Summary

Railroads are critical to grain transportation. In 2015, U.S. Class I railroads originated 1.44 million carloads of grain (4.9 percent of total carloads) carrying 139.4 million tons (8.1 percent of total tons). Grain is also a key commodity for scores of short line and regional freight railroads. Railroads also haul large amounts of grain-related food products, such as soybean cake and meal, corn syrup, flour, prepared animal feed, and dried distillers grains.

Overview of Grain

The United States is the world’s top grain producer — average annual U.S. grain production from 2006 to 2015 was 542 million tons¹ — but what crops are grown, where, and in what quantities, and how, when, and to where they are transported, are determined by a complex interaction of factors. These factors include weather and soil conditions, but also a complicated interplay of many groups — including farmers, various transportation modes and providers, elevator operators, grain marketing companies, grain consumers large and small (both in the United States and abroad), as well as local, national, and foreign governments.

Most grain, of course, is grown to be eaten, most often by animals that are eventually eaten by humans (e.g., cows, pigs, and chickens) or by humans directly, and often after being processed in one way or another (wheat is milled into flour, soybeans are crushed to produce soybean oil and soybean meal, corn is milled to produce corn starch which is further processed to produce corn syrup, and so on).

Some aspects of the grain market are generally predictable — e.g., poultry farms in the southern United States will always need large amounts of grain for feed — but many aspects of the grain market are extremely volatile. For example, large fluctuations in grain production are common from one year to the next. From 2006 to 2015, U.S. grain production ranged from 468 million tons to 605 million tons, a 29 percent spread.

¹ Data on grain production and consumption come from the U.S. Department of Agriculture’s National Agricultural Statistics Service, especially its annual crop production summary reports, and/or from the USDA’s Economic Research Service’s periodic outlook reports for the various types of grain.
Moreover, the various types of grain have unique characteristics and are also marked by volatility. Corn, for example, is grown in large quantities in many different states, but mainly in the Midwest. It accounted for 65 percent of U.S. grain production, on average, from 2006 to 2015, but because the amount of corn produced can change drastically from year to year, the corn share varied from 62 percent to 68 percent and the volume produced varied by 103 million tons. Corn consumption patterns change too. In 2006, feed accounted for approximately 50 percent of U.S. corn consumption and ethanol 19 percent. In 2015, feed and ethanol both accounted for approximately 39 percent of corn consumption.

| U.S. Grain Production by Type of Grain: 2006-2015 (millions of tons) |
|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|
| Barley         | 4.4  | 5.1  | 5.8  | 5.5  | 4.4  | 3.8  | 5.3  | 5.3  | 4.4  | 5.2  |
| Corn           | 294.9| 365.1| 338.6| 366.6| 348.5| 346.1| 301.1| 387.2| 398.0| 380.8|
| Oats           | 1.5  | 1.4  | 1.4  | 1.5  | 1.3  | 0.9  | 1.0  | 1.0  | 1.1  | 1.4  |
| Rice           | 9.6  | 9.8  | 10.1 | 10.8 | 12.0 | 9.1  | 9.9  | 9.4  | 11.0 | 9.5  |
| Rye            | 0.2  | 0.2  | 0.2  | 0.2  | 0.2  | 0.2  | 0.2  | 0.2  | 0.2  | 0.3  |
| Sorghum        | 7.8  | 13.9 | 13.2 | 10.7 | 9.7  | 6.0  | 6.9  | 11.0 | 12.1 | 16.7 |
| Soybeans       | 95.9 | 80.3 | 89.0 | 100.8| 99.9 | 92.8 | 91.3 | 100.7| 117.8| 117.9|
| Wheat          | 54.3 | 61.5 | 75.0 | 66.5 | 66.2 | 60.0 | 67.6 | 64.0 | 60.8 | 61.6 |
| Total          | 468.4| 537.3| 533.3| 562.6| 542.1| 518.8| 483.2| 578.9| 605.4| 593.4|

Source: USDA

Soybeans, meanwhile, accounted for 18 percent of U.S. grain production from 2006 to 2015, far less than corn, though the soybean share varied from 15 percent to 20 percent. Over that period, exports accounted for 44 percent of soybean utilization — more than three times the share for corn — and less than 5 percent went to animal feed. The remainder was crushed at processing plants throughout the country to produce soybean oil and soybean meal. Soybeans are generally produced in large quantities in the same states that produce large quantities of corn.

Wheat, on the other hand, is grown mainly (depending on the type of wheat) in the northern tier of U.S. states, including the Dakotas, Montana, and Idaho, or the plains of Kansas, Oklahoma, and Texas. Wheat accounted for 12 percent of U.S. grain production from 2006 to 2015. Over the past 10 years, approximately 46 percent of the U.S. wheat crop has been exported, slightly more than soybeans and far more than corn. Wheat that is not exported is mostly processed to produce food for human consumption, including bread, pastries, and pasta.

Major grains do not necessarily follow similar production patterns, a function of how regional variances add considerable complexity to the grain market. For example, U.S. soybean production fell in 2012 from 2011, then rose from 2013 to 2015. U.S. wheat production, meanwhile, rose in 2012 from 2011, then was lower again from 2013 to 2015. Hot dry spells or floods may suppress grain yields in one region, while other regions might be enjoying average or exceptional growing conditions at the same time.

Further complexity in grain markets comes from the difficulty in forecasting crop size, even when the forecasts are made close to harvest time. Forecast inaccuracies make planning that much more difficult for those involved in grain logistics. Timing adds yet more complexity. Those who possess grain seek to sell it to the highest bidder. At harvest, a farmer might choose to sell his or her crop immediately — perhaps to a local processor, or perhaps to a local elevator.
— or the farmer might choose to store all or part of the crop on the farm in anticipation of a better price later. Likewise, an elevator might choose to sell the grain to, say, an overseas buyer, or could instead choose to store the grain in anticipation of a better deal later on.

Like U.S. grain production generally, U.S. grain exports fluctuate sharply because they are a function of many market and regulatory factors including global grain production, economic conditions in importer countries, crop yields in competing grain exporting countries, exchange rates, grain prices, government policies, and ocean freight rates. All of these can change significantly from one year to the next or even from month to month, resulting in grain exports that can vary tremendously. Total U.S. grain exports averaged 134 million tons per year from 2006 to 2015, but during this period exports ranged from 113 million tons to 149 million tons.

Grain Transportation

The nature of U.S. grain production and consumption patterns means that the grain logistical chain in the United States must be complex and resilient. As noted above, grain production, movement to storage, and movement out of storage to domestic and export markets depend on a variety of interconnected factors.

Railroads, along with barges and trucks, are a critical part of the grain logistical chain. The fact that this chain generally functions smoothly is a testament to the tremendous efforts that transportation providers, including railroads, put forth in support of their grain-related customers.

Today, grain shippers benefit from strong competition among railroads, trucks, and barges to carry grain. According to USDA data, the truck share of total U.S. grain transport was 64 percent in 2013 (the most recent year for which data are available), compared with just 24 percent for railroads and 12 percent for barges (see the nearby chart). The fact that the truck share has been rising for several years — it was 50 percent as recently as 2006 — is strong evidence of the intensity of the competition that railroads face for grain traffic.
Much of the growth in the truck share of corn movements in recent years is attributable to local shipments of corn to ethanol plants, but even for wheat and soybeans, rail market share has either been steady or declining.

**Overview of Railroads and Grain**

In 2015, Class I railroads originated 1.44 million carloads of grain (4.9 percent of total carloads) carrying 139.4 million tons (8.1 percent of total tonnage) and earning gross revenue of $5.3 billion (7.5 percent of total revenue). There is always some year-to-year volatility in rail grain volumes, but generally speaking the trend over the past decade has been flat to slightly down.

In addition, grain-related food products — which consist of a wide variety of commodities such as flour, animal feed, soybean oil, and corn syrup — typically account for another 4 percent of rail tonnage and revenue.
U.S. freight railroads carry more corn than any other type of grain. From 2006-2015, corn accounted, on average, for 69.7 million tons (50 percent of total rail grain tonnage) and $2.1 billion in gross revenue (45 percent of total grain revenue), well ahead of wheat (36.8 million tons, $1.4 billion) and soybeans (23.6 million tons, $825 million).
The share of rail grain traffic by type of grain varies from year to year depending on how much of the various grains are produced and the market dynamics associated with the various types of grain.

The top states for rail originations of grain are Illinois, Minnesota, Nebraska, and North Dakota, which in 2014 accounted for around half of all originated rail tons of grain. The top states in terms of rail terminations of grain are typically Washington, Texas, Illinois, and California, which accounted for nearly half of all rail grain terminations in 2014.

The charts on the top of the next page show average weekly rail grain carloads by month through June 2016 for U.S. and Canadian railroads.²

² Monthly rail traffic data come from a different source, and thus do not exactly match, rail traffic data taken from the source used for other traffic charts in this paper.
Rail Rates for Grain

The vast majority of rail rates — including rail rates for transporting grain — are driven by competition. Rail revenue per ton-mile (RPTM) is a useful surrogate for rail rates. In 2014, RPTM for grain was 31 percent lower adjusted for inflation than in 1981. RPTM is lower for the major individual types of grain as well.

In recent years, average rail rates for grain have increased. Generally speaking, railroads, like other competitive industries in the United States, set their prices based on the value they provide to their customers, not on their input costs. This market-based approach to pricing allows railroads to balance the desire of each customer to pay the lowest possible rate with the requirement that railroads be able to attract capital and pay for all the things needed to keep their networks functioning now and growing in the future.
That said, increases in rail rates over the years have closely tracked increases in the costs of inputs to rail operations. The chart at right shows the close correlation since 1990 between average rail rates for grain (measured by revenue per ton-mile) and the Rail Cost Adjustment Factor (RCAF). RCAF measures rail inflation in much the same way that the consumer price index measures inflation in the overall economy. The RCAF is prepared by the Association of American Railroads under the direction of the Surface Transportation Board and is subject to independent outside audit every two years. The chart at right shows that, since 1990, rail rates for grain have generally risen less rapidly than rail input costs.

Moreover, since 1990 the average prices farmers paid for most supplies rose much faster than rail rates to move grain. For example, over this period, the cost of seed rose 271 percent (not adjusted for inflation); fuel, 257 percent; and fertilizer, 216 percent. Average rail rates to ship grain (in revenue per ton-mile not adjusted for inflation) rose 86 percent over the same period.

The value of grain production — the average price received by farmers for grain multiplied by grain production — has trended higher over the past 15 years (see the chart below left). Meanwhile, rail revenue from grain as a percentage of the value of farm production has been trending downward over the same period (see the chart below right). The most recent couple of years have gone against these trends because grain prices have fallen since 2013.
The Railroad Grain Car Fleet

As noted above, the amount of grain transported by railroads varies considerably from year to year. Moreover, within any given year, the amount of grain transported within a region or by an individual railroad can be highly cyclical and volatile from week to week. For example, from January 2000 through June 2016, U.S. and Canadian railroads originated an average of 30,143 carloads of grain per week, but the peak week (39,635 carloads) was 142 percent higher than the lowest week (16,383 carloads).

When demand is particularly high (often during or immediately following harvests), so-called shortages of rail grain cars might occur. During these periods, not all grain shippers who want rail cars are able to obtain them easily. Conversely, during periods of relatively low demand, it is common for thousands of grain cars to sit idle on rail sidings, sometimes for long periods.

Railroads know that adequate grain car capacity is critical to efficient grain marketing and transportation, which is why they and other freight car providers work hard to supply a rail car fleet that is as large as can be justified economically. Moreover, when car shortages do occur, railroads and others work diligently to move as much grain as possible as quickly as possible. As of year-end 2015, the North American railroad grain car fleet consisted of more than 263,000 cars (owned by railroads and non-railroads) with a capacity of 1.33 billion cubic feet.

In recent years, new grain cars have been added to the fleet. New cars generally have much larger capacity than the cars they replace, making a focus solely on the number of cars in the fleet misleading. Moreover, because of substantial improvements in utilization through efficiency improvements like unit trains (and especially “shuttle trains”), a rail grain car today typically moves more grain than in the past.

Rail Service Options

Railroads offer various service options (single car, multiple cars, trainload, or shuttle trains) to grain shippers, and data show a clear trend toward more efficient grain movements. Single car movements (typically defined as 1–5 cars) accounted for 36 percent of total U.S. grain carloads in 1985; in 2014, they were 12 percent. Multiple car shipments (6–49 cars) fell from 30 percent in 1985 to 20 percent in 2014. Trains with 50 or more cars include conventional trainload and shuttle trains; they rose from 34 percent in 1985 to 68 percent in 2014. Large, more efficient long-hauls for grain drive down costs. The continuing trend toward such shipments is driven by competition and reflects market forces that call for grain transportation to be as efficient as possible.

Continued Spending Back Into the Rail Network

In the future, transportation demand will grow and new rail capacity will be needed. Recent forecasts from the Federal Highway Administration found that total U.S. freight shipments will rise from an estimated 18.1 billion tons in 2015 to 25.3 billion tons in 2045 — a 40 percent increase.
Freight railroads are preparing for this future demand today. Unlike trucks, barges, and airlines, which travel mainly on infrastructure that the government provides and pays for, America’s privately owned freight railroads operate almost exclusively on infrastructure that they own, build, maintain, and pay for themselves. In recent years, America’s freight railroads have been putting more money back into their networks than ever before. From 1980 through 2015, they spent more than $600 billion — their own funds, not taxpayer funds — on renewal, maintenance, and expansion of their infrastructure and equipment. That’s more than 40 cents out of every rail revenue dollar.

In the years to come, railroads will be asked to continue to grow capacity for grain and other current and potential customers. Additional spending on capacity can only be made if rail earnings are robust enough to attract the capital needed to pay for it.

**Conclusion**

America’s freight railroads do a remarkable job meeting the needs of an extremely diverse set of shippers. The vast majority of rail shipments, including grain shipments, arrive in a timely manner, in good condition, and at lower average rates than shippers elsewhere in the world typically pay. Railroads look forward to continuing to meet the needs of grain shippers safely and efficiently.