Why Did the 2014-16 Oil Price Decline Not Create a Surge in Economic Activity?

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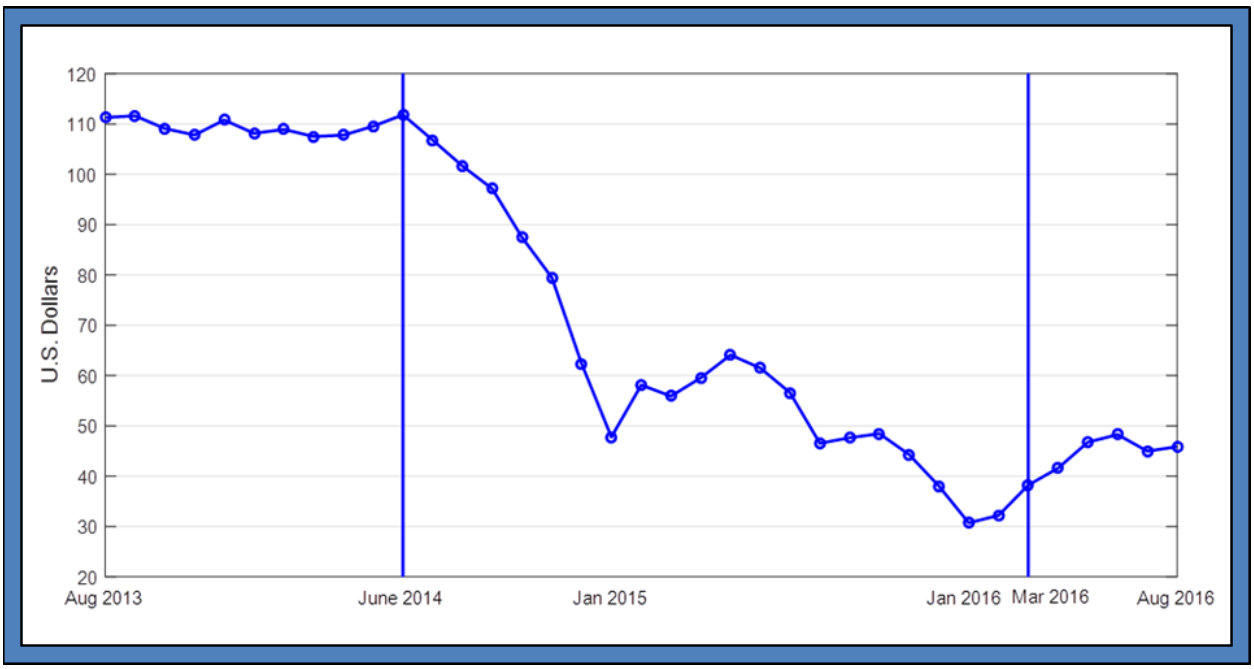
Introduction

Between June 2014 and March 2016, the inflation-adjusted price of oil dropped by 66% (see Figure 1). This price decline was one of the largest in history, yet average U.S. economic growth accelerated only slightly from 1.8% at annual rates before the oil price decline to 2.2% after the oil price decline (see Table 1). The absence of an economic boom in response to falling oil prices has puzzled some observers, given that higher oil prices in the past have been blamed for major economic recessions.

Given the growing consensus in the academic literature that unexpected oil price increases tend to have only modest effects on U.S. economic growth, however, it would be surprising, if an unexpected decline in the price of oil had large stimulating effects on the economy (see Kilian, 2008). Indeed, recent research shows that the sluggish response of U.S. real GDP growth to unexpectedly lower oil prices is exactly what standard economic models that emphasize the effects of oil price shocks on consumer and business spending would have predicted (see Baumeister and Kilian, 2017; Baumeister, Kilian and Zhou, 2017).

Figure 1
Price per Barrel of Brent Crude Oil



Are Oil Price Shocks Demand or Cost Shocks for the U.S. Economy?

A time-honored view has been that lower oil prices stimulate the economy by lowering the cost of producing domestic goods and services. Outside of the refining sector, however, there are few industries that heavily depend on crude oil or oil products as a factor of production, casting doubt on the empirical relevance of this channel. If there is any sector of the economy that should directly benefit from lower prices through this cost channel, it would have to be the transportation sector; yet data for truck freight, rail freight and air transportation volumes show no evidence at all of growth in the U.S. transportation sector accelerating after the 2014 oil price decline.

In fact, the stock returns for industries that rely on oil or oil products in production (such as chemicals or rubber and plastics) increased only slightly more than the average U.S. stock return after June 2014, if at all. Thus, there is no evidence that the cost channel of transmission is important for the U.S. economy.

In contrast, the stock returns of industries whose demand depends on the price of oil (such as tourism and retail sales) have been far above average stock returns. This evidence supports the alternative (and by now widely accepted) view that the primary channel of the transmission of unexpected oil price declines is higher demand for domestic goods and services (see Lee and Ni, 2002; Edelstein and Kilian, 2009; Hamilton, 2013). For example, consumers faced with a windfall gain in income caused by unexpectedly low gasoline prices will spend most of this extra income, stimulating economic growth via a Keynesian multiplier effect. This demand channel of transmission is crucial for understanding what happened after June 2014.

The Demand Channel of Transmission

Changes in the real price of gasoline affect the purchasing power of U.S. consumers to the extent that consumers spend their income on gasoline produced from imported crude oil. As the price of crude oil decreases, so does the price of gasoline.[1] Because the demand elasticity for gasoline is smaller than one, this means that consumers effectively spend less income on imported crude oil than before the gasoline price decline. Thus, they are collectively able to spend more on domestically produced goods and services. If there is slack in the economy, this increase in domestic demand, all else equal, raises real GDP.

Unexpected oil price declines may also increase business investment spending. Domestic firms have an incentive to invest, as consumer demand for goods and services increases in response to lower oil prices. Their spending adds to the overall stimulus for the U.S. economy.

This demand channel of transmission is well documented in the literature. Recently, there has been some debate about whether lower gasoline prices may have failed to stimulate domestic spending this time because of structural changes in the transmission of oil price shocks to consumer spending. It can be shown that these concerns are unfounded.

Has the Effect of Oil Price Shocks on Consumer Spending Changed Since the 2000s?

One concern has been that the decline in the price of oil may not have been passed on to retail motor fuel prices, but the data show that these cost savings were fully passed on by refiners and gasoline distributors. Another conjecture has been that consumers, unlike in the past, chose to pay back credit card debt or to increase their savings rather than spending their extra income, but this hypothesis is not supported by the data either. Nor is there support for the notion that increased uncertainty about gasoline prices has depressed automobile demand, slowing overall consumption growth.

In fact, there was a notable increase in private consumption after June 2014. As Table 1 shows, average real consumption growth accelerated from an average annual rate of 1.9% to 2.9% during 2014Q3-2016Q1. Given that private consumption alone accounts for about 70% of real GDP, this increased consumption growth, all else equal, implies a substantial increase in U.S. real GDP growth.

Table 1
Average Growth at Annual Rates in U.S. Real GDP and some of its Components (Percent)

	2012Q1-2014Q2	2014Q3-2016Q1
Real GDP	1.8	2.2
Private Consumption	1.9	2.9
Nonresidential Investment	5.1	1.5
Oil-Related Investment	7.2	-48.2
Non-Oil Related Investment	4.9	4.6
Exports	3.2	0.7
Imports	2.3	2.9

Note: Oil-related investment includes investment in petroleum and natural gas structures as well as mining and oil field machinery.

Why U.S. Real GDP Growth Remained Sluggish

Why then did U.S. real GDP growth remain so sluggish? Given that the United States produces about half of the crude oil that it consumes, it is not enough to focus on the spending by consumers and by firms satisfying the demand of consumers. The overall change in spending also reflects the response of domestic oil producers to lower oil prices. As Table 1 shows, there was a dramatic drop in nonresidential investment by the oil sector after June 2014, which largely offset the increase in private consumption growth, lowering average real GDP growth to 2.2% at annual rates.

This type of oil investment response is by no means unprecedented. For example, the sharp decline in the price of oil in 1986 resulted in an increase in private consumption and a decline in oil-related nonresidential investment much like that in 2014-16 (see Edelstein and Kilian, 2007).

Did the U.S. Shale Oil Revolution Alter the Transmission of Oil Price Shocks?

A common concern is that there may have been a structural break in the transmission of oil price shocks because of the increased importance of the oil sector for the U.S. economy since about 2011. Much has been made of the increased importance of the shale oil sector, in particular, for understanding the effects of the recent oil price decline on the U.S. economy.

Shale oil (also known as tight oil) refers to crude oil extracted from nonpermeable rock formations by means of horizontal drilling and fracking. Since this new extraction technology was introduced in the late 2000s, U.S. shale oil production has surged, reversing the long-run decline in U.S. crude oil production since the 1970s (see Kilian, 2016; 2017). When the price of oil fell after June 2014, the shale oil industry came under increasing financial pressure. Shale oil producers responded by cutting costs and increasing efficiency on an unprecedented scale.

One argument that increased shale oil production may have changed the transmission of oil price shocks focuses on the banking sector. Many shale oil producers received loans from U.S. banks before the oil price decline, with oil deposits below the ground serving as collateral. The value of this collateral sharply declined after June 2014, making these loans riskier than anticipated by the banks. It has been suggested that oil loans going bad may have caused fears of contagion in the banking sector, not unlike the mortgage loans held by banks during the housing and financial crisis of 2008, undermining financial intermediation and explaining the absence of an economic boom. There is no empirical support for this view, however. In fact, the exposure of banks to the oil sector loans is much smaller than their exposure to mortgage loans prior to the financial crisis, and bank stocks continued to rise long after the 2014 oil price decline.

Given the growth in the U.S. oil sector caused by the shale oil revolution, it has also been argued that declines in investments by the oil sector may have spilled over to investment expenditures in other sectors of the economy, causing a ripple-effect across the economy. For example, lower demand for oil equipment may cause investment in the steel sector to decline. There is no apparent co-movement in investment spending across sectors, however. Nor is there theoretical or empirical support for the notion that oil investment has become more sensitive to oil price fluctuations.

There is evidence that the recent oil price decline, unlike earlier oil price declines, was not associated with increased petroleum imports, given the plentiful supply of shale oil in the United States. The latter effect, however, is not only small, but it implies higher rather than lower real GDP growth and hence cannot explain the observed sluggish growth.

Thus, the sluggish response of U.S. economic growth is not the result of a structural break caused by the shale oil boom. This does not mean that the U.S. shale oil boom did not matter for the response of the U.S. economy, of course. Clearly, without this boom, the share of oil and gas extraction in GDP, which in 2014 was almost the same as in 1985, would have been much lower and the sharp decline in oil-related investment would have mattered less for U.S. real GDP growth.

Did the Recent Decline in the Oil Sector Affect the Economy More Broadly?

Yet another argument for slower economic growth has been that frictions in reallocating workers from the oil sector to other sectors may have caused higher U.S. unemployment. This view is not only hard to reconcile with the continued rapid decline in the overall U.S. unemployment rate, but there is also evidence that even in most oil-producing states (such as Texas, New Mexico or Oklahoma) the unemployment rate declined from June 2014 to March 2016, and that these declines cannot be explained simply by migration away from oil-producing states. For example, the unemployment rate in Texas dropped by 0.8 percentage points and the number of unemployed in Texas declined, while the labor force and the number of employed increased. In fact, in five of the seven most important oil-producing states the unemployment rate declined. Even in North Dakota, one of the states hardest hit by lower oil prices, the unemployment rate only increased from 2.7% to 3.1% in the seven quarters after the oil price decline. We conclude that there is no evidence of frictions preventing the reallocation of labor used in oil production.

It is also possible, of course, that there are frictions that prevent the reallocation of the capital employed in producing oil. The number of oil rigs, for example, in early 2016 had declined by 75% relative to its peak in October 2014. Many of these rigs are sitting unused in storage facilities, suggesting considerable underutilization of capital. Likewise, petroleum rail car loads declined by 30% after September 2014. To the extent that this capital is no longer used, one would expect the value added by the U.S. economy to decline by construction. In fact, the underutilization of capital in oil-producing states such as North Dakota goes much further than the oil sector narrowly defined. It includes motels that are no longer occupied, local bars that are empty, and local stores without customers, for example. It is difficult to quantify the loss in real GDP caused by this widespread underutilization of capital in oil-producing states, but it can be shown that U.S. real GDP growth is much the same whether oil-producing states are included or excluded, suggesting that the state-level effects of underutilized capital are small enough to be ignored. Thus, we can be confident that frictions to the reallocation of capital and labor do not explain the sluggish response of the U.S. economy to lower oil prices.

The Net Stimulus

Given that there is no evidence that the transmission of oil price shocks has changed since the 2000s, one can use standard regression-based methods based on historical data to estimate the cumulative effect of lower oil prices on U.S. real GDP of changes in private consumption and non-oil business investment spending.

It is straightforward to quantify the cumulative effects of unexpected changes in consumers' purchasing power on private consumption by regression methods, accounting for changes in the dependence of the U.S. economy on imports of gasoline and crude oil. It can be shown that between June 2014 and March 2016, the consumption stimulus raised real GDP by 0.51 percentage points. The effect on non-oil business investment may be estimated in much the same way as for private consumption and accounts for an additional cumulative increase by 0.19 percentage points in U.S. real GDP.

This stimulus, however, is largely offset by a decline in real GDP of 0.57 percentage points associated with lower investment by the oil sector, resulting in a very small net stimulus of about 0.1 percentage points of average annual real GDP growth (see Table 2). This estimate is consistent with the observed small increase in average real GDP growth in Table 1. Thus, the absence of a large economic boom in response to lower oil prices is exactly what standard models of the transmission of oil price shocks based on the demand channel predict.

Table 2: The Net Stimulus from Unexpectedly Lower Real Oil Prices, 2014Q2-2016Q1

Effect on U.S. Real GDP of	Percent of Cumulative Real GDP Growth
Private Consumption	0.51
Oil-Related Private Investment	-0.57
Non-Oil Related Private Investment	0.19
Net Stimulus from Investment and Consumption	0.13

Note: All cumulative multipliers have been computed based on an import propensity of 15%.

Is This Time Different?

There are few major oil price declines in history. The episode that is arguably closest to recent events is the oil price drop that started in late 1985, when a shift in Saudi policies caused a large and sustained decline in the global price of oil that extended into 1987. Although there are a number of differences between these two episodes, it can be shown that the economic mechanisms at work in 1986-87 were very much the same as today, as was the outcome that the net stimulus from lower oil prices is effectively zero.[2]

Concluding Remarks

No one familiar with standard empirical models of the transmission of oil price shocks should have been shocked by the lackluster performance of the U.S. economy since June 2014. It is well documented that the consumption stimulus from lower oil prices is only modest, and the recent episode is no exception. Likewise, earlier studies of the large and sustained decline in the price of oil in 1986 already documented the sensitivity of U.S. oil investment to falling oil prices, so the sharp decline in oil investment after June 2014 and the implied reduction in U.S. real GDP growth should not have come as a surprise.

Nevertheless, the most recent episode has sharpened our understanding of the effects of lower oil prices on the economy. What has not been fully appreciated previously is that the oil investment response does not depend on the magnitude of the oil price decline so much, but on how far the expected oil price declines relative to the break-even point. Hence, oil investment may change disproportionately, as oil price expectations change. This fact may hold the key to understanding the macroeconomic consequences of oil price shocks in countries with a sizable oil sector such as the United States.

In contrast, when analyzing European economies without a domestic oil industry of their own, modeling oil investment is not a concern. Our analysis implies that the decline in the Brent price of crude oil, all else equal, should have a larger stimulating effect on these economies than on the U.S. economy. There are several mitigating factors, however. First, one of the determinants of lower oil prices has been a slowdown in the global economy that is likely to slow growth in export-oriented European economies

more than in the United States. Second, the Euro depreciated against the U.S. dollar after June 2014, offsetting in part the decline in the dollar price of Brent crude oil. Third, given the much larger share of gasoline taxes in European retail gasoline prices, the pass-through from lower oil import prices to retail gasoline prices is much smaller, and hence the response of consumers is more muted.

Endnotes

Professor Kilian presented on this article's topic during his keynote speech at the JPMCC's August 2017 international commodity symposium, which took the place of the JPMCC's annual Research Council meeting.

The views in this paper are solely the responsibility of the authors and should not be interpreted as reflecting the views of the Bank of Canada.

1 The extent of the gasoline price increase depends on the cost share of crude oil in producing gasoline.

2 One important difference is that the cumulative decline in the price of oil after June 2014 was twice as large as that in 1986, while the share of oil and gas extraction in GDP was about the same as in late 1985. At the same time, the dependence on imported oil and gasoline was much lower in 1986 compared to today. These facts together explain why the estimated response of private consumption to lower oil prices in particular was much lower in 1986. A second difference is that the oil price decline in 2014-16 was in part associated with a global economic slowdown which slowed the growth in U.S. real exports, whereas the oil price drop in 1986 was caused by political developments in the global oil market. Controlling for the global economic slowdown, U.S. real GDP growth after June 2014 would have been somewhat higher without affecting the substance of the results. Finally, the 1986 oil price decline coincided with the Tax Reform Act of 1986, which makes it difficult to disentangle the causal effects on nonresidential investment, but helps explain the disproportionately large decline in oil investment that took place in 1986.

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