The Role of Oil Price Shocks in Shaping Unemployment Dynamics

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Abstract

In this paper, we utilize local projections to investigate the impact of structural oil price shocks on unemployment rates and spells across the United States, emphasizing both national and state-level variations. Oil supply shocks lead to long-run increases in the national unemployment rate, incidence, and short-term unemployment. In contrast, economic activity shocks reduce all unemployment rates and spells, especially in oil-producing states. Consumption demand shocks have minimal impact on unemployment rates and durations, while inventory demand shocks show only temporary effects on durations.

1 Introduction

The impact of oil price fluctuations on the US Economy has attracted attention and research over the years. Spikes in oil prices like those seen in the 1970s have historically been linked to downturns, increased inflation, and higher unemployment rates. Policymakers and economists need to comprehend how unemployment reacts to changes in oil prices.

Oil price shocks disrupt the stability of the economy by impacting inflation (Aastveit et al. (2021); Baumeister (2023) and economic activity (Baumeister & Hamilton (2019)). Alsalman

(2023b) reveals that oil price shocks can influence employment differently depending on their origins.

This study aims to answer the question: How do overall unemployment rates react to changes in oil prices? Conventional aggregate unemployment rates often overlook the distinct impacts of oil price fluctuations on the workforce originating from different sectors of the economy. This general measure fails to capture differences within the data, such as variations in unemployment trends across regions and durations of unemployment.

Brown & Yücel (2013) examine the historical vulnerability of the US economy to imported energy and the transformative effect of the shale revolution. They find that increased domestic oil and gas production has reduced reliance on imports and diversified the economy, yet introduced new vulnerabilities, particularly in states with significant energy production. They note that oil price increases have a differential impact, with most states suffering adverse effects while certain oil-producing states, such as Texas, North Dakota, Oklahoma, etc., benefit from these hikes. However, while Brown & Yücel (2013) discuss the variation in impacts, they do not differentiate between types of oil price shocks. Recent studies, such as Kilian (2009) and Baumeister & Hamilton (2019), find that the effect of oil price shocks on economic activity varies by source, suggesting the need to distinguish between supply and demand shocks. This study addresses this gap by analyzing the effect of structural supply and demand shocks on the unemployment rate of combined oil and non-oil states as well as individual states.

Karaki (2018) focuses on the state-level implications of oil price shocks. He examines the asymmetrical effects of oil prices on unemployment rates across different states, finding that certain regions are more sensitive to oil market dynamics. Using a structural near-VAR (SVAR) model, he finds that adverse oil supply shocks typically elevate unemployment rates across most states, while aggregate demand shocks lower unemployment rates in oil-producing and non-producing states. However, Karaki employs the Kilian (2009) model, which assumes a zero short-run oil supply elasticity, which has been challenged by Baumeister

& Hamilton (2019) who suggest a higher responsiveness of oil production to price increases, with the short-run oil supply elasticity at around 0.15. This suggests that models, including Karaki (2018), may underestimate the influence of these shocks on the oil market and, by extension, on macroeconomic variables such as unemployment rates.

Furthermore, Karaki (2018) employs the Kilian (2009) index, a measure of global real economic activity derived from shipping costs, as a proxy for world economic activity. However, Hamilton (2021) and Baumeister & Guérin (2021) highlight significant limitations in this measure. Hamilton shows that this index's correlation with world output, particularly annual GDP growth, is weaker than alternative measures and fails to reflect global economic trends accurately. Baumeister & Guérin (2021) show that the Kilian index performs poorly in out-of-sample forecasting of global real GDP. Both studies suggest that the world industrial production index of Baumeister & Hamilton (2019) is a superior indicator of global real activity.

While Karaki's model follows traditional approaches focusing on production, global activity, and oil prices, it overlooks the nuanced role of inventories, as emphasized by Kilian & Murphy (2014) and Baumeister & Hamilton (2019).

Finally, to fully understand the influence of oil price shocks on unemployment, it's essential to dive deeper into the specific mechanisms at play. Alsalman (2023a) explains the various channels through which oil price shocks affect the labor market. Rising oil prices increase production costs, leading to reduced hiring or layoffs. Higher oil prices affect consumer spending as higher fuel costs reduce disposable income (Baumeister & Kilian (2016)), leading to lower demand for goods and services. Additionally, different sectors of the economy react uniquely to oil price changes. For example, the transportation and manufacturing sectors, which are heavily reliant on oil, may experience more significant disruptions compared to other sectors. Herrera et al. (2017) emphasize the importance of these industry-specific responses, demonstrating that sectors have varied sensitivities to these shocks. This insight suggests that we need a detailed analysis of unemployment durations to understand these dynamics thoroughly.

Examining the durations of unemployment spells is another crucial aspect of this study. Alsalman (2023a) highlights that distinguishing between short-term and long-term unemployment is vital to comprehend the full impact of oil price changes. Short-term unemployment might indicate temporary adjustments in the labor market, while long-term unemployment could signal more profound structural issues. By analyzing the lengths of unemployment spells, we can determine whether oil price shocks cause brief disruptions or lead to extended periods of joblessness, allowing policymakers to develop more targeted and effective interventions.

Alsalman (2023a) explores the impact of oil price shocks on unemployment durations using augmenting unemployment durations to the Kilian & Park (2009) SVAR model. She finds that supply shocks tend to increase long-term unemployment while demand shocks have varied effects. Her model shares the same limitations as Karaki's model mentioned earlier. She also conducts a sensitivity analysis using the Baumeister & Hamilton (2019) shocks, similar to our study, but employs an Augmented Distributed Lag (ADL) approach. Choi & Chudik (2019) critique the ADL method for requiring more parameter estimates, which can lead to inefficiency. Their simulations indicate that local projections (LP) achieve lower root mean squared errors (RMSE) than the ADL approach, suggesting that running separate regressions for different horizons is more beneficial. In contrast, we use local projections to estimate the impact of oil price shocks, controlling for 12 months of the shock. Our approach reduces the number of parameters to be estimated and increases the efficiency and accuracy of the results.

Our analysis reveals that the impacts of oil price shocks on unemployment rates are multifaceted and vary significantly depending on the type of shock and the regional economic structure. At the national level, we observed marginal increases in unemployment following oil supply shocks, notable decreases due to economic activity shocks, and increases in response to oil inventory demand shocks. These results align partially with existing literature, such as Karaki (2018) and Alsalman (2023b), but also highlight differences in the timing and magnitude of the impacts. For example, unlike Karaki (2018), who found a significant increase in unemployment one year after a supply shock, our results show a more delayed effect, with notable increases appearing after 18 months.

Our state-level analysis further underscores the heterogeneity in responses to oil price shocks. Oil-producing states, like Texas and North Dakota, initially benefit from adverse supply shocks due to increased oil prices boosting local employment, while non-oil states experience longer-term increases in unemployment. This supports the findings of Brown & Yücel (2013) regarding the differential impacts of oil price increases on oil-producing versus oil-consuming states.

Examining the durations of unemployment spells provided additional insights, especially regarding oil supply shocks. Contrasting with Alsalman (2023a), who found consistent increases across all durations, our results indicate that while short-term and incidence unemployment rise in the long run, medium and long-term unemployment rates return to baseline. This suggests that the long-term effects are driven more by central bank responses to inflation rather than the direct effects of oil price increases. For economic activity shocks, we observed reductions in all durations of unemployment spells, particularly in the short and medium terms, with oil states showing more pronounced benefits compared to non-oil states. In the case of oil consumption demand shocks, there were no significant changes in the size of unemployment duration classes, aligning with Baumeister & Hamilton (2019) who found that these shocks do not profoundly impact economic activity. Lastly, oil inventory demand shocks showed limited impact on unemployment spells, with a temporary reduction in long-term unemployment shortly after the shock, reflecting the transient nature of price increases due to speculative demand.

The remainder of the chapter is organized as follows: In section 2, we list our data sources, the variables, and the methods we use in our analysis. In section 3, we present the results for the response of national unemployment rate to the various structural oil price shocks. We then motivate and present the results for heterogeneity arising from geography and unemployment spells in section 4.1. Finally, section 5 concludes our analysis.

2 Data and Methodology

We now shift to the empirical framework of our study. First, we detail the data used for our analysis, covering the sources and preprocessing steps. Then, we describe the implementation of the local projection model.

2.1 Data Sources

In our estimation, we source the labor market variables from the Current Population Survey (CPS) monthly individual survey data from Flood et al. (2023) for the sample period January 1976 to December 2019.

Our primary objective is to examine labor market dynamics in response to structural oil shocks. To achieve this, we utilize the identified structural oil price shocks from Baumeister & Hamilton (2019), who provide a time series of four distinct shocks: an oil supply shock and three demand shocks - a global economic activity shock, an oil consumption demand shock, and an oil inventory demand shock. Incorporating these distinct shocks into our study allows us to present a comprehensive view of the dynamic interplay between oil market fluctuations and labor market responses.

In our analysis, the main task is to examine the labor market dynamics using structural oil shocks. To this end, we utilize the identified structural oil price shocks from Baumeister & Hamilton (2019), who provide us with a time series of four distinct shocks: an oil supply shock and three demand shocks - a global economic activity shock, an oil consumption demand shock, and an oil inventory demand shock. By incorporating these distinct shocks into our study, we aim to provide a comprehensive view of the dynamic interplay between oil market fluctuations and labor market responses.

For measuring the real oil price, we deflate the monthly US refiner's acquisition cost of imported crude oil (IRAC), sourced from the Energy Information Administration (EIA), using the CPI (CPIAUCSL) from the FRED database. This approach aligns with the methodologies of Karaki (2018) and Alsalman (2023b).

2.2 Variables

We use the monthly CPS data to calculate the number of unemployed and the total labor force at the national, oil state, and state levels. We then seasonally adjust each of these series using the X-13 ARIMA procedure and calculate the seasonally adjusted unemployment rate for the three different subsets of the US.

The granularity of the individual-level data allows us to aggregate the total number of unemployed and the labor force specifically at the oil-state level. Baumeister & Kilian (2016) assert that focusing solely on the direct contribution of the oil sector may underestimate its broader economic impact. This assertion is particularly evident in oil states like North Dakota and Texas, where the oil boom from 2010 to 2015 bolstered the oil sector and led to significant growth in related sectors such as services, residential housing, and infrastructure. The subsequent downturn, triggered by falling oil prices, had a cascading effect, causing contractions across these interconnected sectors. This phenomenon underscores the unique economic dynamics of oil states, which are deeply intertwined with and reactive to oil price fluctuations.

To investigate how oil price shocks differentially impact unemployment rates in distinct groups, we adopt Baumeister & Kilian (2016)'s classification of states into oil and non-oil categories. They define oil states as those where the oil share in value added in 2014 was above 5%. According to this classification, Alaska, Montana, New Mexico, North Dakota, Oklahoma, Texas, and Wyoming are categorized as "oil states."

Further, the CPS data enables a detailed analysis of the duration of unemployment. For data starting from January 1994, we use the variable DURUNEMP, which indicates the number of consecutive weeks each currently unemployed respondent has been without a job and looking for work. If a respondent reported being without work during the preceding week, did not have a job from which they were temporarily absent, and had been actively looking for work in the past four weeks, they were asked, “How many weeks have you been looking for work?” and “How many weeks ago did you start looking?” DURUNEMP also indicates the number of continuous weeks of layoff for workers laid off from a job but expected to return to the same job.

Using DURUNEMP, we classify unemployed individuals into four duration categories, following Alsalman (2023a). The first category, Class 1, includes newly unemployed individuals who have been unemployed for at least one week but less than five weeks. The second category, Class 2, consists of short-term unemployed individuals who have been unemployed for more than four weeks but less than 15 weeks. The third category, Class 3, comprises medium-term unemployed individuals who have been unemployed for more than 14 weeks but less than 26 weeks. The fourth category, Class 4, includes long-term unemployed individuals who have been unemployed for more than 25 weeks.

Both at the national and oil-state levels, we calculate the number of individuals in each duration class and seasonally adjust these figures using the X-13 ARIMA procedure. At each level, these classes sum up to the total number of unemployed individuals.

2.3 Methodology

In our analysis, we employ the Local Projections method, introduced by Jordà (2005), to estimate the impact of structural oil price shocks on unemployment rates. Local projections offer the same impulse response functions (IRFs) as Vector Autoregressions (VARs) but provide greater flexibility by separating the choice of identification scheme from the estimation approach (Plagborg-Møller & Wolf, 2021). This flexibility is particularly beneficial for estimating impulse responses at varying horizons, as it simplifies both the estimation process and subsequent hypothesis testing. Additionally, local projection estimators, being straightforward regression coefficients, offer an intuitive interpretation.

$$u^g_{t+h} = \mu^{g,j}_h + \beta^{g,j}_h \epsilon_{j,t} + \sum_{l=1}^{13} \delta^{g,j'}_{h,l} \mathbf{w}^{g,j}_{t-l} + \xi^{g,j}_{h,t} \tag{1}$$

where $\mathbf{w}^{g,j}_t = (\epsilon_{j,t}, u^g_t)$ is the vector of data at time t, $\epsilon_{j,t}, j = 1, 2, 3, 4$ represents the identified structural oil price shocks, and u^g_t denotes the unemployment rate of subset g of the United States, which can be at the national level, oil-state level, or individual state level. Specifically, $g \in \{\text{US, oil-states, non-oil-states}\} \cup S$,where, $S = \{s : s$ is a state in the US or the District of Columbia$\}$. Our coefficient of interest is $\left\{\beta^{g,j}_h\right\} h \geq 0$, the impulse response function of ut^g with respect to $\epsilon_{j,t}$ at horizon h. Montiel Olea & Plagborg-Møller (2021) suggest that if the true model is believed to be a VAR of order p, then $p + 1$ lags should be included in the local projections. Since our identified shock series comes from the monthly global oil market model estimated by Baumeister & Hamilton (2019), who use a lag length of 12, we choose $p = 13$ in our estimation.

We estimate this Local Projection (LP) separately for each combination of subset g and shock type j, reporting the impulse responses up to two years following the shock. We normalize the impulse responses to structural oil shocks that increase the oil price by 10% on impact. To achieve this, we scale the LP coefficient of the response of the unemployment rate, u^g_{t+h}, to the oil shock $\epsilon_{j,t}$ by $\beta^{o,j}_t$, the LP coefficient of the real oil price at $h = 0$, the impact horizon of the same shock in equation (2).

The LP for the oil price is specified as follows:

$$o^j_{t+h} = \mu^j_h + \beta^{o,j}_h \epsilon_{j,t} + \sum_{l=1}^{13} \delta'^{,j}_{h,l} \mathbf{x}^j_{t-l} + \xi^j_{h,t} \tag{2}$$

where o_{t+h} represents the natural log of the real oil price and $\mathbf{x}^j_t = [o_t, \epsilon_{j,t}]$. In subsequent analyses, we also examine the effect of structural oil shocks on the size of unemployment duration classes. For that analysis, we replace the left-hand side of equation (1) with $d^{i,g}_{t+h}$, the natural logarithm of the size of duration class i, where $i = 1, \ldots, 4$.

3 Results for National Unemployment Rate

In Figure 2, we present the response of the national unemployment rate to various structural oil price shocks, each calibrated to induce a 10% increase in oil prices upon impact.

Upon the impact of an oil supply shock, we observe a marginal increase in the unemployment rate of 0.03 percentage points (pp). The national unemployment rate increases from 0.3 pp 18 months post-shock to 0.45 pp by the end of two years. This delayed effect contrasts with Karaki (2018), who found a significant increase in unemployment one year after the shock.

An increase in oil prices due to an economic activity shock initially reduces the national unemployment rate, reaching a trough of −1.96 pp 12 months post-shock. This short-term stimulatory effect fades in the long run, with the response turning insignificant after two years, deviating from Karaki (2018) and Alsalman (2023b), who reported long-term growth-retarding effects.

The oil consumption demand shock's impact on national unemployment is not significant at the 95% level upon impact and remains muted. However, it is significant only at the 68% level. The maximum decrease in unemployment is −0.15 pp, observed 21 months post-shock, but the effect fades, turning insignificant after 22 months.

The oil inventory demand shock shows a unique pattern. While the immediate impact on unemployment is insignificant, it becomes significantly growth-retarding at most horizons post-shock. The increase in the national unemployment rate is notable three months after the shock at 0.28 pp, intensifying to a 2.56 pp increase 22 months later. Unlike Karaki and Alsalman, who did not report significant impacts of a singular "oil-specific" demand shock on national unemployment, our analysis distinguishes between consumption and inventory demand shocks. This distinction provides a more refined view of the effect of shocks originating from increased demand for oil on unemployment rates.

4 Heterogeneity in Unemployment

The previous section shed light on how various oil price changes impact the unemployment rate in the United States. The results indicate diverse responses based on the source of shock. For example, supply shocks lead to a marginal increase in unemployment, while economic activity shocks initially decrease unemployment but have a neutral long-term impact. These trends underscore the complexity of how the labor market responds to oil price fluctuations and emphasize the importance of examining these responses more granularly.

The aggregate unemployment rate could mask the important variation in the various labor market segments. We highlighted the importance of recognizing the heterogeneities across different geographical regions and among different unemployment spell durations. We now discuss them in detail.

4.1 Geographical Variation

Brown & Yücel (2013) find that geographical differences play a role in how unemployment rates respond to changes in oil prices. States like Texas, North Dakota, and Wyoming, which heavily rely on oil production, usually benefit from price increases as they see job opportunities and economic growth in the industry. On the other hand, states like Wisconsin, Ohio, and Florida that consume more oil tend to experience negative effects from higher prices, leading to increased operational costs and reduced consumer spending. The national analysis reveals that variations in unemployment rates are influenced by both oil supply shocks and demand shocks, but they can vary widely across regions based on their dependence on the oil sector. Therefore, understanding these disparities is vital when assessing how fluctuations in the oil market impact different states.

4.1.1 Response of Oil and Non-Oil State Unemployment Rate

Our approach calculates the average unemployment rate for oil and non-oil states separately to capture the distinct labor market dynamics in these categories. We compute this rate for oil states by summing the total number of unemployed individuals across all oil states and dividing this by the total labor force in these states. We apply a process similar to that of non-oil states. This methodology yields what can be considered the average unemployment rate for each category, providing a clearer picture of how regional economies, characterized by their reliance on the oil sector, respond differently to fluctuations in oil prices.

Figures 3 and 4 display the responses of unemployment rates in oil and non-oil states to the four structural oil price shocks. In these figures, we group the shocks with similar magnitudes: the oil supply and oil consumption demand shocks are plotted together due to their comparable impacts, as are the economic activity and oil inventory demand shocks.

Starting with the oil supply shock, oil states experience a decrease in unemployment rates upon impact, which is significant at medium horizons. However, this trend reverses in the long run, leading to increased unemployment. The initial decrease reaches a trough of -0.25 percentage points (pp) at 6 months; it is insignificant at most horizons after that. In contrast, non-oil states initially see a slight increase in unemployment by 0.04 pp on impact, which quickly becomes insignificant. Nevertheless, the long-term effect is an escalating unemployment rate starting 18 months after the shock, peaking at 0.49 pp at the end of two years. In summary, oil states initially benefit from an adverse oil supply shock, which fades in the long run. However, non-oil states experience higher unemployment rates in the long run.

Regarding the response to increased oil consumption, both oil and non-oil states see a reduction in long-term unemployment rates. Oil states observe a persistent and significant reduction, with a trough of 0.28 pp 20 months post-shock and an overall decrease of 0.23 pp at the end of two years. While non-oil states see a decrease in the unemployment rate, it is less than that of oil states. The most significant decrease in the unemployment rate of

-0.17pp occurs 21 months post-shock.

The impact of increased economic activity leading to higher oil prices shows a similar pattern for both categories of states, with an initial reduction in unemployment rates becoming insignificant over time. The most significant reductions for oil states are 2.18 pp at 13 months, and for non-oil states, 1.99 pp at 10 months after the shock.

Lastly, the response to oil inventory demand shocks differs notably between oil and non-oil states. There is no significant short-term effect for oil states, but unemployment rates increase significantly after a year, reaching a peak of 1.66 pp two years post-shock. Non-oil states experience a rise in unemployment rates starting as early as three months after the shock, escalating continuously thereafter, with a peak increase of 2.72 pp 22 months later.

4.1.2 Response of State Unemployment Rates

Figures 5-9 display the diverse responses of each state to four different structural oil price shocks, all configured to elevate the real oil price by 10% upon impact. To underscore the variation in response magnitudes across states, the left panels in each figure showcase a cross-section of responses at specific horizons. These horizons are selected based on the peak or trough response of the national or the oil state unemployment rate, which we utilize as reference points in our analysis. For both oil (top) and non-oil states (middle), the states are arranged from the largest to the smallest response for each shock. Complementing this, the right panels detail the month of maximum effect for each state or the month of minimum response in the case of a trough. This dual-panel setup allows for an in-depth exploration of the magnitude and timing of state-level unemployment responses to each type of oil price shock.

In our previous subsection, we noted that the oil state unemployment response to an oil supply shock reaches its trough at 6 months, with a decline in the unemployment rate of -0.25 percentage points (pp). Therefore, we initially examine the state-level unemployment rates 6 months following an oil supply shock. At this juncture, national and non-oil state unemployment rates have reverted to their baseline levels. Numerous states exhibit a neutral response to the oil supply shock at this horizon. However, states such as Oklahoma, Texas, Louisiana, and West Virginia demonstrate a notable decrease in unemployment rates. This finding is particularly intriguing when contrasted with Karaki (2018), who did not observe any such decrease in unemployment rates for these states at any horizon.

Interestingly, while we do not include Utah and Louisiana in our categorization of oil states, their inclusion in Karaki's classification strengthens our observation that oil states benefit from oil supply shocks in the short term. West Virginia presents an exceptional case, showing the most significant reduction in unemployment by -0.75pp six months post-shock. This contrasts sharply with Karaki's findings of increasing unemployment rates after an adverse oil supply shock. Karaki's results, citing Brown & Yücel (2013), suggest that with its robust coal industry, West Virginia benefits from higher oil prices due to a parallel rise in coal prices, leading to increased coal production and employment. While Brown and Yucel's reasoning might hold, it aligns more closely with our results than Karaki's. The right panel of Figure 5 further reinforces our findings, indicating that the horizons of the smallest unemployment responses in West Virginia and similar states occur within 15 months of the shock's impact.

As we recall from Figure 1, oil prices remain elevated for almost two years following an oil supply shock. Turning to Figure 6, which examines the long-term impact of this shock, we find that most non-oil states reach their peak response between 21 and two years post-shock. For instance, Oregon, which initially saw short-term benefits, underwent a notable shift, moving up 17 places to 22$^{\text{nd}}$ from the bottom in terms of net response of unemployment to an oil supply shock. Similarly, despite its moderate initial gains, New Mexico is now back to baseline, reflecting a significant long-term impact of the shock. In contrast, Louisiana exhibits a stable trend, continuing to show no significant long-term effects and maintaining its position towards the lower end of the impact spectrum. Most states, with a few exceptions, exhibit their peak response to the oil supply shock around the two-year mark. This timeline aligns with the patterns observed at national and oil-state levels, where the maximum response typically occurs approximately two years after the shock. Such consistency across various levels of analysis highlights the widespread and lasting nature of oil supply shocks on state economies, underscoring the need for tailored economic strategies to mitigate these impacts.

Figure 7 provides a detailed view of the state-level responses to an economic activity shock at horizon 13, corresponding to the trough observed in the unemployment rate response of the oil states. This horizon, 9 to 15 months post-impact, is crucial as it captures the peak decrease in unemployment rates across states due to increased oil prices driven by heightened economic activity. Notably, oil prices remain significant even two years after the shock, underscoring the enduring nature of this impact.

A striking observation from this analysis is that all states exhibit a decrease in unemployment. Of particular interest is West Virginia, which stands out with a substantial long-term decrease in unemployment of approximately 4.2 percentage points. This result is noteworthy, as it indicates that West Virginia, traditionally not categorized as an oil state, gains significantly from increased oil prices linked to economic activity in the long run. Furthermore, Oil states, on average, benefit less from oil price increases due to economic activity than non-oil states. For instance, Wyoming, the oil state that has the highest decrease in the unemployment rate, is only 11^{th} overall, and Oklahoma is 19^{th}. This could indicate an economic dynamic where non-oil states may derive greater relative benefits from economic activities that lead to increased oil prices, possibly due to their diversified economic structures.

In figure 8, we focus on the response to oil consumption demand shocks, particularly at horizon 21, where national and non-oil state unemployment rates reach their trough. Let us first recollect that the oil price continue to remain elevated in the two years after an oil consumption demand shock (See the bottom left panel of figure 1). A key observation from the states responses to the oil consumption demand shock is that a majority of the oil states are among the states with the most reduction in unemployment rate at this horizon. Among them, New Mexico and Oklahoma stand out with the most decrease in unemployment across all states, showing a notable reduction of -0.4 percentage points. Interestingly, Alaska, which is also an oil state, benefits the least from this shock, its unemployment rate reducing by just -0.1 percentage points.

This pattern suggests that oil consumption demand shocks have a variable impact within oil states, with some states, like New Mexico, Oklahoma, and Wyoming, experiencing more substantial benefits than others. We could attribute the variation in the extent of these benefits among oil states to differences in their economic structures and their relative reliance on the oil sector. The fact that three oil states are in the top five states whose unemployment rates have reduced reinforces the idea that oil states, in general, tend to benefit more from oil consumption demand shocks compared to non-oil states, likely due to the direct and indirect employment opportunities these shocks generate within the oil industry. On the other hand, Delaware, which has a huge petrochemical industry where oil is used as an input, shows the highest increase in the unemployment rate.

The final plot in our series, examining the impact of oil inventory demand shocks at horizon 22 (figure 9), reveals a consistent pattern of increasing unemployment rates across 42/51 states. This horizon is particularly significant as it aligns with the peak response for national and oil-state unemployment rates, underscoring the widespread impact of these shocks. Interestingly, states such as Oklahoma, Wyoming, and Montana experience their most significant increases in unemployment around this horizon.

One critical observation is the short-lived nature of the increase in oil prices due to inventory demand, which subsides within a month. This rapid decline warrants a cautious interpretation of our results, as the prolonged impact on unemployment contrasts with the transient nature of the price shock. Michigan and West Virginia stand out in this analysis, exhibiting the highest increases in unemployment rates of approximately 6% at horizon 22.

This analysis of oil inventory demand shocks paints a complex picture. While the direct impact on oil prices is transitory, the effects on state unemployment rates are more persistent and pronounced. This discrepancy highlights the intricate relationship between oil market dynamics and broader economic indicators like unemployment, especially in states with significant oil industry presence or other economic dependencies related to oil prices.

As we end this section, it is crucial to highlight some specific state-level observations. With its significant petrochemical industry, Louisiana exhibited an insignificant response to our economic activity shock. This finding aligns with Karaki's (2018) analysis, suggesting that petrochemical industries in Louisiana and Texas might not benefit from rising oil prices due to their negative impact on petrochemical production. Similarly, Delaware, another state with a notable petrochemical industry, showed a muted response to oil consumption demand shocks.

These state-specific responses underscore the intricate interplay between different sectors within regional economies and how they mediate the impact of oil price shocks. While some oil states displayed pronounced responses, others, like Louisiana and Delaware, had more subdued reactions. This indicates that the effects of oil price fluctuations are different even within states that share specific economic characteristics.

4.2 Unemployment Durations

The duration of the unemployment spell is another key factor contributing to unemployment heterogeneity. Alsalman (2023a) finds that different oil price shocks can have varying impacts on short-term and long-term unemployment. For example, supply shocks tend to increase long-term unemployment, whereas demand shocks have mixed effects. By analyzing the lengths of unemployment spells, we can determine whether oil price shocks cause brief disruptions or lead to extended periods of joblessness. This thorough examination helps in understanding whether the impact of these shocks is transient or more persistent. As discussed in section 2.2, we classify unemployment spells into four duration classes, viz. class 1 – incidence, class 2 – short-term unemployed, class 3 – medium-term unemployed, and class 4 – long-term unemployed.

4.2.1 Response to Oil Supply Shocks

We first look at the effect of an adverse oil supply shock on the various duration classes of unemployment at the national level in figure 10. Recollect from figure 2 that the national unemployment rate's response to an adverse oil supply is very muted for the first 16 months post impact after which it starts rise slowly and increases to 0.5pp at the end of 2 years. When we look at the various unemployment spells, we find that oil supply shocks do not lead fresh and long-term unemployment on impact. Whereas short and medium term unemployment see a reduction on impact. These results are consistent with the logic that oil states tend to benefit in the immediate aftermath of adverse supply shocks. Medium and long term unemployment rates follow a U-shape consistent with our results from chapter 3 where we see an inverted U shape response of the output gap as the central bank initially responds to the oil supply shock and later to sustained high inflation. On the other hand, short term unemployment increases steadily after falling for the first nine months peaking at 6.2pp at the end of two years. Unemployment incidence increases in the long run as well, with a peak increase of 4.1pp 20 months after the shock. Overall, we could argue that the long-run recessionary effects of an adverse oil supply lead to more incidence and short-term unemployment, whereas the medium and long-term unemployment rates go back to the baseline, possibly because people in these categories might be moving out of the labor force. Our results contrast Alsalman (2023a) who finds an increase in short, medium, and long-term unemployment durations. While she attributes the increase to precautionary savings, our results indicate the direct effect of increased oil prices is mostly transitory, and it is the central bank's response to inflation that increases unemployment in the long run. Hence, we see new incidence and short-term unemployment in the long run but not an increase in medium or long-term unemployment.

This is also evident when we look at the responses of unemployment spells at the oil-state level in figure 11. Oil states see a sharp increase in unemployment incidence immediately after an adverse oil supply shock as they are directly affected by reduction in oil production.

The increase in unemployment incidence is off set by decreases in short-term and long-term unemployment although they are insignificant. In the long-run, the oil states see a significant reduction in medium and long-term unemployment up to 23 horizons, but they turn insignificant at the end of two years. Non-oil states on the other hand, see a reduction in unemployment incidence on impact as the oil prices take longer to transmit into the input costs of firms. We see an increasing trend for all four duration classes as time progresses. While the medium and long-term unemployment growths become insignificant, the incidence and short-term unemployment spells follow the national trend with significant increases at the end of two years.

4.2.2 Response to Economic Activity Shocks

Figures 12 and 13 show the responses of various unemployment duration classes at the national and oil-state levels to increased oil prices due to heightened economic activity. By definition, heightened economic activity leads to a reduction in unemployment rate (see figure 2). However, there is considerable heterogeneity in the response of various unemployment spells.

The biggest contributor to a reduction in unemployment rate on impact is the reduction in unemployment incidence, which goes down by 14pp. While there is no response of short and medium term unemployment on impact, long-term unemployment decreases by 4pp on impact. These responses support Alsalman's assertion that not all oil price shocks are growth retarding. All four duration classes see negative growth in the subsequent months, although the reduction in unemployment incidence and short-term unemployment spells go back to baseline an year, 15 months after the shock, respectively. On the other hand, medium and long-term unemployments see substantial dips or longer times. While the decrease in medium-term peaks an year after the shock with a reduction by 50pp, the long-term unemployment decreases by 40pp even two years post the shock.

When it comes to the geographical heterogeneity in unemployment spells in the aftermath of an economic activity shock, we find that the non-oil states contribute to reductions in the national level spells in the short-run. Oil states see higher reductions in unemployment durations compared to the non-oil states in response to this shock. The only exception being unemployment incidence where oil states do not see any conclusive reductions post impact. In the long run, both oil and non-oil states benefit from increased oil prices with the oil states seeing a higher reduction in long-term unemployment. While the short and medium term unemployment rates return to the baseline, oil states continue to benefit from higher prices, increased oil production (Baumeister & Hamilton (2019)) and see substantive reductions in unemployment lasting up to two years post the shock.

4.2.3 Response to Oil Consumption Demand Shocks

Baumeister & Hamilton (2019) find that oil price increases due to increase in consumption demand do not affect economic activity. Our results support their findings. The response of unemployment spells shown in figures 14 and 15 confirm that results to a large extent. We do not find significant changes in the size of unemployment duration classes at the national level with a few exceptions. We find that the short-term unemployment reduces by 1pp four months after the shock, but it goes back to baseline level in the first ten months. Our results are comparable to the response of unemployment spells to oil-specific demand shock in Alsalman's paper.

At the oil-state level, we find staggered periods of increases or decreases in the size of unemployment spells for duration classes 1 and 3 in the oil states. On the other hand, the horizons of reduction in short-term unemployment at the national level coincide with the response of non-oil states. We do not find any significant impact of oil consumption demand shock on the long-term unemployment for both categories of states.

4.2.4 Response to Oil Inventory Demand Shocks

Unemployment spells mostly do not respond to increased oil prices due to speculation, as can be seen in figure 16. The only exception is that the long-term unemployment falls in the first couple of months after the shock by 13pp but this effect nullifies immediately afterward. As a reminder, oil price increases due to an inventory demand shock go back to baseline within a month after the shock. While they are volatile in the subsequent months, it is mostly insignificant. Looking at figure 17, we can see that the initial reduction in long-term unemployment stems from the non-oil states as can be seen from. Apart from this, we can see the unemployment incidence stays at elevated levels in the medium run for oil states since inventory demand shocks do not increase oil production but only the demand for oil inventories.

5 Conclusion

In conclusion, we uncovered significant variations in responses of unemployment at both the national and state levels to structural oil price shocks, highlighting the intricate interplay between global oil market dynamics and local economic conditions. At the national level, the impacts on unemployment rates varied depending on the nature of the oil price shock. We observed marginal increases in unemployment following oil supply shocks, notable decreases due to economic activity shocks, and increases in response to oil inventory demand shocks.

Our state-level analysis provided further insights, revealing how regional economic structures and industry compositions significantly influence local labor market reactions to these global shocks. Particularly interesting were the diverse responses within oil states. While some exhibited pronounced reactions to oil price shocks, others showed more subdued responses. Notably, the short-term impact of oil supply shocks on some oil states was less intense than anticipated.

Furthermore, examining the durations of unemployment spells provided a deeper understanding of how oil price shocks affect different segments of the labor market. The analysis of unemployment durations showed that oil supply shocks do not immediately increase new incidences of long-term unemployment but lead to a rise in short-term and incidence unemployment in the long run. This finding contrasts with previous studies that suggest a uniform increase across all durations.

Economic activity shocks generally led to reductions in all durations of unemployment spells, particularly in the short and medium terms. The impact of these shocks was more pronounced in oil states, highlighting the benefit of increased economic activity and oil production in these regions. Conversely, oil consumption demand shocks did not significantly alter the size of unemployment duration classes, supporting the notion that these shocks do not have a profound impact on economic activity.

Lastly, oil inventory demand shocks showed limited impact on unemployment spells, with the most notable effect being a temporary reduction in long-term unemployment shortly after the shock. This transient effect aligns with the short-lived nature of oil price increases due to speculative demand.

In summary, we demonstrate the importance of the source of an oil price, shock as well as the geographical and temporal heterogeneity when assessing the impact of high oil prices on unemployment. By analyzing responses across different states and unemployment durations, we provide a detailed understanding that can inform more targeted and effective policy interventions to mitigate the adverse effects of oil price volatility on the labor market.

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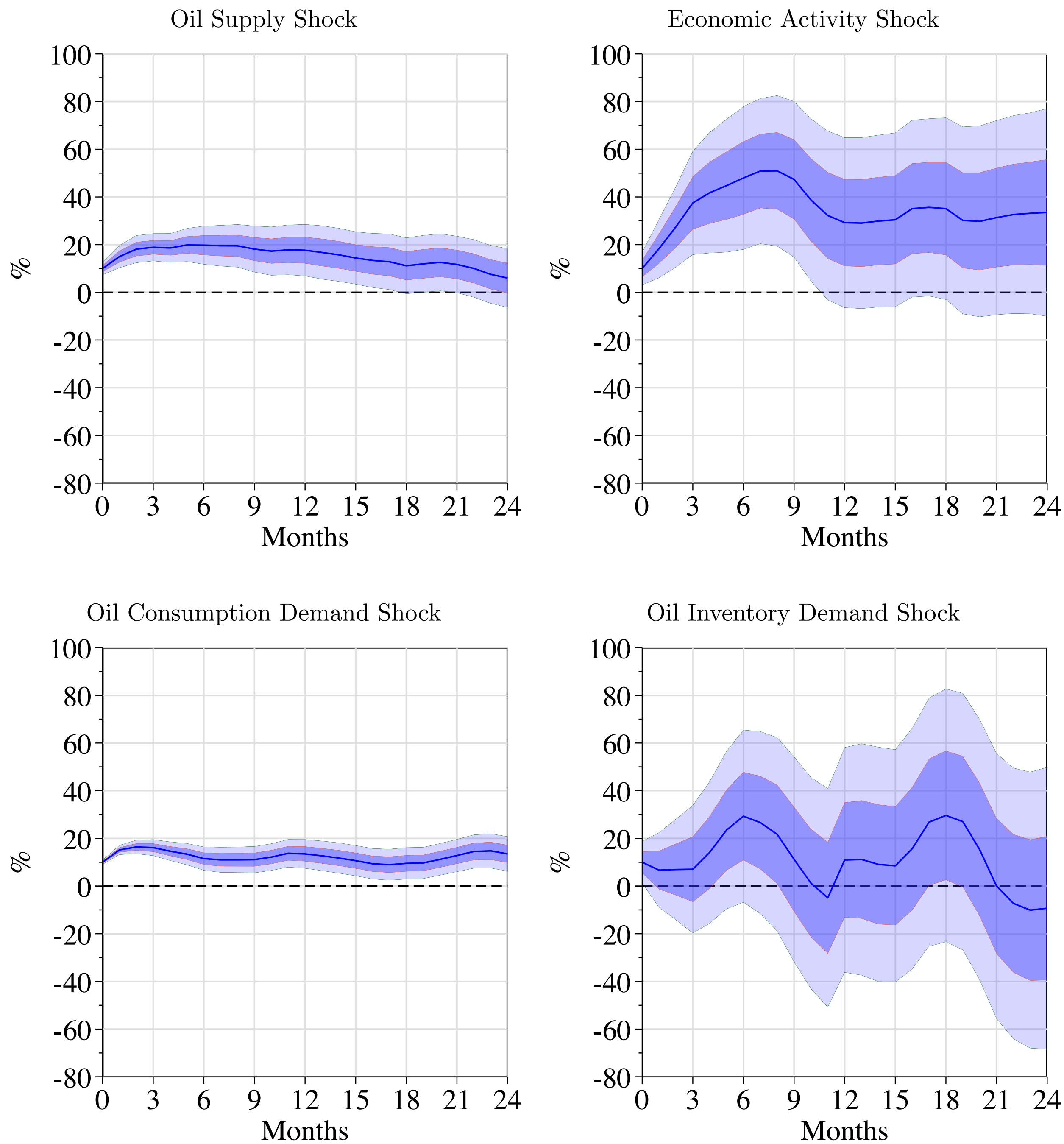

Figure 1: Responses of the real oil price to exogenous oil price shocks. Impulse responses are normalized to increase the real price of oil by 10 percent on impact. The solid line is the point estimate, and the dark and light-shaded areas are 68 and 95 percent confidence bands, respectively, calculated using Eicker-Huber-White robust standard errors.

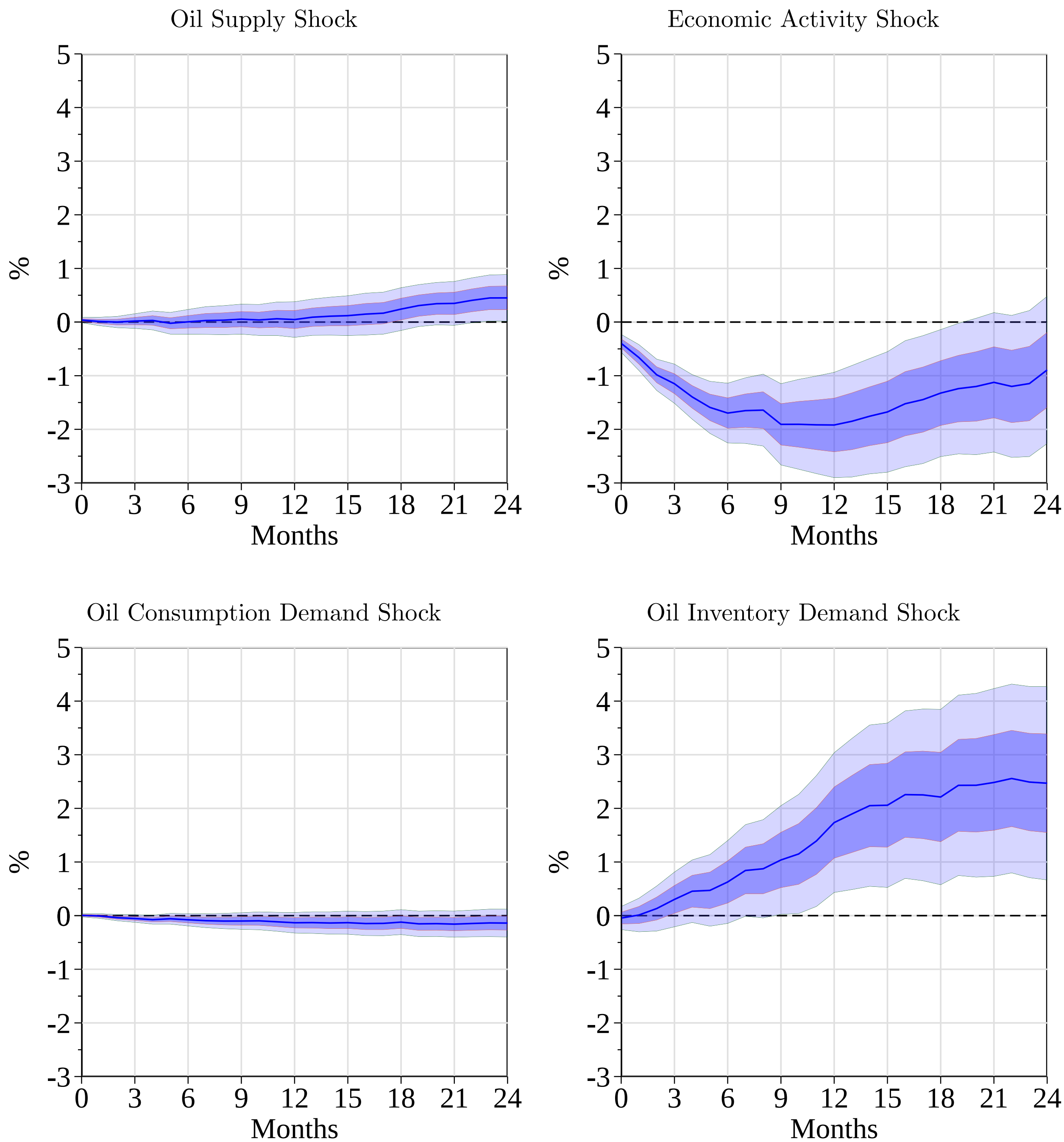

Figure 2: Responses of the national unemployment rate to exogenous oil price shocks. Impulse responses are normalized to increase the real price of oil by 10 percent on impact. The solid line is the point estimate, and the dark and light shaded areas are 68 and 95 percent confidence bands, respectively, calculated using Eicker-Huber-White robust standard errors.

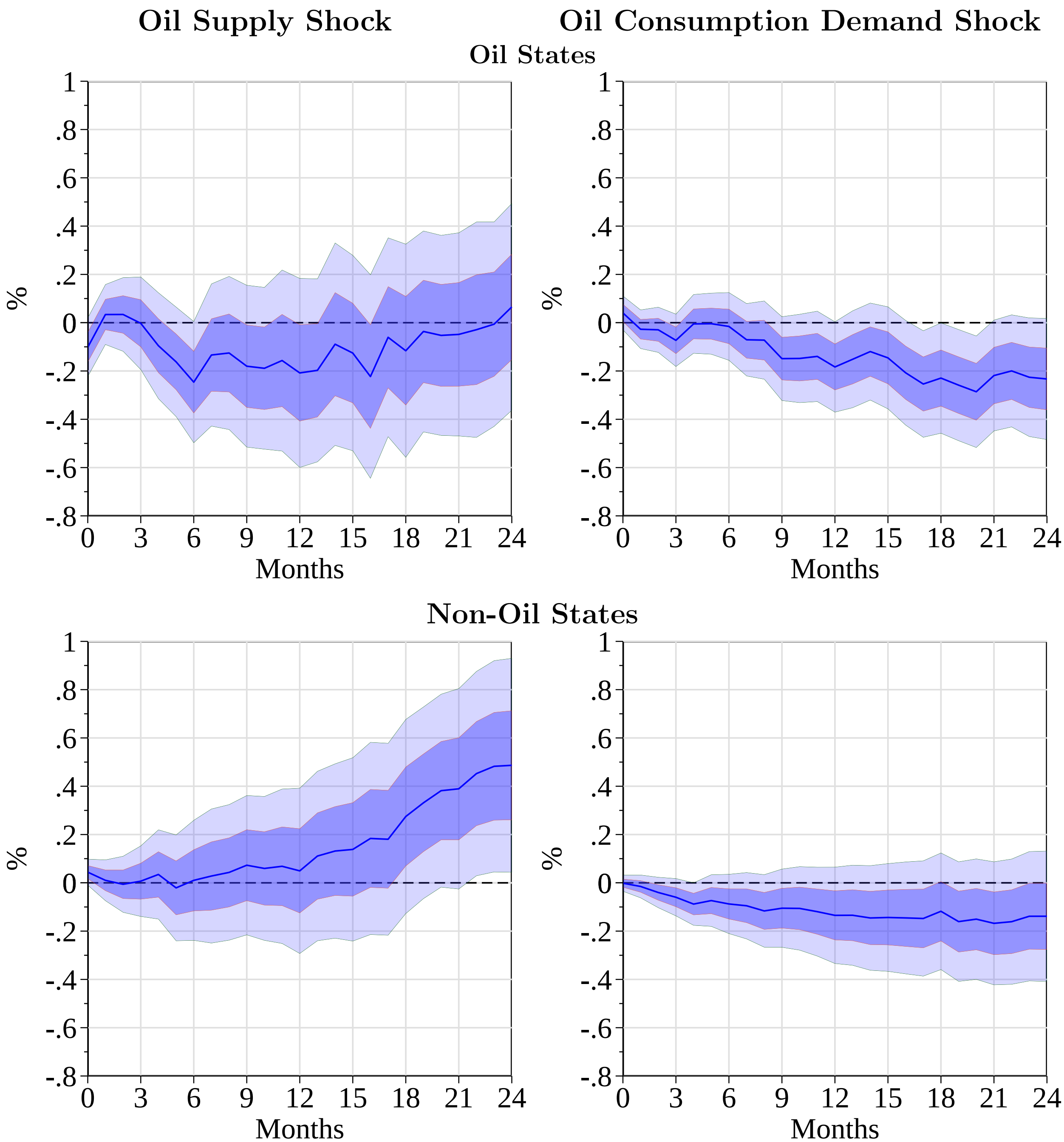

Figure 3: Responses of the oil-state level unemployment rate to exogenous oil price shocks. Impulse responses are normalized to increase the real price of oil by 10 percent on impact. The solid line is the point estimate, and the dark and light-shaded areas are 68 and 95 percent confidence bands, respectively, calculated using Eicker-Huber-White robust standard errors.

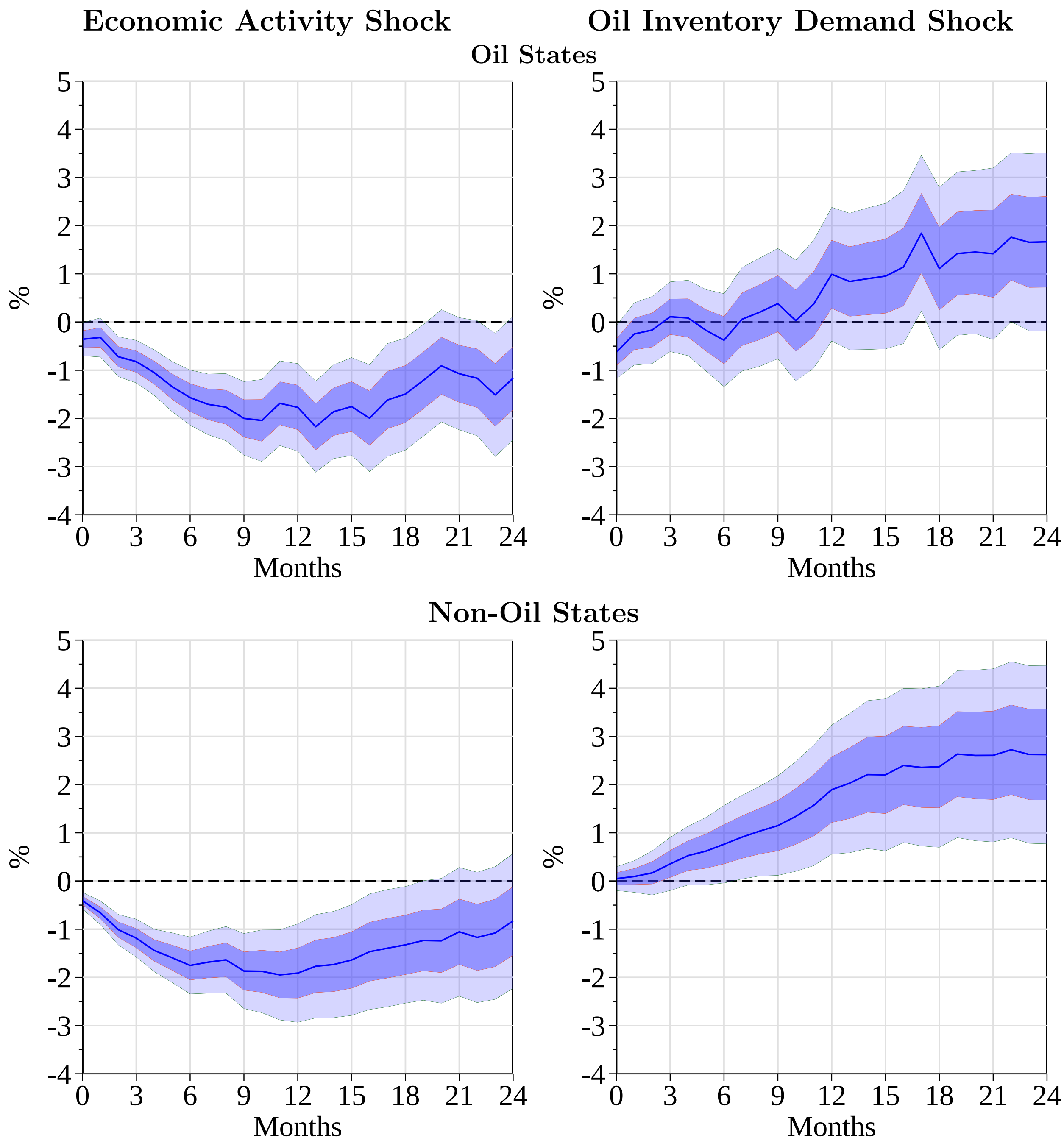

Figure 4: Responses of the oil-state level unemployment rate to exogenous oil price shocks. Impulse responses are normalized to increase the real price of oil by 10 percent on impact. The solid line is the point estimate, and the dark and light-shaded areas are 68 and 95 percent confidence bands, respectively, calculated using Eicker-Huber-White robust standard errors.

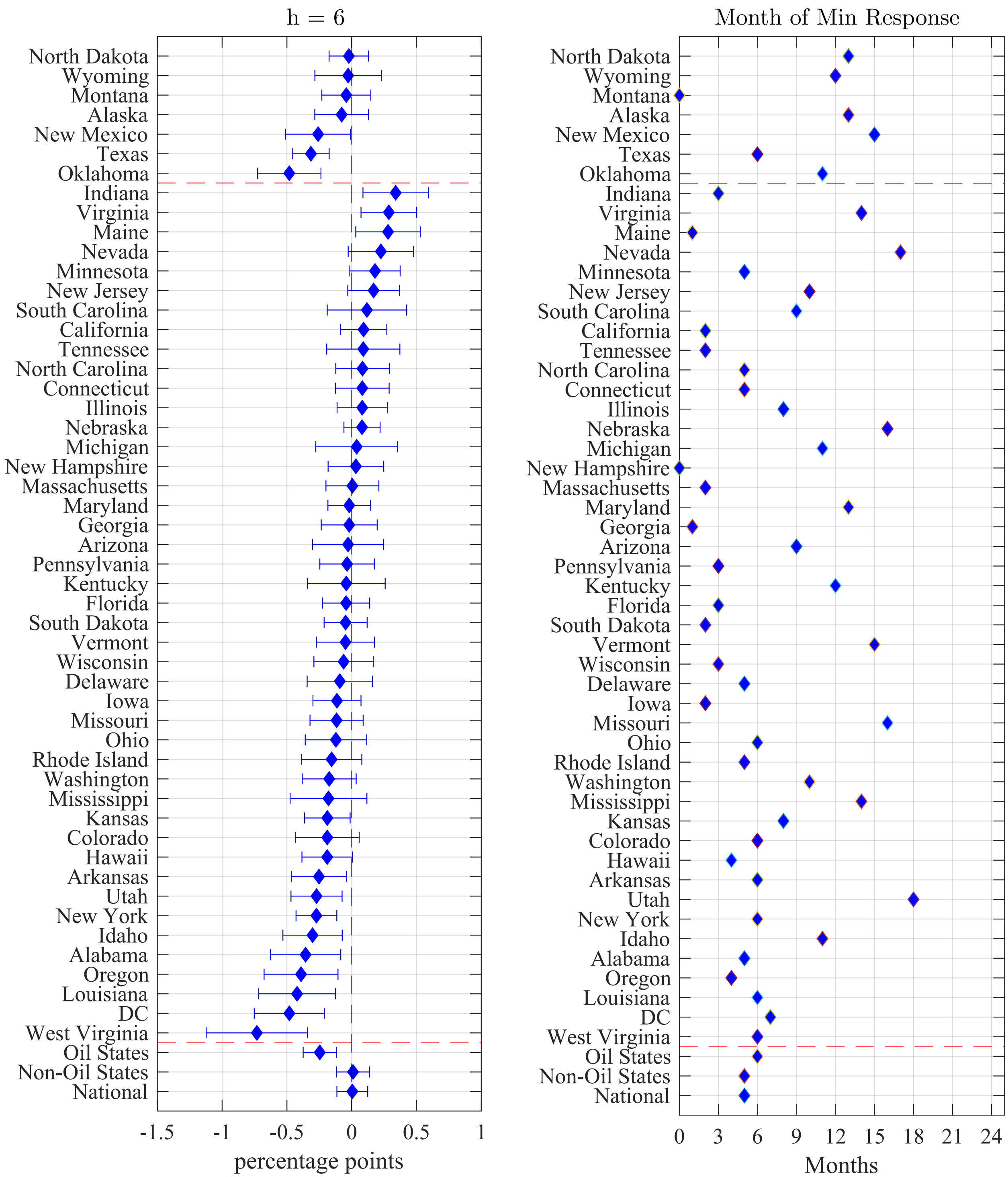

Figure 5: Responses of the state unemployment rates to an adverse oil supply shock. Impulse responses are normalized to increase the real price of oil by 10 percent on impact. In the left panel, the diamonds represent the point estimates with 68 percent confidence intervals calculated using Eicker-Huber-White robust standard errors. In the right panel, the diamonds indicate the month of minimum response of the state's unemployment rate.

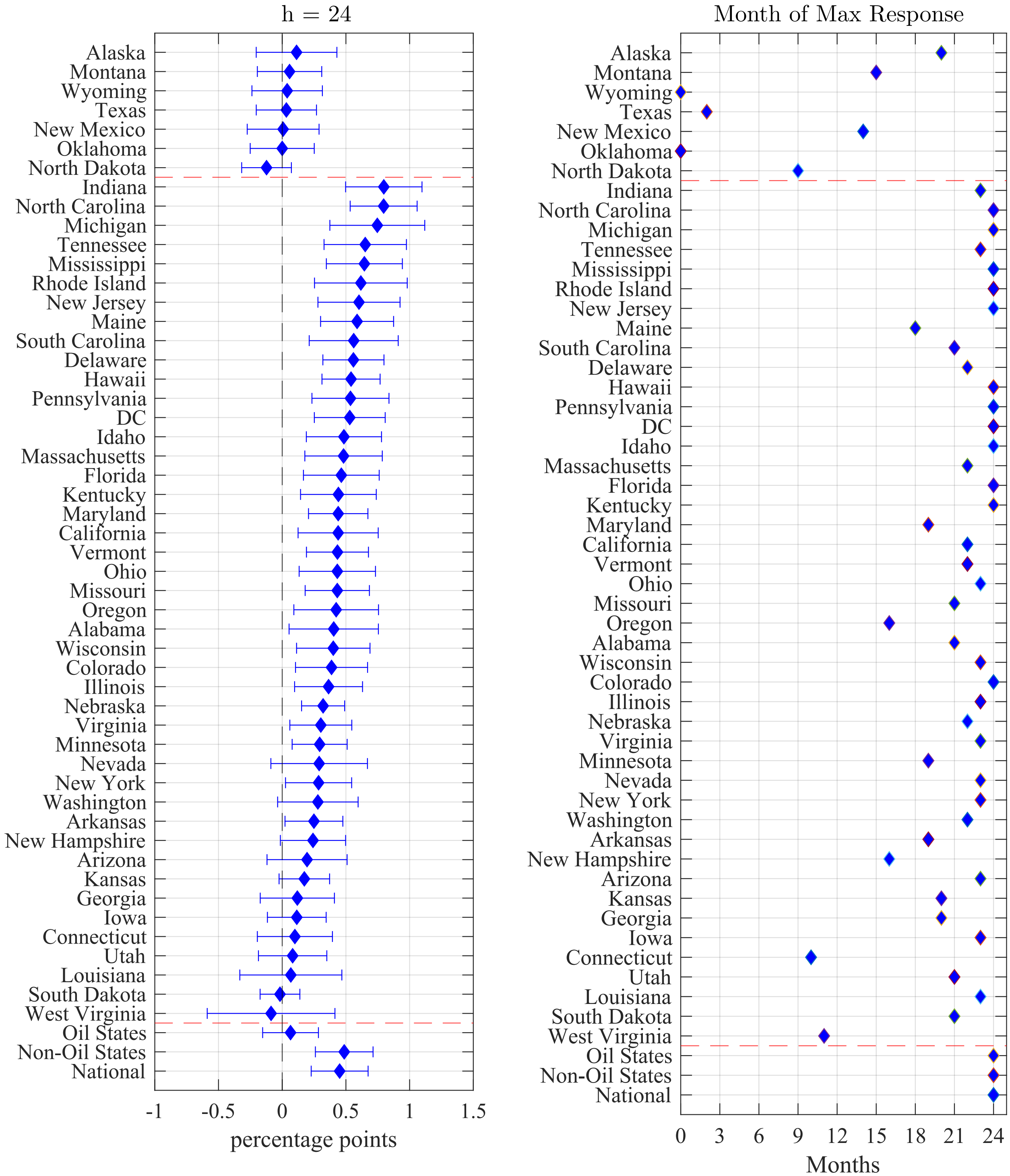

Figure 6: Responses of the state unemployment rates to an adverse oil supply shock. Impulse responses are normalized to increase the real price of oil by 10 percent on impact. In the left panel, the diamonds represent the point estimates with 68 percent confidence intervals calculated using Eicker-Huber-White robust standard errors. In the right panel, the diamonds indicate the month of maximum response of the state's unemployment rate.

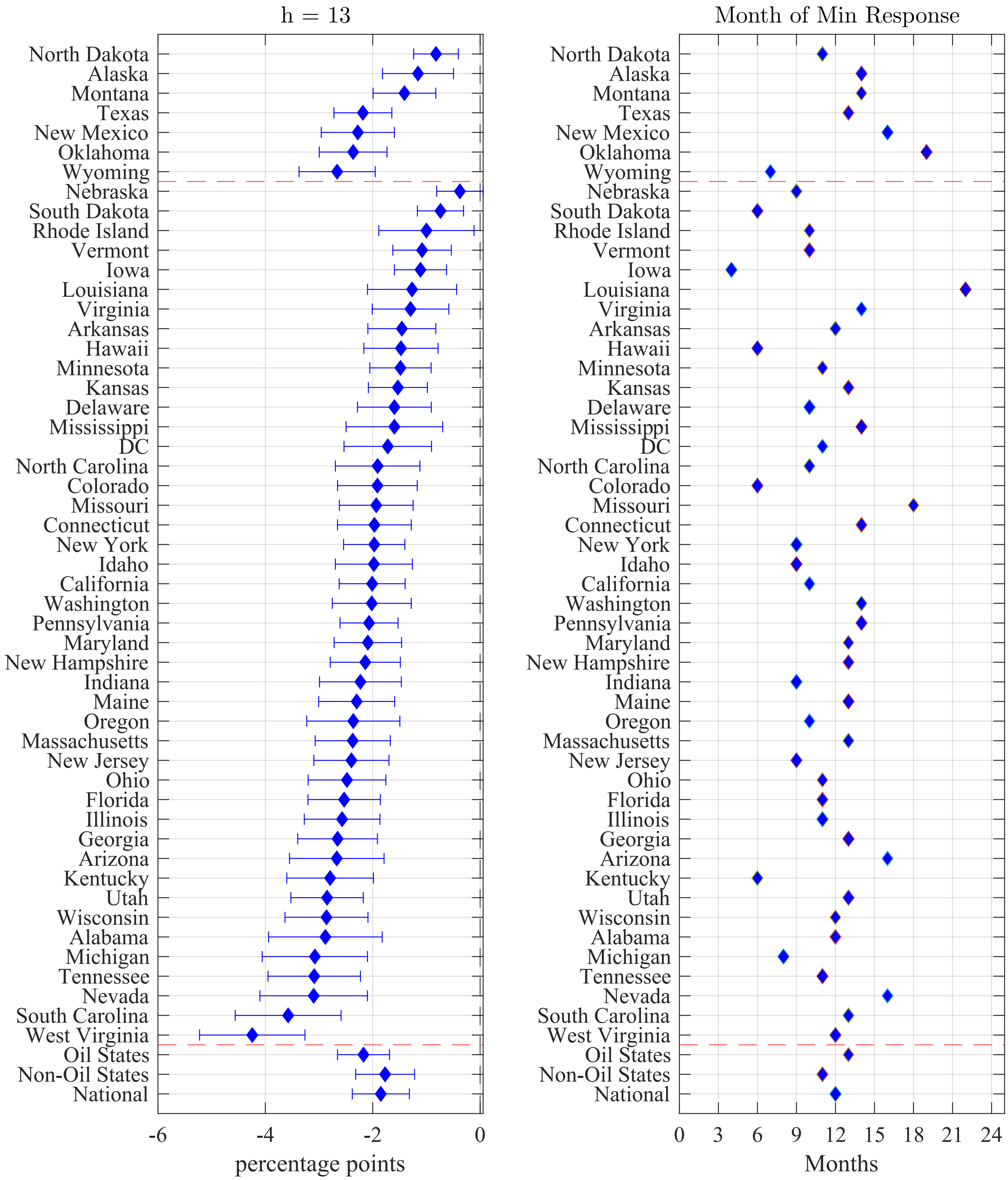

Figure 7: Responses of the state unemployment rates to an economic activity shock. Impulse responses are normalized to increase the real price of oil by 10 percent on impact. In the left panel, the diamonds represent the point estimates with 68 percent confidence intervals calculated using Eicker-Huber-White robust standard errors. In the right panel, the diamonds indicate the month of minimum response of the state's unemployment rate.

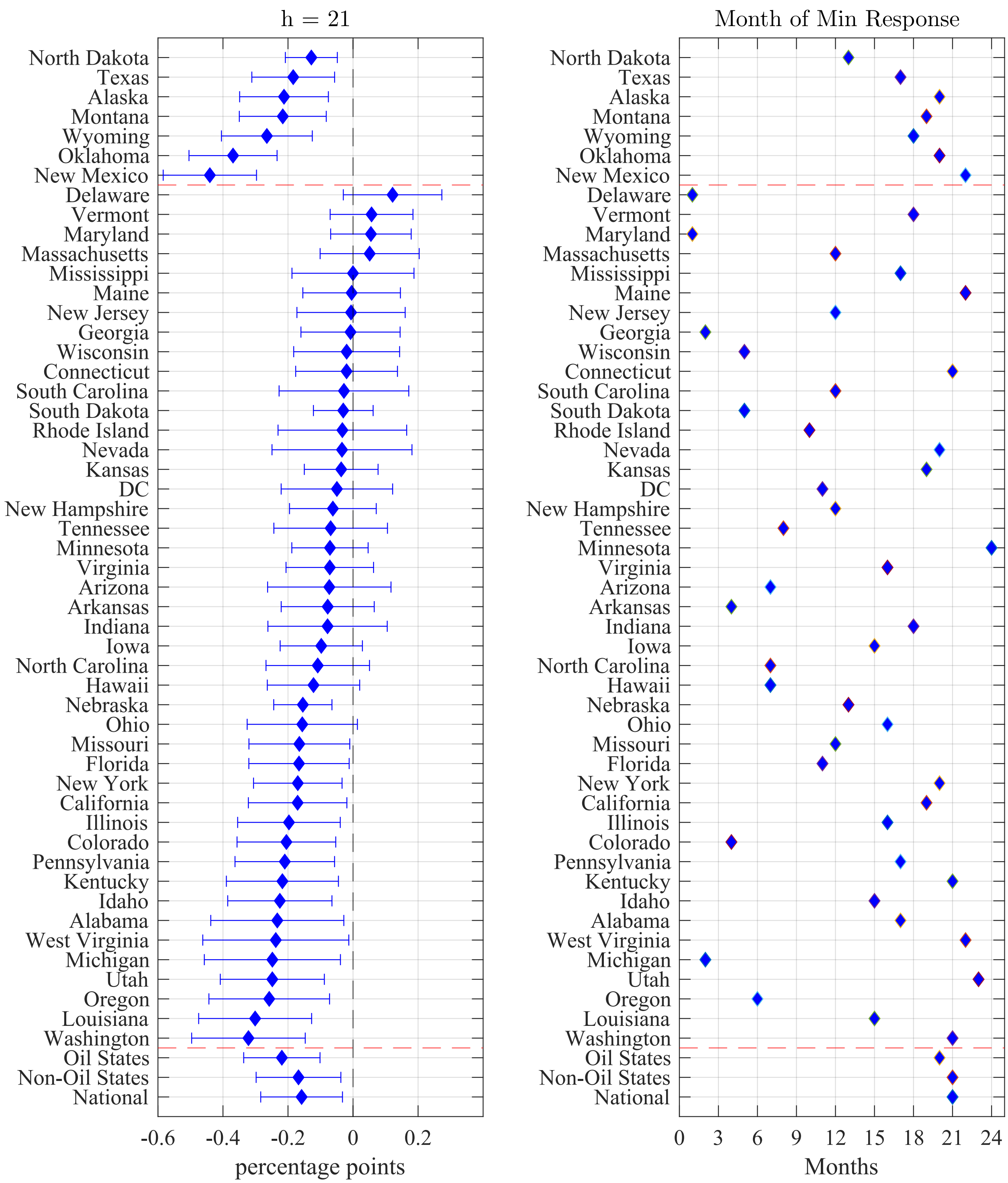

Figure 8: Responses of the state unemployment rates to an oil consumption demand shock. Impulse responses are normalized to increase the real price of oil by 10 percent on impact. In the left panel, the diamonds represent the point estimates with 68 percent confidence intervals calculated using Eicker-Huber-White robust standard errors. In the right panel, the diamonds indicate the month of minimum response of the state's unemployment rate.

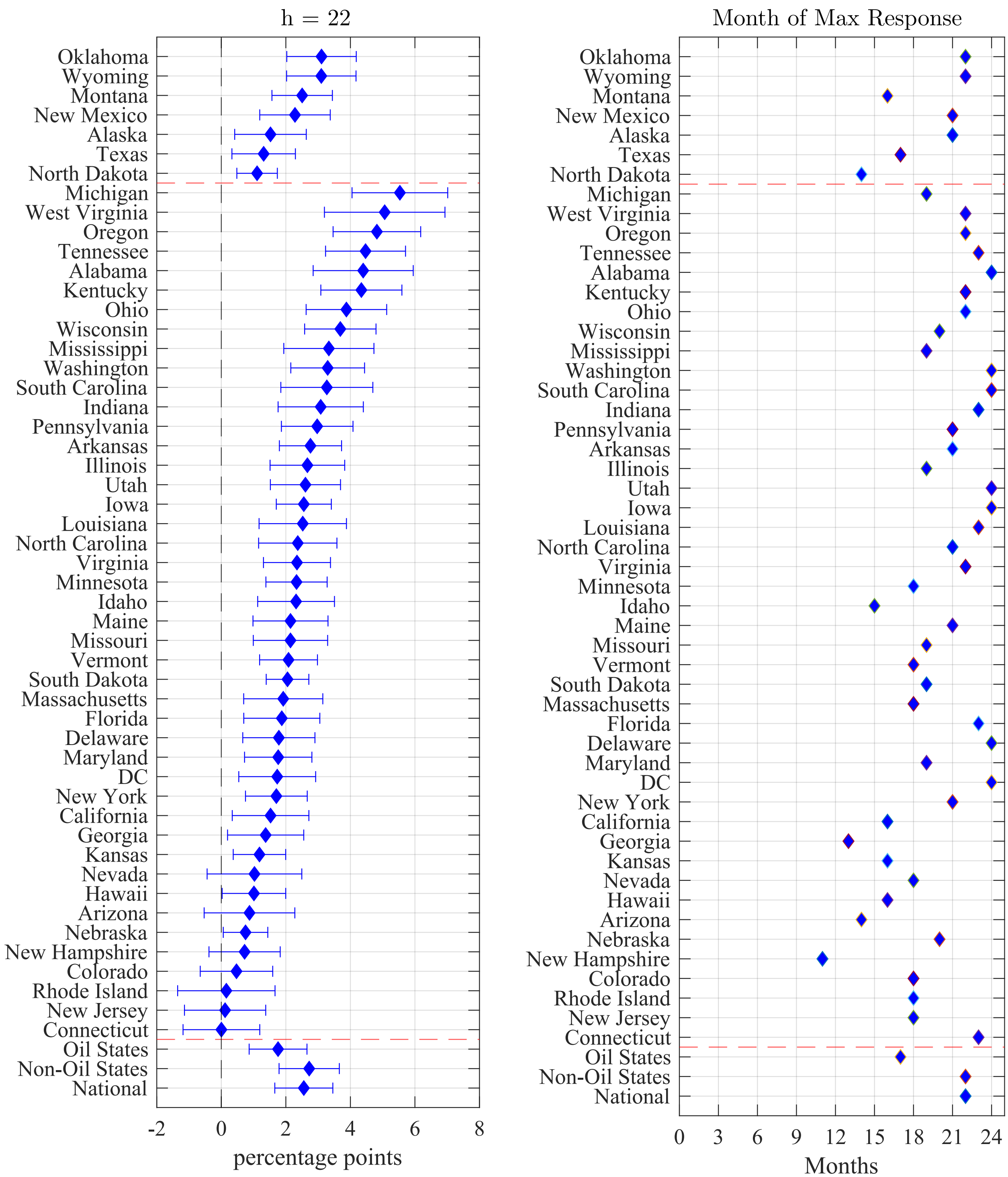

Figure 9: Responses of the state unemployment rates to an oil inventory demand shock. Impulse responses are normalized to increase the real price of oil by 10 percent on impact. In the left panel, the diamonds represent the point estimates with 68 percent confidence intervals calculated using Eicker-Huber-White robust standard errors. In the right panel, the diamonds indicate the month of maximum response of the state's unemployment rate.

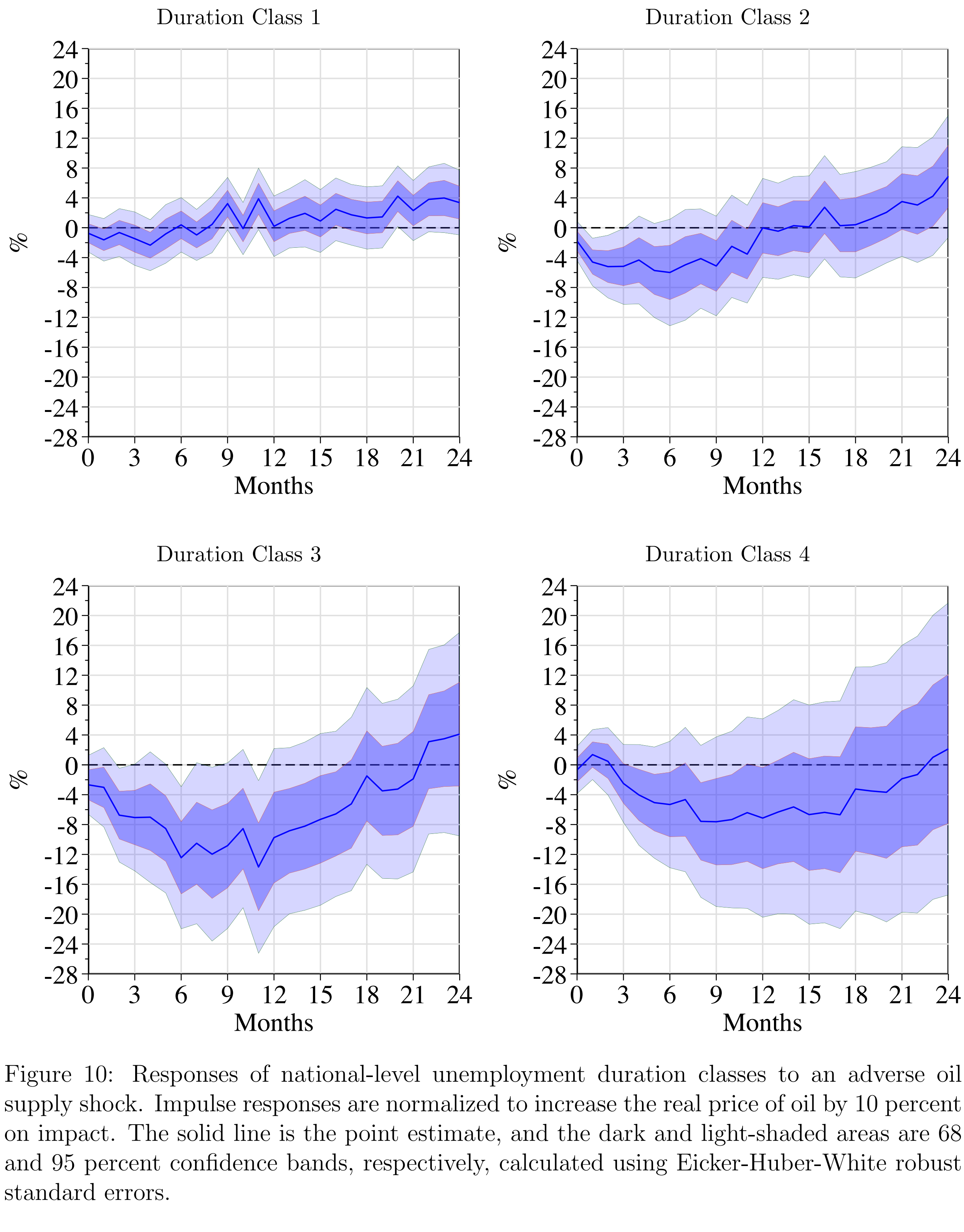

Figure 10: Responses of national-level unemployment duration classes to an adverse oil supply shock. Impulse responses are normalized to increase the real price of oil by 10 percent on impact. The solid line is the point estimate, and the dark and light-shaded areas are 68 and 95 percent confidence bands, respectively, calculated using Eicker-Huber-White robust standard errors.

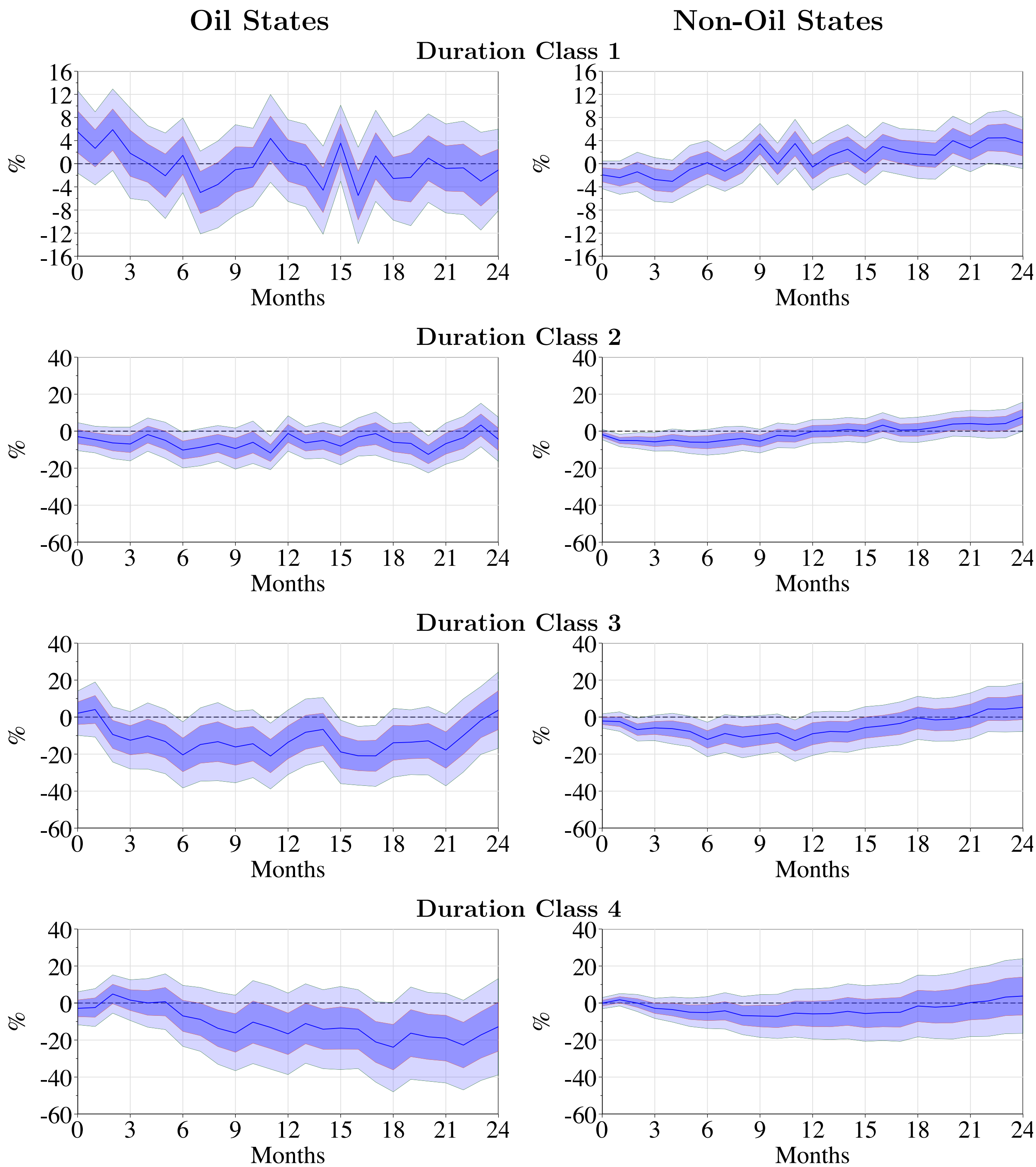

Figure 11: Responses of oil-state-level unemployment duration classes to an adverse oil supply shock. Impulse responses are normalized to increase the real price of oil by 10 percent on impact. The solid line is the point estimate, and the dark and light-shaded areas are 68 and 95 percent confidence bands, respectively, calculated using Eicker-Huber-White robust standard errors.

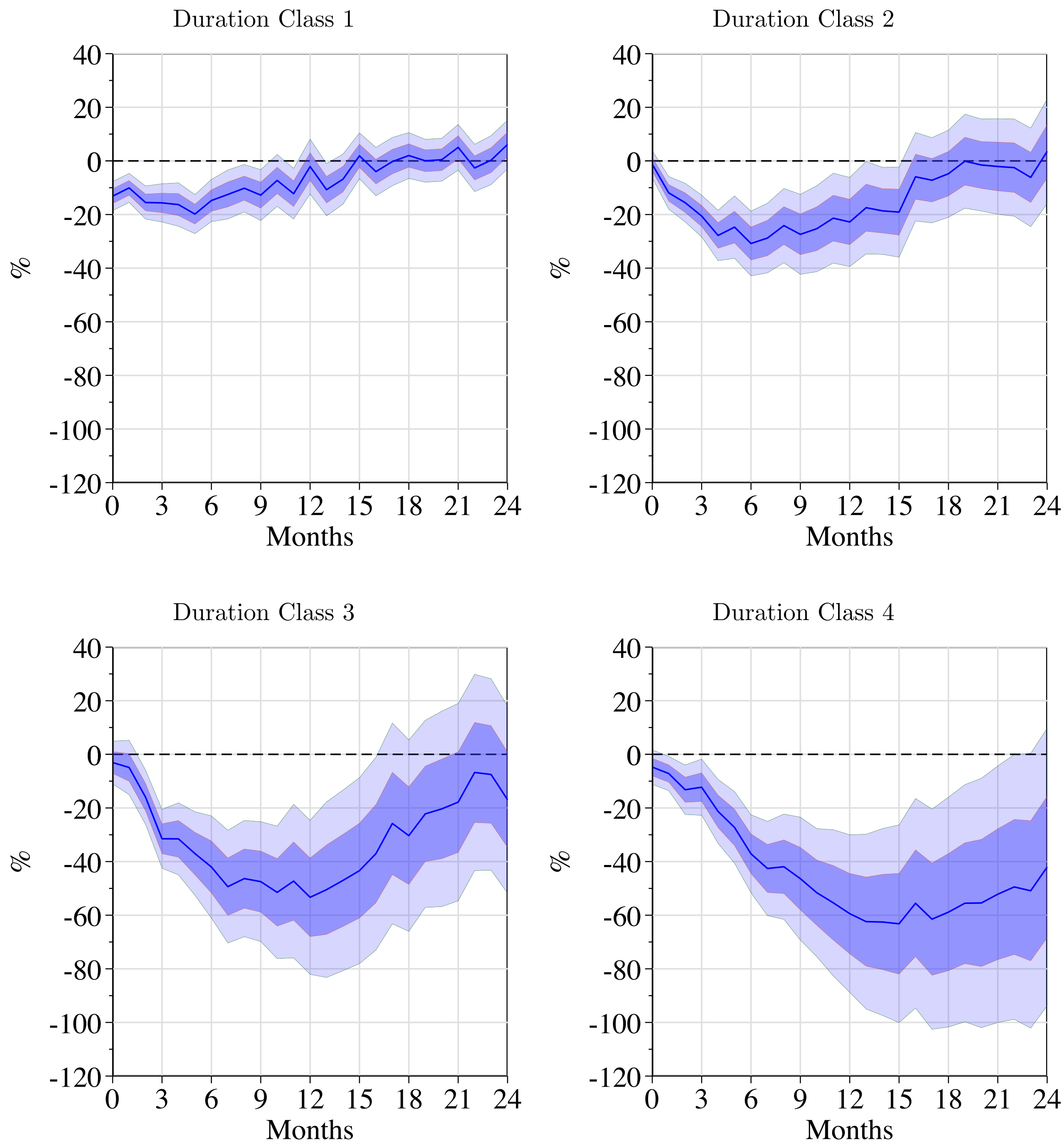

Figure 12: Responses of national-level unemployment duration classes to an economic activity shock. Impulse responses are normalized to increase the real price of oil by 10 percent on impact. The solid line is the point estimate, and the dark and light-shaded areas are 68 and 95 percent confidence bands, respectively, calculated using Eicker-Huber-White robust standard errors.

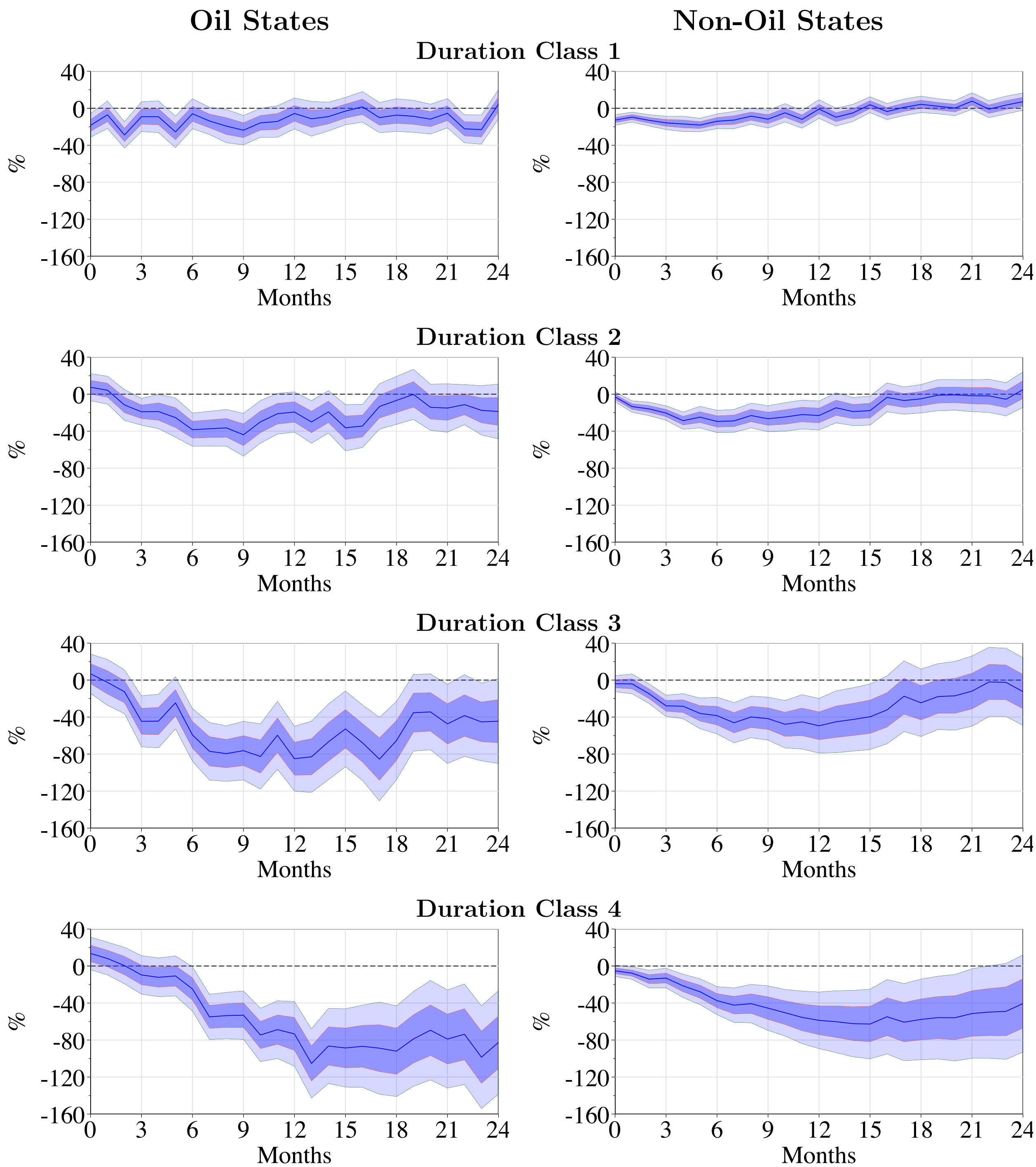

Figure 13: Responses of oil-state-level unemployment duration classes to an economic activity shock. Impulse responses are normalized to increase the real price of oil by 10 percent on impact. The solid line is the point estimate, and the dark and light-shaded areas are 68 and 95 percent confidence bands, respectively, calculated using Eicker-Huber-White robust standard errors.

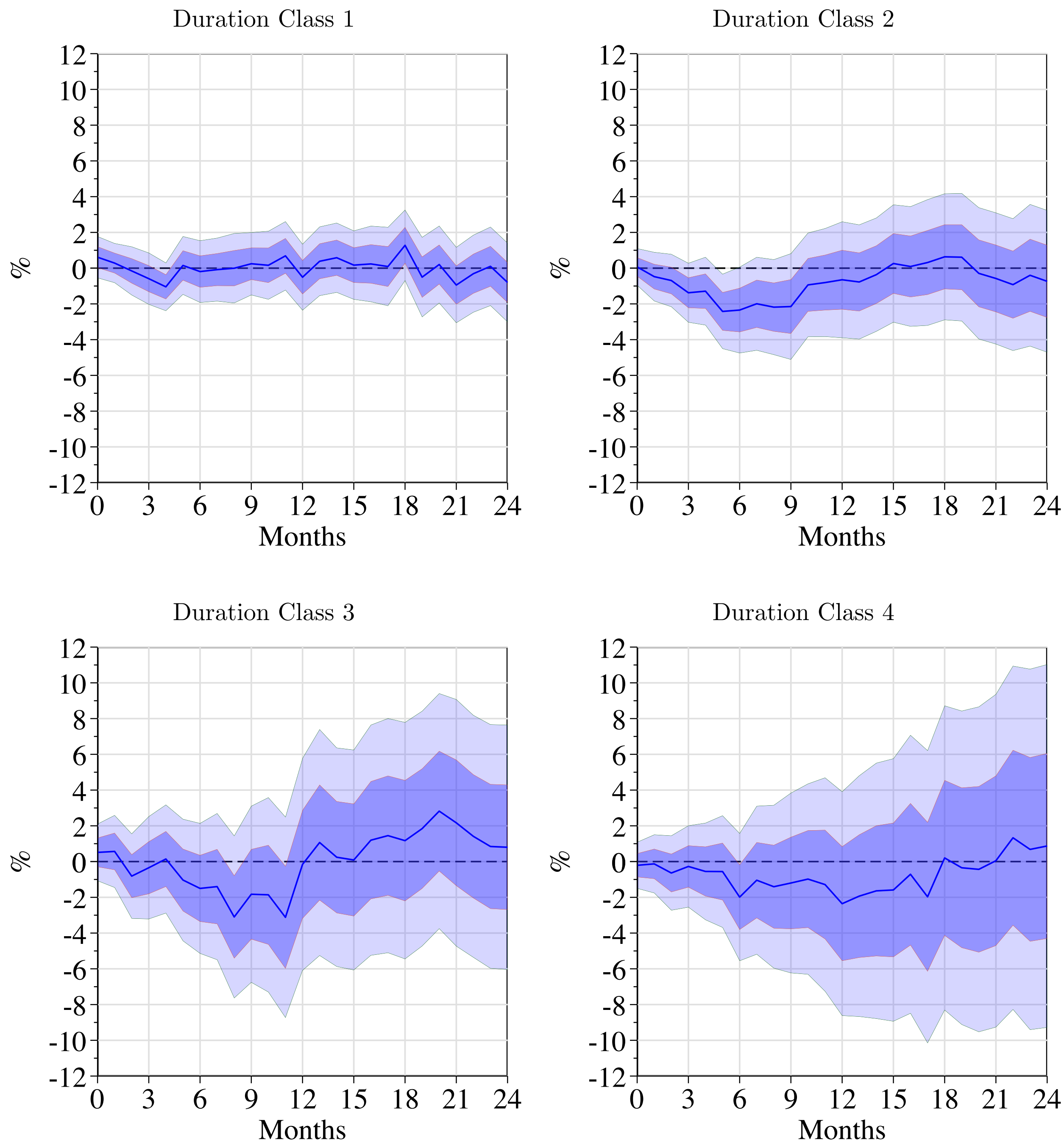

Figure 14: Responses of national-level unemployment duration classes to an oil consumption demand shock. Impulse responses are normalized to increase the real price of oil by 10 percent on impact. The solid line is the point estimate, and the dark and light-shaded areas are 68 and 95 percent confidence bands, respectively, calculated using Eicker-Huber-White robust standard errors.

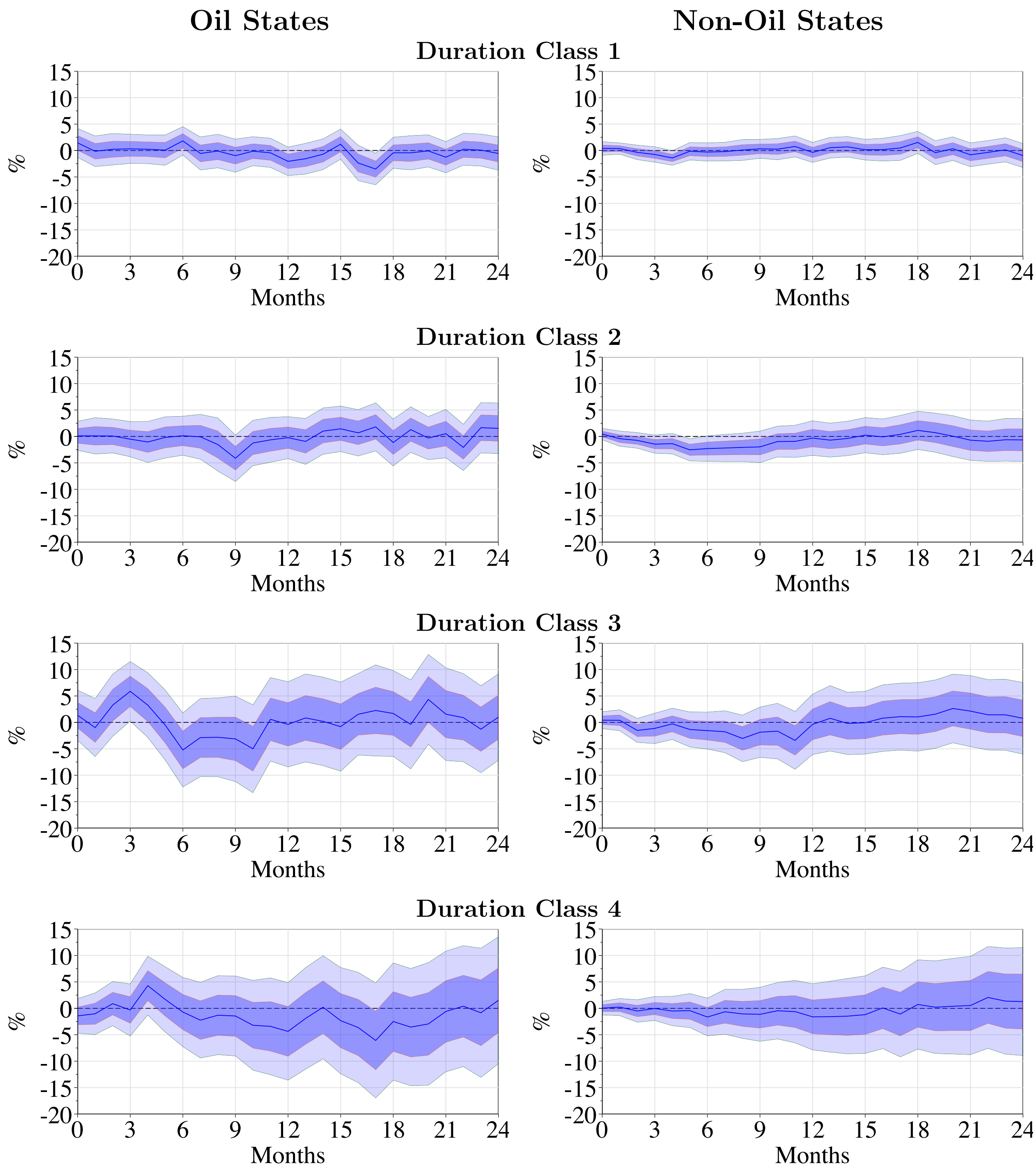

Figure 15: Responses of oil-state-level unemployment duration classes to an oil consumption demand shock. Impulse responses are normalized to increase the real price of oil by 10 percent on impact. The solid line is the point estimate, and the dark and light-shaded areas are 68 and 95 percent confidence bands, respectively, calculated using Eicker-Huber-White robust standard errors.

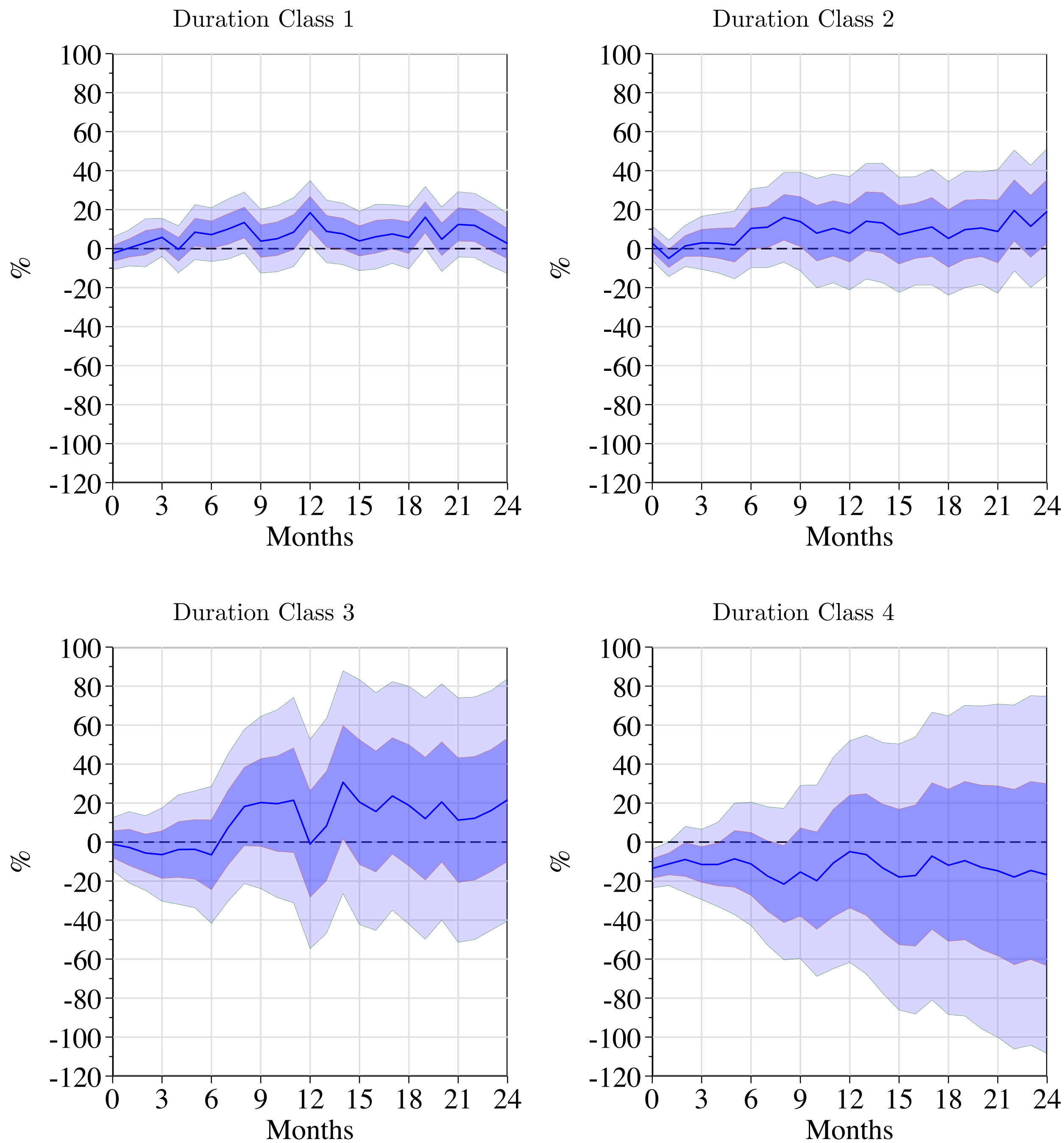

Figure 16: Responses of national-level unemployment duration classes to an oil inventory demand shock. Impulse responses are normalized to increase the real price of oil by 10 percent on impact. The solid line is the point estimate, and the dark and light-shaded areas are 68 and 95 percent confidence bands, respectively, calculated using Eicker-Huber-White robust standard errors.

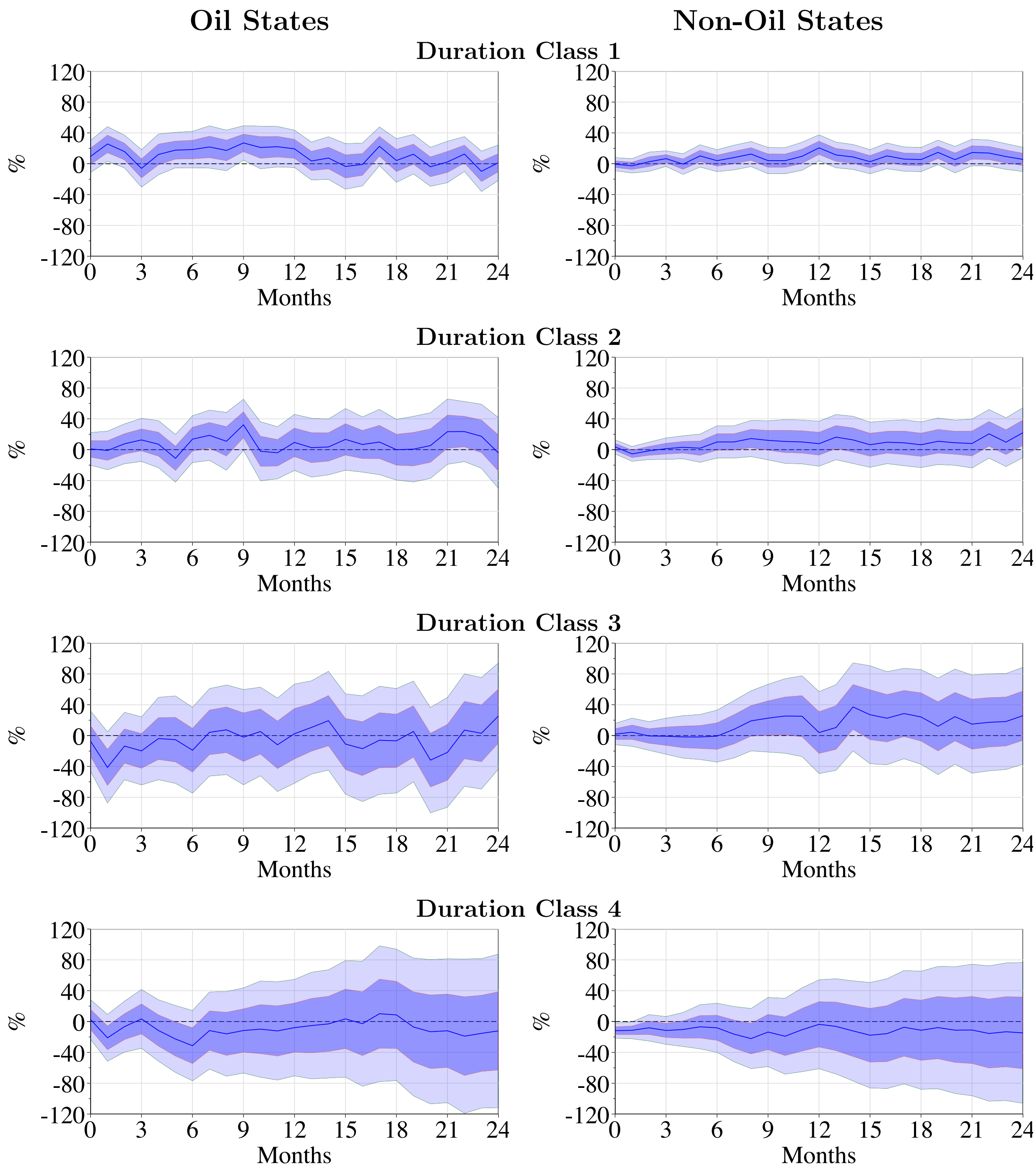

Figure 17: Responses of oil-state-level unemployment duration classes to an oil inventory demand shock. Impulse responses are normalized to increase the real price of oil by 10 percent on impact. The solid line is the point estimate, and the dark and light-shaded areas are 68 and 95 percent confidence bands, respectively, calculated using Eicker-Huber-White robust standard errors.