ECONOMIC OUTLOOK

SPECIAL REPORT

A forecast of the effect of COVID-19 on North Dakota

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NDSU PUBLIC CHOICE PRIVATE ENTERPRISE

Prepared by

Jeremy Jackson, Ph.D.
Director, Center for the Study of Public Choice and Private Enterprise
Associate Professor, Department of Agribusiness and Applied Economics
North Dakota State University
Email: jeremy.jackson@ndsu.edu

Abstract

The COVID-19 pandemic has disrupted the global economy. Many predict the United States will experience an economic downturn alongside a historic increase in unemployment. These factors alone suggest concern for the North Dakota economy. Moreover, these events are coinciding with a collapse in oil prices, a critical source of revenue for the state of North Dakota. This report details the possible effect of expected increases in national unemployment and a decrease in oil prices on the North Dakota economy. We use the North Dakota Forecast Model to estimate a series of scenarios. The model predicts North Dakota will experience a decrease in salaries and wages, a decrease in the labor force, an increase in the unemployment rate, a decrease in gross state product, and a decrease in total tax collections.

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Introduction

The Center for the Study of Public Choice and Private Enterprise has developed a forecast model to showcase the economic outlook for the state of North Dakota. This report details the results of a special release of the forecast model that incorporates recent effects from the COVID-19 pandemic on national unemployment and the West Texas Intermediate (WTI) price of crude oil. For information about the North Dakota Forecast Model, see the most recent edition of the quarterly economic outlook report and the accompanying technical appendix.

Forecasting has long been a mainstay in the field of economics. It conveys much needed information about the world and trends in economic variables that can be useful for public and private decision-makers. However, it is important to acknowledge the limitations of any forecast. A forecast model does not generate perfect predictions of the future, nor should the specific values in the forecast be direct cause for decision-making. Forecasting provides information about what is possible and can help establish expectations. Forecast models use past trends and empirical relationships in data to predict (forecast) future values. There are many reasons a forecast model may not produce correct predictions, but I'll only mention two here. First, patterns in future data may not follow past patterns as revealed in historical data. This may be especially true when unexpected and unprecedented shocks take place that fundamentally change the patterns of behavior for decision-makers and actors in the system. The forecast model assumes all behavior stays the same over time. Second, there are always new shocks to the system that are not anticipated in the forecast itself. Our current situation may fall into both of these categories.

The model is characterized by a set of endogenous variables (variables whose values are determined inside the system) and exogenous variables (variables whose values are determined outside the system and taken as given). For the North Dakota economy, national macroeconomic variables and commodity prices are taken as exogenous. In this forecast, I explicitly impose current predicted values for the national unemployment rate and the WTI crude price as an exogenous shock to the North Dakota economy. This allows us to examine the effect these external forces caused by the COVID-19 pandemic may have on the North Dakota economy.

Predictably, the North Dakota economy does not react favorably to sharp decreases in the price of oil. In addition, the recent spike in unemployment caused by the economic shutdown produces bad news for our state and the country. Contrary to North Dakota, the national economy responds favorably to decreases in the price of oil. This produces an interesting interaction of forces on the North Dakota economy as it tends to respond countercyclical to the national economy.

Executive Summary

- o Scenarios (exogenous variables incorporated into the model):

    - Oil Price Collapse: scenarios with WTI crude prices per barrel of $45, $40, $35, and $25

    - National Unemployment: scenarios with national unemployment reaching 10%, 15%, and 20%

- o Results (endogenous variables forecasted by the model):

    - Total Wages and Salaries: The model predicts North Dakota's total wages and salaries will decline by about 8 percent and could fall by as much as 40 percent.

    - Labor Force: The model predicts the North Dakota labor force will decrease by between 5 percent and 10 percent.

    - Unemployment Rate: The model predicts North Dakota's unemployment rate will increase to 16 percent next quarter but decline again starting in the first quarter of 2021.

    - Gross State Product: The model predicts North Dakota's gross state product will fall by between 27 percent and 45 percent next quarter.

    - Total Tax Collections: The model predicts North Dakota's total tax collections will decrease by about 16 percent and could fall by as much as 50 percent.

Scenarios

There are an infinite number of possible scenarios that could be run to forecast the impact of COVID-19 on the North Dakota economy. There are also a number of channels through which the impact on the North Dakota economy can be modelled. I model a total of 12 scenarios to be compared against a baseline forecast extending from the second quarter of 2020 (2020q2) through the first quarter of 2022 (2022q1). The effect of COVID-19 on the North Dakota economy comes from two sources that are taken as exogenous: the price of West Texas Intermediate (WTI) crude oil and the national unemployment rate. Each of these interact to affect other national economic variables which then influence the state of North Dakota.

I want to insert a word of caution here about forecasting in general and this exercise in particular. First, every forecast model (including this one) is wrong. While forecasting models and their outputs provide useful information, the model works by reducing a complex world into a summary of variables and interactions that cannot incorporate everything. Second, the forecast technique used in this model (VAR) relies on historical data and trends to make future predictions. This presents two limitations: 1) the effect of a change in one variable on others takes place over time and is not instantaneous; and 2) the model cannot capture any fundamental shift in the functioning of the economy that renders historical correlations and patterns irrelevant. Lastly, this technique does not model the effect of COVID-19 on the North Dakota economy directly. Rather, the effect happens through exogenously imposed changes in the WTI oil price and national unemployment rate and then looks at how these changes impact North Dakota over time. This means the earliest the effects of COVID-19, which began in the second quarter of 2020 (2020q2), can influence North Dakota is during the third quarter of 2020 (2020q3).

For this report, I ran a total of 12 alternative scenarios to compare to the baseline. These scenarios represent four different trends in the WTI price of oil and three possible trends for the national unemployment rate.

Figure 1

Crude (WTI)

Legend:
- $45
- $40
- $35
- $25
- Pre-COVID
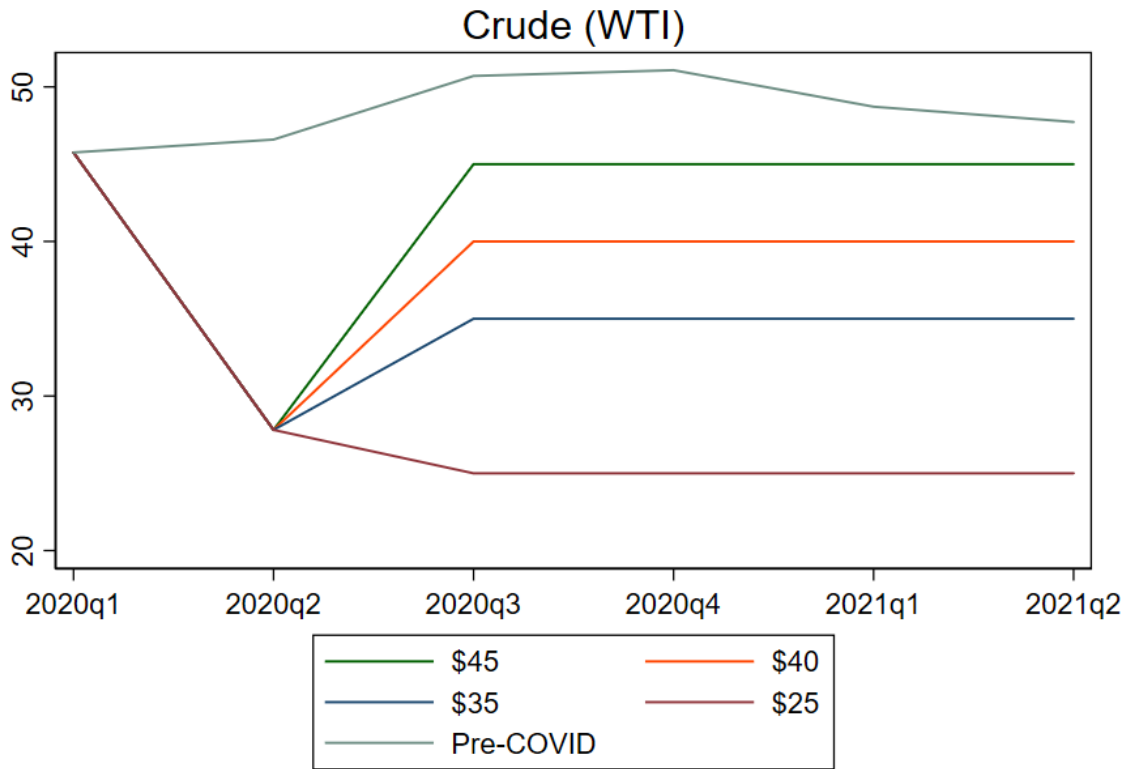
Oil Price

The WTI price on August 7, 2020, was roughly $41.22 per barrel. The average price of WTI was $56.96 in the fourth quarter of 2019 (2019q4) and $45.76 in the first quarter of 2020 (2020q1). The price of oil has rebounded after future's prices went negative in a historic drop on April 20, 2020. While the price has regained ground, it remains difficult to predict the future price of oil because it is subject to complicated interactions between global supply and global demand. Oil prices are unlikely to return to pre-COVID-19 levels in the near future.

To examine the impact of the oil price collapse on North Dakota, I ran forecast scenarios for four possible WTI price levels: $40, $40, $35, and $25. Each price scenario starts at the specified level for the third quarter of 2020 (2020q3) and holds constant for the duration of the forecast period extending to the first quarter of 2022. These WTI price trends are displayed in the first panel of Figure 1, as well as a baseline showing the pre-COVID trend.

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Figure 2
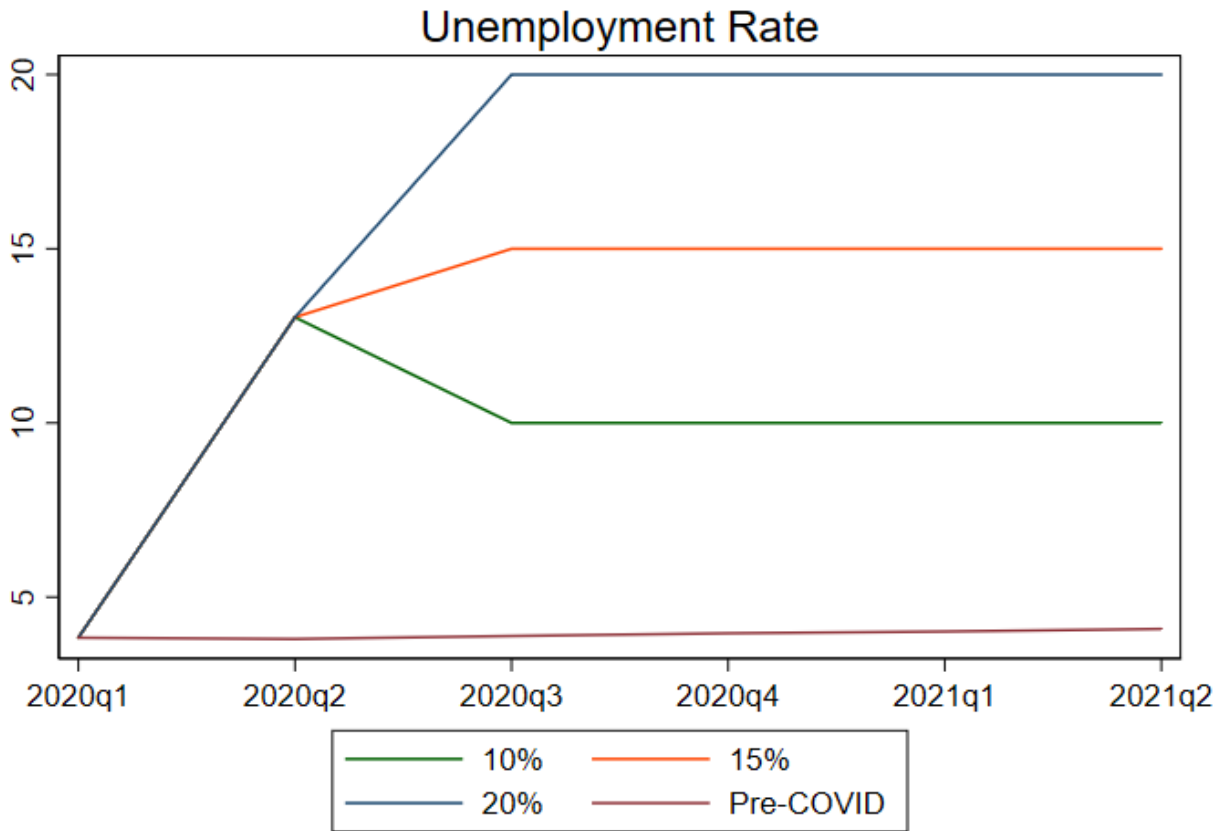
Unemployment Rate

The national unemployment rate was 3.83% in the first quarter of 2020 (2020q1). In a historic increase, the national unemployment rate rose to 13.03% in the second quarter (2020q2). [These rates represent quarterly averages of the monthly unemployment rate.] The unemployment rate in July 2020 was 10.2%, down from the peak of 14.7% in April. While unemployment is trending down, there are no indications we will see pre-COVID unemployment rates soon. Current applications for unemployment benefits suggest the high unemployment rate will hold. Still, much uncertainty around the unemployment rate persists. I ran three scenarios for possible trends in national unemployment due to COVID-19. The first scenario sets the unemployment rate at 10% through the second quarter of 2021 (2020q3, 2020q4, 2021q1). The second scenario sets the unemployment rate at 15% through the second quarter of 2021 (2020q3, 2020q4, 2021q1). The third scenario sets the unemployment rate at 15% for the third quarter of 2020 (2020q3) and then raises unemployment to 20% through the second quarter of 2021 (2021q2). Figure 2 showcases the different scenarios for the national unemployment rate along with the baseline prediction from before the pandemic.

National GDP

The national economy is detrimentally affected by increases in unemployment, but it tends to respond positively to decreases in oil prices. The trends in national gross domestic product (GDP) are the result of a combination of these two effects. The trends in GDP can be seen in the three panels of Figure 3. Each panel shows scenarios for different unemployment rates as compared to the baseline.

Figure 3
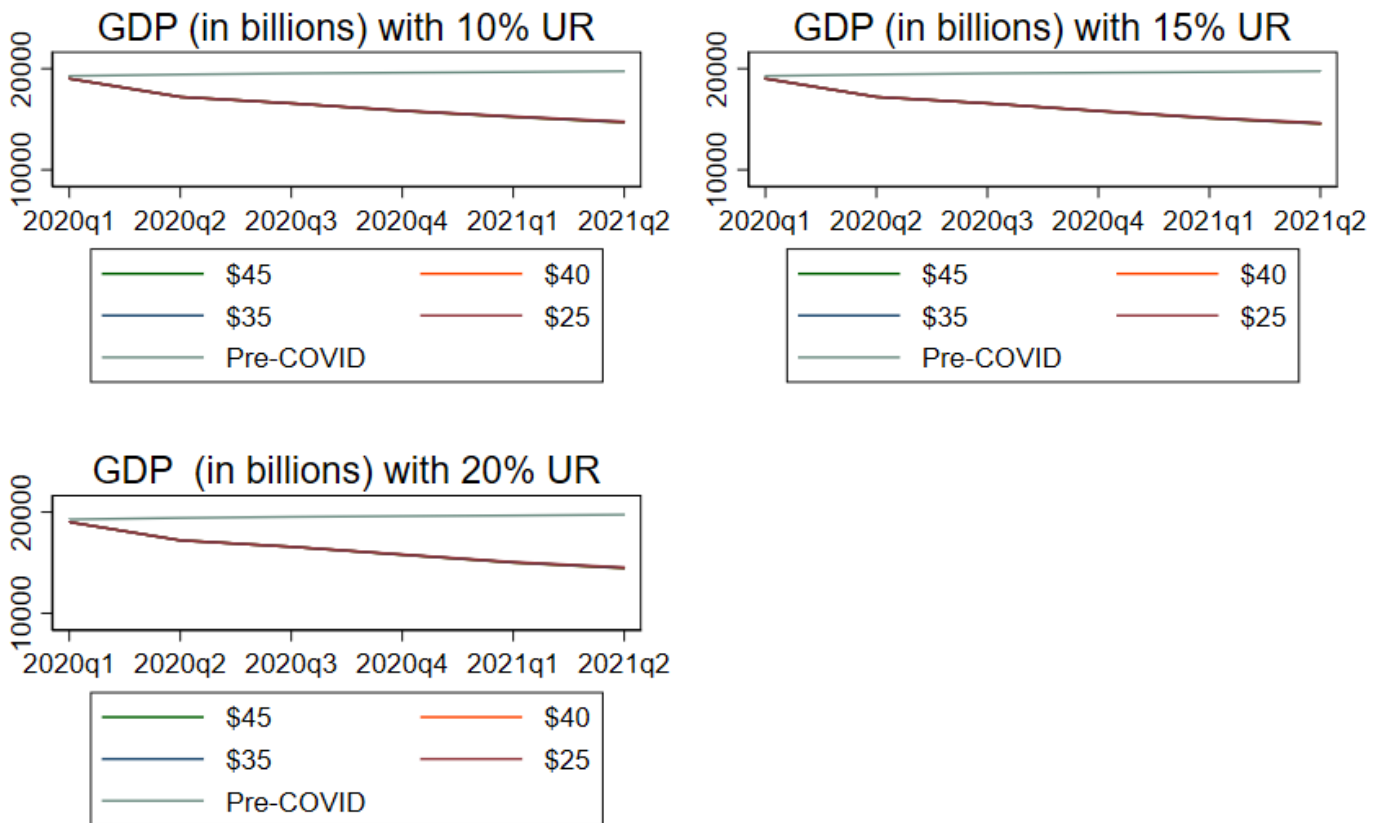
Under each scenario, national GDP steadily declines across the forecast periods. The three panels each represent GDP forecasts for different WTI scenarios at a given national unemployment rate. Interestingly, the GDP forecasts are similar enough that the graphs cannot be distinguished, demonstrating current GDP forecasts are relatively independent of trends in the price of oil. As we examine the resultant effects on North Dakota, it is important to remember that the North Dakota economy has responded to trends in national GDP counter-cyclically. The North Dakota economy tends to grow when the national economy is contracting. Also, the North Dakota economy responds very differently to trends in the price of oil.

North Dakota Economy

In the following sections, Figures 4, 5, and 6 display the effect of a 10%, 15%, and 20% national unemployment rate, respectively, coupled with the WTI price scenarios on the North Dakota economy. Each figure shows trends in total wages and salaries, labor force, unemployment rate, gross state product, and total tax collections for the state of North Dakota. With the exception of total tax collections and total wages and salaries, most variables show a similar effect size for all WTI price trends.

The model incorporates the impact of the shocks, which occur starting in the second quarter of 2020 (2020q2), through a lag structure. This means the earliest date that the lower WTI price and increased national unemployment can impact the North Dakota economy is in the third quarter (2020q3). The structure of the VAR model has three lags, meaning that the full force of the COVID-19 economic shocks don't enter the model until the first quarter in 2021 (2021q1).

Key Points

o   Total wages and salaries are likely to decline, with the most likely projection showing a decrease of 8 percent and the most severe showing a 40 percent decline.

o   North Dakota labor force participation will fall by between 5 and 10 percent.

o   The North Dakota unemployment rate will rise next quarter but is predicted to decline starting next year.

o   Gross state product has a wide range of possible reductions. It is expected to fall by between 27 percent and 45 percent in the third quarter of 2020.

o   Total tax collections are expected to decrease by about 16 percent and could fall by as much as 50 percent.

Figure 4

North Dakota Outlook - 10% National UR
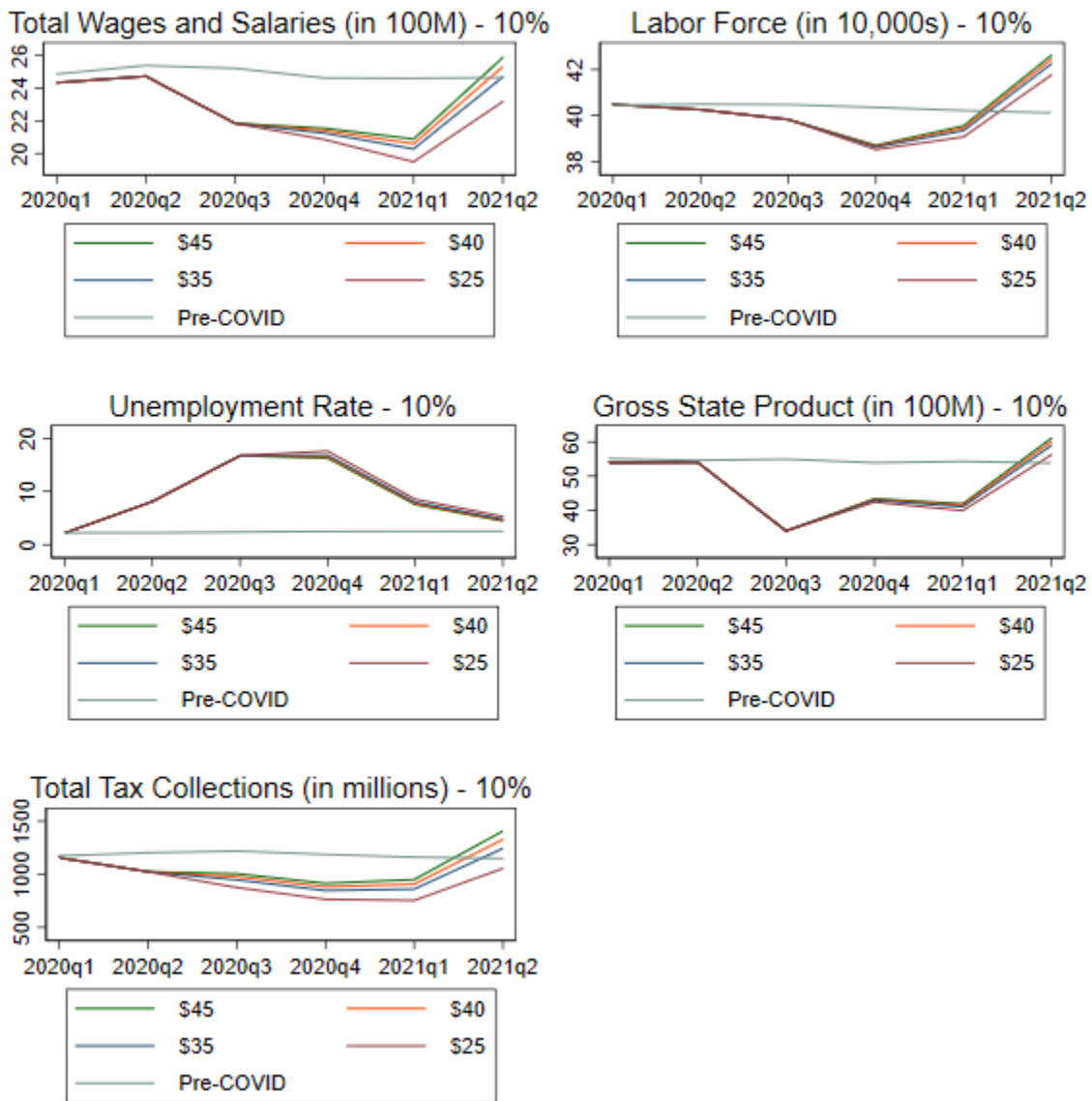
North Dakota Outlook with 10% National Unemployment

Figure 4 displays the effect of lower oil prices and a 10% national unemployment rate on key economic variables.

- Total wages and salaries fall by 8.3% in in 2020q3 with continued decline through 20201q1.
- The labor force is predicted to drop by 5% before experiencing an uptick in 2021q1.
- Unemployment rates rise to about 16% in 2020q3 before coming back down in 2021q1.
- Gross state product is projected to fall by about 36% in 2020q3 and fully recover by 2021q2.
- Each of these trends contributes to a significant reduction in total tax collections, which fall by between 16.7% and 33.3%, depending on the WTI scenario.

Figure 5

North Dakota Outlook - 15% National UR

North Dakota Outlook with 15% National Unemployment

Figure 5 displays forecast trends for a 15% national unemployment rate with various WTI prices. Overall, trends are similar to the 10% scenario but with larger magnitudes.

- Total wages and salaries fall by 8.3% in 2020q3 with another drop in 2021q1.
- The labor force is forecast to decrease by 5%.
- Unemployment rates rise to about 19% before declining in 2021q1 and 2021q2.
- Gross state product is projected to fall by about 36% before increasing to pre-pandemic levels in 2021q2.
- Total tax collections could fall by between 16.7% and 37.5%, depending on the WTI scenario.

Figure 6

North Dakota Outlook with 20% National Unemployment

Figure 6 shows forecast trends with a 20% national unemployment rate. It mirrors the trends of Figures 4 and 5 but with slightly more extreme consequences for the North Dakota economy. Percentage changes are relative to 2020q1 levels unless otherwise noted.

- Total wages and salaries fall by 10% in 2020q3 and further decrease in 2021q1 with a $40 WTI.
- The labor force is expected to fall by 5%.
- Unemployment rates rise to approach 20%.
- Gross state product declines by 40% in 2020q3, and total tax collections fall by between 16.7% and 37.5%.

Confidence Intervals

The forecast scenarios presented in Figures 1-6 may give the reader the impression that forecast estimates are precise and without error. This is not the case. The scenarios presented cannot consider all of the complexity and uncertainty in an economic system. This can be clarified by presenting confidence intervals that provide estimates for a given scenario.

For the sake of being conservative and realistic, I choose to present 90% confidence intervals for the scenario with a $40 WTI price and 10% unemployment rate. A 90% confidence interval demonstrates the range of values that the data suggest the forecast could fall between with 90% confidence. Confidence intervals show that while point estimates and the lines they generate (Figures 4-6) are nice to look at, they also hide large levels of uncertainty regarding the size of the effect. Even in just this one scenario, the range of what is possible is quite large. Additionally, it is entirely possible for a real value to fall outside the confidence interval. Figure 7 shows the point estimates and confidence intervals for the scenario with a 10% unemployment rate and $40 WTI. It also includes the baseline point estimate for comparison.

In this scenario, Figure 7 demonstrates the range of possible outcomes.

> Total wages and salaries is clearly forecast to decrease. Yet, the high end of the confidence interval shows total wages and salaries holding constant through the end of 2020. This means that, at best, we can hope total wages and salaries will not decline. However, on the bottom of the confidence interval, we see total wages and salaries decline by 40% from 2020q1 to 2021q1.

> The labor force follows a similar but less severe pattern. The high end of the confidence interval shows the labor force holding constant through the end of 2020. On the lower end, labor force declines by 10% from 2020q1 to 2021q1.
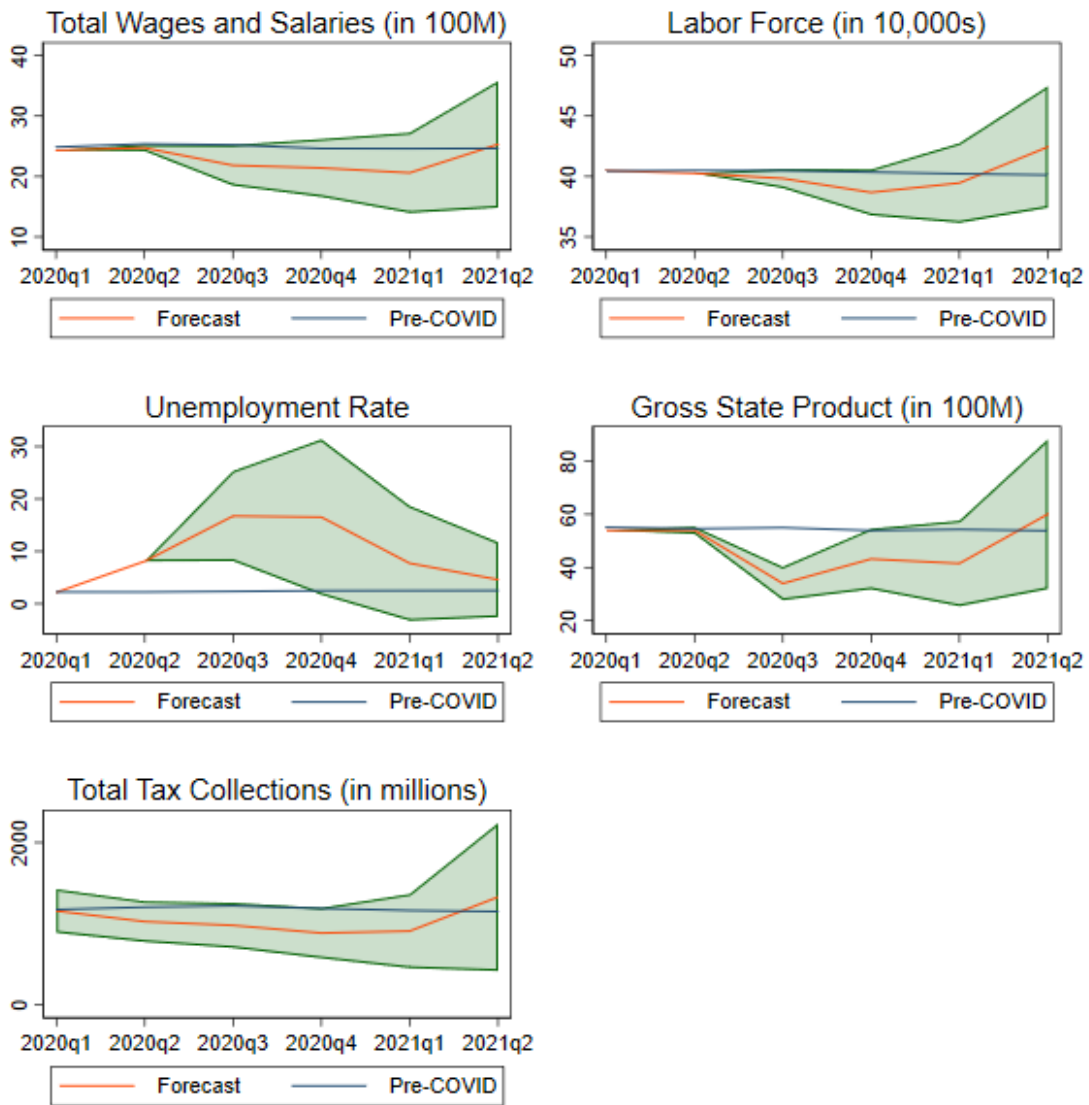
> The North Dakota unemployment rate is forecast to rise to about 16% in 2020q3 before declining into the start of 2021. The large confidence interval surrounding this variable represents significant uncertainty. The best outcome forecast (the bottom of the confidence interval) has unemployment remaining constant in 2020q3 and then beginning to come back down. However, it is within the bounds of the confidence interval for unemployment to peak at roughly 30% in 2020q4.

> The forecast for gross state product (GSP) paints a dismal picture for 2020q3. On the lower end of the confidence interval, GSP declines by 45% in 2020q3, with the upper end of the confidence interval showing a decline of 27%. This means the model predicts, with 90% confidence, GSP will decline by between 27% and 45% from 2020q3 to 2020q3. This represents a massive economic downturn.

> Data on total tax collections is currently only available through 2019q4, so the forecast window for this variable is longer. On the upper end of the confidence interval, we can expect total tax collections to hold constant throughout 2020 and possibly grow in 2021. Unfortunately, the lower end of the confidence interval shows it is possible for total tax collections to decline all the way through 2021q2. In other words, the best case scenario has total tax collections remaining the same, but it is much more likely total tax collections will decline, and the decline could be severe.

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Figure 7

North Dakota Outlook - 10% National UR - $40 Crude

Conclusion

This report details predictions by the North Dakota Forecast Model under a variety of possible scenarios for the West Texas Intermediate price of crude oil and the national unemployment rate. Last quarter, conditions in international oil markets collided with a sudden decrease in oil demand due to the COVID-19 pandemic, resulting in a major collapse in oil prices. Crude prices have since recovered to about $40 per barrel, which remains below the recent pre-COVID levels of $55-60 per barrel. The economic shutdown caused by the COVID-19 pandemic has also led to historic increases in unemployment. Currently, the national unemployment rate is 10.2%, down from a peak of 14.7%, but questions linger regarding the continued effects of COVID-19 on labor market trends. While each of these trends are external to the North Dakota economy, they will impact statewide economic conditions.

The forecast scenarios in this report paint a bleak picture for the coming months in North Dakota. Unemployment will go up. Wages and salaries will go down. The statewide economic downturn will be felt by reductions in gross state product of between 27% and 45%. While these forecast outcomes represent economic trials to come, much uncertainty remains about what will happen as the pandemic clears and businesses begin to operate again. The forecast method uses past data and trends to forecast future trends. If there is a fundamental shift in the way the economy operates, then the forecast model will lose accuracy in its predictions. Uncertainty in the model is additionally evidenced by its large confidence intervals. The reality is that under each scenario a wide range of outcomes is possible. Economic conditions could be much better than the forecast suggests, but they could also be much worse.