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## **Forecasting the U.S. and Wisconsin Economies in 2022**

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### **Abstract**

This paper provides forecasts for the United States and Wisconsin economies in 2022. For each economy, we estimate a mixed-frequency vector auto-regression model using data both before March 2020 and after June 2020, with the extreme observations between March and June 2020 dropped to eliminate their impacts on the model estimates. Given the estimated model, we forecast each economy forward to the end of 2022. The model suggests that both economies will transit from the path of rapid recovery in 2021 to the slower growth observed before the pandemic. However, employment in both economies will remain below their pre-pandemic levels due to a low labor force participation rate that is consistent with the high number of workers quitting their jobs observed recently. For the U.S. economy, we forecast that the year-over-year growth rate of real GDP will be 2%, personal consumption expenditures will grow by 5%, inflation will drop to about 2%, the unemployment rate will remain at round 3.9%, the economy will add 1.7 million nonfarm jobs, and the average hourly earnings will increase by 3.9%. For the Wisconsin economy, we forecast that the year-over-year growth rate of real GDP will be 1.8%, the unemployment rate will drop to about 2.2%, and the economy will add 30 thousand nonfarm jobs. We project that both economies face significant uncertainties. There is a significant chance that both economies will grow by 4% or more, but also a significant chance that both economies will grow by 1% or less.

## 1 Overview

This paper provides forecasts for the United States and Wisconsin economies in 2022. For each economy, we estimate a mixed-frequency vector auto-regression model using data both before March 2020 and after June 2020, with the extreme observations between March and June 2020 dropped to eliminate their impacts on the model estimates. Given the estimated model, we forecast each economy forward to the end of 2022.

The model suggests that both economies will transit from the path of rapid recovery from the pandemic recession to the relatively slower growth observed in the years before the pandemic. However, even with a low unemployment rate, employment in both economies will remain below their pre-pandemic levels due to a low labor force participation rate that is consistent with the historically high number of workers quitting their jobs observed recently. Our forecasts also suggest that both economies face significant uncertainties in 2022.

### National Forecast

Our median forecasts suggest that, by the end of 2022, the year-over-year growth rate of real GDP will drop to about 2%, personal consumption expenditures will grow by about 5%, inflation will drop from its current high level of over 5% to about 2%, the unemployment rate will remain flat at round 3.9%, the economy will add 1.7 million nonfarm jobs, and average hourly earnings will increase by 3.9%. The manufacturing sector will not grow as fast as the overall economy. Manufacturing output may decline by 1.1%, and the sector may only add 30 thousand jobs.

The model also suggests that the economy faces some significant uncertainty, even though we do not directly model the uncertainties about the spread of the virus. There is a significant chance that real GDP will grow by about 4%, the unemployment rate will drop below 3%, the economy will add more than 4 million nonfarm jobs, and inflation will be 3% or higher. At the same time, there is also a significant chance that real GDP will grow by 1% or less, the unemployment rate will rise to 5% or more, and the economy may lose some nonfarm jobs. Finally, the model projects that there is a 19% chance that real GDP will decline in two consecutive quarters, a common definition of a recession.

### Wisconsin Forecast

For the Wisconsin economy, the median forecasts suggest that, by the end of 2022, the year-over-year growth rate of real GDP will be 1.8%, the unemployment rate will drop from its current value of 3% to about 2.2%, and the economy will add 30 thousand nonfarm jobs. The manufacturing output will grow by 2%, the sector will add 12 thousand jobs, and the hourly wage of manufacturing workers will increase by 3%.

As with the national economy, the model forecasts that the state economy faces some significant uncertainty. Our model suggests there is a significant chance that real GDP will grow by 4% or more, and nonfarm employment will reach its pre-pandemic level by adding over 90 thousand jobs. At the same time, there is also a significant chance that

the growth rate of real GDP will be negative, and nonfarm employment will remain at its current level without adding any job. Finally, the model projects there is a 27% chance that real GDP in Wisconsin will decline in two consecutive quarters, higher than the national value of 19%. This reflects the enhanced volatility in the state-level data.

### Methodology

Our forecasts are based on a mixed-frequency vector auto-regression model with exogenous variables (MF-VARX). As with other VAR models used for forecasting, the MF-VARX model assumes that a variable in a given period depends on its lagged values as well as the current and lagged values of other variables. This dependence is estimated using historical data. Assuming the recent trends and relationships between economic variables at the national and state levels will continue, the estimated model is then used to forecast each variable forward. Changes in federal and state policy going forward thus only enter our forecasts to the extent that expectations of these changes are reflected in current variables. For example, expectations of future fiscal and monetary policies are priced into current financial indicators and investment decisions.

We use 18 variables for the national economy covering measures of overall economic activity, like GDP and investment, as well as measures of specific sectors like the labor market, the financial market, and the manufacturing sector. Our model for the Wisconsin economy includes 11 state-level variables with similar coverage as the national variables, which are also included and treated as exogenous to the state economy.

To address the unprecedented impact of the pandemic, we exclude the extreme observations from March to June 2020 from our estimation sample. Schorfheide and Song (2021) show that, as an alternative of a sophisticated modeling of outliers, this ad-hoc strategy of dropping extreme observations is a promising way of handling VAR estimation going forward. They provide evidence showing that the median forecasts generated from this approach are comparable with others such as those from the Survey of Professional Forecasters.

## 2 The Model and Data

As discussed above, we use a mixed-frequency vector auto-regression model with exogenous variables (MF-VARX). A detailed description of the model can be found in Guo and Williams (2018), which uses the same model to forecast the U.S. and Wisconsin economies in 2018. Here we only describe the model briefly.

Traditional VAR models require all variables to be measured at the same frequency. For example, quarterly variables cannot be used directly in a model of monthly variables. To relax this restriction and utilize the information from variables of different frequencies for forecasting, Schorfheide and Song (2015) developed a mixed-frequency vector auto-regression (MF-VAR) model that treats a low frequency (e.g. quarterly) variable as evolving at the high frequency (e.g. monthly) but are only measured infrequently. Working with national variables only, Schorfheide and Song (2015) assume that all variables are endogenous and could affect each other. We use the same approach in our

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model for the national economy, but extend the original MF-VAR model to allow for exogenous variables at the national level in our model for the Wisconsin economy.

As with other VAR models used for forecasting, the MF-VARX model assumes that a variable in a given period depends on its lagged values as well as the current and lagged values of other variables. This dependence is estimated using historical data. Assuming the recent trends and relationships between economic variables at the national and state levels will continue, the estimated model is then used to forecast each variable forward.

Changes in federal and state policy going forward only enter our forecasts to the extent that expectations of these changes are reflected in current variables. For example, expectations of future fiscal and monetary policies are priced into current financial indicators and investment decisions.

Table below 1 lists the variables used in this paper. There are 18 variables for the national economy and 11 variables measuring the Wisconsin economy. For each economy, we use both measures of overall economic activity like GDP and investment and indicators for specific sectors like the labor market, the financial market, and the manufacturing sector. The variables are measured either monthly or quarterly. With the exception of state tax collections, which is obtained from the U.S. Census Bureau, all other variables are retrieved from the FRED database maintained by the Research division of the Federal Reserve Bank of St. Louis.

We use data available by January 14, 2022. By this date, the quarterly variables were available until the third quarter (Q3) of 2021, most of the monthly variables at the national level were available until December (M12) 2021, and most of the monthly variables at the state level were available until November (M11) 2021.

In a recent paper, Schorfheide and Song (2021) discussed several approaches to modifying the MF-VAR model to account for the unprecedented impact of the pandemic. They find that, as an alternative of a sophisticated modeling of outliers, simply dropping the extreme observations from March to June 2020 from the estimation sample is a promising way of handling VAR estimation going forward. In particular, they provide evidence showing that the median forecasts generated from this approach are comparable with others such as those from the Survey of Professional Forecasters. Following their recommendation, to estimate the model parameters, we use observations both before March 2020 and after June 2020, and then use the estimated model to generate the forecasts for 2022.

Given the recent indications that the Federal Reserve may increase the federal funds rate to temp the rising inflation, we feed in an expected future path of the federal funds rate from the Federal Reserve Bank of Atlanta.<sup>1</sup> Specifically, we assume the effective federal funds rate will rise to 0.34% in March, 0.59% in June, 0.8% in September and 1% in

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<sup>1</sup> <https://www.atlantafed.org/cenfis/market-probability-tracker>

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December. We forecast other variables conditional on this expected path of the effective federal funds rate.

Table 1: Description of Variables

Variable (short name)	End	Series name in FRED
U.S.		
Real gross domestic product (gdp)	Q3	GDPC1
Fixed private investment (fpi)	Q3	FPI
Real government expenditures (gce)	Q3	GCEC1
Manufacturing real output index (outms)	Q3	OUTMS
Civilian unemployment rate (ur)	M12	UNRATE
Total nonfarm payroll employment (emp)	M12	PAYEMS
Manufacturing employment (manemp)	M12	MANEMP
Aggregate weekly hours index (hrs)	M12	AWHI
Average hourly earnings in private sector (wage)	M12	AHETPI
Average hourly earnings in manufacturing (manwage)	M12	CES3000000008
Personal consumption expenditures (pce)	M11	PCE
PCE price index (pcepi)	M11	PCEPI
PCE price index excluding food and energy (pcepilfe)	M11	PCEPILFE
Industrial production index (indpro)	M12	INDPRO
Effective federal funds rate (fedfunds)	M12	FEDFUNDS
10-year treasury bond yield (gs10)	M12	GS10
Moody's seasoned Baa corporate bond yield (baa)	M12	BAA
S&P 500 index (sp500)	M12	SP500
Wisconsin		
Real GDP (wigdp)	Q3	WIRQGSP
Manufacturing GDP (wimangdp)	Q3	WIMANRQGSP
Personal income (wipinc)	Q3	WIOTOT
All-transactions house price index (wihpi)	Q3	WISTHPI
Tax collections (witax)	Q3	Census Bureau
Unemployment rate (wiur)	M11	WIUR
Civilian labor force (wilf)	M11	WILF
Nonfarm employment (wiemp)	M11	WINA
Manufacturing employment (wimanemp)	M11	WIMFG
Initial unemployment insurance claims (wiiclaims)	M12	WIICLAIMS
Average hourly earnings: manufacturing (wimanwage)	M11	SMU55000003000000008SA

Note. The second column (End) reports the last period (month: M or quarter: Q) when the data is available. Except for tax collections obtained from the U.S. Census Bureau, all other variables are retrieved from the FRED database maintained by the Research division of the Federal Reserve Bank of St. Louis.

### 3 Forecast for the U.S. Economy

This section reports our forecasts for the U.S. economy. Overall, the model forecasts that 2022 will be a year when the national economy transits from the path of rapid recovery from the pandemic recession to the relatively slower growth patterns observed before the pandemic. Given the low levels of economic activities in early 2021, many year-over-year growth indicators will start high, but most of them will converge to their pre-pandemic

values by the end of the year. However, some key indicators such as employment may not recover fully to their pre-pandemic levels. This happens not because of unemployment, the rate of which will be relatively low, but because of a low labor force participation rate which is consistent with the historically high number of workers quitting their jobs reported recently by the U.S. Bureau of Labor Statistics.

Specifically, the median forecasts suggest that the year-over-year growth rate of real GDP will be 3.8% in the first quarter, and then drop gradually to about 2% in the fourth quarter. The year-over-year growth rate of personal consumption expenditures will be 11.3% in the first quarter, and then drop gradually to about 5% in the fourth quarter. Inflation will drop from the current high level of over 5% to about 2% by the end of the year, which is still higher than the pre-pandemic values of less than 2%. The unemployment rate will remain roughly flat at its current value of 3.9%. The economy will add about 1.7 million nonfarm jobs, lower than the value of around 2 million observed in the few years before the pandemic. The average hourly earnings will increase by about 3.9%, higher than both the recent experience of around 3.5% in 2018-2019 and the average growth of around 2.5% in the few years before that. The manufacturing sector will expand in the first two quarters before shrinking. Overall, manufacturing output may decline by about 1.1%, and the sector may only add about 30 thousand jobs.

The model also suggests that the economy faces some significant uncertainties. There is a significant chance that real GDP will grow by about 4%, the unemployment rate will drop to 3%, the economy will add over 4 million nonfarm jobs, and inflation will be 3% or higher. At the same time, there is also a significant chance that real GDP will grow by 1% or less, the unemployment rate will rise to 5% or higher, and the economy will lose some nonfarm jobs. Finally, the model projects that there is a 19% chance that real GDP will decline in two consecutive quarters, a common definition of a recession.

The rest of this section discusses these forecasts in detail.

### 3.1 Output and Expenditures

Table 2 reports the median forecasts of year-over-year growth rates of real GDP (GDP) and personal consumption expenditures (PCE). We forecast that real GDP in 2021Q4 is 4.6% higher than the relatively low level in 2020Q4. This growth rate will decline over time and reach 1.99% by the end of the year. The year-over-year growth rates of personal consumption expenditures are larger in levels but follow a similar pattern over time. Starting from 13.45 in 2021Q4 and 11.31% in 2022Q1, the growth rate will drop gradually to 4.99% by the end of the year.

Table 2. Year-Over-Year Growth Rates of Output and Expenditures

Quarter	GDP	PCE
2021Q4	4.60	13.45
2022Q1	3.80	11.31
2022Q2	2.63	7.75
2022Q3	2.44	6.90
2022Q4	1.99	4.99

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While the median forecasts are useful, they are not informative of the potential risks that the economy may face. For this, we plot the 67% forecast intervals as the shaded areas in Figure 1. The black curve shows the historical values and our median forecasts. The red vertical line indicates December 2021, the last month when the values of some variables were observed.

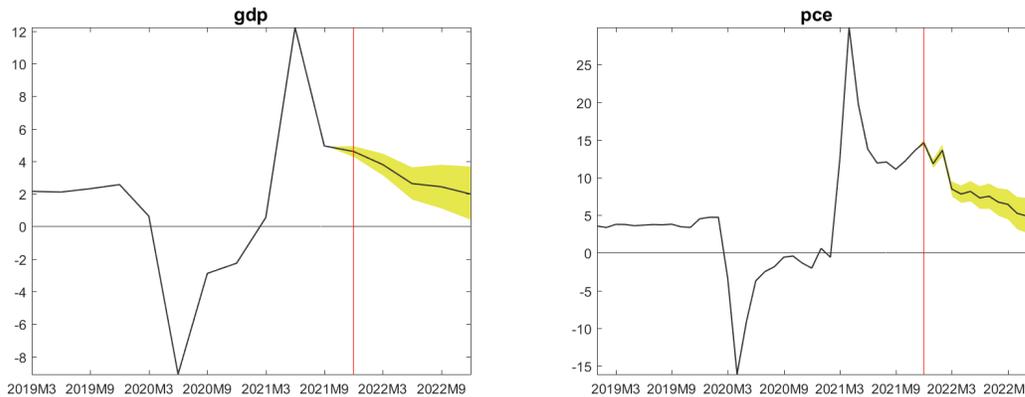


Figure 1: Year-over-year growth rates of real GDP (gdp) and personal consumption expenditures (pce) in the U.S., measured in percentage points. The red vertical line indicates December 2021. The black curve reports the actual values when available and median forecasts otherwise. The yellow shaded area reports the 67% forecast intervals.

For real GDP, the median forecast of 1.99% by the end of the year is comparable with the values observed before the pandemic in 2019. For personal consumption expenditures, the median forecast of 4.99% by the end of the year is slightly higher than the values observed in 2019.

As indicated by the yellow shaded areas in Figure 1, the model suggests the economy faces some uncertainty. In particular, the left panel shows that there is a significant chance that real GDP will grow by either about 4% or less than 1%. One common definition of a recession is that real GDP declines in two consecutive quarters. According to this definition, the model forecasts that the probability of a recession in 2022 is about 19%.

### 3.2 Inflation

Figure 2 reports our inflation forecasts. We use two measures of inflation: the year-over-year growth rate of the price index of overall personal consumption expenditures (pcepi) and the year-over-year growth rate of the price index of personal consumption expenditures excluding food and energy (pcepilfe). Both measures have been rising since the start of 2021 and are now at a high level of around 5%. Going forward, the median forecasts suggest that both measures will drop to about 2% by the end of 2022, which is still higher than the pre-pandemic values of less than 2% observed in 2019. However, the yellow shaded areas suggest that there is a significant chance that inflation will be 3% or higher, which is almost twice of the values observed before the pandemic.

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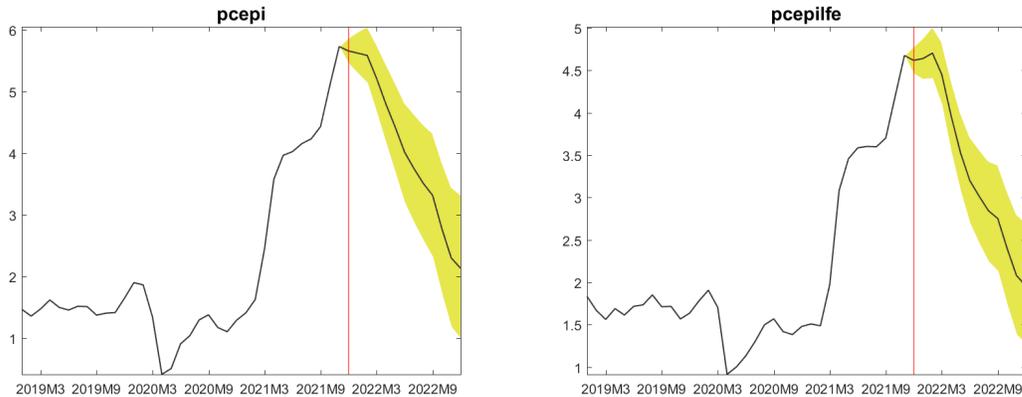


Figure 2: Year-over-year growth rates of price indices for personal consumption expenditures in the U.S: overall (pcepi) and excluding food and energy (pcepilfe). The red vertical line indicates December 2021. The black curve reports the actual values when available and median forecasts otherwise. The yellow shaded area reports the 67% forecast intervals.

### 3.3 The Labor Market

Figure 3 reports our forecasts for the labor market. The first panel (ur) shows that the unemployment rate will remain roughly flat at its current value of 3.9%, which is comparable with the values observed before the pandemic in 2019.

The second panel (emp) suggests that employment will continue to grow in 2022. The median forecasts suggest the economy will add about 1.7 million nonfarm jobs, lower than the value of around 2 million observed in the few years before the pandemic. Because of this slower growth, the median forecasts suggest employment will not recover fully to its pre-pandemic level by the end of the year.

Together, the low unemployment rate and low employment level reflect a low labor force participation rate, which is consistent with the historically high number of workers quitting their jobs reported recent by the U.S. Bureau of Labor Statistics.

The last panel (wage) shows that the average hourly earnings in the private sector will continue to increase. The median forecasts suggest that it will rise from \$26.61 in 2021M12 to about \$27.65 in 2022M12. This represents a 3.9% increase, higher than both the recent experience of around 3.5% in 2018-2019 and the average growth of around 2.5% in the few years before that.

Finally, the 67% forecast intervals shown by the yellow-shaded areas again suggest that the labor market face some uncertainty. There is a significant chance that the unemployment rate may drop to 3% and the economy may add more than 4 million nonfarm jobs. At the same time, there is also a significant chance that the unemployment rate may rise to 5% and the economy may lose some nonfarm jobs.

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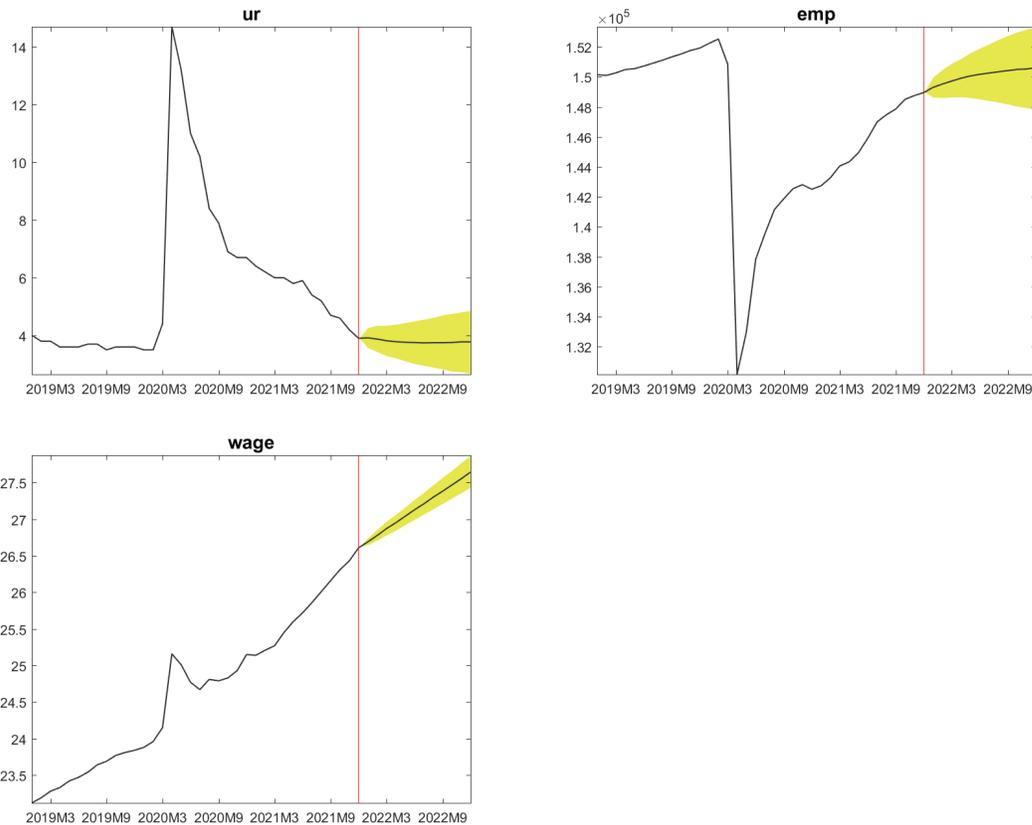


Figure 3: Labor market indicators in the U.S: the unemployment rate (ur), nonfarm employment in thousands (emp), and average hourly earnings of production and nonsupervisory employees in dollars (wage). The red vertical line indicates December 2021. The black curve reports the actual values when available and median forecasts otherwise. The yellow shaded area reports the 67% forecast intervals.

### 3.4 The Financial Market

Figure 4 plots our forecasts for the financial market. As mentioned above, we assume the federal funds rate will rise to 0.34% in March, 0.59% in June, 0.8% in September and 1% in December. Given this, the median forecasts suggest that the 10-year treasury yield (gs10) will decline slightly to about 1.4%, the Moody's seasoned Baa corporate bond yield (baa) will rise slightly to about 3.6%, and the S&P 500 index (sp500) will reach about 5000.

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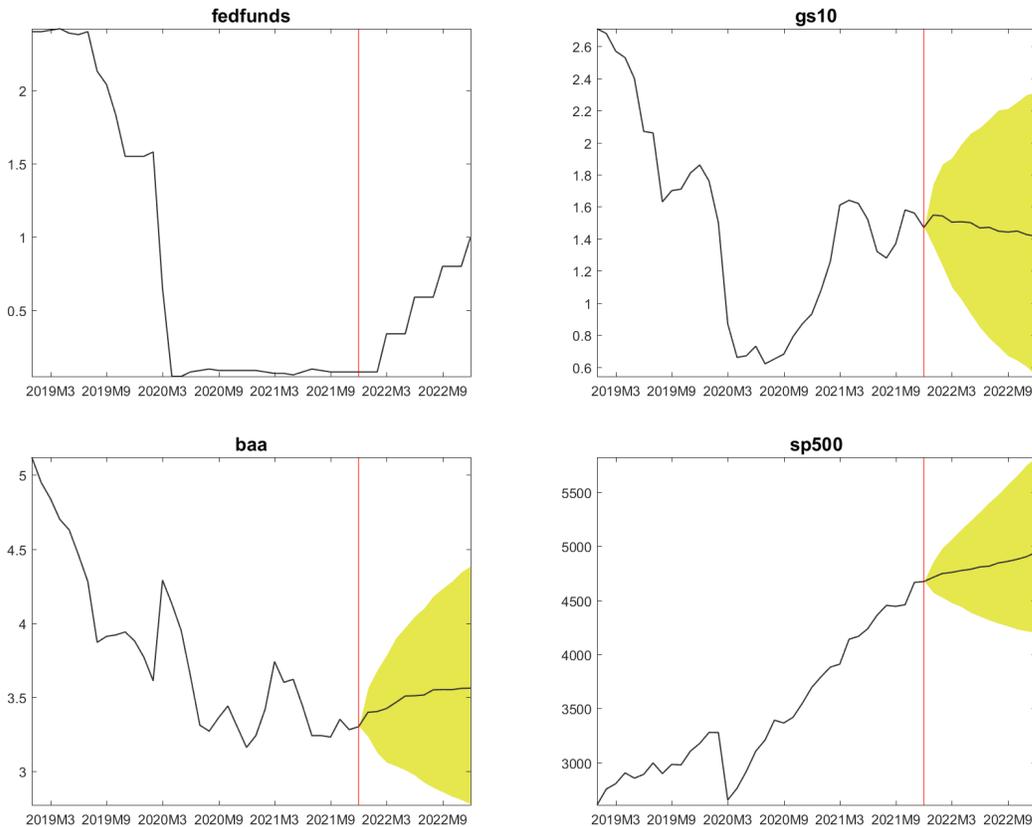


Figure 4: Financial market indicators in the U.S: effective federal funds rate (fedfunds), 10-year treasury constant maturity rate (gs10), Moody's seasoned Baa corporate bond yield (baa), and S&P 500 index (sp500). The red vertical line indicates December 2021. The black curve reports the actual values when available and median forecasts otherwise. The yellow shaded area reports the 67% forecast intervals.

### 3.5 The Manufacturing Sector

Figure 5 plots our forecasts for the manufacturing sector. The first panel shows an index of manufacturing output (outms). According to this index, the manufacturing output in 2021Q3 was similar to its level in 2019Q1. The median forecasts suggest that the recovery will end by the first quarter of 2022. After that, manufacturing output will decline slightly in the rest of the year, as it did in 2019. Overall, manufacturing output may decline by about 1.1% during the year.

The second panel shows manufacturing employment (manemp) in thousands. By the end of 2021, manufacturing employment was still below its pre-pandemic level by about 230 thousand. As with manufacturing output, the median forecasts suggest that manufacturing employment will increase in early 2022 before declining slightly. By the end of the year, the sector may only add about 30 thousand jobs.

The third panel shows the average hourly earnings of production and nonsupervisory employees in manufacturing (manwage). The median forecasts suggest that the average wage will rise from its current value of \$24.33 to about \$25.03. This represents an

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increase of about 2.9%, which is comparable with the growth rates observed in the few years before the pandemic.

Finally, the 67% forecast intervals shown by the yellow-shaded areas suggest that there is a significant chance that manufacturing output will increase by about 2.4% and the sector will add about 340 thousand jobs. At the same time, there is also a significant chance that manufacturing output may decline by about 4.3% and the sector may lose about 260 thousand jobs.

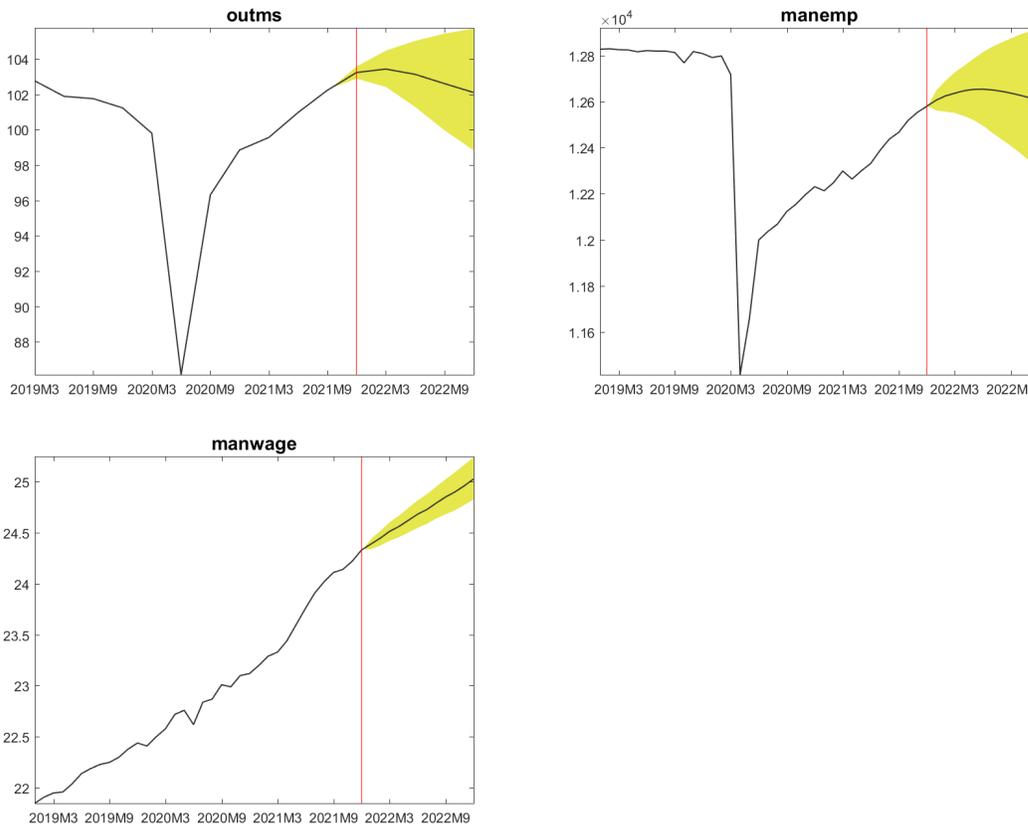


Figure 5: Indicators for the manufacturing sector in the U.S: an index of real output (outms), employment in thousands (manemp), and average hourly earnings of production and nonsupervisory employees in dollars (manwage). The red vertical line indicates December 2021. The black curve reports the actual values when available and median forecasts otherwise. The yellow shaded area reports the 67% forecast intervals

### 4 Forecast for the Wisconsin Economy

This section reports our forecasts for the Wisconsin economy in 2022. Overall, as with the national economy, the model forecasts that the state economy will transit from the path of pandemic recovery to the growth patterns observed before the pandemic. With a historically low unemployment rate, the labor market will be tight, but employment will not recover to its pre-pandemic level due to a low labor force participation rate.

Specifically, the median forecasts suggest that the year-over-year growth rate of real GDP will start at 3.21% in the first quarter before dropping to 1.82% in the fourth quarter. Due

to the high level of income in 2021Q1 from the American Rescue Plan, the year-over-year growth rate of personal income will be -2.47% in 2022Q1, and it will be 3.39% by the end of the year. The unemployment rate will drop from its current value of 3% to about 2.2%. The economy will add about 30 thousand nonfarm jobs. But the total nonfarm employment in December will still be below its pre-pandemic level by about 55 thousand. The growth of the manufacturing sector will be faster, which is true in terms of both output and employment, and the average hourly earnings of manufacturing workers will grow by about 3%.

As with the national economy, the model forecasts that the state economy faces some significant uncertainty. There is a significant chance that real GDP will grow by 4% or more, and nonfarm employment will reach its pre-pandemic level by adding over 90 thousand jobs. At the same time, there is also a significant chance that the growth rate of real GDP will be negative, and nonfarm employment will remain at its current level without adding any job. Finally, the model projects that there is a 27% chance that real GDP in Wisconsin will decline in two consecutive quarters, higher than the national value of 19%.

The rest of this section discusses the forecasts in detail.

### 4.1 Output and Income

Table 3 and Figure 6 report our forecasts of the year-over-year growth rates of real GDP (wigdp) and personal income (wipinc) in Wisconsin.

Table 3: Year-Over-Year Growth Rates of GDP and Personal Income for Wisconsin

Quarter	GDP	Personal Income
2021Q4	3.21	7.22
2022Q1	3.54	-2.47
2022Q2	2.30	4.75
2022Q3	2.94	5.95
2022Q4	1.82	3.39

The median forecasts suggest that real GDP in 2021Q4 is 3.21% higher than its level in 2020Q4, and real GDP in 2022Q1 will be 3.54% more than its level in 2021Q1. After that, the growth rate will be lower and reach about 1.82% by the end of the year, which is still slightly higher than the growth rate of about 1.5% in 2019.

The pattern for personal income is somewhat different. In particular, we forecast that personal income in 2021Q4 will be 7.22% higher than its value in 2020Q4. However, in 2022Q1, personal income will be 2.47% lower than its value one year ago, which was unusually high due to the income from the American Rescue Plan. After that, the year-over-year growth rate of personal income will be around 5% in the second and third quarter before dropping to 3.39% in the fourth quarter. Roughly speaking, the growth rates in the last three quarters are comparable with the pre-pandemic values of around 4% in 2019.

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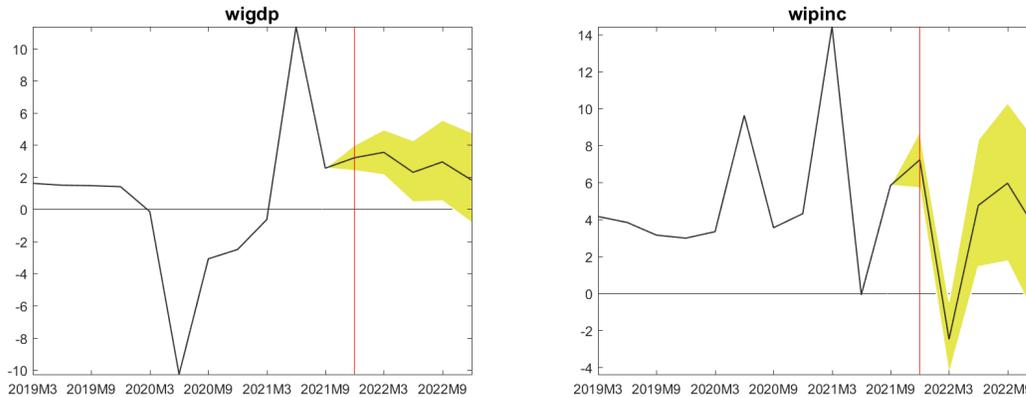


Figure 6: Year-over-year growth rates of real GDP (wigdp) and personal income (wipinc) for Wisconsin. The red vertical line indicates December 2021. The black curve reports the actual values when available and median forecasts otherwise. The yellow shaded area reports the 67% forecast intervals.

The yellow-shaded areas in Figure 6 indicate the uncertainties faced by the Wisconsin economy. There is a significant chance that the year-over-year growth rate of real GDP in 2022Q4 will be 4% or more. At the same time, there is also a significant chance that this rate will drop below zero. The probability that real GDP in Wisconsin will decline in two consecutive quarters in 2021 is 27%, higher than the national value of 19%.

### 4.2 The Labor Market

Figure 7 below plots our forecasts for the Wisconsin labor market. The first panel (wiur) shows the unemployment rate, which was at a historical low of 3% in November 2021. The median forecasts suggest that the unemployment rate will drop below 3% to about 2.2% by the end of the year. In other words, the state labor market will remain tight as it had been in the years before the pandemic.

The second panel shows nonfarm employment (wiemp) in thousands. Different from the unemployment rate, nonfarm employment has not recovered to its pre-pandemic level yet. In November 2021, nonfarm employment was about 94 thousand lower than its level in November 2019. The median forecasts suggest that nonfarm employment will continue to grow at a slow pace. By the end of the year, the state will add about 30 thousand nonfarm jobs, and the level of nonfarm employment will still be below its pre-pandemic value by about 55 thousand.

As with the national economy, the low unemployment rate and low employment level reflect a low labor force participation rate, which is consistent with the historically high number of workers quitting their jobs reported recently by the U.S. Bureau of Labor Statistics.

The 67% forecast intervals represented by the shaded areas suggest that the unemployment rate may remain around 3%, and there is a significant chance that the nonfarm employment may either recover to its pre-pandemic level by adding about 90 thousand jobs, or remain at its current level without adding any job.

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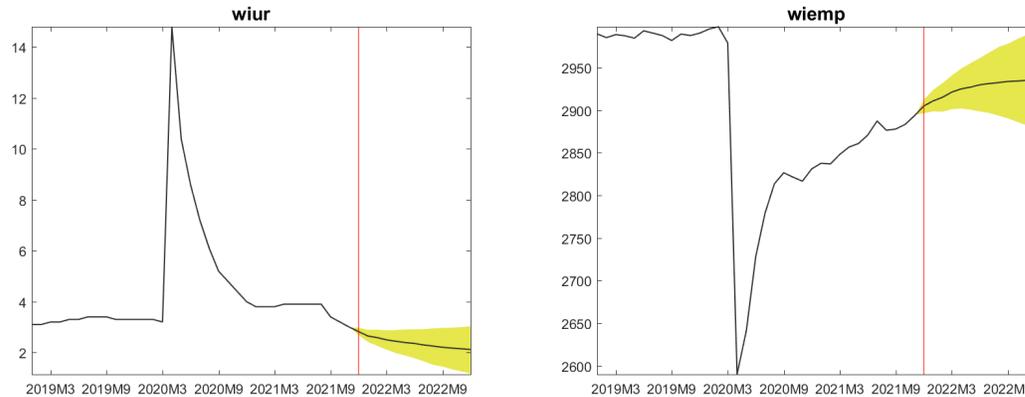


Figure 7: Labor market indicators in Wisconsin: the unemployment rate (wiur) and nonfarm employment (wiemp) in thousands. The red vertical line indicates December 2021. The black curve reports the actual values when available and median forecasts otherwise. The yellow shaded area reports the 67% forecast intervals.

### 4.3 The Manufacturing Sector

Figure 8 reports our forecasts for the manufacturing sector. The first panel shows the year-over-year growth rates of manufacturing output (wimangdp). The median forecasts suggest that the growth rate will be 7.56% in 2021Q4, 5.66% in 2022Q1, 3.03% in 2022Q2, 5.28% in 2022Q3 and 1.97% in 2022Q4. These numbers are slightly higher than the growth rates for the overall state economy reported in Table 3 and Figure 6, but roughly comparable with the growth rates of manufacturing output in 2019.

The second panel shows manufacturing employment (wimanemp) in thousands. By November 2021, manufacturing employment had recovered fully to its pre-pandemic level of around 480 thousand. The median forecasts suggest that it will continue to increase and reach about 495 thousand by the end of the year.

The third panel shows the average hourly earnings of manufacturing workers (wimanwage). The median forecasts suggest that it will increase from \$22.5 in November 2021 to \$23.2 in December 2022. This represents a 3% increase which is roughly comparable with the values observed before the pandemic.

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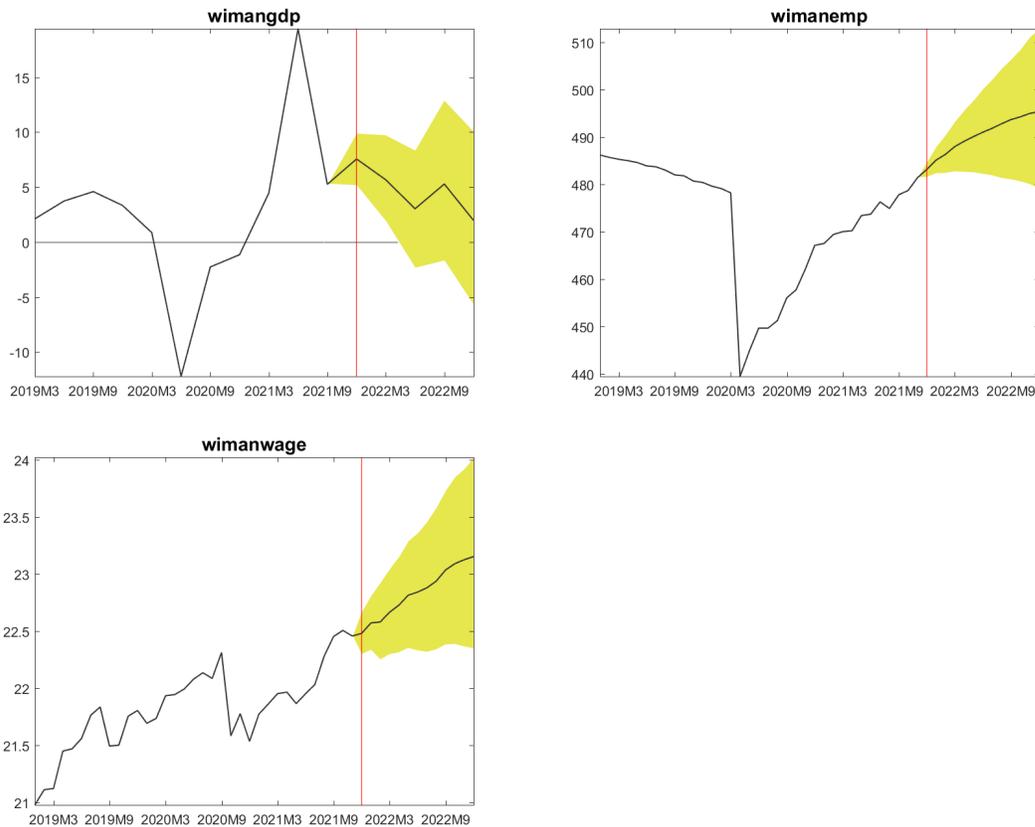


Figure 8: The year-over-year growth rate of manufacturing output (wimangdp), and manufacturing employment in thousands (wimanemp), and average hourly earnings of manufacturing workers (wimanwage). The red vertical line indicates December 2021. The black curve reports the actual values when available and median forecasts otherwise. The yellow shaded area reports the 67% forecast intervals.

## 5 Conclusion

Overall, our forecasts suggest that both the U.S. and Wisconsin economies will transit from the path of rapid recovery in 2021 to the relatively slower growth observed in the years before the pandemic. However, even with a low unemployment rate, employment in both economies will remain below their pre-pandemic levels due to a low labor force participation rate that is consistent with the historically high number of workers quitting their jobs observed recently. Our forecasts also suggest that both economies face significant uncertainties in 2022.

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