

U.S. Senate Budget Committee Testimony—Adam Rose (University of Southern California) 10/25/23

Chairman Whitehouse, Ranking Member Grassley, members of the Committee, my name is Dr. Adam Rose and I'm a research professor at the University of Southern California. I am also a research team member on the Defense Advanced Research Projects Agency's Resilient Supply-and-Demand Networks program – an effort to improve the resilience of strategic supply chains.¹

I'm honored to appear before the Committee to provide input into the discussion of Climate Change Impacts on Supply Chains. My testimony pertains to an on-going study, "Supply-Chain Impacts of Mississippi River Fertilizer Shipment Disruptions on Agricultural Production and the U.S. Economy," which I've co-authored with Professor Zhenhua Chen of The Ohio State University, Professor Fred Roberts of Rutgers University, and retired Coast Guard Captain, Andrew Tucci.² This research is being sponsored by the DHS Center for Accelerating Operational Efficiency (CAOE) at Arizona State University, and is being carried out at the DHS Center for Risk and Economic Analysis (CREATE) at the University of Southern California and the DHS Command, Control and Interoperability Center for Advanced Data Analysis (CCICADA) at Rutgers University.

Our research is focused on complex supply chain disruptions, where multiple events combine to have compound or cascading impacts across economic sectors or geographic areas. Currently, we are working on a case study that examines compound disruptions affecting barge traffic on the Mississippi, which is vital to agriculture and other industries. Any such impact would spread to the economies of Mississippi River states and the nation as a whole.

The first of the compound disruptions is drought, which is currently in its second consecutive year on the River, with water levels at historical lows. The most likely cause of this situation is climate change. The second disruption is a failure of Lock/Dam 27 near St. Louis. The Lock and Dam network on this river and others are part of America's aging infrastructure, and is especially vulnerable to climate change driven events such as heat, floods, and drought. Our third disruption pertains to an interruption of fertilizer imports through New Orleans, which could also be due to climate change, since this city is a typical bull's-eye for hurricanes.

We estimated the economic impacts using a state-of-the-art economic tool known as computable general equilibrium modeling, which characterizes the economy as a set of interrelated supply chains, or a "supply web." Here are our major findings about the impact of this combination of disruptions:

GDP impacts: A national loss of \$18.1 billion, with the vast majority of the impacts incurred by the 5 upper Mississippi River states (Illinois, Iowa, Minnesota Missouri, and Wisconsin).

Employment impacts: A net loss of 51,000 job-years. This figure would be higher except that, in our scenario, there is need for more labor to have to load and unload more barges because each can only carry a lighter load at low water levels.

¹ <https://www.darpa.mil/news-events/2023-10-18>

² Chen, Z., A. Rose, F. Roberts, and A. Tucci. 2023. "Supply-Chain Impacts of Mississippi River Fertilizer Shipment Disruptions on Agricultural Production and the Regional and National Economies," Center for Risk and Economic Analysis (CREATE), University of Southern California, and Command, Control and Interoperability Center for Advanced Data Analysis (CCICADA), Rutgers University, forthcoming.

Price impacts: An increase in the Producer Price Index of 0.30% and in the Consumer Price Index of 0.25%. In an era of high inflation these seemingly small percentages are very meaningful.

We believe that this research is important because impacts on agriculture affect U.S. and world food security. While this consideration doesn't get as much attention in the U.S. as in developing countries, it is a problem for low-income families and many people of color in our country.

While we don't expect disruptions like this every year, they are likely to increase in frequency and magnitude as climate change accelerates. This will impact the production of critical goods and services, seaports, and other infrastructure, thereby disrupting supply chains in the U.S. and among our trading partners.

I also note that the climate change impacts I've reported today only pertain to fertilizer supply-chain impacts on the Mississippi River. This commodity represents only about 6% of all barge traffic on the River, so our estimates are only a small part of the total national economic impacts that climate change is likely to have on this transportation route and other inland waterways. In particular, the estimates do not account for the impacts to shipments of corn, wheat, and other grains on the River, which would increase the impacts just reported considerably.

Our research team is also examining compound disruption scenarios in the Port of New York/New Jersey and the Ports of Los Angeles/Long Beach stemming from additional stressors, including sea-level rise and wildfires. We expect the impacts from these compound disruptions to be in the tens of billions of dollars.

I've reported in depth on only one of a myriad of supply chain disruptions that will be caused by climate change. In fact, given the high degree of interdependence between sectors of the U.S. economy and our economy's connection with those of most every other country on the globe, it is only a very small proportion of the total negative impacts. Many people will be affected thorough loss of jobs and profits, but, most widely, every consumer in the U.S. will see their purchasing power diminished by the inflation caused by increased production costs, shortages, and delays of goods and services.