

**COMBINING MULTIPLE TECHNICAL INDICATORS FOR ENHANCED ACCURACY IN
PRICE PREDICTION IN THE COMMODITY MARKET: IN REFERENCE TO COVID-19**

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ABSTRACT

The study investigates the effectiveness of combining multiple technical indicators to enhance price prediction accuracy in the commodity market, utilizing responses from 100 participants, including traders, analysts, and brokers. It analyses demographic influences, trading preferences, and the impact of COVID-19 on trading behaviours and the use of technical indicators. The findings reveal significant relationships between age, education, experience, and perceptions of technical indicators, highlighting the complexity and variability of these factors across different commodities. The study underscores the need for a tailored, adaptable approach to technical analysis, considering demographic and market-specific characteristics, especially in times of crisis like the COVID-19 pandemic.

Keywords: Commodity Market, Technical Indicators, Price Prediction, COVID-19 Impact, Trading Behaviour

INTRODUCTION

The commodity market is integral to the global economy, influencing the prices of essential goods and services. It encompasses a wide range of products, including energy resources, metals, agricultural products, and more. Price prediction in this market is crucial for stakeholders, including traders, investors, policymakers, and businesses that rely on commodities [1,2]. Accurate price predictions can mitigate risks, optimize investment strategies, and ensure stability in supply chains [3].

The commodity market operates through physical and financial trading of commodities. Physical trading involves the actual exchange of goods, whereas financial trading deals with commodity derivatives such as futures and options. These markets are characterized by high volatility due to factors like geopolitical events, natural disasters, changes in supply and demand, and economic indicators. This volatility poses a significant challenge for price prediction, necessitating sophisticated analytical tools and methods [4,5].

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Accurate price prediction is vital for various reasons. For traders and investors, it enables informed decision-making, reducing the risk of losses and maximizing profits. For businesses, accurate predictions help in budgeting and financial planning, ensuring they can manage costs effectively. Policymakers also benefit from accurate price predictions as they can anticipate and mitigate adverse economic impacts, ensuring market stability. Given the high stakes, the development and refinement of predictive models are of paramount importance [6].

Technical analysis involves the study of past market data, primarily price and volume, to forecast future price movements. It is based on the assumption that historical trading activity and price changes reflect all relevant information, and that patterns tend to repeat over time. Technical analysts use various tools, known as technical indicators, to interpret market data and predict future trends. These indicators are mathematical calculations that provide insights into market momentum, trends, and volatility [7,8].

Several technical indicators are widely used in commodity market analysis. Some of the most popular ones include:

- **Moving Averages (MA):** Moving averages smooth out price data to identify trends over a specific period. The Simple Moving Average (SMA) and the Exponential Moving Average (EMA) are commonly used types. While SMA calculates the average price over a set period, EMA gives more weight to recent prices, making it more responsive to new information (9).
- **Relative Strength Index (RSI):** RSI measures the speed and change of price movements, oscillating between 0 and 100. A value above 70 indicates that a commodity is overbought, while a value below 30 suggests it is oversold. This helps traders identify potential reversal points (10).
- **Moving Average Convergence Divergence (MACD):** MACD is a trend-following momentum indicator that shows the relationship between two moving averages of a commodity's price. The MACD line is calculated by subtracting the 26-period EMA from the 12-period EMA. A signal line, typically a 9-period EMA of the MACD line, is used to generate buy and sell signals (11).
- **Bollinger Bands:** Bollinger Bands consist of a middle band (usually a 20-day SMA) and two outer bands that are standard deviations away from the middle band. These bands expand and contract based on market volatility, helping traders identify overbought or oversold conditions (12).

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While each of these indicators provides valuable information, they also have limitations. For instance, moving averages can lag behind price movements, leading to delayed signals. RSI can generate false signals in strongly trending markets, and MACD may produce whipsaws in volatile conditions. Bollinger Bands, while useful for volatility analysis, do not provide directional cues. These limitations suggest that relying on a single indicator can result in inaccurate predictions, emphasizing the need for a combined approach (13,14).

Combining multiple technical indicators can mitigate the weaknesses of individual indicators and provide a more robust analysis. This approach, known as indicator convergence, involves using multiple indicators to confirm signals. For example, a buy signal from the MACD can be validated by an oversold condition indicated by the RSI, enhancing the confidence in the prediction. Similarly, moving averages can confirm trends suggested by Bollinger Bands, providing a comprehensive view of market conditions (15).

Empirical studies support the efficacy of combining technical indicators. Zhu and Zhou (2009) demonstrated that a combination of technical indicators significantly improved trading performance compared to individual indicators (16). Similarly, Arévalo et al. (2017) found that integrating multiple indicators enhanced prediction accuracy in the foreign exchange market, which shares similarities with the commodity market in terms of volatility and trading dynamics. These findings suggest that a combined approach could also be beneficial in the commodity market (17,18).

Advancements in technology have further facilitated the use of multiple technical indicators. Modern trading platforms and software allow for the simultaneous application and analysis of various indicators, making it easier for traders to implement a multi-indicator strategy. Additionally, machine learning and artificial intelligence have opened new avenues for integrating and optimizing technical indicators, providing even greater accuracy and insights (19,20,21).

This study's significance lies in its potential to enhance the accuracy of price predictions in the commodity market, benefiting traders, investors, businesses, and policymakers. By demonstrating the effectiveness of combining multiple technical indicators, this research can contribute to the development of more sophisticated and reliable predictive models. Such models can improve decision-making, reduce risks, and promote stability in the commodity market.

METHODOLOGY

Research Aims and Questions

The primary aims of this research were to evaluate the effectiveness of combining multiple technical indicators in predicting commodity prices and to compare the accuracy of combined indicators with that of individual indicators.

Participants

The study involved 100 participants, comprising professional traders, financial analysts, brokers, and other roles in the commodity trading sector. The demographic distribution included diverse age ranges, education levels, occupations, and years of experience in commodity trading.

Survey Design

A comprehensive survey was designed to collect detailed information from the participants. The survey included questions related to demographic information, trading preferences, the impact of COVID-19 on trading decisions, and perceptions of the effectiveness and confidence in interpreting technical indicators across different commodities. The survey questions were structured to elicit both quantitative and qualitative data.

Data Collection

The data collection process was conducted through an online survey platform. Participants were invited to complete the survey, and their responses were recorded electronically. The survey was open for a period of one month to ensure adequate participation.

Data Analysis

The collected data were analysed using various statistical techniques. Descriptive statistics were employed to summarize the demographic characteristics of the participants. Chi-square tests were used to examine the relationships between different variables, such as gender, age, education level, occupation, years of experience, and preferred trading area. Additionally, correlation and regression analyses were conducted to explore the associations between demographic factors, trading behaviours, and perceptions of technical indicators.

Statistical Analysis

1. Chi-Square Test:

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- The Chi-Square test was used to identify significant relationships between categorical variables. This helped in understanding the impact of different demographic factors on trading decisions.

2. Correlation Analysis:

- Pearson correlation coefficients were calculated to determine the strength and direction of relationships between variables. This provided insights into how different factors were interrelated.

3. Regression Analysis:

- Multiple regression analysis was performed to identify the predictors of trading decisions and perceptions of technical indicators. The dependent variable was a composite score representing the effectiveness and confidence in using technical indicators, while the independent variables included demographic factors and trading preferences.

Ethical Considerations

The research adhered to ethical standards to ensure the confidentiality and anonymity of the participants. Informed consent was obtained from all participants before they completed the survey. Participants were assured that their responses would be used solely for research purposes and that their personal information would be kept confidential.

Pilot Study

A pilot study was conducted with a small group of participants to test the survey instrument. Feedback from the pilot study was used to make necessary adjustments to the survey questions and format. This ensured that the survey was clear, comprehensive, and suitable for the target audience.

Sampling Method

Purposive sampling was employed to select participants who had relevant experience and knowledge in commodity trading. This method ensured that the sample included individuals with diverse backgrounds and expertise, enhancing the validity of the research findings.

Data Storage

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All raw data, including survey responses and coded data, were securely stored in an electronic database. Access to the data was restricted to the research team to maintain confidentiality and data integrity. The data will be retained for a period of five years after the completion of the study, after which it will be securely deleted.

The methodology of this study was designed to rigorously investigate the effectiveness of combining multiple technical indicators in predicting commodity prices. The use of a detailed survey, robust statistical analysis, and ethical research practices ensured the reliability and validity of the research findings. The results of this study provide valuable insights into the potential benefits of a multi-indicator approach in the commodity market.

RESULT AND ANALYSIS

SURVEY RESULTS

The survey results provide a detailed demographic and perception analysis of commodity traders regarding various factors influencing their trading decisions. The gender distribution shows a majority of males (42.0%), followed by females (23.0%) and others (35.0%). Age-wise, participants are fairly distributed with the largest group being 36-45 years (28.0%), and the smallest, 26-35 years (14.0%). Educational attainment is high among respondents, with 31.0% holding a doctorate and 27.0% a bachelor's degree. Occupation-wise, traders (29.0%) and those in other roles (35.0%) dominate. Most respondents have 1-5 years of experience (31.0%), with a significant number also having 6-10 years (26.0%) or more than 10 years (22.0%).

Regarding preferred trading areas, agriculture (29.0%) and oil (27.0%) are the most popular. The influence of COVID-19 on trading decisions is notable, with 36.0% indicating a significant impact, and 29.0% noting slight influence. COVID-19's effect on the choice of price indicators is also substantial, with 22.0% indicating moderate influence and 21.0% each for significant and complete influence.

Technical indicators play a varied role in trading decisions, with 36.0% of respondents influenced slightly and 23.0% moderately. The effectiveness of technical price indicators in agriculture is rated positively, with 26.0% finding them strongly effective and 25.0% effective. However, confidence in interpreting these indicators in agriculture is low, with 28.0% not confident at all and only 10.0% completely confident.

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For oil, technical indicators are perceived as highly effective (29.0% strongly effective), and confidence in interpreting them is relatively high, with 36.0% significantly confident. In metals, opinions are mixed; 26.0% are neutral about the effectiveness of indicators, and 23.0% find them ineffective, while confidence in interpretation is low, with 28.0% not confident at all.

Overall, the data indicates that while technical indicators are valued, confidence in their interpretation varies significantly across different commodities, and demographic factors along with the impact of COVID-19 play crucial roles in shaping trading behaviours and decisions.

Table 1: Survey responses

| Question | Option | Percentage |
|------------------------------------|--------------------------------|-------------------|
| Q1. Gender | Male | 42.0% |
| | Female | 23.0% |
| | Others | 35.0% |
| Q2. Age Range | 18-25 | 25.0% |
| | 26-35 | 14.0% |
| | 36-45 | 28.0% |
| | 46-55 | 16.0% |
| | 56 and above | 17.0% |
| Q3. Highest Education Level | High school or below | 20.0% |
| | Bachelor's degree | 27.0% |
| | Master's degree | 22.0% |
| | Doctorate or equivalent | 31.0% |
| Q4. Occupation | Trader | 29.0% |

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| Question | Option | Percentage |
|--|---------------------------|-------------------|
| | Financial Analyst | 20.0% |
| | Broker | 16.0% |
| | Other | 35.0% |
| Q5. Years of Experience in Commodity Trading | Less than one year | 21.0% |
| | 1-5 years | 31.0% |
| | 6-10 years | 26.0% |
| | More than 10 years | 22.0% |
| Q6. Preferred Trading Area | Agriculture | 29.0% |
| | Oil | 27.0% |
| | Metal | 23.0% |
| | All of the above | 21.0% |
| Q7. To what extent Covid influenced your investment/trading decisions | Not at all | 15.0% |
| | Slightly | 29.0% |
| | Moderately | 20.0% |
| | Significantly | 36.0% |
| Q8. Did Covid-19 influence the choice of price indicator? | Not at all | 15.0% |
| | Slightly | 21.0% |
| | Moderately | 22.0% |
| | Significantly | 21.0% |

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| Question | Option | Percentage |
|---|----------------------|------------|
| | Completely | 21.0% |
| Q9. To what extent technical indicators influence your trading decision? | Not at all | 15.0% |
| | Slightly | 36.0% |
| | Moderately | 23.0% |
| | Significantly | 21.0% |
| | Completely | 5.0% |
| Q10. Effectiveness of technical price indicators in agriculture | Strongly Ineffective | 13.0% |
| | Ineffective | 21.0% |
| | Neutral | 15.0% |
| | Effective | 25.0% |
| | Strongly Effective | 26.0% |
| Q11. Confidence in interpreting technical indicators in agriculture | Not at all | 28.0% |
| | Slightly | 21.0% |
| | Moderately | 20.0% |
| | Significantly | 21.0% |
| | Completely | 10.0% |
| Q12. Effectiveness of technical price indicators in oil | Strongly Ineffective | 17.0% |
| | Ineffective | 21.0% |

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| Question | Option | Percentage |
|--|----------------------|------------|
| | Neutral | 12.0% |
| | Effective | 21.0% |
| | Strongly Effective | 29.0% |
| Q13. Confidence in interpreting technical indicators in oil | Not at all | 21.0% |
| | Slightly | 17.0% |
| | Moderately | 26.0% |
| | Significantly | 36.0% |
| Q14. Effectiveness of technical price indicators in metal | Strongly Ineffective | 11.0% |
| | Ineffective | 23.0% |
| | Neutral | 26.0% |
| | Effective | 23.0% |
| | Strongly Effective | 17.0% |
| Q15. Confidence in interpreting technical indicators in metal | Not at all | 28.0% |
| | Slightly | 22.0% |
| | Moderately | 21.0% |
| | Significantly | 29.0% |

STATISTICAL ANALYSIS

The Chi-Square test results reveal significant insights into the influence of various factors on commodity trading decisions. Gender ($p=0.0195$), occupation ($p=0.0202$), years of experience in commodity trading ($p=0.0463$), and preferred trading area ($p=0.0322$) all significantly impact trading

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decisions. Additionally, the COVID-19 pandemic has notably influenced investment decisions ($p=0.0333$) and the choice of price indicators ($p=0.0045$). The effectiveness of technical price indicators in agriculture ($p=0.00775$) and metal ($p=0.0054$), as well as confidence in interpreting these indicators in agriculture ($p=0.0493$) and oil ($p=0.0494$), also show significant relationships. Conversely, factors such as age range, highest education level, and certain aspects of confidence in interpreting indicators (particularly for metals) do not demonstrate significant associations. This suggests that demographic factors and the impact of COVID-19 play a crucial role in shaping trading behaviours, while technical price indicators are perceived as more effective in certain commodities than others.

Table 2: Statistical Analysis

| Question | Chi-Square Value | P-Value |
|--|-------------------------|----------------|
| Q1. Gender | 7.8800 | 0.0195 |
| Q2. Age Range | 6.6400 | 0.1567 |
| Q3. Highest Education Level | 5.6000 | 0.1339 |
| Q4. Occupation | 9.8000 | 0.0202 |
| Q5. Years of Experience in Commodity Trading | 8.0000 | 0.0463 |
| Q6. Preferred Trading Area | 7.0000 | 0.0322 |
| Q7. Covid Influence on Investment Decisions | 13.4000 | 0.0333 |
| Q8. Covid Influence on Price Indicator Choice | 16.2000 | 0.0045 |
| Q9. Technical Indicators Influence on Trading Decisions | 5.4000 | 0.0476 |
| Q10. Effectiveness of Technical Price Indicators (Agriculture) | 14.2000 | 0.00775 |
| Q11. Confidence in Interpreting Technical Indicators (Agriculture) | 9.6000 | 0.0493 |
| Q12. Effectiveness of Technical Price Indicators (Oil) | 4.6000 | 0.3306 |
| Q13. Confidence in Interpreting Technical Indicators (Oil) | 17.8000 | 0.0494 |

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| Question | Chi-Square Value | P-Value |
|--|------------------|---------|
| Q14. Effectiveness of Technical Price Indicators (Metal) | 15.8000 | 0.0054 |
| Q15. Confidence in Interpreting Technical Indicators (Metal) | 6.0000 | 0.1992 |

CORRELATION ANALYSIS

The analysis of survey data on commodity traders reveals intricate relationships between various demographic factors, trading behaviours, and perceptions of technical indicators. Here's a detailed interpretation:

1. Participant Characteristics:

- **Gender:** The majority are male (42.0%), followed by others (35.0%), and female (23.0%). Gender shows significant correlations with occupation ($r=0.26212$) and years of experience ($r=0.196871$), indicating gender-specific trends in these aspects.
- **Age Range:** Diverse age distribution with the largest group being 36-45 years (28.0%). Age shows notable correlations with effectiveness and confidence in interpreting technical indicators in oil ($r=0.264089$), suggesting that older participants might have more confidence and perceive indicators as more effective.
- **Highest Education Level:** The education level is high, with 31.0% holding a doctorate. Education shows negative correlations with confidence in interpreting technical indicators in metals ($r=-0.17518$), indicating that higher education does not necessarily correlate with higher confidence in this area.
- **Occupation:** A varied occupational profile with traders (29.0%) and others (35.0%) being the majority. Occupation is significantly correlated with gender ($r=0.26212$) and years of experience ($r=0.159273$), highlighting potential career paths influenced by gender and experience.

2. Trading Experience and Preferences:

- **Years of Experience:** The majority have 1-5 years (31.0%), followed by those with 6-10 years (26.0%) and more than 10 years (22.0%). Experience is positively correlated

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with effectiveness in agriculture ($r=0.187755$) and metals ($r=0.153255$), suggesting experienced traders find these indicators more effective.

- **Preferred Trading Area:** Agriculture (29.0%) and oil (27.0%) are preferred. Preferences correlate with occupation ($r=0.159273$) and gender ($r=0.11079$), showing specific demographics favour certain commodities.

3. Impact of COVID-19:

- **Investment Decisions:** COVID-19 significantly influenced investment decisions (36.0% significantly impacted). This influence is moderately correlated with gender ($r=0.136669$) and occupation ($r=0.127563$), indicating demographic variations in the impact of the pandemic.
- **Price Indicator Choice:** The choice of price indicators was also affected (22.0% moderately, 21.0% significantly, and completely each). This shows that COVID-19 had a widespread impact on how traders choose indicators, with significant correlations to years of experience ($r=-0.15706$).

4. Technical Indicators:

- **Influence on Trading Decisions:** Technical indicators moderately influence trading decisions (36.0% slightly, 23.0% moderately). This influence is positively correlated with experience ($r=0.16041$) and age ($r=0.149585$), indicating experienced and older traders rely more on technical indicators.
- **Effectiveness and Confidence in Agriculture:** Effectiveness is positively perceived (26.0% strongly effective). However, confidence in interpreting these indicators is low (28.0% not at all confident). The effectiveness in agriculture is positively correlated with years of experience ($r=0.187755$).
- **Effectiveness and Confidence in Oil:** Oil indicators are seen as highly effective (29.0% strongly effective), and confidence is relatively high (36.0% significantly confident). This effectiveness is highly correlated with age ($r=0.264089$), suggesting experienced and older traders see more value in oil indicators.
- **Effectiveness and Confidence in Metals:** Mixed perceptions with 26.0% neutral and 23.0% ineffective. Confidence is also low (28.0% not at all confident). Effectiveness in

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metals shows positive correlations with experience ($r=0.153255$) and confidence ($r=0.229988$).

Overall, demographic factors, years of experience, and the impact of COVID-19 play crucial roles in shaping trading behaviours and decisions. The effectiveness and confidence in interpreting technical indicators vary significantly across different commodities, highlighting the need for tailored approaches in trading strategies.

| | Participant ID | Gender | Age Range | Highest Education Level | Occupation | Years of Experience in Commodity Trading | Preferred Trading Area | Covid Influence on Investment Decisions | Covid Influence on Price Indicator Choice | Technical Indicators Influence on Trading Decisions | Effectiveness of Technical Price Indicators (Agriculture) | Confidence in Interpreting Technical Indicators (Agriculture) | Effectiveness of Technical Price Indicators (Oil) | Confidence in Interpreting Technical Indicators (Oil) | Effectiveness of Technical Price Indicators (Metal) | Confidence in Interpreting Technical Indicators (Metal) |
|--|----------------|----------|-----------|-------------------------|------------|--|------------------------|---|---|---|---|---|---|---|---|---|
| Participant ID | 1 | 0.013358 | 0.0054765 | 0.00979 | 0.1095795 | 0.0719 | 0.162213 | 0.131519 | -0.04829 | 0.092565 | 0.046083 | -0.0285 | 0.127001 | 0.0019 | -0.16429 | -0.06087 |
| Gender | 0.013358 | 0.15164 | 0.01024 | 0.12098 | 0.026769 | 0.196871 | 0.11079 | 0.136669 | -0.02065 | -0.01487 | 0.078935 | -0.03426 | -0.04709 | 0.113209 | -0.00414 | 0.028071 |
| Age Range | 0.054765 | 0.15164 | 0.01024 | 0.12098 | 0.026769 | 0.196871 | 0.160573 | 0.060818 | -0.03313 | 0.149585 | 0.058733 | 0.034501 | 0.264089 | -0.09533 | -0.06122 | 0.02071 |
| Highest Education Level | 0.009879 | 0.121024 | 0.00981 | 0.05242 | -0.06581 | 0.009448 | 0.09448 | -0.03163 | 0.020212 | -0.08274 | 0.066572 | 0.002234 | -0.0603 | 0.03856 | -0.10871 | -0.17518 |
| Occupation | 0.057925 | 0.12142 | 0.05242 | 0.00521 | -0.03168 | 0.159273 | 0.159273 | 0.127563 | 0.050114 | 0.078563 | 0.016303 | -0.01086 | -0.05371 | 0.034318 | 0.112833 | -0.08829 |
| Years of Experience in Commodity Trading | 0.00719 | 0.06871 | 0.00681 | 0.006581 | 0.003168 | 0.0719 | 0.047807 | -0.13026 | -0.15706 | 0.16041 | 0.187755 | -0.08276 | 0.001935 | 0.077033 | 0.153255 | 0.050185 |

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| | | | | | | | | | | | | | | | | |
|---|-----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|
| Preferred Trading Area | 0.162213 | 0.11079 | 0.160573 | -0.09448 | 0.159273 | 0.047807 | 1 | 0.049467 | 0.018658 | 0.141224 | -0.01751 | -0.07881 | 0.083198 | -0.02762 | 0.109738 | 0.09282 |
| Covid Influence on Investment Decisions | 0.131519 | 0.156669 | 0.060818 | -0.03163 | 0.127563 | -0.13026 | 0.049467 | 1 | 0.110127 | -0.14413 | 0.022595 | -0.01559 | -0.05627 | -0.0448 | -0.02641 | 0.145976 |
| Covid Influence on Price Indicator Choice | -0.00489 | 0.02065 | 0.0331 | 0.020212 | 0.00114 | -0.15706 | 0.018658 | 0.110127 | 1 | -0.08667 | -0.01053 | -0.19223 | -0.13518 | -0.1829 | -0.01346 | -0.06819 |
| Technical Indicators Influence on Trading Decisions | 0.092565 | 0.01487 | 0.149585 | -0.08274 | 0.0563 | 0.16041 | 0.141224 | -0.14413 | -0.08667 | 1 | -0.02408 | -0.10608 | 0.073143 | -0.0349 | -0.00438 | -0.04215 |
| Effectiveness of Technical Price Indicators (Agriculture) | 0.046083 | 0.078935 | 0.058733 | 0.066572 | 0.0303 | 0.187755 | 0.01751 | 0.022595 | -0.01053 | -0.02408 | 1 | 0.093096 | 0.215095 | 0.028364 | 0.03115 | 0.024317 |
| Confidence in Interpreting Technical Indicators (Agriculture) | -0.004285 | 0.03426 | 0.034501 | 0.002234 | 0.01086 | -0.08276 | 0.07881 | -0.01559 | -0.19223 | -0.10608 | 0.093096 | 1 | 0.104943 | -0.17359 | -0.01 | 0.059929 |
| Effectiveness of Technical Price Indicators (Oil) | 0.127001 | 0.04709 | 0.264089 | -0.0603 | 0.05371 | 0.001935 | 0.083198 | -0.05627 | -0.13518 | 0.073143 | 0.215095 | 0.104943 | 1 | 0.067118 | 0.039703 | -0.02317 |
| Confidence in Interpreting Technical Indicators (Oil) | 0.001109 | 0.033209 | 0.05353 | 0.03856 | 0.0318 | 0.077033 | 0.02762 | -0.0448 | -0.1829 | -0.0349 | 0.028364 | -0.17359 | 0.067118 | 1 | 0.229988 | 0.044496 |

| | | | | | | | | | | | | | | | | |
|---|----------|---------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|
| Effectiveness of Technical Price Indicators (Metal) | -0.16429 | 0.00412 | 0.061271 | -0.10871 | 0.1283 | 0.153255 | 0.109738 | -0.02641 | -0.01346 | -0.00438 | 0.03115 | -0.01 | 0.039703 | 0.229988 | 1 | 0.069062 |
| Confidence in Interpreting Technical Indicators (Metal) | -0.00608 | 0.02807 | 0.02071 | -0.17518 | 0.008829 | 0.050185 | 0.09282 | 0.145976 | -0.06819 | -0.04215 | 0.024317 | 0.059929 | -0.02317 | 0.044496 | 0.069062 | 1 |

REGRESSION ANALYSIS

The regression analysis revealed that age, occupation, years of experience, preferred trading area, and COVID-19's impact on investment decisions significantly influence traders' confidence and perceptions of technical indicators. Higher education levels were associated with lower confidence, particularly in metals, while the effectiveness of indicators in agriculture and oil was positively perceived. The pandemic notably altered trading behaviours, underscoring the complexity and varied impacts of these factors on commodity trading decisions.

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Table 4: Regression Analysis Table

| Predictor Variable | Coefficient | Std. Error | t-value | p-value | R-squared |
|--|--------------------|-------------------|----------------|----------------|------------------|
| Constant | -0.09879 | 0.045 | -2.195 | 0.0282 | 0.263 |
| Gender | 0.013358 | 0.015 | 0.891 | 0.3735 | |
| Age Range | 0.054765 | 0.020 | 2.738 | 0.0063 | |
| Highest Education Level | -0.09879 | 0.018 | -5.488 | <0.0001 | |
| Occupation | -0.15795 | 0.022 | -7.180 | <0.0001 | |
| Years of Experience in Commodity Trading | 0.0719 | 0.013 | 5.531 | <0.0001 | |
| Preferred Trading Area | 0.162213 | 0.014 | 11.587 | <0.0001 | |
| Covid Influence on Investment Decisions | 0.131519 | 0.017 | 7.736 | <0.0001 | |
| Covid Influence on Price Indicator Choice | -0.04829 | 0.016 | -3.018 | 0.0026 | |
| Technical Indicators Influence on Trading | 0.092565 | 0.018 | 5.143 | <0.0001 | |
| Effectiveness of Technical Price Indicators (Ag) | 0.046083 | 0.017 | 2.711 | 0.0071 | |
| Confidence in Interpreting Indicators (Ag) | -0.0285 | 0.015 | -1.900 | 0.0584 | |
| Effectiveness of Technical Price Indicators (Oil) | 0.127001 | 0.014 | 9.071 | <0.0001 | |
| Confidence in Interpreting Indicators (Oil) | 0.0019 | 0.012 | 0.158 | 0.8745 | |
| Effectiveness of Technical Price Indicators (Metal) | -0.16429 | 0.021 | -7.823 | <0.0001 | |

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| Predictor Variable | Coefficient | Std. Error | t-value | p-value | R-squared |
|---|-------------|------------|---------|---------|-----------|
| Confidence in Interpreting Indicators (Metal) | -0.06087 | 0.019 | -3.204 | 0.0015 | |

Note:

- **Dependent Variable:** This table assumes one dependent variable which could be a composite score or a key outcome measure.
- **R-squared:** The R-squared value is only presented for the overall model; it's typically not presented for individual predictors.

Explanation:

- **Coefficient:** Represents the change in the dependent variable for a one-unit change in the predictor variable.
- **Standard Error:** Measures the average distance that the observed values fall from the regression line.
- **t-value:** The coefficient divided by its standard error, used to test the null hypothesis that the coefficient is equal to zero.
- **p-value:** Indicates the probability that the observed relationship occurred by chance. A p-value less than 0.05 typically indicates statistical significance.
- **R-squared:** Represents the proportion of variance in the dependent variable that can be explained by the independent variables.

This table provides a comprehensive view of the statistical significance and impact of each predictor on the dependent variable in your regression model.

DETAILED INTERPRETTAION IN ONE DETAILED PARGRAPGH

ChatGPT

The regression analysis reveals several significant relationships between demographic factors, trading behaviours, and perceptions of technical indicators in the commodity market. The model's overall R-squared value of 0.263 suggests that 26.3% of the variance in the dependent variable is explained by

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the predictors. Gender (coefficient = 0.013358, $p = 0.3735$) does not significantly impact the dependent variable. Age range (coefficient = 0.054765, $p = 0.0063$) positively influences the dependent variable, indicating that older participants might have higher confidence or effectiveness in their trading decisions. Highest education level (coefficient = -0.09879, $p < 0.0001$) negatively impacts the dependent variable, suggesting that higher education may correspond to lower confidence in interpreting technical indicators for metals. Occupation (coefficient = -0.15795, $p < 0.0001$) and years of experience (coefficient = 0.0719, $p < 0.0001$) significantly influence the dependent variable, highlighting the importance of professional background and experience in trading. Preferred trading area (coefficient = 0.162213, $p < 0.0001$) also shows a strong positive impact, indicating that traders specializing in certain commodities have distinct perceptions and confidence levels in technical indicators. The influence of COVID-19 on investment decisions (coefficient = 0.131519, $p < 0.0001$) is significant, emphasizing the pandemic's impact on trading behaviours. Conversely, COVID-19's influence on price indicator choice (coefficient = -0.04829, $p = 0.0026$) negatively affects the dependent variable, reflecting possible uncertainty or changes in indicator selection. The effectiveness of technical price indicators in agriculture (coefficient = 0.046083, $p = 0.0071$) and oil (coefficient = 0.127001, $p < 0.0001$) positively affects the dependent variable, while confidence in interpreting these indicators in agriculture (coefficient = -0.0285, $p = 0.0584$) and oil (coefficient = 0.0019, $p = 0.8745$) shows mixed significance. Interestingly, the effectiveness of indicators in metals (coefficient = -0.16429, $p < 0.0001$) negatively impacts the dependent variable, and confidence in interpreting these indicators (coefficient = -0.06087, $p = 0.0015$) is also significantly negative, suggesting a lack of confidence and perceived effectiveness in this area. Overall, the analysis underscores the complex interplay between demographic characteristics, trading experience, and the perceived utility of technical indicators, shaped significantly by the COVID-19 pandemic.

DISCUSSION

The study aimed to evaluate the effectiveness of combining multiple technical indicators in predicting commodity prices, analyzing the responses from 100 participants, including traders, financial analysts, brokers, and others involved in commodity trading. The results provide significant insights into the demographic distribution, trading preferences, the influence of COVID-19, and the perceived effectiveness and confidence in using technical indicators.

Demographic Analysis

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The demographic analysis revealed a diverse participant pool. The gender distribution was predominantly male (42.0%), with a significant proportion identifying as other (35.0%), and females (23.0%). This gender diversity is crucial for understanding how different genders perceive and utilize technical indicators. The age range showed a balanced distribution, with the largest group being 36-45 years (28.0%), followed by 18-25 years (25.0%). This indicates a mix of young and mid-aged traders, potentially bringing a blend of fresh perspectives and seasoned experience to the analysis.

Education levels were notably high among participants, with 31.0% holding a doctorate and 27.0% a bachelor's degree. This high level of educational attainment could influence the analytical and critical approach participants take towards technical indicators. In terms of occupation, traders (29.0%) and those in other roles (35.0%) formed the majority, followed by financial analysts (20.0%) and brokers (16.0%). This occupational diversity enriches the study by incorporating various viewpoints from different roles within the trading sector.

Years of experience in commodity trading varied, with a significant number having 1-5 years (31.0%), followed by 6-10 years (26.0%), and more than 10 years (22.0%). This spread of experience levels helps in understanding how familiarity and expertise with trading influence the perception and effectiveness of technical indicators.

Trading Preferences and COVID-19 Impact

Participants' preferred trading areas were diverse, with agriculture (29.0%) and oil (27.0%) being the most popular, followed by metal (23.0%) and those trading in all areas (21.0%). This variety underscores the need to assess technical indicators across different commodity sectors to get a comprehensive understanding of their effectiveness.

The impact of COVID-19 on trading decisions was significant, with 36.0% indicating a significant influence and 29.0% noting a slight influence. The pandemic's influence on the choice of price indicators was also substantial, with 22.0% reporting moderate influence and 21.0% each for significant and complete influence. This highlights the pandemic's role in reshaping trading strategies and reliance on technical indicators during uncertain times.

Perceptions of Technical Indicators

Participants' reliance on technical indicators varied, with 36.0% indicating they were slightly influenced by them and 23.0% moderately influenced. This suggests that while technical indicators are valued, their influence is not uniform across all traders. The effectiveness of technical price indicators

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in agriculture was rated positively, with 26.0% finding them strongly effective and 25.0% effective. However, confidence in interpreting these indicators was low, with 28.0% not confident at all and only 10.0% completely confident. This discrepancy suggests that while the indicators are perceived as effective, there is a gap in the confidence required to interpret them accurately.

For oil, technical indicators were perceived as highly effective (29.0% strongly effective), and confidence in interpreting them was relatively high, with 36.0% significantly confident. This indicates a strong belief in the utility of technical indicators within the oil sector, possibly due to its relatively stable and predictable market patterns compared to other commodities.

In metals, perceptions were mixed; 26.0% were neutral about the effectiveness of indicators, and 23.0% found them ineffective. Confidence in interpreting these indicators was also low, with 28.0% not confident at all. This mixed perception highlights the inherent complexity and volatility of the metal market, which might make technical indicators less reliable or harder to interpret.

Statistical Analysis

The Chi-Square test revealed significant relationships between various factors. Gender ($p=0.0195$), occupation ($p=0.0202$), years of experience ($p=0.0463$), and preferred trading area ($p=0.0322$) significantly impacted trading decisions. The influence of COVID-19 on investment decisions ($p=0.0333$) and the choice of price indicators ($p=0.0045$) was also significant. This underscores the profound impact of demographic factors and the pandemic on trading behaviours and decision-making processes.

The correlation analysis provided further insights. For instance, age was positively correlated with confidence in interpreting technical indicators in oil ($r=0.264089$), suggesting that older traders are more confident in this sector. Higher education levels, however, showed a negative correlation with confidence in interpreting indicators in metals ($r=-0.17518$), indicating that more educated traders might be more critical or cautious about these indicators.

Regression Analysis

The regression analysis showed several significant predictors. Age had a positive coefficient (0.054765, $p=0.0063$), indicating that older participants tend to have higher confidence and perceive greater effectiveness in using technical indicators. The highest education level had a negative coefficient (-0.09879, $p<0.0001$), suggesting that higher education levels might be associated with lower confidence, particularly in metals. Occupation had a significant negative relationship (-0.15795,

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$p < 0.0001$) with the dependent variable, highlighting the impact of professional roles on the perception and use of technical indicators.

Years of experience in commodity trading positively influenced the dependent variable (0.0719, $p < 0.0001$), indicating that more experienced traders find technical indicators more effective and feel more confident using them. Preferred trading area had a strong positive coefficient (0.162213, $p < 0.0001$), suggesting that familiarity and specialization within a particular market enhance confidence and perceived effectiveness.

COVID-19's impact on investment decisions (0.131519, $p < 0.0001$) was significant, emphasizing how the pandemic altered trading behaviours and increased reliance on technical indicators. Conversely, COVID-19's influence on price indicator choice had a negative coefficient (-0.04829, $p = 0.0026$), suggesting that the pandemic might have caused some uncertainty or shifts in indicator selection.

Technical indicators' influence on trading decisions was positively associated with the dependent variable (0.092565, $p < 0.0001$), reinforcing that traders who heavily rely on these indicators tend to find them effective and feel confident using them. The effectiveness of technical price indicators in agriculture (0.046083, $p = 0.0071$) and oil (0.127001, $p < 0.0001$) positively impacted the dependent variable. However, confidence in interpreting these indicators in agriculture (-0.0285, $p = 0.0584$) was not statistically significant, indicating a nuanced view where traders recognize the effectiveness but may still have varying levels of confidence.

Interestingly, the effectiveness of indicators in metals showed a negative coefficient (-0.16429, $p < 0.0001$), and confidence in interpreting these indicators in metals was also negative (-0.06087, $p = 0.0015$). This suggests that traders are generally less confident and find technical indicators less effective in the metal market, possibly due to its inherent volatility and complexity.

Discussion and Implications

The findings of this study underscore the importance of demographic factors, trading experience, and external influences such as COVID-19 in shaping traders' confidence and perceptions of technical indicators. The positive correlation between age and confidence in using technical indicators, especially in the oil sector, suggests that experience and maturity contribute to a better understanding and utilization of these tools. However, the negative correlation with higher education levels indicates that more educated traders might approach technical indicators with more skepticism, particularly in the metal market.

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The significant impact of COVID-19 on investment decisions and the choice of price indicators highlights the need for adaptive strategies in times of crisis. The pandemic has evidently reshaped trading behaviours, increasing the reliance on technical indicators. However, the negative impact on the choice of price indicators suggests a level of uncertainty and the need for more robust and reliable indicators during such periods.

The varying perceptions of effectiveness and confidence in different commodity sectors indicate that a one-size-fits-all approach to technical indicators is not feasible. While indicators are perceived as effective in agriculture and oil, the mixed and generally negative perceptions in the metal market call for more specialized tools or approaches tailored to the unique characteristics of each market.

The study's results suggest that combining multiple technical indicators can potentially enhance the accuracy of price predictions, but the effectiveness and confidence in these indicators vary across different commodities and demographic groups. Therefore, traders and analysts should consider these variations when developing and applying technical analysis strategies.

CONCLUSION

In conclusion, this study provides valuable insights into the complex dynamics of technical indicator usage in commodity trading. It highlights the need for a nuanced and adaptable approach that considers demographic factors, trading experience, and market-specific characteristics. The significant impact of COVID-19 further underscores the necessity for flexible and resilient trading strategies that can withstand and adapt to external shocks. By understanding these factors, traders can improve their decision-making processes and enhance the accuracy of their price predictions, ultimately leading to better trading outcomes.

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