The Relationship Between Commodity Prices and the Canada-US Exchange Rate: An Empirical Investigation

Introduction:

Exchange rates and commodity prices have been at the heart of international finance and macroeconomics for centuries. In commodity-exporting countries, exchange rate fluctuation is typically explained by fluctuations in global commodity prices, a practice well recognized as the commodity currency hypothesis (Chen and Rogoff, 2003). Canada, as a significant commodity exporter, especially in energy and natural resources, has exchange rate behavior highly correlated with global commodity price volatility (Amano and van Norden, 1995). The Canadian dollar (CAD) relative to the US dollar (USD) is commonly considered to be a commodity price-sensitive currency, i.e., fluctuations in these prices may affect its value.

A number of studies have actually tested the empirical relation between exchange rates and commodity prices, pointing out that commodity price shocks have a substantial effect on the exchange rates of commodity-rich nations. Chen et al. (2010) concluded that the variability of the real exchange rates of commodity-exporting countries such as Canada, Australia, and New Zealand is mostly explained by fluctuations in global commodity prices. The Present Value Model (PVM) of the exchange rate contends that a country's exchange rate should embody expectations of future macroeconomic fundamentals, such as terms of trade, which are driven by commodity prices (Engel and West, 2005).

In light of the theoretical and empirical significance of commodity prices in exchange rate determination, this research explores both long-run and short-run dynamics that exist between Canada's commodity prices and the CAD/USD exchange rate. The Johansen cointegration test is employed to determine the existence of a long-run stable relationship between the two variables. A Vector Error Correction Model (VECM) is also employed to look at short-run adjustments as well as long-run equilibrium relationships. Lastly, I employ Impulse Response Functions (IRFs) to examine the dynamic relationships between exchange rate shocks and commodity price shocks over time.

My empirical results contribute to the burgeoning literature on exchange rate determinants of commodity-exporting economies. The relationship between commodity prices and exchange rates has important monetary policy implications for monetary authorities, financial markets, and international investors. Policymakers and central banks can utilize commodity price trends in the forecasting of exchange rates and making monetary policy decisions if commodity prices are a leading indicator of exchange rate changes.

The paper is structured as follows: Section 2 addresses the economic theory underlying exchange rate and commodity price relationship, e.g., the Present Value Model and cointegration model. Section 3 presents empirical methodology, detailing data sources, stationarity tests, cointegration test, and VECM methodology. Section 4 presents a discussion of empirical results, e.g., the Impulse Response Functions. Lastly, Section 5 presents a synthesis of key findings, policy implications, research limitations, and my concluding remarks.

2. Economic Theory and Conceptual Framework:

2.1 The Relationship Between Commodity Prices and Exchange Rates

The theoretical connection between exchange rates and commodity prices is achieved under macroeconomic and international finance theory paradigms. In commodity-exporting nations such as Canada, the fluctuations in international commodity prices influence the terms of trade, and in so doing, impact the home currency value (Cashin, Céspedes, and Sahay, 2004). The connection is of deep relevance, particularly in regimes of floating exchange rates where exchange rates adjust to mirror movements in economic fundamentals.

A primary explanation for this correlation is the fact that higher commodity prices boost export revenues, thereby generating higher demand for the domestic currency (CAD in this case). The opposite occurs when commodity prices fall, decreasing export revenues and leading to the devaluation of the currency against other currencies, such as the USD. This process agrees with the monetary approach to exchange rate determination, which associates exchange rates with macroeconomic fundamentals, such as trade balances and price levels (Dornbusch, 1976).

2.2 The Present Value Model (PVM) of Exchange Rates

The Present Value Model (PVM) assumes that currency exchange rates are forward-looking in nature, and they include forecasts of future economic fundamentals, such as commodity price trends. Engel and West (2005) argue that, under rational expectations, exchange rates should incorporate information relating to expected macroeconomic conditions, thus implying a long-run equilibrium between exchange rates and underlying factors.

Mathematically, the PVM expresses the exchange rate (et) as:

$$e_t = \sum_{j=0}^{\infty} \beta^j E_t[f_{t+j}]$$

Where:

- et is the exchange rate at time t,
- β is a discount factor ($0 < \beta < 1$),
- Et is the expectation operator,
- $ft+j$ represents future fundamental variables, including commodity prices

This equation suggests that exchange rates are a non-stationary process and, as such, shocks to commodity prices can have permanent effects on exchange rates. For commodity prices and exchange rates to be cointegrated in the long term, we would anticipate that they have a stable relationship even though each of the variables is non-stationary on its own.

2.3 Cointegration and the Vector Error Correction Model (VECM)

As exchange rates and commodity prices are usually of order one integrated (I(1)), i.e., they are non-stationary and become stationary after first differencing, the appropriate strategy is to

conduct cointegration testing (Johansen, 1991). The Johansen test for cointegration is employed to test whether there is a long-run equilibrium relationship between such variables.

If cointegration exists, then the suitable econometric model is the Vector Error Correction Model (VECM) that encompasses both short-run and long-run dynamics. The VECM equation for the exchange rate (Δet) and commodity prices (Δct) can be expressed as:

$$\Delta e_t = \alpha_1(e_{t-1} - \beta c_{t-1}) + \sum_{i=1}^{p} \gamma_{1i} \Delta e_{t-i} + \sum_{i=1}^{p} \delta_{1i} \Delta c_{t-i} + \varepsilon_{1t}$$

$$\Delta c_t = \alpha_2(e_{t-1} - \beta c_{t-1}) + \sum_{i=1}^{p} \gamma_{2i} \Delta e_{t-i} + \sum_{i=1}^{p} \delta_{2i} \Delta c_{t-i} + \varepsilon_{2t}$$

Where:

- α_1, α_2 represent the error correction terms, measuring how fast the variables adjust to deviations from the long-run equilibrium,
- β is the cointegration coefficient,
- γ and δ represent short-run dynamics,
- ε_{1t}, ε_{2t} are error terms.

If α_1 is significant, it suggests that the exchange rate responds to deviations from the long-run equilibrium. Similarly, if α_2 is significant, commodity prices adjust to correct deviations.

2.4 Impulse Response Functions (IRFs)

Apart from long-run relationships, I examine Impulse Response Functions (IRFs) to trace the exchange rate and commodity price shocks passage through time. IRFs display how a one-time shock to one variable (e.g., a commodity price increase) will affect the other variable (exchange rate) over subsequent periods.

From my empirical findings, I notice that a positive commodity price shock in the short term causes depreciation of the CAD/USD exchange rate but, in the long term, the exchange rate appreciates. The observation above agrees with theory that commodity price shocks influence exchange rate volatility in the short term prior to the attainment of equilibrium.

2.5 Summary of Theorectical Expectations

1. If commodity prices and exchange rates are cointegrated, they maintain a long-run relationship despite short-run fluctuations.
2. The Present Value Model (PVM) suggests that exchange rates should reflect expected future movements in commodity prices.
3. The Vector Error Correction Model (VECM) allows us to separate long-run equilibrium effects from short-run adjustments.
4. Impulse Response Functions (IRFs) provide insights into how exchange rates and commodity prices respond dynamically to shocks.

3. Empirical Methodology

3.1 Data and Variable Description

This study utilizes monthly time-series data from January 1997 to April 2017, sourced from Statistics Canada. The two key variables analyzed are:

- Exchange Rate (CAD/USD): The nominal bilateral exchange rate between the Canadian dollar and the US dollar, expressed as the amount of Canadian dollars per one US dollar.
- Commodity Price Index (CPI): This index reflects the price movements of key commodities exported by Canada.

The choice of these variables follows from earlier research (Chen et al., 2010) that demonstrates that there is a relationship between the movement of commodity prices and the volatility of exchange rates in commodity-exporting nations. Given that the Canadian economy relies heavily on commodity exports, we anticipate that the CAD/USD exchange rate will be influenced by volatility in global commodity prices.

In order to maintain data integrity, a period of 20 years was chosen to include both the short and long trends. The data was converted into time-series data in Stata prior to conducting the analysis.

3.2 Stationarity Tests: Augmented Dickey-Fuller (ADF) Test

Prior to econometric modeling, it is crucial to determine the stationarity of the variables. When a time series is non-stationary, classical regression methods can provide misleading conclusions. The Augmented Dickey-Fuller (ADF) test is used to check if the variables have a unit root, which suggests non-stationarity.

The ADF test was applied to both commodity prices and the exchange rate in their level forms. The null hypothesis (H_0) assumes that the variable has a unit root, meaning it is non-stationary.

The results are as follows:

- H_0:Variable has a unit root (non-stationary)
- H_1: Variable is stationary

The commodity price index was found to be non-stationary in levels but became stationary after first differencing. The exchange rate also exhibited non-stationarity in levels but was stationary after first differencing.

```
. dfuller commodity_price, lags(4)

Augmented Dickey-Fuller test for unit root

Variable: commodity_price                    Number of obs  = 239
                                             Number of lags =   4

H0: Random walk without drift, d = 0

                                       Dickey-Fuller
                   Test       -------- critical value ---------
              statistic           1%           5%          10%
---------------------------------------------------------------
 Z(t)            -2.250       -3.464       -2.881       -2.571
---------------------------------------------------------------
MacKinnon approximate p-value for Z(t) = 0.1886.
```

```
. dfuller d_commodity_price, lags(4)

Augmented Dickey-Fuller test for unit root

Variable: d_commodity_pr~e                   Number of obs  = 238
                                             Number of lags =   4

H0: Random walk without drift, d = 0

                                       Dickey-Fuller
                   Test       -------- critical value ---------
              statistic           1%           5%          10%
---------------------------------------------------------------
 Z(t)            -7.250       -3.464       -2.881       -2.571
---------------------------------------------------------------
MacKinnon approximate p-value for Z(t) = 0.0000.
```

```
. dfuller exchange_rate, lags(4)

Augmented Dickey-Fuller test for unit root

Variable: exchange_rate                      Number of obs  = 239
                                             Number of lags =   4

H0: Random walk without drift, d = 0

                                       Dickey-Fuller
                   Test       -------- critical value ---------
              statistic           1%           5%          10%
---------------------------------------------------------------
 Z(t)            -1.375       -3.464       -2.881       -2.571
---------------------------------------------------------------
MacKinnon approximate p-value for Z(t) = 0.5943.
```

```
. dfuller d_exchange_rate, lags(4)

Augmented Dickey-Fuller test for unit root

Variable: d_exchange_rate                       Number of obs   = 238
                                                Number of lags  =   4

H0: Random walk without drift, d = 0

                                                 Dickey-Fuller
                    Test                    critical value
                statistic           1%              5%              10%
------------------------------------------------------------------------
 Z(t)             -5.831         -3.464          -2.881          -2.571
------------------------------------------------------------------------
MacKinnon approximate p-value for Z(t) = 0.0000.
```

3.3 Cointegration Test: Johansen's Cointegration Test

Since both variables are integrated of order one (I(1)), meaning they become stationary only after first differencing, I test for cointegration using Johansen's Cointegration Test.

Johansen's test determines whether a long-run equilibrium relationship exists between the exchange rate and commodity prices. The null hypothesis states that there is no cointegrating relationship (H_0: $r = 0$) while the alternative hypothesis suggests at least one cointegrating vector.

- H_0: No cointegration between exchange rate and commodity prices
- H_1: At least one cointegrating relationship exists

The results of the Trace Test and Maximum Eigenvalue Test confirm that one cointegrating equation exists, meaning there is a stable long-run relationship between commodity prices and the Canada-US exchange.

```
. vecrank commodity_price exchange_rate, lags(4) max

Johansen tests for cointegration
Trend: Constant                          Number of obs   = 240
Sample: May1997 thru Apr2017             Number of lags =   4
```

Maximum rank	Params	LL	Eigenvalue	Trace statistic	Critical value 5%
0	14	-494.56675	.	26.1635	15.41
1	17	-482.19999	0.09792	1.4299*	3.76
2	18	-481.48501	0.00594		

Maximum rank	Params	LL	Eigenvalue	Eigenvalue Maximum	Critical value 5%
0	14	-494.56675	.	24.7335	14.07
1	17	-482.19999	0.09792	1.4299	3.76
2	18	-481.48501	0.00594		

```
* selected rank

.
end of do-file

.
```

3.4 Vector Error Correction Model (VECM)

Given that the two variables are cointegrated, I estimate a Vector Error Correction Model (VECM) to distinguish between short-run and long-run effects. The VECM framework can be represented as:

$$\Delta e_t = \alpha_1(e_{t-1} - \beta c_{t-1}) + \sum_{i=1}^{p} \gamma_{1i}\Delta e_{t-i} + \sum_{i=1}^{p} \delta_{1i}\Delta c_{t-i} + \varepsilon_{1t}$$

$$\Delta c_t = \alpha_2(e_{t-1} - \beta c_{t-1}) + \sum_{i=1}^{p} \gamma_{2i}\Delta e_{t-i} + \sum_{i=1}^{p} \delta_{2i}\Delta c_{t-i} + \varepsilon_{2t}$$

Where:

- α_1, α_2 are the error correction terms, representing how quickly variables adjust to deviations from the long-run equilibrium.
- β is the cointegration coefficient, capturing the strength of the long-run relationship.
- γ and δ are short-run coefficients,

My VECM results confirm that the commodity price index significantly adjusts to deviations from equilibrium, while the exchange rate exhibits weaker adjustment.

```
. vec commodity_price exchange_rate, lags(4) rank(1)

Vector error-correction model

Sample: May1997 thru Apr2017                    Number of obs     =       240
                                                AIC               =      4.16
Log likelihood =    -482.2                      HQIC              =   4.25934
Det(Sigma_ml)  =    .19063                      SBIC              =  4.406545

Equation           Parms      RMSE     R-sq      chi2     P>chi2
------------------------------------------------------------------
D_commodity_pr~e       8   23.5754   0.2157  63.80786   0.0000
D_exchange_rate        8   .021685   0.1374   36.9682   0.0000
------------------------------------------------------------------
```

	Coefficient	Std. err.	z	P>|z|	[95% conf. interval]	
D_commodity_price						
_ce1						
L1.	-.1454963	.0296336	-4.91	0.000	-.203577	-.0874155
commodity_price						
LD.	.3791957	.0712431	5.32	0.000	.2395619	.5188296
L2D.	.1314042	.0749904	1.75	0.080	-.0155743	.2783827
L3D.	.0998819	.0741789	1.35	0.178	-.0455062	.2452699
exchange_rate						
LD.	96.01191	81.38497	1.18	0.238	-63.49971	255.5235
L2D.	-.9363373	84.34865	-0.01	0.991	-166.2567	164.384
L3D.	134.888	81.4458	1.66	0.098	-24.74285	294.5188
_cons	-2.88e-09	1.523939	-0.00	1.000	-2.986865	2.986865

D_exchange_rate						
_ce1						
L1.	.0000377	.0000273	1.38	0.167	-.0000157	.0000911
commodity_price						
LD.	-.0000939	.0000655	-1.43	0.152	-.0002223	.0000345
L2D.	-.0000889	.000069	-1.29	0.197	-.0002241	.0000463
L3D.	-.000083	.0000682	-1.22	0.224	-.0002167	.0000507
exchange_rate						
LD.	.2606131	.0748596	3.48	0.000	.113891	.4073351
L2D.	-.1112238	.0775856	-1.43	0.152	-.2632889	.0408412
L3D.	-.1025729	.0749155	-1.37	0.171	-.2494047	.0442588
_cons	-.0000108	.0014018	-0.01	0.994	-.0027582	.0027366

Cointegrating equations

Equation	Parms	chi2	P>chi2
_ce1	1	175.1569	0.0000

Identification: beta is exactly identified

Johansen normalization restriction imposed

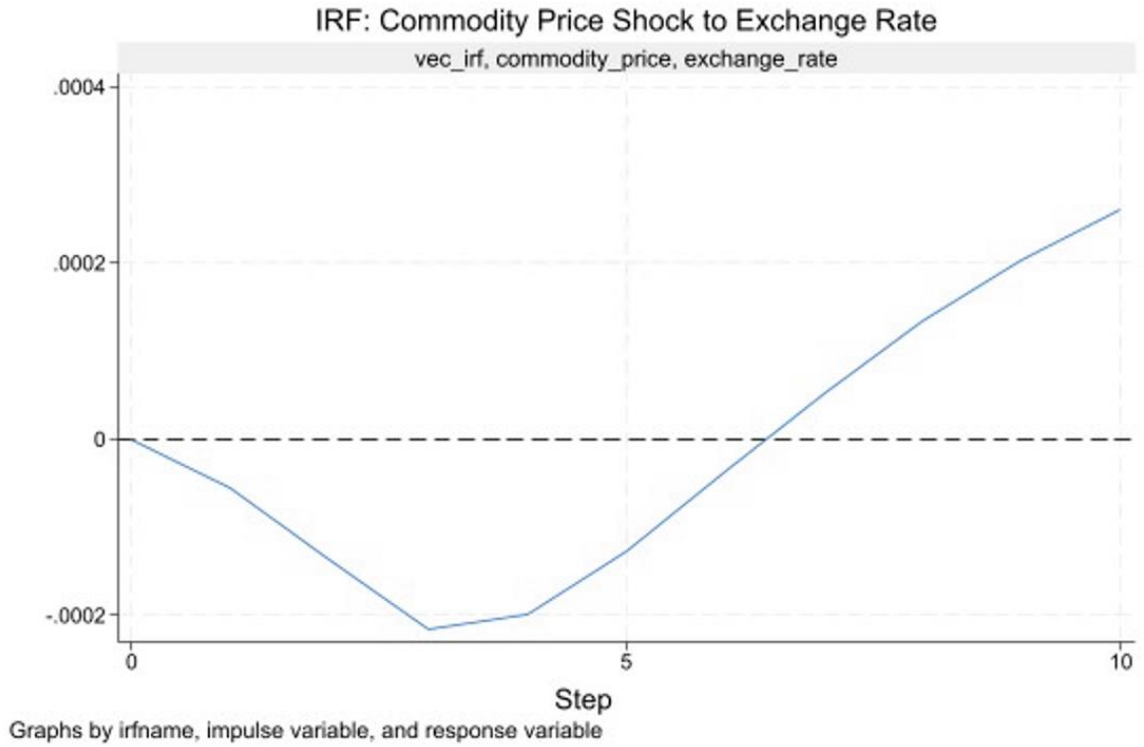
beta	Coefficient	Std. err.	z	P>|z|	[95% conf.	interval]
_ce1						
commodity_price	1	.	.	.	.	.
exchange_rate	689.4957	52.09762	13.23	0.000	587.3862	791.6051
_cons	-1314.725	.	.	.	.	.

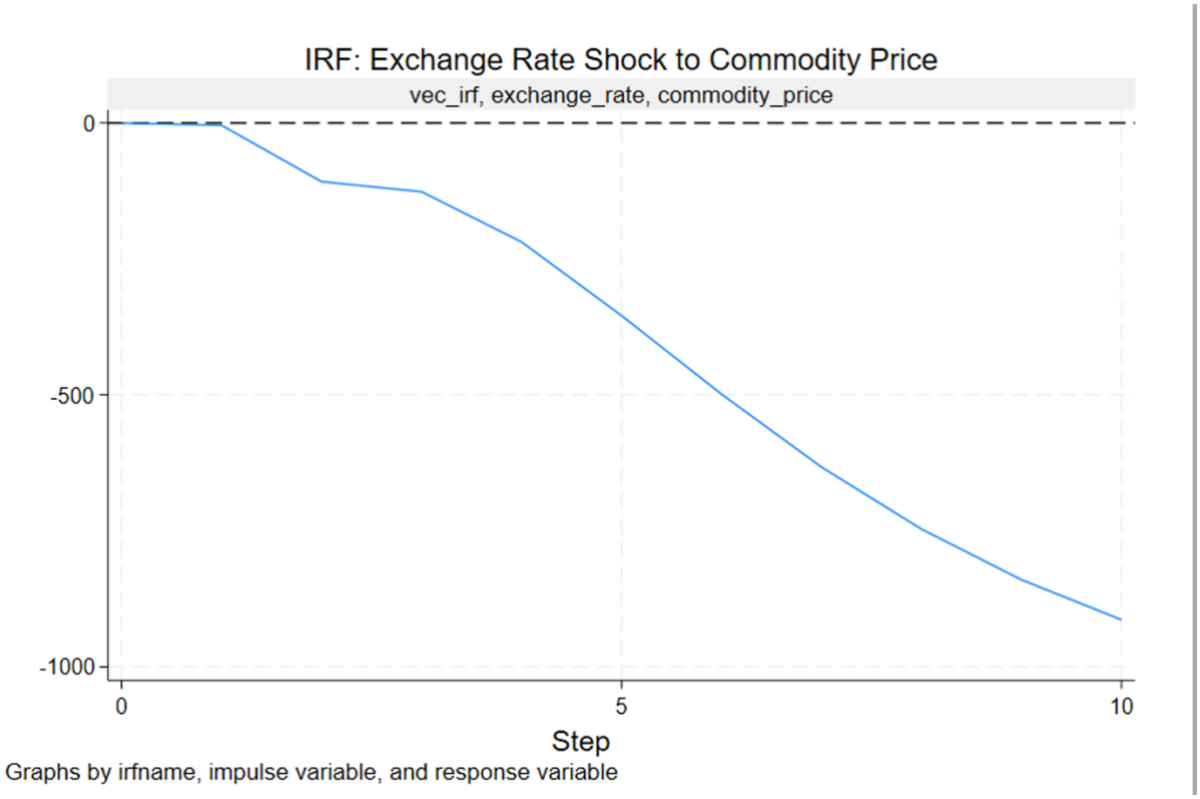
3.5 Impulse Response Functions (IRFs)

To further analyze the dynamic interaction between commodity prices and the exchange rate, I generate Impulse Response Functions (IRFs). These functions show how the exchange rate responds to a one-time shock in commodity prices and vice versa.

- A positive shock in commodity prices initially leads to a depreciation of the exchange rate, but in the long run, the exchange rate appreciates.
- A shock to the exchange rate causes commodity prices to decline over time.

These findings suggest that commodity prices influence exchange rates both directly and indirectly through terms of trade and market expectations.





3.6 Summary of Empirical Methodology

1. Stationarity tests confirmed that both commodity prices and exchange rates are non-stationary in levels but stationary after first differencing ($I(1)$).

2. Johansen's cointegration test confirmed the existence of one cointegrating equation, supporting a long-run relationship between exchange rates and commodity prices.
3. VECM analysis showed that commodity prices significantly adjust to deviations from equilibrium, while exchange rate responses are weaker.
4. Impulse Response Functions (IRFs) revealed that commodity price shocks initially depreciate the exchange rate but eventually lead to appreciation, supporting theoretical expectations.

These empirical findings provide strong evidence that commodity price movements play a critical role in shaping exchange rate dynamics in Canada. The next section presents a detailed discussion of the results and their implications.

4. Results and Discussion

This section presents and interprets the results of my empirical analysis. I first discuss the findings from stationarity tests, followed by the cointegration test, Vector Error Correction Model (VECM), and Impulse Response Functions (IRFs). These results provide insights into the dynamic relationship between commodity prices and the Canada-US exchange rate.

4.1 Stationarity Tests and Order of Integration

Before conducting cointegration analysis, I tested for stationarity using the Augmented Dickey-Fuller (ADF) test. The results show that both the commodity price index and the exchange rate are non-stationary in levels but stationary after first differencing.

This means that both variables are integrated of order one, I(1), meaning they exhibit a unit root at levels but become stationary when first differences are taken. Since both series are I(1) cointegration analysis is appropriate to determine whether they share a long-term equilibrium relationship.

4.2 Cointegration Analysis: Long-Run Relationship

To determine whether commodity prices and exchange rates are cointegrated, I applied Johansen's Cointegration Test. The trace statistic and maximum eigenvalue statistic both confirm the presence of one cointegrating equation at the 5% significance level.

Interpretation of Cointegration Findings

- The existence of one cointegrating equation implies that commodity prices and the exchange rate move together in the long run.
- This supports the Present Value Model (PVM) of exchange rates, which suggests that currency values reflect expectations of future economic fundamentals, including commodity price movements (Engel & West, 2005).
- The findings are consistent with Chen et al. (2010), who found evidence of cointegration between commodity prices and exchange rates in commodity-exporting economies.

Thus, my results confirm that fluctuations in commodity prices are an important determinant of exchange rate movements in Canada.

4.3 Short-Run and Long-Run Dynamics: VECM Results

Since cointegration exists, I estimated a Vector Error Correction Model (VECM) to analyze both short-run adjustments and long-run equilibrium relationships. The error correction term (ECT) provides key insights:

- The coefficient of the ECT in the commodity price equation is statistically significant ($p < 0.01$), indicating that commodity prices adjust to deviations from the long-run equilibrium.
- The ECT in the exchange rate equation is not statistically significant, meaning the exchange rate does not significantly adjust to correct disequilibrium.
- This implies that commodity prices drive the exchange rate in the long run, rather than the other way around.

Short-Run Effects

- Lagged values of commodity prices significantly influence current commodity prices, confirming momentum effects in the commodity market.
- Lagged values of the exchange rate significantly affect the exchange rate but have a weaker effect on commodity prices.

Implications of VECM Results

- Commodity price shocks influence exchange rates more in the long run than in the short run.
- Exchange rate fluctuations have minimal feedback on commodity prices, suggesting that currency markets are driven by other macroeconomic factors in the short run.
- This finding supports prior studies (Amano & van Norden, 1995) that highlight the dominant role of commodity prices in shaping Canada's exchange rate movements.

4.4 Impulse Response Functions (IRFs): Dynamic Interactions

To analyze the dynamic response of exchange rates and commodity prices to shocks, I generated Impulse Response Functions (IRFs) for a 10-month period.

Findings from IRFs

1. **Effect of Commodity Price Shocks on Exchange Rate**

    - A positive shock to commodity prices initially causes a depreciation in the exchange rate.
    - However, after a few months, the CAD/USD exchange rate appreciates, suggesting a delayed positive impact of rising commodity prices on the Canadian dollar.
    - This pattern may be due to delayed capital flows, market speculation, and central bank interventions.

2. **Effect of Exchange Rate Shocks on Commodity Prices**

    - A shock to the exchange rate results in an immediate and persistent decline in commodity prices.
    - This suggests that exchange rate volatility negatively impacts commodity prices, likely due to increased uncertainty in international trade and pricing.

Economic Interpretation of IRF Findings

- The delayed positive effect of commodity prices on the exchange rate supports the Terms of Trade Hypothesis, which argues that improvements in export prices strengthen the currency.
- The strong negative response of commodity prices to exchange rate shocks suggests that currency depreciation increases uncertainty and market risk, leading to lower commodity prices.
- These findings align with Chen et al. (2010), who also found that exchange rate movements incorporate forward-looking information about future commodity price changes.

4.5 Summary of Findings

The empirical results provide strong evidence that commodity prices and the Canada-US exchange rate are cointegrated, meaning they share a long-run equilibrium relationship. The VECM results suggest that commodity prices play a leading role in exchange rate adjustments, rather than the reverse. Finally, Impulse Response Functions show that commodity price shocks lead to exchange rate appreciation after an initial depreciation, while exchange rate shocks negatively impact commodity prices.

Comparison to Existing Literature

- This findings support Chen et al. (2010), who found that exchange rate movements incorporate information about future commodity prices.
- The results also align with Amano & van Norden (1995), who emphasized the role of commodity price shocks in Canadian exchange rate dynamics.
- However, unlike some studies that find a symmetric relationship, my results indicate asymmetry, with commodity prices influencing the exchange rate more strongly than the other way around.

Policy and Market Implications

- For policymakers: Understanding the commodity-exchange rate link is crucial for monetary policy and exchange rate management.
- For investors: Commodity prices serve as a leading indicator for currency movements, providing valuable information for forex trading strategies.
- For businesses: Export-oriented industries should consider commodity price risks when forecasting exchange rate movements.

4.6 Transition to Conclusion

The findings of this study contribute to the broader discussion on exchange rate determinants in commodity-exporting economies. In the final section, I summarize my key insights, discuss limitations, and propose directions for future research.

5. Conclusion

This study empirically examined the relationship between commodity prices and the Canada-US exchange rate, focusing on both long-run and short-run dynamics. Using monthly data from 1997 to 2017, I applied Johansen's Cointegration Test, a Vector Error Correction Model (VECM), and Impulse Response Functions (IRFs) to assess the interactions between these two variables.

5.1 Summary of Key Findings

1. **Stationarity Tests (ADF Test):**
    - Both commodity prices and the exchange rate were found to be non-stationary in levels but stationary after first differencing, confirming they are integrated of order one (I(1)).
2. **Cointegration Test (Johansen's Test):**
    - The results confirmed one cointegrating equation, meaning that commodity prices and the exchange rate share a stable long-run relationship.
    - This supports the Present Value Model (PVM), which suggests that exchange rates incorporate expectations of future macroeconomic fundamentals, including commodity price trends.
3. **VECM Results:**
    - The error correction term (ECT) was significant for commodity prices but not for the exchange rate, indicating that commodity prices adjust to deviations from the long-run equilibrium, while exchange rates exhibit weaker adjustment.
    - This suggests that commodity prices drive exchange rate movements over time, rather than the reverse.
4. **Impulse Response Functions (IRFs):**
    - A positive shock in commodity prices initially leads to a depreciation of the exchange rate, but over time, the CAD/USD exchange rate appreciates as the effects of rising commodity prices strengthen the currency.
    - Conversely, an exchange rate shock leads to a persistent decline in commodity prices, highlighting the asymmetric impact of currency fluctuations on commodity markets.

These findings align with previous research by Chen et al. (2010) and Amano & van Norden (1995), reinforcing the idea that commodity-exporting economies like Canada experience exchange rate fluctuations that are strongly influenced by commodity price movements.

5.2 Economic and Policy Implications

1. **For Monetary Policymakers:**
    - The Bank of Canada should closely monitor global commodity price trends as part of its exchange rate forecasting and monetary policy framework.
    - If commodity prices serve as a leading indicator for exchange rate movements, interest rate adjustments could be timed more effectively to manage currency volatility.
2. **For Financial Markets and Investors:**
    - Foreign exchange traders and institutional investors can use commodity price trends as a predictor for CAD/USD movements, improving forex trading strategies.
    - The strong long-term link between commodity prices and exchange rates suggests that commodity futures markets provide valuable insights into currency fluctuations.
3. **For Trade and Business Strategy:**
    - Canadian exporters and importers dealing in commodities must consider exchange rate risks when making pricing and supply chain decisions.
    - Hedging strategies could be adopted to mitigate risks associated with currency fluctuations tied to commodity price movements.

5.3 Limitations of the Study

While this study provides valuable insights, there are a few limitations:

1. **Omitted Macroeconomic Variables**
    - This analysis focuses solely on commodity prices and exchange rates. However, other macroeconomic factors such as interest rate differentials, inflation, and global demand shocks may also play significant roles in exchange rate determination.
2. **Limited Time Frame (1997 – 2017)**
    - While a 20-year dataset is sufficient for long-run analysis, the study is constrained by data availability. The 'Foreign exchange rates in Canadian dollars, Bank of Canada' dataset from Statistics Canada stops in April 2017. Extending the study to include more recent data, if available, would help assess whether the relationship holds in more recent periods.

3. **Potential Structural Breaks**

    - External events such as financial crises, policy shifts, and geopolitical events may have affected the relationship between commodity prices and exchange rates. Future research could explore structural break tests to account for these potential disruptions.

5.5 Final Thoughts

This study provides empirical evidence that commodity prices play a significant role in determining the Canada-US exchange rate, confirming a long-run equilibrium relationship between these two variables. The results support theoretical models such as the Present Value Model (PVM) and the Terms of Trade Hypothesis, reinforcing the importance of commodity markets in shaping exchange rate dynamics.

By understanding the interplay between commodity prices and exchange rates, policymakers, investors, and businesses can make more informed decisions in response to global economic fluctuations.

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