Measuring a Port's Performance Using the Economic Value of Commodities

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The marine transportation system plays a significant role in the US and other countries' economies. Ports play a vital role in this system by serving as gateways to economic activities. Depending on their cargo, some ports are considered as primarily container ports, bulk cargo ports, or a combination of cargoes. The importance of all of these ports is undisputable, but their ability to provide services often depends on the state of their facilities and ability to obtain resources to support them. Resources are scarce, however, and in the United States all ports compete for federal, state, local and private resources. To allocate scarce resources efficiently and effectively, decision-makers must be able to assess a port's performance not only over time but also relative to other ports. The heterogeneity of cargo, however, makes port performance comparison difficult. Conventionally, TEU's tonnage or tons per mile statistics are used in port evaluations. These indicators, however, do not reflect the monetary value ports help to create or the economic significance of their service. For example, when using the tonnage indicator, decision-makers essentially weigh one ton of coal equally to one ton of wheat. In reality, however, one ton of wheat is much more valuable than one ton of coal: in 2010, hard red winter wheat was valued at $246 per net ton and subbituminous coal was $14 per net ton.

To capture the heterogeneity of cargo and the economic role of ports, we propose using the value of commodities as one of port performance measures. In fact, container ports already collect this data, but bulk ports typically do not. The improvement to the existing cargo value tracking practice is that we propose using the total *real* value of a port's cargo, which adjusts the nominal value for inflation and helps reveal the trends in the demand for a given port's services. This metric is another tool that port and waterway navigational authorities can use in creating future port development plans. In addition, tracking the value of bulk cargo is useful in the development of economic impact studies.

Two other proposed indicators are the average real value per ton moved and the real value index of a port. The average real value per ton moved can be used along with the cargo total real value to compare different ports economic performances, whereas the port's real value index can help track each port's economic performance over time. Using the Port of Duluth-Superior as a case study, we illustrate how these economic performance measures can be estimated on an annual basis using publicly available data.

The following formula was used for calculating the proposed total real value of a port's cargo indicator (TRV), where P stands for a market price of a commodity, Q stands for commodity's tonnage moved through a port, PPI stands for a producer price index, i indices all transported commodities, and t indices years:

$$TRV_t = \sum_{i=1}^{N} P_{it} Q_{it} \div \left(\frac{PPI_{it}}{100} \right)$$

The total real value of the cargo indicator as an aggregate measure does not explicitly reflect how many tons were actually moved or how valuable a ton of cargo is. Therefore, to improve the allocation of resources, we suggest that the average real value per ton moved and tonnage are factored into the decision-making, as well as other metrics. For example, if two ports have the same tonnage indicator but different total real values of the cargo, the port with a higher

average real value per ton may have economic justification for additional funding. The following formula was used for calculating the average real value per ton:

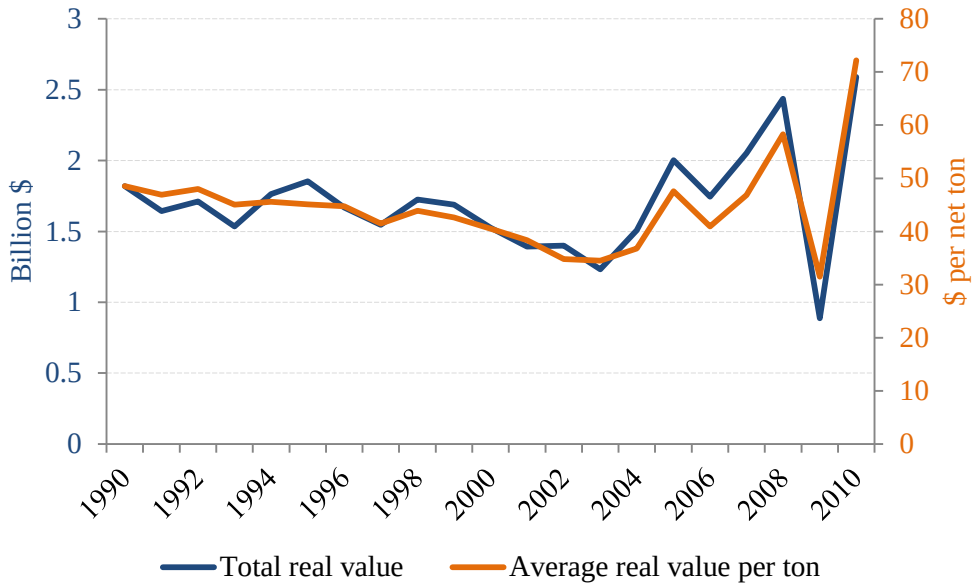
$$ARV_t = \frac{TRV_t}{\sum_{i=1}^{N} Q_{it}}$$

TRV and *ARV* are useful in comparing different ports performances to each other. To track a given port's performance over time, we suggest using the real value index of a port. The following formula was used for calculating the proposed real value index of a port, which compares the total real value of the port's cargo in a given year to a base year of 2005. Alternatively, the base year could also represent the time period when a port received public funds.

$$RVI_t = \frac{TRV_t}{TRV_{2005}} \times 100$$

To estimate the three proposed port performance indicators, we collected statistical data on the Port of Duluth-Superior cargo tonnage, market prices for commodities shipped through the port, and producer price indices. All data was collected from publicly available sources, including the US Army Corps of Engineers, World Bank, US Energy Information Administration, Bureau of Labor Statistics, and MN DNR. Figures 1 and 2 illustrate the proposed port performance indicators calculated for the Port of Duluth-Superior.

Figure 1. Port of Duluth-Superior Total Real Value and Average Real Value Per Net Ton

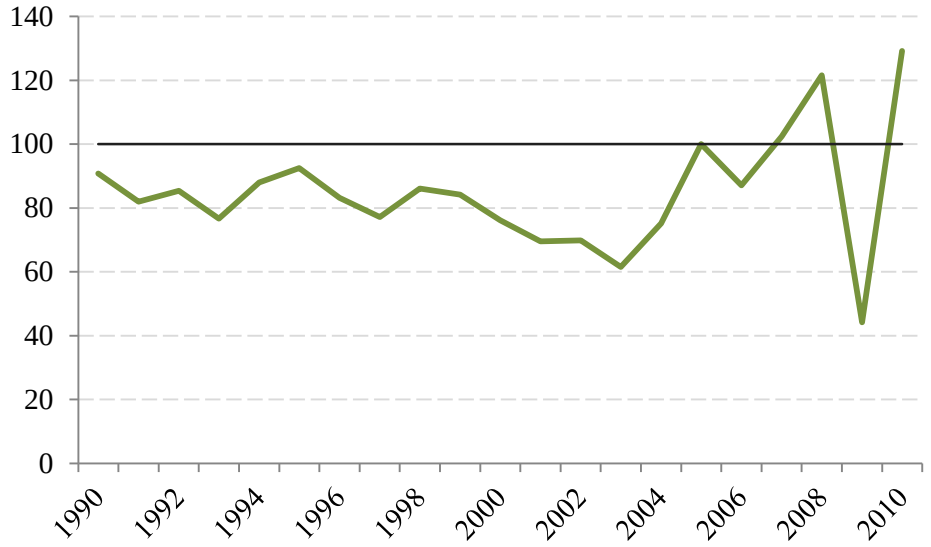


The total real value of the port (blue line, figure 1) averaged about $1.6 billion in 1990-2004 and $2.1 billion between 2005 and 2008. The 2007-2009 recession has affected the port, with the total real value of the cargo dropping to $0.9 billion in 2009. However, a strong world demand for iron ore helped rebound the port's total real value of the cargo to $2.6 billion in 2010.

The average real value of the port's cargo (orange line, figure 1) was about $42.5 per net ton in 1990-2004 and $48.4 per net ton in 2005 and 2008. In 2009, the port's average real value dropped to $31.5 per net ton but then more than doubled by 2010, peaking at $72.2 per net ton. Analysis of these two time-series suggests that the majority of the fluctuations resulted from the variability in iron-ore prices and tonnage.

Figure 2. Port of Duluth-Superior Real Value Index

(2005 = 100)



The real value index of the Port of Duluth-Superior illustrates that in 2007 and 2008 the port has performed significantly better than in 2005 (see figure 2). Not surprisingly, in 2009, the index dropped to 44% but then rebounded to 129% in 2010. Given the severity of the 2007-2009 recession, it is remarkable that the real value index dropped for only one year. This suggests that there is a strong demand for the commodities transported by the port and, hence, port's services.

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