



RESEARCH ARTICLE

Comparative Impact of Days of the Week and Months of the Year on WTI and Brent Crude Oil Prices

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ABSTRACT

This study investigates the seasonality in crude oil returns, with a focus on West Texas Intermediate (WTI) and Brent crude oils, aiming to uncover how specific temporal patterns can impact market dynamics for WTI and Brent. This study analyses a comprehensive dataset that extends from January 1986 to July 2022 for WTI, and from May 1987 to July 2022 for Brent, utilizing regression analysis with variables to assess daily and monthly price returns for days-of-week and months-of-the-year effects. Analysis reveals consistent patterns where Mondays experience the lowest average returns and Thursdays the highest for both types of crude. On a monthly basis, May shows the highest returns, contrasting sharply with November and December, which register the lowest. The days-of-week effect is present in both WTI and Brent, while the months-of-the-year effect is significantly more pronounced in WTI, with Brent showing negligible monthly variations. It is important to recognize that many similar studies using a cross-sectional approach typically cover a shorter time span of 2-5 years and are often limited to specific locations. This limitation may affect the generalizability of their findings across different periods and geographies. By extending the dataset duration to include both pre- and post-pandemic economic conditions, this study aims to provide a more robust and applicable analysis for today's fluctuating global economy. These insights are crucial for stakeholders in the energy sector, aiding in the formulation of informed market strategies and policy decisions.

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INTRODUCTION

Seasonality is a time of the season, identified based on changes. Changes could be economic, political, or in the case of business – Impact. Seasonality is the features of the period of the year and its expected changes that are re-occurrent by nature. Because it is expected, it is a predictable fluctuation or pattern. Faubel et al., (2022) posit that all physical activities are impacted by seasonality. Crude oil activities are physical activities and are subject to seasonality per annum. Crude oil is the raw material that is refined to get petroleum products. It is petroleum products in their natural state. It is contained in a liquid phase in reservoirs below ground level as a mixture of hydrocarbons. Atsegbua et.al (2016) argue that crude oil is a natural source of social-economic

development oil producing and consuming nations of the world. The West Texas Intermediate (WTI) and Brent are two types of crude oil that are widely traded in the global oil market. *West Texas Intermediate (WTI)* is a form of crude oil, possesses the highest quality, and is easy to refine. It is sourced from inland Texas in the United States, traded in the New York Mercantile Exchange (NYMEX), and used as the benchmark for oil benchmarks. It is a major benchmark for the economy of the United States, and the news of WTI poses a market volatility list (Faseli, 2019). *Brent* is a low-density, low-sulfur blend of crude oil which accounts for two-thirds of global oil. It is commonly sourced from the Middle East, the North Sea between the Shetland Islands, Norway, Africa, and Europe. It is priced at a differential to Brent based on market speculations. Brent oil also impacts global prices due to its global source and coverage (Vochozka et al., 2020). Returns for both crude WTI and Brents are a function of global trade. While both forms of crude oil are sources of petroleum products in pursuance of global demand and supply, the change in time of year impacts the ability of these products to meet their objectives.

Numerous studies have affirmed that markets are primarily driven by speculation, focusing more on current and projected future activities rather than past economic events. This speculative nature is rooted in how investors anticipate and react to market signals and expected economic outcomes. In their comprehensive analysis, (Aggarwal & Jha, 2023) highlight the significant influence of seasonality on stock market returns, indicating that investors might be able to forecast returns based on seasonal patterns, potentially leading to uneven or unfair trading advantages. This phenomenon, known as seasonal anomalies, has been thoroughly documented across various studies in the field of finance (Akhter & Yong, 2021; Andrieş et al., 2017; Lobão, 2019; Seif et al., 2017).

The most researched theme for the study of these seasonal anomalies is the month-of-the-year effect and the day-of-the-week effect (Constantine & Ziemba, 2010). Most of this research are conducted to test the efficient market hypothesis also known as Efficient Market Hypothesis-EMH, given by Fama (1970) which assumes that share prices reflect all the information and it is difficult to beat or predict the market. Some researchers suggest that markets can be predictable by studying the market anomalies and by adapting high-tech trading strategies (Latif et al., 2011). According to this notion, EMH appears to be dubious because the presence of seasonality can affect it and an investor can exploit it by adopting specific strategies (Rossi, 2016).

Various studies also been conducted for stock and foreign exchange markets to prove the market anomaly. Stock market studies such as (Gu, 2023; Kim & Shamsuddin, 2023; Meier, 2014; Rossi, 2016; Woo et al., 2020; Ziemba, 2023) all suggested that the mean returns are different on each day of the week. Several work has also been done for the foreign exchange market to find the day-of-the-week effect which includes (Cao et al., 2021; Chakrabart & Sen, 2011; Farooq et al., 2013; JAFFE & WESTERFIELD, 1985; Yamori & Kurihara, 2004). There are very few studies that provide evidence for the oil market. Studies in energy economics have equally shown that there has been extreme volatility in crude oil prices over the past decades which is due to different factors such as hurricanes, OPEC production, worker's strike, wars, etc (Pan et al., 2022). In developing nations, crude oil price volatility has been a major issue for businesses because it affects both importers and exporters. When the prices fall governments find it difficult to offer service debt and social services. High oil prices for the exporting countries result in windfall in tax receipts and economic rent (Ali & Badhani, 2023). Volatility in oil prices also results in unemployment in the oil sector (Pan et al., 2022). It is sufficiently validated that there is a seasonal impact on crude oil returns regardless of WTI and Brent. These seasonality effects could be days of the week, months of the year or relative to location and the idiosyncrasies of the locations. While some seasons show high prices, other show low prices but it is safe to conclude that the prices are not the same over all days and months.

However, the cross-sectional approach typically involves data collection and analysis over a short period of about 2-5 years and is often location-specific. Post-pandemic, significant changes in the

global economy have highlighted that pre-pandemic assumptions may no longer hold true. This limitation presents a methodological gap, as the limited timeframe of cross-sectional analysis can undermine the validity of the findings. This study addresses this gap by comparatively investigating the impact of the day-of-the-week and month-of-the-year effects on Brent and WTI crude oil prices. Relying solely on pre-pandemic findings risks overlooking critical post-pandemic economic shifts. Therefore, this study proposes a cross-sectional analysis with an extended coverage from 1987 to 2022, encompassing a global perspective.

This study seeks answer to the question

“Do Days of the Week and Months of the Year Affect WTI and Brent Prices Differently?”

We hypothesize that

H1: *The impact of the days of the week and the months of the year on WTI and Brent crude oil prices varies significantly*

The objective of this study is to analyse the seasonal effects on WTI and Brent crude oil prices, specifically focusing on the variations that occur across different days of the week and months of the year. By examining these patterns, the study aims to provide insights into how temporal factors influence crude oil markets. These findings will help investors and stakeholders make more informed and strategically timed decisions, contributing to more effective risk management and policy formulation in the energy sector.

This study assumes that the sourced data on WTI and Brent crude oil accurately captures the actual returns from 1987 to 2022. It is also assumed that the analysis of recent data will provide an updated perspective on the impact of seasonal effects on crude oil returns. A major limitation is the cross-sectional approach starting from 1987. However, this limitation is offset by the opportunity for this study’s experimental analysis as pre-1987 and post-2022 data become available.

LITERATURE REVIEW

The study of seasonality on crude oil product prices has always been a significant importance to the stakeholder in the industry, due its ability to help determine the volatility, pricing and investments.

Valadkhani (2013) investigates the rationale that petrol prices are more affordable in certain areas of Australia. The seasonality study conducted a time series analysis of a cross-sectional period - 2005-2012 datasets from 114 locations across the country. The study found that Thursday and Friday are the days of the week with peaked prices, whereas, Sunday and Tuesday have the least prices. This trend happened repeatedly over the years, particularly in the capital regions of the country. Although the impact was also present in the less capital areas, it was with insignificant differences. These findings were aimed to support the Australian Automobile Association (AAA) and Australian Competition and Consumer Commission (ACCC) towards development and implementation of policies relative to regional impact within Australia (Valadkhani, 2013).

Arendas et al., (2018) focus on the investigation of oil price seasonal patterns and their exploitability in the investment process. Their research spans the period from 1983 to 2017, analyzing Brent and WTI crude oil prices. They identify specific months—March, April, and August—where oil prices tend to record abnormally positive returns, and October and November, where prices tend to show negative returns. This cyclical behavior suggests potential opportunities for investors to develop strategies that exploit these predictable trends. The authors posit that, previous studies have extensively documented the importance of oil in the global economy, both as a crucial energy source and a highly traded commodity. The significant impact of oil prices on macroeconomic indicators, such as inflation and GDP growth, underscores the need for a deep understanding of oil market

dynamics (Ahmed, 2023). Moreover, the financialization of oil through futures and derivative markets has intensified the link between oil prices and broader financial markets (Creti 2015). The work of Auer (2014) and Suenaga and Smith (2011) adds to this understanding by examining daily and seasonal volatility in oil prices. They reveal that oil price volatility is significantly higher on Mondays, a pattern that persists across different sub-periods and econometric models. This volatility is partially attributed to investor behavior and market sentiment, aligning with behavioural finance theories (Shu, 2010). Arendas et al. (2018) proposes investment strategies based on their findings, suggesting that a simple approach of switching investments between the oil market and money markets can outperform traditional buy-and-hold strategies. These insights are crucial for both retail and institutional investors, as they offer a method to mitigate risk and optimize returns based on seasonal trends in oil prices.

Quayyoun (2020) studied the month-of-the-year effect and day-of-the-week effect for December 1987 to January 2016 for the Brent and WTI crude oil returns. The study reported a negative Monday effect whereas returns for the Thursday were highest. The study also revealed that the month-of-the-year effect was also present in the crude oil prices because November and December reported negative returns. Olowe (2011) found out that there is a significant presence of the day-of-the-week effect in both volatility and return in the oil market. The study reported significant Thursday effects in volatility and significant positive Thursday and Friday effects in return. The study used the daily data of UK Brent crude oil throughout 2nd January 1997 to 27th May 2009.

Another study by Perdiguero et.al (2021) investigates the Monday effect on the Spanish oil market prices. It was assumed that ascertaining the average price per week day would help the government in tackling anti-competitive economic policies. The study sourced data on petrol stations prices for the period between 2012–2013. To econometrically investigate variations, the study uses a difference-in-difference estimator to exploit this regulatory change. Findings shows that three main companies account for 70% of the Spanish share and have systematically lowered the petrol price for Mondays of every week. The study revealed that this seasonal effect was a function of collaborative effort dominant oil operators as such, it is recommended that government should scrutinise the sector more intensely. This seasonality effect on the days of the week impacts the government's ability to be competitive with the European oil ecosystem(Perdiguero et.al, 2021).

Qadan et.al (2021) explore this phenomenon, focusing on the volatilities of oil, gold, silver, and energy sector securities. They identify non-random patterns of movement on Mondays and Fridays, with a systematic increase in volatility on Mondays and a decrease on Fridays. This observation is robust across various subsamples and econometric procedures, underscoring the significance of weekday effects in commodity markets. The authors suggests that market returns vary systematically with the day of the week (Birru, 2018). Other studies present mixed findings, with some challenging the existence or consistency of this effect (Elangovan et.al 2023; Degenhardt et.al 2018). Qadan et.al (2021) study contributes to this ongoing debate by extending the analysis to volatility products, which are less explored in existing literature. The integration of financial markets with commodity markets has increased, necessitating a deeper understanding of volatility patterns (Agyei et al., 2022). Volatility products, designed to track the implied volatility of commodities, trade like stocks and exhibit daily price fluctuations. Despite extensive literature on daily seasonality in financial vehicles, the weekday seasonality in volatility products remains underexplored. Qadan et.al (2021) research addresses this gap by examining the price distribution of volatility products across weekdays. They find that the implied volatility of commodities such as oil, gold, and silver significantly correlate with investors' mood swings throughout the week. This correlation aligns with behavioral finance theories suggesting that mood influences market volatility (Akin et.al, 2023). Their findings have practical implications for investors and policymakers in the energy sector. By

understanding these patterns, stakeholders can develop informed strategies for hedging and speculation, thereby optimizing their market positions and risk management practices.

Meek et.al (2023)) explore the effect within the context of petroleum and petroleum products through futures markets. Their study focuses on five key energy futures: WTI (West Texas Intermediate), Brent, RBOB Gasoline, Heating Oil, and Natural Gas, providing a comprehensive analysis of the DOW effect across different commodities. The DOW effect is an anomaly where asset returns differ systematically across the days of the week, challenging the Efficient Market Hypothesis (EMH) which asserts that asset prices reflect all available information (Lim et al., 2012). Meek et.al (2023) extend this line of inquiry by employing advanced econometric models such as GARCH, EGARCH, PGARCH, QGARCH, and TGARCH to account for asymmetric responses to positive and negative shocks. Their findings reveal heterogeneous DOW effects across the five energy markets studied. For example, WTI exhibits a positive Friday effect, while RBOB Gasoline shows a negative Monday effect. These results suggest that the DOW effect is not uniform across different energy commodities, underscoring the importance of commodity-specific analyses.

The study of seasonality in crude oil prices is crucial for stakeholders in the energy industry, as it helps determine volatility, pricing, and investment strategies. Research consistently shows significant day-of-the-week and month-of-the-year effects on crude oil prices. For instance, prices peak on Thursdays and Fridays and dip on Sundays and Tuesdays. These findings are consistent across various studies and regions, indicating that temporal patterns significantly influence market behavior. Understanding these seasonal trends enables investors and policymakers to make informed decisions, optimizing their strategies and enhancing market stability and competitiveness in a post-pandemic economic environment.

THEORETICAL FRAMEWORK

Efficient Market Hypothesis (EMH)

The Efficient Market Hypothesis (EMH) serves as the cornerstone of this study's theoretical framework for analyzing the seasonal effects on WTI and Brent crude oil prices. EMH, formulated by Eugene Fama in the 1970s, posits that financial markets are "informationally efficient," meaning that asset prices fully reflect all available information at any given time (Malkiel, 2003). According to EMH, it is impossible to consistently achieve returns that exceed average market returns on a risk-adjusted basis, given that market prices should only respond to new information (Lim et al., 2012).

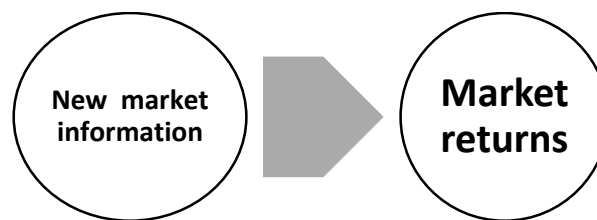


Figure 1: Theoretical Framework| Authors Computations

EMH can be categorized into three forms based on the degree of information reflected in market prices:

1. **Weak form efficiency:** This form asserts that all past trading information, such as historical prices and volumes, is fully reflected in asset prices. Hence, technical analysis and patterns derived from historical data should not provide investors with a consistent advantage.
2. **Semi-strong form efficiency:** This form suggests that all publicly available information, including financial statements, news releases, and economic reports, is reflected in asset prices.

Under semi-strong efficiency, neither fundamental analysis nor publicly available information can be used to achieve superior returns.

3. **Strong form efficiency:** This most stringent form claims that all information, both public and private (insider information), is fully reflected in asset prices. Therefore, even insider information cannot provide any advantage in predicting future price movements.

CONCEPTUAL FRAMEWORK

The conceptual framework for this study is designed to explore the relationship between calendar anomalies (specifically the day-of-the-week and month-of-the-year effects) and crude oil prices for WTI and Brent. This framework integrates key concepts from the Efficient Market Hypothesis (EMH) and behavioral finance to analyze how these temporal patterns impact market behavior and investment strategies.

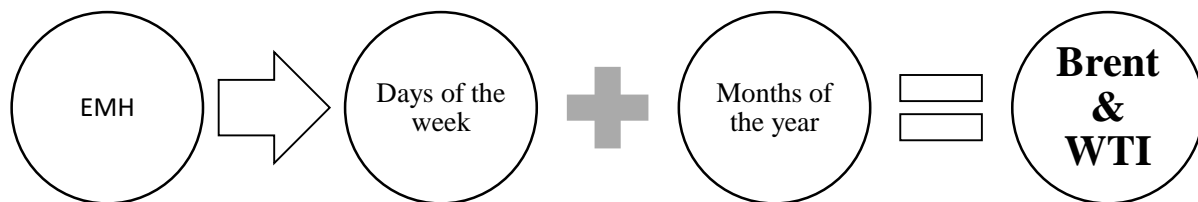


Figure 2: Conceptual Framework | Authors Computations

This foundational theory (EMH) posits that all relevant information is already reflected in crude oil prices, making it challenging to achieve consistently higher returns through market timing or analysis. Despite EMH, the study investigates specific temporal patterns, such as the day-of-the-week and month-of-the-year effects, to identify any deviations from market efficiency. This study focuses on two primary benchmarks—WTI and Brent—analyzing their price behavior over a comprehensive historical period. This conceptual framework provides a structured approach to understanding and analyzing the impact of temporal patterns on crude oil prices, integrating theoretical insights with empirical analysis to offer practical implications for stakeholders.

METHODOLOGY

Research design - research onion

The research design is based on the research onion by Saunders et al. (2007). This study is based on the philosophical assumptions of epistemology positivism. Philosophical considerations are better studied and understood in light of ontology and epistemology. Ontology refers to the originality and reality of information. On another hand, epistemology is defined as the correctness of the information needed for a particular study and how that information can be obtained. Commonly used research philosophies in the world of research are the positivism and interpretivism philosophies. Interpretivism philosophy is built on the notion that through observations, meanings of certain occurrences can be deduced and that these occurrences are creations of the communal surroundings. Positivism, as research philosophy, advances the belief of objectivity supported by facts in the study of any given occurrence.

This study adopts a deductive approach as opposed to an inductive approach to enable the formulation of a study hypothesis based on existing theories for testing. Deductive reasoning indicates extracting inferences based on validation theories and hypothesis from analysis of data. The study research strategy is experimental. Saunders et al., (2007) posit that experiment is test of casual effect of a phenomena or establish of relationship between multiple variables. This study aims

to carry out an experiment on relationship phenomena. More specifically, to experiment on the casual effect of open data implementation on entrepreneurial ability within a state.

Applicable research choice of method is quantitative. Quantitative analysis involves both descriptive and inferential evaluation of collected data to identify and measures variables under study (Saunders et al., 2007).

Research time horizon for the study is from January 1986 to July 2022. The study can adopt a cross-sectional or longitudinal time horizon. Longitudinal studies conducted over some time, while a cross-sectional study is restricted to a specific time frame.

Data source and variables

This research has been done using the data extracted from U.S. Energy Information Administration (EIA) official website. The data set consists of daily and monthly closing prices of Brent crude oils and West Texas Intermediate (WTI) which are considered to be benchmark for crude oil pricing. WTI is extracted from the US mainly Texas and Brent is extracted from the North Sea. For WTI, daily and monthly data for the period from January 1986 to July 2022 has been used and for Brent, the period is May 1987 to July 2022. Crude oil price returns is the dependent variable while few independent dummy variables are generated (see Statistical Models below) to understand the two seasonal anomalies which are the month-of-the-year effect and the day-of-the-week effect.

Statistical models

Researchers have widely used dummy variables in regression techniques to study the seasonal anomalies of the stock market (Olowe, 2011). The statistical technique used in this study is also the same which is Ordinary least squares (OLS) using dummy variables but the only difference is that this time it is for crude oil market. The returns are calculated by taking the log of daily and monthly closing prices of crude oil. The formula used to calculate the returns is:

$$R_t = \ln\left(\frac{P_t}{P_{t-1}}\right) \quad (1)$$

Where P_t is the crude oil price for the current period and P_{t-1} is the price for the previous period.

The regression model used to check the day-of-week- effects is as follows:

$$R_t = \alpha + B_2D_2 + B_3D_3 + B_4D_4 + B_5D_5 + \epsilon_t \quad (2)$$

Where R_t represents crude oil return for the period t and B_2 to B_5 are the dummy variables that represent Tuesday to Friday (for instance, if the day is Tuesday, then, $D_2 = 1$ and 0 for all other days and so on). The coefficient of α represents the mean value of average returns on Monday because for Monday all the dummy variables will be zero.

The regression model for the month-of-the-week effect is:

$$R_t = \alpha + B_2D_2 + B_3D_3 + B_4D_4 + \dots + B_{12}D_{12} + \epsilon_t \quad (3)$$

Where R_t represents crude oil return for the period t and B_2 to B_{12} are the dummy variables that represent February to December (for instance, if the month is February, then, $D_2 = 1$ and 0 for all other months and so on). The coefficient of α represents the mean value of average returns in January because for January all the dummy variables will be zero. In our OLS estimation technique, the standard errors are both heteroscedasticity and autocorrelation robust.

RESULTS AND DISCUSSION

The table 1 below shows the descriptive statistics of daily prices for WTI and Brent crude oil for the period of January 1986 to July 2022 and May 1987 to July 2022 respectively. According to the results,

Monday has the lowest mean crude oil price returns for both Brent and WTI, whereas, Thursday has the highest mean crude oil price returns for both the markets. For WTI oil market, skewness for Tuesday and Wednesday is positive, whereas, for Monday, Thursday, and Friday it is negative. On the other hand, the Brent oil market is positive for Wednesday and Friday, and negative for all other days of the week.

Table 1: Descriptive statistics for WTI and Brent daily crude oil prices

WTI daily crude oil prices					
	Monday	Tuesday	Wednesday	Thursday	Friday
Mean	-0.0014	-0.0001	0.0007	0.001	0.0008
Std. Deviation	0.03033	0.02651	0.02819	0.02739	0.02327
Skewness	-0.667	1.328	1.213	-1.314	-0.751
Kurtosis	13.666	25.634	34.892	36.922	11.289
Brent daily crude oil prices					
	Monday	Tuesday	Wednesday	Thursday	Friday
Mean	-0.00103	-0.00089	0.000467	0.001724	0.000707
Std. Deviation	0.026597	0.027617	0.0251734	0.02559	0.022768
Skewness	-0.902	-7.038	2.133	-1.032	0.166
Kurtosis	11.597	165.063	43.098	36.98	8.99

The table 2 shows the descriptive statistics for monthly prices for WTI and Brent crude oil for the period of January 1986 to July 2022 and May 1987 to July 2022 respectively. According to the results, November and December have the lowest mean crude oil price returns for both Brent and WTI, whereas, May has the highest mean returns for both the markets.

Table 2: Descriptive statistics for WTI and Brent monthly crude oil prices

Descriptive statistics - WTI monthly crude oil prices					Descriptive statistics - Brent monthly crude oil prices				
Month	Mean	Std. Deviation	Skewness	Kurtosis	Month	Mean	Std. Deviation	Skewness	Kurtosis
Jan	0.019153	0.082603	-1	1.349	Jan	0.008174	0.096382	-1.216	1.407
Feb	-0.00966	0.093315	-2.185	7.402	Feb	0.004884	0.077422	-0.194	0.653
Mar	0.014794	0.133128	-1.985	8.119	Mar	0.008202	0.127878	-2.477	10.728
Apr	0.011811	0.121598	-3.225	14.198	Apr	0.012001	0.131017	-2.709	10.168
May	0.034607	0.113041	2.586	11.019	May	0.032912	0.105317	2.195	8.072
Jun	0.003923	0.087627	0.978	1.981	Jun	-0.00215	0.091945	1.273	3.296
Jul	0.004951	0.069515	-0.719	-0.142	Jul	0.016313	0.066582	0.066	0.076
Aug	0.01367	0.100939	1.682	5.502	Aug	0.015858	0.104931	2.013	9.328
Sep	0.009504	0.068785	0.313	0.933	Sep	0.013551	0.084553	0.048	1.003
Oct	-0.00075	0.084928	-1.289	3.78	Oct	-0.00340	0.089495	-1.43	3.378
Nov	-0.03145	0.086539	-0.675	1.194	Nov	-0.03322	0.092855	-0.816	1.212
Dec	0.030868	0.112229	-0.595	0.037	Dec	-0.02558	0.115726	-0.26	-0.395

Table 3 reports the day-of-week-effect for the WTI and Brent crude oil markets using dummy variables in the regression estimation technique. The results show that Monday has negative returns for both WTI and Brent but at a 5% level, it is only significant for WTI crude oil market.

Hence, it proves that the traditional Monday effect is only present in WTI not in the Brent Crude oil market. The main reason behind Monday effect is arrival of news as mentioned by K.-Y. Ho et al. (2020) and Kannianen and Yue (2019). The markets are not active on weekends but news keep releasing which effect the markets on Monday when they are opened. The results of this study are different from the research by Quayyoun et al. (2020) which reported that the Monday effect is present in Brent rather than WTI. The reason behind that could be that time span of both the studies is different and secondly Brent is used as benchmark by OPEC countries and most of the OPEC countries are working on Saturdays and Sundays and only Friday is off there so the release of the news on these doesn't create any impact on Monday. Another justification of no Monday effect in the Brent oil market is that the dynamics of price determination in financial assets and commodity markets are significantly different from each other. The investor focuses on supply and demand at the macro level while making the investment decision in the commodity market, but the capital markets investors rely on market information at both micro and macro level because their goal is to outpace the market in the shorter term using this knowledge. It is also observed that Thursday and Friday effects are positively significant for the Brent Crude oil market. Same results were reported from the studies conducted previously, for instance, Quayyoun et al. (2020) and Olowe (2011) reported the lowest returns on Monday, and highest returns on Thursday and Friday for oil markets, whereas, Lakonishok & Levi (1982), Jaffe et al. (1989) and French (1980) also found the same results but on stock markets.

On the other hand, Monday, Wednesday, Thursday, and Friday have significant returns for WTI crude oil market. All the weekdays have positive returns except Monday. Previously, Quayyoun et al. (2020) reported Wednesday, Thursday, and Friday effects, and Yu (2011) reported the Wednesday effect for oil markets.

Table 3: The day-of-the-week-effect for Brent and WTI crude oil returns

Brent					WTI				
	B	Std. Error	t	Sig.		B	Std. Error	t	Sig.
(Constant)	-.001	.001	-1.679	.093	(Constant)	-.001	.001	-2.145	.032*
Tuesday	.0001	.001	.157	.875	Tuesday	.001	.001	1.423	.155
Wednesday	.001	.001	1.719	.086	Wednesday	.002	.001	2.361	.018*
Thursday	.003	.001	3.137	.002*	Thursday	.002	.001	2.649	.008*
Friday	.002	.001	2.055	.040*	Friday	.002	.001	2.389	.017*

*Significance at the 5% level.

Our results show that investor in the oil market mostly buys on Mondays when the returns are negative and after holding it for mid of the week sell it on weekends. This pattern returns has been consistent for both the WTI and Brent crude oil markets. Meanwhile, the reason behind Wednesday, Thursday, and Friday significant results for WTI is mainly that American Petroleum Institute regularly releases news about crude oil on Tuesdays.

Table 4: The month-of-the-year effect for Brent and WTI crude oil returns

Brent					WTI				
	B	Std. Error	t	Sig.		B	Std. Error	t	Sig.
(Constant)	.008	.017	.482	.630	(Constant)	.019	.016	1.199	.231
Feb	-.0001	.024	-.005	.996	Feb	-.018	.023	-.803	.423
Mar	.005	.024	.216	.829	Mar	.002	.023	.076	.940
Apr	.0002	.024	.009	.993	Apr	-.008	.023	-.333	.740
May	.026	.024	1.088	.277	May	.011	.023	.505	.614
Jun	-.008	.024	-.333	.739	Jun	-.011	.023	-.503	.615
Jul	.005	.024	.210	.834	Jul	-.014	.022	-.633	.527
Aug	.008	.024	.318	.751	Aug	-.005	.023	-.243	.808
Sep	.005	.024	.222	.824	Sep	-.010	.023	-.427	.670
Oct	-.012	.024	-.479	.632	Oct	-.020	.023	-.881	.379
Nov	-.042	.024	-1.750	.081	Nov	-.051	.023	-2.240	.026*
Dec	-.034	.024	-1.426	.155	Dec	-.050	.023	-2.214	.027*

*Significance at the 5% level.

Table 4 above reports the month-of-the-year effect for WTI and Brent crude oil returns. The results show that there is no traditional January effect for the oil markets instead there is a November and December effect but only for WTI crude oil returns not for Brent. Previously, Quayyoun et al. (2020) reported November and December effects for both Brent and WTI crude oil markets which is different from the results of this study whereas Olowe (2011) reported that monthly seasonal effect is absent in the oil price return series for Brent which is similar to our results. The negative returns for November and December are mainly due to the crude oil demand because in the summer there is more demand and prices tend to increase and in winter demand decreases resulting in lower prices. People are traveling in summers and oil consumption is high but in winters they travel less. Brent is extracted from OPEC countries may be the winters are not harsh that's why there is no effect.

The results of this study have significant implications. For instance, the oil traders should time their flows of order in a way that the information is kept confidential since it has been observed from the results that news affects the oil prices. Secondly, for the policymakers, the results will help them to capture the trading times in a better way and to access the policies so the impact of oil prices on the economy can be controlled.

CONCLUSION AND RECOMMENDATIONS

Understanding the seasonality effects on stock markets has been a hot topic among researchers and many studies have been done in the past which reported different days of the week affecting the stock returns. This study particularly studies the days-of-week effect and month-of-the-year effect on crude oil price returns. To study the effects of WTI daily and monthly data for the period from January

1986 to July 2022 has been used and for Brent, the period is May 1987 to July 2022. The regression technique using dummy variables for days and months has been used to understand the days-of-week effect and month-of-the-year effect on crude oil price returns. Our results show that Monday has the lowest mean crude oil price returns for both WTI and Brent whereas Thursday has the highest mean crude oil price returns for both the markets. In addition to that results also show that November and December have the lowest mean crude oil price returns for both WTI and Brent whereas May has the highest mean crude oil price returns for both the markets. Thursday and Friday's effect has been observed in the Brent and Monday, Wednesday, Thursday, and Friday effect have been seen in WTI crude oil market. Our results reflect that there is no month-of-the-year effect in Brent whereas November and December effect is reported in WTI crude oil market. Future research can be performed using ARCH and GARCH models to confirm the results of this research. In addition to that seasonality effects in the crude oil market can also be checked by investigating the specific news or information in the market.

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