

The relationship between energy commodities and exchange rates

Seminar in Applied Financial Economics: Applied Econometrics of FX Markets - Professor Reitz

Josef Fella and Robert Hennings

Christian Albrechts University of Kiel

josef.fella@stu.uni-kiel.de and robert.hennings@stu.uni-kiel.de

GitHub: <https://github.com/RobertHennings>

Kiel - 14.11.2025



Outline

1 Modern Energy Commodities Markets - The current state

Physical Markets: Global Oil and Gas Production and Consumption over time
Financial Markets: Global Oil and Gas Open Interest over time

2 Research Hypothesis

Energy Commodity Price Shocks: The Pass-Through Effect and implications for Monetary Policy
Energy Commodity Price Shocks: Economic Rationale
Formulated Research Hypothesis

3 Literature Review

The connection between Energy Commodity Prices and Inflation

4 Methodology Overview

Impact of Inflation on Measurements: What are prices and how are they measured?
A simple model of exchange rates and commodity prices
Systematic Methodology Overview: Linear vs. Non-linear approaches

5 Theoretical Framework

Classical (Linear) and Machine-Learning (Non-linear) Approaches: A comparison
(Financial) Market Distress: Important periods and their characteristics

6 Used Data

7 Model Results

Paragraphs and Lists
Blocks
Columns

8 Table and Figure Examples

Table
Figure

9 Mathematics

Intro: Energy Commodities and Exchange Rates

This has led some to suggest that an unidentified real factor may be causing persistent shifts in real equilibrium exchange rates.

— R.A. Amano, S. van Norden¹

This may in fact be the case or it is also possible that the relationship between exchange rates and oil shocks is non-linear and not being detected by a linear regression framework.

— S. A. Basher, A. A. Haug, P. Sadorsky²

The long-run real exchange rate of these 'commodity currencies' is not constant (as would be implied by purchasing power parity-based models) but is time varying, being dependent on movements in the real price of commodity exports.

— P. Cashin, L. F. Céspedes, R. Sahay³

¹Oil prices and the rise and fall of the US real exchange rate, R.A. Amano, S. van Norden, Journal of International Money and Finance 17 (1998) 299-316, p.301

²The impact of oil shocks on exchange rates: A Markov-switching approach, S. A. Basher, A. A. Haug, P. Sadorsky, Energy Economics 54 (2016) 11–23, p.17

³Commodity currencies and the real exchange rate, P. Cashin, L. F. Céspedes, R. Sahay, Journal of Development Economics 75 (2004) 239–268, p.239

Intro: The PPP puzzle and Commodity Currencies

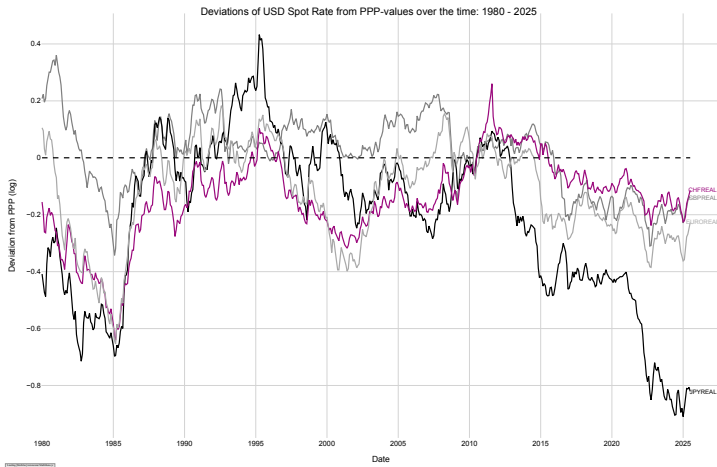


Figure: Deviations of USD Spotrate from PPP-values (in log terms).⁴

⁴Own Illustration based on XYZ (2000), page 7 and data accessed 10.09.25.

This puzzle concerns the finding of many researchers that the speed of mean reversion of real exchange rates is too slow to be

Modern Energy Commodity Markets The current state

Oil: Global Production and Consumption over time

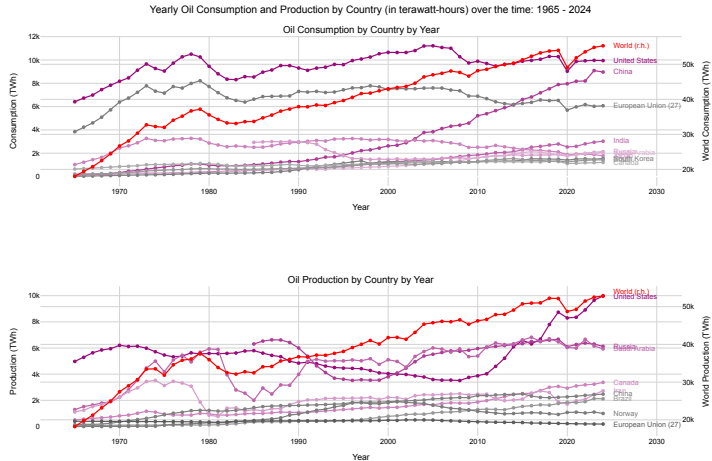


Figure: Global Oil Production and Consumption over time - in terawatt-hours (TWh).⁵

⁵Own Illustration based on XYZ (2000), page 7 and data accessed 10.09.25.

Gas: Global Production and Consumption over time

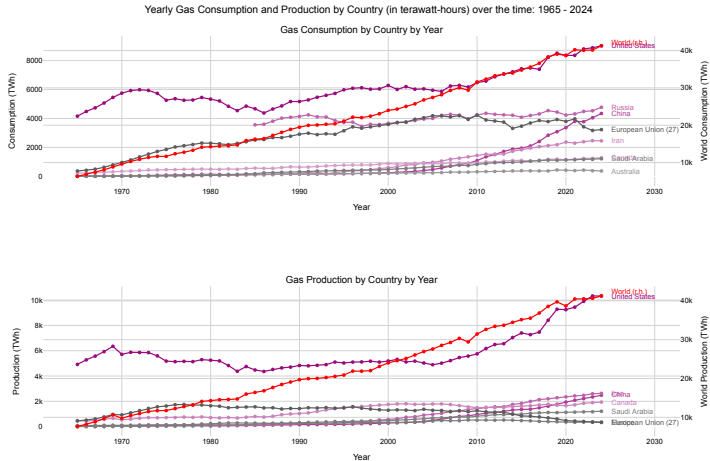


Figure: Global Natural Gas Production and Consumption over time - in terawatt-hours (TWh).⁶

⁶Own Illustration based on XYZ (2000), page 7 and data accessed 10.09.25.

Financial Markets: Oil and Gas OI over time

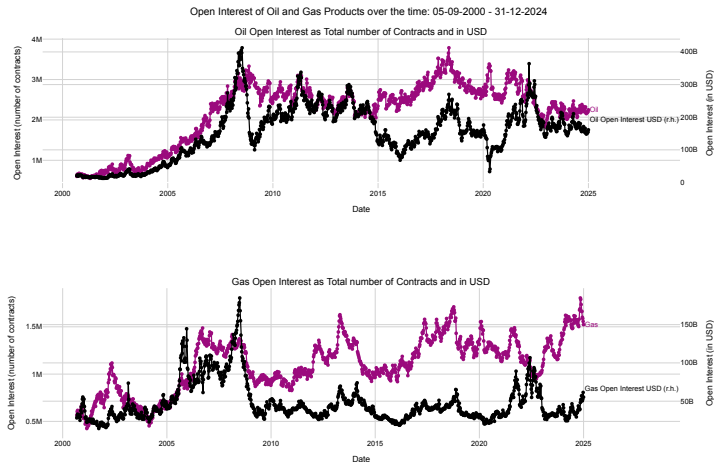


Figure: Oil and Gas Open Interest over time.⁷

⁷Own Illustration based on XYZ (2000), page 7 and data accessed 10.09.25.

Research Hypothesis

Energy Price Contributions to Inflation

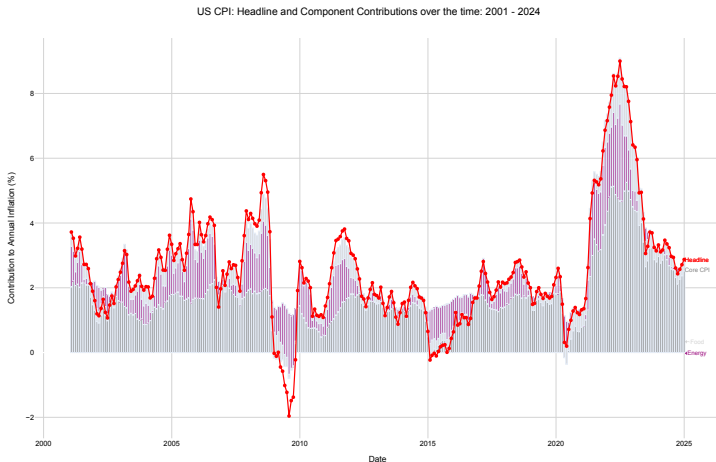


Figure: US CPI and its main components over the time: 2000 - 2025.⁸

⁸Own Illustration based on U.S. Bureau of Labor Statistics (2025), page 7 and data accessed 10.09.25.

Energy Price Contributions to Inflation

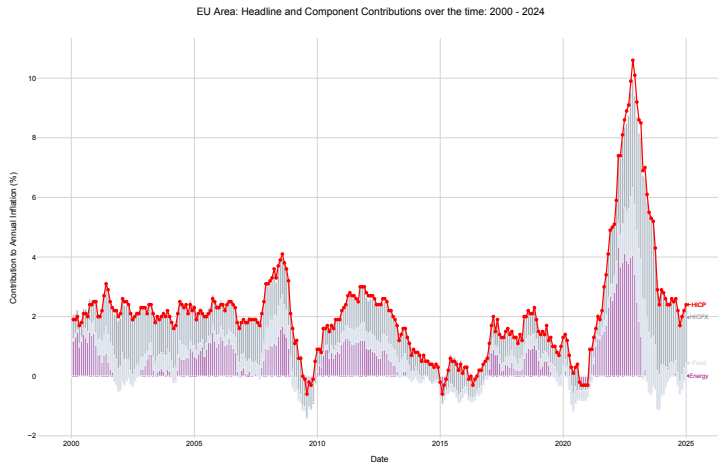


Figure: EU Area CPI and its main components over the time: 2000 - 2025.⁹

⁹Own Illustration based on U.S. Bureau of Labor Statistics (2025), page 7 and data accessed 10.09.25.

Energy Commodity Price Shocks: Economic Rationale

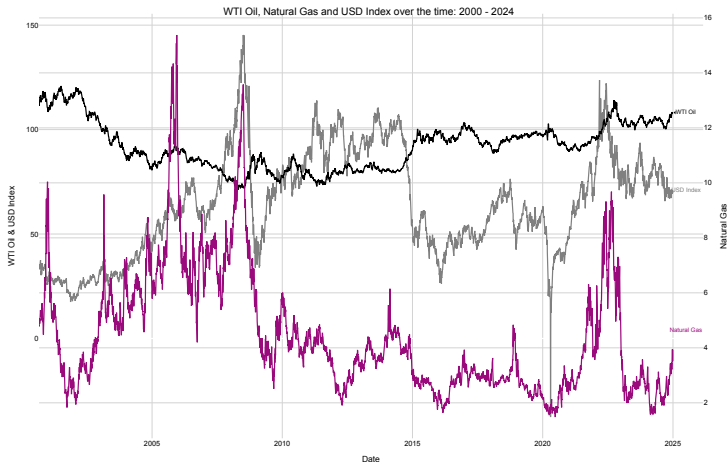


Figure: USD Index, WTI and Natural Gas over the time: 2000 - 2025.¹⁰

¹⁰Own Illustration based on U.S. Bureau of Labor Statistics (2025), page 7 and data accessed 10.09.25.

Formulated Research Hypothesis

Main Research Hypothesis

“Exchange Rates and energy commodity prices are interconnected over several time frequencies and horizons, predominantly during times of (financial market) distress. Energy commodity price shocks primarily enter through the inflation dynamics channel, influencing both short-term price levels and long-term inflation expectations, thereby also affecting monetary policy decisions.”

Additional Research Hypothesis I

“The pass-through effect of energy commodity price shocks to overall inflation is asymmetric, non-linear and time-varying, with price increases having a more pronounced effect than price decreases.”

Additional Research Hypothesis II

“The pass-through effect intensified with growing financialization of energy commodity markets, leading to stronger correlations between

Literature Review



The connection between Energy Commodity Prices and Inflation

- Energy prices have been a significant driver of inflation in recent years, particularly due to geopolitical tensions and supply chain disruptions.
- The volatility in energy markets has led to increased costs for transportation, manufacturing, and household energy consumption.
- Central banks face challenges in managing inflation expectations while considering the transitory nature of energy price shocks.

Systematic Literature Overview: Main Approaches

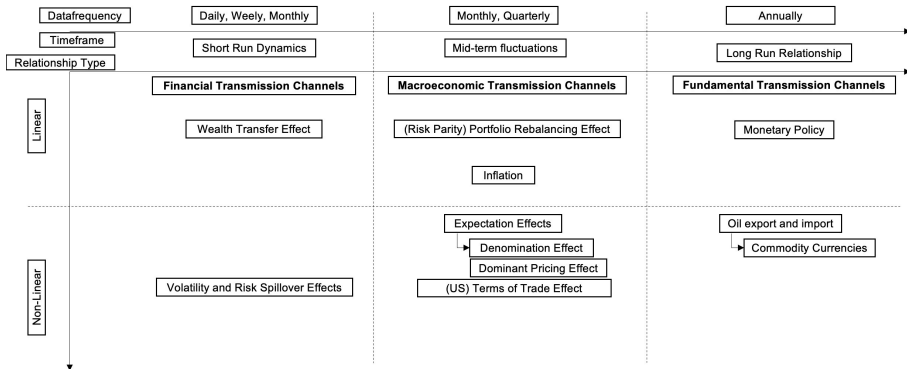


Figure: Systematic Overview about main approaches.¹¹

¹¹ Own Illustration based on XYZ (2000), page 7 and data accessed 10.09.25.

Methodology Overview

Definitions

A simple model of exchange rates and commodity prices

Systematic Methodology Overview: Linear vs. Non-linear approaches

Theoretical Framework

Classical (Linear) and Machine-Learning (Non-linear) Approaches: A comparison

(Financial) Market Distress: Important periods and their characteristics

Used Data

Model Results

Paragraphs of Text

Sed iaculis **dapibus grvida**. Morbi sed tortor erat, nec interdum arcu. Sed id lorem lectus. Quisque viverra augue id sem ornare non aliquam nibh tristique. Aenean in ligula nisl. Nulla sed tellus ipsum. Donec vestibulum ligula non lorem vulputate fermentum accumsan neque mollis.

Sed diam enim, sagittis nec condimentum sit amet, ullamcorper sit amet libero. Aliquam vel dui orci, a porta odio.

— *Someone, somewhere...*

Nullam id suscipit ipsum. Aenean lobortis commodo sem, ut commodo leo grvida vitae. Pellentesque vehicula ante iaculis arcu pretium rutrum eget sit amet purus. Integer ornare nulla quis neque ultrices lobortis.

- Lorem ipsum dolor sit amet, consectetur adipiscing elit
 - Aliquam blandit faucibus nisi, sit amet dapibus enim tempus
 - Lorem ipsum dolor sit amet, consectetur adipiscing elit
 - Nam cursus est eget velit posuere pellentesque
 - Nulla commodo, erat quis gravida posuere, elit lacus lobortis est, quis porttitor odio mauris at libero
-
- 1 Nam cursus est eget velit posuere pellentesque
 - 2 Vestibulum faucibus velit a augue condimentum quis convallis nulla gravida

Blocks of Highlighted Text

Block Title

Lorem ipsum dolor sit amet, consectetur adipiscing elit. Integer lectus nisl, ultricies in feugiat rutrum, porttitor sit amet augue.

Example Block Title

Aliquam ut tortor mauris. Sed volutpat ante purus, quis accumsan.

Alert Block Title

Pellentesque sed tellus purus. Class aptent taciti sociosqu ad litora torquent per conubia nostra, per inceptos himenaeos.

Suspendisse tincidunt sagittis gravida. Curabitur condimentum, enim sed venenatis rutrum, ipsum neque consectetur orci.

Heading

- 1 Statement
- 2 Explanation
- 3 Example

Lorem ipsum dolor sit amet, consectetur adipiscing elit. Integer lectus nisl, ultricies in feugiat rutrum, porttitor sit amet augue. Aliquam ut tortor mauris. Sed volutpat ante purus, quis accumsan dolor.

Table

Subtitle

| Treatments | Response 1 | Response 2 |
|-------------|------------|------------|
| Treatment 1 | 0.0003262 | 0.562 |
| Treatment 2 | 0.0015681 | 0.910 |
| Treatment 3 | 0.0009271 | 0.296 |

Table caption

Definitions & Examples

Definition

A p is a number that has exactly two divisors.

Example

- 2 is prime (two divisors: 1 and 2).
- 3 is prime (two divisors: 1 and 3).
- 4 is not prime (**three** divisors: 1, 2, and 4).

You can also use the theorem, lemma, proof and corollary environments.

Theorem, Corollary & Proof

Theorem (Mass–energy equivalence)

$$E = mc^2$$

Corollary

$$x + y = y + x$$

Proof.

$$\omega + \phi = \epsilon$$



Equation

$$\cos^3 \theta = \frac{1}{4} \cos \theta + \frac{3}{4} \cos 3\theta \quad (1)$$

Example (Theorem Slide Code)

```
\begin{frame}  
\frametitle{Theorem}  
\begin{theorem}[Mass--energy equivalence]  
$E = mc^2$  
\end{theorem}  
\end{frame}
```

Slide without title.

An example of the `\cite` command to cite within the presentation:

This statement requires citation [Smith, 2022, Kennedy, 2023].

Appendix

Appendix - Figures and Tables

Appendix - Data and Definitions

References

References - Literature



John Smith (2022)

Publication title

Journal Name 12(3), 45 – 678.



Annabelle Kennedy (2023)

Publication title

Journal Name 12(3), 45 – 678.



John Smith (2022)

Publication title

Journal Name 12(3), 45 – 678.



Annabelle Kennedy (2023)

Publication title

Journal Name 12(3), 45 – 678.

List of Figures

- Figure 2: Global Oil Production and Consumption (Slide 6)
- Figure ?? : Global Coal Production and Consumption (Slide ??)

Thank you for your attention!

We await your Questions and/or Comments.

Josef Fella

josef.fella@stu.uni-kiel.de

Robert Hennings

robert.hennings@stu.uni-kiel.de

Public GitHub Project Repository: <https://github.com/RobertHennings>

- 1 Have you expected this outcome?
- 2 What do you think about the dynamics?
- 3 What other variables could be potentially included?

Josef Fella

josef.fella@stu.uni-kiel.de

Robert Hennings

robert.hennings@stu.uni-kiel.de

Public GitHub Project Repository: <https://github.com/RobertHennings>

Further Material for Illustrations - Questions