The Mississippi River System Barge Industry – Perfectly Competitive or Oligopolistic?

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Abstract

Most transportation textbooks and articles on inland waterway navigation assume a perfectly competitive Mississippi River System barge industry. However, one study found the 1972 and 1977 grain barge industries were oligopolistic. Using the concentration ratio and the Herfindahl Index to estimate the structure of the Mississippi River barge industry, this study found the barge industry to be more oligopolistic in 2005 than in 1972 and 1977. This suggests that inland waterway studies, that assume a perfectly competitive barge industry, overestimate the demand for barge transport and the benefits that accrue to shippers and receivers from publicly financed waterway infrastructure investments.

INTRODUCTION

Much has been written about the competitive nature of the Mississippi River system barge industry. Early writers believed that the barge industry to be very competitive relative to other modes. Pegrum stated:

> “barge costs are mostly variable and the industry is therefore highly competitive.”

Shabman implied perfect competition when he noted that the benefits of a policy of free use of public funded waterway navigation investments are apparently shifted forward to shippers and their customers.

Sorenson, in examining rail-barge competition in wheat transportation stated:

> “the inland water-carrier industry is structurally competitive. Entry is relatively unrestricted and capacity for established firms can be expanded or reduced with relative ease. Costs are specific to traffic units and hence dominantly variable with traffic volume. Under these conditions, rates over a reasonable period of time would be expected to reflect carrier costs.”

Sorenson implicitly stated that the barge industry is perfectly competitive.

The U.S. Army Corps of Engineers (Corps) assumes that the barge industry is perfectly competitive in their feasibility studies and papers. For example, Berry, in the executive summary of a report describing the Corps’ Tow Cost Model states:

> “It is assumed that any changes in the costs specified in the base year (for such movement and determined in the RRPP) will induce proportional changes in the base year transportation rates.”

The Tow Cost model is used by the Corps to estimate benefits to shippers from almost all proposed Corps construction projects. In the Corps study of “water-compelled rail rates,” the unidentified authors assume that barge rates are always “competitively priced at marginal costs.”

Two National Research Council reviews were very critical of the Corps’ Upper Mississippi Waterway Feasibility study. Following these two reviews, the Corps commissioned 16 papers to develop alternative methods for the Corps feasibility studies. Several of these papers assume the barge industry is perfectly competitive. For example, the Anderson-Wilson paper, “Spatial Modeling in Transportation, Railroad Pricing, Alternative Markets and Capacity Constraints,” explicitly states that:

> “Shipping by truck and by barge is perfectly competitive and constant per unit per distance shipped at rates t and b respectively.”

Economic theory tells us that the competitive structure of any industry is an important issue. A perfectly competitive industry maximizes producer and consumer surplus, and prices are set at marginal costs. Therefore, the benefits from any public investment in the industry will be passed back to the selling or buying public and to their customers. A less competitive industry will attempt to restrict output and increase price to capture consumer surplus and economic profits. Firms in a less competitive industry will likely capture part of any public investment in their industry. Therefore, barge industry structure is crucial in any study estimating benefits from proposed public investments in inland waterway infrastructure.

None of the above text books or articles cites any empirical evidence to justify their explicit or implicit assumptions of a perfectly competitive barge industry. The purpose of this paper is to review the available research on the structure of the Mississippi River system barge industry and to update these analyses with current data to determine if the conclusions from earlier studies are still valid.

STRUCTURE OF THE MISSISSIPPI RIVER SYSTEM BARGE INDUSTRY

A review of the literature found just one study that examined the structure of the Mississippi River barge industry. Woolverton used the traditional "structure, conduct and performance" approach to evaluate the structure of the grain barge industry. He examined the number and size of firms, the degree of product differentiation, barriers to entry and the extent of vertical integration. Using barge industry and Corps data on the number of covered dry cargo barges owned, Woolverton calculated the percent of covered dry cargo barges owned by the largest 4, 8 and 20 firms in the industry. Adding these percentages, he calculated the concentration ratios for the barge industry on January 1, 1972 and 1977, shown in Table 1.

Table 1. Percent of total numbers of covered dry cargo barges owned on January 1, 1972 and 1977.

	1972	1977
Total number of firms	31	35
Percent of barges owned by		

the largest:		
4 firms	44.5	28.6
8 firms	57.7	45.6
20 firms	72.3	82.6

Woolverton concluded that:

1. The barge industry was concentrated, but not highly concentrated.

2. Based on criteria developed by Richard Caves, the barge industry was classified as a type 1 oligopoly, in which the largest 8 firms owned at least 50 percent of the total number of covered dry cargo barges, and the largest 20 owned at least 75 percent. Woolverton concluded that the 1972 and 1977 grain barge industries met the conditions for a Class I oligopoly.

3. There was little basis for concluding that the degree of product differentiation would allow one firm to charge a substantially higher price for its services than other barge firms.

4. Absolute cost barriers may have prevented entry into the barge industry during the period examined.

5. The estimated cost to barge grain for the period examined was not significantly related to the negotiated rates to barge grain. Therefore, the null hypothesis that there was no relationship between barge rates and estimated barge costs was accepted. This means that estimated barge costs could not accurately be used as a proxy for barge rates.

UPDATING THE WOOLVERTON STUDY

The second purpose of this paper is to update the Woolverton study of the structure of the Mississippi River system barge industry. Woolverton limited his analysis to barge firms that hauled grain. Therefore, he used the number of covered dry cargo barges owned by each firm to estimate the level of concentration in the barge industry. This update will expand the Woolverton analysis to include barge firms that owned both covered and/or open top dry cargo barges. The update will also estimate concentration in the liquid cargo barge industry. There are two reasons for this expanded analysis:

1. Covered dry cargo barges can be converted to open top dry cargo barges by simply storing the covers. Therefore, limiting the analysis to covered dry cargo barges ownership and their owning firms omits the impact of open top dry cargo barges on the structure of the dry cargo barge industry,
2. The Mississippi River system barge industry is a major carrier of liquid cargos. Therefore, the structure of this sector of the barge industry will also be examined.

Woolverton used the concentration ratio as the main tool to evaluate the level of concentration in the grain barge industry. This analysis will also use the concentration ratio as well as the Herfindahl Index to evaluate the level of concentration in the dry and liquid barge sectors.

UPDATED BARGE INDUSTRY CONCENTRATION

Two measures commonly used by economists to measure the degree of industry concentration are the concentration ratio and the Herfindahl index. The concentration ratio, Cx, is the percent of the market sector controlled by the largest x firms. C4, the percent of the industry controlled by the four largest firms, is the most commonly used concentration ratio to judge the level of concentration in an industry. Oligopoly Watch considers a C4 $\geq$ 50 percent to be a tight oligopoly. Other economics writers consider a C4 above 60 percent to be an oligopoly.

The concentration ratio is frequently criticized because it does not indicate the relative size of the four - - or x - - largest firms. An alternative measure, the Herfindahl index, is calculated by squaring the percent of the sector controlled by each firm in the industry. Then, the squared percents are summed over all firms.

A full measure of the Herfindahl Index (HI) requires data on the market shares of all firms in the industry. However, Amos WEB suggests that the squares of the market shares for only the top five or ten firms can provide a close approximation of the actual HI. This analysis calculates the HI for the five largest firms in the dry cargo barge sector and also for the five largest firms in the liquid cargo barge sector. Therefore, the H5's presented in this paper slightly underestimate the HI's for the entire industry.

Oligopoly Watch offers the following criteria to evaluate the C4 and HI concentration measures:

Concentration Ratio	
C4	Level of Concentration
< 25	No oligopoly

25 – 50	Loose oligopoly
>50	Tight oligopoly

Herfindahl Index	
HI (for all firms)	Level of Concentration
< 1,000	Low
1,000 – 1,800	Moderate
> 1,800	Acute

Oligopoly Watch states:

> "The U.S. Antitrust Department has traditionally judged the seriousness of a measure by using the Herfindahl Index. If a merger or acquisition increases the index by 100 or more, or pushes the overall index over 1,000, it is likelier to attract FTC attention."

Table 2 shows the level of concentration in the 2005 dry cargo barge industry on the Mississippi River system measured by C4 and H5.

Table 2. Number and Concentration of Dry Cargo Barges Operated on the Mississippi River System by the Five Largest Barge Companies, December 31, 2005.

Company	Number* of barges	Cumulative	Cumulative

		Concentration Ratio	Herfindahl Index
Ingram Barge Co.	3,633	20.3	412
ACBL	2,639	35.1	631
AEP-MEMCO	2,628	49.8	847
American River Transport	2,061	61.3	979
Cargo Carriers	909	66.5	1,006
Other	5,959		
Total	17,789		

- ACL 2006 Annual Report

The C4 ratio in Table 2 is 61.3. Using the Oligopoly Watch criteria, a C4 of 61.3 indicates that the dry cargo barge sector is a tight oligopoly. The C4 ratio of 61.3 also exceeds the higher standard of above 60 percent to be an oligopoly. The 2005 C4 concentration ratio is 38 percent higher than Woolverton's 1972 ratio and 114 percent higher than Woolverton's 1977 concentration ratio. This suggests that the 2005 dry cargo barge sector is sharply more concentrated than the 1972 and 1977 grain barge sector.

The H5 for the five largest firms is 1,006. This indicates that the dry cargo barge sector is a moderate oligopoly. Industry sources indicate that there were approximately 40 firms operating dry cargo barges on the Mississippi River system in 2005. Therefore, the HI for the entire 2005 dry cargo barge sector will be higher than 1,006, probably around 1080-1,100.

Table 3 shows the level of concentration in the liquid cargo barge sector on the Mississippi River system.

Table 3. Number of Barges and Concentration of the Five Largest Firms Operating Liquid Cargo Barges in the Mississippi River System, December 31, 2005.

Company	Number of Liquid Barges*	Cumulative Concentration Ratio	Cumulative Herfindahl Index
Kirby	912	32.5	1,056
ACBL	372	45.7	1,230
Marathon-Ashland	180	52.1	1,271
Canal	170	58.2	1,308
Ingram Barge Co.	165	64.1	1,343
Others	763		
TOTAL	2,809		

* ACL 2006 Annual Report

The C4 ratio in Table 3 is 58.2. The Oligopoly Watch criteria indicate that the liquid cargo barge sector is also a tight oligopoly. However, it is slightly below the higher standard of 60 percent. The H5 for the five largest liquid cargo barge firms is 1,343 or 33 percent higher than the H5 for the five largest dry cargo barge firms. Industry sources indicate that the number of liquid barge firms is approximately the same as for the dry cargo barge sector. Therefore, the liquid barge sector HI is greater than 1,343. This suggests that the liquid cargo barge sector is more concentrated than the dry cargo barge sector.

The dry cargo barge sector operates 86 percent of the total number of barges on the Mississippi River System. Therefore, most of the remainder of the discussion in this paper focuses on the dry cargo barge sector.

Tables 4 and 5 outline the history of how Ingram Barge and ACBL became the two largest barge firms on the Mississippi River system. Since 1960, Ingram Barge merged with, or purchased 10 competing barge firms and purchased the assets of four additional barge companies. ACBL merged with, or purchased nine competing barge firms. Thus, Ingram Barge and ACBL eliminated 19 barge firms and purchased the barge assets of five additional firms. Industry sources suggest that the total number of barge firms has declined from approximately 100 in the late 1980s to about 75 in 2006.

Table 4. History of Ingram Barge Company Mergers and Acquisitions of Competing Barge Firms.

Date	Mergers and Acquisitions
1946	Ingram Barge Company (IBC) formed
1960s	IBC purchase Barrett Lines
1978	IBC became part of Ingram Industries
1984	IBC purchased Ohio Barge Line including 15 boats and 365 barges
1980s	IBC purchased: 4 barges from Oil Transport 27 barges from Chotin Transport 23 barges and 5 boats from System Fuels 15 barges and 7 boats from Arthur Smith and Georgia Transporters
1989	IBC purchased American Barge and Towing, including 8 boats and 365 barges
1994	IBC purchased M/B Transport including 8 boats and 354 barges
1997	IBC purchased the marine business of Occidental Chemical Corporation

2002	IBC purchased Midland Enterprises, including The Ohio River Company and Orgulf Transport Company
2005	IBC purchased Riverway Company, including 7 boats, 430 barges, 4 tug boats

Source: www.ingrambarge.com/barge_history.asp

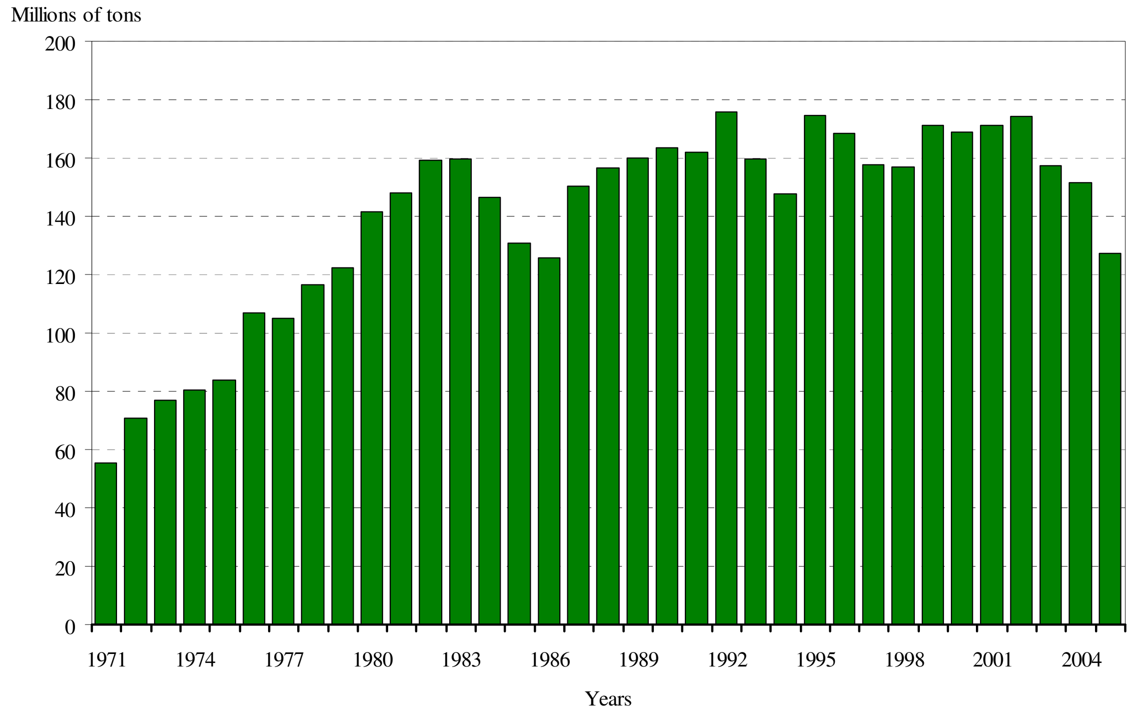
Table 5. History of American Commercial Barge Line (ACBL) Mergers and Acquisitions of Competing Barge Companies

Date	Mergers and Acquisitions
1927	Inland Waterway Company merged with W.C. Kelly Barge Line to form American Barge Line Company (ABLC)
1938	ABLC purchased Sweeny Shipyard, later renamed Jeffboat, Inc.
1957	ABLC merged with Commercial Transport Company to form American Commercial Line Company (ACBL)
1991	ACBL purchased Hines Corporation
1993	ACBL purchased ContiCarriers, a subsidiary of Continental Grain Company
1996	ACBL merged with Valley Lines
1998	ACBL purchased Southern Marine Service LLC and NMI Holdings
2000	ACBL purchased Peavy Barge Line, a subsidiary of Peavy Grain Company
2007	ACBL purchased 20 boats from McKinney Group

Source: www.aclines.com/main/ACL_history.asp

Tables 4 and 5 show how Ingram Barge and ACBL became the two largest barge firms. They do not explain why the barge industry became more concentrated. Figure 1 shows the trend in farm product shipments by barge for the period from 1971-2005. From 1971-1982, farm product exports increased 189 percent. During the mid-to-late 1970's, it was widely believed that the United States would feed the world.

Figure 1. Barge shipments of food and farm products on the Mississippi River System, in millions of tons, 1971-2005.



US Army Corps of Engineers. "Waterborne Commerce of the United States: Part 5 Waterways and Harbors National Summaries," various years.

Barge companies responded by purchasing record numbers of barges from 1978-1981. In expectation of rapidly increasing exports, several thousand barges were built during these four years. However, farm product exports declined 21 percent from 1983-1986, resulting in a huge overcapacity barge fleet. Most of the Ingram Barge line mergers occurred during this period of low farm product exports as smaller companies elected to exit the barge industry.

During the mid-1990's, increased grain exports, mostly to China, resulted in optimistic forecasts that China would buy increasing amounts of US grains. Again, the barge industry responded by buying large numbers of barges. From 1996-2000, several thousand barges were added to the Mississippi River System barge fleet. The predicted increases in grain exports failed to materialize, resulting in a continuation of an excess capacity barge fleet. Many firms wished to exit the barge industry but there were few, if any, new entrants into the industry to buy their barges. Therefore, existing barge firms were the only potential buyers of excess barges. Most of the ACBL acquisitions and mergers occurred during this period. This suggests that Sorenson's statement that "Entry is relatively unrestricted and capacity for established firms can be expanded or reduced with relative ease" no longer holds.

During this same period, the ethanol industry began consuming increasing amounts of corn. Hardy, et.al., estimated that, if all announced Iowa ethanol plants are actually built, and existing and under construction ethanol plants operate at capacity, Iowa ethanol production alone will consume more than all of the corn produced in the record 2007 Iowa corn crop. Iowa, Illinois and Minnesota ethanol plants are already consuming huge amounts of corn that have historically moved down the Mississippi River by barge. Increasing ethanol production has already contributed to the declining farm product barge traffic--mostly corn and soybeans--on the Mississippi River system. Thus, market conditions were and will continue to be a major reason for increased concentration in the Mississippi River System barge industry. Furthermore, a reversal of the concentration of the barge industry is unlikely unless there is a major change in the market conditions that has driven the current trend toward barge industry concentration.

As the number of barge firms declined and the concentration of the five largest barge firms increased, the size of the total barge fleet declined. In its 2005 annual report, American Commercial Lines, Inc. states:

> "We believe that existing capacity will continue to be retired from the barging sector. According to Informa, from 1998 to 2005, the industry fleet size was

> reduced by 2,521 barges, or a 10.9% reduction to its 2005 year-end level of 20,571. This level represents the lowest number of barges in operation within our industry since 1992. We believe capacity will continue to be taken out of the industry as older barges reach the end of their useful lives."

As the number of barges and barge firms decline, barge rates have increased sharply. In its 2006 Form 10-K report to the U.S. Securities and Exchange Commission, presented in their 2006 annual report, ACL states:

> "Market conditions continued to be strong during 2006. This represents the continuation of a trend which began in the first half of 2004. Throughout 2006, we continued to experience year after year increases in market freight rates for dry and liquid cargo commodities. We believe that the increases in dry cargo fuel neutral rates displayed in the key operating statistics table have been driven by the reduction in the industry supply of dry cargo barges, and an increasing demand for freight transported by barge, particularly coal and grain. The positive impact from increased freight rates was partially offset by an approximately $0.28 per gallon increase in fuel price in 2006 compared to 2005. As a result, our average rate per ton-mile for dry cargo freight and liquid cargo freight increased, on a fuel neutral basis, approximately 23.7% and 11.7% respectively in 2006, compared to 2005."

The same increases from 2004 to 2005 on a fuel neutral basis were 24% and 10% respectively. As a result, dry cargo barge rates per net ton-mile increased about 50 percent in two years on a fuel neutral basis. In a purely competitive market, these large increases in rates would result in large increases in the number of dry cargo barges, but the reverse has occurred. Moreover, ACL expects rates to continue to increase and the size of the barge fleet to decline even in the face of a small increase in the barge fleet in 2006. The reduction in the size of the barge fleet will likely accelerate as the large number of barges purchased in 1978-1981 become 30 years old, the age at which most barges reach the end of their economic life.

BARRIERS TO ENTRY

In its 2005 Annual Report, ACL states:

> "Since 1980, the industry has experienced consolidation as the acquiring companies have moved toward attaining the widespread geographic reach necessary to support major national customers."

This "widespread geographic reach necessary to support national customers" requires huge investments to provide transfer, fleeting, cleaning, construction, repair, maintenance, and logistics services, demanded by national customers. Indeed, the report states that Cargill is the largest ACBL customer provider with 12 percent of the ACBL 2005 revenue. ACBL's largest 10 customers, including Cargill, Alcom, BASF Corporation, Bunge, Con Agra Trade Group, United States Steel, and Shell Chemical, provided 34 percent of ACBL's 2005 revenue. A possible reason why Ingram Barge Co. and ACBL purchased or merged with the 19 companies is to spread the cost of providing the services demanded by these large customers over a larger volume of traffic. They also probably purchased the assets at a discounted price.

To accommodate their fewer, but larger, customers, ACBL's December 31, 2006 investment in equipment, land, and buildings totaled $456 million. It is no longer possible to buy a $200,000 used barge, and with free access to the river, compete successfully with the large integrated barge firms dealing with large integrated customers. Indeed, the five largest dry cargo barge companies are owned by large integrated companies that generate huge amounts of capital that barge companies need to finance the large investments needed to provide the services demanded by large national shippers.

Table 6 shows the ownership of the five largest barge companies along with the 2006 revenues and other businesses of the owning firms. Two of the top five barge firms are owned by Cargill and ADM, the two largest grain firms in the world, with combined 2006 revenues exceeding $111 billion. One firm, AEP MEMCO, is owned by American Electric Power, the largest generator of electricity in the United States with 2006 revenues of $12.6 billion.

Table 6. Revenues and Other Businesses Operated by Companies Owning the Five Largest Barge Companies on the Mississippi River System

Barge Company	Owning Company	2006 Revenue in $ Billions	Other Major Businesses
Cargo Carriers	Cargill	$75.2	Grain, other agricultural and industrial
American River Transportation Company	ADM	$36.6	Grain and other agricultural
AEP MEMCO	American Electric Power	$12.6	Electrical power generation
Ingram Barge Company	Ingram Industries, Inc.	$2.30 a)	Wholesale book distribution and high risk driver insurance
American Commercial Barge Line	American Commercial Lines, Inc.	$1.0	Barge and ship construction

Sources: www.cargill.com , www.admworld.com/naen/it/news/asp., www.aep.com , www.ingram.com , American Commercial Lines Inc. 2006 Annual Report.

a) 2005 revenues.

It is likely that these three firms buy a large portion of the transportation services of their subsidiary barge firms. These three barge firms are part of highly integrated firms that can exercise substantial control over barge supply and prices.

VERTICAL INTEGRATION

The largest barge firm is owned by Ingram Industries, a diversified firm with 2005 revenues of $2.3 billion. Ingram Barge Co. also builds some of its own barges. The second largest barge firm, American Commercial Barge Lines (ACBL) owns Jeffboat, Inc. the second largest builder of barges in the United States. Therefore, ACBL and Ingram are integrated backwards in the barge industry.

In its 2006 Annual Report, ACL states:

> "We believe the synergy created by our transportation operation and Jeffboat's manufacturing and repair capabilities is a competitive advantage. Our vertical integration permits optimization of manufacturing schedules and asset utilization between internal requirements and sales to third party customers and gives Jeffboat engineers an opportunity to collaborate with our barge operations on innovations that enhance towboat performance and barge life."

Vertical integration can and is used to control raw material supplies and coordinate shipping to optimize prices and profits in the marketing chain. The grain industry is a classic example of using barges to optimize prices and profits. Table 7 shows the concentration of the grain export industry in the New Orleans area which is served primarily by the Mississippi River System barge industry.

Table 7. Locations and Owners of Grain Export Elevators on the Mississippi River Deep Water Corridor* from Baton Rouge, Louisiana to the Gulf of Mexico, August, 2006

Owner	Number of Elevators	Elevator Locations	Percent of Elevators	Cumulative Percent
ADM	4	Reserve Destrehan Ama** St. Elmo-Paulina	40	40
Cargill	3	Port Allen Westwego Terra Haute – Reserve	30	70
Bunge International	1	Destrehan	10	80
Harvest States	1	Myrtle Grove	10	90
Zen Noh ***	1	Covenant	10	100
Total	10		100	

* Commonly referred to as New Orleans (NOLA)
** Operated by ADM and jointly owned with Growmark
*** A Japanese firm

Table 7 shows that ADM and Cargill own and operate 70 percent of the 10 grain export elevators in the New Orleans area. In addition, ADM and Cargill operate a substantial portion of the barge loading grain elevators on the Mississippi River system. There is a high probability that Cargill and ADM buy a large portion of the Cargo Carriers and American River Transport Company capacity. Moreover, as ACBL indicates that Cargill is their largest customer, Cargill and ADM are likely large customers of the remaining barge companies. Thus, the large barge owning grain companies are integrated backward and forward in the grain industry. This integration is further evidence that the barge industry is not perfectly competitive.

PRODUCT DIFFERENTIATION

In 1978, Woolverton stated that:

> "There is little basis for concluding that the degree of product differentiation would allow the firm to charge a substantially higher price for its service than other barge firms."

However, in 2005, ACL stated that barge company consolidation is driven by the need for "widespread geographic reach necessary to support national customers." This means that the large barge firms compete by offering services to national customers including manufacturing, repairs, terminals, intermodal, port, third-party logistics, including stevedoring customs services, tracking shipments, and stock-to-stock services. These are attempts to differentiate their services from their competitors.

CONCLUSIONS

- Many economics textbooks and research papers have explicitly or implicitly assumed that the Mississippi River system barge industry is purely competitive and therefore, publicly funded waterway expenditures are shifted forward to shippers and receivers. None of these textbooks, papers or reports cites empirical evidence to support their assumption of a perfectly competitive barge industry.

- In his1978 Ph.D. Thesis to the Faculty of the University of Missouri-Columbia, Woolverton states "Concentration ratios based on the number of covered grain barges owned by each firm indicated that market concentration in the industry has declined slightly in the past five years but still is high enough to classify the industry as oligopolistic rather than purely competitive.
- This paper updates the Woolverton study of the Mississippi River barge industry by expanding the analysis to include both open top and covered dry cargo barges and liquid cargo barges. It also expands the analysis to include the Herfindahl index to evaluate the market structure of the barge industry. Using data obtained from barge firm reports and websites, the conclusions from this updated study are:
    - The 2005 C4 concentration ratio for dry cargo barges was 38 percent higher than the Woolverton C4 ratio in 1972, and 114 percent higher than the Woolverton 1977 concentration ratio.
    - The Herfindahl index for the top five dry cargo barge firms is 1006, higher than the 1,000 minimum value for all firms in an industry to be an oligopoly. The Herfindahl index for the entire dry cargo barge sector is probably in the range of 1,080-1,100.
    - Both measures of concentration indicate that the Mississippi River system barge industry is oligopolistic, not perfectly competitive.

- The 2006 concentration ratio and Herfindahl index indicate that the liquid cargo barge industry is also oligopolistic.
- The declining number of barge firms, combined with the declining number of barges and rising barge rates, provide further evidence of the oligopolistic structure of the Mississippi River system barge industry.
- The huge capital requirements of this declining number of barge firms, extensive vertical integration with barge companies and companies integrating backward and forward, also provide additional evidence that the Mississippi River barge industry is not perfectly competitive.
- The major reason for the increasing concentration of the barge industry is the changing structure of the markets for barge freight, and the excess capacity of the barge fleet brought about by overly optimistic expectations of the demand for Mississippi River system barge freight.

IMPLICATIONS

- The large number of studies evaluating the feasibility of publicly funded investments of navigation infrastructure on the Mississippi River System , based on the assumption that the barge industry is perfectly competitive, have the following flaws:
    - They overestimate the demand for barge transport
    - They overestimate the benefits that accrue to shippers and receivers
    - The overestimate the benefits of investments in waterway navigation infrastructure and the shares that are passed back to the taxpaying public.

If future inland waterway navigation researchers expect to accurately estimate the public benefits from public investments in waterway navigation infrastructure and the shares of these benefits passed back to shippers and their customers, the assumption of a perfectly competitive barge industry must be abandoned and replaced with the realistic assumption of an oligopolistic Mississippi River barge industry. A good place for these researchers to start modifying their assumptions, models and data is the recommendations in the two National Research Council reviews of the Corps' Upper Mississippi River Waterway Feasibility study.

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