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3.2 Strategic trading in brent oil: evaluating the profitability of contrarian technical approaches

The European Union started the process of bringing competition to the European natural gas market almost twenty years ago. The organization and coordination of the gas market, as well as the participation of various actors, underwent substantial changes as a result. The restructuring process is still in progress as of mid-2016. There is a prevalent belief that the market requires more development, which leads to the frequent release of new laws, guidelines, and interventions. At first, the market restructuring process's delays were blamed for the issues. The efficient operation of the EU gas market was impeded by producers, wholesale, and retail companies using their market power. In north-west Europe, supplier competition has grown the most, while other regions continue to rely on a single [122].

Crude oil market volatility remains a central concern for investors, policymakers, and industry stakeholders worldwide. This volatility arises from a complex interplay of factors, including geopolitical instability, macroeconomic trends, and imbalances in global supply and demand. Given crude oil's foundational role in the global economy—impacting everything from energy pricing to transportation and goods—understanding and managing this volatility is essential for effective decision-making and risk management.

To navigate the uncertainty inherent in oil markets, investors frequently turn to technical analysis and rule-based trading strategies. These methods leverage historical price data to generate insights about market behavior and guide entry and exit decisions. Among the most commonly used tools in this domain are the Relative Strength Index (RSI) and the Stochastic Oscillator Indicator (SOI), which are designed to detect overbought and oversold conditions. These indicators are particularly valuable in contrarian investment strategies, which seek to capitalize on temporary market overreactions and price overshooting—situations where prices deviate significantly from their fundamental values. When such deviations occur, they often revert to mean levels, offering profitable opportunities for well-timed trades. Momentum-based strategies, in contrast, aim to exploit continuing price trends. Technical trading rules based on moving average (MA) crossovers are often used to signal trend direction and determine optimal points for entering or exiting the market. These rules support trend-following behavior by identifying sustained price movements and allowing investors to align with dominant market directions.

The utility of technical analysis in oil markets has been extensively supported in academic literature and by financial information platforms such as Bloomberg, Investing.com, and MarketWatch. These sources offer real-time technical insights, further reinforcing the widespread reliance on such tools in navigating oil price fluctuations. However, much of the existing research on contrarian and momentum strategies relies on static thresholds and does not adequately account for seasonal patterns or behavioral biases such as herding and imitation.

Investor sentiment and social influence can significantly impact oil price dynamics, especially in volatile conditions. Herding behavior—where market participants mimic the actions of others to mitigate uncertainty or avoid losses—often results from asymmetric information and the fear of missing out on profitable trades. These behavioral dynamics can amplify price movements and distort technical signals, reducing the efficacy of rigid, rule-based approaches. Consequently, there is a growing need for adaptive trading strategies that respond dynamically to changing market conditions. Another important consideration in assessing the effectiveness of trading strategies is performance evaluation. Key performance metrics include the Average Holding Period Return (AHPR), which measures the average return across multiple trades; the Sharpe Ratio, which evaluates risk-adjusted returns; Maximum Drawdown (MDD), reflecting the largest loss from peak to trough; and various learning-based metrics that assess model generalization and return consistency. Among these, AHPR is particularly suitable for evaluating technical trading strategies, as it offers a comprehensive view of returns across different signals and holding durations.

This study addresses key gaps in the literature by incorporating big data analytics to dynamically adjust the parameters of RSI and SOI indicators. It also evaluates their seasonal performance using the AHPR metric. By tailoring the technical rules to different market conditions and seasonal cycles, the analysis aims to improve trading outcomes and provide a more robust framework for decision-making in crude oil markets. Furthermore, the study challenges the assumptions of the Efficient Market Hypothesis by demonstrating that rule-based strategies—especially those adapted in real-time—can yield superior performance in volatile environments.

In sum, this research contributes to the growing body of evidence supporting the application of technical analysis in commodity markets. It highlights the importance of adaptive, data-driven strategies that consider both behavioral and seasonal factors in enhancing investment performance in the highly dynamic crude oil market. This study focuses on evaluating the performance of contrarian technical trading strategies in the Brent crude oil market, with a particular emphasis on rules derived from the Relative Strength Index (RSI) and the Stochastic Oscillator Indicator (SOI). These indicators are widely used to identify overbought and oversold market conditions, which often precede price corrections or reversals. In technical analysis, overbought signals typically occur when the RSI exceeds a value of 70 or the SOI's line rises above 80, suggesting that the asset may be overvalued and a price decline could be imminent. Conversely, oversold conditions arise when the RSI drops below 30 or the SOI falls under 20, indicating that the asset may be undervalued and a price recovery is likely. These thresholds have become standard benchmarks in traditional technical trading approaches. However, the fixed nature of these thresholds has been increasingly scrutinized in light of market complexity and the growing availability of real-time data. As a response, this research explores whether dynamically adjusting these parameters using big data analytics can lead to more effective trading signals and superior performance. By applying adaptive RSI and SOI thresholds to historical Brent crude oil data, the study aims to measure not only the profitability of these strategies but also their utility as risk management tools under volatile market conditions. The empirical findings suggest that such flexibility enhances the responsiveness of trading rules to shifting market dynamics, improving decision-making accuracy for investors operating in energy markets.

A key innovation of this research lies in the integration of adaptive parameter settings with seasonally informed trading strategies. In contrast to previous studies that rely on static rules, this study introduces a dynamic framework that recalibrates RSI and SOI thresholds in alignment with seasonal patterns and market regimes. For instance, evidence from the analysis indicates that employing a lower RSI threshold (e.g., RSI25) during certain quarters—such as Q2 for oversold detection—produces more favorable entry points, while higher thresholds (e.g., RSI75) are more effective for signaling overbought conditions. This adaptive methodology not only improves timing accuracy but also enhances risk-adjusted returns, particularly in environments marked by frequent overreactions and price volatility.

To assess the effectiveness of these contrarian strategies, the study employs the Average Holding Period Return (AHPR) as the primary evaluation metric. AHPR offers a nuanced and time-sensitive measure of performance by capturing the average return across various trading signals and holding periods. This metric is especially valuable in the context of seasonally adjusted strategies, where profitability may vary significantly across different times of the year. The results demonstrate that strategies incorporating flexible RSI thresholds tend to outperform those based on SOI rules—particularly under overbought conditions—underscoring the importance of selecting and optimizing technical indicators in relation to market behavior.

Furthermore, the study contributes to the broader technical analysis literature by providing robust, data-driven evidence on the advantages of abandoning one-size-fits-all trading rules in favor of more adaptive frameworks. By highlighting the superior performance of the RSI75-based contrarian strategy under certain market conditions, the research emphasizes the critical role of contextual parameter tuning in boosting return potential. The results also affirm the notion that trading strategies grounded in market psychology and behavioral finance—such as exploiting price overshooting due to investor overreaction—can be significantly enhanced through data analytics and adaptive model design.

Ultimately, this study offers several important contributions to both academic research and practical investment strategy development. First, it pioneers the use of big data techniques to dynamically adjust technical indicator thresholds in the crude oil market. Second, it demonstrates the empirical effectiveness of integrating flexible parameters with seasonally optimized trading schedules. Third, it identifies the superior performance of certain RSI configurations—particularly under high-volatility scenarios—relative to conventional SOI-based rules. And fourth, it provides practical guidance for investors aiming to refine their technical strategies in energy markets. These findings not only challenge the prevailing reliance on static rules in technical trading but also underline the importance of adaptability and timing in generating sustained performance in a highly dynamic market environment.

Technical analysis presents a fundamental challenge to the Efficient Market Hypothesis (EMH) by suggesting that financial markets, including the oil market, do not always reflect all available information accurately or instantly. According to the EMH, prices follow a random walk and incorporate all relevant data, leaving no room for consistent excess returns. However, technical analysis is grounded in the belief that price movements are not purely stochastic but rather exhibit recurring patterns and trends shaped by investor sentiment, behavioral biases, and psychological responses—core themes in the field of behavioral finance [123].

These inefficiencies are particularly visible in commodity markets such as crude oil, where prices are heavily influenced by exogenous shocks, including geopolitical developments, economic sanctions, supply disruptions, and speculative trading behavior. In such environments, price deviations from intrinsic values are common, creating opportunities to identify trading signals through indicators that detect overextended price behavior. Overbought and oversold conditions, for instance, can act as precursors to trend reversals, allowing traders to deploy systematic, rule-based strategies that go beyond traditional fundamental valuation methods [124]. Empirical studies increasingly support the effectiveness of technical indicators such as moving averages and the Relative Strength Index (RSI), demonstrating that these tools can generate statistically significant returns in Brent and WTI futures trading. These findings suggest that persistent price anomalies exist within oil markets, undermining the strong-form version of the EMH, which asserts that market prices always reflect their fair value based on available information. Thus, technical analysis contributes value not merely by offering heuristics but by systematically identifying and capitalizing on inefficiencies that arise due to human behavior, incomplete information dissemination, and irrational market dynamics.

Among the various strategies under the umbrella of technical analysis, contrarian trading holds a particularly interesting position. This approach involves taking investment positions contrary to prevailing market trends or sentiment, with the rationale that markets often overshoot due to investor overreaction or herd behavior. In oil markets, where prices are highly sensitive to unpredictable events such as OPEC announcements, regional conflicts, and macroeconomic shocks, contrarian strategies aim to exploit these behavioral inefficiencies. By relying on tools like the RSI and the Stochastic Oscillator Indicator (SOI), traders can detect market extremes and position themselves to benefit from subsequent corrections or reversals [125].

Recent literature highlights that contrarian strategies not only offer potential for abnormal returns but also serve as effective portfolio diversifiers, especially during periods of elevated volatility when trend-following or momentum-based strategies may falter [126]. However, the success of contrarian trading in oil markets requires more than mere signal interpretation—it demands a nuanced understanding of market sentiment and the ability to distinguish between temporary price dislocations and more structural shifts. Effective implementation hinges on the trader’s capacity to assess whether current price movements reflect fundamental changes or speculative overreactions. By challenging prevailing market consensus, contrarian approaches offer a compelling alternative to conventional trading methods and provide a robust framework for managing uncertainty and capitalizing on inefficiencies inherent to oil markets. The Stochastic Oscillator Indicator (SOI) is a popular technical tool that helps identify momentum shifts and potential reversal points in asset pricing, including in the context of crude oil trading [127]. It compares the asset’s closing price to its price range over a specific period—commonly nine or fourteen days—to produce values on a scale of 0 to 100. Readings above 80 generally indicate overbought conditions, while those below 20 suggest the market is oversold. These signals can be particularly useful in volatile markets like oil, where prices frequently fluctuate due to both external and internal market pressures. The SOI thus enables traders to anticipate possible downturns or upswings and refine their trading strategies accordingly. Traders often integrate the SOI with other indicators to improve the reliability of trade entry and exit points, thereby enhancing the overall precision of short-term trades. Similarly, the Relative Strength Index (RSI) is a widely used momentum oscillator in technical analysis and has proven especially effective in volatile commodity markets such as oil. Calculated over a 14-day period, the RSI provides a normalized value between 0 and 100, allowing traders to easily interpret market conditions. An RSI reading above 70 is interpreted as a sign that the asset may be overbought, indicating a potential for downward correction. Conversely, an RSI below 30 typically suggests oversold conditions and a potential for upward movement. Given the frequency of price swings in oil markets, the RSI is particularly useful in capturing short-term trading opportunities and validating directional trends.

Importantly, both the RSI and SOI are most effective when used in conjunction with other indicators or within broader trading systems. Their ability to highlight key turning points in the market—especially when corroborated by other data—provides traders with a more informed and strategic basis for decision-making. The integration of these tools into contrarian strategies allows traders to systematically exploit price dislocations and navigate the inherent volatility of the oil market with greater confidence and precision [128].

In sum, technical analysis—particularly through tools like the RSI and SOI—offers a compelling framework for analyzing and trading in the crude oil market. By acknowledging and exploiting behavioral biases and market inefficiencies, it stands in contrast to the EMH and provides investors with actionable strategies for navigating the complexities of global energy markets.

The Stochastic Oscillator Indicator (SOI) and the Relative Strength Index (RSI) are widely used in technical analysis, each with distinct advantages. The SOI captures short-term price reversals by measuring recent closing prices relative to their high–low range, making it responsive in volatile markets like Brent crude. However, this sensitivity often generates noise, requiring careful filtering. The RSI, on the other hand, offers a smoother signal by tracking average gains and losses over a set period—typically 14 days. With clear threshold levels (70 for overbought, 30 for oversold), it provides more stable momentum readings and is effective in identifying broader trend reversals, particularly in high-volatility environments. Unlike the SOI, the RSI better filters out noise, aiding more precise decision-making. This study underscores RSI's superior reliability in signaling reversals, forming the basis for Hypothesis 1 (H1).

Rule-based trading strategies, grounded in technical indicators, systematically identify mispricing caused by market sentiment and behavioral biases—contradicting the Efficient Market Hypothesis (EMH). In oil markets, strategies using oversold signals to initiate long positions and overbought signals to short offer structured methods to exploit price corrections. These strategies' strength lies in their responsiveness to momentum shifts and investor overreaction, potentially outperforming traditional approaches. This study enhances such systems by applying seasonal segmentation and refining indicator thresholds, resulting in a more adaptive framework. Hence, it proposes Hypothesis 2 (H2).

This study also explores the characteristics of adaptive contrarian trading, which recalibrates RSI thresholds dynamically using big data analytics. Unlike static strategies that rely on fixed levels (e.g., RSI 30/70), adaptive models adjust in real time to reflect changing market dynamics. This flexibility allows traders to align strategies with evolving sentiment, especially amid geopolitical uncertainty or macroeconomic shocks. Such adaptability improves precision and return potential, making contrarian signals more reliable under volatility. Thus, the study proposes Hypothesis 3 (H3).

By implementing contrarian strategies across different quarters, traders can better exploit cyclical inefficiencies and emotional price swings. Oil markets often experience temporary dislocations driven by seasonality, speculative behavior, and global events. Contrarian approaches that move against prevailing sentiment can uncover reversal points during periods of irrational exuberance or panic. A quarterly adaptive model improves entry timing and reduces exposure to herding behavior, providing a robust framework for navigating cyclical volatility. Accordingly, this study proposes Hypothesis 4 (H4).

Finally, the research advances an adaptive trading model that adjusts parameters quarterly using big data analytics. This model accounts for the oil market's cyclical patterns and high sensitivity to external shocks. Unlike rigid systems, the adaptive approach tailors threshold values to the prevailing economic context, enhancing the accuracy of contrarian signals during uncertain or rapidly changing conditions. This innovation contributes a responsive, data-driven framework for oil trading strategies and forms the basis for Hypothesis 5 (H5).

This study integrates contrarian strategies based on technical indicators such as the Stochastic Oscillator (SOI) and the Relative Strength Index (RSI), aiming to exploit market inefficiencies and investor overreactions. In light of rising crude oil price volatility—driven by climate-related events and geopolitical shocks—investors may benefit from reallocating assets into oil-linked instruments like Brent oil ETFs, guided by contrarian signals [129].

We assess the profitability of RSI and SOI-based strategies across different quarters, focusing on oversold and overbought signals. Our analysis also emphasizes the importance of flexible thresholds, rather than strict adherence to traditional RSI/SOI values, to enhance trading performance.

H1: Empirical findings show that RSI and SOI perform similarly in identifying oversold conditions, capturing mean-reversion opportunities. However, for overbought conditions, the RSI at a 75 threshold outperforms other configurations, suggesting that higher thresholds better capture extended bullish trends. This partially supports H1, underscoring the need for adaptable thresholds to optimize contrarian strategies.

H2: Our results indicate that buying Brent oil ETFs on oversold signals is generally more profitable than short-selling on overbought signals. This diverges from prior research, aligning with Ni et al. [123], and highlights the context-dependent nature of technical strategies. The weaker performance of short positions may stem from sustained bullish momentum and external shocks, which delay reversals. Thus, H2 is supported for oversold cases, but not for overbought.

H3: Testing non-traditional thresholds (e.g., RSI25, RSI35, K15, K25), we find limited improvement for oversold signals, suggesting traditional values may suffice. In contrast, overbought strategies using RSI75 consistently outperform others, reinforcing the value of customized settings in bullish conditions. These findings support H3, illustrating the benefit of flexibility in volatile markets.

H4: Quarterly performance analysis shows Q2 outperforms other periods, particularly for RSI30 and SOI20 in oversold scenarios. However, overbought conditions show mixed results, with only RSI70 in Q1 standing out. This provides partial support for H4, affirming that timing and seasonal factors can significantly affect strategy outcomes.

H5: Combining timing and parameter adjustments yields substantial gains. For instance, RSI25 in Q2 achieves a 45% AHPR250 under oversold conditions, while RSI75 in Q2 surpasses 22% under overbought conditions. These results support H5, confirming that dynamic timing and threshold calibration enhance the effectiveness of contrarian trading approaches.

In sum, this study highlights the importance of adaptive, seasonally-aware strategies in energy markets. It offers a practical framework for improving trading precision and profitability through flexible parameterization and strategic timing, challenging the assumptions of the Efficient Market Hypothesis (EMH) [130].

This study offers novel insights that address gaps in prior research and significantly enrich the existing literature on technical trading strategies in crude oil markets.

First, results show that RSI-based strategies match SOI performance in oversold conditions but outperform in overbought scenarios, especially when using RSI75, supporting H1. This highlights the strategic advantage of adjusting RSI thresholds to better identify profitable signals in bullish markets [130].

Second, the study underscores the value of flexibility in technical trading rules. While parameter adjustments have limited effect on oversold signals, they considerably improve overbought signal performance—particularly with RSI75—demonstrating that rigid adherence to traditional thresholds may constrain returns [130].

Third, findings confirm the importance of seasonal timing. Contrarian strategies deliver superior returns in Q2, especially for oversold signals. For overbought signals, gains are generally stable across quarters, with RSI70 in Q1 showing a notable exception. These outcomes emphasize the need for timely strategy adjustments in response to changing market conditions.

Fourth, the analysis shows statistically significant positive returns from both RSI and SOI contrarian strategies over a 250-day holding period. Notably, RSI25 achieves an AHPR250 above 40%, highlighting its effectiveness in exploiting mean-reversion dynamics [131].

Finally, combining adaptive parameters with seasonal timing yields the highest profitability, especially using RSI25 in Q2 for oversold signals and RSI75 for overbought scenarios. These results affirm that dynamic, context-aware strategies are more effective in capturing opportunities in volatile energy markets. Investors are thus encouraged to continuously adjust strategies to optimize performance in evolving market environments.