



*Commodity Prices and Currency Movements:
Exploring the Link Between
Commodities and Commodity-Linked Currencies*

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1 Abstract

This study analyzes the strength and stability of the relationship between three commodities—West Texas Intermediate (WTI) crude oil, Brent crude oil, and gold—and their respective commodity-linked currencies (CAD / USD, USD / RUB, and AUD / USD). We use over twenty years of data (2006–2025) to estimate linear regression models that capture these links, while also accounting for key macroeconomic events. By aligning daily and quarterly price series and controlling for factors such as GDP and interest rates, we obtain a sufficiently large sample to draw robust conclusions. Demonstrating a strong, stable correlation could lay the groundwork for a new trend-following trading strategy, one that exploits predictable currency moves driven by underlying commodity price changes.

2 Introduction

Many studies document that currencies of resource-rich economies comove with the global prices of their key export commodities (Chen and Rogoff 2003; Coudert et al. 2008). Canada is the third largest exporter of oil in the world; crude oil dominates its foreign-exchange earnings. When the price of crude oil rises, Canada's exports will increase, therefore increasing the strength of the Canadian dollar. The opposite is also true, with a decrease in the price of the commodity. The relationship between AUD/USD and gold exists because Australia is the largest producer of gold in the world. The country has a robust gold mining industry with it being a major supplier of the global gold supply. Similarly to Canada, a rise in gold prices increases Australian export revenue, which therefore will strengthen the Australian dollar. The Russian ruble is connected to Brent oil prices in a similar way as the two commodity-backed currencies previously explained, however, there are a few reasons why choosing Brent oil prices over crude oil Urals is correct, even though Urals is Russia's primary export blend. The Brent oil price is the primary international crude oil price, which is used to price Russian oil exports. Also, Urals usually trade at a lower amount than Brent oil because of different geopolitical factors such as sanctions. The purpose of this research is to observe if there is a strong enough correlation between these currencies to be able to take advantage of price changes in commodities in the foreign exchange markets. This research could lead to a trend following trading strategy that would make decisions based on the price of the commodity.

The strength of the correlations has changed throughout time with other macroeconomic factors like interest rates and geopolitical events changing prices. There has been previous research in the past by Chen, Rogoff, and Rossi (2008), that shows a strong predictability of commodity prices based on currency exchange rates. Although this is the reverse of my hypothesis, this shows that there is a strong enough link between the two to be able to take advantage of the markets. More research done by Bodenstein, Erceg, and Guerrieri (2011) highlighted how the relationship, specifically between oil and CAD/USD, isn't always straightforward. There are three main factors that they mention about the complex

relationship, the first being that there are many economic events that happen during the same period. For example, when oil prices increase, the US would have to spend more money on oil, which would then lead to a depreciation of the dollar. However, there could be reduced spending on other goods that would help to combat the previous depreciation. The second factor that they mention is how changes in policy, interest rates, and global demand can also impact the currencies. The third factor of the complex relationship is the reason why the change in the oil price happens. Different reasons as to why the price change happens can make the change in the currency price harder to predict.

Throughout the rest of this research, there is evidence that depicts this relationship in a way that could be taken advantage of. There are references to past literature, and evaluation of current models created with up-to-date data to be able to determine the strength of these relationships, the causes for them, the outside factors that influence them, and ways to be able to take advantage of predicted price movements.

3 Methodology

The data collection consisted of using resources from Investing.com and Federal Reserve Economic Data (FRED) to obtain data from over the past 19 years (2006-2025) to create advanced linear regression models. Then, a multi-layered dataset was created to help analyze the true relationship between the CAD/USD exchange rate and the price of Western Texas Intermediate (WTI) oil. All the data was transformed into CSV files, cleaned, and then used in Visual Studio to be able to create linear regression models. Data was cleaned by eliminating all blank rows and making sure all the data matched up with the dates. The output for my code for WTI and CAD/USD created an R-squared score to show how well the model shows the variation in CAD/USD exchange rate. The output also produces a correlation coefficient to show how much the exchange rate changes with a change in \$1 of the WTI. My code also outputs a linear regression graph that is a scatter plot of all the data points as well as a linear regression line. There is also another part of my code that runs a least squares regression model that outputs a Pearson and Spearman correlation to show the strength of the relationship. A 95% confidence interval was created to be able to show the difference between actual and predicted values. If there is a high correlation coefficient (in absolute terms), a high R-squared, statistically significant p-values, and well-behaved residuals then there would be a very strong connection between WTI and CAD/USD with an ability to use WTI to predict CAD/USD.

For the analysis of the relationship between XAU/USD and AUD/USD, data from Investing.com from over the past 19 years was used. The data was cleaned through code, eliminating all blank rows and unnecessary data. The code also created a simple linear regression analysis model, as well as an OLS regression to find p-values, t-statistics, and confidence intervals which all could be used to determine the true strength of the relationship. This code has produced Pearson and Spearman correlation coefficients like it

did for CAD/USD, as well as a residual plot. The residual plot confirmed whether the model's assumptions hold. There is also another visualization that overlays the linear regression line with a 95% confidence interval.

My third and final analysis also uses data from Investing.com to create a combined CSV file of USD/RUB price and the price of Brent oil over time. The code that runs this file cleans it, as well as makes sure the data is read correctly. It sorts the data chronologically, making sure that the data is consistent with its corresponding dates. Like the other two models, this one uses Pearson and Spearman correlation coefficients. However, this model also includes a function that shows the relative strength of the correlation and explains whether this correlation is positive or negative. This code also creates a 30-day rolling correlation to be able to show how the relationship between the two assets changes over time. This allows specific macroeconomic events to be identified to show why the relationship changed. The diagram will also give an insight as to whether the price movements in the short term are related. There is also a linear regression model that is produced, which creates an R-squared metric, a correlation coefficient, and an intercept. A scatter plot is also created with 95% confidence bands to show how the data points are surrounded by a linear regression line.

4 Results

Our analysis found different results for each different commodity-linked currency. The relationship between WTI and CAD/USD can be seen as a linear regression model as shown in Figure 1. Many of the data points surround the red predictive line. The R-squared score for this model is 0.4605, which means that there is a moderate relationship between WTI and CAD/USD, but there are still outside factors that affect the model. The correlation coefficient of this model is 0.0021 which means that every change in 1 USD of WTI means that CAD/USD changes by 0.0021. A multiple regression model was created that predicts CAD/USD using the U.S. federal funds rate, as well as Canada's GDP over time. The R-squared for this model is 0.9211, indicating a strong relationship between CAD/USD and WTI, using WTI, the US federal funds rate, and Canada's GDP to help predict future values of CAD/USD. As seen in Figure 2, the actual vs. predicted values of CAD/USD line up very close to each other.

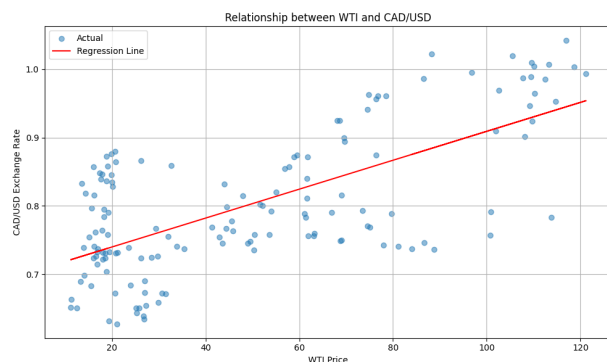


Figure 1

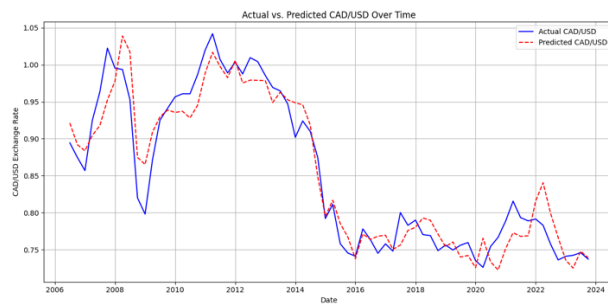


Figure 2

For the relationship between AUD/USD and XAU/USD, a 95% confidence interval was used to interpret the relationship. Including the U.S. federal funds rate in my model was used to help use outside macroeconomic factors that influence AUD/USD. As you can see in Figure 3, many of the data points are scattered throughout the graph. The model equation for the linear regression line, which is shown as the blue line on the graph, is $AUD/USD = 0.6848 + 0.0002 \times \text{Gold Price}$. This means that for every 1 increase in the price of gold, there is a 0.0002 increase in AUD/USD. The R-squared score for the model is 0.0582, which means that 5.82% of the variance is explained by the changes in gold prices. The Pearson correlation for this model is 0.2412 which means there is a weak positive relationship between XAU/USD and AUD/USD. The Spearman correlation is 0.3132 indicating that the relationship isn't perfectly linear, but it has a positive relationship.



Figure 3

My third and final model explains the relationship between Brent oil prices and USD/RUB. A multiple linear regression model is created to be able to use U.S. federal funds rates as well as Brent oil prices to predict changes in USD/RUB. As seen in Figure 4, the multiple regression model includes both the oil prices as well as the federal funds rate to predict USD/RUB. There is a negative relationship between them, as the line is trending down. The equation for the line is $USD/RUB = 75.9780 - 0.3594 \times (\text{Brent oil}) + 2.9019 \times (\text{FFR})$. The R-squared for this model is 0.2118, indicating that 21.18% of the variability is indicated by

Brent oil and the federal funds rate. The Pearson correlation for USD/RUB and Brent oil prices is -0.3883 and the Spearman correlation is -0.3260, both indicating a moderately strong negative correlation between Brent oil and USD/RUB. Figure 5 shows the actual vs. predicted values of USD/RUB based on Brent oil and the federal funds rate.

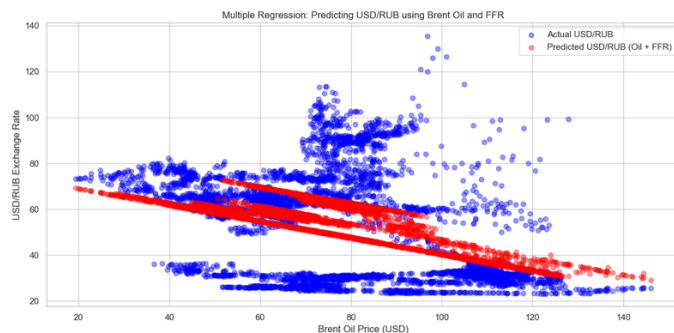


Figure 4

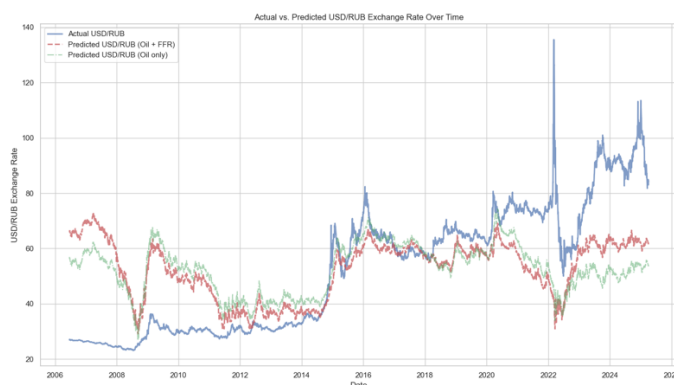


Figure 5

5 Discussion

For my first model, just using WTI to predict CAD/USD would not be reliable because the R-squared score is 0.4605, only indicating a moderate relationship between the two variables. However, by introducing the U.S. federal funds rate as well as Canada's GDP over time, the R-squared score goes up to 0.9211. This means that 92.11% of the variability of changes in the price of CAD/USD is explained by WTI, federal funds rate, and Canadian GDP. This data indicates a very strong relationship, that can be used to help predict CAD/USD prices over time. This R-squared value is high, however, due to overfitting, and it does not represent the true relationship between the variables. A basic trend-following rule ("long CAD when oil rises") would have lost money, with an annualized Sharpe of about -1.0 versus -0.7 for buy-and-hold. In short, despite strong historical links, none of these commodity-based models produce reliable, actionable forecasts without further refinements. Finding another variable to reduce overfitting is imperative to be able to use this data.

My second model which uses gold to predict AUD/USD prices has a R-squared value of 0.0582, which indicates a weak positive relationship between the two assets. This is because only 5.82% of the variability of AUD/USD is because of the price of gold. It would be extremely hard to accurately predict prices based on this model because there are outside factors that affect the prices. To be able to use this model the variables that most affect the exchange rate of AUD/USD would need to be identified. This doesn't support the hypothesis that AUD/USD can be predicted by using XAU/USD. It would be difficult to use XAU/USD prices in a trend-following strategy to be able to predict AUD/USD prices.

My third and final model indicates a negative relationship between Brent oil and USD/RUB. This relationship is negative because as the price of Brent oil goes up, the Ruble becomes stronger, therefore causing the price of USD/RUB to go down. The R-squared of the linear regression model is 0.2118, which indicates a moderately strong relationship between the two assets. A trading strategy could take advantage of this data to be able to create a trend following strategy in the USD/RUB market. This data could be used as a basis for this strategy, but more research would have to be done on the other factors that influence the USD/RUB markets.

6 Conclusion

The beginning of my analysis shows a strong relationship between WTI and CAD/USD that could be used to create a strategy if we implement another variable to deal with overfitting. However, there is a very weak relationship between the price of gold and AUD/USD and a moderate relationship between the price of Brent oil and USD/RUB. My future research could include other macroeconomic factors that influence USD/RUB that could be added to my model that can help predict future prices. Adding a basic trading strategy using the data could provide an example that could exploit the trends based on the relationship between commodities and their respective currencies.

This research has compiled over 19 years of data to help predict future prices of different currencies. Including different macroeconomic factors such as GDP and federal funds rates into my models was necessary to help show the real strength of the relationship between each commodity and the currency that they are linked to. This research can be used in many ways to be able to take advantage of predicted values.

7 References

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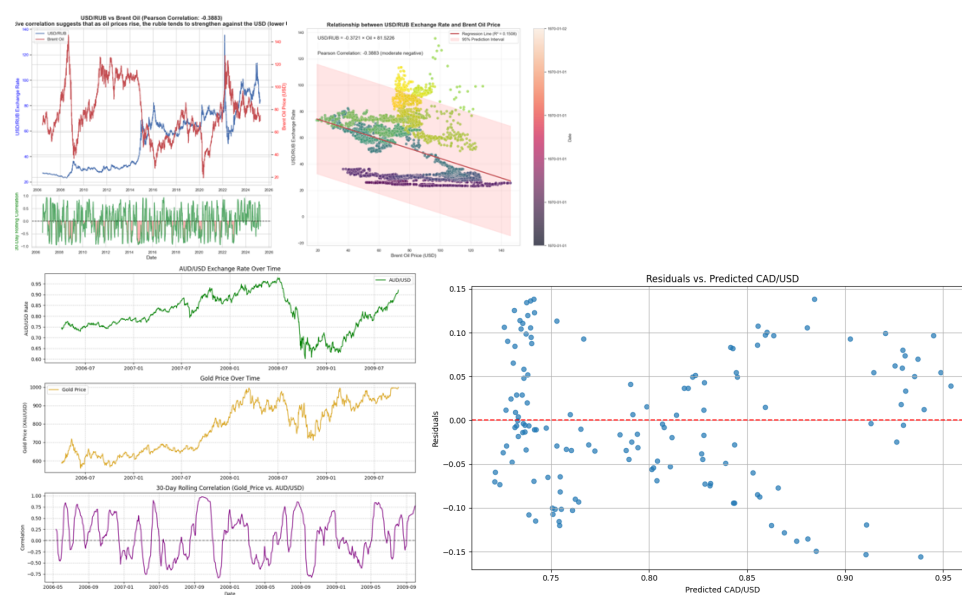
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8 Appendices



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