Regional Economic Impacts of Infrastructure Failures in the Mississippi River System (Summary)

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This is a summary of "Regional Economic Impacts of Inland Waterways Systems Failure in the Mississippi River and the Role of Transportation Resilience" by Zhenhua Chen and Junmei Cheng.[1] The research and analysis received funding from USDA's Agricultural Marketing Service (AMS) through cooperative agreement number 21-TMTSD-OH-0014. The opinions and conclusions are the authors' and do not necessarily reflect the views of USDA or AMS. The full paper is available at: https://papers.ssrn.com/sol3/papers.cfm?abstract_id=4719260.

WHAT IS THE ISSUE?

The Mississippi River System (MRS) plays a vital role in moving agricultural goods and other commodities efficiently and sustainably. In recent years, the MRS has faced escalating challenges, including disruptions caused by extreme weather events (e.g., flooding, droughts, hurricanes) and disruptions from aging infrastructure. For instance, in 2022, water levels along the MRS dropped to record lows, forcing tow boats to move fewer and lighter barges than normal. Barge movements to the U.S. Gulf slowed, and spot rates rose to record highs. Disruptions to the MRS vary in severity, location, and duration. Understanding their nature and impact is crucial for shipping, planning, and investment decisions.

The researchers provide an empirical assessment of the regional economic consequences of MRS disruptions (drought, fog, flood, snow and ice, other weather conditions, system failure, system maintenance, and water level), focusing on the Upper Mississippi River-Illinois River (UMR-IR) region comprising five states (Illinois, Iowa, Missouri, Minnesota, and Wisconsin).

WHAT DID THE STUDY FIND?

The researchers found that a lock closure in the UMR-IR region can have severe economic consequences, affecting not only States in the closure's direct vicinity, but also neighboring states.

Notably, nonscheduled disruptions (i.e., caused by extreme weather, such as droughts, floods, and ice, or emergency repairs) have more significant economic consequences than scheduled maintenance disruptions. Furthermore, the duration of the disruption has a significant influence on the barge rate, both locally and also in surrounding States. Specifically, an

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extra day of a disruption at any particular lock leads to an increase in the barge rate of 3.5 percent at surrounding locks. However, the spillover effects are generally larger than the direct effects such that 1.1 percent of the increase is located in the State with the lock disruption and 2.4 percent of the increase accrues in neighboring States.

Using data from 2013 to 2021, a 30-day closure at Lock and Dam 25 (located in Winfield, MO, about 50 miles north of St. Louis) would result in substantial economic losses, including a $3.0 billion reduction in national gross domestic product (GDP). Over one-third of this GDP loss ($1.2 billion) would occur in the UMR-IR region. This closure would also jeopardize over 15,000 jobs in the five UMR-IR States. If the shutdown were extended to 180 days, national GDP losses would rise to $15.2 billion, with 42 percent of the losses ($6.4 billion) in the UMR-IR region. In the 180-day scenario, over 84,000 jobs in the UMR-IR region could be lost.

To explore the MRS's resilience, the researchers also calculated how much economic harm from MRS disruptions could be mitigated by shifting shipments from barge to rail. For instance, 9 percent of national GDP losses in the case of a 30-day shutdown and 18 percent of national GDP losses in the 180-day case could be avoided with barge-to-rail substitution. In the UMR-IR region, the avoided losses would be 11 percent and 22 percent, respectively. Similarly, barge-to-rail substitution can mitigate job losses from MRS disruptions: the researchers estimate, in the UMR-IR, that barge-to-rail substitution would save 2,000 jobs in the 30-day case and 19,000 jobs in the 180-day case.

Finally, the authors discuss the implications of their research. For instance, given the significant adverse effects of disruptions (both scheduled and unscheduled), the researchers suggest decisions on infrastructure investment should prioritize maintenance and upgrades of the inland waterway system (including the MRS). In addition, the researchers emphasize that proactive planning can streamline barge operations and minimize the impact of scheduled disruptions. The researchers also underscore the role of rail substitution in enhancing the MRS's resilience. To maximize resilience, they advocate for expanding multimodal shipping facilities along inland waterways and optimizing schedule coordination between barge companies and railroads.

HOW WAS THE STUDY CONDUCTED?

The analysis consisted of three major components: (1) a statistical analysis examining the relationships between variations in inland barge rates and environmental conditions (e.g., water levels, temperature, lock system failures) using weekly data spanning from 2013 to 2021; (2) a panel regression analysis, investigating the substitution dynamics between barge and rail transportation; and (3) a state-of-the-art multiregional computable general equilibrium model estimating the regional economic impacts (e.g., GDP and employment) of MRS failures.

PREFERRED CITATION

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