



## GRAIN AND SOYBEAN INDUSTRY DYNAMICS AND RAIL SERVICE

### Trends in Grain and Soybean Economics

#### EXECUTIVE SUMMARY

The logistics of grain and soybean production and distribution, especially in the North American western regions, is undergoing significant restructuring driven by the desire and need to achieve economies of scale and reach export markets where prices have been at historically high levels. This study examines the factors shaping the grain and soybean sector in terms of *market competition, demand and supply trends, and industry dynamics*. This includes the extent to which global market developments are leading to the restructuring underway in the North American production regions as producers seek to improve and leverage their global market competitiveness.

The motivation behind the study is to gain understanding of the factors affecting grain and soybean transportation. An exhaustive literature review reveals that agriculture transportation demand, and more specifically grain and soybean demand, depends on **global trade patterns, competition in production from other countries, commodity price fluctuations, competition from other products and industries, weather disruptions and climate, variations in annual crops sizes, and quality concerns**.

The study first considers the **drivers behind grain demand, supply and trade**, and the factors affecting **market competitiveness**. Accordingly, we identify **the major global players and associated historic trends**, and the United States' relative competitive position in international grain and soybean markets. Within this broader context, we examine in more detail **major trends in the U.S. grain industry**, along with insights into its interrelation with the transportation sector.

The main determinants of long-term grain and soybean **demand** include *population and economic growth*, as well as *government policies' impact on the biofuels market*. The role of *population trends* is revealed through a high positive correlation between population growth and soybean consumption in China, the largest global consumer of soybean. However, this is only one side of the equation; equally important is the *economic status* of the population. In China, the growth in Gross Domestic Product (GDP) impacts the demand for different types of grain or oilseed differently. In our data, wheat consumption in China was not highly correlated with GDP growth, and actually exhibited an inverse correlation for GDP values between \$1B and \$2B. As people's purchasing power increases, they often move away from consuming wheat to buying meat (and in turn corn and soybean used for animal feed). On the other hand, soybean and corn consumption in China were highly correlated with the country's GDP.

Aside from the economic environment, *government policies* can also influence consumption and demand patterns. For example, in the case of biofuels, the corn share used for ethanol jumped in the U.S. at the onset of the Energy Policy Act of 2005. The Act mandated that gasoline contain increasing amounts of ethanol, while the Energy Independence and Security Act of 2007 required gasoline producers to blend 15 billion gallons of ethanol into U.S. gasoline supply by 2015. Land farm planted corn acreage increased by 20% in the following year.

**Supply**, on the other hand, is determined by *technology, production costs and returns, price signals and weather and climate*. *Technology* is the most prominent determinant, highly discussed in genetically modified organisms (GMO) debates. It was also repeatedly brought up by producers our team interviewed in North Dakota. This report examined this factor through USDA data to observe that average corn yields in the United States grew by 36% since 1996, when the first applications of genetic engineering were introduced in the U.S. agriculture sector.

While technology can boost yield when producers decide to plant and produce more, the factors behind their decision to do so in the first place depend on *the interplay between production costs and price received* for their products, in other words, their profits. To that end, our work highlighted periods in the United States with high incentive to produce soybean based on profitability (post 2006) and an associated increase in soybean planting during that period. This study also analyzed *prices received by producers* through USDA data on soybean prices and production to conclude that: **(1)** price is a signal for production, **(2)** it is a lagged signal with an approximate period of two years between price signals and production responses and **(3)** the current price is more of a signal to producers than is the trend of prices over the past three years. Finally, factors external to both producers and markets, include the *weather and climate's* role in production volumes. The United States witnessed several droughts that damaged and destroyed crops. Weather in particular was widely brought up in discussions with stakeholders in North Dakota.

Aside from demand and supply drivers that determine grain and soybean market fundamentals, production and transportation are considered within a **global market competitiveness framework** as the U.S. is becoming increasingly export-oriented. In terms of **production**, the U.S. has historically consistently produced more than it consumed, generating sufficient surplus volumes to export grain and soybean after accounting for domestic demand and food security. However, U.S. producers are not cost-competitive in production relative to South American counterparts, in particular Brazil and Argentina, primarily due to the relatively higher cost (rent) of land in the United States.

However, what the U.S. lacks in production cost competitiveness, it finds in **transportation** system efficiency. Indeed, U.S. grain and soybean companies have lower total landed *costs* (i.e. total transportation cost and farm price) from farm to market than South American companies. In general, this can be attributed to an efficient and reliable domestic supply chain, but also more directly to innovations introduced by railroads to increase system throughput and reliability. Most notable in this regard is the introduction of shuttle trains that travel as a single entity from origin to destination without having to stop at classification yards. Aside from transportation costs, the U.S. supply chain's *reliability* gives a competitive edge to domestic producers in their relation with international customers, as was highlighted to the study by stakeholders in North Dakota and Minnesota.

Still, transportation systems in the United States are vulnerable to system disruptions due to, among other things, traffic growth and change in traffic mix. Those, as well as the direction of change in speed relative to changes in volumes should be closely monitored. These factors may contribute to capacity tightening that is reflected in bids in the secondary rail market. Such dynamics are typified in the rail service problems encountered in February to April 2014.

Examining country profiles for **major global players** and their historic **supply, demand and trade trends**, the *United States* is a top producer of corn and soybean, *China* is a major consumer of soybean and producer of wheat, the *European Union (EU)* is a top producer and consumer of wheat and *Brazil* is a major producer of soybean followed by *Argentina*. However, these ranks are not stable over time and relative standings vary somewhat from one year to the next depending on relative harvests and droughts, although the major players in the global market have tended to be the same in recent years.

In trade, the *United States* is the top exporter of corn and second largest top exporter of soybean, leaving the first place to *Brazil*. The *European Union (EU)* is a top exporter of wheat. Finally, *China* is undoubtedly the top importer of soybean, *Japan* of corn and *Egypt* of wheat. China's supply and consumption trends are particularly interesting as they highlight how China became completely soybean import-dependent post-2001, with balances varying between 10 and 70 million metric tons (MMT). This helps explain why China's trade share reached 50% in 2005, thus driving world soybeans trade since. It grew to approximately 65% in 2015. The *United States* is also a major grain and soybean trader with historical shares as high as 90% for soybean and 60% for grain. However, it has increasingly been losing market share for the past 20 years. In 2014, U.S. grain shares were as low as 30%. However, our data analysis from USDA forecasts shows that there remains a place for U.S. grain and soybean in the international markets in the next 10 years.

Our analysis shows that the *relative value of international soybean prices* to U.S. market prices can act as an incentive for U.S. producers to export rather than sell locally to maximize profits. Also, the desire to reach international markets should be complemented by a cost-effective domestic production and an efficient and reliable supply chain to allow the United States to reach those markets. This is why both producers and transportation providers restructure their operations to maximize efficiency and minimize costs. To that end, our analysis showed that the share of goods transported by rail for export increased after *shuttle trains* were introduced by U.S. rail companies. Finally, this study also showed that U.S. farmers substituted wheat planting by soybean planting at the onset of Chinese soybean demand, showing *high reactivity of U.S. producers to international demand*.

Although most of the discussion above highlighted that **(1)** the U.S. market is becoming increasingly export-oriented and **(2)** soybean is the major story from a global trade standpoint, the United States currently transports more grain and soybean domestically than for exports. Corn movement is dominant in this regard, with an increasingly large domestic market for locally-sourced corn, driving domestic product flows to ethanol plants.

For local production, our analysis shows that core production areas are well-established. For example, the Plains region has always planted and produced more soybean than any other region in the United States. What is less predictable, and highly dependent on most of the factors discussed in this summary is the annual production level within regions. An example is the number of acres planted in the Southwest

that decreased from 550,000 to 187,000 over the span of 7 years but recovered to more than 600,000 in 2015. These shifts reflect volatility due to cropping considerations and relative profitability among alternative crops as well as the impacts of climate and weather.

As part of the study, the team conducted fieldwork in Minnesota and North Dakota, visiting terminal elevator operations and meeting with key stakeholders across the grain supply chain, including grain trading and hedging activities. These stakeholders convey a **positive outlook** towards the railroads' communication with them and their commitment to resolve congestion problems through ongoing capital investment. Specific current and future concerns pertained to *train arrival and departure time, loading time, shuttle system throughput utilization, competition with other commodities* and *pricing*.

Throughout this report we examined the fundamental changes in global grain and soybean markets, providing context for the internal restructuring occurring in the United States. The trends witnessed over the past fifteen years show no sign of abating or changing course; as the global economy and population continue to grow, so will the need for food and in turn for grain and soybean. Furthermore, with growing global competitiveness and infrastructure improvements in competing countries, the ability of producers to scale up demand while maintaining cost competitiveness and quality will be essential. The introduction of shuttle trains as well as improvements in grain elevator operational capacity have placed the U.S. grain industry on an improved course, giving it a competitive edge over competitors in other parts of the world, particularly in South America. However, investment in transportation operations needs to continue because infrastructure improvements in competing producing countries could put the U.S. at a disadvantage. Addressing and mitigating these challenges while remaining competitive will be crucial for the U.S. to remain a major global player in the grain sector, with far-reaching implications for the domestic economy.