# *Surface Transportation Board*

*Office of Economics, Environmental Analysis & Administration*
*Section of Economics*

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# Study of Railroad Rates: 1985-2007

The Surface Transportation Board (STB or Board) monitors freight railroad rates in the United States. Periodically, the STB's Section of Economics distills its data and analysis of freight rail rates into formal reports that are shared with the Board and the public. This updated report summarizes our latest findings on trends in freight railroad rates and brings our measurement of the rail rate index up through 2007.[1]

The data used to prepare this report come from the STB's Carload Waybill Sample (Waybill Sample). Certain limitations exist with this information that will be discussed in detail later; however, we find that the data present a useful way to monitor rates. In addition, we have significantly improved our rate index so it does a better job accounting for changes in service type and car ownership.

## Rail Rates Increase

### *Overview of Rail Rate Trends*

The Section of Economics finds that inflation-adjusted rail rates increased in 2005, 2006, and 2007. This represents a significant change from prior years, given that inflation-adjusted rail rates declined in every year but one from 1985 through 2004. Since 2004, however, rail rates have increased. In fact, adjusting for the purchasing power of the dollar, shippers spent $7.8 billion more in 2007 than they would have if the rate levels of 2004 had remained in place.

[1] Our previous reports can be found on the internet at **http://www.stb.dot.gov/stb/industry/econ_rateindex.html**.

While a number of factors account for the increase in rail rates through 2007, it would appear that rising railroad input prices and declining productivity growth – not enhanced railroad market power – accounts for the bulk of the rate increases.[2]

Although many input prices increased between 2004 and 2007, the rise in fuel prices was extraordinary. For the Class I railroads, fuel costs rose $4.6 billion in nominal terms and $4.1 billion in real (inflation-adjusted terms) between 2004 and 2007. For the shipments covered by this study, the increase in fuel costs would have been even larger, because our data covers not only the Class I carriers, but also the Class II and Class III railroads. Thus, well over half of the increase in rail rates experienced by shippers between 2004 and 2007 can be attributed to higher fuel costs. Nevertheless, even after factoring out rising fuel costs, railroad rates have risen in the last three years after falling for decades.

**Figure 1. STB Rail Rate Index 1985 to 2007**
**Real Revenue Per Ton-Mile (1985=100)**

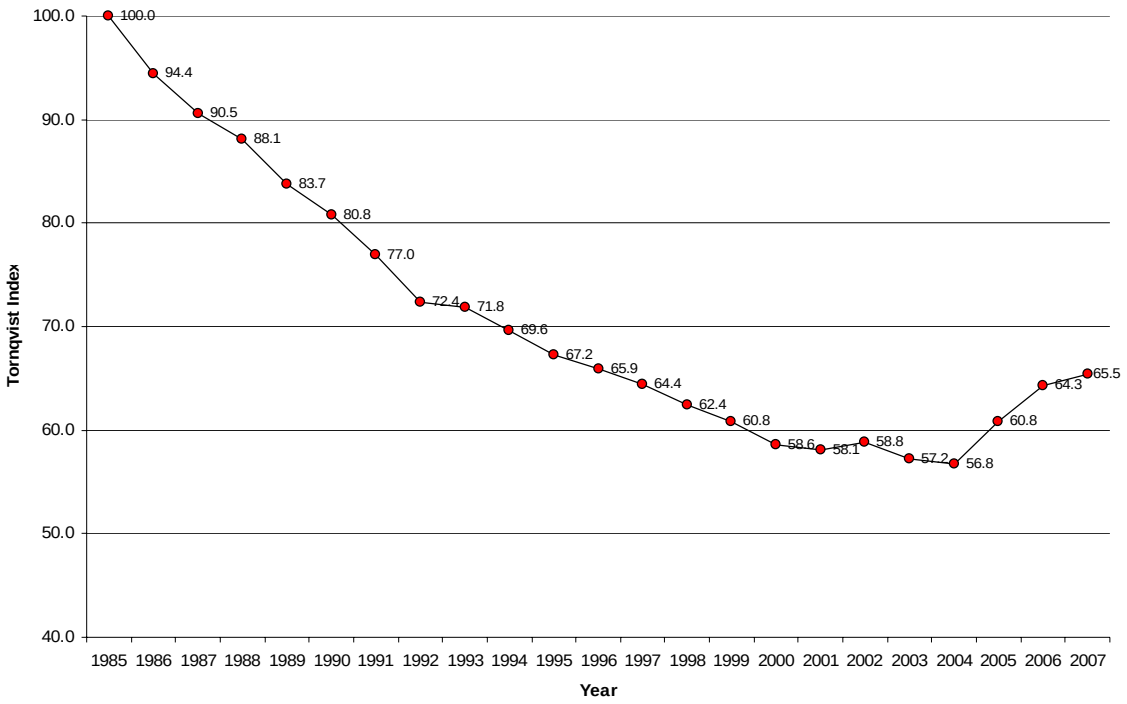



**Figure 1** shows that rates declined steadily from 1985 to 2000, flattened out thereafter, before turning sharply upwards in 2005 and 2006, followed by a smaller increase in 2007. Even so, our index value of 65.5 for 2007 implies that rail rates remain 34.5% *below* the level of rates as they existed in 1985.

[2] This is the conclusion of Christensen Associates, a prominent economic consulting firm. Recently, Christensen completed a comprehensive examination of competition in the freight railroad industry. See our website, www.stb.dot.gov, for a link to this study, *A Study of Competition in the U.S. Freight Railroad Industry and an Analysis of Proposals that Might Enhance Competition.* Although this study was commissioned by the STB, it was conducted on a completely independent basis by Christensen Associates.

### *Details of Analytic Approach*

In pursuing this analysis, the Section of Economics kept two principles in mind: (1) the study should account for the effects of inflation; and (2) the study should not allow a change in the mix of commodities to bias the index. To ensure that inflation plays no part in the index measure created, we use real or inflation-adjusted dollars. To ensure that the commodity mix does not bias the index, we employ what is known as a Tornqvist Index.

In developing our Tornqvist index, we first assigned each railroad movement to one of 67 separate categories based on its commodity and service characteristics. An ideal selection of groups would place nearly identical railroad products within the same output category. Then, any differences in the amount being charged could be interpreted as a change in price rather than a change in what is being supplied. Of course, we cannot define traffic categories too narrowly. If all origin-destination pairs and all seven-digit Standard Transportation Commodity Codes represented unique products, there would be many thousands of categories, most of which would have no transactions in them at all, making comparisons of price changes impossible.

The Tornqvist index measures the change in prices within each category and assigns a percentage weight to each category based on its share of total revenues. The total index is essentially the weighted average of price changes within the various categories. A key feature of the Tornqvist index is that its permits both the prices within the various categories and the weights assigned to each category to vary over time. This ensures that the index is not biased by a shift in traffic from one category to another.

Our concern that changes in the railroad product mix might have a meaningful effect on railroad rates is well founded. For example, it is possible for a revenue-per-ton-mile measure to show a decline in rates even if all shippers are experiencing rate increases. This would occur if the effect of rising rates on all traffic categories were masked by an increase in the market share of low-priced movements. Indeed, we have a specific reason to control for this effect. The past 22 years railroads have seen large increases in unit train operations. In particular, the amount of Powder River Basin (PRB) coal has increased tremendously. On a revenue-per-ton-mile basis, PRB traffic is among the lowest priced traffic moving on the railroad system. As a result, simply reporting revenue per ton-mile overstates the actual decline in railroad rates. Our Tornqvist index, by controlling for the change in commodity mix, ensures that our results are not biased in this manner.

The previous Section of Economics study on this issue divided railroad output into 30 groups—one for each region of the country in which the shipment originated (East or West) and one for each of 15 different commodity groups. The Board has historically treated Eastern and Western carriers somewhat differently and there are, of course, significant differences between the Eastern and Western carriers. Nonetheless, the territories of the Eastern and Western carriers overlap one another and many movements originate in one region only to be terminated in another. In this study, Section of Economics has eliminated the distinction between Eastern and

Western railroads and instead included movement information and car ownership characteristics. We believe that these changes substantially improve our index. The new categories include:

1. **Length of Haul (LOH)**. Our previous studies accounted for LOH indirectly by looking at the region where the shipment originated. Although Western movements tend to be longer than Eastern movements, even within regions there are significant differences between long-haul and short-haul rates. Using LOH directly is superior than relying on a rough proxy based on region.

2. **Car Ownership**. Rates differ between railroad supplied and privately owned cars. Unless car ownership is factored in, we might confuse lower rates with greater shipper investment in cars.

3. **Train Type**. Consistent with our Carload Waybill Sample, we identified three specific train types: *single car* movements (5 or fewer cars in a shipment); *multi-car* movements (6 to 49 cars in a movement); and *unit train* movements (50 or more cars in a movement). There is great benefit in controlling for train type. For example, some grain shippers claim that railroads will offer substantial discounts when the shipper loads out 110-car unit trains at large elevators, rather than shipping grain in smaller lots from local elevators. While such a lower rate may be attractive to grain shippers, it also may require them to carry the cargo for a longer distance by highway to reach the more-remote consolidated elevator. Accounting for train type thus presents a more accurate picture of the cost of shipping by rail.

4. **Intermodal Shipments**. This study improves on our previous rate study methodology by examining whether a shipment is intermodal movement. Such shipments have entirely different cost characteristics from those that are railroad-only. In recent years, this segment of railroad output has increased substantially relative to the rest of railroad output, so placing these shipments into a separate category presents a more complete picture of rate-setting trends.[3]

[3] In order to distinguish intermodal shipments from all others, only two variables on each record of the Waybill file need to be examined. The first variable examined is called "TOFC_Serv_Code". This variable provides an indication of the type of intermodal service that is to be provided by the railroad on an intermodal move. Where that variable is not null or blank, the movement was intermodal. The next variable examined, called "Int_Eq_Flag" indicates whether the commodity is being moved in intermodal equipment. When the value of this variable is greater than zero, then intermodal equipment had been used to move the commodity shipped and the move is classified as intermodal.

Table 1 lists the categories we selected for this rate study. There are 67 categories in all.

## Table 1. Categories of Railroad Output

| COMMODITY | STCC | LOH | Car Own | Train Type |
|---|---|---|---|---|
| Intermodal | NA | S, M, L, VL | Not Used | Not Used |
| Farm Products (not Grain) | 01 | Not Used | Not Used | Not Used |
| Grain | 0113-0114 | S, M, L | P, R | S, M, U |
| Metallic Ores | 10 | S, M, L* | Not Used | Not Used |
| Coal | 11 | S, M, L, VL | P, R | Not Used |
| Non-Metallic Minerals | 14 | S, M, L* | Not Used | Not Used |
| Food and Kindred | 20 | S, M, L | Not Used | Not Used |
| Lumber and Wood Products | 24 | S, M, L | Not Used | Not Used |
| Pulp, Paper and Allied | 26 | S, M, L | Not Used | Not Used |
| Chemical | 28 | S, M, L | Not Used | Not Used |
| Petroleum | 29 | S, M, L | Not Used | Not Used |
| Stone, Clay and Glass | 32 | S, M, L | Not Used | Not Used |
| Primary Metal Products | 33 | S, M, L | Not Used | Not Used |
| Transportation Equipment | 37 | S, M, L | Not Used | Not Used |
| Waste and Scrap | 40 | S, M, L | Not Used | Not Used |
| All Other | NA | S, M, L | Not Used | Not Used |

**Definitions:**

| Item | Meaning |
|---|---|
| STCC | Standard Transportation Commodity Code |
| LOH | *Length of Haul Category* |
| S | Short (<500 miles) |
| M | Medium (from 500 but <1000 miles) |
| L | Long (from 1000 but <1500 miles) |
| VL | Very Long (1500 miles or more) |
| Car Own | *Car Ownership Category* |
| P | Privately Owned |
| R | Railroad Owned |
| Train Type | *Train Type Category* |
| S | Single (<6 cars) |
| M | Multicar (6-49 cars) |
| U | Unit (>49 cars) |
| Not Used | Indicates that the dimension represented by that cell is not used to calculate rate trends. For example, "Farm Products (not Grain)" is not separated by distance groups. |

**Notes**

*For these cases, a short distance is less than 100 miles, a medium distance is from 100 miles to less than 250 miles, and a long distance is 250 miles or more.

The primary source of information on freight rail shipments terminated in the United States is our Waybill Sample. Using the Waybill Sample, we calculated revenue per ton-mile and used this measure as our proxy for rail rates. This is consistent with our previous rate studies, but developing revenues per ton-mile was somewhat more challenging in this study because of the increase in railroad fuel surcharges in recent years.

In the past, the Waybill Sample's freight revenue field contained all of the funds received by the railroads for the purpose of moving the freight and these revenues were used to develop our rate index. Thus our index ignored certain other revenues, such as port charges and third-party charges which we did not consider part of the rate. Revenues of this sort were reported in a separate field called "miscellaneous charges."

Starting in 2003, however, some railroads began collecting fuel surcharges and reporting those amounts as miscellaneous charges rather than as freight revenue. We now require railroads to present fuel surcharge revenue in a separate Waybill field, but for the years 2003-2007 if a carrier reported its fuel surcharge revenues as a miscellaneous charge we included all of its miscellaneous charges as revenue for the purposes of this study. We understand including the entire miscellaneous revenue field slightly overstates railroad revenues, but this effect is very small and does not, by itself, account for the recent increase in railroad rates. We would also note that in some cases, carriers reported figures in the miscellaneous charges field that were precisely equal to amounts reported in the freight revenue field. After verifying that these reports were the result of clerical error, we excluded them.

We recognize that our rail rate index is not perfect. On the one hand, whenever shippers must bear the costs of services that were previously the province of railroads, our index overstates the actual decline in rail rates. This has occurred, for example, in cases where shippers are paying for third-parties to load or unload trains that were previously handled by the railroad. Any resulting drop in freight rates is not fully attributable to railroad productivity improvements being passed along to the shippers. On the other hand, our index can understate rate reductions in certain cases. For example, since 1985, the percentage of revenue from movements under contract has grown (though the rate of increase in this category of business arrangement has recently slowed, it is still continuing to increase). The revenues from these contracts as reported in the Waybill Sample will not always account for volume discounts. Overall, however, we are confident that our index captures the real savings in railroad rates that shippers have enjoyed over the past 20 years, while also recognizing that in the most recent three years rates have increased.

## *Additional Analysis of Grain and Coal Rates*

The experience of grain and coal shippers has attracted substantial attention from the shipping public and other interests. We focus on these commodities for additional analysis for several reasons. With respect to coal, we note that most of the formal rate complaints handled by the Board have been brought by coal shippers. In addition, many of the applications for railroad construction filed with the Board are for new coal movements, either from mines or to coal-fired utilities.

The Board is also interested in rail transportation of grain. For example, in November 2006 we held a hearing dedicated to this subject. (See the Board's website, www.stb.dot.gov, for video or audio recordings of this hearing). We also note that the recent Christensen Associates study of competition in the railroad industry found that grain movements are subject to greater captivity, on balance, than most other railroad traffic.

While our additional analysis is limited here to grain and coal, in future studies we plan to expand our analysis to other commodities.

### *Grain Rates*

Grain shippers have been particularly concerned about rates in recent years. Many of these shippers believe that railroads have increasingly relied upon them to provide rolling stock. They also believe that railroads have increasingly attempted to "de-market" single-car and multi-car service by increasing prices on those segments of the market. Grain shippers have also alleged that certain longer-haul shipments are charged a lower rate than shipments that move a shorter distance on the railroad. For these reasons, we have used the data created in this study to prepare a thorough analysis of the rates paid by grain shippers relative to rolling stock ownership, type of train, and length of haul.

**Figure 2** shows the trend in the real revenue per ton-mile for grain shipments depending on equipment ownership. Since the car ownership variable was not available in 1985 or 1986, the starting year on this chart is 1987. The top line shows the revenue received by railroads when they supply the car. The bottom line shows the revenue received by railroads for shipments in privately-owned cars. Based on that graph, it would appear that substantial savings were originally made available to shippers that provided their own rolling stock. Since 2000, however, that advantage of using privately-owned rolling stock appears to have disappeared. Railroad revenue per ton-mile is about the same, regardless of who supplies the equipment.

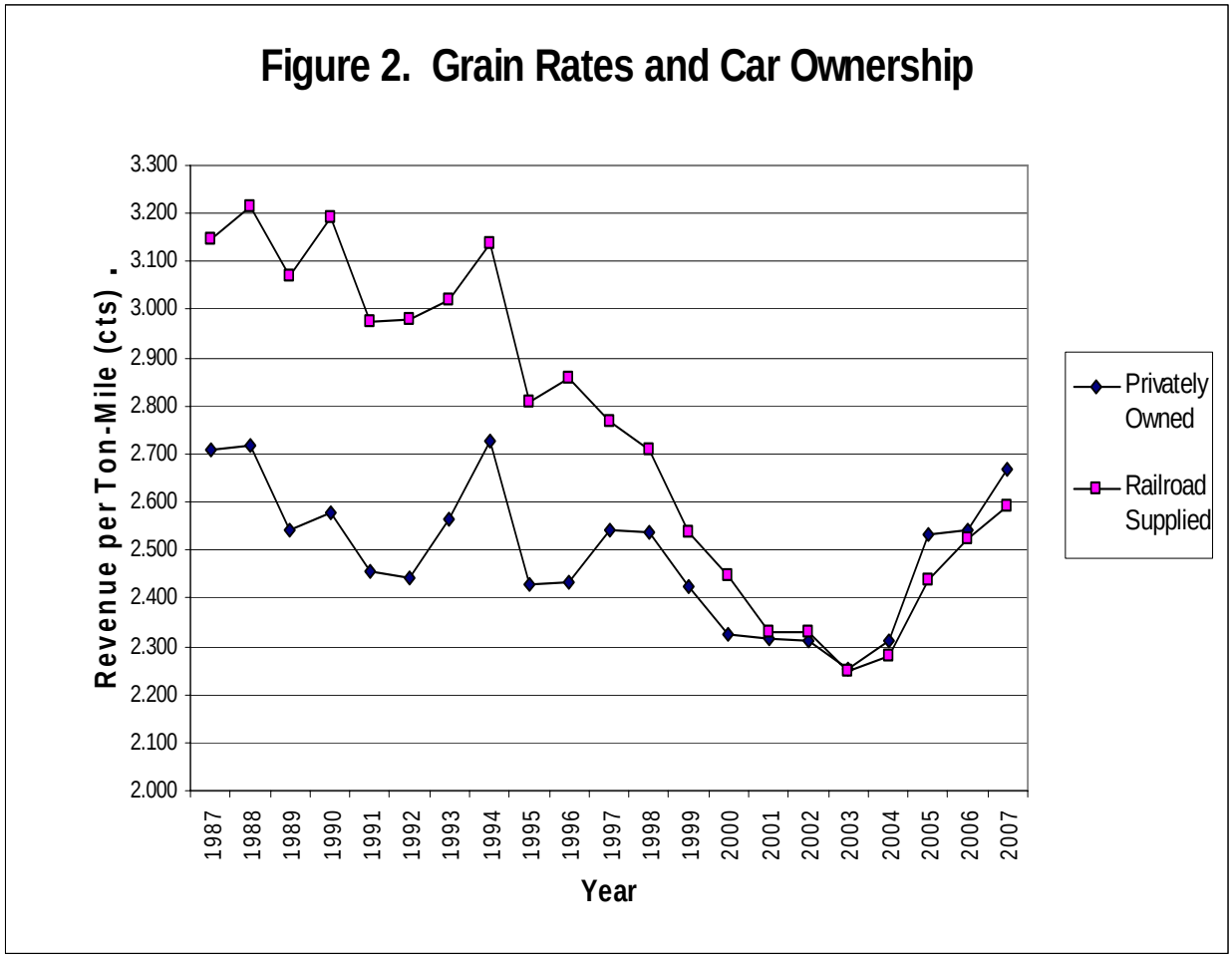
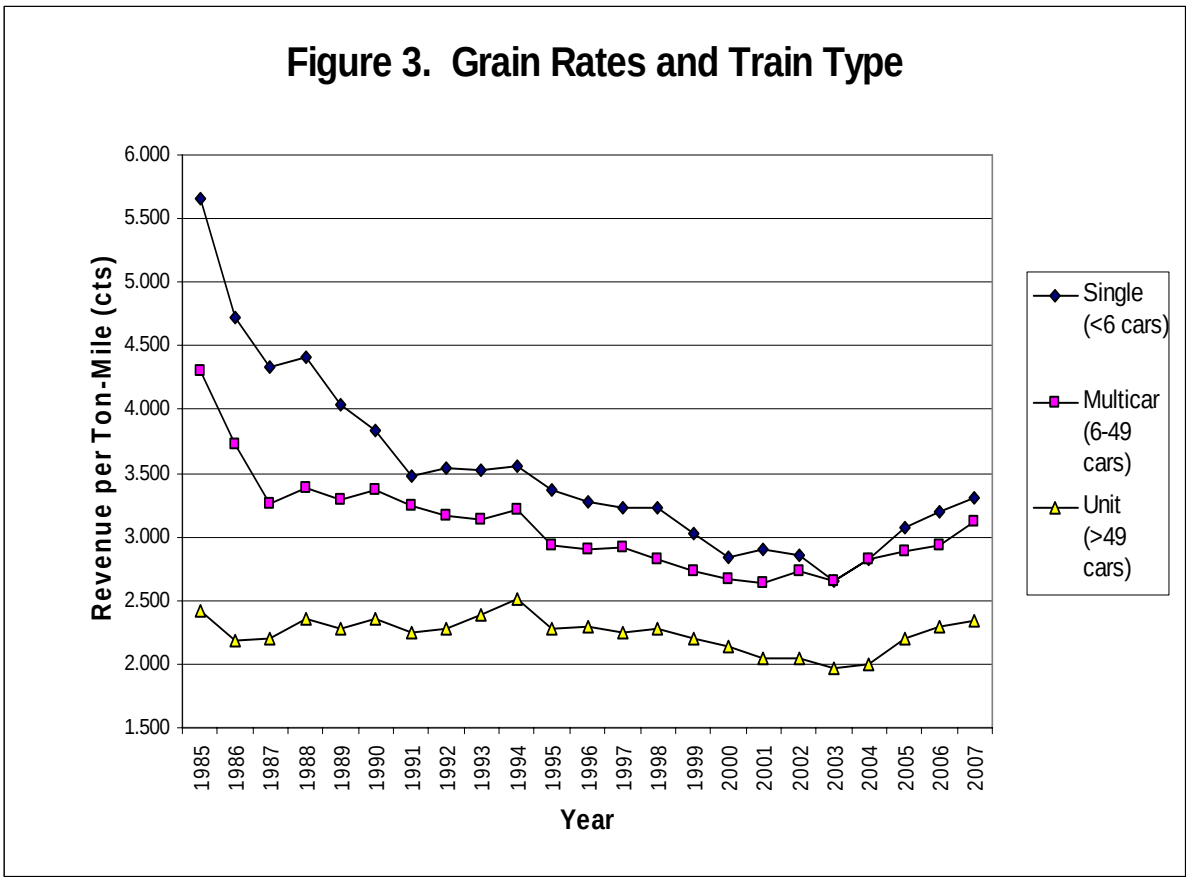
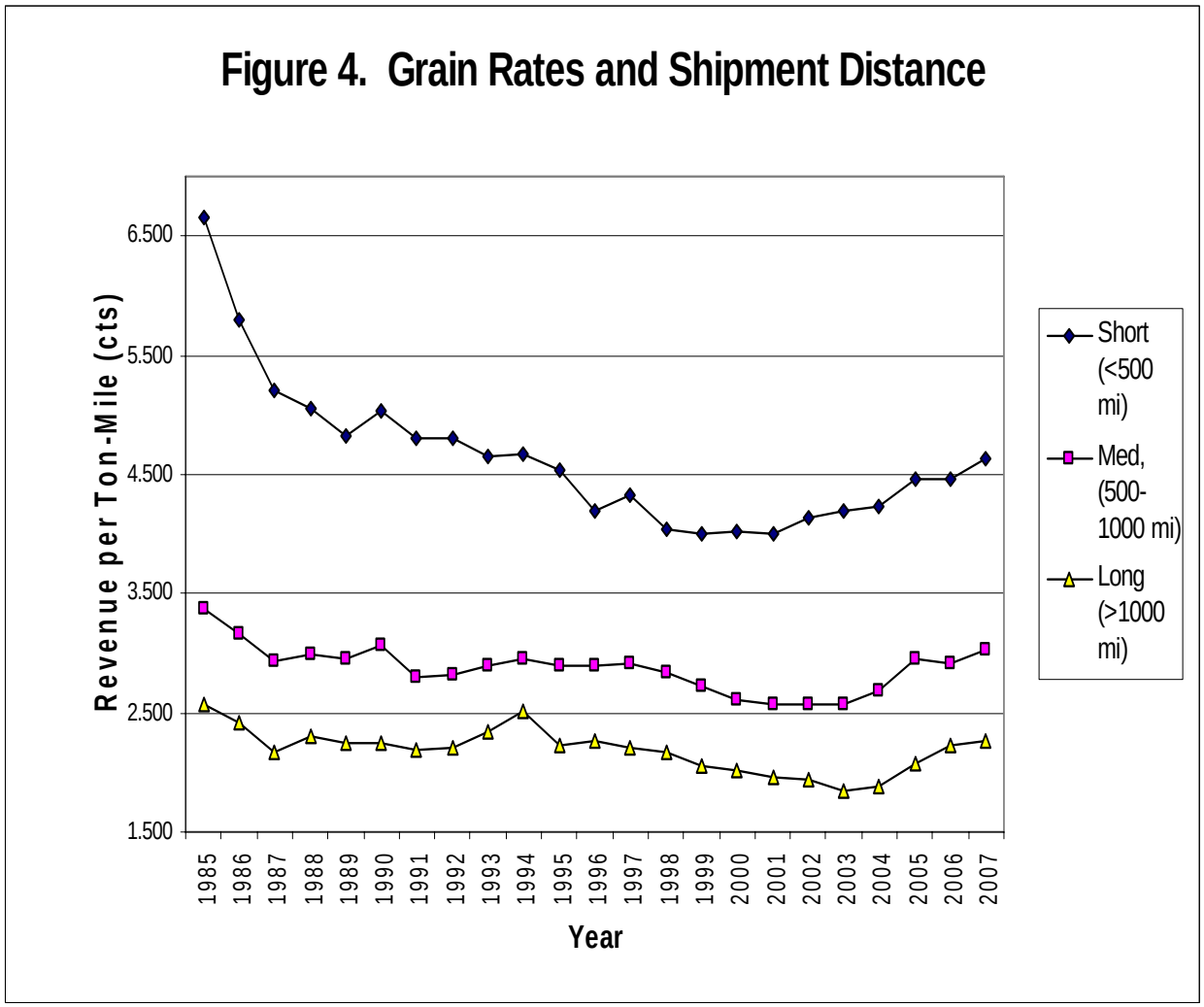


**Figure 3** looks at grain rates with respect to train type, showing how the rates vary depending on the number of cars tendered to the railroad in each shipment. Figure 3 tells an interesting story. The data would indicate that the real revenue per ton-mile for grain in unit trains has followed a pattern of rising and falling over the entire period. Rates on single-car and multi-car shipments, on the other hand, fell almost continuously from 1985 through 2003, before seeing an increase. In addition, rates on single-car shipments are at this time only a bit more than half of their level in 1985. Rates on unit-train shipments, on the other hand, are only slightly lower than those charged back in 1985. This observation runs counter to concerns that have been expressed that premiums for non-unit train shipments may be excessive. On the average, those premiums appear to be falling, although this may not be the case for all individual railroad-customer arrangements.




In addition, Figure 3 suggests that the discount offered for multi-car shipments has all but disappeared over the years. And, while the discount for unit trains continues, its relative size has significantly declined over the years. The chart shows us that in 1985, when grain shipped in single carloads was charged 5.7 cents per ton-mile, grain could be shipped in unit trains for only 2.4 cents. This represented a discount of 57 percent. In 2007, grain in single carload lots would cost the shipper 3.3 cents per ton-mile, while grain in unit trains carried a charge of 2.3 cents per ton-mile. So by 2007, the discount for shipping by unit train rather than single carload had fallen from 57% to 29%.

A third category of interest to grain shippers is distance. Generally, railroads will charge less per ton-mile for shipments moving a longer distance. **Figure 4** shows how much distance has actually affected the rates over the last few years. This chart clearly shows that rates on longer-distance shipments are, in general, lower per ton-mile than rates on shorter-distance shipments.



## *Coal Rates*

As with grain, many shippers are concerned about the service they receive and the amounts they must pay to ship coal by rail. The choices of car ownership and length of haul also play important roles with coal shippers.

**Figure 5** presents the trend in real rates per ton-mile for coal from 1987 through 2007 (again, 1985 and 1986 are not shown due to lack of car ownership data in those years). Figure 5 shows a relatively continuous decline in rates for both privately-owned equipment and railroad-owned equipment until 2004. The rates then showed a slight uptick from 2004 through 2007. The discount available for the privately-owned equipment is reasonably constant in percentage terms for the entire period. However, the discount was about 40% in 1987, fell gradually to a low of 34% in 1994 and then rose gradually to 40% again in 2006. In 2007, the discount fell to 35%.

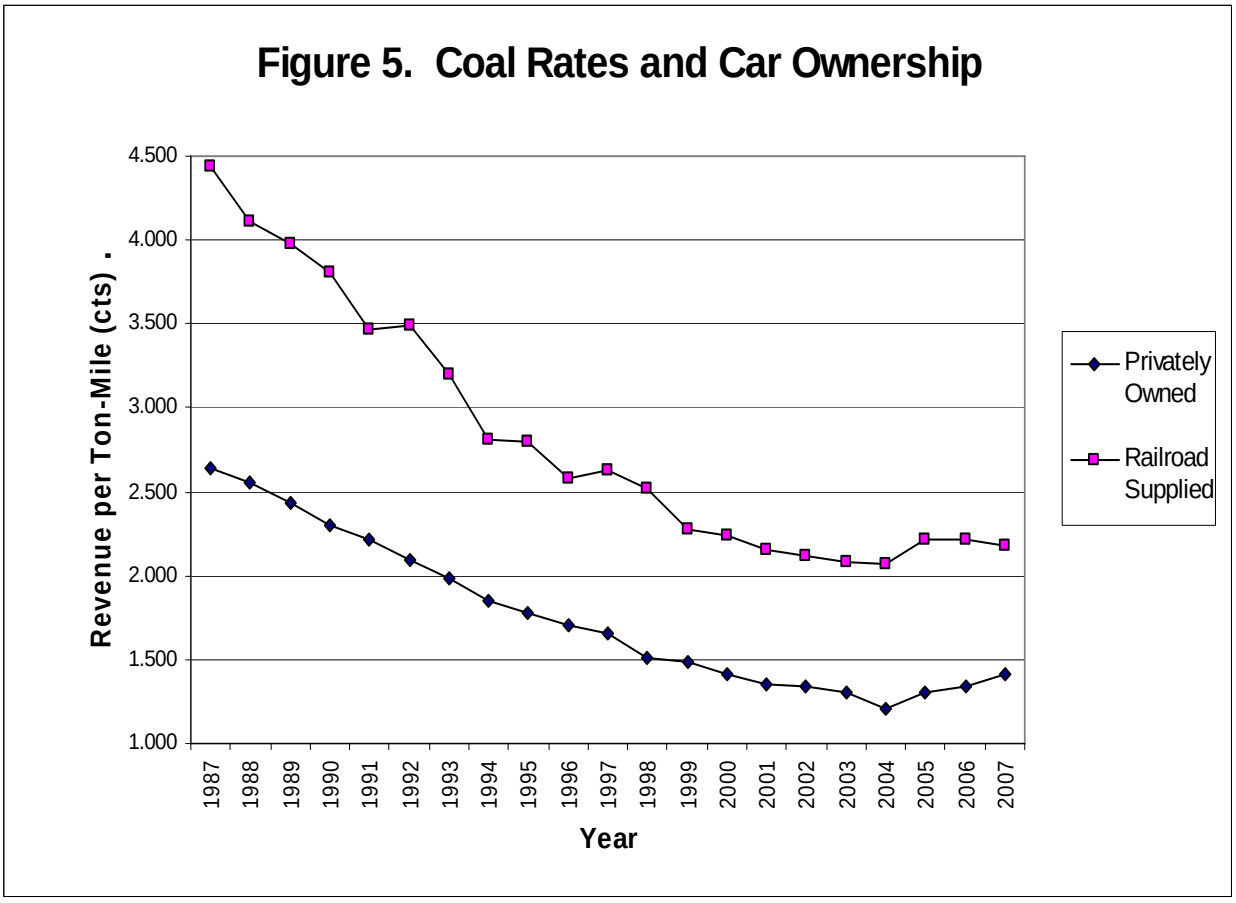
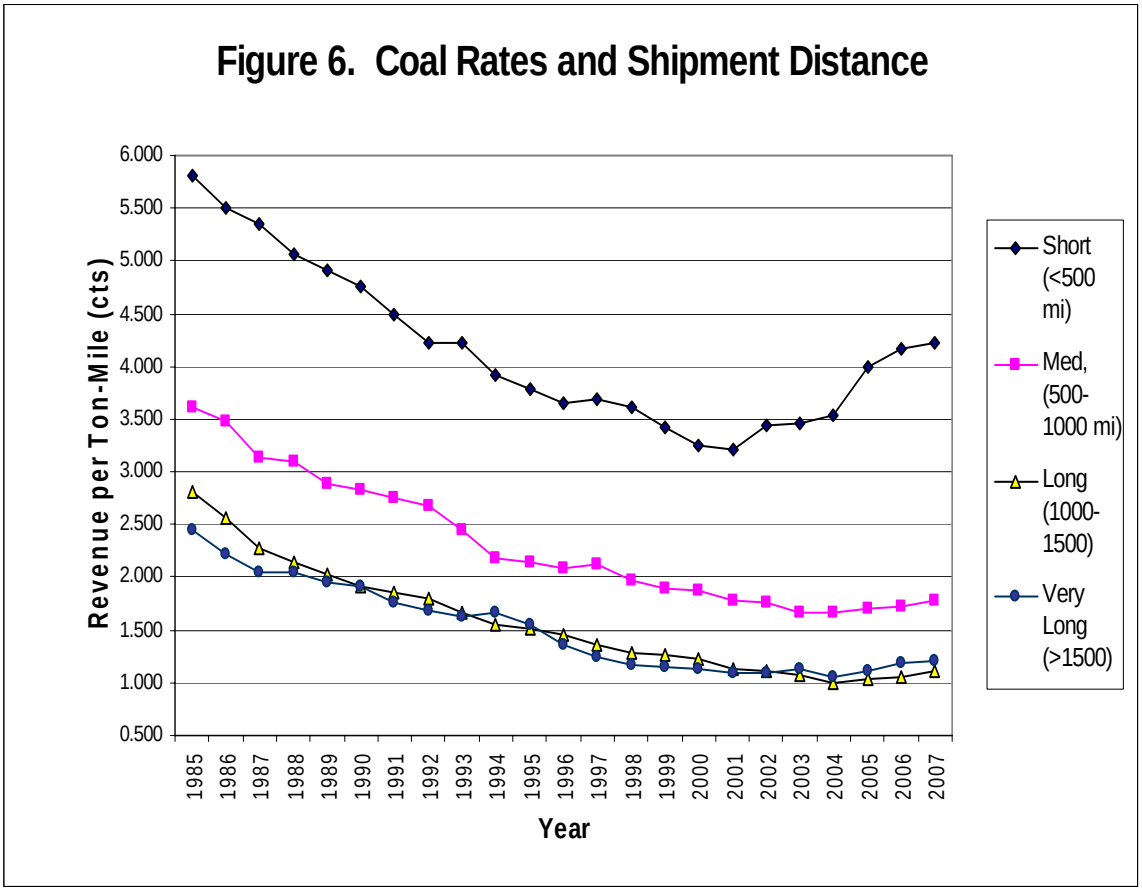


**Figure 6** presents the trends in coal rates per ton-mile for four distance categories. The figure shows that rates declined in all four categories from 1988 through 2001. Rates in the short-distance category rose continuously from 2001 through 2007, with 2007 rates exceeding those in 2001 by 32%. The longer-distance services did not see as dramatic a shift. Their rates became fairly stable in 2001 and did not rise until after 2004. For medium-distance hauls, rates fell 0.9% when comparing 2007 to 2001; for long-distance hauls, this decrease was 1.9% (notwithstanding the slight uptick in 2005, 2006, and 2007. For very long-distance hauls, rates actually increased by 10.7 percent over that six-year period. In sum, recent trends show increases in short-distance hauls and relative stability in long-distance ones.



## Technical Notes

The data used in preparing this study come from the Waybill Sample information collected each year from the railroads by the Section of Economics. There are two versions of this database—a confidential version and a public-use version. The public-use version does not contain all of the information available in the confidential version. In particular, the revenues received by the railroad for each move are disguised in the public-use version. For this study, actual revenues are needed and come from the confidential version of the Waybill Sample. As this study aggregates data from 500,000 to 700,000 records into 67 categories, the information presented in this report cannot be used to obtain confidential data on a single movement.

## Contributors

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