# The Response of U.S. Investment to Oil Price Shocks: Does the Shale Boom Matter?

*By Nida Çakır Melek*

After an unprecedented decline from June 2014 to March 2016, the real price of oil more than doubled, renewing interest in the effects of oil price fluctuations on the U.S. economy. An increase in oil prices can affect the economy of a net oil importing country by lowering the consumers' demand for other goods and services. At the same time, an increase in oil prices can increase the cost of production, thereby lowering profits and reducing investment.

However, the effect of higher oil prices on investment may have changed. Following the recovery in oil prices from mid-2016 to mid-2018, U.S. oil investment almost doubled. This is unsurprising, as higher oil prices make oil businesses more profitable, allowing them to increase production and investment. More surprising is that total U.S. business fixed investment appears to have mimicked the pattern of oil investment: increasing until late 2014, declining in 2015, then increasing once again since 2016. This more recent, positive correlation between oil prices and U.S. investment growth may be related to the surge in U.S. oil production known as the shale boom.

In the mid-2000s, the United States began increasing its oil and gas production through horizontal drilling and hydraulic fracturing, becoming one of the largest oil producers in the world. As a result,

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when oil prices increase, U.S. oil producers benefit more now than in the past. These benefits may also spill over to other industries, positively affecting the overall economy. Given increasing production, declining imports, and some specific properties of shale oil—high initial production rates, the continuous drilling required to maintain production, and higher sensitivity to price changes—it is plausible to expect that the United States may respond differently to oil price changes now than in the past.

In this article, I explore the effect of unexpected oil price changes—or "shocks"—on U.S. investment, a key channel through which oil price shocks affect the economy. After controlling for the source of the changes in oil prices, I investigate the effect of oil supply, oil-specific (shocks that only affect the oil market), and aggregate demand shocks on oil and non-oil components of U.S. private nonresidential fixed investment and explore how the response of U.S. investment may have changed since the shale boom. I find that oil investment has become more responsive to oil supply, oil-specific, and aggregate demand shocks since the shale boom. The changing responsiveness to fluctuations in oil prices extends beyond the more direct effects on oil investment. I find that non-oil and total investment have also become more responsive to demand shocks and less responsive to oil supply shocks since the shale boom. These greater spillovers from the oil sector are not present prior to the shale boom.

## I. Oil Price Changes and the U.S. Economy

The sharp oil price decline from June 2014 to March 2016 fueled a debate about its overall effect on the U.S. economy. Oil price shocks affect the economy primarily through consumers' and firms' spending (Hamilton 2008). A decline in oil prices can increase consumption, as consumers spend less of their income on fuels and increase their demand for other goods and services. Increased demand for a firm's output can, in turn, increase business capital spending too. The lower cost of production associated with declining oil prices can also lead to increased investment. As a result, many observers expected the 2014–16 oil price decline to boost U.S. economic growth. However, that boost did not seem to materialize (Baumeister and Kilian 2016b;

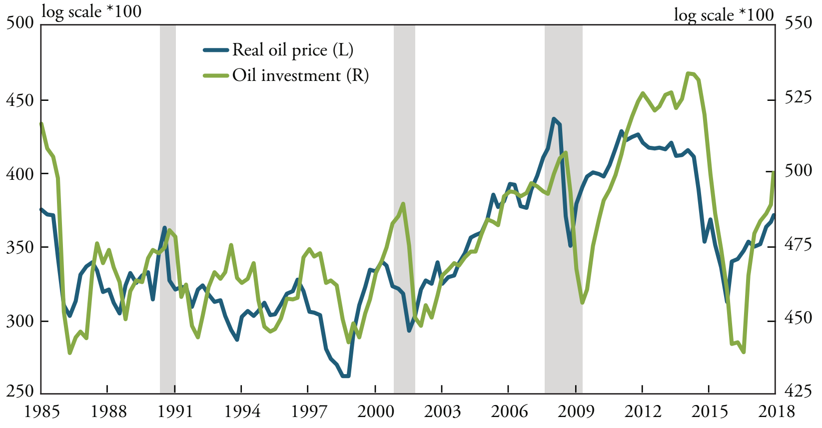
International Monetary Fund 2016). The reason may be related to the recent boom in U.S. oil production.

The shale revolution—brought about by the broad application of horizontal drilling and hydraulic fracturing—ended a decades-long period of declining U.S. oil production. In 2005, the United States began increasing its oil and gas production and became a major producer in a short time. Since 2013, the United States has been the world's top producer of petroleum hydrocarbons (Energy Information Administration 2018). Therefore, although the United States is still a net importer of oil, its dependence on foreign oil has declined significantly as net oil imports have plummeted.

In line with the increased production, the share of oil investment in total U.S. investment has also increased materially. The share of oil investment in total nonresidential fixed investment in structures and equipment increased from an average of 3.4 percent in the 1986:Q1–2005:Q4 period to an average of 10.5 percent in the 2006:Q1–2014:Q2 period. As a result, when oil prices fell sharply, the oil sector was hit hard. For example, Chart 1 shows that following the substantial decline in oil prices in the second half of 2014, U.S. oil investment collapsed. Given the increased importance of this sector, it is natural to ask whether the shale boom may have changed the overall relationship between oil and the U.S. economy.

How oil price shocks are transmitted to the economy has been a central question in macroeconomics and of interest to policymakers. Academic researchers have extensively studied the effects of oil price changes on consumer spending, finding quantitatively important effects (for example, Mehra and Petersen [2005]; Edelstein and Kilian [2009]; Gelman and others [2016], Ready [2018]; Iacoviello [2016]; Alsalman and Karaki [2017]; and Baumeister, Kilian, and Zhou [2018]). However, few have studied the response of firms' investment spending to oil price changes. Notable exceptions are Edelstein and Kilian (2007) and Loria (2017). Edelstein and Kilian (2007) investigate how nonresidential fixed investment in structures and equipment responds to energy price changes. They find that while the estimated response of nonresidential fixed investment in structures and equipment excluding oil is small and statistically insignificant, the estimated response of oil investment is large and statistically significant.[1] Loria (2017) shows that the

*Chart 1*
Real Oil Price versus Oil Investment




Notes: Variables are measured on a log scale and multiplied by 100 so that their swings represent percent changes. Gray bars denote National Bureau of Economic Research (NBER)-defined recessions.
Sources: BEA, BLS, EIA, NBER, and author's calculations.

size of the shock matters for the response of U.S. nonresidential fixed investment in structures and equipment. She finds that while a small oil price increase leads to a decline in investment, the effect of a large oil price increase is ambiguous, as it results in higher oil and oil-related investment but lower non-oil investment.[2]

Recent changes in the price of oil have raised questions once again about the effect of changing oil prices on the U.S. economy (see, for example, Klein [2018]; Liesman [2018]; and Yang and Sider [2018]). The real price of oil has more than doubled since its low in early 2016, bringing with it a substantial increase in oil investment (Chart 1). Motivated by the recent recovery in oil prices and the small amount of prior research, I investigate the effect of oil supply and demand shocks on U.S. private nonresidential fixed investment categories and assess whether this effect may have changed after the shale boom.

## II. The Effects of Oil Price Shocks on Nonresidential Fixed Investment in Structures and Equipment

Oil prices fluctuate for several reasons. Increasing global economic activity can push up demand and increase oil prices, whereas a larger global oil supply can cause oil prices to decline. Oil prices can also move due to shifts in expectations about future oil supply or demand growth. Distinguishing between the factors driving oil price changes is important, as these factors tend to have very different effects on macroeconomic aggregates (Kilian 2009). For example, if an oil price increase is driven by an unexpected increase in global economic activity, aggregate investment will likely increase due to booming aggregate demand. However, if an oil price increase is driven by an unexpected decline in the global oil supply, aggregate investment will likely decline due to the higher cost of production. Investigating the dynamic effects of oil price shocks on U.S. investment requires a model that incorporates measures of the supply and demand shocks driving oil price changes.

### *Decomposing oil price shocks into oil supply and demand shocks*

To disentangle the factors driving oil price movements, I use the framework from Kilian (2009). Kilian proposes a monthly three-variable structural vector autoregression (SVAR) to identify underlying demand and supply shocks in the global oil market. This framework identifies three shocks: aggregate demand shocks, oil-specific demand shocks (or precautionary demand shocks), and oil supply shocks. Aggregate demand shocks capture shifts in oil prices driven by changes in global real economic activity. These shocks reflect changes in demand for all industrial commodities. Oil-specific demand shocks, on the other hand, capture oil price changes driven by shocks specific to the crude oil market. For example, changes in expectations about future oil supply growth—such as an unexpected discovery of supply resulting in expectations of higher future supply growth—or demand growth can cause fluctuations in oil-specific demand. Finally, oil supply shocks capture shifts in oil prices driven by changes in the global oil supply. For example, a disruption to oil production would cause oil prices to increase.

I extract the monthly series of oil supply and demand shocks from the SVAR for two periods: January 1986 to December 2005—the pre-shale period—and January 1986 to December 2017—the full sample (see the appendix for details on how the shocks are recovered from observables). I end the pre-shale period in 2005 because that is the year U.S. oil and gas production began increasing (Çakır Melek 2015).

Responses of the real price of oil to the shocks extracted from the SVAR show that demand shocks and oil supply shocks have different effects (see the appendix for the responses and more details). Consistent with the findings in Kilian (2009) and Davig and others (2015), an unexpected positive aggregate demand shock leads to a persistent increase in the price of oil, while an unexpected positive oil-specific demand shock causes a sharp, very large, and persistent increase in the real price of oil that is also highly statistically significant. The increase in the price of oil due to a negative oil supply shock, on the other hand, is less persistent.

These findings reemphasize the importance of decomposing changes in real oil prices into oil supply shocks and oil-specific and aggregate demand shocks in examining the effect of oil price shocks on macroeconomic aggregates.

### *The response of U.S. investment to oil price shocks*

After extracting the series of structural oil shocks from the model, I estimate the effects of these shocks on real private nonresidential fixed investment in structures and equipment as well as its components.

Because data on U.S. investment are only available at the quarterly frequency, I construct measures of quarterly oil price shocks by averaging the monthly structural innovations derived from the SVAR for each quarter. I then estimate the response of several U.S. investment categories to oil supply and demand shocks via ordinary least squares (OLS) according to the following equation:

$$\Delta I_{s,t} = \alpha_j + \sum_{i=1}^{4} \beta_{ji} \Delta I_{t-i} + \sum_{k=0}^{8} \gamma_{jk} OILSHOCK_{jt-k} + u_{jt}, \qquad j=1,2,3$$

where $\Delta I_{s,t}$ refers to the quarterly percent change of component *s* of real private nonresidential fixed investment in structures and equipment, $\alpha_j$ denotes the constant, $u_{jt}$ denotes the error, and *j* refers to aggregate demand, oil-specific demand, and oil supply shocks.[3]

The Bureau of Economic Analysis (BEA)'s National Income and Product Accounts provide data on different components of private nonresidential fixed investment in structures and equipment. Table 1 shows the average shares of different components of private nonresidential fixed investment in structures and equipment. The BEA presents nonresidential private fixed investment in structures in five broad categories that have subcategories—or in some cases, sub-subcategories.

*Table 1*
Average Shares of Private Nonresidential Fixed Investment in Structures and Equipment by Category

| Investment component | Share (percent) | |
|---|---|---|
| | 1986:Q1–2005:Q4 | 1986:Q1–2017:Q4 |
| Structures | 31.2 | 32.5 |
| Commercial and health care | 13.1 | 11.8 |
| Manufacturing | 4.1 | 3.9 |
| Mining exploration, shafts, and wells | 3.0 | 5.0 |
| Power and communication | 4.7 | 5.4 |
| Other | 6.3 | 6.3 |
| Equipment | 68.8 | 67.5 |
| Information processing | 24.7 | 23.9 |
| Industrial | 15.8 | 15.0 |
| Transportation | 14.7 | 14.5 |
| Other | 13.2 | 13.2 |
| Mining and oil field machinery | 0.4 | 0.9 |
| Total | 100 | 100 |
| Oil | 3.4 | 5.9 |
| Non-oil | 96.6 | 94.1 |

Source: BEA.

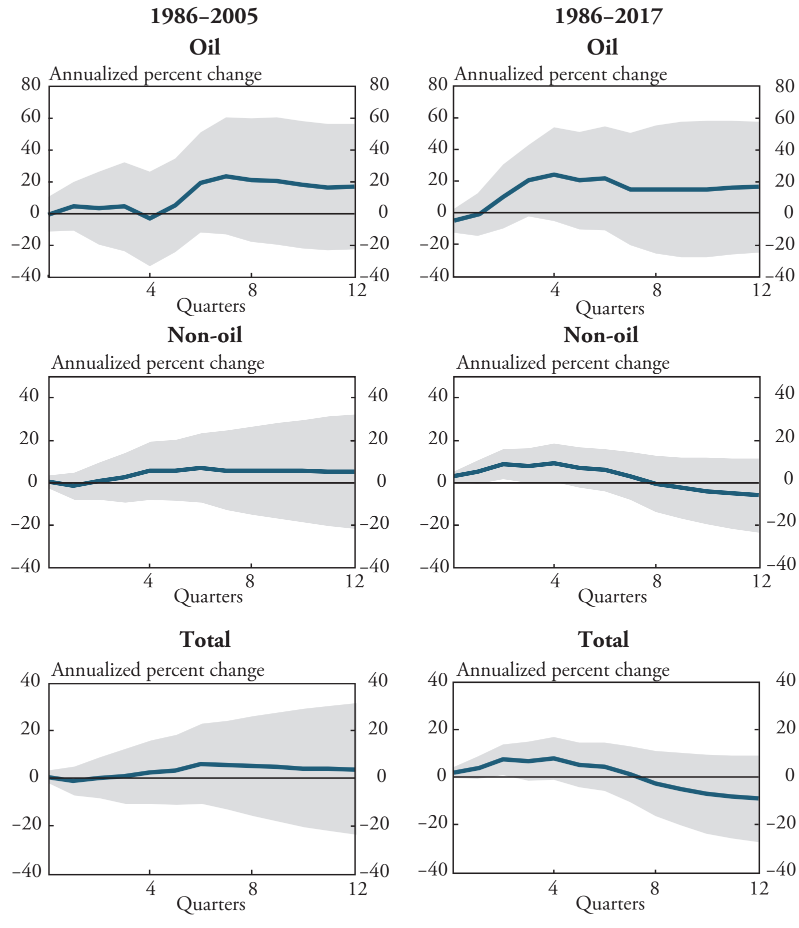
Similarly, the BEA breaks nonresidential private fixed investment in equipment into four broad categories that themselves have subcategories or sub-subcategories.

In this article, I consider the following broad investment categories for the impulse responses: oil, non-oil, and total investment. I define oil investment as the sum of investment in mining exploration, shafts, and wells (structures) as well as investment in mining and oil field machinery (equipment). And I define non-oil investment as the sum of the rest of the components of investment in structures and equipment. Total investment is total private nonresidential fixed investment in structures and equipment. The average shares of these broad categories are presented near the bottom of Table 1.

## *Investment responses to aggregate demand shocks*

Chart 2 shows the point estimates of the cumulative responses of each investment category to aggregate demand shocks.[4] The

*Chart 2*
## Investment Responses to Aggregate Demand Shocks




Notes: Solid lines show point estimates. Gray shaded regions represent 90 percent confidence intervals.
Sources: BEA, BLS, EIA, and author's calculations.

left-hand-side panel presents the results for the pre-shale period (1986:Q1–2005:Q4). An unexpected surge in aggregate demand drives up investment in all investment categories but with a delay of about a year in the pre-shale period. The responses of non-oil and total investment categories are flat in the first year before increasing and remaining positive. In response to an aggregate demand shock, oil investment shows a transitory increase in the first year followed by a large, sustained increase. However, the responses are not statistically significant.

The recent boom in U.S. oil production, brought about by the application of horizontal drilling and hydraulic fracturing, has been a major event in the global oil markets. In late 2017, average monthly oil production surpassed its previous peak in the 1970s. Moreover, U.S. net oil imports have declined substantially following the shale boom (Çakır Melek and Nie 2018). As the share of oil investment in U.S. aggregate investment has increased, U.S. investment patterns have changed too (Rodziewicz 2018). To assess the effect of the shale boom on the response of U.S. investment to oil price shocks, I next present impulses responses for the full sample covering 1986:Q1–2017:Q4.[5]

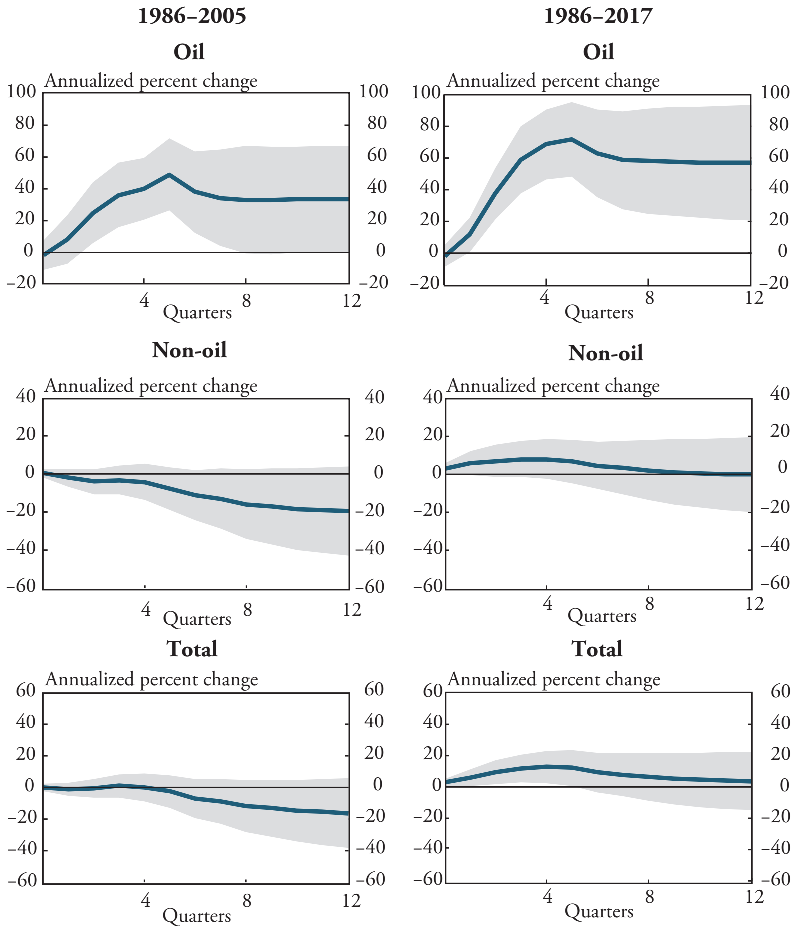
The right-hand-side panel in Chart 2 shows the responses of all three categories of investment in structures and equipment to aggregate demand shocks over the full sample period. An unexpected surge in aggregate demand drives up non-oil and total investment. The responses are positive on impact, statistically significant for about a year, and remain positive for almost two years before turning negative in the third year. The direct stimulating effect of higher aggregate demand on U.S. investment seems to dominate the indirect negative effect of higher oil prices in the short run. Higher costs due to higher oil (and other commodity) prices do not begin to weigh in for non-oil-related businesses until the second year. The response of oil investment, on the other hand, is positive at all horizons except in the first quarter and larger, but not statistically significant.

### *Investment responses to oil-specific demand shocks*

Chart 3 shows the responses of each investment category to oil-specific demand shocks. The left-hand-side panel of Chart 3 presents pre-shale responses. In the pre-shale period, an unexpected increase in oil-specific demand causes oil investment to increase relatively sharply in the first year, with the effect peaking in the second year. The increase is sustained and mostly statistically significant. The responses of investment in the other two categories, however, are either flat or negative in the first year and are negative after. The responses are not statistically significant.

In the full sample period, overall, investment is even more responsive to oil-specific demand shocks, as shown by the right-hand-side panel of Chart 3. An unexpected increase in oil-specific demand causes oil investment to increase sharply in the first year. The increase is

*Chart 3*
## Investment Responses to Oil-Specific Demand Shocks




Notes: Solid lines show point estimates. Gray shaded regions represent 90 percent confidence intervals.
Sources: BEA, BLS, EIA, and author's calculations.

sustained and highly statistically significant. More striking is the positive response of non-oil investment to an unexpected increase in oil-specific demand in the first two years. Non-oil investment increases on impact, with the effect peaking at the end of the first year. The response is statistically significant for more than a quarter. These patterns carry over to the response of total investment. An oil price increase driven by an unexpected increase in oil-specific demand increases total investment on impact, with the effect peaking in the second year. The increase is persistent and statistically significant for more than one year.

The sustained increase in non-oil investment for more than a year in response to a positive oil-specific demand shock in the full sample is a notable result. Some might expect higher oil prices to *decrease* non-oil investment due to higher costs and depressed consumer demand. However, positive spillover effects from the oil sector could drive this result. Higher oil prices make oil businesses more profitable, boosting oil investment and potentially boosting investment in other sectors. To the extent that additional investment in the oil sector creates additional demand for other sectors, positive spillovers from the oil sector to the aggregate economy may lead to higher aggregate investment.

Although the oil sector represents a small share of the U.S. economy—around 1.6 percent of U.S. GDP in 2014—oil is an important production input and consumption good. As a result, oil price shocks can have important macroeconomic implications. Baqaee and Farhi (2017) find that negative shocks to crucial industries, such as "oil and gas," can have a significantly larger aggregate effect than negative shocks to larger but less crucial industries. Moreover, oil shocks are highly persistent and can thus generate significant welfare costs (Hitzemann and Yaron 2016). With potential spillover effects to other areas of the economy, the implications of oil price shocks might be amplified.

Given the emergence of the shale oil sector in the past decade, positive spillover effects are likely. In fact, several studies document such effects. For instance, Allcott and Keniston (2018); Feyrer, Mansur, and Sacerdote (2017); and Gilje, Ready, and Roussanov (2016) examine the local implications of the shale boom and find strong positive spillovers to employment and wages at the local and regional level. Çakır Melek, Plante, and Yücel (2017) and Bjørnland and Zhulanova (2018) investigate spillovers to the aggregate economy after the shale oil boom and find positive spillovers to output and investment.

In that context, the responses presented in the left and right panels of Chart 3 reveal a key result that positive spillovers were not present before the shale boom. In the pre-shale period, an oil price increase driven by shocks specific to the oil market induces almost no effect—and in the second year, a negative effect—on non-oil investment. The response of total investment is flat in the first year before turning negative. These responses contrast with the positive, significant on impact responses of non-oil and total investment in the full sample, which peak in about a year.

### *Investment responses to oil supply shocks*

Chart 4 presents the responses of investment to an unexpected decline in the global oil supply in the pre-shale period and in the full sample. The left-hand-side panel shows that pre-shale responses are mostly negative at all horizons in all categories. The response of oil investment is flat in the first year and statistically insignificant at all horizons. The negative responses of non-oil investment and total investment are persistent and statistically significant for about a year.

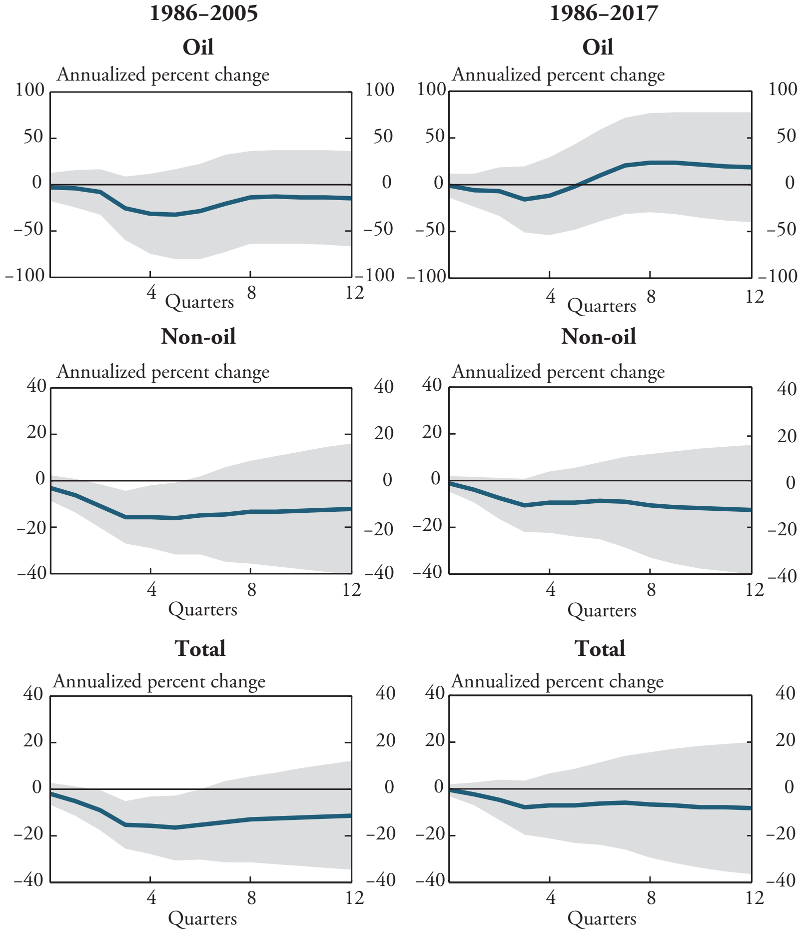
The right-hand-side panel in Chart 4 shows that an unexpected decline in global oil supply causes non-oil investment and total investment to decrease and remain persistently low at all horizons in the full sample as well. Oil investment, on the other hand, turns from negative to positive in the second year and remains positive thereafter. All three responses are statistically insignificant.[6]

### *Key takeaways*

Together, the impulse responses presented in Charts 2–4 reveal important differences in how the demand and supply shocks underlying the real price of oil affect U.S. investment—in other words, the source of the shock matters. In addition, the full sample results reveal that overall, investment is more responsive to aggregate and oil-specific demand shocks in the first two years, but not as responsive to disruptions in the global oil supply. This is consistent with results showing that the real price of oil is more responsive to aggregate and oil-specific demand shocks than oil supply shocks, and that recently, oil price fluctuations have been driven largely by aggregate and oil-specific demand shocks (see the appendix for details).

Comparing the impulse responses for the pre-shale period to those for the full sample yields two more key findings. Oil investment is less responsive to oil price shocks in the pre-shale period than in the full sample, regardless of the type of shock. In the pre-shale period, the response of oil investment to an oil price increase is delayed: either the recovery begins much later or the increase is less sharp than in the full sample (the top panels of Charts 2–4). This is in line with conventional

*Chart 4*
## Investment Responses to Oil Supply Shocks




Notes: Solid lines show point estimates. Gray shaded regions represent 90 percent confidence intervals.
Sources: BEA, BLS, EIA, and author's calculations.

oil production's lower sensitivity to oil price changes than shale (unconventional) production, which relies more on investment.[7] Shale production is more capital intensive with high initial production rates, requires continuous drilling for maintaining production, and is more responsive to price changes, with shorter investment payback periods.

Finally, investment is less responsive to an aggregate demand shock but more responsive to an oil supply shock in the pre-shale period. A positive aggregate demand shock increases non-oil and total investment in the pre-shale period, too, but with a delay, and the responses are not statistically significant. An oil price increase driven by a negative oil supply shock, on the other hand, causes a larger and significant decline in non-oil and total investment for about a year in the pre-shale period compared with a more muted, insignificant response in the full sample.

In summary, my findings suggest that the U.S. shale boom changed the response of U.S. investment to oil price shocks. Oil investment has become more responsive to an oil price increase, inducing higher non-oil investment. These positive spillovers from an oil price increase to U.S. aggregate investment are not present in the pre-shale period.

## III. Conclusion

Oil prices have more than doubled since their lows in early 2016, renewing interest in the effect of increasing oil prices on the U.S. economy. A primary channel through which oil price shocks affect the economy is investment. After controlling for the source of changes in oil prices, I find that oil investment has become more responsive to oil supply and demand shocks since the shale boom. Changes in the sensitivity of investment to oil price fluctuations extend beyond the more direct effects on oil investment. The response of non-oil investment has changed too. Non-oil investment has also become more responsive to demand shocks and less responsive to oil supply shocks since the shale boom, a pattern which has carried over to aggregate investment.

Together, these results suggest that the increased U.S. presence in the global oil market has led to greater spillovers from the oil sector to the aggregate economy. These findings may help explain why U.S. investment exhibited recessionary-like dynamics following the substantial decline in oil prices from June 2014 to March 2016 and then recovered as oil prices rose.

## Appendix

### Decomposing Changes in the Real Price of Oil into Oil Supply and Demand Shocks

Structural vector autoregressions (SVARs) are commonly used to model the global oil market and study the effect of oil price shocks on macroeconomic aggregates. The shocks recovered from an SVAR may differ depending on the variables included in the model and the identification scheme. The SVAR specification I use in this article is similar to Davig and others (2015), which is based on Kilian (2009).

I use a three-variable SVAR based on monthly data that include the percent change in global oil production, a suitable index for real global economic activity, and the real price of oil. The model is identified recursively. Oil supply does not respond contemporaneously (within a month) to changes in oil demand—that is, the short-run supply curve is vertical.[8] Additionally, changes in real oil prices driven by oil-specific shocks have no contemporaneous effect on global economic activity.

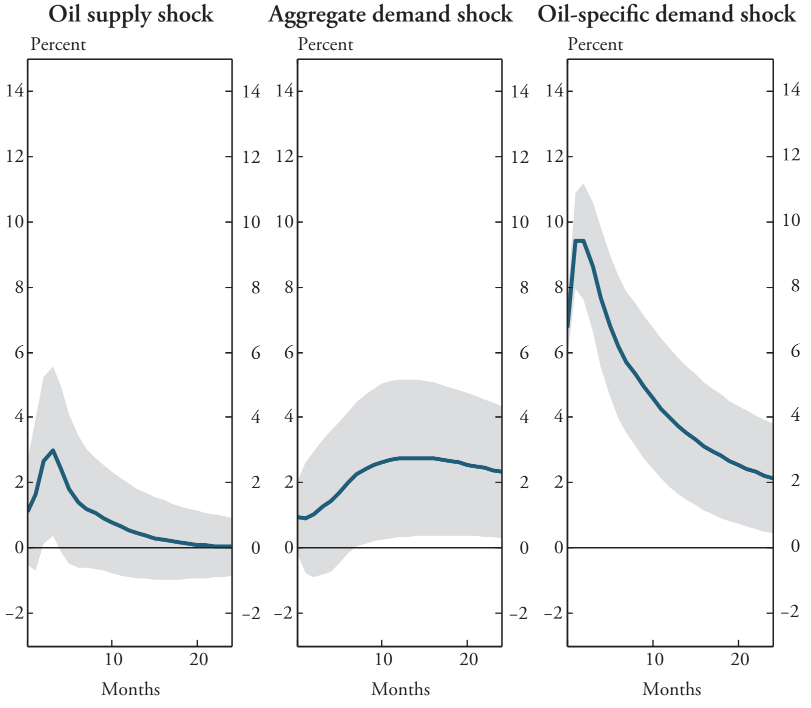
The SVAR covers the sample periods of January 1986 to December 2005 and January 1986 to December 2017 with four lags. The choice of starting date is motivated by Baumeister and Peersman (2013).[9] The lag order tends to be larger than estimates suggested by the Akaike Information Criterion conditional on an upper bound of 12 lags. Although the qualitative results are not sensitive to the lag order choice, I adopt a conservative approach due to the possibility of underfitting a VAR model (Hamilton and Herrera 2004).

Global oil production is obtained from the Energy Information Administration (EIA), and an updated time series for Kilian's (2009) index of global economic activity is obtained from his website.[10] The real price of oil is measured as the refiners' acquisition cost of imported crude oil, provided by the EIA, which is deflated by the U.S. Consumer Price Index (CPI). Both the real economic activity index and the real price of oil are expressed in logs. The model is estimated following Kilian (2009).

Charts A-1 and A-2 show the responses of the real price of oil to one standard deviation structural changes in the pre-shale period and in the full sample, respectively. Solid blue lines show point estimates with 90 percent confidence intervals. In the pre-shale period,

*Chart A-1*

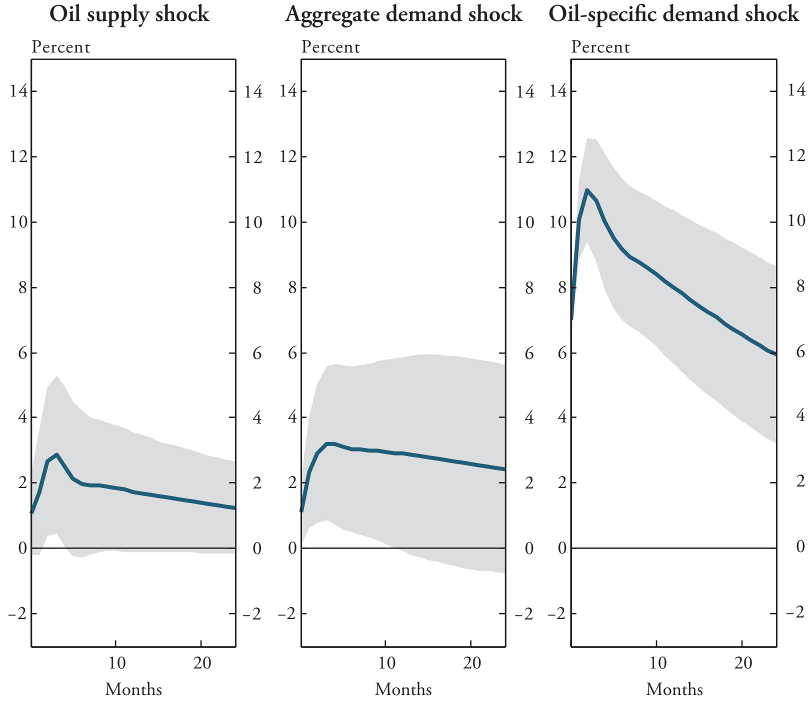
## Oil Price Responses to One-Standard-Deviation Structural Shocks, 1986–2005




Notes: Solid lines show point estimates. Gray shaded regions represent 90 percent confidence intervals.
Sources: BLS, EIA, and author's calculations.

*Chart A-2*

## Oil Price Responses to One-Standard-Deviation Structural Shocks, 1986–2017



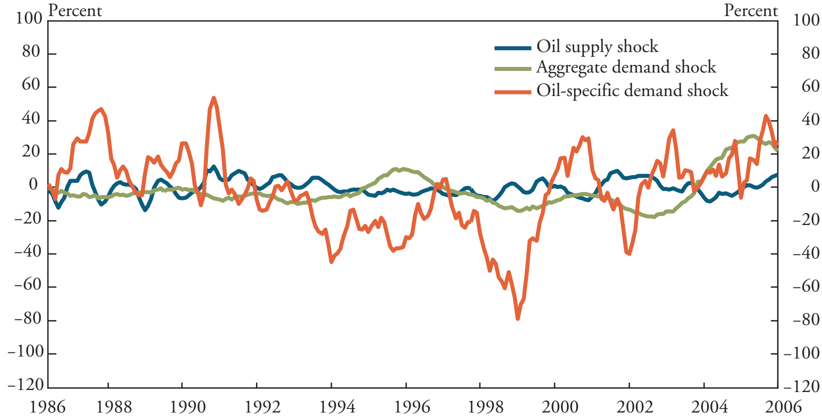

Notes: Solid lines show point estimates. Gray shaded regions represent 90 percent confidence intervals.
Sources: BLS, EIA, and author's calculations.

an unexpected negative oil supply shock causes a transitory increase in the price of oil. The effect of an unanticipated positive aggregate demand shock is similar on impact to that of a negative oil supply shock but highly persistent. A surprise increase in oil-specific demand has a more distinct effect on the price of oil. It causes a sharp, very large, and persistent increase in the real oil price, which is also highly statistically significant. The oil price responses in the full sample are similar to the pre-shale responses except a persistent increase in the real oil price in response to a negative supply shock in the full sample. These results are overall similar to estimates obtained by Davig and others (2015) using data from January 1985 to March 2015.

A historical decomposition is useful for understanding the contribution of these shocks to oil price movements. Charts A-3 and A-4 present the respective cumulative contribution of oil supply and demand shocks to the real price of oil over the two sample periods. Overall, the charts show that the real oil price is indeed driven by all shocks at all times, but their contributions differ. Historically, oil supply shocks have made smaller contributions to the real price of oil relative to demand shocks. And while aggregate demand shocks have caused long swings, oil-specific shocks are associated with fairly sharply defined swings in oil price. Charts A-3 and A-4 also suggest that demand shocks have played a larger role in recent episodes of large oil price changes, such as the global financial crisis and the 2014–16 oil price declines.[11] Oil-specific demand shocks played an especially important role in the 2014–16 decline (for more details, see Davig and others [2015]).

*Chart A-3*

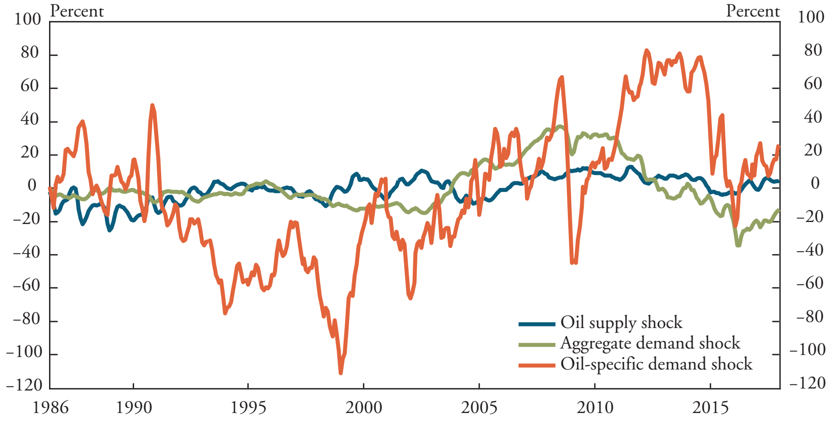
## Historical Decomposition of the Real Price of Oil, 1986–2005




Sources: BLS, EIA, and author's calculations.

*Chart A-4*

## Historical Decomposition of the Real Price of Oil, 1986–2017




Sources: BLS, EIA, and author's calculations.

## Endnotes

[1]These results rely on the assumption that investment responds symmetrically to energy price increases and decreases.

[2]She then builds a model to explain her empirical findings and shows that the oil firm's ability to cover high fixed costs in the sector, which depends on the size of the oil price shock, is important in understanding the responses.

[3]The lag structure follows existing research—see, for example, Hamilton (2003), Edelstein and Kilian (2007), Kilian (2008), and Baumeister and Kilian (2016b).

[4]I obtain the level responses for the three investment categories by cumulating the estimated impulse responses.

[5]Splitting the sample at 2005 results in too few observations for the empirical analysis in the post-2005 period.

[6]Oil investment being more responsive to demand shocks than supply shocks is consistent with Bornstein, Krusell, and Rebelo's (2017) finding that investment in the oil industry is driven mostly by demand shocks.

[7]See, for example, Dale (2016); and Bjørnland, Nordvik, and Rohrer (2017).

[8]The very low short-run oil supply elasticity estimate (annual 0.12) reported by Bornstein, Krusell, and Rebelo (2017)—along with the finding of Anderson, Kellogg, and Salant (2018) that oil production from existing wells in Texas does not respond to oil prices—supports this assumption.

[9]The authors find a considerable break in oil market dynamics in the first quarter of 1986 in a time-varying SVAR framework. Moreover, prior research frequently uses this date for splitting samples, which coincides with the collapse of the Organization of the Petroleum Exporting Countries (OPEC)'s market share and the start of the Great Moderation.

[10]The index is the cumulative average of the increase in bulk dry cargo ocean freight rates, deflated by the U.S. CPI and linearly detrended. Kilian and Zhou (2018) provide detailed information on this index and other indicators of global real economic activity.

[11]For a more detailed discussion on major oil price events, see Hamilton (2011) and Baumeister and Kilian (2016a).

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