In 2015, sorghum was commonly used to replace half of the corn in feed formulations. Some duck and pig farms had reportedly completely eliminated corn from their feed. The group reported that sorghum use was still in an exploratory stage.

During the 2014/15 marketing year, Chinese imports of corn from Ukraine surged, and the group learned that some feed mills were using Ukrainian corn to replace Chinese corn. Nevertheless, demand for imported sorghum remained strong. The group also found that imported barley was substituted for domestic wheat bran.

During 2014, Chinese officials acknowledged the problems created by price support programs. That year, the price supports for soybeans and cotton were eliminated and replaced, on a trial basis, with a "target price" deficiency payment subsidy for producers in the main production regions. During 2015, the rapeseed price support was eliminated, and the central government issued funds to provincial authorities, who could choose to give direct subsidies to farmers or to processors.

As the 2015 corn harvest approached, authorities announced a 10-percent reduction in the price support for corn in order to avoid accumulating an even larger stockpile and to reduce the difference in price between domestic corn and imported substitutes. Officials indicated that they intended to replace the "temporary reserve" stockpiling policy with a target price subsidy, although no firm plans were announced (*Economic Information Daily*, 2015).

## High Raw Material Costs Reshape Feed Industry

Raw materials account for 80 to 90 percent of feed millers' costs in China, so rising costs are influencing company strategies (China Feed Industry Association, 2014). Zhang (2006) observed that narrow profit margins make feed enterprises highly sensitive to variations in the cost of raw materials. Wang (2011) observed that feed companies in China respond to cost pressure by seeking alternative ingredients and by shifting feed-milling operations from coastal Provinces to grain-producing regions. Narrow or negative profit margins may alleviate excess capacity in the industry by prompting the exit of small feed mills (*China Feed Industry Information Net*, 2014).

Some companies appear to be raising prices by offering premium-priced feeds with special brands or attributes and offering more technical services to customers. Large feed company conglomerates hope to offset low feed profits with earnings from holdings in meat and food sectors, or unrelated industries like real estate, chemicals, and banking (Fu, 2011). Several companies are emphasizing their expansion into branded consumer products sold in supermarkets, company-operated specialty shops, and restaurant chains.

Although feed industry growth has slowed during the “new normal” period, most long-term assessments anticipate that China's feed industry will increase imports of raw materials as demand outstrips domestic feed supplies. USDA anticipates that feed will account for most of the growth in China's grain consumption over the next decade. China's feed use of grains will grow nearly 80 mmt from 2014 to 2024 (fig. 11). Other uses of grain—consumption directly as food or flour, industrial processing, and seed—are expected to grow less than 10 mmt over that period. The USDA projections expect feed to account for nearly half of grain use in China by 2024 and soybean meal consumption to continue as the chief source of protein for China's feed industry. Soybean meal consumption is projected to increase by 26 mmt during 2014-24 while consumption of other types of oilseed meals combined is forecast to rise by less than 3 mmt.

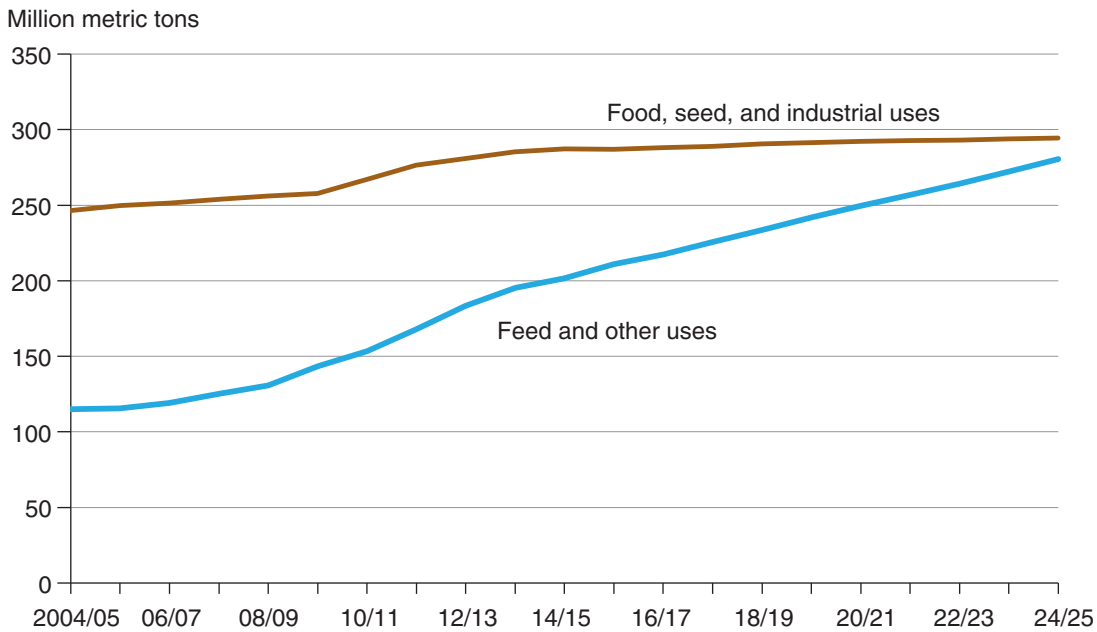
Feed's growing share in China's consumption of grains and oilseeds is expected to increase demand for imported soybeans and feed grains. USDA projects that China's soybean imports will increase by 33 mmt during 2014-24. Corn is expected to account for most of the increase in feed grain use, but much of the increased supply will come from further increases in domestic output and from drawing down large stockpiles of corn. China's corn imports (total, not only from the United States) are projected to increase from 2.5 mmt to 7.2 mmt during 2014-24. China is also projected to continue importing a combined total of over 10 mmt of sorghum and barley, much of it used for feed.

Chinese officials have adjusted their food security strategy based on similar projections that anticipate growing demand for imported feeds.<sup>14</sup> The State Council's Development Research Center advocated addressing the growing demand for feed grains by relaxing self-sufficiency objectives for feed grains and oilseeds, taking measures to insulate the Chinese market from global price fluctuations, and gaining control over the supply chain for imported commodities (Han, 2012; Han, 2014). China has added feed grain suppliers by reaching agreements to allow corn imports from Ukraine, Argentina, and Bulgaria and sorghum imports from Argentina. A free trade agreement signed in 2014 will eliminate Chinese tariffs on Australian sorghum and barley.

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<sup>14</sup>Gale et al. (2015) compare several import projections and discuss Chinese food security policies.

Figure 11  
**Estimated uses of grain in China, 2004-2024**



Note: "Other" includes residual grain that cannot be directly allocated to a specific category.  
 Source: U.S. Department of Agriculture, International Baseline Data, Long-Term Projections to 2024.  
<http://www.ers.usda.gov/data-products/international-baseline-data.aspx#52416>

The rising cost of feeds in China is also contributing to rising imports of livestock-based food products (Hansen and Gale, 2014). China's agreement with Australia will eventually phase out tariffs on imports of beef and dairy products, and China has reached agreements with several countries in Eastern Europe to import cattle, sheep, and pork. Many of China's overseas investments—including the purchase of Smithfield Foods by China's Shuanghui Group in 2013—are focused on meat and dairy production (Gooch and Gale, 2015). China's largest feed company, New Hope Group, has built feed mills in Vietnam and Russia, and it has acquired a beef operation in Australia (Fu, 2011). If the wide differential between Chinese and world feed grain prices persists, the potential cost savings from investing in feed-supply or meat production outside of China will make such investments even more attractive.

## Conclusion

China's feed industry plays a critical role in facilitating the country's emergence as a major consumer and producer of animal protein. With raw materials composing over 90 percent of costs, feed companies have strong incentives to explore new feedstuffs and procure them from the lowest-cost sources. Livestock producers all over China—traditionally constrained by local availability of feeds—now have access to feeds composed of materials procured all over the world.

As advocates for lower barriers to imports, feed companies contribute to forging closer integration between China's agricultural markets and global markets. The feed industry's need for high-protein feeds contributed to China's emergence as the leading soybean importer. More recently, the industry diversified the supply of energy-type feed ingredients by procuring imported distillers dried grains with solubles, sorghum, and barley. The anticipated need for feed grains has contributed to relaxing self-sufficiency requirements in China's revised national food security strategy, and may curb the use of trade barriers to protect Chinese grain and oilseed producers.

Feed companies will continue to facilitate changes in dietary and production structure in coming years by identifying new feeds and increasing the degree of vertical coordination in livestock production. Major feed companies are engaged with the production and processing of livestock products to varying degrees. This integration may grow further as companies consolidate and increase their scale and scope of operations.

As feed companies become engaged in livestock production and food manufacturing, some are exploring production of livestock overseas where production costs are lower. Some Chinese feed companies may establish operations in the United States or other countries where they have better access to raw materials. As raw material and production costs rise in China, feed companies may shift from procuring raw materials overseas to processing meat and dairy products in countries with lower feed costs.

This trend will increase Chinese demand for U.S. commodities and lower food costs for Chinese consumers by using feed resources closer to their origin. The trend will also relieve pressure on China's stressed land and water resources.

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