

# Forecasting Short-Term Crude Oil Prices



---

*EIA Workshop on Financial and Physical Oil market Linkages  
September 29, 2015 / Washington, D.C.*

*By*

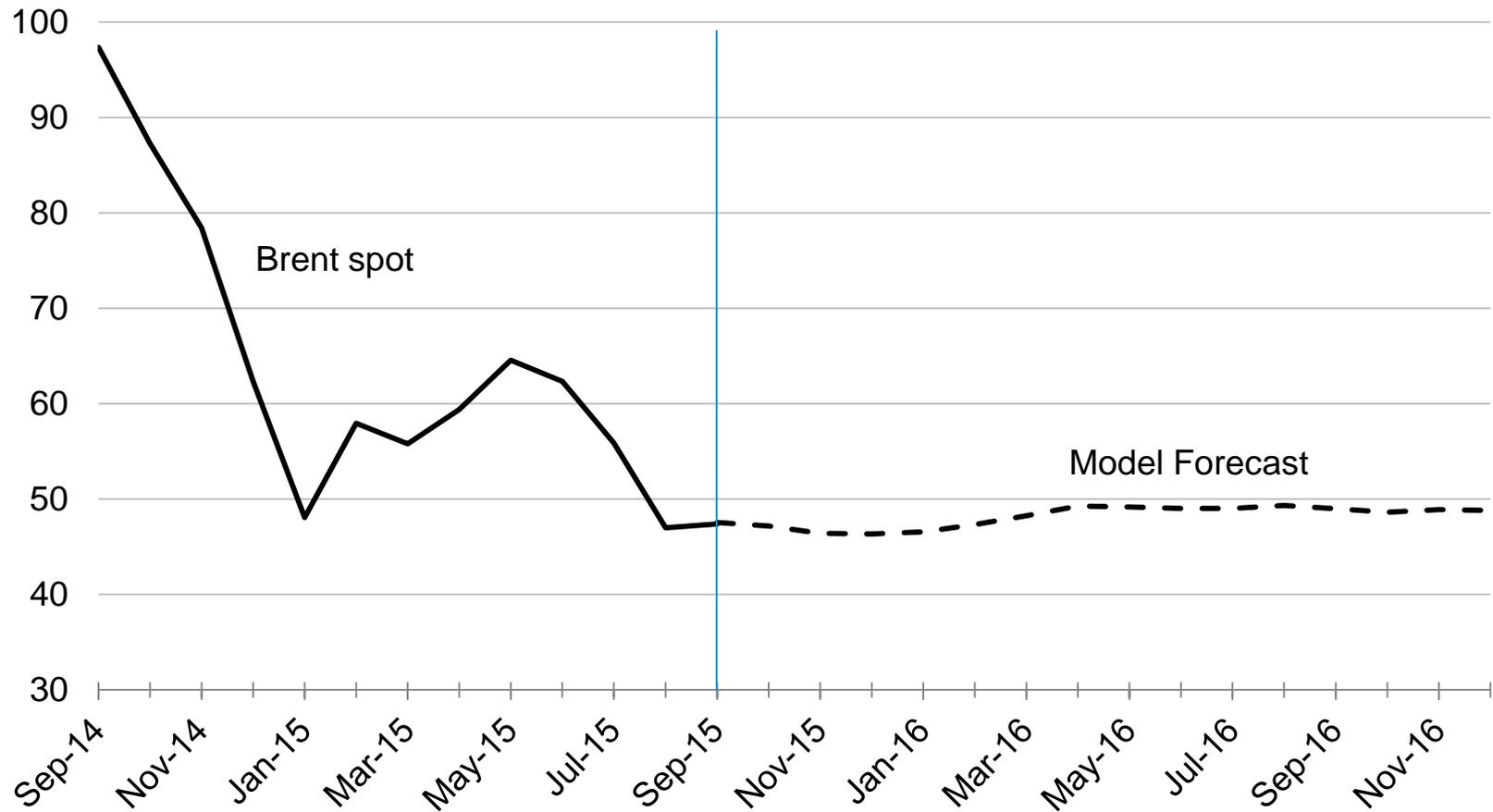
*Rebecca George*

*Office of Energy Markets and Financial Analysis*

*Energy Information Administration*

# Brent crude oil price forecast

Nominal dollars per barrel



Note: This is not a Short-Term Energy Outlook projection

# EIA implementation of crude oil price forecast models

- Crude oil price forecast models based a recent study:
  - “Are there gains from pooling real-time oil price forecasts?” by Baumeister, Kilian and Lee, *Energy Economics*, 2014
    - [http://www.eia.gov/workingpapers/pdf/oilprice\\_forecasts.pdf](http://www.eia.gov/workingpapers/pdf/oilprice_forecasts.pdf)
- Since 2014, the Markets and Financial Analysis team has made improvements to the models and generates price forecasts each month
- Price forecasts are included in discussions of official EIA price projections for the Short-Term Energy Outlook (STEO)

# Outline of Price Forecasting Models

- Models generate U.S. imported refiners acquisition cost (IRAC) forecasts in real time
  - Forecast horizon up to 2 years
- Pooled IRAC forecast is based on equal-weighted average of models used
  - Five models are used to forecast IRAC
  - Models are based on economic theory
- Pooled IRAC forecast is then converted to Brent
  - Based on an EIA internal *ad hoc* regression

# Five Selected Models to Forecast Imported Refiners Acquisition Cost

## 1. Vector autoregressive (VAR) model

- Global oil market model
  - IRAC as a proxy for the global real price of oil
  - Percent change month to month in global crude oil production
  - Level change month to month in above-ground OECD crude oil inventories
  - Index of global real economic activity (Baltic Dry Index)

## 2. Time-varying crack spreads model

- Demand for crude oil derives from the demand for refined products such as gasoline and heating oil
- Uses NY harbor conventional gasoline, NY harbor No.2 diesel, and WTI spot prices

# Five Selected Models to Forecast Imported Refiners Acquisition Cost, cont.

## 3. U.S. crude oil inventory model

- Changes in U.S. crude oil inventory captures shifts in expectations of the future real price of oil

## 4. Crude oil futures market model

- Uses WTI futures curve to project changes in IRAC

## 5. Industrial raw materials based model

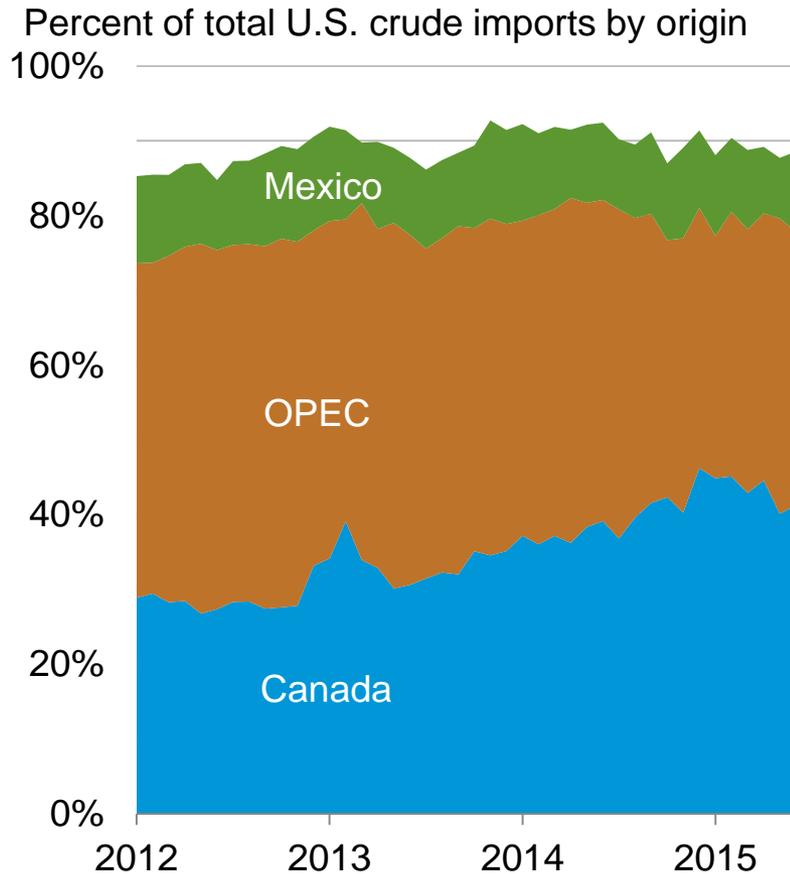
- Changes in the price of industrial raw materials have significant predictive power for the price of oil in the short horizons
- Uses Raw Industrials Index from the Commodity Research Bureau (CRB Rind)

# What If We Had Perfect Data?

<b>Ex-post Revised Data for VAR model</b>	<b>Recursive Mean Squared Prediction Error Ratio Relative to No-Change Forecast</b>	<b># of Months Lagged</b>	<b>Average # of Revisions</b>
<b>None of the time series</b>	<b>0.806</b>		
Global oil inventories	0.803	4	7.60
Global oil production	0.806	3	8.59
IRAC	0.739	2	1.21
U.S. consumer price index	0.798	1	0.66
U.S. oil inventories	0.811	1	1.54
<b>All time series</b>	<b>0.735</b>		

Source: Baumeister and Kilian (2012). "Real Time Forecasts of Real Price of Oil," JBES.

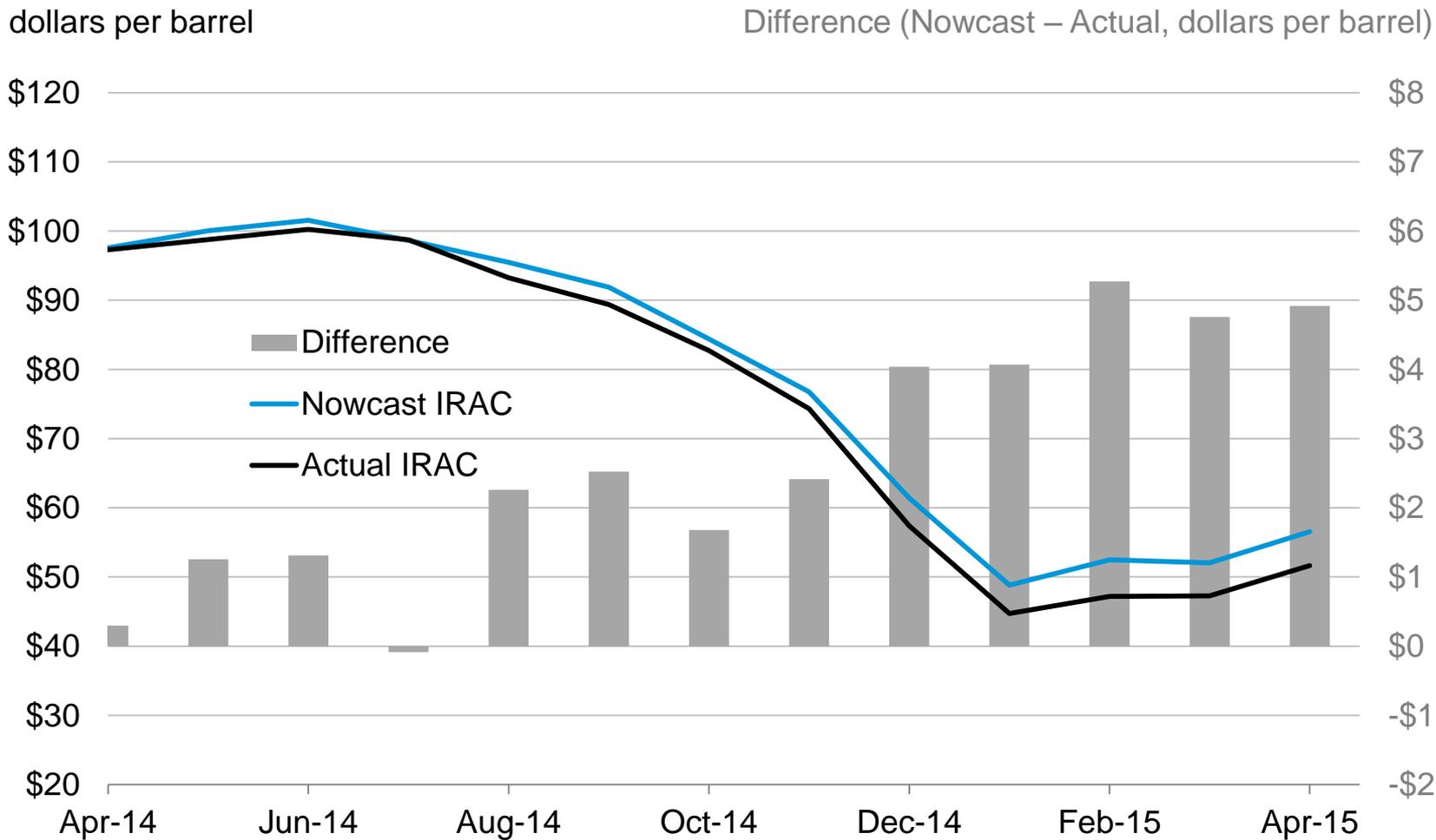
# Improvements made to five original forecasting models



Source: U.S. Energy Information Administration

- April 2014: IRAC nowcasting method #1
  - IRAC data is lagged 2 months
  - Original method used price changes in WTI to nowcast 2 months of IRAC
  - EIA developed a nowcasting equation based on price changes in OPEC, Canada, and Mexican crude oil streams

# EIA's IRAC nowcasting equation worked well until December 2014

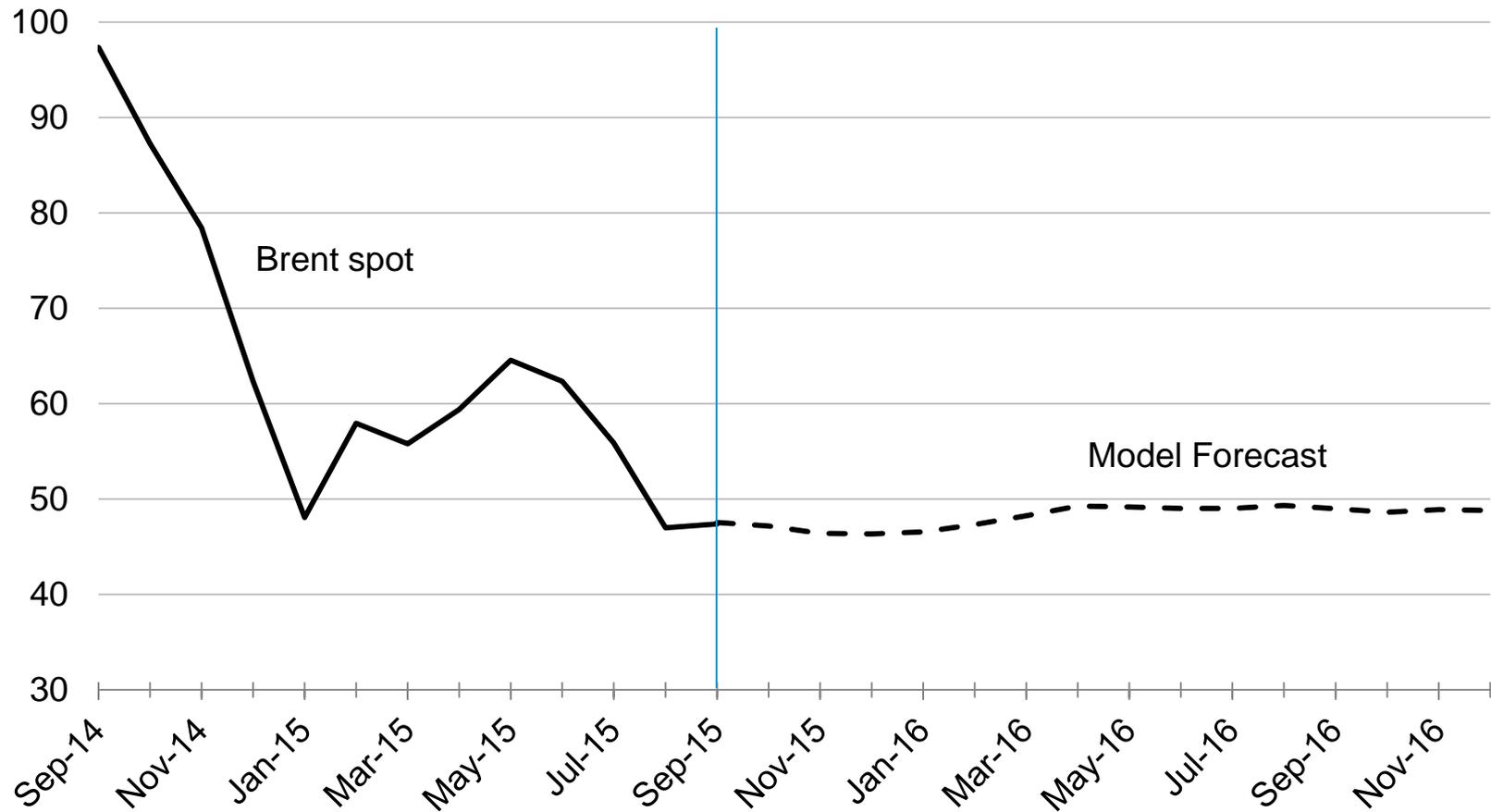


# Improvements made to five original forecasting models

- June 2015: IRAC nowcasting method #2
  - EIA's nowcasting equations were re-estimated and slightly modified but still used OPEC, Canada, and Mexican crude oil stream price data
- September 2015: Eliminate need for IRAC
  - Replaced any use of IRAC prices with Brent prices in each model
  - Replaced any WTI prices or domestic fundamental data that appeared in the models with comparable international data
    - U.S. Inventory model is now OECD Inventory Model
    - Futures model now uses Brent spot and Brent futures curve
    - Crack spreads model now uses Brent as the underlying crude
  - Avoids introducing any extra errors when converting final forecast from IRAC to Brent

# Brent crude oil price forecast

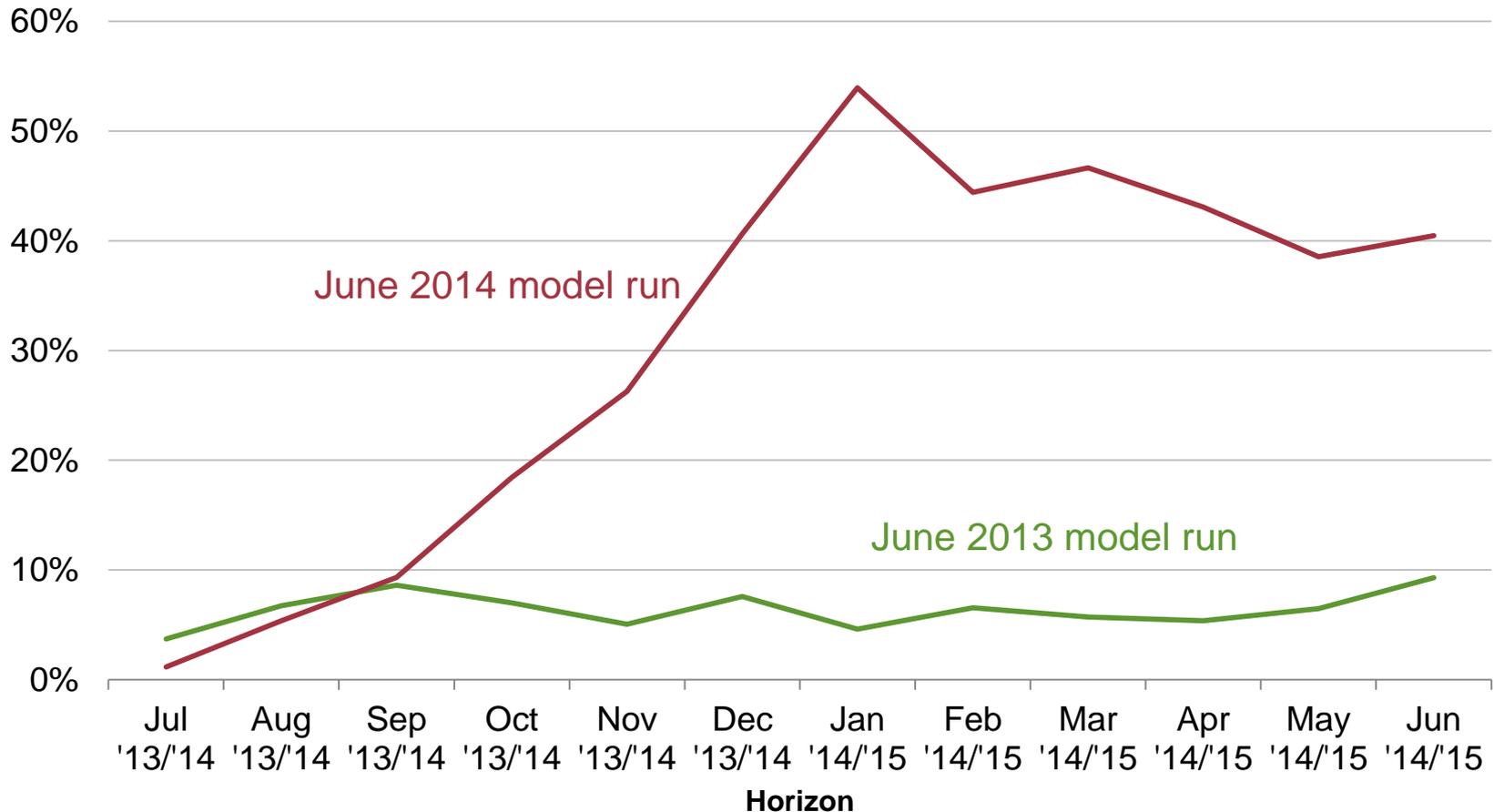
Nominal dollars per barrel



Note: This is not a Short-Term Energy Outlook projection

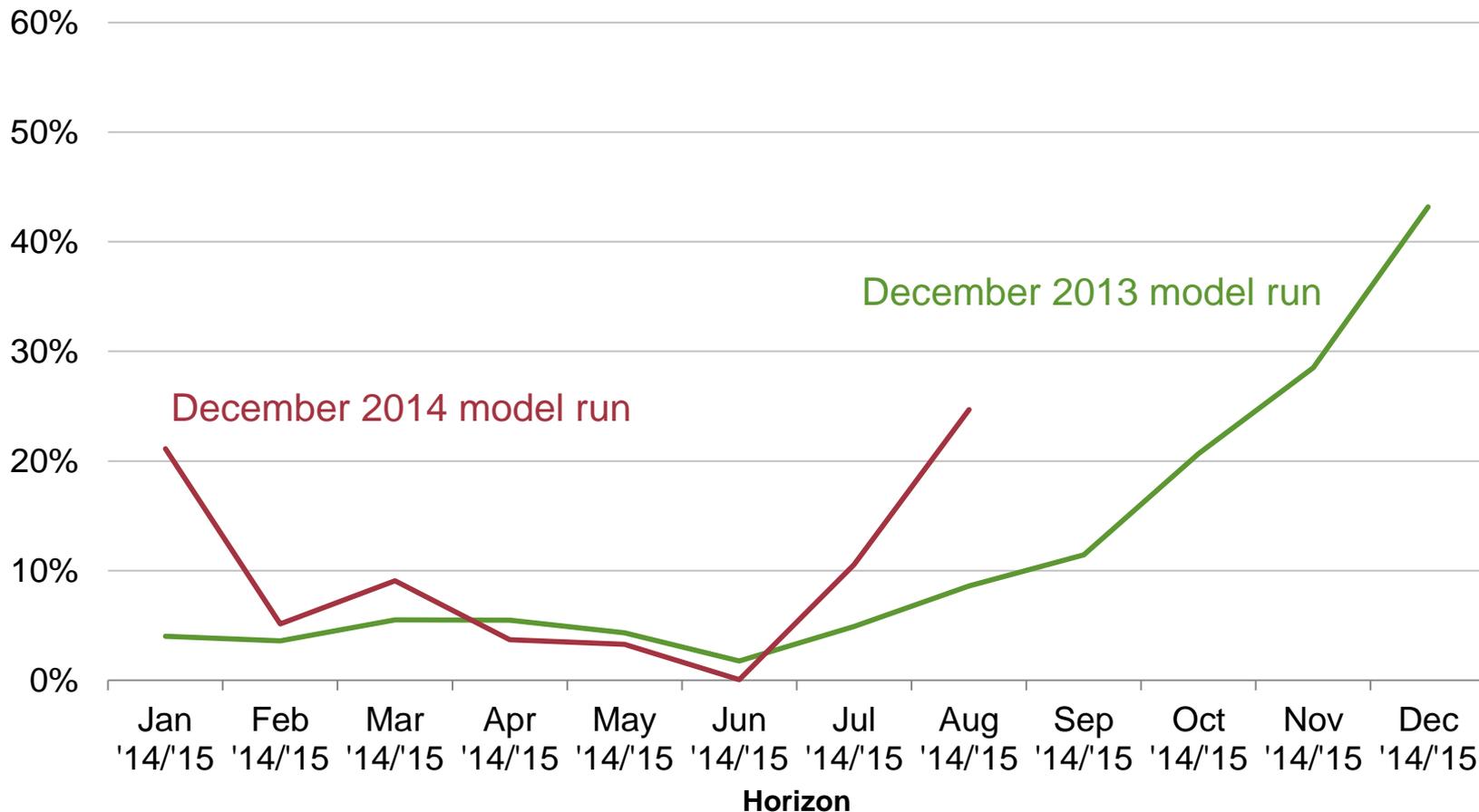
# Sample pooled Brent 12-month forecast accuracy for the June 2013 and June 2014 model runs

Absolute average percent error from actual Brent



# Sample pooled Brent forecast accuracy for the December 2013 and December 2014 model runs

Absolute average percent error from actual Brent



# Going forward

- Continue testing and monitoring performance of crude oil price models
- Focus on 3-6 month forecast accuracy
  - Narrow down models that perform well at shorter horizons
- Develop new price models that use other EIA projections (global production, consumption, etc.) as inputs

# Backup

# Aggregated errors for pooled Brent forecasts up to 12 months out

Absolute average percent error from actual Brent

