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Christiane Baumeister
Lutz Kilian

CESIFO WORKING PAPER NO. 5755
CATEGORY 10: ENERGY AND CLIMATE ECONOMICS
FEBRUARY 2016

ISSN 2364-1428

CESifo
Center for Economic Studies & Ifo Institute

CESifo *Working Paper No. 5755*

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Abstract

Some observers have conjectured that the steep decline in the price of oil between June and December 2014 resulted from positive oil supply shocks in the second half of 2014. Others have suggested that a major shock to oil price expectations occurred when in late November 2014 OPEC announced that it would maintain current production levels despite the steady increase in non-OPEC oil production. Both conjectures are perfectly reasonable ex ante, yet we provide quantitative evidence that neither explanation appears supported by the data. We show that more than half of the decline in the price of oil was predictable in real time as of June 2014. We attribute $11 of this predictable decline to the cumulative effects of adverse demand shocks prior to July 2014, reflecting a slowing global economy, and $16 to positive oil supply shocks and to shocks to expected oil production that occurred prior to July 2014. The remaining oil price decline is accounted for by a shock to oil price expectations in July 2014 that lowered the demand for oil inventories and a shock to the demand for oil associated with an unexpectedly weakening economy in December 2014, which lowered the price of oil by an additional $9 and $13, respectively.

JEL-codes: Q430, C530.

Keywords: oil price declines, OPEC, oil supply, oil demand, shale oil.

Christiane Baumeister
University of Notre Dame
Department of Economics
722 Flanner Hall
USA – Notre Dame, IN 46556
cjsbaumeister@gmail.com

*Lutz Kilian**
University of Michigan
Department of Economics
611 Tappan Street
USA – Ann Arbor, MI 48109-1220
lkilian@umich.edu

*corresponding author

First version: January 21, 2015. This version: September 13, 2015
We thank Christopher Hau for excellent research assistance. We thank Lucas Davis, Ana Maria Herrera, Ryan Kellogg, Chris Knittel, John Parsons, Bob Pindyck, and Rob Vigfusson as well as four anonymous referees for helpful comments We thank the Friedrich August von Hayek-Foundation and Jackstädt Foundation for financial support.

1. Introduction

Recently, the price of oil experienced one of its largest declines in modern history. Between June 2014 and December 2014, the monthly average price of Brent crude oil fell by $49, which amounts to 44% of its original value (see Figure 1). Sustained declines in the price of oil are rare events. The 2014 oil price decline is only surpassed in magnitude by the 56% cumulative decline in the price of oil in early 1986, after Saudi Arabia abandoned its policy of stabilizing the price of crude oil, and the 67% cumulative decline during the financial crisis of late 2008.

Low oil prices have put severe economic stress on oil producers around the world and have even called into question the sustainability of alternative forms of energy production. They have also undermined the fiscal stability of countries such as Iran, Russia and Venezuela that rely heavily on foreign exchange earnings from crude oil exports, while providing an economic stimulus to many net oil importers. There is growing concern that further steep declines in the price of oil may threaten the economic and political stability of oil-producing countries, but also the hope that lower oil prices would add much needed strength to the global economy.

It remains an open question what caused the decline in the price of oil after June 2014, the severity of which surprised even industry experts. Unlike the decline in early 1986, which was clearly associated with a policy shift in Saudi Arabia, and the decline in late 2008, which was caused by the global financial crisis, the causes of the decline in the second half of 2014 are not immediately obvious. A natural question is whether this oil price decline is different and, if so, how. The objective of this paper is to examine these questions, drawing on insights from the literature on modelling the determinants of the price of oil.

The traditional view among economists has been that changes in the price of oil are inherently unpredictable. This view has been questioned in recent years, with several studies highlighting the economic determinants of the price of oil, and exploiting predictable variation in these determinants for out-of-sample forecasting (see, e.g., Baumeister and Kilian 2012, Alquist, Kilian and Vigfusson 2013). Building on these advances in modelling the global oil market, we provide evidence that more than half of the decline in the price of oil between June and December 2014 was predictable using only information publicly available as of June 2014.

Our oil price forecasts are constructed from a simple vector autoregressive (VAR) model that has been shown to be helpful in understanding historical oil price fluctuations and that, hence, provides a natural baseline for studying the recent oil price decline. This VAR model relates the inflation-adjusted price of oil to its own past and past values of other oil market variables such as changes in global oil production, changes in crude oil inventories, and a measure of global real economic activity designed to capture across-the-board shifts in the demand for commodities that are associated with global business cycle fluctuations.

We trace the predictable component in the price of oil in part to the cumulative effects of adverse demand shocks prior to July 2014 that reflected an unexpected slowdown of the global economy. We also trace it in substantial part to the cumulative effects of positive oil supply shocks and to shocks to expected oil production that occurred prior to July 2014. Only in July 2014 and in December 2014 is there evidence of large negative forecast errors for the price of oil. We show that neither of these two forecast errors is consistent with the occurrence of a large positive shock to the supply of crude oil. We provide evidence that the December 2014 shock, in particular, did not reflect the November 27 OPEC decision not to lower its oil production in response to higher oil production by non-OPEC producers. The pattern of the forecast errors for December, instead, is highly suggestive of a large negative flow demand shock associated with an unexpectedly slowing global economy, while the July forecast error appears consistent with a negative shock to storage demand reflecting a more positive outlook on oil production, a gloomier outlook on the global economy, or both.

The remainder of the paper is organized as follows. In section 2 we review the salient data. In section 3, we assess the extent to which the oil price decline was predictable as of June 2014. In section 4, we examine the timing and magnitude of the oil price shocks occurring after June 2014 and their economic determinants. Section 5 presents an outlook for early 2015 based on the information available in December 2014. In section 6 we compare the 2014 oil price decline to similar episodes in the past, and we discuss similarities and differences across these episodes. Section 7 explores the implications of declining oil prices for oil producers. Section 8 examines the question of whether the global oil market is still working normally in light of the continued decline in oil prices. The concluding remarks are in section 9.

2. What Has Changed since June 2014? A Review of the Data

Before presenting our methodology it is useful to review some of the key oil market data since June 2014. Given the speed of the decline in the price of oil, it is natural to suspect that there should be large shifts in other observables as well. As we show, this is not the case in general. Most oil market indicators other than the price of oil have evolved smoothly and no indicator shows nearly the same variability as the price of oil.

2.1. Global Oil Production

A first question is whether there have been important changes in global oil production since June 2014. Unexpected changes in oil production traditionally have been considered important in explaining oil price fluctuations (see Hamilton 2003). Arezki and Blanchard (2014), for example, cite surprise increases in global oil production as one of the main causes of the decline in the price of oil. They attribute these supply surprises notably to the recovery of Libyan oil production and the resilience of oil production in Iraq. Table 1 shows that indeed Libya, Iraq and Syria combined have been able to increase their oil production since June 2014 by 18%, but the increments are nevertheless modest in that Iraqi oil production as a share of world oil production only increased from 3.9% in June to 4.0% in December.

Among the three largest oil producers in the world, Saudi Arabia reduced its oil production ever so slightly by 0.23%, whereas oil production in the former USSR and in the United States continued to grow by 1.9% and 3.9%, respectively. Overall, both OPEC and non-OPEC countries increased their production, with the world total growing at 0.9%. Figure 1 confirms that the growth rate of global oil production since June 2014 has been modest, notwithstanding the surge in U.S. shale oil production in recent years (see Kilian 2014). It may be tempting to conclude from this evidence that oil supply shocks cannot have been important in the second half of 2014, but what matters for answering this question is not whether oil production moved a lot or not, but whether it moved relative to what it was expected to be. If oil production was expected to decline, for example, but did not because of a positive oil supply shock, then this shock would trigger an additional adjustment of the price of oil without a change in observed oil production. In section 4, we will show how this question can be addressed empirically.

2.2. Global Real Economic Activity

Figure 1 also plots the global real economic activity indicator originally developed in Kilian (2009). This index has been designed as a measure of the business cycle in industrial commodity markets and can be interpreted as a leading indicator for global industrial production (also see

Bakshi, Panayotov and Skoulakis 2011; Ravazzolo and Vespignani 2015).[1] Negative index number values represent recessionary phases and positive numbers expansionary phases. The magnitude of the deviation from zero in the index has no intrinsic meaning. It should only be viewed in relation to its own past. The bar chart provides evidence of a weakening global economy, especially in the first half of 2014, with some recovery in the second half, as the price of oil declined, followed by a sharp deterioration in global real activity in December 2014. Again it is important to keep in mind that this index measures the state of the global economy rather than shocks to the economy.

2.3. Other Commodity Prices

It has been noted that there is a close relationship in the long run between the price of crude oil and the prices of other industrial commodities. Both respond to fluctuations in the global business cycle (see, e.g., Barsky and Kilian 2002; Baumeister and Kilian 2012). Baumeister and Kilian (2014a) recently showed that there is a similar business-cycle driven component also in the price of food commodities. The fact that the price indices of industrial raw materials, metals and food all have declined since June 2014 therefore is a strong indication of a reduction in the demand for crude oil associated with the global business cycle. The fact that the cumulative decline is on average between 5% and 15% compared with 44% for crude oil, however, tells us that there must be additional oil-market specific explanations for the disproportionate decline in the price of oil.

2.4. Crude Oil Inventories

[1] Unlike measures of monthly global real GDP or global industrial production, this index does not depend on ad hoc exchange rate weights or interpolation assumptions, it allows for changes in the share of the industrial sector in the economy over time, and its coverage is truly global. Unlike alternative measures such as proxies for global electricity consumption, the index is available for a longer time span and more closely tied to the demand for industrial raw materials.

Another potential explanation of the decline in oil prices is related to declining stocks of crude oil. The role of inventories and of forward-looking behavior in the market for crude oil has recently received increased attention with contributions by Hamilton (2009), Kilian and Murphy (2014), and Knittel and Pindyck (2015), among others. It can be shown that an unexpected reduction in the demand for storage is followed by lower oil prices as well as lower oil inventory holdings. At first sight, this explanation may seem at odds with the recent crude oil inventory data. Data from the International Energy Agency (IEA) show that industry crude oil stocks in OECD countries have remained largely flat, with only a slight decline between July and September (see International Energy Agency 2015). It is important to keep in mind, however, that these data are by no means inconsistent with strongly reduced demand for oil storage putting downward pressure on the price of crude oil.

For example, the work of Kilian and Murphy (2014) shows that, following an unexpected reduction in the demand for storage in anticipation of a future excess of oil supplies relative to demand, one would expect oil inventories to fall. It also shows, however, that an unexpected reduction in the flow demand for crude oil associated with a weakening global economy would cause oil inventories to rise, as would a positive shock to oil supply, representing higher than expected oil production. All three types of shocks are potentially important (and not mutually exclusive) explanations of the oil price decline since June 2014. Their net effect on the path of inventories is indeterminate without further information on the magnitude of these shocks. For example, the observed nearly flat path of inventories in Figure 1 would be consistent with a situation in which lower flow demand for oil and/or a higher flow supply of oil increased oil stocks, while at the same time lower demand for storage (associated with expectations of an increasing oil glut) reduced oil stocks, resulting in approximately unchanged inventories.

How plausible is it that demand for storage declined unexpectedly in recent months? Arezki and Blanchard (2014), for example, attribute a large part of the recent decline in oil prices to a shift in expectations about the future path of global oil production, following OPEC's announcement on November 27 that it would not reduce its oil production to compensate for higher oil production elsewhere. It is not clear that this explanation fits the data. First, at best this explanation could help account for the additional decline in the price of oil starting in December. It leaves unexplained the earlier decline. Second, if this explanation were correct, assuming no major change in global oil production or real activity for other reasons, one would have expected a sharp drop in the price of oil and in inventories in December. The OECD inventory data in Figure 1 do not show such a drop in November, nor do subsequent data releases for the December inventory data. Moreover, a simple event study using daily Brent spot prices shows no clear effect of the announcement on the Brent price of oil relative to the ongoing decline in the Brent price. If there are any effects, they appear short-lived. This could mean that the announcement effect was simply not quantitatively important or that perhaps this OPEC decision was anticipated by the market in the months leading up the OPEC meeting and was already priced in.

Of course, expectations of weaker demand for oil from Europe and Asia could have lowered demand for storage independently and more gradually. The apparent failure of Abenomics leading up to the Japanese elections in November 2014; Draghi publicly announcing in November that he was willing to purchase government bonds, given the euro zone's weak growth during the summer; the renewed discussion about a Greek exit from the euro zone starting in July 2014; concerns over the effects of sanctions against Russia on the European economy starting in July 2014; as well as the slowdown of the Chinese economy starting in the third quarter of 2014 all could have lowered oil demand for storage in the second half of 2014.

2.5. The Role of the U.S. Dollar Exchange Rate

The last panel of Figure 1 shows that the U.S. dollar trade-weighted exchange rate has appreciated against a broad range of currencies by 8 percent since June 2014. It is common in the press to attribute oil price fluctuations to the depreciation or appreciation of the dollar. Because crude oil is traded in dollars, an appreciating dollar all else equal makes it more expensive for refineries outside of the United States to buy crude oil, reducing non-U.S. demand for oil. It may seem that this mechanism could help explain the extent of the fall in the price of oil in recent months. There are three reasons to be skeptical of any exchange-rate based explanation. First, an appreciating U.S. dollar also stimulates exports outside the United States, which in turn increases the demand for oil, potentially offsetting the initial effect. Second, this argument applies equally to the dollar price of crude oil and the dollar-denominated price of other commodities, but Figure 1 showed much more modest declines in other commodity prices than in the price of oil. Third, the premise that the U.S. exchange rate appreciation was unrelated to the determinants of the price of oil is not credible. To the extent that both the price of oil and the U.S. exchange rate depend on the evolution of the global economy, one cannot think of the exchange rate having an independent or additional effect. Indeed, there is no evidence of a systematic predictive relationship between the trade-weighted U.S. exchange rate and the price of oil over extended periods of time (see Alquist et al. 2013).

3. Measuring Surprises in the Data

Given the comparative stability of the Brent price of oil until June 2014, it is tempting to conclude that the recent oil price decline must have been caused by oil demand and supply shocks in the second half of the year, as conjectured by Arezki and Blanchard and (2014). This explanation presumes that the Brent price of oil is largely unpredictable, however, and ignores strong recent evidence that changes in the price of oil often are predictable at least to some extent (see, e.g., Alquist, et al. 2013). This fact raises the question of how much of the recent price decline was actually predictable using information publicly available as of the end of June 2014 (or for that matter, given the additional information available in subsequent months) and how much was unforeseen. Answering this question is helpful because it tells us whether the recent oil price decline was triggered by economic shocks occurring prior to July 2014 or by more recent shocks. It can also help us in identifying when these shocks occurred and in determining what type of economic shock provides a plausible explanation for the decline in the price of oil.

A natural thought experiment is to take the reduced-form representation of recently developed structural models of the global oil market and to ask how much of the recent oil price decline this forecasting model would have predicted when estimated only on data available at the end of June 2014.[2] In this paper, we follow Baumeister and Kilian (2012) and other recent studies in employing a four-variable vector autoregressive forecasting model based on the structural model of Kilian and Murphy (2014). The model contains the real price of crude oil (measured by the U.S. refiners' acquisition cost of crude oil imports deflated by the U.S. consumer price index), the percent change in global oil production, a proxy for changes in global crude oil inventories, and a measure of global real economic activity due to Kilian (2009) that is specifically designed to capture fluctuations in demand for industrial commodities.[3] The model allows each of the four model variables to linearly depend on its own lags as well as lags of the other model variables up to a pre-specified lag order, allowing unrestricted feedback across the model variables. It has been shown that this class of VAR forecasting models, even when

[2] For a similar approach in a different context see Hamilton (2009).
[3] For details on the definition and construction of the data the reader is referred to Baumeister and Kilian (2012).

implemented subject to real-time data constraints, has significant predictive power for the real price of oil at horizons up to 6 months, especially when there are persistent shifts in economic fundamentals as occurred in 2003-09. Our forecasts are constructed recursively using only information that was publicly available at the time when a given forecast is generated.[4]

As our baseline model we consider a model specification with 24 lags, an intercept and seasonal dummies, as in the analysis of Kilian and Murphy (2014), estimated recursively by least squares on data extending back to early 1973. Forecasts from this model may be converted to forecasts for the Brent price by applying a scale factor, as discussed in Baumeister and Kilian (2014b). We focus on the Brent price because of the recent instability in the spread between the Brent and WTI price (see Kilian 2014). The real oil price forecasts are converted to nominal U.S. dollar prices based on a monthly version of the real-time inflation gap forecasting model proposed by Faust and Wright (2013).

Figure 2a shows the evolution of the nominal price of Brent crude oil together with the forecasts of the Brent price generated by the VAR model in real time using only information available as of the time marked by the vertical line, which is the end of June 2014. Our objective in Figure 2a is to assess to what extent the observed decline in the price of oil since June 2014 was predictable and to what extent it was associated with unpredictable variation in the price of oil that must be associated with economic shocks hitting the oil market in recent months. The discussion focuses on the VAR(24) model, but we also include two alternative VAR forecasts for comparison.[5]

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[4] Real-time data constraints refer to the fact that a forecaster generating a forecast as of today must operate subject to the constraint that the most recent observations of many time series are not yet available, or, if they are, are still subject to subsequent revisions. These data limitations make it considerably harder to forecast out of sample than suggested by simulated forecasting exercises based on fully revised and complete data.

[5] Figure 2a reports additional analogous results for a VAR(24) model estimated using the data-based Bayesian estimation procedure of Giannone, Lenza, and Primiceri (2015) and a more parsimonious version of the VAR model with only 12 lags. Although the VAR(24) model is less parsimonious than the other forecasting models and would

Figure 2a shows that more than half of the observed decline in the Brent price was predictable as of June 2014. The VAR(24) model predicted that the price of oil would fall to $99 by October and to $84 by December. This amounts to 25 percentage points of the 44% cumulative decline between June and December. In contrast, only a very small decline in the price of oil would have been predicted by anyone relying on Brent futures prices as the forecast of the price of oil instead. The Brent futures curve as of June 2014 was nearly flat. It may seem that the poor forecasting ability of oil futures prices for this episode may be explained by a large time-varying risk premium.[6] Historically, the time-varying risk premium often has been large (see Baumeister and Kilian 2014c). Baumeister and Kilian estimate the risk premium based on the term structure model of Hamilton and Wu (2014), which they show to be the most reliable risk premium model for the WTI oil futures market. Estimates of the risk premium at the 6-month horizon may be as high as $26. It can be shown, however, that in the current episode, the risk premium as of June 2014 is quite small, indicating that the market failed to anticipate the decline in the Brent price of oil. For example, the risk premium for December 2014, implicit in the 6-month futures price for June 2014, is only about $3, which is far too small to explain the observed decline in the price of oil. The corresponding risk premia at shorter horizons are even smaller.[7]

not have been the preferred forecasting model in the 1990s, when available samples were much shorter, in the current context we have the benefit of being able to rely on the full sample until June 2014 in estimating the model, allowing us to use the same lag structure as in Kilian and Murphy (2014). Figure 2 suggests that the real-time forecasts implied by this VAR(24) model tend to be closer to the realizations of the price of oil than the two other VAR forecasts, adding credence to our choice of baseline model. This result is consistent with the emphasis in Kilian (2009) and related studies on including enough lags in modelling long cycles in commodity prices. Although in some cases there are important differences in the degree of fit between our baseline model and the two alternative models, it is comforting to see that the pattern of the forecast paths in this and the subsequent figures is similar overall.

[6] The presence of a risk premium drives a wedge between oil futures prices and the market expectation of the price of oil, rendering the oil futures price a poor predictor of the price of oil. This fact helps explain the comparatively poor average forecasting ability of oil futures prices in many earlier episodes (see, e.g., Alquist et al. 2013).

[7] This conclusion is based on fitting the Hamilton-Wu risk premium model to weekly Brent price data since 2005, accounting for the differences in the timing of the expiration dates of the contracts compared with the WTI market.

Given the difference between the VAR(24) forecast and forecasts obtained by other forecasting methods, one obvious concern is that the forecasting ability of the VAR(24) model may simply be a coincidence. For example, one may be concerned that the VAR(24) model always predicts large oil price declines and that the forecast in Figure 2a just happened to be right as of June 2014. This concern is addressed in Table 2, which shows that, as recently as February 2014, the VAR(24) did not predict a large cumulative oil price decline, but rather a slight increase. Only starting in March, the model predicted a decline and this predicted decline increased substantially in June. Thus, luck seems unlikely to explain the forecasting results.

Another potential concern is that this class of VAR forecasting models somehow may be prone to predicting a steep decline in all commodity prices as of June 2014, because of the way the model is constructed. If this conjecture were correct, one would expect this type of model to predict a large decline in other industrial commodity prices as well, which we know did not occur (see Figure 1). This reasoning suggests a second plausibility check. Although we cannot apply the VAR(24) model underlying Figure 2 to non-oil industrial commodity prices, because there are no data on production and inventories for these industrial commodities, we can evaluate the real-time forecast accuracy of a simpler VAR(24) model including only the real CRB index of industrial raw materials (which excludes crude oil) and the global real activity measure. This bivariate model as of June 2014 predicts a 5% cumulative decline in the nominal CRB index by December 2014. This forecast is quite accurate compared with the observed cumulative decline of 7% (see Figure 1). Fitting an analogous VAR forecasting model for the real price of oil and global real activity results in a predicted cumulative decline in the nominal Brent price of 9% by December. This result is consistent with the view that predictable variation in global real activity can explain only a modest fraction of the observed oil price decline. Indeed, this is what one would have expected given recent evidence that oil and non-oil commodity prices share a common component associated with global business cycle fluctuations, with cumulative changes in broad-based indices of non-oil commodity prices at short horizons helping to predict one-for-one cumulative changes in oil prices (see, e.g., Baumeister and Kilian 2012). The much larger cumulative decline of 25% predicted in Figure 2a based on the 4-variable VAR model thus is related to the inclusion of the global oil production and oil inventory data in the VAR forecasting model.

The central question is what explains the fact that the VAR model predicts a disproportionately larger decline in the price of oil than in the price of non-oil commodities. By construction, the incremental predictable decline in the price of oil must reflect structural shocks that already occurred prior to July 2014. Economic models of the global oil market contain only two types of shocks capable of explaining this result. One is a positive oil supply shock and the other is a negative shock to the storage demand for oil driven by expectations of rising crude oil production (see, e.g., Kilian and Murphy 2014; Knittel and Pindyck 2015). The reason we know that these negative storage demand shocks cannot have been in response to expectations of a slowing global economy is that, in the latter case, these shocks would have caused a predictable decline in both the price of oil and the price of other industrial commodity prices.

Positive oil supply shocks (or expectations of falling oil prices due to higher oil production) clearly are not recessionary. If anything, they should stimulate the global economy. Hence, to the extent that there was a reduction in global real activity prior to July 2014, as shown in Figure 1, and that there is evidence of a predictable decline in a broad index of non-oil industrial commodity prices in the second half of 2014, a reasonable presumption is that this predictable decline must have been caused by adverse demand shocks associated with an unexpected slowdown of the global economy prior to July 2014.

The same adverse demand shocks would also be expected to affect the price of crude oil. A reasonable conclusion in light of the empirical results in Baumeister and Kilian (2012), among others, is that the predictable decline in the price of oil of 9% (or $11) in the second half of 2014 based only on past data for the real price of oil and for global real activity (which is similar in magnitude to the average decline in other industrial commodity prices) was associated with the cumulative effect of these adverse demand shocks in the global economy. If so, the remaining $16 of the predicted decline of $27 must have been associated with surprises about the actual and expected oil production prior to July 2014. Thus, even allowing for some uncertainty about the precise cumulative effects of the adverse demand shocks prior to July 2014, the supply side of the oil market appears to have played an important part in generating the predicted decline in the price of oil as of June 2014.

4. What Did the Real-Time Forecasting Model Fail to Predict?

Figure 2a shows that $22 of the cumulative decline in the Brent price between June and December was unpredictable and hence must have been associated with economic shocks that occurred only after June 2014. We now turn to the question of when these shocks occurred and what their nature was. Figure 2a shows that the model's oil price forecast for July missed by about $9, indicating the presence of a large shock in this month. In fact, with the exception of the oil price forecast for December, all subsequent forecasts in the figure are off by roughly the same amount as the initial forecast error for July, suggesting that the initial error was propagated over time. Further insights into the nature of this shock may be obtained by evaluating the forecast errors for all four VAR model variables. As shown in Kilian and Murphy (2014) and Kilian and Lee (2014), for example, we have some knowledge of the signs of the forecast errors associated with different structural oil demand and oil supply shocks that may be used to discriminate between alternative structural shocks on the basis of the reduced-form forecasts errors.

The bar chart in Figure 3 shows the one-step ahead forecast error of the VAR(24) model for the price of oil, for global oil production, for global real economic activity, and for crude oil inventories.[8] The first entry in each of the bar charts corresponds to the errors in forecasting the July 2014 observations based on the information available in June 2014. It shows that the oil price forecast error of -$9 coincided with a negligible negative forecast error for global real activity (corresponding to 1.7% of the value of the real activity index in Figure 1), with a large negative forecast error for the change in inventories (corresponding to about 3.4% of OECD industry oil stocks), and with a small negative forecast error for global oil production (corresponding to 0.35% of global oil production). To appreciate the small magnitude of the latter forecast error, it is useful to compare it with the oil supply shocks studied in Hamilton (2003) which involved reductions in oil production of between 7% and 10% of global oil production.

The forecast error for global oil production is not only small, but of the wrong sign for the negative forecast error in the price of oil to be explained by a positive oil supply shock. At the same time, the very small negative forecast error for global real activity allows us to rule out the hypothesis that the large negative forecast error for the price of oil was caused by an unexpected weakening of the global economy. The observed pattern, however, appears consistent with the forecast error being driven primarily by an unexpected reduction in the demand for storage, given the simultaneous large unexpected decline in inventories and in the

[8] The global oil production data in the Baumeister and Kilian (2012) forecasting model are based on data in the Energy Information Administration's (EIA) Monthly Energy Review. These data only become available with a delay of three months. We therefore extrapolate the EIA world oil production data using the growth rates of the world oil production data reported by the IEA. Although the level of these two series differs, their growth rates are quite similar, justifying this approximation.

price of oil. This pattern is suggestive of a drop in oil price expectations. Without further information we cannot tell what lowered oil price expectations in July, but in general such a shock to storage demand could reflect expectations of lower future demand for oil or of higher future oil production or both.

Figure 2b examines the forecast implied by the model as of the end of July 2014, after the unexpected decline in the price of oil that occurred in July. It shows that with the benefit of an additional month of information about the four model variables, the one-step ahead forecast error of the previous forecast is corrected for, and the VAR(24) model forecasts are much closer to the realizations of the price of oil in all months from August until December. The VAR(24) model predicts a decline in the price of oil to $74 in December, followed by a recovery to $77 in January 2015. The forecast as of August 2014 in Figure 2c comes very close to the actual price of oil in September, October and November. It only misses the December realization by $17. This pattern is repeated in Figures 2d and 2e, showing the forecasts generated as of September and October 2014. Finally, Figure 2f shows that even as of November 2014, the model misses the December price by $13. This evidence suggests that a second important price shock occurred only in December 2014.

What was the cause of this second major shock? The December entry in Figure 3 suggests that the observed forecast error for the price of oil is associated with a strongly negative forecast error for global real activity (corresponding to almost two thirds of the December value of the real activity index in Figure 1) and a negligible positive forecast error in global oil production (corresponding to 0.24% of global oil production, which again is small by the standards of the shocks discussed in Hamilton (2003)). This pattern is compatible with a large negative flow demand shock in December 2014, but inconsistent with a large positive supply shock in this month.

What about the alternative explanation of the OPEC announcement of November 27 causing a sharp reduction in oil inventory demand in December? This alternative explanation, although reasonable ex ante, seems inconsistent with the forecast error for real activity, because a large negative shock to inventory demand should have raised global real activity, as the lower oil price would have stimulated oil consumption. This assessment is also consistent with the EIA oil inventory data that became available only several months after this paper was written. These data imply a positive inventory surprise in December, as shown in Figure 3, which is at odds with the conjecture of a major unexpected reduction in inventory demand caused by the OPEC announcement, but consistent with a negative flow demand shock (see Kilian and Murphy 2014). Thus, a strong case can be made that the large negative forecast error for real activity and the large negative forecast error for the price of oil must have been caused by an unexpected weakening of the global economy in December 2014.

We conclude that of the $22 decline in the price of oil to be explained by additional shocks between July and December, $9 are explained by a shock to oil price expectations in July 2014 and $13 are explained by an unexpected slowdown of the global economy in December. There is no evidence that positive oil supply shocks after June 2014 or the OPEC decision of late November 2014 played an important role in the observed oil price decline.

5. What Does the Future Hold?

As of the end of 2014, a question of obvious importance was how the price of oil would evolve in the first half of 2015. Figure 4 contains nominal Brent oil price forecasts generated using the data available as of the end of December 2014 and originally reported in January 2015. It also shows the realizations of the Brent spot price for January through June 2015 that became available only after these forecasts had been made. Figure 4 shows that as of December 2014 all three real-time forecasting models predicted that the Brent price would bottom out at near $60 in January or February, followed by a slow recovery to between $64 and $68 by June, depending on the model. These predictions, of course, were built around the premise of no further demand or supply shocks in the first half of 2015. They nevertheless are of economic interest because they suggest that – in the absence of further shocks – the price of oil would have been expected to stabilize in the near future. Unlike during earlier months, the predictable oil price decline had lost its momentum, as the cumulative effect of earlier shocks had weakened. Thus, any further declines in the price of oil in 2015 can only be explained by additional shocks in 2015.

The fact that the actual Brent price fell below $50 in January is evidence that the crude oil market experienced another large shock in January. Obvious candidates would be a further downward revision of oil price expectations, a further unexpected reduction in global real economic activity, or a positive oil supply shock.[9] Nevertheless, it is remarkable that the model predicted the turning point in the evolution of the price of oil correctly in real time. By May 2015 the Brent price was converging toward the VAR(24) model forecast. The fact that it did not reach the predicted level of $68 in June is likely related to the deterioration of economic conditions in June, as the Chinese stock market meltdown started and the Euro crisis worsened.

6. How Different is the Oil Price Decline of 2014 from the 1986 and 2008 Episodes?

It is useful to put the current episode into historical context. As mentioned in the introduction, this is not the first episode of falling oil prices. One prominent example is the decline in oil prices from its peak level in 1980. This decline accelerated in January 1986, when Saudi Arabia

[9] Such forecast scenarios may be evaluated within the framework of Kilian and Murphy (2014), as illustrated in Baumeister and Kilian (2014d). For example, an unexpected increase in global oil production by 1% would cause a decline in the price of oil of close to $5 three months later.

ceased all attempts to prop up the price of crude oil and lifted the self-imposed restrictions on its oil production. Another prominent example in recent history is the sharp drop in oil prices after July 2008. Figure 5 compares the evolution of the nominal price of oil and of the global production of crude during these episodes with that after June 2014.[10] All time series have been normalized to 1 at the beginning of each episode. Figure 5 shows that the recent episode is not unusual by historical standards. The cumulative decline in the price of oil in the six months since June 2014 was less than the corresponding decline in 1986 or 2008, and it occurred more gradually. Figure 5 also shows that global oil production then as well as now remained largely flat. Even after July 2008 there was only a negligible reduction in global oil production.

The latter finding may be surprising to some observers. There has been much discussion recently about the traditional role of Saudi Arabia as the swing producer in global oil markets. The presumption in this debate often is that Saudi Arabia tends to reduce its oil production in times of low demand and falling prices. This view dates back to the early 1980s when Saudi Arabia responded to the Volcker recession by reducing its oil production, effectively allowing other oil producers to gain market share. The intent was to stabilize the price of oil.[11] This approach proved not only ineffective in that the price of oil continued to fall, albeit at a slower rate, but unsustainable in that falling production in conjunction with falling oil prices resulted in a substantial reduction in Saudi oil revenues. By the end of 1985, Saudi Arabia was forced to reverse course, and the real price of oil collapsed. Much of the observed decline in the price of oil in 1986 reflected a reduction in storage demand, as market fears regarding what OPEC might do dissipated (see Kilian and Murphy 2014). The remainder reflected increased Saudi oil production. Figure 5 illustrates that, five months after the change in policy, Saudi oil production

[10] The price of Brent has been extrapolated backwards as discussed in Baumeister and Kilian (2014b).
[11] For a detailed discussion of how these policies were implemented see Skeet (1988).

rapidly accelerated. One obvious lesson from this episode has been that even Saudi Arabia is unable to control the price of oil and unable to preserve oil revenue by reducing production. Thus, the recent November 27 OPEC announcement, which reflected the Saudi position in particular, should perhaps not have come as a surprise.

Figure 5 confirms that Saudi Arabia has not lived up to its reputation as a swing producer after June 2014, even granting that in late 2008, during the financial crisis, Saudi Arabia had responded to falling oil prices by reducing production. This decision came four months after the price of oil had peaked, as shown in Figure 5. As it turned out, Saudi Arabia was the only major oil producer to respond in this fashion in late 2008, and its production cuts were only modest. Likewise, U.S. oil production dipped only slightly in September of 2008, while Russia's oil production remained steady throughout this period. Oil production in the rest of the world hardly changed.

This evidence may raise the question of why there is not more cooperation among oil producers to stabilize the price of oil by coordinating cuts in production. The case can be made that concerted action by the major oil producers to stabilize the price of oil following a plunge in the oil price poses a coordination problem. As predicted by the theory of cartels, this problem proved insurmountable in the 1980s, when OPEC members deviated from the cartel policy of restricting oil production, prompting Saudi Arabia to act unilaterally (see Green and Porter 1984; Skeet 1988; Almoguera, Douglas and Herrera 2011). With the rise of Russia, the United States, Canada and even China as major oil producers, this coordination problem has only increased. In the case of the United States and Canada an additional complication is that the oil industry is private and decentralized. In the case of Russia, the problem is that Russia heavily relies on oil revenues to sustain its economy much like some OPEC producers such as Venezuela or Iraq.

This raises the question of what response would be in the best interest of Saudi Arabia. It does not seem possible to make a good case for Saudi production restraint, given that such a policy would only involve a repeat of the failed pre-1986 policies. If Saudi Arabia is unable to stabilize the price of oil on its own, it would be foolish to try. If uncooperative high-cost oil producers such as Russia, Iran, or Venezuela (or for that matter companies engaged in deep-sea off-shore drilling) are ultimately forced to cease production, as a result of Saudi Arabia maintaining its current level of production, this side effect would presumably be welcome from the Saudi point of view, but it does not seem necessary to appeal to geopolitical factors to rationalize the Saudi position. It should be noted that the Saudi position today is not markedly different from that of, say, the United States, yet no one is calling for U.S. shale oil production to be scaled back for the benefit of foreign oil producers.

Producers concerned with their oil revenue in fact may even have an incentive to increase their production in response to lower prices associated with lower demand, if they have enough financial reserves or access to credit to sustain this policy for several years, as Saudi Arabia does. Table 1 shows very modest increases in aggregate oil production only, suggesting that most producers, including notably Saudi Arabia, as of early 2015 have not given in to this temptation, although they have not reduced production either.[12] One clear exception is the United States, which continued to increase oil production in the second half of 2014. Whether the decision by many state-owned oil producers in other countries not to increase production has been a deliberate decision or reflects the fact that producers have already reached their capacity limit is not clear.

[12] This policy may be changing as of March 2015 with Saudi Arabia increasing oil production, ostensibly in response to expectations of rising demand for oil and lower oil production elsewhere. The quantitative significance of this production increase is not clear at this point, but is likely to be small.

7. Implications for Oil Producers

It seems that the only way to resolve this situation, unless the global economy (and hence the demand for oil) recovers, is for oil producers whose long-run marginal cost exceeds the current price of oil to exit the market. We are already seeing some oil producers such as Venezuela experiencing severe economic strain. A similar, if less severe, adjustment occurred after 1986 when Saudi Arabia effectively eroded the profit margins of high-cost oil producers elsewhere. Once this process is complete, one would expect the price of oil to stabilize.

There are important differences in how oil producers in different regions of the world would be affected by lower prices. Saudi Arabia, for example, enjoys low marginal costs of production, but requires much higher oil prices in the long run to sustain its welfare state.[13] For the time being, Saudi Arabia is using the oil wealth it accumulated in years past to finance the fiscal deficits caused by falling oil prices. There is a good chance that Saudi Arabia, if necessary, will be able to sustain this response long enough for oil producers worldwide to consolidate. Other OPEC members that rely on oil revenue for financing their welfare programs such as Venezuela or Iraq appear much less prepared for weathering the current price slump. Oil producers in Western Canada, where unconventional crude oil is produced at relatively high cost from oil sands, are also likely to be vulnerable to a further downturn in oil prices, although to date changes in the Canadian exchange rate have cushioned the impact of lower U.S. dollar prices for oil somewhat.

In the United States, in contrast, the marginal cost of the production of shale oil, which a few years ago was quite high, appears to have fallen to the point that many shale oil producers are able to remain profitable at current prices. For example, the Wall Street Journal recently cited

[13] Smith (2009), for example, cites marginal cost estimates for Middle Eastern oil producers ranging from $5 to $10, well below recent estimates for U.S. shale oil producers.

industry spokespersons for two major U.S. shale oil producers, suggesting that improved efficiency in shale oil production allowed their operations to remain profitable even at $40 a barrel in some locations (see Gold 2015). Even if reliable, these estimates need not apply to other companies or locations, however, making it difficult to generalize these observations.

Figure 6 assesses the extent to which U.S. oil producers have come under pressure in recent months by plotting U.S. oil drilling rotary rig counts, which traditionally have been viewed as a leading indicator of oil production. The U.S. oil rig count peaked in September 2014, when the WTI price of oil fell below $95. Although Figure 6 only shows a modest decline in the rig count by December 2014, weekly rig counts by the end of June 2015 have declined by 61% relative to their peak in September 2014. These rig count data have to be viewed with some caution, however, given recent increases in U.S. productivity per well. Undoubtedly part of the observed decline in the rig count reflects the increased efficiency of shale oil production. In other words, it takes fewer rigs to achieve the same shale oil production now compared with only a year ago. There nevertheless are indications that the reduced rig count also reflects reduced investment in the U.S. oil sector in response to lower oil prices. For example, it has been widely reported in the financial press that many oil companies are scaling back their investment plans and that oil support service companies such as Baker Hughes, Halliburton and Schlumberger are laying off thousands of employees. This does not mean that U.S. oil production will fall immediately, but a longer-term reduction seems very likely. Figure 6 shows that, according to EIA estimates, current total U.S. oil production has continued to increase in early 2015, but may have peaked in recent months. Only future data will show whether the gradual decline since April 2015 is the beginning of a sustained reduction in U.S. oil production in response to lower oil prices.

One reason for the sluggish response of oil production is that short-run operating costs tend to be quite low, once a rig is in place. As stressed by Anderson, Kellogg and Salant (2014), it is suboptimal for oil producers to reduce oil production from existing wells, given the cost structure of the oil industry and geological constraints on oil extraction. Anderson et al. provide evidence that even in competitive markets oil production from existing wells need not respond to shocks to spot and expected future oil prices. Their theoretical analysis suggests that the adjustment of oil production instead works primarily through firms adjusting the number of new wells to be drilled, which affects oil production only with a delay. This result is consistent with the rig count and oil production data in Figure 6. It is also useful to keep in mind that there are substantial differences in long-run marginal costs across U.S. oil fields. Thus, one would not expect all of them to curtail drilling at the same time in response to a price decline. Rather this process would start with the least competitive producers and gradually extend to more and more operations, as the price of oil declines further.

8. Is the Oil Market Working Normally?

The sluggishness in the short-run response of oil production to a decline in the price of oil caused by excess supply has a long tradition in oil markets, as discussed in Kilian (2009). This feature of the oil market suggests the possibility of an undershooting of the price of oil. Given uncertainty about the long-run marginal cost of individual oil producers and the high fixed cost of restarting oil production following a shut-down, there is an incentive for each oil producer to test the resolve of its competitors to stay in the market. Considering the high stakes involved, oil producers have an incentive to wait and see who blinks first and exits the market. This reasoning helps understand the recent posturing by proponents of U.S. shale oil on the one hand and of Saudi Arabia on the other about their ability to survive low oil prices.

An important question is whether anything about the response of oil producers to the fall in the price of oil since June 2014 has been unexpected or unusual, given the history of the oil market to date, suggesting that existing models are inadequate. Our analysis indicates that there is no evidence of additional oil supply shocks in the second half of 2014 that would signal that producers are doing anything different from what one would have expected. In fact, if Saudi Arabia had chosen to act as the swing producer in the current environment, this decision would have had to be considered the historical exception and would have been an oil supply shock in its own right. Oil producers not only behaved much like in the past, but their behavior seems fully consistent with economic theory (see Anderson, Kellogg and Salant 2014). Moreover, there is no indication of the predictive accuracy of oil market models breaking down, as would be expected in the presence of major structural change.

There are some scenarios in which forecasting models such as ours would not be expected to work as well going forward, as they have done so far. One such scenario would be U.S. shale oil production responding to falling oil prices more sluggishly than predicted based on the responses of conventional oil production to similar shocks in the past. Another scenario would be a state-owned oil producer subsidizing its operating losses based on previously accumulated oil wealth, thereby forcing other producers to exit. Neither outcome seems likely at this point. This does not mean that a consolidation of global oil production could not ultimately happen. Going forward, there remains the risk that further positive oil supply shocks and/or unexpected reductions in the demand for oil caused by a further weakening of the global economy or by the liquidation of oil stocks could drive the price of oil to much lower levels. Only a sustained period of very low oil prices, however, is likely to force a consolidation of oil production. A temporary drop in the price of oil, as occurred in 1998, when the Brent price of oil briefly reached $10 a barrel following a reduction in demand triggered by the Asian crisis in 1997, is not enough. No oil producers exited the market then, even at this very low price of oil.

Our analysis suggests that the recent decline in the price of oil primarily reflects changes in the economic environment. This interpretation of the evidence is at odds with the common perception that falling oil prices can be attributed primarily to political decisions by oil producers. Much has been made of the institutional characteristics of the crude oil market and of the special role of Saudi Arabia, in particular. The case can be made, however, that the behavior of producers of crude oil is not fundamentally different from that of iron ore producers, for example. There are many similarities in the economic environment faced by iron ore and crude oil producers. The fact that the evolution of the price of iron ore appears quite similar to that of the price of oil, even in the absence of a major state-owned iron ore producer, suggests that political factors are not as important in oil markets as sometimes suggested.

Specifically, both markets experienced a surge in demand and in prices after 2003. Iron ore production companies responded by opening new mines and increasing production much like oil companies increased their production. The iron ore market is dominated by three companies: Blue Scope Steel, Rio Tinto and Vale. Their main customer has been China, which makes about half of the world's steel. By early 2014 demand for steel from China weakened, and so did the demand for iron ore. As a result, the price of iron ore started plunging, yet to date there is no sign that iron ore producers have reduced their production growth. The reason is simply that, even at these lower prices, iron ore production remains profitable. Increased iron ore production in turn has put continued downward pressure on the price of iron ore. The result has been a fall in the spot price of iron ore for delivery in China that has been every bit as dramatic as the fall in crude oil prices. For example, the index of the spot market price of iron ore with 62% ferrous content for delivery in Qingdao port in China started falling as early as January 2014 and by the end of the year matched the cumulative decline in the price of oil (see Figure 7).[14] In the absence of a recovery of the demand for steel, this process is likely to continue until the price of iron ore falls below the long-run marginal cost of iron ore production. This situation closely resembles recent developments in the crude oil market, suggesting that private companies under similar circumstances behave no differently from state-owned companies such as ARAMCO, and that Saudi production decisions are more informed by economic factors than by political considerations.

9. Concluding Remarks

Understanding the recent evolution of the price of oil is important in assessing the macroeconomic outlook. It also has the potential to affect the political stability of oil-producing countries, and it has profound implications for many industries and for environmental policies. Providing an assessment of the decline in the price of oil between June 2014 and December 2014 in real time is complicated by the fact that even preliminary oil market data for late 2014 became available only with a delay. For this reason, existing analysis of this question has been very informal. The objective of this paper has been to provide a quantitative real-time analysis of these events. We relied on insights from structural economic models of the oil market to assess the plausibility of competing explanations of the decline in oil prices in light of this evidence.

Many observers have conjectured that factors specific to the oil market played an important role. Notably, Arezki and Blanchard (2014) suggested an important contribution of oil supply shocks, highlighting the examples of Libya, Iraq and the United States. They also

[14] The data source is Bloomberg. This fall in the price of iron ore clearly cannot be explained by oil prices lowering the cost of shipping, first, because then other commodity prices would have declined similarly, and, second, because much of the decline in the price of iron ore occurred well before the drop in the price of crude oil.

suggested that a major shock to oil price expectations occurred when in late November 2014 OPEC announced that it would maintain current production levels despite the steady increase in non-OPEC oil production. Both conjectures are perfectly reasonable ex ante, yet we provided evidence that neither explanation appears supported by the data.

Based on a vector autoregressive model of the global oil market, we showed that more than half of the observed decline in the price of oil of $49 was predictable in real time as of June 2014 and hence must have reflected the cumulative effects of earlier oil demand and supply shocks. We attributed $11 of this predictable decline to the cumulative effects of adverse demand shocks prior to July 2014 that reflected an unexpected weakening of the global economy. We traced the remaining $16 of the predictable decline to the cumulative effects of positive oil supply shocks and to shocks to expected oil production that occurred prior to July 2014. The unpredictable component of the oil price decline between June and December is accounted for by a shock to oil price expectations in July 2014 that lowered the demand for oil inventories and a shock to the demand for oil associated with an unexpectedly weakening economy in December 2014. These two shocks lowered the price of oil by an additional $9 and $13, respectively.

Real-time forecasts based on this model indicated that as of December 2014, the monthly average Brent price of oil was not expected to decline much further in the absence of additional unforeseen oil demand or oil supply shocks. Rather our model predicted a gradual recovery from $60 to $68 by June 2015. Despite an unexpected drop in the price of oil in January 2015, the overall pattern of these out-of-sample predictions proved remarkably accurate. By April 2015, the Brent spot price had recovered to $60, followed by an increase to $64 in May. Only in June 2015, the recovery ended and the price of oil fell to $61, arguably reflecting an unexpected weakening of the Chinese economy and an unexpected worsening of the Greek debt crisis. Our analysis illustrated how quantitative models may be used to shed light on the evolution of the price of oil in real time providing an alternative to more heuristic approaches.

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Table 1: IEA Crude Oil Production Estimates

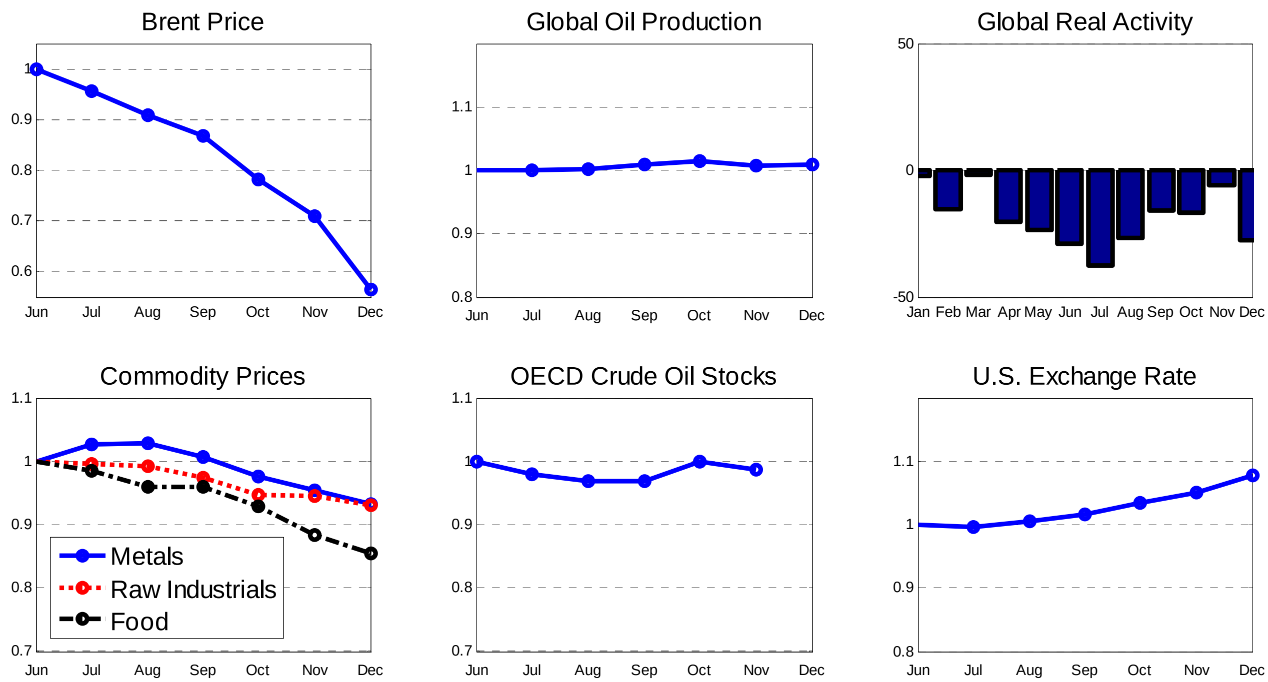
	June 2014 – December 2014		
	Change in Oil production (*Mbd*)	Percent Change	Percent Share in World in Dec. 2014
Saudi Arabia	- 0.026	- 0.23	12.18
United States	+0.460	+3.87	13.12
Former USSR excluding Estonia	+0.263	+1.91	14.90
Iraq	+0.425	+12.64	4.02
Libya	+0.230	+85.19	0.53
Syria	+0.006	+21.43	0.04
Iraq+Libya+Syria	+0.661	+18.06	4.59
OPEC	+0.429	+1.17	39.25
Non-OPEC including processing gains	+0.389	+0.68	60.75
World Total	+0.818	+0.88	N.A.

NOTES: The data source is the IEA Monthly Oil Data Services at http://www.iea.org/statistics/mods/. The definitions employed by the International Energy Agency differ from those used by the U.S. Energy Information Administration with the IEA using a broader definition of crude oil production. This has little effect on estimates of the change in production over time, but may result in changes in countries' share in world oil production such as the relative position of Saudi Arabia and the United States.

Table 2: Cumulative 6-Month Percent Changes in the Brent Price of Crude Oil

Starting in:	Actual	Brent Futures	Model Forecast
Feb 2014	-6.7	-2.1	+1.8
Mar 2014	-9.7	-1.7	-13.1
Apr 2014	-18.9	-1.6	-19.7
May 2014	-27.5	-3.1	-13.7
June 2014	-44.2	-2.3	-24.8

Figure 1: Oil Market Indicators for 2014



NOTES: The data on global crude oil production and oil stocks held by industry in OECD countries are based on IEA estimates in the IEA's monthly *Oil Market Report*. The commodity price indices are from the Commodity Research Bureau. The global real economic activity indicator is based on Kilian (2009). This index has been designed as a measure of the business cycle in industrial commodity markets and is a leading indicator for industrial production. The U.S. dollar exchange rate from the FRED database is the trade-weighted nominal exchange rate measured against a broad basket of trading partners. The Brent price is from the EIA. All data but the global real activity index have been converted to an index that equals 1 in June 2014.

Figure 2a: Real-Time Forecast of the Price of Brent Crude Oil as of June 2014

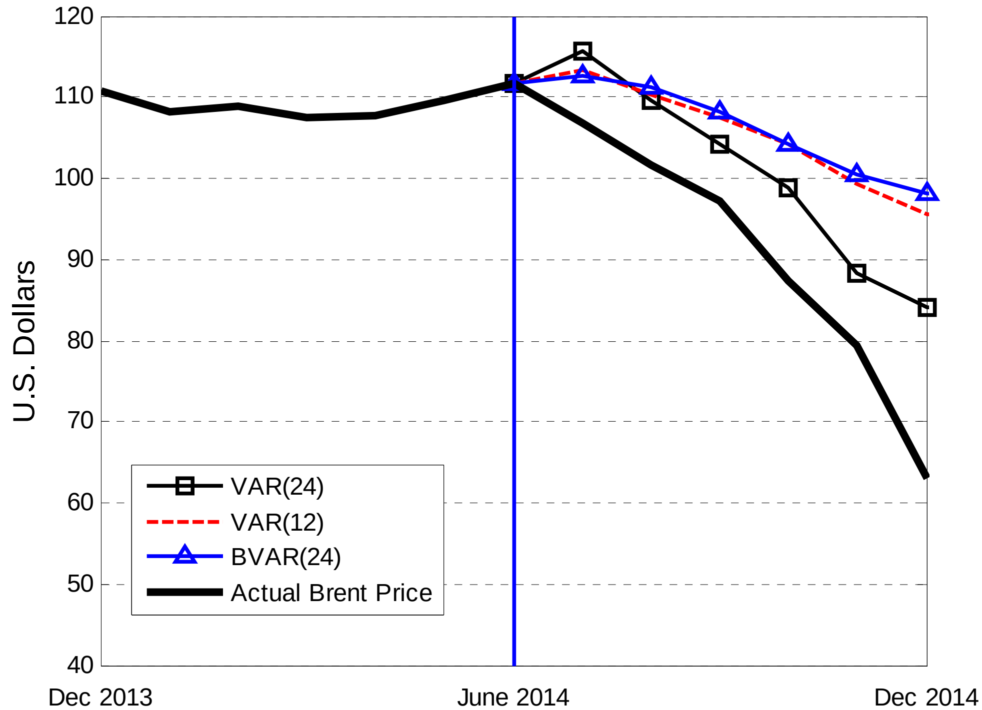


Figure 2b: Real-Time Forecast of the Price of Brent Crude Oil as of July 2014

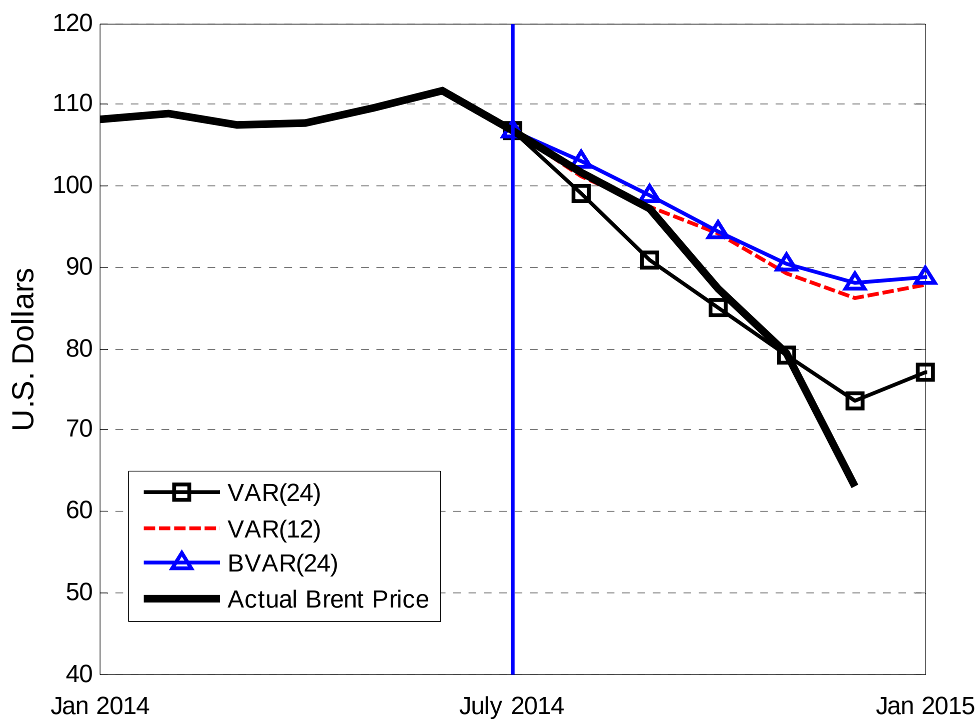


Figure 2c: Real-Time Forecast of the Price of Brent Crude Oil as of August 2014

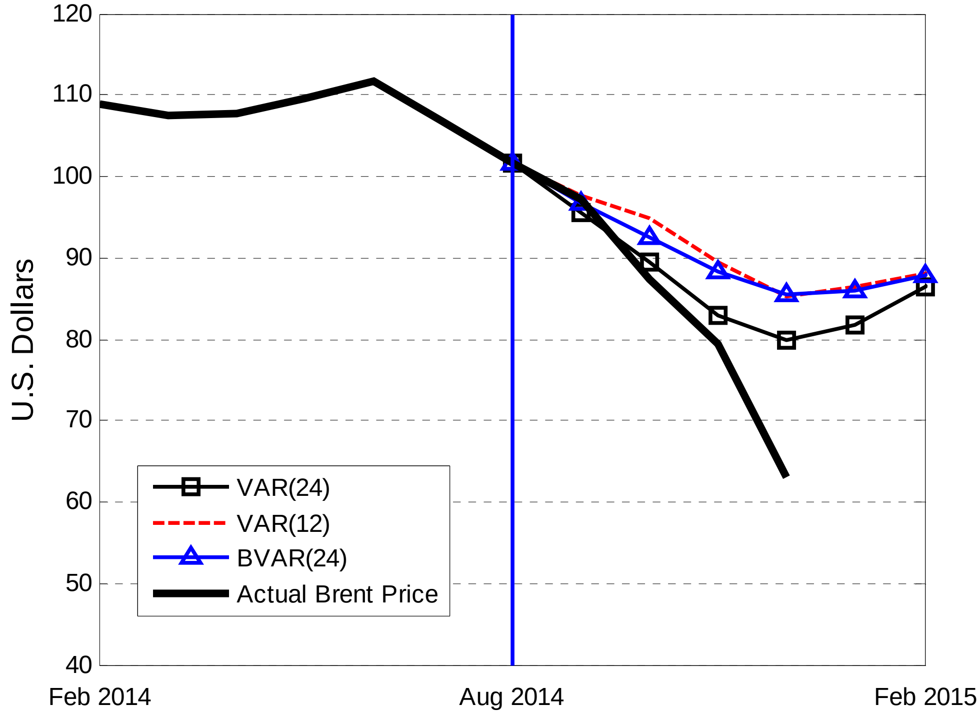


Figure 2d: Real-Time Forecast of the Price of Brent Crude Oil as of September 2014

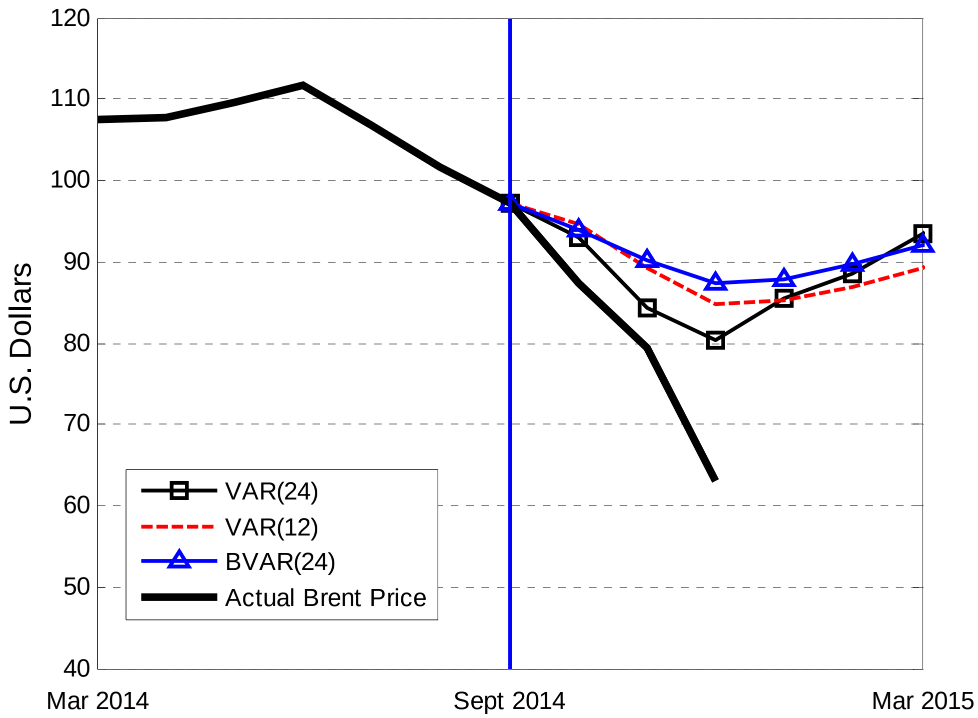


Figure 2e: Real-Time Forecast of the Price of Brent Crude Oil as of October 2014

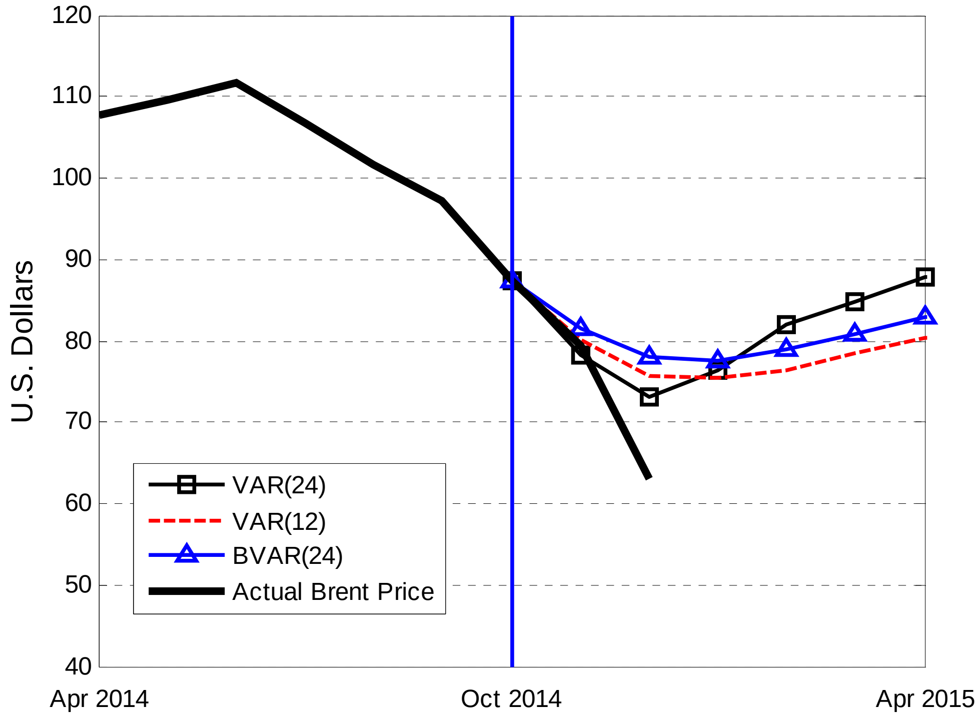


Figure 2f: Real-Time Forecast of the Price of Brent Crude Oil as of November 2014

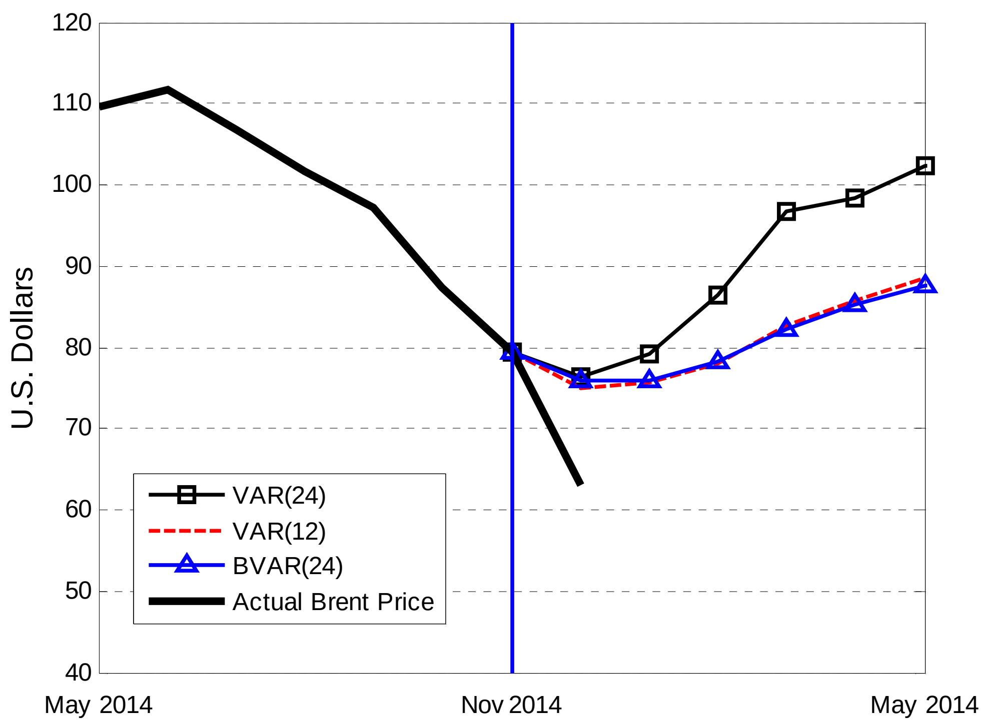
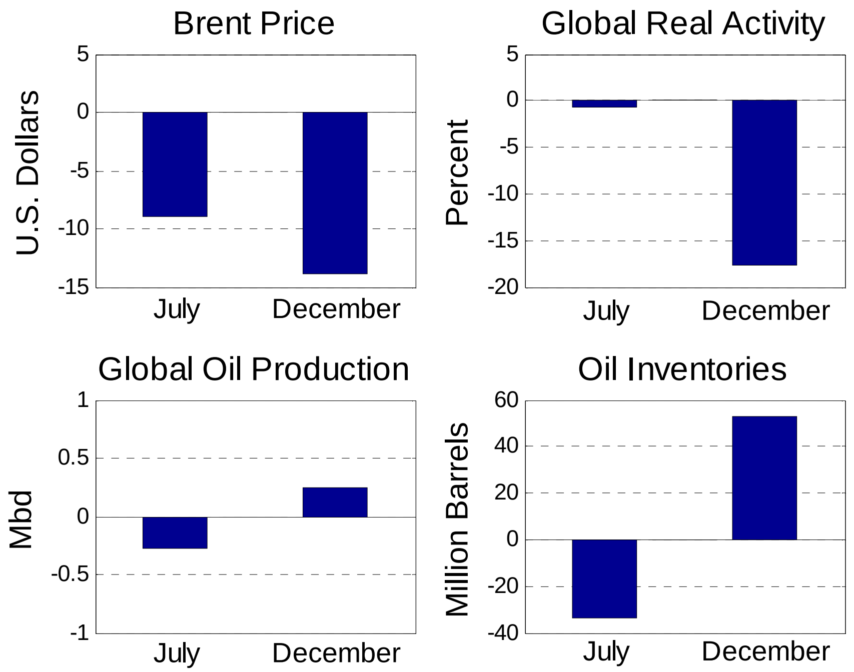


Figure 3: 1-Step-Ahead Forecast Errors for July 2014 and December 2014



NOTES: All forecast errors shown are from the VAR(24) model in Figure 2. The analysis focuses on the two months, in which large oil price forecast errors occur. No oil inventory data are available for evaluating the December forecast.

Figure 4: Real-Time Forecast of the Price of Brent Crude Oil as of December 2014 and the Brent Price Realizations to Date

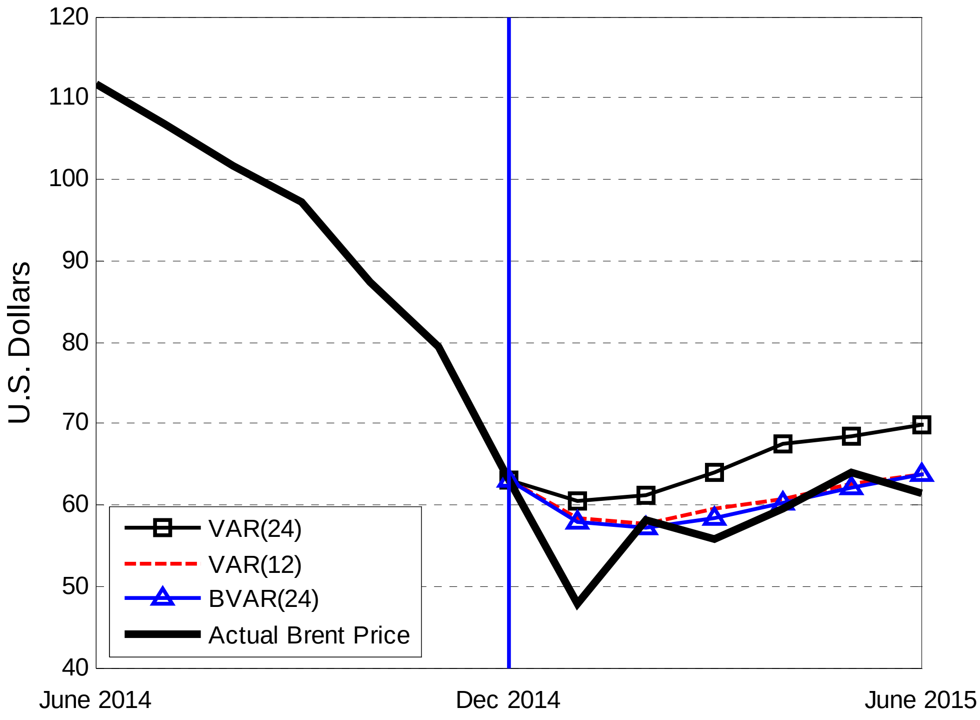
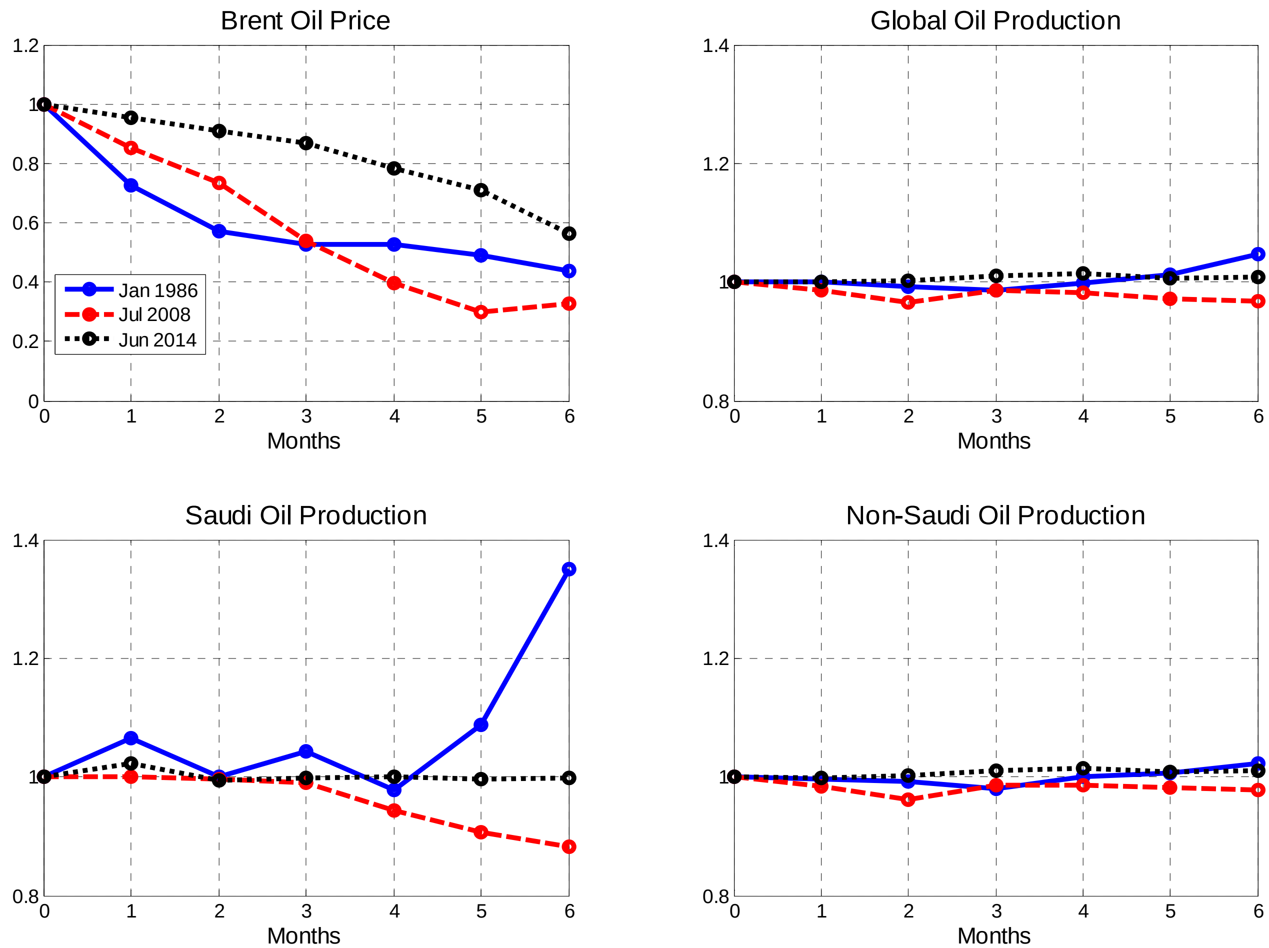
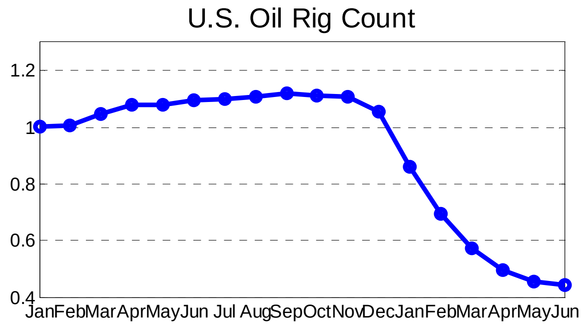


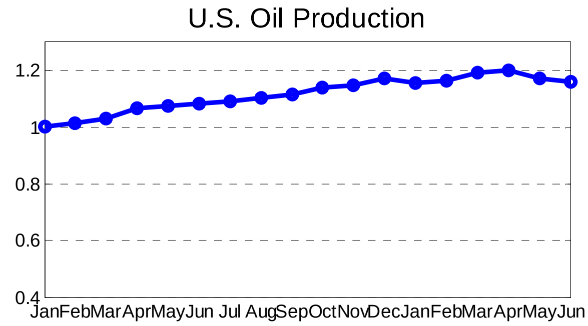
Figure 5: Oil Price Declines in Historical Perspective



NOTES: The data on global crude oil production are from the IEA's monthly *Oil Market Report*. The Brent price is from the EIA.

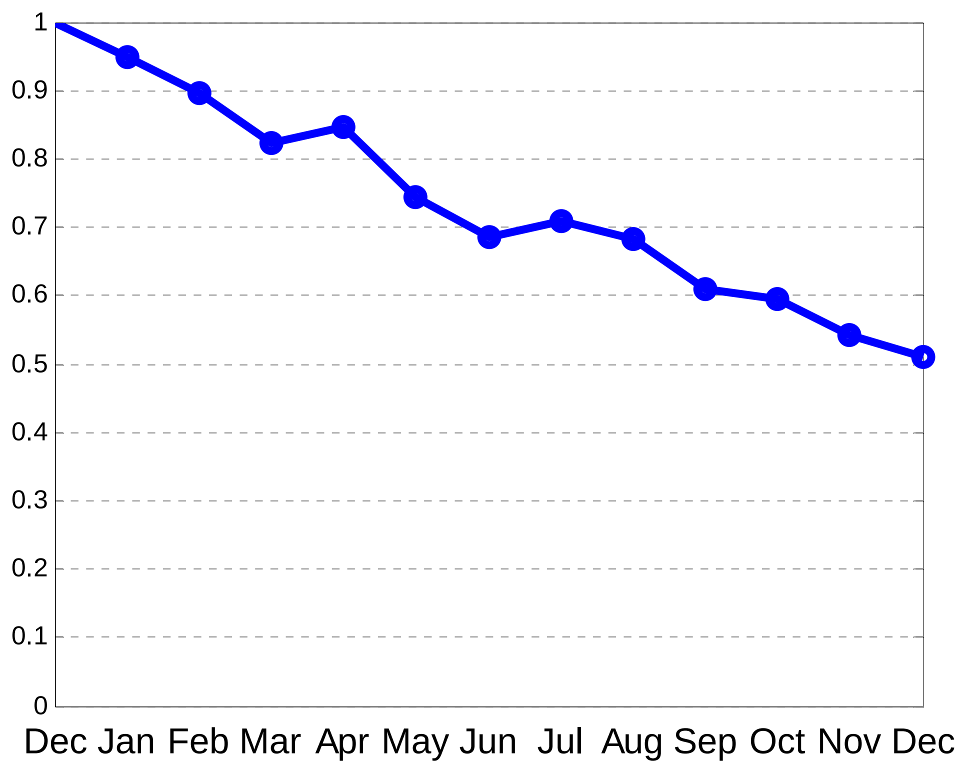
Figure 6: Indicators of U.S. Oil Production: 2014.1-2015.6





NOTES: The monthly U.S. oil production data are from the EIA's *Monthly Energy* Review for 2014 and the EIA-914 Survey for 2015. The end-of-the-month U.S. rotary oil rig count is from Baker Hughes (http://phx.corporate-ir.net/phoenix.zhtml?c=79687&p=irol-reportsother).

Figure 7: Chinese Spot Price of Iron Ore during 2013.12-2014.12



Source: Bloomberg.