



## Forecasting the U.S. and Wisconsin Economies in 2023 and 2024\*

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### Executive summary

We use a mixed-frequency vector auto-regression model to forecast the U.S. and Wisconsin economies through the end of 2024.

For the United States, the model suggests that

- real GDP will grow by about 2.2% in 2023 and 1.6% in 2024; the probability that real GDP will decline in two consecutive quarters is 6.7% for the second half of 2023 and 24% in 2024;
- the unemployment rate will remain around 3.5% in 2023 and rise to 4% by the end of 2024;
- inflation will remain above 3.3% in 2023 and drop to 2.5% by the end of 2024;
- the federal funds rate will remain around 4.9% in 2023 and drop to 4.4% by the end of 2024.

For Wisconsin, the model suggests that

- real GDP will grow by about 1.5% in 2023 and 1.8% in 2024; the probability that real GDP in Wisconsin will decline in two consecutive quarters is 6% for the second half of 2023 and 19% in 2024;
- the unemployment rate will rise to about 3.3% by the end of 2024;
- housing prices will increase by about 4% in both 2023 and 2024.

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\*The views expressed herein are those of the authors and not necessarily those of the Center for Research on the Wisconsin Economy, the Department of Economics, or the University of Wisconsin – Madison.

We forecast the U.S. and Wisconsin economies in 2023–2024. For the U.S. economy, we use the mixed-frequency vector auto-regression (MF-VAR) model developed by Schorfheide and Song (2015). For the Wisconsin economy, we use an extended version of the MF-VAR model that allows the state economy to be affected by the variables determined at the national level (Guo and Williams, 2018).

Traditional vector auto-regression (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, Schorfheide and Song (2015) developed a 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. To forecast the economy for the state of Wisconsin, Guo and Williams (2018) introduce exogenous variables into the original MF-VAR model. Determined at the national level, the exogenous variables are allowed to affect the state-level variables, but not vice versa.

As with other VAR models used for forecasting, the MF-VAR 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 in the model. 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 when expectations of these changes are reflected in observed values of the variables used in the model. For example, expectations of future fiscal and monetary policies are priced into current financial indicators and investment decisions.

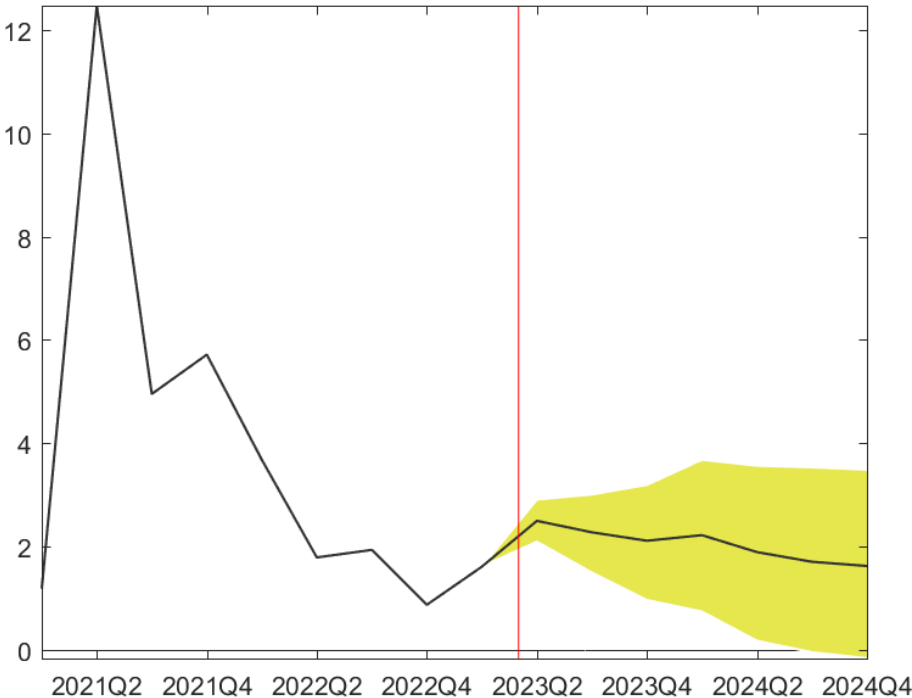
Table 1, in the appendix, lists the variables that we use for the two economies. There are 18 measures of the national economy, including 4 quarterly measures and 14 monthly measures. These measures cover both overall economic activity, e.g., GDP and investment, and specific sectors like the labor market, the financial market, and the manufacturing sector. The quarterly measures are available until the first quarter of 2023 (2023Q1), and most of the monthly measures are available until April 2023 (2023M4). In comparison, there are 11 measures of the Wisconsin economy, including 5 quarterly measures and 6 monthly measures. The quarterly measures are available until the fourth quarter of 2022 (2022Q4), and most of the monthly measures are available until April 2023 (2023M4). The coverage of the state-level measures is similar to that of the national variables, which are also included and treated as exogenous in the model for the state economy.

To address the unprecedented impact of the COVID-19 pandemic, we exclude from our estimation sample the extreme observations from March 2020 to June 2020. Schorfheide and Song (2021) show that, as an alternative to a more 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.

## 1 Forecast for the U.S. Economy

Figure 1 plots the year-over-year growth rates of U.S. real GDP. The red line indicates May 2023, the last month with available data. The black line plots the observed growth rates until the first quarter of 2023 (2023Q1), and the median forecasts thereafter. The yellow-shaded area plots the 67% forecast intervals. That is, according to the model, the chance that the growth rate falls into the yellow-shaded area is 67%. Other graphs reported below are formatted in the same way.



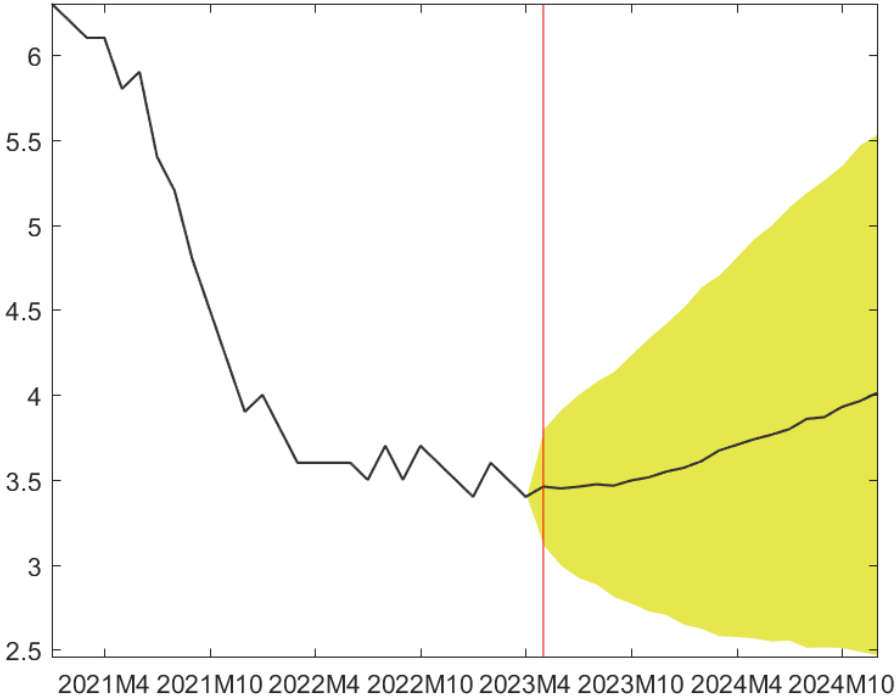
**Figure 1: Year-over-Year Growth Rates of U.S. Real GDP (%)**

The median forecasts suggest that the year-over-year growth rate of U.S. real GDP will be around 2.2% in the second half of 2023, and then drop to about 1.6% by the end of 2024. The yellow-shaded area suggests that the economy faces some significant uncertainties. There is a significant chance that the year-over-year growth rate of real GDP will be either negative or over 3.5% by the end of 2024. The chance that real GDP will decline in two consecutive quarters, a standard definition of a recession, is 6.7% in the second half of 2023 and 23.8% in 2024.

### 1.1 The Labor Market

Figure 2 plots the monthly unemployment rate in the United States. The median forecasts suggest that the unemployment rate will remain around 3.5% in the second half of 2023, and then rise to

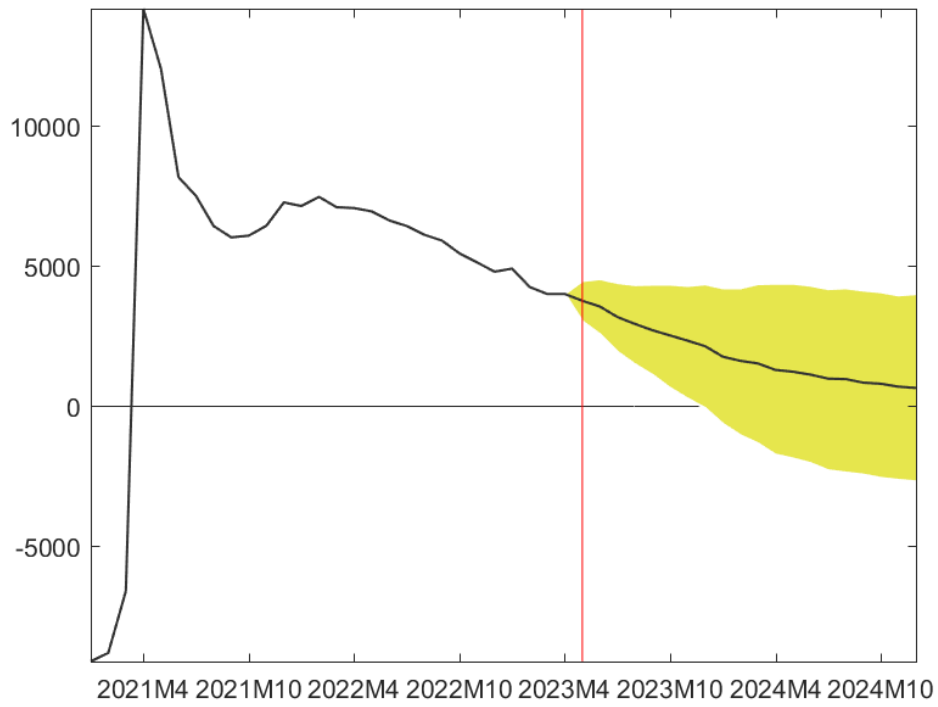
about 4% by the end of 2024. The yellow-shaded area suggests that there is a significant chance that the unemployment rate will either drop below 3% or rise above 5% by the end of 2024.



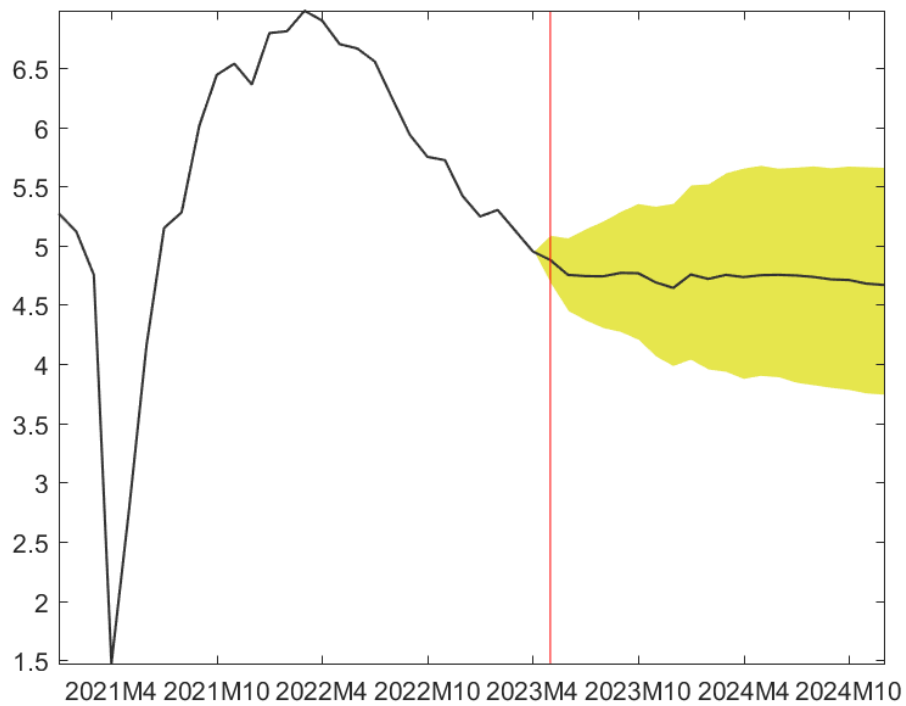
**Figure 2: U.S. Monthly Unemployment Rates (%)**

Figure 3 plots the year-over-year growth of nonfarm employment in the United States. The median forecasts suggest that the year-over-year growth will remain over 2 million in the second half of 2023, and then drop to about 638 thousand by the end of 2024. The yellow-shaded area suggests that there is a significant chance that the economy will either add 4 million jobs or lose 2 millions jobs in 2024.

Figure 4 plots the year-over-year growth rates of average hourly earnings across all production and non-supervisory employees in the private sector in the United States. The median forecasts suggest that this measure of wage growth will be around 4.7% in both the second half of 2023 and 2024.



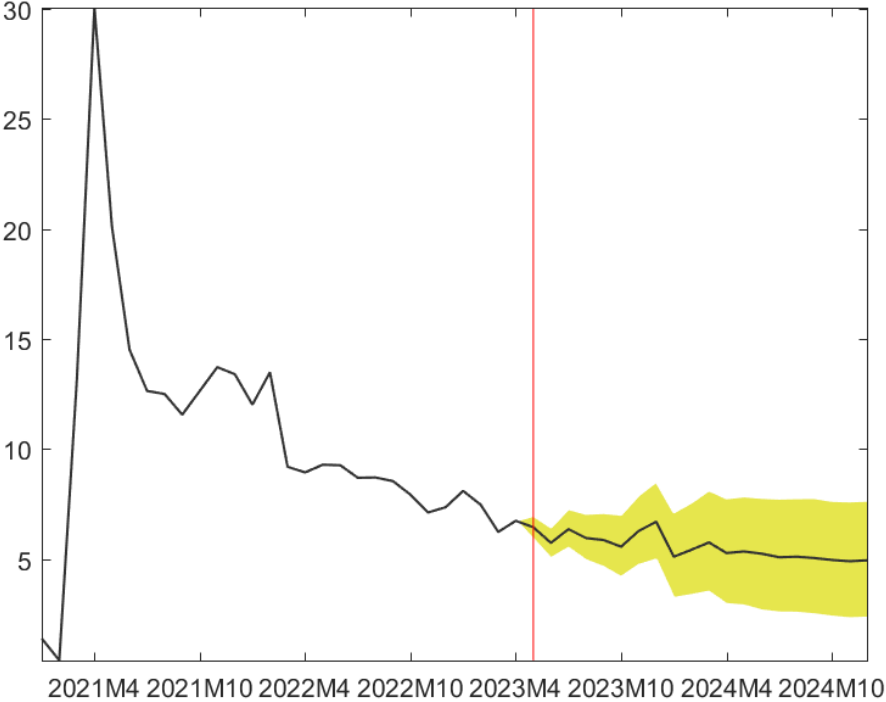
**Figure 3: Year-over-Year Growth of U.S. Nonfarm Employment (Thousands of Persons)**



**Figure 4: Year-over-Year Growth Rates of Average Hourly Earnings (%)**

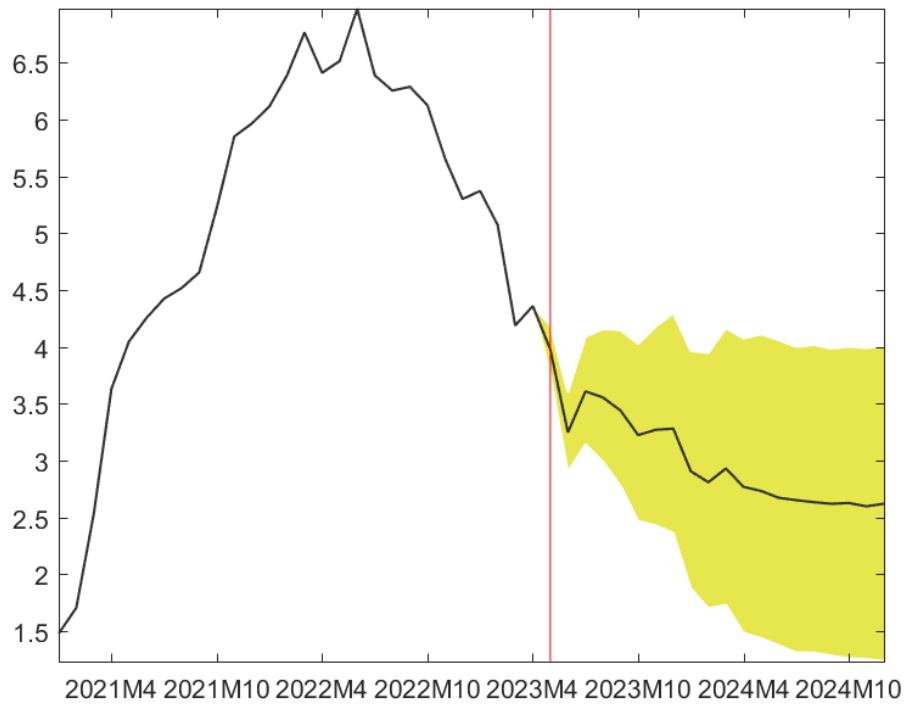
## 1.2 Consumption and Inflation

Figure 5 plots the year-over-year growth rate of personal consumption expenditures (PCE) in the United States. The median forecasts suggest that the growth rate will remain around 6% in the second half of 2023, and then drop to about 5% by the end of 2024.

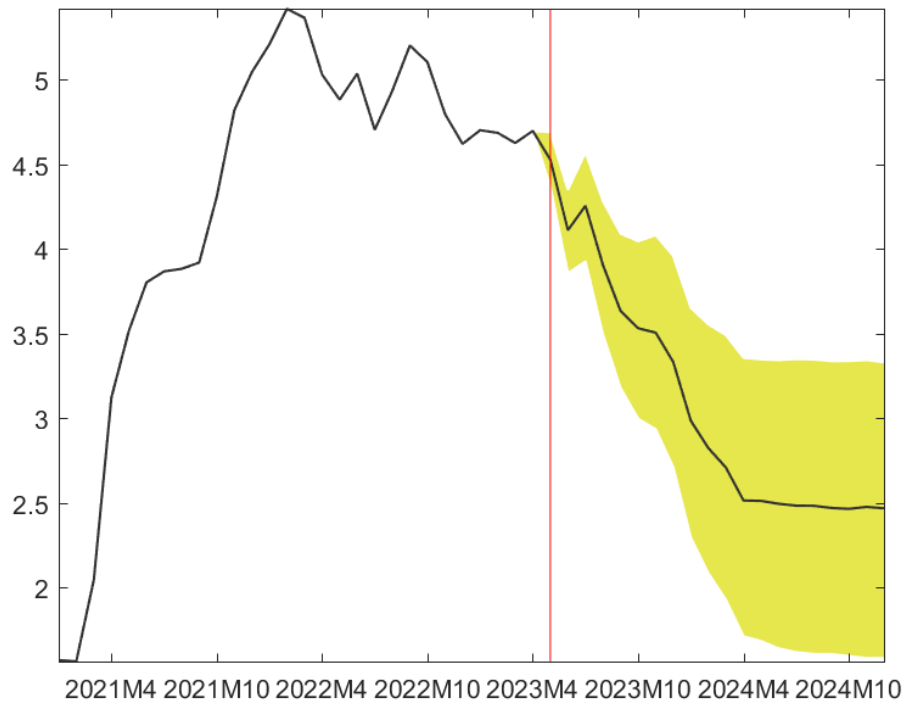


**Figure 5: Year-over-Year Growth Rates of U.S. Personal Consumption Expenditures (%)**

Figure 6 plots overall inflation, measured by the year-over-year growth rate of the price index for personal consumption expenditures (PCE). Figure 7 plots core inflation measured by the year-over-year growth rate of the price index for PCE excluding food and energy. The median forecasts suggest that both measures of inflation will remain above 3.3% in the second half of 2023, and then drop to about 2.5% by the end of 2024. The yellow-shaded area suggests that there is a significant chance that inflation will either remain around 4% or drop to about 1.5% by the end of 2024.



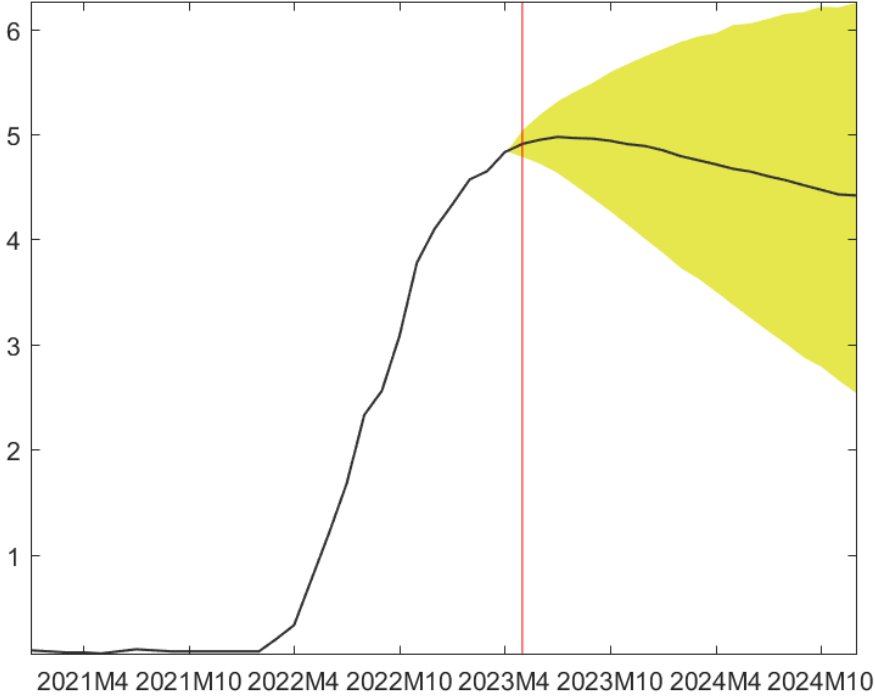
**Figure 6:** Year-over-Year Growth Rates of the PCE Price Index (%)



**Figure 7:** Year-over-Year Growth Rates of the PCE Price Index, Excluding Food and Energy (%)

### 1.3 Interest Rates

Figure 8 plots the effective federal funds rate, the interest rate at which depository institutions trade federal funds (balances held at Federal Reserve Banks) with each other overnight. The rate that the borrowing institution pays to the lending institution is determined between the two banks. The weighted average rate for all of these types of negotiations is called the effective federal funds rate. The effective federal funds rate is essentially determined by the market but is influenced by the Federal Reserve through open market operations to reach the federal funds rate target.

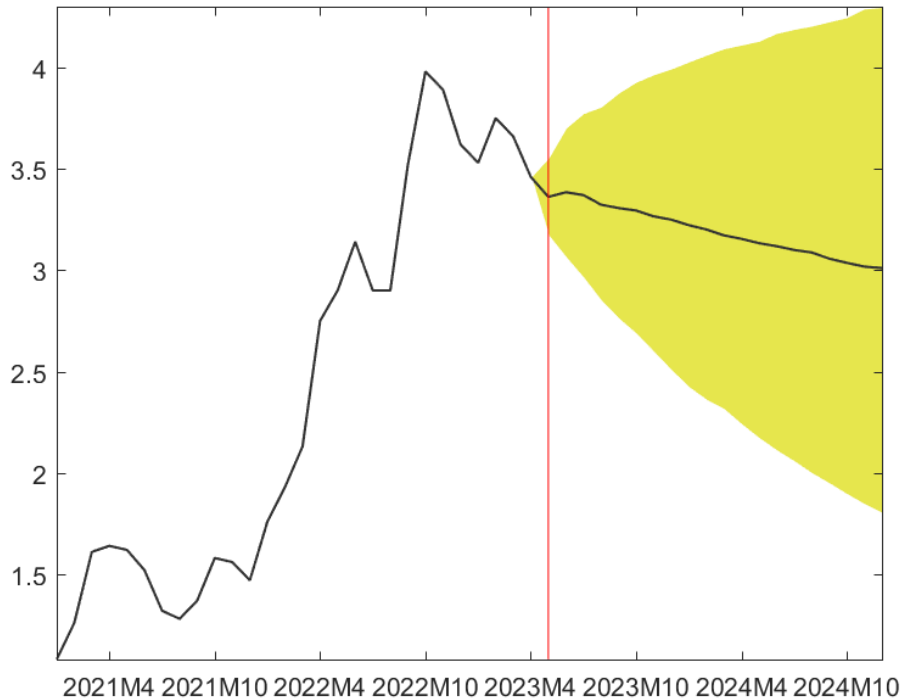


**Figure 8: The Effective Federal Funds Rate (%)**

The median forecasts suggest that the effective federal funds rate will remain around 4.9% in the second half of 2023, and then drop to about 4.4% by the end of 2024. The yellow-shaded area suggests that there is a significant chance that the effective federal funds rate will either reach above 6% or drop below 3% by the end of 2024.

Figure 9 plots the market yield on U.S. treasury securities at 10-year constant maturity. The median forecasts suggest that this relative long-term interest rate will drop gradually from its current value of around 3.5% to around 3% by the end of 2024. The yellow-shaded area suggests that there is a significant chance that this interest rate will either reach above 4% or drop below 2% by the end of 2024.

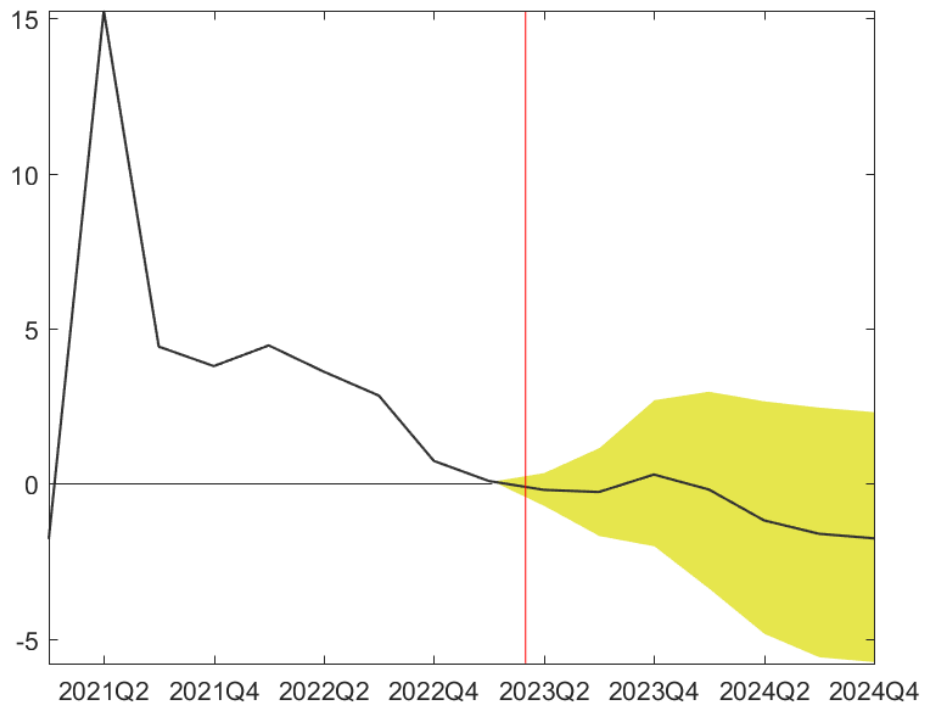




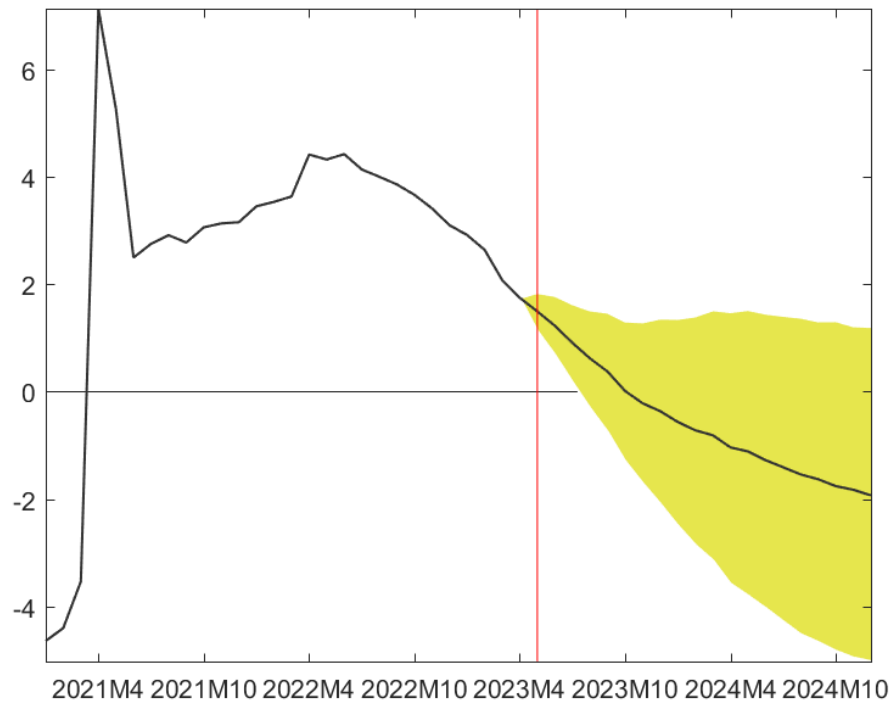
**Figure 9: Market Yield on U.S. Treasury Securities at 10-Year Constant Maturity (%)**

#### 1.4 The Manufacturing Sector

Figure 10 plots the year-over-year growth rate of U.S. manufacturing output. Figure 11 plots the year-over-year growth rate of U.S. manufacturing employment. Both measures suggest that the sector will continue its decline started before the pandemic. The median forecasts suggest that, in 2024, manufacturing output will decline by about 1.7% and manufacturing employment will drop by about 1.9%. The yellow-shaded areas suggest that there is a significant chance that the manufacturing sector will either grow by over 1% or decline by over 4% in 2024.



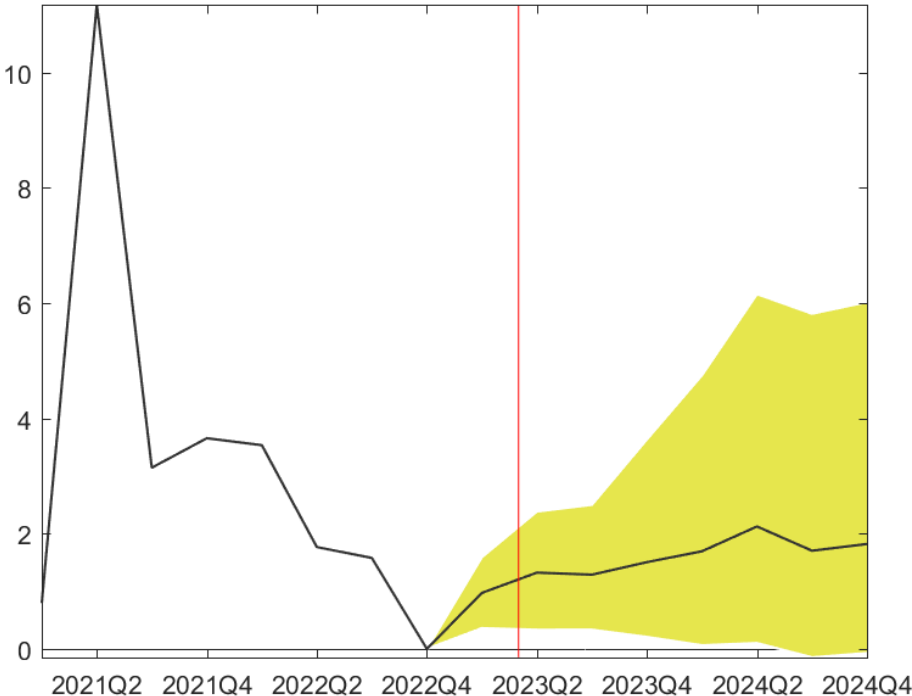
**Figure 10:** Year-over-Year Growth Rates of U.S. Manufacturing Output (%)



**Figure 11:** Year-over-Year Growth Rates of U.S. Manufacturing Employment (%)

## 2 Forecast for the Wisconsin Economy

Figure 12 plots the year-over-year growth rate of real GDP in Wisconsin. The median forecasts suggest that the growth rate will be about 1.5% in 2023 and 1.8% in 2024. The yellow-shaded area suggests that there is a significant chance that the year-over-year growth rate will be either negative or as high as 6% by the end of 2024. The chance that real GDP in Wisconsin will decline in two consecutive quarters, a standard definition of a recession, is 6% in the second half of 2023 and 18.5% in 2024.

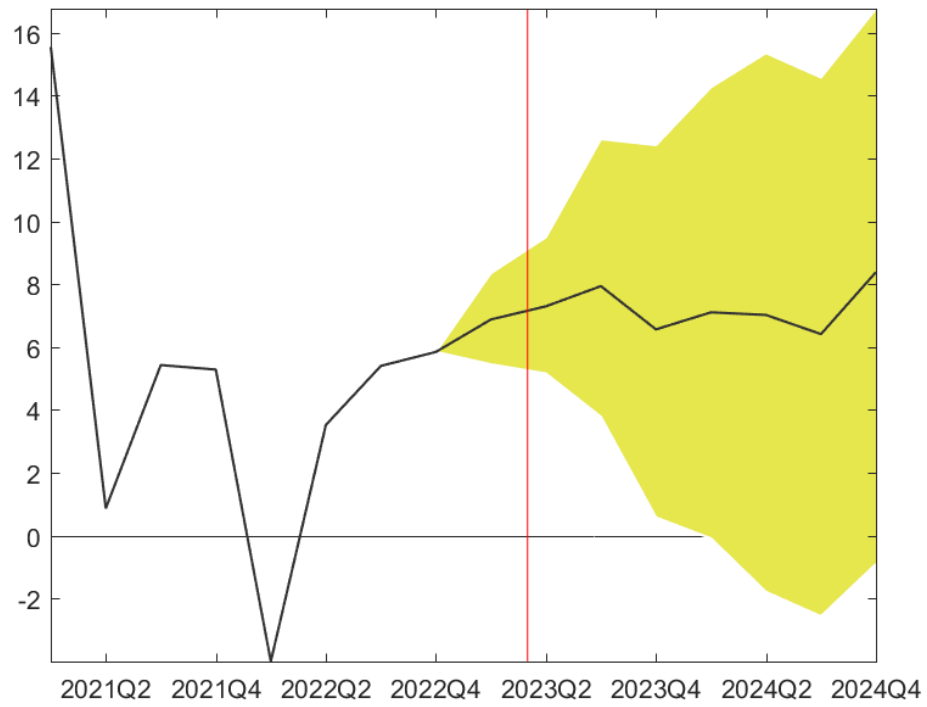


**Figure 12:** Year-over-Year Growth Rates of Real GDP in Wisconsin (%)

### 2.1 Income and Taxes

Figure 13 plots the year-over-year growth rate of personal income in Wisconsin. The median forecasts suggest that the growth rate will be around 6-8% through the end of 2024.

Figure 14 plots the year-over-year growth rate of total taxes in Wisconsin. We use data from the Quarterly Summary of State & Local Taxes by the U.S. Census Bureau. The median forecasts suggest that the growth rate will be around 8-12% through the end of 2024.



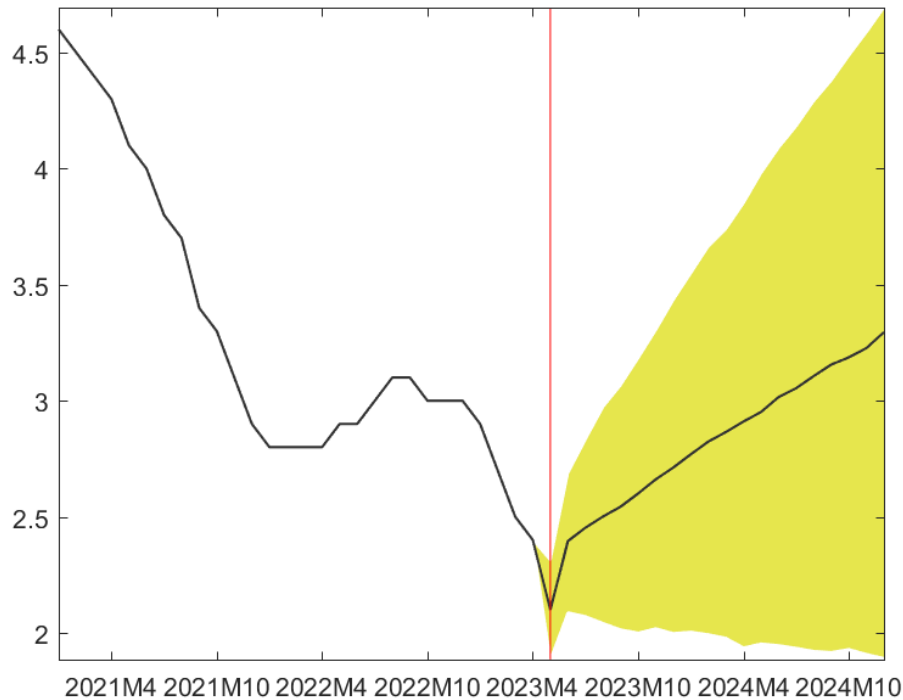
**Figure 13: Year-over-Year Growth Rates of Personal Income in Wisconsin (%)**



**Figure 14: Year-over-Year Growth Rates of Total Taxes in Wisconsin (%)**

## 2.2 The Labor Market

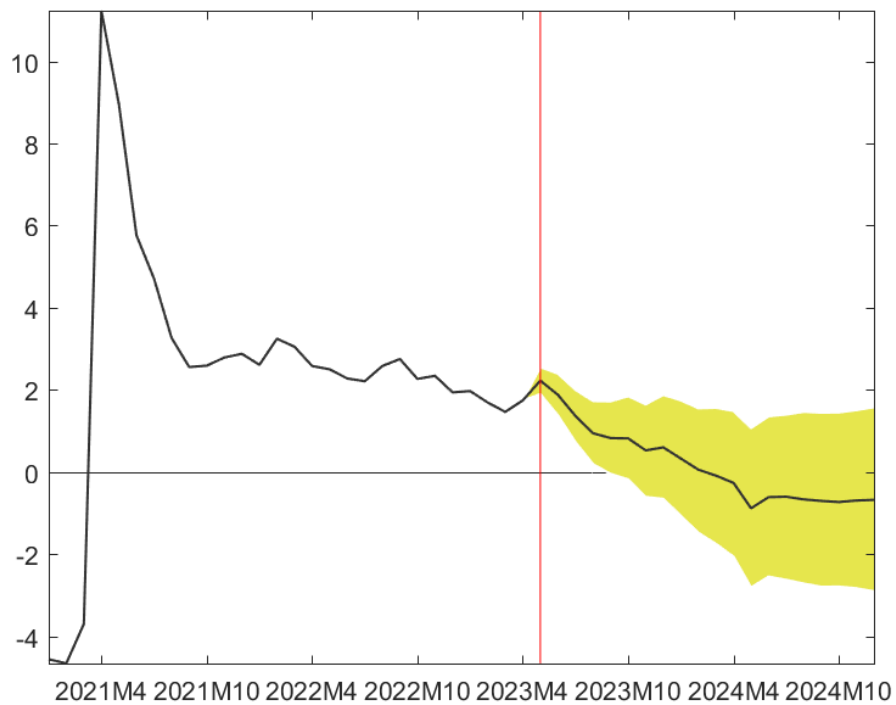
Figure 15 plots the monthly unemployment rate in Wisconsin. The median forecasts suggest that the unemployment rate will rise to about 3.3% by the end of 2024. The yellow-shaded area suggests that there is a significant chance that the unemployment rate will either rise above 4.5% or drop below 2% by the end of 2024.



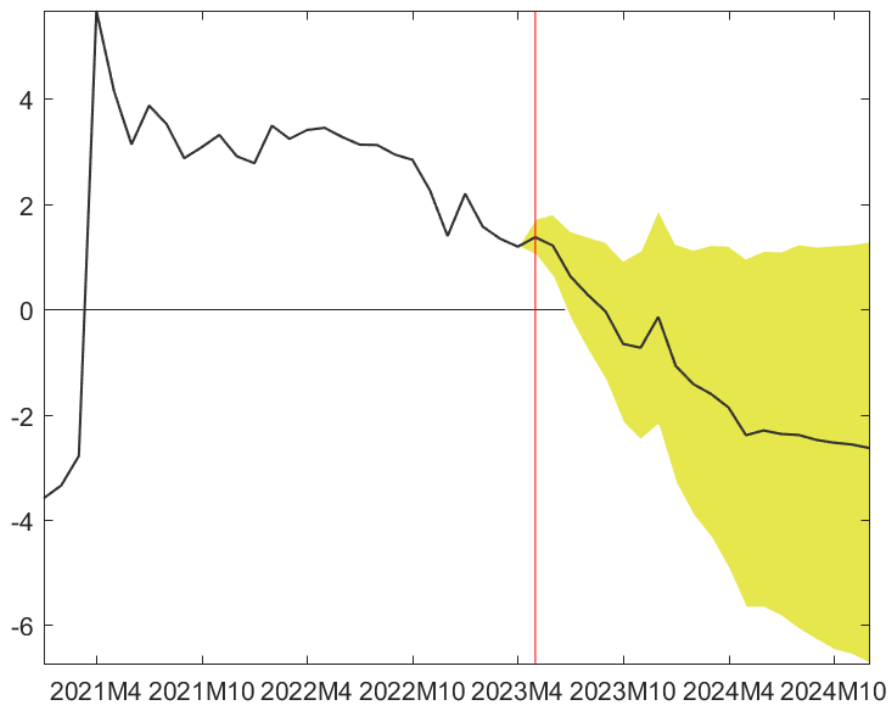
**Figure 15: Monthly Unemployment Rates in Wisconsin (%)**

Figure 16 plots the year-over-year growth rate of nonfarm employment in Wisconsin. The median forecasts suggest that the state's nonfarm employment will increase by about 0.6% (18,000 persons) in 2023 and drop by about 0.7% (20,000 persons) in 2024. The yellow-shaded area suggests that there is a significant chance that Wisconsin's nonfarm employment will either increase by about 1.6% (47,000 persons) or decrease by about 2.9% (86,000 persons) by the end of 2024.

Figure 16 plots the year-over-year growth rate of manufacturing employment in Wisconsin. The median forecasts suggest that the state's manufacturing employment will drop by about 0.1% (700 persons) in 2023 and 2.6% (12,600 persons) in 2024. The yellow-shaded area suggests that there is a significant chance that Wisconsin's manufacturing employment will either increase by about 1.3% (6,200 persons) or decrease by about 6.7% (31,900 persons) by the end of 2024.



**Figure 16:** Year-over-Year Growth Rates of Nonfarm Employment in Wisconsin (%)



**Figure 17:** Year-over-Year Growth Rates of Manufacturing Employment in Wisconsin (%)

### 2.3 The Housing Market

Figure 18 plots the year-over-year growth rate of the all-transactions house price index for Wisconsin. The median forecasts suggest that the growth rate will be around 4% in the second half of 2023 and 2024. The yellow-shaded area suggests that there is a significant chance that the growth rate will either reach about 10% or drop below zero by the end of 2024.



**Figure 18:** Year-over-Year Growth Rates of All-Transactions House Price Index for Wisconsin (%)

## References

**Guo, Junjie and Noah Williams**, “Forecasting the US and Wisconsin Economies in 2018,” Technical Report, Center for Research on the Wisconsin Economy, University of Wisconsin-Madison 2018.

**Schorfheide, Frank and Dongho Song**, “Real-time forecasting with a mixed-frequency VAR,” *Journal of Business & Economic Statistics*, 2015, 33 (3), 366–380.

— **and** — , “Real-time forecasting with a (standard) mixed-frequency VAR during a pandemic,” Technical Report, National Bureau of Economic Research 2021.



**Table 1: List of Variables for the United States and Wisconsin**

Variable	Data source	End period
U.S.		
Real gross domestic product (GDP)	FRED	2023Q1
Fixed private investment	FRED	2023Q1
Real government expenditures	FRED	2023Q1
Manufacturing: real output index	FRED	2023Q1
Civilian unemployment rate	FRED	2023M4
Total nonfarm payroll employment	FRED	2023M4
Manufacturing employment	FRED	2023M4
Aggregate weekly hours index	FRED	2023M4
Average hourly earnings in private sector	FRED	2023M4
Average hourly earnings in manufacturing	FRED	2023M4
Personal consumption expenditures (PCE)	FRED	2023M4
PCE price index	FRED	2023M4
PCE price index: excluding food and energy	FRED	2023M4
Industrial production index	FRED	2023M4
Effective federal funds rate	FRED	2023M4
10-year treasury bond yield	FRED	2023M4
Moody's seasoned Baa corporate bond yield	FRED	2023M4
S&P 500 index	FRED	2023M5
Wisconsin		
Real GDP	FRED	2022Q4
Manufacturing GDP	FRED	2022Q4
Personal income	FRED	2022Q4
All-transactions house price index	FRED	2022Q4
Tax collections	Census Bureau	2022Q4
Unemployment rate	FRED	2023M4
Civilian labor force	FRED	2023M4
Nonfarm employment	FRED	2023M4
Manufacturing employment	FRED	2023M4
Initial unemployment insurance claims	FRED	2023M5
Average hourly earnings: manufacturing	FRED	2023M4