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# The Cost of Shutting Down Wisconsin's Economy

A statewide and  
county-by-county  
analysis

By Andrew Hanson



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## Summary

- Estimates suggest that the partial shutdown of Wisconsin's economy costs the state \$178.9 million in lost production daily, or GDP. This figure represents 18.7% of 2020 daily forecast production, amounting to \$30.62 per state resident per day. Lost production from the shutdown varies widely by counties across Wisconsin – Milwaukee County forgoes about \$30 million per day, and Dane County about \$20.7 million per day, while Menominee County loses \$37,659 per day and Pepin County loses \$91,355 per day.

- There are many caveats to the estimates of lost production presented here, but they are meant to give policymakers a starting point for thinking about the economic costs of partially shutting down Wisconsin's economy. These estimates are not a value judgement on the economic shutdown as a response to the spread of COVID-19, but meant as an input to that value judgement. Any policy decision should consider how these costs compare to effectiveness of the policy as measured by health outcomes such as caseload reductions and lives saved, and consider many other factors.

## Introduction

As the COVID-19 virus continues to spread through human interaction, policymakers are grappling with agonizing decisions about how much (or how little) economic activity to allow.

Recent events and public announcements have made clear that this decision will largely be made at the state level, albeit with federal assistance and advice.

These decisions are made more difficult by a lack of high-quality, real-time data on many of the vital factors that state policymakers should consider on both the public health and economic fronts.

There is some economic data that exists for states – notably the number of unemployment claims, and some industry-specific metrics like reductions in air travel. But the lack of all-encompassing economic measures turns an agonizing decision into an impossible, ill-informed and even more difficult one.

This short brief aims to partially fill the data void by offering

estimates for how much economic activity Wisconsin and each of its counties forgoes when the state economy is partially shut down. To be clear, what is presented here is an estimate of lost economic activity, not a calculated accounting. Only a careful post-mortem of the crisis after it has long passed will be able to offer a completely accurate picture.

These estimates are also not meant to be a value judgement. They do not suggest one way or the other, for or against, certain levels of economic restriction. They are, instead, meant as an input to this value judgement. They should be weighed along with many other factors when making any decisions about both economic and public health considerations.

## A Note About GDP at the State and County Level

The typical way economists measure economic activity is through Gross Domestic Product, or GDP. GDP is the value of goods and services produced in an economy over a given period of time, typically a year or a quarter.

GDP is inherently a broad measure of all economic activity, an attempt to measure the entire economy rather than a partial measure like unemployment, which highlights only one aspect of the labor market. It allows policymakers to see the big picture – all the areas of the economy that might not be making headlines but do affect Wisconsinites' lives.

GDP highlights all productivity regardless of where it comes from; but it is also a rather anonymous measure. It does not tell a story about specific jobs lost or individuals sacrificing income.

The data on GDP used in this analysis comes from the U.S. Bureau of Economic Analysis (BEA), and includes market production and some non-market production. For a full explanation of GDP and its components, see BEA (2015).

Measuring lost GDP is a reasonable way to estimate the economic cost of shutting down an economy. But even this broad measure has some notable omissions. For example, GDP cannot measure the production of caring for one's own children (something that has probably drastically increased during the current crisis), or illegal economic activity (such as "off the books" childcare). With some exceptions, what it mostly measures is economic activity that takes place where there is a market transaction.

## Model Estimates

To estimate lost GDP from partially shutting down Wisconsin's economy, I use the procedure outlined in the appendix of this document. This procedure relies on a pre-pandemic forecast of U.S. GDP. It then allocates a portion of that to Wisconsin – and its counties – in line with prior levels of local and state GDP as a percentage of the national figure.

The pre-pandemic forecast of Wisconsin's total state GDP was about \$349.7 billion for 2020.<sup>1</sup> GDP for each of the 72 counties is contained in the spreadsheet accompanying this paper and ranges from \$63.3 billion in Milwaukee County to \$146.6 million in Florence County.

The essential question is how much of that GDP both at the state and county level is being retained – i.e., continues to be created – despite the crises, and how much is being lost. For each county, I determine how much is being retained by using estimates of the amount of work that can be done from home and the percentage of work that is retained outside of home production under the shutdown.

My estimate suggests that if the shutdown were to last for all of 2020 (including actual pre-shutdown months), it would cost Wisconsin \$65.3 billion in lost economic activity. This implies that every day of the economic shutdown costs Wisconsin about \$178.9 million in lost GDP, which is about 18.7% of the predicted daily GDP for the state in 2020.

Extrapolating the daily estimates out to the future, with

<sup>1</sup>Based on 2019 nominal U.S. GDP of \$21.43 trillion from the Bureau of Economic Analysis, OECD forecast of 2% GDP growth for the U.S., and Wisconsin historically producing 1.6% of U.S. GDP.

no changes in policy, if the shutdown lasts for one month it would cost Wisconsin \$5.3 billion in lost production. If the shutdown lasts for two months, the toll would reach \$10.7 billion. Four months of an economic shutdown would impose an economic cost of \$21.5 billion dollars on the state economy.

That level of lost economic production is \$30.62 per person each day in the state. Describing the estimate in a more positive way, one could also say that despite the shutdown and public health measures being undertaken, the state likely retains about 81.3% of economic production.

Any determination of whether these costs are large or small depends on both the dollar estimates and what is obtained for those dollars. Answering that question requires some comparison to how effective the shutdown is at stopping the spread of COVID-19 and saving lives (both things that are far beyond the ability of this author to judge).

Across the state, the cost of the shutdown varies substantially, both in dollar and per-person terms. The county-level effects of the shutdown depend on both the ability of workers to move to home production and the mix of industries in a county.

Unsurprisingly, counties with high levels of economic activity have the highest cost of a shutdown. The estimates suggest that the economic shutdown costs Milwaukee County about \$30 million per day, and Dane County about \$20.7 million per day. Brown County is losing an estimated \$9.6 million per day.

On the other end of the spectrum, Menominee County (\$37,659), Pepin County (\$91,355) and Florence County (\$96,452) are all estimated to lose less than \$100,000 in economic activity per day.

In terms of the percentage of production lost, Manitowoc has the highest at 32.35% of daily production lost, while Langlade (29.5%), Chippewa (27%), Ashland (26.8%) and Washburn (25.9%) are all estimated to lose more than one-fourth of economic activity every day of the shutdown. The least affected counties by percentage of lost economic activity are Menominee (7.3% of daily economic activity lost), Kewaunee (11%), Pepin (12.1%), Lafayette (12.4%) and Polk (12.6%). Milwaukee County (17.32%) and Dane County (15.9%) are more toward the bottom of the distribution in terms of the percentage of lost economic activity among counties in Wisconsin.

The per-person, per-day GDP loss at the county level ranges from a high of \$50.41 in Manitowoc County to a low of \$8.83 in Menominee County. Some of the top per person losses are estimated in places with relatively high populations including Eau Claire County (\$43.61), Dane County (\$38.62), Sheboygan County (\$38.35) and Winnebago County (\$37.34). The counties with low per-person losses are mostly more rural areas, highlighted by Pierce County

Estimated GDP loss from economic shutdown in Wisconsin

County	Annual Forecast 2020 GDP	Annual GDP Loss	Daily GDP Loss	Daily % Loss	Daily GDP Loss per Person
ADAMS	\$516,721,679	\$80,640,653	\$220,933	15.61%	\$10.71
ASHLAND	\$798,379,331	\$214,178,694	\$586,791	26.83%	\$36.80
BARRON	\$2,276,398,902	\$544,590,130	\$1,492,028	23.92%	\$32.11
BAYFIELD	\$441,087,671	\$96,274,551	\$263,766	21.83%	\$17.20
BROWN	\$19,573,838,251	\$3,508,757,267	\$9,613,034	17.93%	\$36.63
BUFFALO	\$594,790,538	\$94,710,186	\$259,480	15.92%	\$18.93
BURNETT	\$542,825,693	\$105,239,600	\$288,328	19.39%	\$18.57
CALUMET	\$1,829,299,933	\$400,440,553	\$1,097,097	21.89%	\$20.69
CHIPPEWA	\$3,022,530,822	\$817,587,396	\$2,239,965	27.05%	\$34.52
CLARK	\$1,605,007,087	\$338,854,335	\$928,368	21.11%	\$26.72
COLUMBIA	\$3,121,219,369	\$696,779,694	\$1,908,985	22.32%	\$33.33
CRAWFORD	\$803,280,318	\$187,447,047	\$513,554	23.34%	\$30.81
DANE	\$47,636,239,199	\$7,574,706,414	\$20,752,620	15.90%	\$38.62
DODGE	\$3,848,218,233	\$876,770,877	\$2,402,112	22.78%	\$26.68
DOOR	\$1,372,917,359	\$262,655,613	\$719,604	19.13%	\$25.12
DOUGLAS	\$2,125,167,027	\$467,775,173	\$1,281,576	22.01%	\$28.82
DUNN	\$1,962,268,056	\$377,478,558	\$1,034,188	19.24%	\$23.18
EAU CLAIRE	\$6,784,181,591	\$1,642,083,288	\$4,498,858	24.20%	\$43.61
FLORENCE	\$146,618,106	\$35,204,916	\$96,452	24.01%	\$21.55
FOND DU LAC	\$5,569,855,543	\$1,181,031,911	\$3,235,704	21.20%	\$30.99
FOREST	\$338,787,078	\$52,111,617	\$142,772	15.38%	\$15.53
GRANT	\$2,431,373,047	\$373,447,028	\$1,023,143	15.36%	\$19.32
GREEN	\$1,748,942,300	\$292,592,918	\$801,624	16.73%	\$21.62
GREEN LAKE	\$758,756,932	\$162,737,779	\$445,857	21.45%	\$23.19
IOWA	\$1,274,495,514	\$284,803,689	\$780,284	22.35%	\$32.65
IRON	\$210,156,192	\$49,717,703	\$136,213	23.66%	\$23.11
JACKSON	\$981,545,583	\$229,827,297	\$629,664	23.41%	\$30.23
JEFFERSON	\$4,666,595,256	\$982,649,326	\$2,692,190	21.06%	\$31.83
JUNEAU	\$922,399,391	\$156,050,452	\$427,535	16.92%	\$15.70
KENOSHA	\$7,257,414,936	\$1,631,238,452	\$4,469,146	22.48%	\$26.28
KEWAUNEE	\$944,035,729	\$104,075,173	\$285,137	11.02%	\$13.72
LA CROSSE	\$7,535,579,102	\$1,387,390,397	\$3,801,070	18.41%	\$31.81
LAFAYETTE	\$789,361,070	\$97,959,840	\$268,383	12.41%	\$15.79
LANGLADE	\$815,599,118	\$241,243,829	\$660,942	29.58%	\$32.91
LINCOLN	\$1,236,821,736	\$247,237,261	\$677,362	19.99%	\$23.39
MANITOWOC	\$4,644,513,645	\$1,502,300,940	\$4,115,893	32.35%	\$50.41
MARATHON	\$9,299,657,362	\$1,895,029,547	\$5,191,862	20.38%	\$38.03
MARINETTE	\$2,273,335,502	\$513,797,059	\$1,407,663	22.60%	\$34.00
MARQUETTE	\$425,179,586	\$70,773,041	\$193,899	16.65%	\$12.60
MENOMINEE	\$189,052,846	\$13,745,359	\$37,659	7.27%	\$8.83
MILWAUKEE	\$63,344,430,992	\$10,974,205,936	\$30,066,318	17.32%	\$31.77
MONROE	\$2,407,821,769	\$416,194,925	\$1,140,260	17.29%	\$24.26
OCONTO	\$1,175,120,368	\$213,050,112	\$583,699	18.13%	\$15.05
ONEIDA	\$1,731,682,686	\$370,254,443	\$1,014,396	21.38%	\$27.96
OUTAGAMIE	\$11,856,150,140	\$2,207,473,953	\$6,047,874	18.62%	\$32.33
OZAUKEE	\$5,400,249,648	\$841,010,691	\$2,304,139	15.57%	\$25.63
PEPIN	\$275,189,992	\$33,344,562	\$91,355	12.12%	\$12.29
PIERCE	\$1,269,152,802	\$160,594,979	\$439,986	12.65%	\$10.42
POLK	\$1,705,326,057	\$215,779,117	\$591,176	12.65%	\$13.27
PORTAGE	\$3,992,738,106	\$742,260,417	\$2,033,590	18.59%	\$28.37
PRICE	\$630,923,019	\$132,491,648	\$362,991	21.00%	\$25.53
RACINE	\$9,730,365,008	\$1,932,761,627	\$5,295,237	19.86%	\$26.95
RICHLAND	\$805,970,367	\$119,690,825	\$327,920	14.85%	\$18.21
ROCK	\$7,934,049,915	\$1,530,486,145	\$4,193,113	19.29%	\$26.13
RUSK	\$610,452,211	\$142,562,456	\$390,582	23.35%	\$26.18
SAUK	\$3,839,863,763	\$713,634,946	\$1,955,164	18.58%	\$30.90
SAWYER	\$705,074,722	\$161,973,122	\$443,762	22.97%	\$26.27
SHAWANO	\$1,427,508,620	\$236,978,984	\$649,257	16.60%	\$15.54
SHEBOYGAN	\$7,723,418,677	\$1,631,205,365	\$4,469,056	21.12%	\$38.35
ST. CROIX	\$3,422,242,139	\$558,638,589	\$1,530,517	16.32%	\$17.06
TAYLOR	\$984,475,888	\$217,887,101	\$596,951	22.13%	\$28.63
TREMPEALEAU	\$1,491,619,021	\$325,833,663	\$892,695	21.84%	\$29.79
VERNON	\$1,117,420,684	\$208,269,817	\$570,602	18.64%	\$18.76
VILAS	\$945,323,746	\$148,864,183	\$407,847	15.75%	\$18.71
WALWORTH	\$4,450,120,601	\$875,747,515	\$2,399,308	19.68%	\$23.06
WASHBURN	\$616,130,752	\$159,657,046	\$437,417	25.91%	\$27.29
WASHINGTON	\$6,503,977,751	\$1,079,555,587	\$2,957,687	16.60%	\$21.49
WAUKESHA	\$32,180,195,035	\$5,332,254,163	\$14,608,916	16.57%	\$35.98
WAUPACA	\$2,259,518,383	\$420,679,073	\$1,152,545	18.62%	\$22.01
WAUSHARA	\$666,225,703	\$136,967,953	\$375,255	20.56%	\$15.31
WINNEBAGO	\$10,848,385,660	\$2,387,422,144	\$6,540,883	22.01%	\$38.34
WOOD	\$4,357,875,378	\$878,621,465	\$2,407,182	20.16%	\$31.90
<b>WISCONSIN TOTALS</b>	<b>\$349,723,446,234</b>	<b>\$65,298,288,113</b>	<b>\$178,899,419</b>	<b>18.67%</b>	<b>\$30.62</b>

(\$10.42), Adams County (\$10.71), Pepin County (\$12.29) and Marquette County (\$12.60). Milwaukee County is near the middle of the distribution at \$31.77 in lost daily economic activity per person.

### Caveats and Other Concerns

The estimates of lost economic activity from shutting down Wisconsin's economy are intended to be a useful guide to policymakers as they determine how to navigate the current health and economic crisis. The estimates provided here should be thought of as "point estimates." There is not a confidence range around the estimates, but they represent a "best guess" given the available information, forecasting and related parameters.

As the estimates require reliance on imperfect or unknown factors, there is of course the potential for error. Only long after the COVID-19 crisis and response have been over will we have a more precise estimate of the economic toll of the quarantines.

One of the major assumptions of these estimates is in what economists call "dynamic effects," or how the effects of the shutdown might change as time goes on. The estimates presented here implicitly assume a linear dynamic effect – i.e., the daily cost is the same for each day of a shutdown, regardless of how many days it lasts.

In the real economy, which is always changing and where policymakers are reacting, there could be non-linear dynamic effects. One such possibility is that there is a tradeoff between incurring more economic costs upfront in exchange for smaller economic costs in the future. This could happen if front-loading economic costs vanquishes COVID-19 at a more rapid rate, allowing for a less severe economic shutdown in the future, or fewer days of overall shutdown. The estimates also cannot account for differentiating between what economic activity is merely delayed and what economic activity is permanently lost.

The estimates presented here also do not account for how economic activity might recover when a shutdown is lifted. The reopening of the Wisconsin economy likely will not happen all at once and with a full return to normalcy. This means that the daily GDP estimates on economic activity are likely to at first return in some fraction, rather than going from the full loss estimate to the forecast activity amount. This is as much a function of policy choices as it is of the people being willing to participate fully in normal economic activities.

The estimates presented here also do not account for how the economic shutdown interacts with other policies in Wisconsin or other areas. Notably, Wisconsin has closed schools for the remainder of the academic year. Outside of the educational aspects of this choice, it has direct implications for the GDP estimates presented here. Much of the

### Production in Wisconsin counties that can be done from "home"

County	Closest MSA	Wage Weighted % of Employment
ADAMS	WAUSAU	36.50%
ASHLAND	DULUTH	34.71%
BARRON	EAU CLAIRE	35.10%
BAYFIELD	DULUTH	34.71%
BROWN	<b>GREEN BAY</b>	40.88%
BUFFALO	EAU CLAIRE	35.10%
BURNETT	DULUTH	34.71%
CALUMET	<b>APPLETON</b>	38.53%
CHIPPEWA	<b>EAU CLAIRE</b>	35.10%
CLARK	WAUSAU	36.50%
COLUMBIA	<b>MADISON</b>	51.25%
CRAWFORD	LA CROSSE	37.47%
DANE	<b>MADISON</b>	51.25%
DODGE	FOND DU LAC	35.26%
DOOR	GREEN BAY	40.88%
DOUGLAS	<b>DULUTH</b>	34.71%
DUNN	EAU CLAIRE	35.10%
EAU CLAIRE	<b>EAU CLAIRE</b>	35.10%
FLORENCE	GREEN BAY	40.88%
FOND DU LAC	<b>FOND DU LAC</b>	35.26%
FOREST	WAUSAU	36.50%
GRANT	LA CROSSE	37.47%
GREEN	<b>MADISON</b>	51.25%
GREEN LAKE	OSHKOSH	38.63%
IOWA	<b>MADISON</b>	51.25%
IRON	DULUTH	34.71%
JACKSON	LA CROSSE	37.47%
JEFFERSON	JANESVILLE	35.03%
JUNEAU	WAUSAU	36.50%
KENOSHA	<b>CHICAGO</b>	49.59%
KEWAUNEE	<b>GREEN BAY</b>	40.88%
LA CROSSE	<b>LA CROSSE</b>	37.47%
LAFAYETTE	JANESVILLE	35.03%
LANGLADE	WAUSAU	36.50%
LINCOLN	<b>WAUSAU</b>	36.50%
MANITOWOC	SHEBOYGAN	35.66%
MARATHON	<b>WAUSAU</b>	36.50%
MARINETTE	GREEN BAY	40.88%
MARQUETTE	WAUSAU	36.50%
MENOMINEE	GREEN BAY	40.88%
MILWAUKEE	<b>MILWAUKEE</b>	46.42%
MONROE	LA CROSSE	37.47%
OCONTO	<b>GREEN BAY</b>	40.88%
ONEIDA	WAUSAU	36.50%
OUTAGAMIE	<b>APPLETON</b>	38.53%
OZAUKEE	<b>MILWAUKEE</b>	46.42%
PEPIN	MINNEAPOLIS	51.24%
PIERCE	<b>MINNEAPOLIS</b>	51.24%
POLK	MINNEAPOLIS	51.24%
PORTAGE	WAUSAU	36.50%
PRICE	WAUSAU	36.50%
RACINE	<b>RACINE</b>	34.07%
RICHLAND	LA CROSSE	37.47%
ROCK	<b>JANESVILLE</b>	35.03%
RUSK	EAU CLAIRE	35.10%
SAUK	<b>MINNEAPOLIS</b>	51.24%
SAWYER	MADISON	51.25%
SHAWANO	DULUTH	34.71%
SHEBOYGAN	GREEN BAY	40.88%
ST. CROIX	<b>SHEBOYGAN</b>	35.66%
TAYLOR	WAUSAU	36.50%
TREMPEALEAU	EAU CLAIRE	35.10%
VERNON	LA CROSSE	37.47%
VILAS	WAUSAU	36.50%
WALWORTH	RACINE	34.07%
WASHBURN	DULUTH	34.71%
WASHINGTON	<b>MILWAUKEE</b>	46.42%
WAUKESHA	<b>MILWAUKEE</b>	46.42%
WAUPACA	WAUSAU	36.50%
WAUSHARA	WAUSAU	36.50%
WINNEBAGO	<b>OSHKOSH</b>	38.63%
WOOD	WAUSAU	36.50%

Metropolitan areas in **BOLD** are defined as part of an MSA, non-bold indicates closest MSA

retention in economic activity estimated here depends on jobs that can be completed “from home,” but these estimates do not consider how home production might be affected by the presence of school-aged children in the home as parents take on an increased role in caring for and educating their children. It also does not consider the effect of other state shutdowns or reopening plans in places that are part of the production chain in Wisconsin, which will surely affect the level of economic activity in the state.

Finally, while GDP offers an all-encompassing measure of the cost of shutting down Wisconsin’s economy, it does not detail how the shutdown disproportionately affects different workers. It is apparent that most white collar workers have the ability to at least partially work from home, while those in the food service industry, for example, do not. Preliminary accounts suggest that the economic effects of shutdowns (and of the COVID-19 virus) are disproportionately felt by lower-wage workers (see Thomson-DeVeaux and Wolfe, 2020 for a summary). County and industry level data offer some clue as to how the incidence of a shutdown is felt across the state, but even within these partitions there are vast differences in the type of workers and their ability to absorb the effects of a shutdown.

The estimates presented here suggest that every day of the economic shutdown costs Wisconsin about \$178.9 million in lost GDP; about 18.7% of the predicted daily GDP for the state in 2020, or \$30.62 per state resident. These estimates should prove useful to policymakers as they decide whether and to what extent the economic shutdown in Wisconsin continues.

### Appendix:

#### Procedure for Estimating Economic Cost of an Economic Shutdown in Wisconsin

The following outlines the procedure for estimating the Gross Domestic Product cost of shutting down Wisconsin’s economy. The procedure can be broken into two major parts: forecasting what 2020 GDP would have been in Wisconsin counties in the absence of COVID-19 or any intervention in the economy; and estimating how much actual GDP will differ from the pre-intervention forecast.

1) The procedure starts with an estimate of U.S. Gross Domestic Product in the absence of COVID-19 or any intervention in the economy. This is done by starting with the known 2019 annual GDP and scaling it up by the Organization for Economic Co-operation and Development (OECD) forecasted growth rate. The OECD predicted 2% growth in annual U.S. GDP in 2020. According to the Bureau of Economic Analysis (BEA), GDP for the U.S. was \$21.4 trillion in 2019. Estimated GDP in the absence of the economic shock and response is \$21.8 trillion for 2020.

2) Wisconsin consistently produces 1.6% of U.S. GDP. Allocating 1.6% of the 2020 forecast GDP to Wisconsin results in an estimated 2020 Wisconsin GDP of \$349.7 billion.

3) To account for differences in the industry mix across areas of the state and how they would be impacted differently by the shutdown order, I conduct the remainder of the analysis at the county level, beginning with allocating the state GDP estimate for 2020 across the counties of Wisconsin using the historic percentage of state GDP that each county produces. The average percentage across 2015-2018 from the Bureau of Economic Analysis is used to allocate the 2020 forecast state GDP (available as an

#### Non-home industry level GDP retained

Industry	% Retained
UTILITIES	100%
CONSTRUCTION	100%
AGRICULTURE, FORESTRY, FISHING AND HUNTING	100%
WHOLESALE TRADE	100%
GOVERNMENT AND GOVERNMENT ENTERPRISES	100%
MANUFACTURING	75%
FINANCE, INSURANCE, REAL ESTATE, RENTAL, AND LEASING	75%
HEALTH CARE AND SOCIAL ASSISTANCE	75%
PROFESSIONAL AND BUSINESS SERVICES	50%
MINING, QUARRYING, AND OIL AND GAS EXTRACTION	50%
EDUCATIONAL SERVICES	50%
ACCOMMODATION AND FOOD SERVICES	50%
OTHER SERVICES (except government and government enterprises)	50%
RETAIL TRADE	25%
TRANSPORTATION AND WAREHOUSING	25%
INFORMATION	25%
ARTS, ENTERTAINMENT, AND RECREATION	0%

*Notes: Percent retained is the estimated percent of business that can still be conducted from among all production that is not able to shift to “home production.” Percentages are based on the author’s reading of the provisions and FAQs of the Safer at Home document.*

Excel file from the BEA at: <https://www.bea.gov/data/gdp/gdp-county-metro-and-other-areas>).

4) To discern how much economic activity will be retained from the pre-intervention forecast, I first estimate how much output can be shifted to “at home” production, and assume that this productivity is not affected by the shutdown order. The second step is to estimate, for production that cannot be shifted to “work at home,” how much is impacted by a shutdown order.

a. To estimate how much work can be done “at home,” I follow metropolitan area estimates from Dingel and Nieman (2020), which produce a wage-weighted percentage of jobs that can be completed at home. I apply these percentages exactly for Wisconsin counties that are part of metropolitan area definitions, and I apply the metropolitan area per-

centage to non-metropolitan area counties based on their proximity to a county that is part of a metropolitan statistical area (MSA). This likely provides an over-estimate of how much production can be done at home as some counties that are part of a larger MSA (for example, Kenosha is part of the Chicago MSA) would actually have lower percentages of work that can be done at home than the MSA average and counties that are not part of an MSA would likely have much lower percentages of work that can be done at home than counties in an MSA. The number of counties that are part of an MSA varies by the size of the MSA; some MSAs are only one county (Oshkosh), while others are many counties (the Milwaukee MSA is four counties). Appendix Table 1 shows the percentage of work that can be done at home for all Wisconsin counties.

**b.** I assume that counties are able to retain all production that can be done at home. Importantly, the model assumes that the ability to produce at home is unaffected by other aspects of the shutdown, such as school closures and hours worked. If, for example school closures result in increased parental responsibilities and lost work time, the model would overestimate how much production is retained. If, instead, working from home results in more productive work time or more hours worked at the same level of productivity per hour, the model would underestimate how much output is retained.

**c.** I estimate how much of the remaining production that cannot be done from home is likely to be retained under shutdown guidelines by mapping an interpretation of the provisions and FAQs released about Wisconsin's Safer at Home guidelines to an industry level of GDP production. For this exercise, I estimate how much production that does not occur

at home will be retained because part (a) takes into account all production that can still occur at home.

**d.** I map the shutdown to industries based on five broad categories – all production retained, 75% production retained, 50% retained, 25% retained or none retained. Appendix Table 2 shows the percentages applied at the industry level. After mapping industry level production, I then calculate a weighted average production retained for each county based on how much production occurs in each industry for each county.

**5)** After calculating the GDP retained in each county using the procedure in (1)-(4), I then divide it by 365 to get a daily amount of output retained. The difference between the 2020 forecast GDP and retained GDP is the economic cost of the shutdown. Note that a typical GDP calculation treats working days and non-working days differently, and there are 251 working days and 114 non-working days in a standard calculation, with a non-working day producing about 2/3 the production of a working day, according to Mulligan (2020). The calculations presented here are the average of a working and non-working day.



## About the author

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