

Local Economic Impacts of Deepening the Menominee Harbor

MARCH 2024

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EXECUTIVE SUMMARY

Purpose of Report

The City of Menominee partnered with the US Army Corps of Engineers (USACE) to conduct a feasibility study to deepen the Menominee Harbor. The feasibility study includes an economic evaluation focused on the construction costs and national and regional transportation benefits associated with the deepening project. The City of Menominee later contracted with researchers at Michigan Technological University, Dr. Laura Connolly, Dr. Jenny Apriesnig, and Mr. Travis White, to further analyze the anticipated economic impacts associated with the deepening project in the local area. We first provide a brief overview of the Menominee Harbor and the local economic context. Then, we estimate the economic impacts associated with the deepening project for Michigan's Upper Peninsula (UP) and Northeast Wisconsin (NE WI).

Overview of Methodology

We use IMPLAN to estimate the projected economic impacts associated with deepening the Menominee Harbor. IMPLAN is an input-output economic database and modeling software that accounts for linkages across industries and household spending patterns. Based on interviews with local stakeholders, we developed five scenarios to evaluate the potential impacts associated with the deepening project. The scenarios vary in the magnitude of direct economic shocks across industries and geographic locations to represent a spectrum of possible outcomes. We estimate the direct, indirect, and induced economic impacts for each scenario for two local geographic regions: Michigan's Upper Peninsula and Northeast Wisconsin.

Summary of Main Findings

The results highlight both the potential economic gains in the local area if the Menominee Harbor is deepened and the significant potential losses if the status quo is maintained. If the federal navigation channel is deepened, we estimate that shipping efficiencies and cost savings translate to an additional: 860 to 1,700 jobs, \$191 to \$380 million in output, and \$9 to \$19 million in state and local tax revenue each year. In contrast, if the harbor is not deepened and local stakeholders must absorb higher costs, we estimate significant annual losses: 1,500 to 2,900 jobs, \$327 to \$641 million in output, and \$16 to \$31 million in state and local tax revenue. We separately analyze the impacts associated with the construction required to dredge the harbor; the construction phase contributes an additional 180 total jobs and \$27 million in economic output (although construction is a one-time event). Across scenarios, the majority of the impacts (positive or negative) are concentrated in Northeast Wisconsin.

Disclosure of Projected Impacts

This report projects future economic impacts. All estimated economic impacts are inherently subject to risk and uncertainty. This risk and uncertainty may lead the actual results to differ from the projected impacts in this report.

SIGNIFICANCE OF WATERBORNE TRANSPORTATION

Waterborne transportation is the most economical, energy efficient, and environmentally friendly cargo transport option domestically and internationally (Cohen, 2005). For example, a 1,000-foot vessel can haul approximately 70,000 tons of cargo, which would require seven 100-car trains with capacity of 10,000 tons each or 3,000 trucks with capacity of 25 tons each (Integrated Analysis Task Force Homeland Infrastructure Threat and Risk Analysis Center; IATF/HITRAC, 2014). There are also significant differences in fuel efficiency across transportation modes; for every one gallon of fuel per cargo ton, a Great Lakes vessel can travel 607 miles compared to 202 miles for freight trains and 59 miles for trucks (IATF/HITRAC, 2014).

Throughout America's Marine Transportation System (MTS), every inch of water depth has a direct impact on achieving waterborne transportation efficiencies and economies of scale. Throughout the MTS, each waterway and port have a minimum water depth for safe navigation; the US Army Corps of Engineers (USACE) is tasked with maintaining the navigable waters of the United States by planning and constructing new navigation channels, locks, and dams and dredging to maintain channel depths. In federally managed waterways, a design depth (or authorized depth) is the depth to which the USACE has been authorized to maintain the federal channel by the enabling legislation for that federal project. The draft of a vessel is defined as the vertical distance between the waterline and the bottom of the hull (keel), at the lowest point. A vessel's draft, based on its design and cargo loading, must always be less than design depth for a waterway to avoid grounding.

Water levels fluctuate naturally, and waterway depths change over time due to natural and human-caused changes to the lake bottom. Also, economic activities change in local regions, impacting waterway utilization. It is generally true that an increase in water depth can translate to positive economic outcomes, whereas a decrease in water depth can have the opposite impact; this assumes the depth of the waterway is a limiting factor to demand for waterborne transportation and utilization. For example, in 2004 the Great Lakes St. Lawrence Seaway's draft increased from 26 feet, 3 inches to 26 feet, 6 inches enabling cargo ships to carry up to 300 tonnes of additional cargo per voyage (Great Lakes St. Lawrence Seaway System, n.d.). Conversely, draft reductions of one to two feet in Alpena Harbor led transportation costs to increase by \$570,000 to \$1,600,000 per year (USACE, 2006), and reductions of two to three feet in the Great Lakes-St. Lawrence Seaway System increased transportation costs between \$752,000 and \$2,000,000 per year (IATF/HITRAC, 2014). Maritime commerce is vital to the United States' economy and security; USACE maintains 12,000 miles of inland and intracoastal waterways and oversees dredging and construction projects at hundreds of ports and harbors at an average annual cost of over \$1.3 billion. USACE dredges over 210 million cubic yards of material each year to keep the nation's waterways navigable. In addition to maintenance projects, changes to channel design must be carefully considered with respect to local economic activities and macro infrastructure needs.

MENOMINEE HARBOR

The Menominee Harbor is at the mouth of the Menominee River and feeds into Lake Michigan. It is located on the border between Michigan’s Upper Peninsula and Wisconsin, between the cities of Menominee, MI and Marinette, WI. The harbor is a deep draft commercial harbor; the federal navigation channel has an authorized depth of 21 feet and a width of 300 feet. For comparison, the current Great Lakes St. Lawrence Seaway System is maintained at a “seaway draft” of 26 feet, 6 inches. This depth establishes the size and loading of all vessels operating within the Great Lakes St. Lawrence Seaway. Where ports and harbors have less draft than seaway depth, incoming vessels cannot be fully loaded, resulting in significantly greater transportation cost and inefficiency. To maintain the current authorized depth, Menominee Harbor requires maintenance dredging every five to ten years, which was last performed in 2014 (U.S. Army Corps of Engineers, 2023). The Menominee Harbor has three primary users: KK Integrated Logistics (KKIL), Marinette Fuel & Dock, Co. (MFD), and Fincantieri Marinette Marine (FMM; the shipyard). Commodities brought in through the port include coal, pig iron, pulp, and paper (USACE, 2023).

Dredging the Menominee Harbor

Dredging the Menominee Harbor to deepen the federal navigation channel will impact local stakeholders and the region’s economic activity. The authorized depth of the federal navigation channel combined with changes in lake levels have created economic challenges for the local area. Larger vessels must light-load to avoid grounding in the harbor. This creates transportation inefficiencies, restricts commodities transported, and increases the cost of shipping for local stakeholders (USACE, 2023). The current channel depth also impacts FMM’s recent contract to build Constellation-class guided-missile frigates (FFG) for the US Navy. The shipyard is under contract with the Navy to build the first four FFGs, with an option for up to 10 ships for a cumulative value of \$5.5 billion (Fincantieri Marinette Marine, 2023). FMM has already invested in deepening their berth at their facility in Marinette for construction of the new frigates and vertical ship launch, but the current channel depth limits FMM’s ability to launch the FFG. At full displacement, the FFG will have a maximum navigation draft of 23 to 24 feet, which is greater than the current authorized depth of the federal navigation channel in Menominee Harbor (Congressional Research Service, 2020). Of the shipyard's locations, Marinette is the only site that can support construction and launching of the FFG. The cost of moving FFG construction elsewhere would be crippling for the shipyard and could jeopardize its FFG contract with the US Navy and possibly its entire business.

United States Marine Highway Designation and FMM’s Ship Building “System-of-Yards”

The waterways connecting Menominee Harbor, Sturgeon Bay, and Green Bay have been designated as a Marine Highway Project under the Maritime Administration’s United States Marine Highway Program. This initiative aims to promote freight transportation along navigable waterways as an alternative to land-based transport. Known as the Transbay Freight Service

Project, it will divert the transportation of large vessel modules and material-handling equipment from highways to waterways, improving marine transportation between Fincantieri Marine Group's shipyards in Marinette, Green Bay and Sturgeon Bay. The designation is expected to ensure the long-term sustainability and growth throughout the region, providing cost-effective shipping to sustain and create jobs. The project has received funding, including a grant of \$3.3M for the M-90 Transbay Marine Highway Equipment Acquisition Project, which will contribute to acquiring equipment for safe, sustainable, and efficient cargo transfers between shore and vessel at FMM's facilities.

All three of Fincantieri's shipyards in Northeast Wisconsin will work on the frigate project. Bay Shipbuilding in Sturgeon Bay will build large portions of the frigate's hull and then ship them by barge to Marinette. ACE Marine in Green Bay will also be leveraged to build certain modules for the FFG and ship them to Marinette. FMM's newest facility, Building 34, was recently erected to house construction of the entire FFG ship, prior to launching. This "system-of-yards" approach will leverage capabilities and capacity across the three Northeast Wisconsin facilities, allowing the shipyard to complete up to two FFG's a year, satisfying the Navy's projected demand and delivery schedule requirements.

LOCAL ECONOMIC CONTEXT

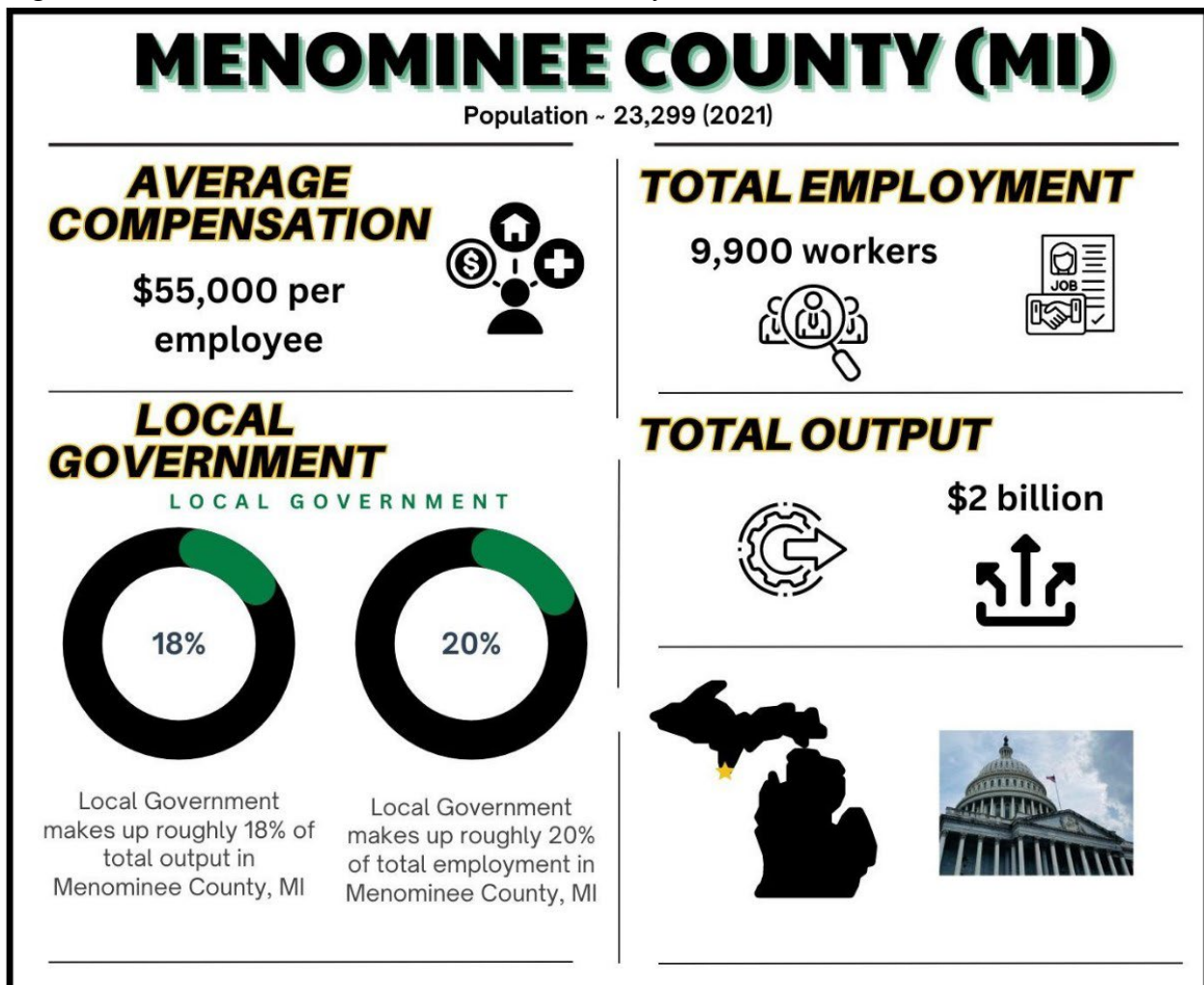
We first present an overview of local economic conditions and activities to provide context behind the methodology, analysis, and results. The Menominee Harbor is located along the Michigan-Wisconsin state border, between Menominee County (MI) and Marinette County (WI). In our analysis, we directly shock economic activity in these two counties. Therefore, we start with an overview of each county, followed by a brief overview of the region: the Upper Peninsula (UP) and Northeast Wisconsin (all data referenced is for year 2021). The UP is made up of 15 counties: Alger, Baraga, Chippewa, Delta, Dickinson, Gogebic, Houghton, Iron, Keweenaw, Luce, Mackinac, Marquette, Menominee, Ontonagon, and Schoolcraft. Northeast Wisconsin is made up of 16 counties: Brown, Calumet, Door, Florence, Forest, Kewaunee, Langlade, Manitowoc, Marinette, Menominee, Oconto, Oneida, Outagamie, Shawano, Vilas, and Winnebago.

Menominee and Marinette Counties

Menominee County is in Michigan's Upper Peninsula along the state border with Wisconsin. The county's population was 23,300 people with a total employment of almost 10,000 jobs and total economic output of \$2 billion (IMPLAN, 2024). Marinette County, in the northeast corner of Wisconsin, had a population of approximately 42,000 people with total employment near 23,000 jobs and total economic output of \$4.4 billion in 2021. Although Marinette County's population and employment are nearly double that of Menominee County, we observe several similarities across the two counties. Both counties are rural, production-based economies. Over 10% of jobs in each county are in production occupations, approximately 50% of households in each county

have income less than \$50,000, and less than 20% of adults (those age 25 and older) have a college degree (IMPLAN, 2024). Although, average employee compensation is approximately \$7,000 higher in Marinette County, \$62,000, compared to Menominee County, \$55,000 (IMPLAN, 2024). Figures 1 and 2 provide an overview of the economic conditions in 2021 in Menominee County (MI) and Marinette County (WI), respectively.

Figure 1. Economic Overview of Menominee County, MI

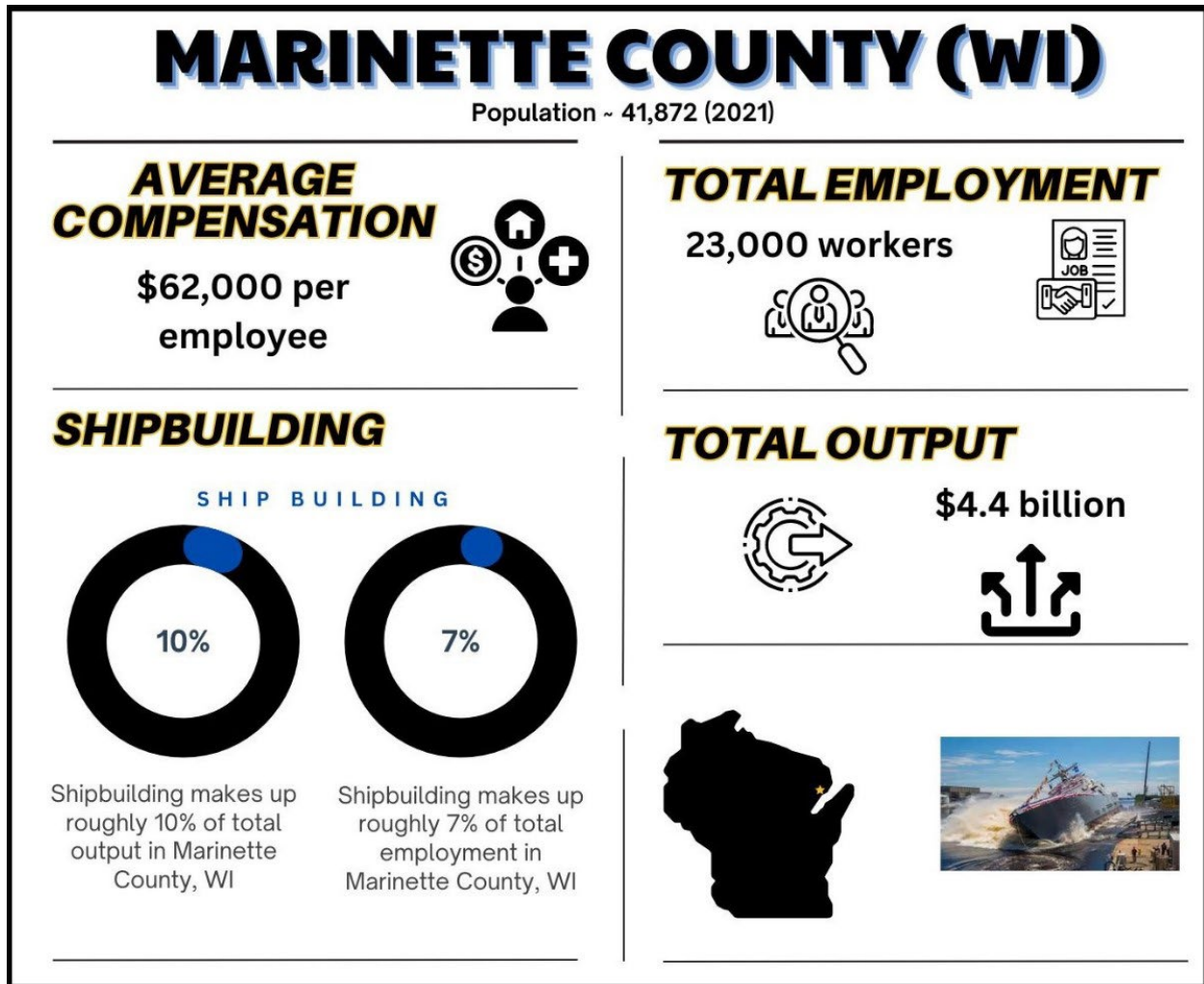


We can also consider the top industries for employment and economic output in each county. Local government is the top industry for both employment and output in Menominee County, making up nearly 20% of total employment and output.¹ In contrast, shipbuilding and repair is the top industry for both employment and output in Marinette County (which reflects FMM). Nearly 10% of output and 7% of employment in Marinette County is tied to FMM. Other industries that stand out across

¹ The local government sector includes education (employment of 457; output of \$32 million), hospitals and health services (employment of 189; output of \$13.2 million), other services (employment of 384; output of \$30.5 million), and other local government enterprises (employment of 897; output of \$274.2 million) (Data Team, 2017; IMPLAN, 2024).

counties include mills (paper, saw, or pulp); miscellaneous manufacturing; and motor vehicle gas engine and parts manufacturing. These industries continue to highlight the production-based nature of the local economies.

Figure 2. Economic Overview of Marinette County, WI



The Upper Peninsula and Northeast Wisconsin

We explore economic impacts to both Michigan’s Upper Peninsula and Northeast Wisconsin from the Menominee Harbor deepening project. The UP makes up approximately one-third of Michigan’s land mass, but less than 3% of the state’s population – approximately 300,000 people. The UP has total employment of approximately 143,000 jobs and total economic output over \$25 billion (IMPLAN, 2024). The area is known for tourism due to its outdoor amenities, recreation activities, and access to the Great Lakes. This is reflected in some of the area’s top industries for employment: limited and full-service restaurants; retail, food, and drinking places; and hotels/motels. Other top industries for employment include local and state government; hospitals; and real estate. The UP’s history is rooted in mining, which continues to influence the area’s

economic activity today. Two of the top ten industries for output include iron ore mining and copper, nickel, lead and zinc mining. Other top industries for output relate to real estate; paper mills; hospitals; and local or state government (IMPLAN, 2024).

In comparison to the rural UP, economic activity is significantly higher in Northeast Wisconsin. The region has a population of over 1 million people, total employment of approximately 650,000 jobs, and total economic output over \$130 billion (IMPLAN, 2024). The top industries for employment are also more diversified. Top industries for employment include local and state government; hospitals; real estate; restaurants; management of companies and enterprises; truck transportation; and nursing and community care facilities. Top industries for output include cheese manufacturing; real estate; insurance carriers; paper mills; hospitals; management of companies and enterprises; truck transportation; and manufacturing (IMPLAN, 2024). The region is often known for its farmlands and agricultural production, particularly related to cattle/dairy and corn. This cross-region comparison highlights the different economic structures between Michigan's UP and Northeast Wisconsin, which must be considered when synthesizing the results from the economic impact analysis.

METHODOLOGY

We use IMPLAN to evaluate the possible economic outcomes of dredging versus not dredging the Menominee Harbor. IMPLAN is a regional input-output modeling software that estimates direct, indirect, and induced effects, accounting for the interdependence across industries and household spending (Clouse, 2020). For the analysis, we employ IMPLAN's multi-region input-output model (Clouse, 2017) and directly shock employment or output in specific industries in Menominee County (MI), Marinette County (WI), and Door County (WI). Then, we analyze how these direct economic shocks circulate through the local region, Michigan's Upper Peninsula and Northeast Wisconsin. The direct economic impacts come from local businesses adjusting employment or output in response to changes in shipping efficiencies, construction, or costs associated with dredging or not dredging the harbor. Indirect economic impacts are then generated from changes in business-to-business purchases as money associated with the direct effects circulates through the supply chain. Last, the induced economic effects capture changes in household spending in the local economy (stemming from changes in both direct and indirect employment).

Prior to conducting any economic analyses, we interviewed local stakeholders (both in person and virtually). The interviews provided important context regarding the region's economic activity, local stakeholders' current use of the Menominee Harbor, and limitations of the harbor. We interviewed individuals representing: Fincantieri Marinette Marine (FMM), KK Integrated Logistics (KKIL), Back Forty Mine, Marinette Fuel & Dock Co. (MFD), and The Interlake Steamship Company. We also relied on information from interviews previously conducted by USACE with other local stakeholders.

Across interviews with local stakeholders, a few common themes emerged. First, the harbor is primarily used to bring products into the local area, with fewer opportunities for exporting products out of the local area.² Second, many products that are shipped into the area are more likely to “weigh out” than “cube out.” In other words, ships are often constrained by weight before they are constrained by volume due to the current depth of the federal navigation channel, so they must light-load, which negatively impacts the cost efficiency of shipping. Additional channel depth would allow more fully loaded ships, improve efficiency, and translate to cost savings for local stakeholders; although, there is no anticipated change in the types of vessels utilizing the channel in the future. Third, several local stakeholders anticipate expanding their employment if the harbor is deepened and shipping becomes more cost efficient. Last, there were no concerns regarding the proposed deepening project across local stakeholders.

Scenarios

We developed five scenarios to evaluate the possible outcomes of deepening the Menominee Harbor. The scenario assumptions were driven by interviews with local stakeholders and information from USACE and the City of Menominee. Our scenarios analyze both the positive impacts anticipated if the channel is deepened (Scenario 1 and 2) and the negative impacts if the channel is not deepened (Scenario 3 and 4), as well as the impacts associated with the construction required to deepen the harbor (Scenario 5). For each scenario, we shock either the level of employment or the level of output in specific industries in the local area of study. These employment or output shocks are in reference to the baseline economic conditions in each county, which are included in Tables A.1 and A.2 in the appendix. The scenarios vary in the magnitude of the employment or output shocks across industries and geographic locations. Scenario assumptions for Scenario 1 through 4 are detailed in Table 1 and we present assumptions for Scenario 5 in Table 2.

² Although, Black Forty Mine’s current plan once in operation is to use a combination of rail and shipping to transport their product out of the local area.

Table 1: Scenario Assumptions, Scenarios 1 through 4

| Label | | Description | Menominee County (MI) | Marinette County (WI) | | | Door County (WI) | |
|------------|----------------------|--|-----------------------|-----------------------|-------------------------|----------------------------------|------------------------------|-------------------------|
| | | | Truck Transportation | Truck Transportation | Shipbuilding and Repair | Federal Government, Non-Military | Federal Government, Military | Shipbuilding and Repair |
| Scenario 1 | Optimistic Positive | high-end local employment gains; FMM builds 2 ships per year | +15 | +5 | +600 | +30 | +84 | +275 |
| Scenario 2 | Moderate Positive | 50% local employment gains; FMM builds 1 ship per year | +8 | +3 | +300 | +15 | +42 | +138 |
| Scenario 3 | Moderate Negative | FMM declines 50% | -- | -- | -760 | -38 | -69 | -- |
| Scenario 4 | Pessimistic Negative | FMM declines 100% | -- | -- | -1,519 | -77 | -112 | -- |

Note: Numbers represent the change in employment in each specific industry for each scenario across three local counties. Federal government, military includes both temporary, ship crew positions (0.33 each) and permanent military positions in the area.

Table 2: Scenario 5 Assumptions, Construction Associated with Dredging

| Industry Description | Menominee County (MI) | | Marinette County (WI) | |
|--|-----------------------|--------|-----------------------|-------|
| | Output (\$) | Share | Output (\$) | Share |
| All Industries | \$6,834,927 | 35.2% | \$12,595,073 | 64.8% |
| Architectural, engineering, and related services | \$70,660 | 24.4% | \$219,340 | 75.6% |
| Commercial and industrial machinery and equipment repair and maintenance | \$921,213 | 31.8% | \$1,978,787 | 68.2% |
| Construction of other nonresidential structures (including Labor) | \$3,333,200 | 25.0% | \$10,006,800 | 75.0% |
| Environmental and other technical consulting services | \$290,000 | 100.0% | \$0 | -- |
| Wholesale - Grocery and related product wholesalers | \$388,650 | 67.0% | \$191,350 | 33.0% |
| Wholesale - Machinery, equipment, and supplies | \$91,204 | 31.4% | \$198,796 | 68.6% |
| Wholesale - Petroleum and petroleum products | \$1,740,000 | 100.0% | \$0 | -- |

Note: Output numbers represent the change in output, measured in US dollars, in each specific industry for each county associated with the construction phase of dredging the Menominee Harbor. “Share” represents each county’s share of construction costs within each industry and across all industries. The share is determined based on each county’s share of output in a particular industry relative to the two-county total output in that industry.

Scenario 1 represents the most optimistic, positive outcome from deepening the harbor. This is associated with FMM’s full capacity for building the new frigates, two per year, and high-end estimated employment increases from other local stakeholders (Shelbourne, 2023). FMM’s program to build the new frigates will also require more federal government employees on site, in both military and non-military positions. We used the following information from local stakeholders to inform changes in federal government employment. First, the current littoral combat ships require a military crew of 75 per ship; the new frigates will require a military crew of 150 per ship, or a marginal increase of 75 per ship. Second, these military ship crew positions are temporary, lasting up to approximately 120 days or 4 months. Therefore, we count each military crew position as 0.33 jobs, or a marginal increase of 25 full-time-equivalent jobs. Third, we assume that 95% of other federal government jobs in the area are affiliated with FMM, and that these 95% grow at the same rate as direct FMM employment.³ Scenario 2 represents more modest, positive outcomes from deepening the harbor, which correspond to 50% of the most optimistic outcomes in Scenario 1.

Scenarios 3 and 4 represent the anticipated negative impacts if the harbor is not deepened. Most local stakeholders indicated they would maintain the status quo if the deepening project does not proceed, with one exception. FMM anticipates significant cost increases to fulfill their contract with the Navy if they are not able to launch the new frigates on site due to current depth limitations of the harbor. We follow USACE assumptions for our most pessimistic scenario, Scenario 4, where FMM declines by 100% as they are driven out of business by these cost increases in the absence of deepening the channel. We continue to assume that changes in federal government employment mirror changes at FMM – for Scenario 4, this translates to a 100% decline for the 25 full-time-equivalent military crew positions on the existing littoral combat ships and 95% of the remaining federal government jobs in the area. Scenario 3 represents more moderate, negative outcomes from maintaining the status quo, which is modeled as a 50% decline relative to Scenario 4.

The last scenario, Scenario 5, captures the economic impacts associated with the construction required to deepen the harbor (Table 2). USACE provided the estimated total construction costs (\$29 million), the spending categories, percent of spending for each category (presented in Table A.3 in the appendix), and the local purchase coefficients for relevant industries. We then used this information to map spending categories to industries for our analysis and determine which spending categories are relevant to the local region. We estimate that approximately two-thirds of the construction costs, or \$19.4 million, will be spent in the local area. Last, we allocate construction costs to Menominee and Marinette counties as follows:

1. We determine the output for each relevant industry in each county using IMPLAN and calculate the total output per industry across the two counties.

³ Information from the City of Menominee and other local stakeholders support this assumption as they were not aware of a large federal government presence outside of FMM operations.

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2. Then, we calculate the share of industry output in each county relative to the two-county total.
 3. Finally, we use this share or proportion to allocate construction costs in each county.

For example, output in the wholesale grocery and related products industry is \$16.12 million in Menominee County and \$7.94 million in Marinette County, for a two-county total of \$24.06 million. Menominee County's share of the two-county total is 67% and Marinette County's share is 33%. Therefore, we allocate 67% of the construction costs associated with the wholesale grocery and related products industry to Menominee County, and the remaining 33% to Marinette County.

As shown in Table 2, several wholesale industries are included in Scenario 5. An additional consideration for this last scenario is an underlying assumption of the IMPLAN model related to wholesale and retail sectors. IMPLAN assumes both a purchaser price and producer price for each wholesale industry (Lucas 2019a). The purchaser price is the price paid by the consumer, which includes the producer price, wholesale/retail service costs, and transportation costs. Therefore, the purchase price is greater than the producer price of the product. By default, IMPLAN assumes that any direct shock in a wholesale sector is the purchaser price when modeling an industry output event. Therefore, IMPLAN adjusts the direct output shock to the producer price based on industry specific, estimated margins. The difference between the producer and purchaser prices are considered leakages to the regional economy (i.e. not circulated to other sectors or to households) (Lucas, 2019a). In the model for Scenario 5, IMPLAN scales back the direct output shocks in three wholesale industries: wholesale grocery and related product wholesalers; wholesale machinery, equipment, and supplies; and wholesale petroleum and petroleum products. We include IMPLAN's assumed margins and the adjusted direct shocks for the wholesale sectors in Table A.4 in the appendix.

ECONOMIC IMPACTS OF DEEPENING THE MENOMINEE HARBOR

There are many ways to evaluate the outcomes of the impact analysis. The impacts of Scenarios 1 through 4 are considered ongoing while the impacts of dredging the harbor are a one-time event. For this reason, we present the results of Scenario 5 separately.

Forecasted Results: Scenarios 1 - 4

We begin with the results of Scenarios 1 through 4 and focus on the employment, output, and tax implications. The results of these scenarios should be interpreted as the annual impact to the specified region as long as the assumed changes in employment (Table 1) are valid.

Employment

Scenarios 1 through 4 are based on direct changes to employment across the region, so we focus on employment results first. Table 3 shows the total change in employment across the regions for

each scenario. The total annual employment impacts across NE WI and the UP, the sum of the direct, indirect, and induced effects, range from an increase of over 1,700 jobs in the most optimistic scenario (S1) to a decrease of almost 2,900 jobs across the region in the most pessimistic scenario (S4). In all scenarios, over 95% of the anticipated employment increases or decreases occur in NE WI. The concentration of estimated impacts in NE WI reflect both the higher magnitude of direct employment shocks in Marinette and Door counties compared to Menominee County (Table 1), as well as the higher level of economic activity in NE WI compared to the UP.

Table 3: Change in Employment (jobs) Across Regions, Scenarios 1 - 4

| | NE Wisconsin | UP Michigan | Total Local Region |
|--------------------------|--------------|-------------|--------------------|
| S1: Optimistic Positive | 1,642 | 77 | 1,719 |
| S2: Moderate Positive | 823 | 39 | 862 |
| S3: Moderate Negative | -1,411 | -66 | -1,476 |
| S4: Pessimistic Negative | -2,760 | -130 | -2,890 |

Note: NE Wisconsin includes 16 counties, including Marinette County; UP Michigan includes 15 counties, including Menominee County (specific counties for each region are listed on page 4). Total Local Region aggregates the results across NE Wisconsin and UP Michigan.

Next, we disaggregate the total employment impacts into the direct, indirect, and induced effects by region across the scenarios (Figure 3). Consistent with the total effects reported in Table 3, the direct, indirect, and induced employment effects are larger in NE WI compared to the UP. Interestingly, we notice that in Northeast Wisconsin, the indirect effect is larger than the induced effect in all scenarios except Scenario 3. In the Upper Peninsula, the induced effect is larger than the indirect effect across all scenarios. This suggests that in NE WI, the direct economic shock generally spurs more economic activity through business-to-business purchases than through consumer spending. In the UP, the opposite is true; the direct economic shock spurs more additional economic activity through consumer purchases than from business-to-business purchases. Based on benchmark data, this difference across the UP and NE WI likely stems from where expenditures occur in the production process. In NE WI, a greater proportion of expenditures are for intermediate goods (or business-to-business purchases) than in the UP. Conversely, in the UP a greater proportion of output expenditures are passed on to households through labor income.

We can further disaggregate total employment impacts by industry to identify which industries are most affected by the deepening project. Figure 4 shows the industries across the local region (the UP and NE WI combined) that experience the largest changes in employment. In the two positive scenarios (S1 and S2), wholesale-machinery, equipment, and supplies; employment services; truck transportation; federal government; and shipbuilding and repair experience the largest employment impacts. We observe similar industries for the two negative scenarios (S3 and S4), but full-service restaurants replace truck transportation. The difference in industries affected partially stems from

the difference in our assumptions across the scenarios. We assume that deepening the Menominee Harbor will increase truck transportation in the two positive scenarios, while we assume the status quo for truck transportation is maintained in the absence of dredging. Two of the other industries most impacted (ship building and repair; federal government) are also industries in which we modeled direct economic effects. In contrast, the impacts to wholesale-machinery, equipment, and supplies; employment services; and full-service restaurants illustrate interindustry connections in the local area through induced and indirect effects. That is, the estimated impacts to these industries are solely due to linkages between business-to-business purchases and consumer spending.

Figure 3: Direct, Indirect, and Induced Employment Impacts Across Regions, Scenarios 1 – 4

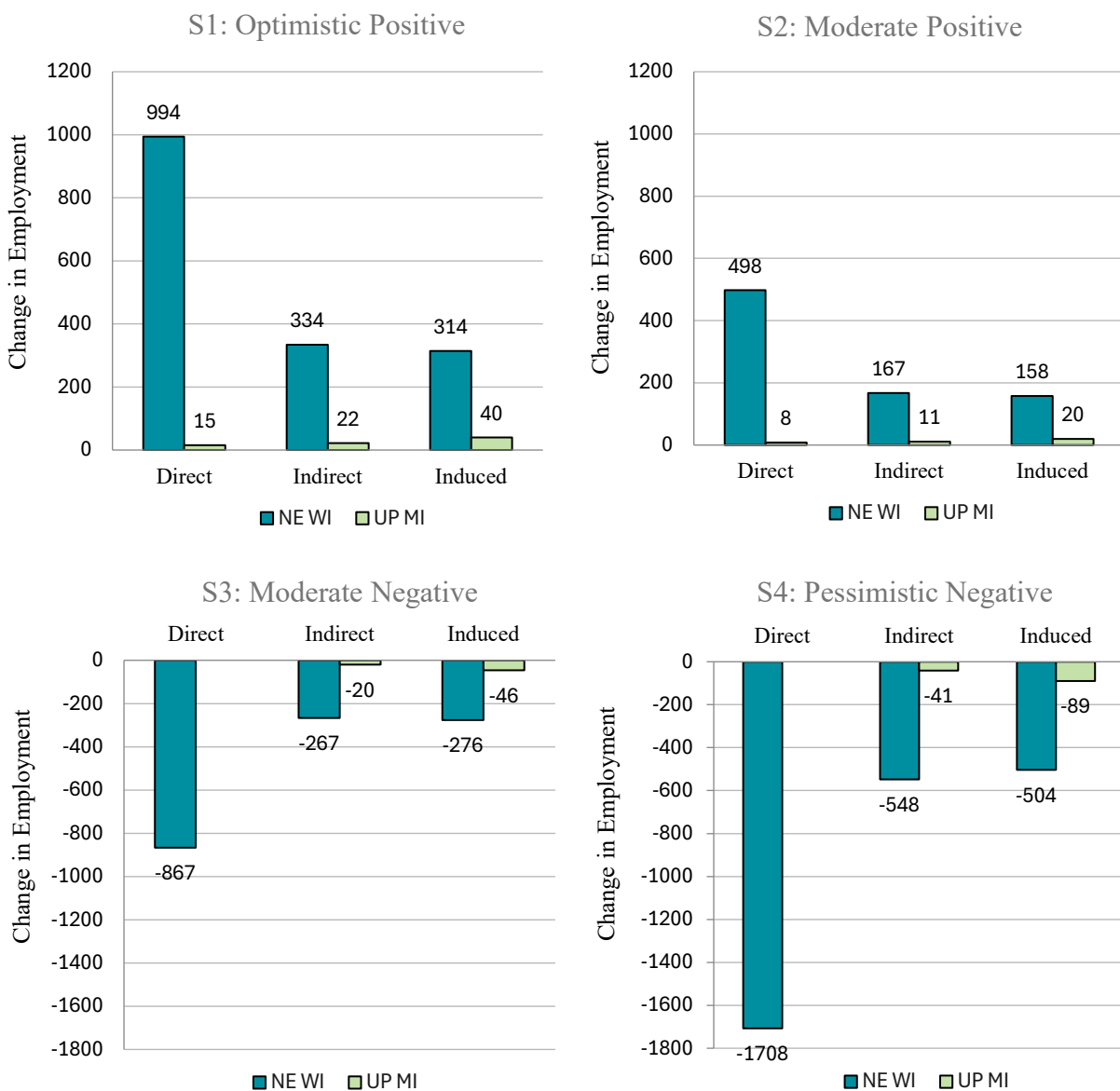
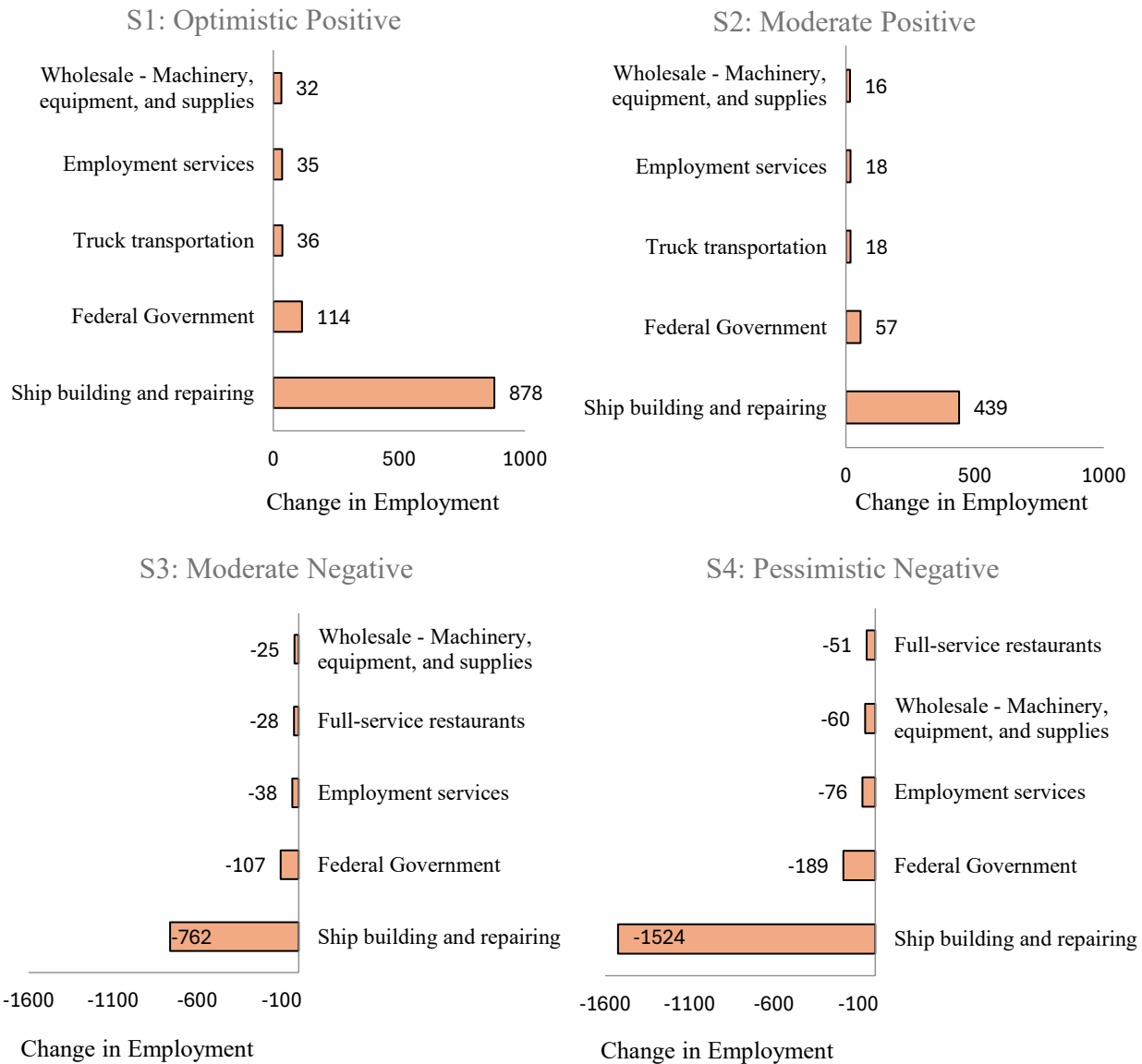


Figure 4: Industries with Largest Employment Impacts Across Scenarios 1 - 4 (All Regions)



Output

Next, we turn our attention to output; the impacts highlight the changes to the total value of production throughout the region (Lucas, 2019b). These output impacts should be interpreted as annual changes as long as the assumed employment changes (Table 1) remain valid. Table 4 shows the total output impacts across Scenarios 1 through 4 (the sum of the direct, indirect, and induced effects). Impacts across the local region, NE Wisconsin and the UP combined, range from an increase in output in the most optimistic scenario (S1) of over \$380 million to a decrease in output in the most pessimistic scenario (S4) of \$641 million. Consistent with the total employment impacts, we see that most of the output impacts are experienced in NE WI (96%). Also, consistent

with the employment impacts, the most pessimistic scenario (S4) results in the largest output change across the scenarios, which is not surprising given that it includes the largest direct shock.

Table 4: Change in Output (dollars) Across Regions, Scenarios 1 - 4

| | NE Wisconsin | UP Michigan | Total Local Region |
|--------------------------|--------------|-------------|--------------------|
| S1: Optimistic Positive | 367,539,045 | 12,894,157 | 380,433,202 |
| S2: Moderate Positive | 184,155,182 | 6,590,475 | 190,745,657 |
| S3: Moderate Negative | -316,017,278 | -11,387,403 | -327,404,681 |
| S4: Pessimistic Negative | -620,790,023 | -20,535,576 | -641,325,599 |

The disaggregated output impacts into direct, indirect, and induced effects (Figure 5) also illustrate a similar pattern compared to the disaggregated employment impacts. Across all scenarios, NE WI experiences larger direct, indirect, and induced impacts than the UP. Beyond the direct impacts, we see that the indirect impacts are larger than the induced impacts in NE WI across all scenarios while the induced effects are larger than the indirect effects in the UP. This is consistent with the employment results, which further highlights that business-to-business purchases drive economic impacts in NE WI and consumer spending drives economic impacts in the UP.

We further evaluate output impacts by industry. Figure 6 shows industries with the largest total output changes across Scenarios 1 through 4 in the local region (the UP and NE Wisconsin combined). Many of the industries with the largest output impacts are the same industries that experienced the largest employment impacts. This includes ship building and repair; federal government; and wholesale-machinery, equipment, and supplies across all scenarios and truck transportation in the positive scenarios. However, we observe some differences between the employment and output results by industry. For example, across all the scenarios, owner-occupied dwellings experience some of the largest output impacts. Additionally, monetary authorities and depository credit intermediation in Scenario 3 and insurance carriers in Scenario 4 replace truck transportation as the industries with the largest output impacts. While full-service restaurants experiences large employment impacts if the harbor is not dredged, that is not the case with output. These differences across industry impacts for output versus employment partially reflect different industrial structures and reliance on labor in the production process – the highest employment industries do not always coincide with the highest output industries.

Figure 5: Direct, Indirect, and Induced Output Impacts Across Regions, Scenarios 1 – 4

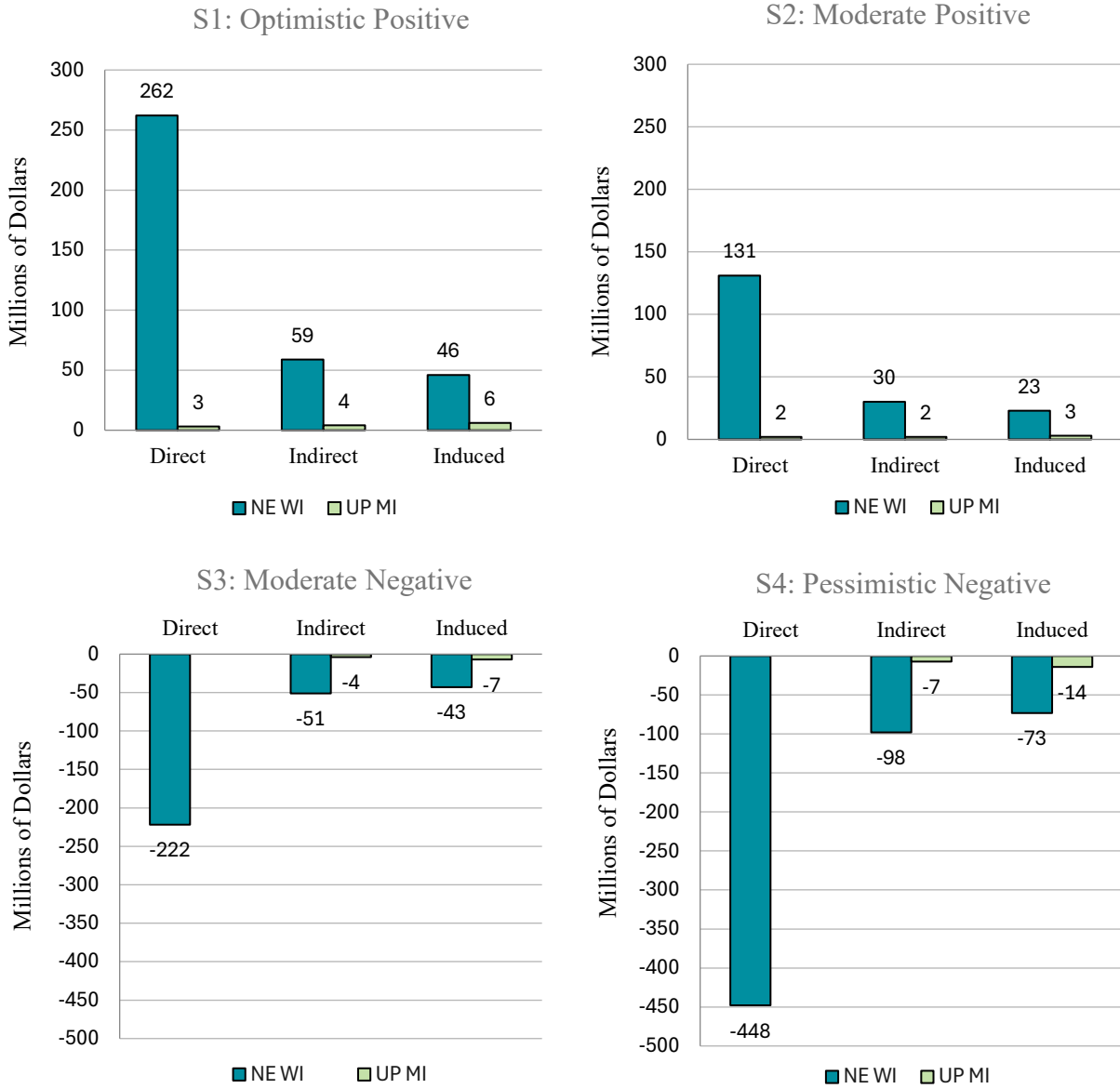
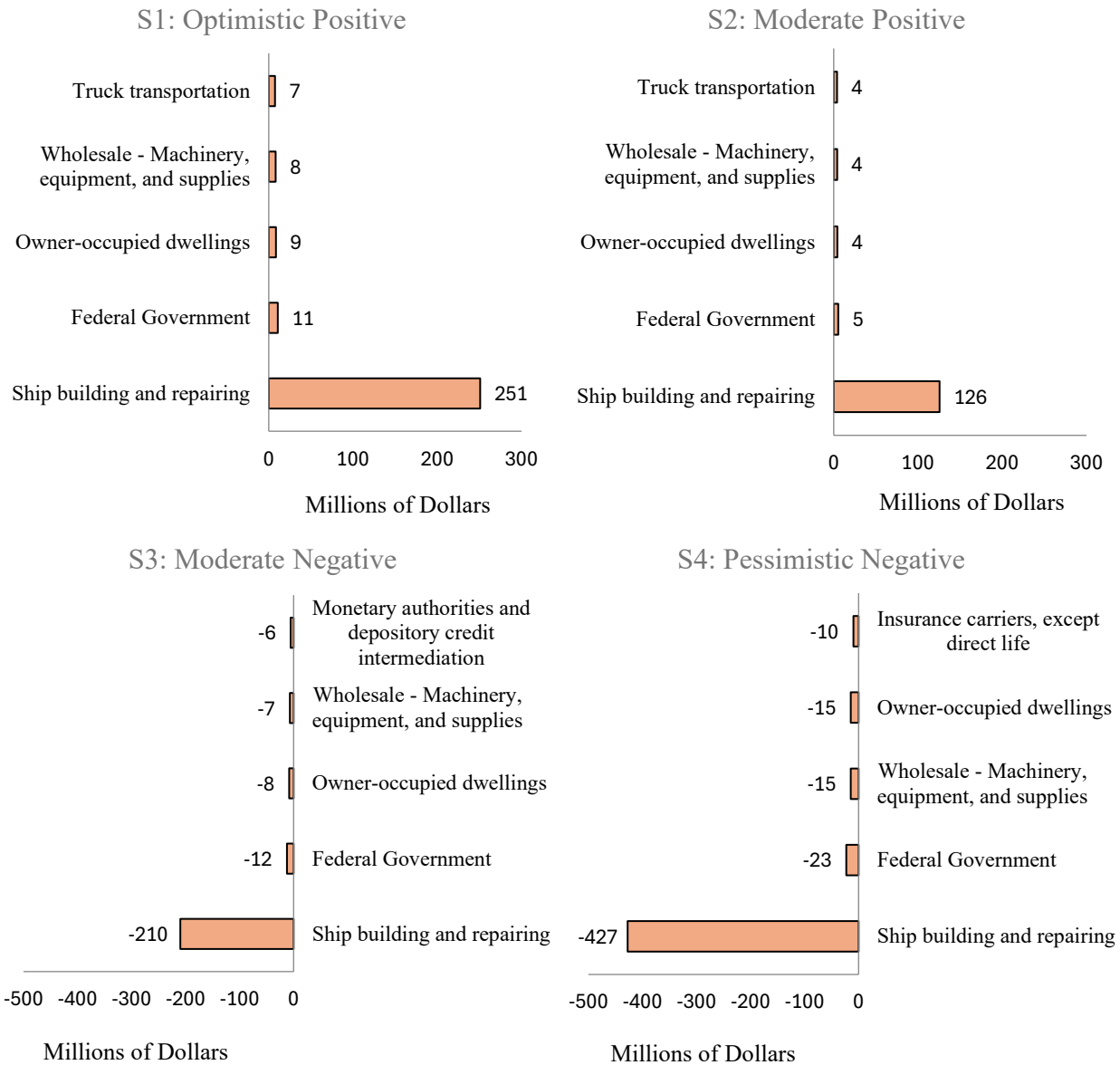


Figure 6: Industries with Highest Output Impacts Across Scenarios 1 - 4 (All Regions)

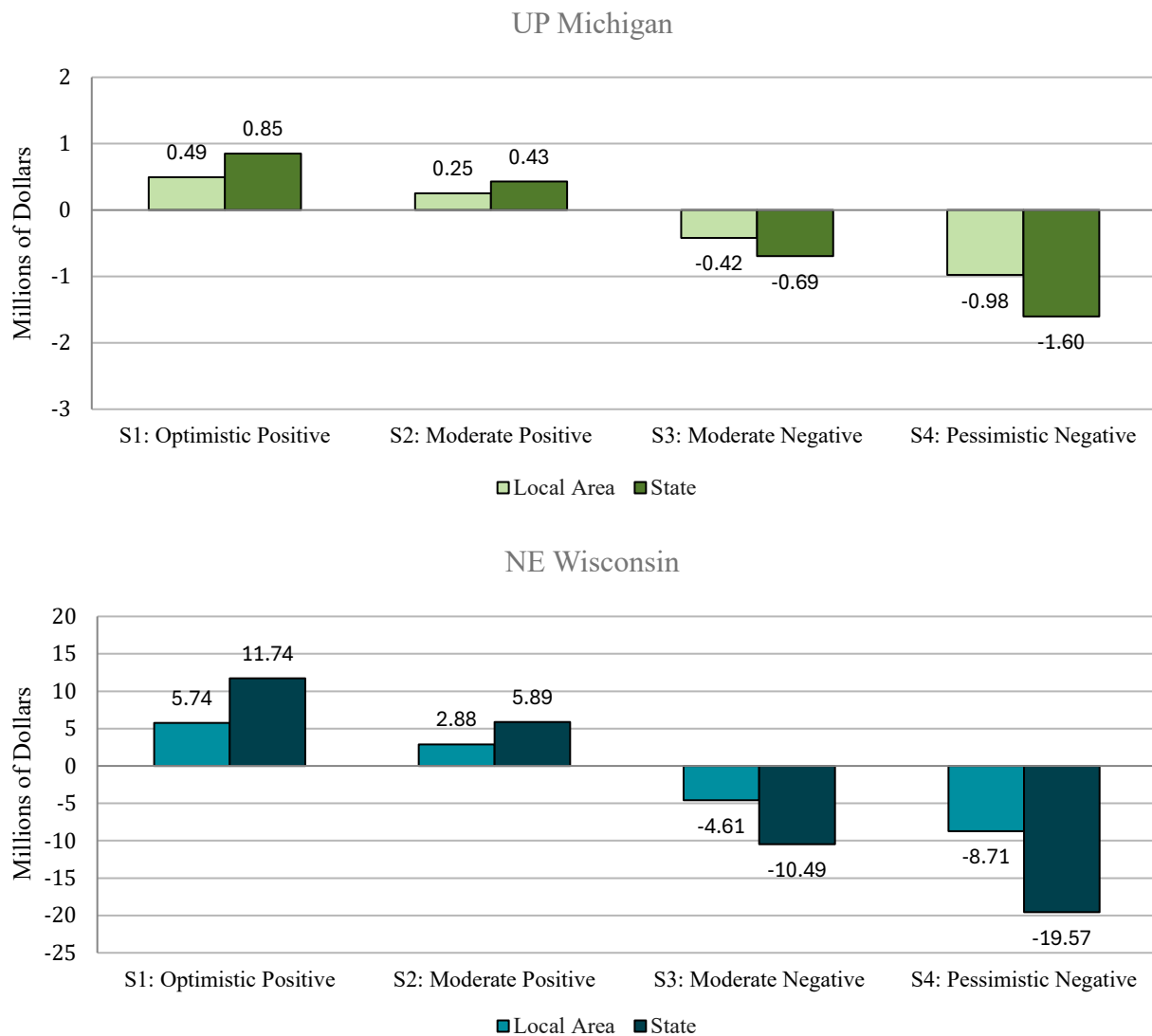


Taxes

In addition to output and employment impacts, we also consider the estimated tax impacts to the local area. Figure 7 presents the changes in tax revenue accrued to the state and local region each year that can be associated with the Menominee Harbor deepening project. Local area taxes include county, sub-county special districts (which can include entities like fire and school districts), and sub-county general (such as city and township jurisdictions) (Nealy, 2023). In the most optimistic scenario (S1), the state of Michigan and the local area respectively earn approximately \$850,000 and \$490,000 annually in additional tax revenue. In the most pessimistic scenario (S4), the estimates indicate that the state will lose approximately \$1.6 million, and the local area will lose

approximately \$980,000 in annual tax revenue. The tax impacts continue to be larger in NE WI. In Scenario 1, our analysis estimates that the state of Wisconsin receives approximately \$11.7 million in additional tax revenue each year and local areas see additional tax revenue of approximately \$5.7 million annually. In the most pessimistic scenario in the absence of dredging (S4), the state of Wisconsin and the local area are predicted to experience a loss in annual tax revenue of \$19.6 million and \$8.7 million, respectively. Across the entire local region, both NE WI and the UP, potential tax revenue gains aggregate to over \$18 million annually (S1) or losses over \$30 million each year. Thus, the decision to deepen the Menominee Harbor has significant annual tax implications for the state of Michigan, the state of Wisconsin, and the local areas in the UP and Northeast Wisconsin.

Figure 7: Local and State Tax Impacts by Region Across Scenarios 1 – 4



Forecasted Results: Scenario 5

Thus far, the results focus on Scenarios 1 through 4, the anticipated annual positive and negative impacts associated with the decision to deepen the Menominee Harbor. We now turn our attention to the anticipated impacts from the actual construction necessary to deepen the harbor (Scenario 5, presented in Table 2). For the construction analysis, we do not dictate what year the dredging would occur or how many years the dredging will take. Therefore, Scenario 5 results should be interpreted as the total impact of the dredging construction, recognizing these impacts are a one-time occurrence and will not persist after the construction phase is completed.

Table 5: Change in Employment and Output for Scenario 5

| | Employment (Jobs) | Output (Dollars) |
|--------------------|-------------------|------------------|
| UP Michigan | 54 | 7,733,764 |
| NE Wisconsin | 126 | 19,135,569 |
| Total Local Region | 180 | 26,869,333 |

Table 5 presents the employment and output results for Scenario 5. We see that construction required to dredge the Menominee Harbor contributes a total of 180 jobs and over \$26 million dollars of output in the local region. Approximately 35% of the construction expenditures occur in the UP via direct spending in Menominee County (Table 2), and we observe that approximately 30% of the employment and output increases occur in the UP. This contrasts with the results from Scenarios 1 through 4 as over 95% of the direct shock and estimated impacts were in NE WI.

Figure 8: Direct, Indirect, and Induced Output and Employment Impacts Across Regions, Scenario 5

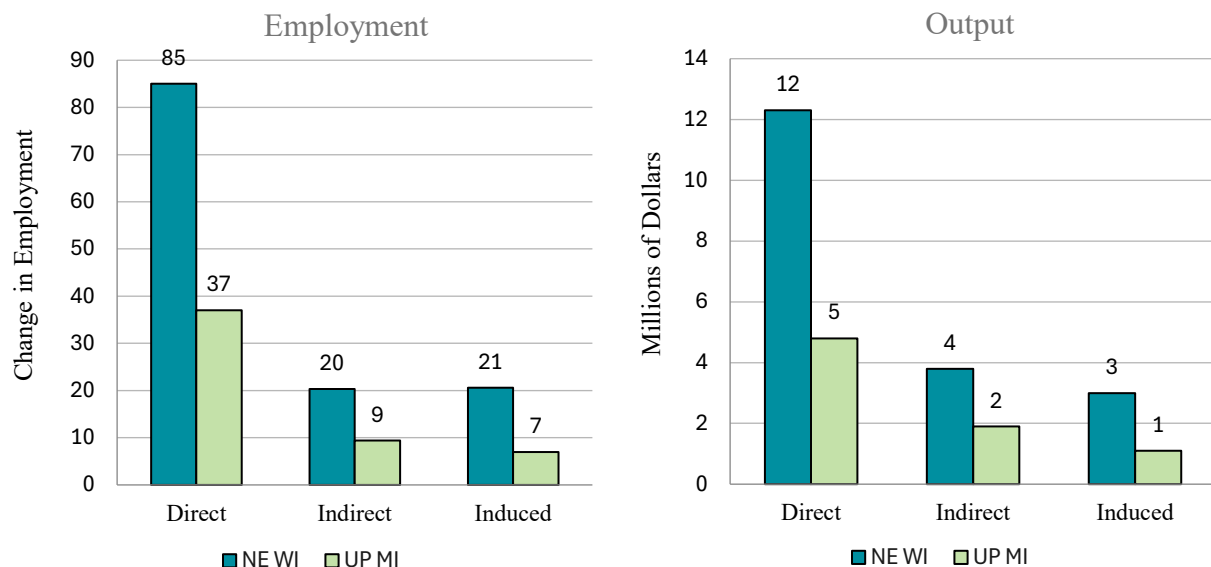
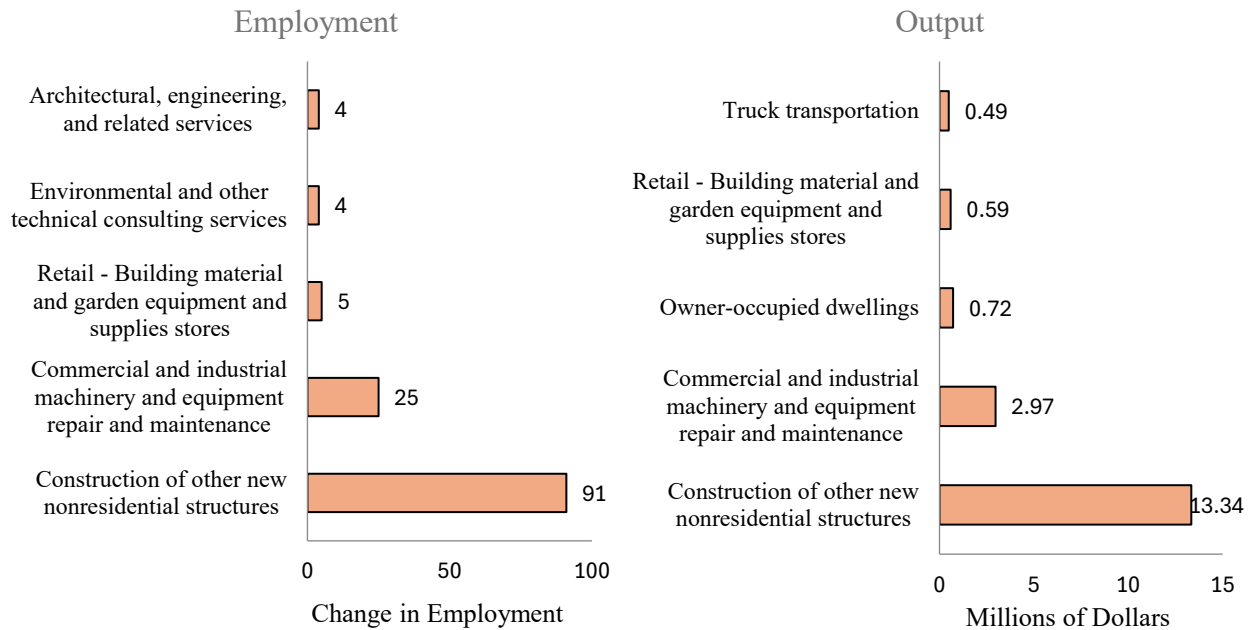


Figure 8 shows the direct, indirect, and induced effects on employment and output from construction necessary to deepen the Menominee Harbor. Recall that we model the direct shocks in the construction scenario (S5) as changes in industry output, which represent the direct output impacts from construction. Then, IMPLAN estimates the number of jobs directly supported based on these direct output shocks. The results show that output expenditures related to construction and dredging support over 120 direct jobs in the local area, 85 direct jobs in Northeast Wisconsin and 37 direct jobs in the Upper Peninsula. The indirect and induced impacts then represent additional output and employment via linkages across industries and household spending in the broader local region. For both employment and output we see that the induced and indirect effects are similar within both regions – approximately 20 indirect and 21 induced jobs and \$4 million indirect and \$3 million induced output in NE WI; 9 indirect and 7 induced jobs and \$2 million indirect and \$1 million induced output in the UP.

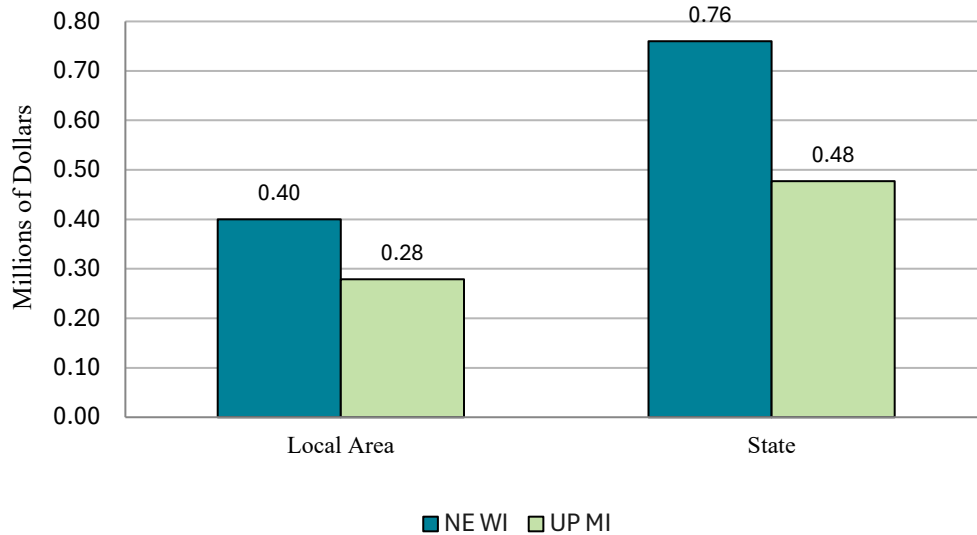
Figure 9: Industries with Largest Output and Employment Impacts, Scenario 5 (All Regions)



Next, we disaggregate the output and employment impacts by industry to identify the industries most impacted by the construction required to dredge the Menominee Harbor (Figure 9). We observe that several industries without direct shocks in our analysis for Scenario 5 face relatively large impacts: retail - building materials and garden equipment; truck transportation; and owner-occupied dwellings. The retail category is among the top five industries for both employment and output, while truck transportation and owner-occupied dwellings are among the industries with the largest output impacts. These outcomes highlight that although construction and dredging is a one-time event, there are still positive spillover effects to industries not directly related to the dredging activity. All together, we see that the approximately \$19 million in direct dredging and construction expenditures (\$17 million after accounting for the wholesale leakages) in the local

area will lead to approximately \$10 million in additional output across the entire region. This indicates that every dollar spent on construction and dredging in Menominee County leads to \$1.61 of total output in Michigan’s Upper Peninsula and every dollar spent on construction and dredging in Marinette County leads to \$1.56 of total output in Northeast Wisconsin.

Figure 10: Local and State Tax Impacts by Region, Scenario 5



Last, we look at the tax implications for Scenario 5. Figure 10 shows the change in local and state taxes for the two study areas. Similar to Figure 7, local area taxes include county, sub-county special districts, and sub-county general (Nealy, 2023). We see that construction and dredging generates approximately \$70,000 in tax revenue for the local area and approximately \$1.24 million in state tax revenue, with NE WI receiving nearly 80% of the tax revenues.

Additional Cost Savings

The use of IMPLAN allows for the modeling of direct, indirect, and induced economic impacts on the local regions, providing insight into effects such as employment, output, and tax gains or losses, business-to-business purchase adjustments, and changes in household spending patterns. However, interviews with local stakeholders revealed additional impacts associated with the proposed Menominee Harbor dredging project, in the form of additional transportation cost savings, which are not reflected in our formal impact analysis.

The Back Forty Mine anticipates potential cost savings of \$13.9 million over the estimated nine-year life of the mine if dredging occurs. These savings would result from the ability to use fully loaded cargo vessels to export their product via the harbor, compared to the currently planned use of trucks and rail for transportation. Concentrate created in the mine’s processing plant will need

to be transported to copper and zinc refiners for final transformation and payment. The concentrate will be transported by truck to a local infrastructure, KKIL, which can load both railcars and vessels. It is expected the concentrate will mostly be transported by train to Eastern Canada, but the potential for shipping by vessel could allow Back Forty Mine to take advantage of better terms with refiners overseas (Gold Resource Corporation, 2023).

Furthermore, estimates from USACE indicate additional transportation cost savings in the local area if the harbor is deepened. These include an average annual equivalent of \$5,298,000 with shipyard costs factored in and \$287,000 without shipyard costs. These additional cost savings, not otherwise captured in the local economic impact analysis, should also be considered with respect to the overall economic feasibility and benefits of the proposed Menominee Harbor deepening project.

CONCLUSION

The Menominee Harbor is an important component of the local region's economy, particularly for the three primary users: KK Integrated Logistics, Marinette Fuel & Dock Co., and Fincantieri Marinette Marine. It provides important access to waterborne transportation via the Great Lakes, which is the most cost and energy efficient transportation option. Economic activity is currently limited by the authorized depth of the federal navigation channel. Therefore, the City of Menominee requested a feasibility study from USACE regarding deepening the Menominee Harbor. We supplement the existing USACE study by taking a "boots on the ground" approach – interviewing local stakeholders and further quantifying local economic impacts associated with the deepening project.

We evaluate a spectrum of five scenarios associated with deepening or not deepening the harbor. These scenarios range from the most optimistic (S1), which reflects FMM's full capacity to build two new frigates per year for the US Navy, to the most pessimistic (S4), which reflects the detrimental impact to FMM if they are not able to launch the new frigates on site due to limitations of the current channel depth. We separately estimate the anticipated economic impacts associated with the construction required to dredge the harbor, since the construction is considered a one-time event rather than ongoing impacts that occur each year.

The analysis highlights the significant economic impacts to the local region, Michigan's Upper Peninsula and Northeast Wisconsin, associated with deepening the Menominee Harbor. Employment, output, and tax impacts from our two positive scenarios (S1 and S2) range from approximately 860 to 1,700 additional jobs, \$191 to \$380 million in additional output, and additional tax revenue of \$9 to \$19 million per year. If the status quo is maintained and the harbor is not deepened (S3 and S4), we estimate approximately 1,500 to 2,900 fewer jobs, \$327 to \$641 million in output losses, and a \$16 to \$31 million reduction in tax revenue annually. The

construction required to dredge the harbor is associated with employment impacts of 180 jobs, output impacts of \$27 million, and additional tax revenue of approximately \$2 million; although, the construction should be considered a one-time event.

The analysis also identifies the industries most impacted by the decision to deepen the federal navigation channel, which illustrates the spillover effects to industries beyond those directly located on the water. These industries include owner-occupied dwellings; wholesale machinery, equipment, and supplies; insurance carriers; full-service restaurants; and employment services. We consistently observe that most of the impacts are concentrated in Northeast Wisconsin; although, this is expected given the magnitude of the direct economic shock in Marinette County (WI) relative to Menominee County (MI) and differences in economic activity in NE WI versus the UP. Last, we highlight the additional transportation cost savings associated with deepening the harbor, which improves efficiency and costs associated with waterborne transportation: USACE estimated annual equivalent cost savings of \$5.3 million per year (including the shipyard), and the Back Forty Mine estimated total cost savings of \$13.9 million over the life of the mine.

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APPENDIX

Table A.1: Baseline Employment Levels for Specific Industries, 2021

| Industry Description | Menominee County (MI) | Marinette County (WI) | Door County (WI) |
|-------------------------------|----------------------------------|----------------------------------|-----------------------------|
| All | 9,911 | 22,986 | 19,696 |
| Shipbuilding and Repair | 0 | 1,519 | 174 |
| Truck Transportation | 93 | 477 | 51 |
| Federal Govt., Civilian* | 6 | 81 | 9 |
| Federal Govt., Military (All) | 39 | 117 | 169 |

Note: Employment levels in 2021 from IMPLAN for specific industries relevant to economic shocks in Scenarios 1 through 4 (IMPLAN, 2024).

Table A.2: Baseline Output Levels for Specific Industries, 2021

| Industry Description | Menominee County (MI) | Marinette County (WI) | Door County (WI) |
|--|----------------------------------|----------------------------------|-----------------------------|
| All Industries | 2,008.61 | 4,441.61 | 2,985.94 |
| Architectural, engineering, and related services | 3.43 | 10.64 | 45.54 |
| Commercial and industrial machinery and equipment repair and maintenance | 2.72 | 5.84 | 1.44 |
| Construction of other nonresidential structures (including Labor) | 4.30 | 12.91 | 15.73 |
| Environmental and other technical consulting services | 1.19 | -- | 3.84 |
| Wholesale - Grocery and related product wholesalers | 16.12 | 7.94 | 2.02 |
| Wholesale - Machinery, equipment, and supplies | 27.19 | 59.26 | 7.77 |
| Wholesale - Petroleum and petroleum products | 0.23 | -- | 5.13 |

Note: Output levels (millions of dollars) in 2021 from IMPLAN for specific industries relevant to economic shocks in Scenario 5 (IMPLAN, 2024).

Table A.3: Construction Spending Categories, USACE

| Spending Category | Percentage | Local Area |
|--|------------|------------|
| 1 Dredging Fuel | 6% | IN |
| 2 Metals and Steel Materials | 5% | OUT |
| 3 Dredging Consumables -- Textiles, Lubricants, Metal Valves and Parts | 2% | OUT |
| 4 Machinery Materials | 1% | IN |
| 5 Electrical Materials | 4% | OUT |
| 6 Dredge Equipment (Depreciation and Capital Expenses) | 6% | OUT |
| 7 Insurance (bond) and Workman's Comp | 2% | OUT |
| 8 Construction of Other Nonresidential Structures | 23% | IN |
| 9 Cement Materials | 3% | OUT |
| 10 Architectural, Design, and Engineering Services | 1% | IN |
| 11 Environmental Compliance, Planning, and Technical Services | 1% | IN |
| 12 Industrial Machinery and Equipment Repair and Maintenance | 10% | IN |
| 13 Dredging Consumables -- Food and Beverages | 2% | IN |
| 14 USACE Overhead | 4% | OUT |
| 15 USACE Wages and Benefits | 7% | OUT |
| 16 Private Sector Labor or Staff Augmentation (Construction) | 23% | IN |

Note: Spending categories received from USACE for construction required to dredge Menominee Harbor. "Percentage" indicates the percentage of total construction costs associated with each spending category. "Local Area" indicates whether the spending for each specific category will occur in the local area or outside of the local area.

Table A.4: Adjusted Direct Output Shock to Wholesale Industries

| Industry Description | Menominee County (MI) | | Marinette County (WI) | | IMPLAN Margins |
|---|-----------------------|----------|-----------------------|----------|----------------|
| | Base | Adjusted | Base | Adjusted | |
| Wholesale - Grocery and related product wholesalers | \$388,650 | \$65,293 | \$191,350 | \$32,147 | 16.8% |
| Wholesale - Machinery, equipment, and supplies | \$91,204 | \$26,449 | \$198,796 | \$57,651 | 29.0% |
| Wholesale - Petroleum and petroleum products | \$1,740,000 | \$88,740 | \$0 | \$0 | 5.10% |

Note: The base number for each wholesale industry represents the direct output shock associated with construction required to dredge the Menominee Harbor. IMPLAN assumes the base number is the purchaser price, and adjusts the direct shock to the producer price using the industry-specific margin (producer price equals margin multiplied by base). The difference between the base and adjusted numbers is attributed to transportation costs and wholesale/retail service costs, which are leakages from the regional economy.

About the Authors

Dr. Laura Connolly is an Assistant Professor of Economics in the College of Business at Michigan Technological University. She is a labor economist with research interests in labor market outcomes across different populations and the interaction between public policy and labor market dynamics. She also has experience with local economic impact studies within the Upper Peninsula.

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Mr. Travis White has over 15 years of experience as a licensed captain on the Great Lakes and holds a Bachelor of Science in Mechanical Engineering from Michigan Technological University. In his role as a Research Engineer at the Great Lakes Research Center, he supports a wide variety of interdisciplinary research, providing expertise in marine engineering, project management, and maritime operations.

Acknowledgements

The authors thank the team of undergraduate research assistants for their work on this report and associated analyses. Each research assistant provided valuable contributions to the project, which are included below. Marguerite Goldman, Daegan Sayles-Devine, and Nolan Smith: literature review, background research, and copyediting; Miles West and Alex White: IMPLAN simulations, data compilation, and data cleaning; Sydney Lurvey and Nick Schwartz: data synthesis, visualizations, and infographics.