The Informational Content of Inventory Announcements:

Intraday Evidence from Crude Oil Futures Market

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INTRODUCTION

❑ Crude oil plays an important role in the global economy, and there is considerable interest in understanding oil price dynamics. Inventory information is of critical importance in crude oil price discovery because it measures directly the supply and demand fundamentals. If inventories are falling over time then it is likely that either demand is increasing or supply is decreasing, and hence the price of oil is likely to increase.

❑ In this study, we explore the impact of inventory information embedded in public announcements on crude oil futures returns. The impact of the inventory report released by the Energy Information Administration (EIA) on daily and intraday energy futures return has been widely studied (e.g. Gay, Simkins, and Turac, 2009; Halova, Kurov, and Kucher, 2014; Hui, 2014). Our contribution is to investigate the impact of a similar report released by the American Petroleum Institute (API) on crude oil futures returns and explore possible asymmetric impact of positive and negative petroleum inventory surprises in these reports.

❑ According to the efficient markets hypothesis, prices should move only when public announcements contain additional information beyond market participants' expectations. However, crude oil futures price can still fluctuate if:

   1. Traders are irrational and still adjust their positions even if the announcement has no additional information.

   2.Other energy products' inventory changes, which are also included in API and EIA reports, affect crude oil futures market.

RESEARCH GOALS

❑ Our study examines the behavior of intraday crude oil futures returns and how returns respond to crude oil, distillate, and gasoline inventory information contained in API and EIA inventory reports.

❑ Specifically, we investigate how the 15-minute returns in crude oil futures market respond to

   1. Unexpected positive and negative inventory shocks

   2. Expected inventory changes

PREVIOUS STUDIES

Gay, Simkins, and Turac (*The Journal of Futures Markets*, 2009): study the impact of surprise component of EIA's natural gas inventory reports on intraday natural gas futures returns

Halova, Kurov, and Kucher (*The Journal of Futures Markets*, 2014): explore the impact of oil and gas inventory surprises in EIA reports on intraday energy futures returns

Hui (*Energy Economics*, 2014): investigates the effect of the unexpected part in EIA's crude oil inventory reports on daily crude oil returns and volatility

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DATA

❑ **Sample period**: May 24, 2013–May 9, 2014 (50 weeks or 249 trading days)
❑ **Dependent variable**: 15-minute crude oil futures return
❑ **API report**: Tuesdays at 4:30pm EST (or Wednesdays at 4:30pm due to holidays); industry-backed; survey is voluntary
❑ **EIA report**: Wednesdays at 10:30am EST (or Thursday at 11:00am due to holidays); government based; survey is mandated; main market mover
❑ **Both API and EIA reports**: Provide information about changes in inventories of crude oil, distillate oil, and gasoline in the United States from the previous Friday.
❑ **Reuters forecasts**: Tuesdays around 2:00pm EST; the median of weekly survey collecting forecasts from various analysts on inventory changes of crude oil and petroleum products.

Average returns on API report release days

Average returns on EIA report release days
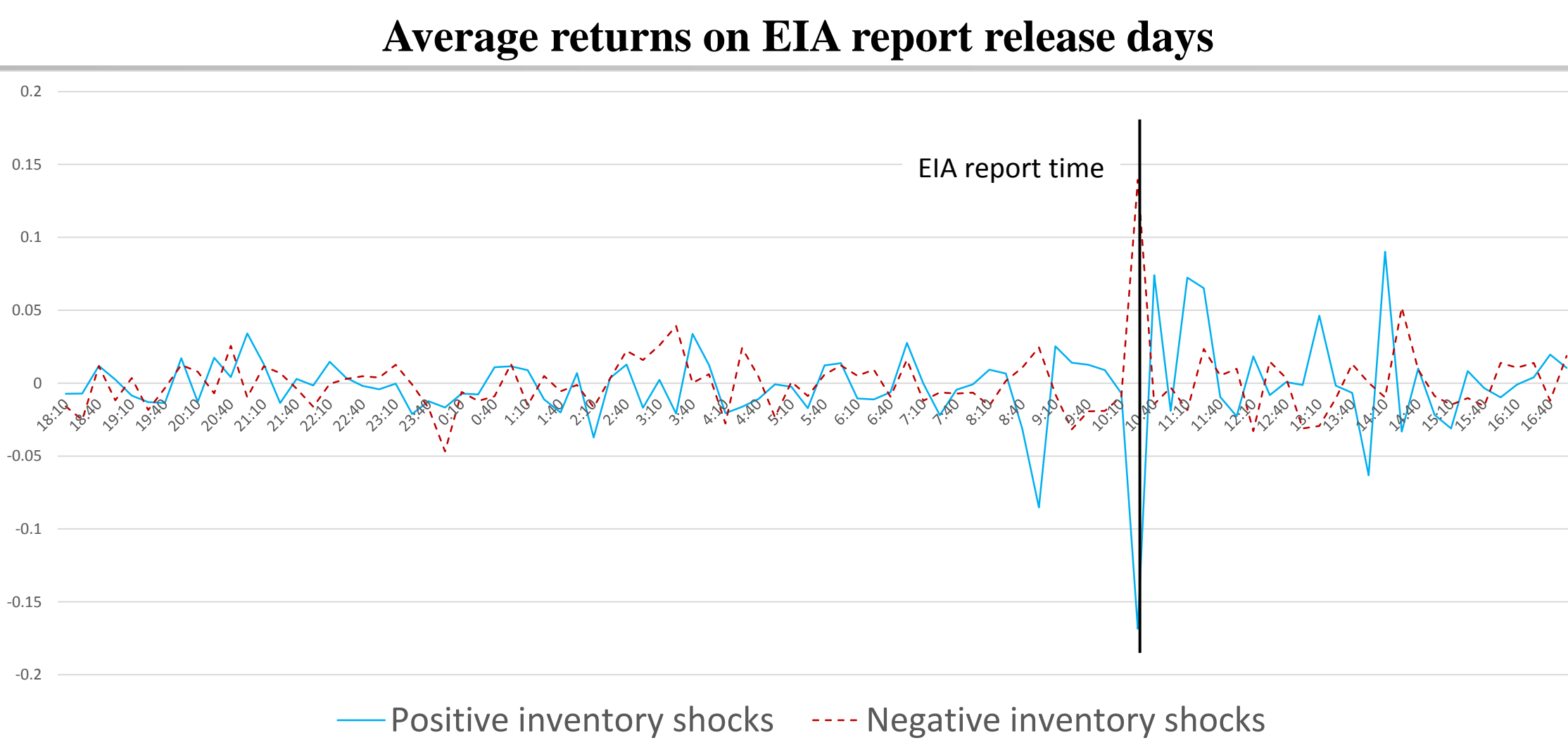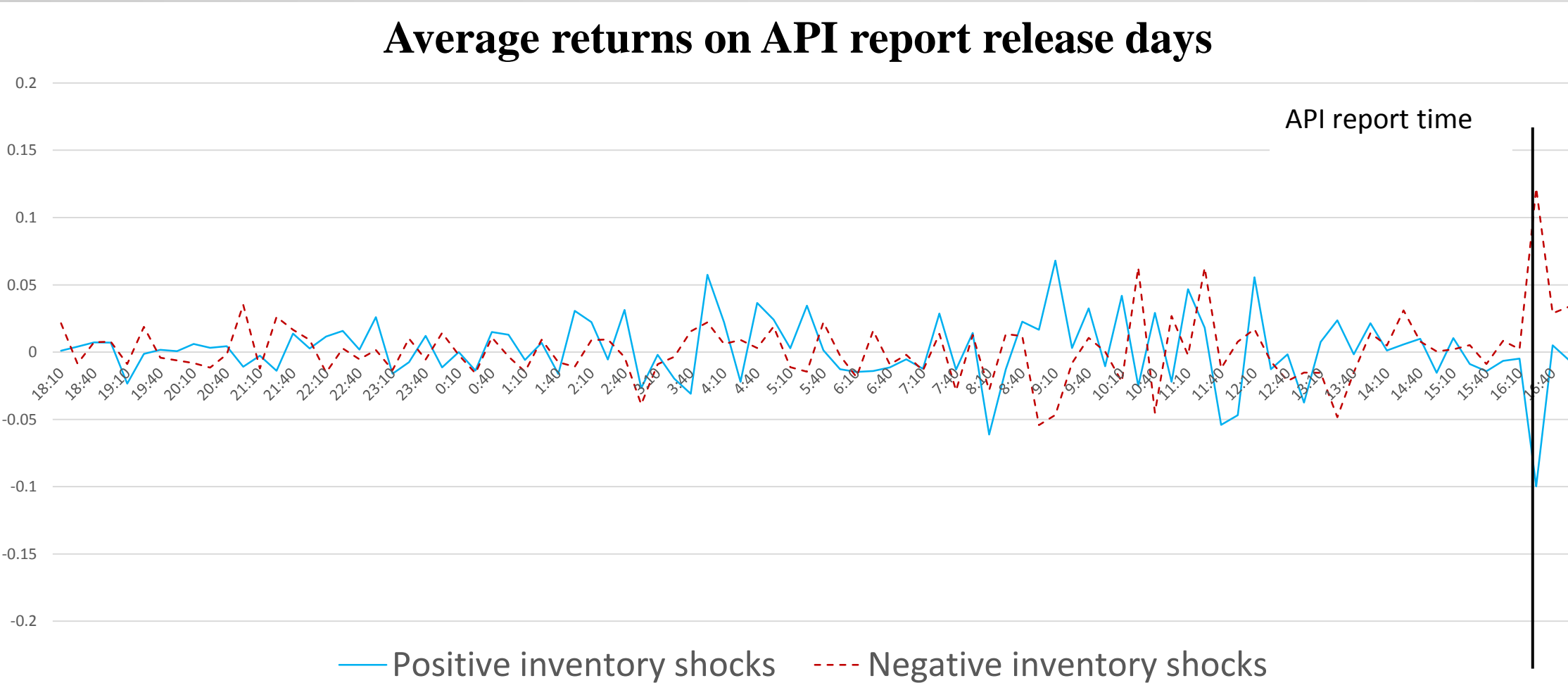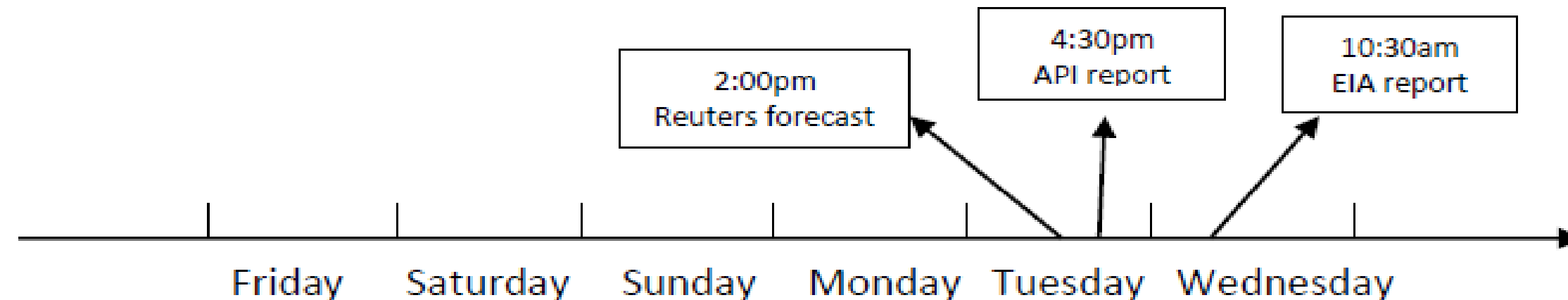
METHODS AND RESULTS

❑ We apply both nonparametric (jump statistic) and regression methods to study the impact of inventory announcements on crude oil futures return. Jump statistic identifies significantly large intraday return jumps surrounding inventory announcements that violate the assumption of a continuous diffusion model. Regression method measures the impact of expected and unexpected inventory changes in crude oil, distillate oil, and gasoline on electronic crude oil futures market.

Jump Statistic

Table 1. Frequency of return jump

Time Interval	00:00-23:59	8:55-9:10 Floor Trading Begins	10:25-10:40 EIA Report Release (Normal)	10:55-11:10 EIA Report Release (holiday)	14:10-14:40 Floor Trading Ends	16:25-16:40 API Report Release	18:00-18:10 Electronic Trading Begins
Frequency of jumps	133	18	14	7	13	1	8

❑ We detect 133 significant jumps in our sample period.
❑ The number of jumps during the opening (18) and closing (13) of floor trading are considerably high.
❑ We identify 14 jumps in interval 10:25-10:40, with 9 of these jumps occurring at the time of the EIA report release. Similarly, 2 of the 7 jumps found in interval 10:55-11:10 coincide with the EIA report release. In total, 11 out of 50 EIA reports generated significant return jumps.
❑ Only 1 significant jump is detected in 16:25-16:40 interval, indicating that API report does not often generate intraday return jump.

Regression

$$R_t^j = \alpha^j + \sum_{i=1}^{k} \beta_i Shock_{it}^j I_{it}^{S+} + \sum_{i=1}^{k} \gamma_i Shock_{it}^j I_{it}^{S-} + \sum_{i=1}^{k} \theta_i Expected_{it} + \varepsilon_t^j$$

$t = 1, \dots, 249; \; j = \{API, EIA\}; \; i = \{crude\ oil, distillate\ oil, gasoline\}$

R_t^{API} = continuously compounded return in interval 4:25-4:40pm on day t

R_t^{EIA} = continuously compounded return in interval 10:25-10:40am on day t

$Shock_{it}^j = \left(\Delta Inventory_{it}^j - \Delta Inventory_{it}^R\right) \div Inventory_{it}^j$

$Expected_{it} = \Delta Inventory_{it}^R \div Inventory_{it}^j$

$\Delta Inventory_{it}^R$ = Reuters' forecast for inventory changes of commodity i

$Inventory_{it}^j$ = inventory level of commodity i released in report j

$I_{it}^{S+} = 1$ if $Shock_{it}^j \geq 0$; 0 otherwise

$I_{it}^{S-} = 1$ if $Shock_{it}^j < 0$; 0 otherwise

Table 2. Response of crude oil futures returns to inventory announcements

	Variable	API Return	EIA Return
Crude oil	Positive Inventory Shock	**-0.134 (0.000)**	**-0.231 (0.004)**
	Negative Inventory Shock	**-0.126 (0.000)**	**-0.247 (0.033)**
	Expected Inventory Change	-0.025 (0.637)	0.205 (0.129)
Distillate	Positive Inventory Shock	**-0.031 (0.005)**	**-0.123 (0.007)**
	Negative Inventory Shock	0.012 (0.575)	-0.032 (0.545)
	Expected Inventory Change	0.017 (0.634)	0.002 (0.982)
Gasoline	Positive Inventory Shock	-0.000 (0.995)	-0.009 (0.936)
	Negative Inventory Shock	**-0.086 (0.000)**	-0.073 (0.301)
	Expected Inventory Change	-0.023 (0.419)	-0.022 (0.843)
	Constant	0.000 (0.235)	0.000 (0.103)
	Adj-Rsquare	0.455	0.109

P-values are shown in parentheses and calculated using heteroskedasticity robust standard errors.

❑ Crude oil returns do not react to expected inventory changes.
❑ Returns only respond to:
   1. positive and negative crude oil inventory shocks (API & EIA)
   2. positive distillate inventory shocks (API & EIA)
   3. negative gasoline inventory shocks (API)
❑ The impact of crude oil inventory surprises in EIA report is almost twice the impact of the surprise in API reports.
❑ The impact of positive and negative crude oil inventory shocks are not statistically different from each other.

CONCLUSIONS

❑ Our study reveals that, as shown in previous studies, it is the unexpected inventory change that affects intraday crude oil futures returns, confirming the efficient markets hypothesis.
❑ The unexpected component of API inventory reports, which hasn't been studied previously, is found to have a significant impact on intraday crude oil futures returns.
❑ However, the surprise component of EIA reports results in larger movements in intraday returns, providing empirical evidence that EIA report is the main market mover.
❑ Crude oil returns are also affected by the unexpected inventory changes in distillate oil and gasoline.
❑ This study investigates and compares the two important crude oil inventory reports in the United States. These results suggest crude oil market participants to utilize all relevant information, not just crude oil, in these reports and to take into consideration the asymmetric impact of the positive and negative inventory shocks in the petroleum products in their hedging and risk management decisions.