STATE STREET

OIL AND DOLLAR

Dawn of a new era?

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Contents

Abstract

The movements in oil prices and the US dollar exchange rate, and the relationship between the two, are major determinants of fiscal policy, domestic growth, inflation, and, in turn, monetary policy.

Over the last several decades, oil prices and the US dollar have moved in opposite directions, providing a necessary relief valve from fiscal pressures, particularly for emerging market oil-importing economies.

Recently, this negative correlation in the oil-dollar relationship has reversed. Oil prices and dollar value have moved together in a positive direction for the last few years, a linkage which may herald a new (and potentially more volatile) era.

Positive co-movements of rising oil prices and dollar appreciation can significantly impact the economic fortunes of oil importers — a dynamic that is not fully priced into markets.

In this paper, we examine the reasons for this change in correlation and explore whether the recent reversal is cyclical or structural. Our analysis shows that the role of the United States as a major oil exporter, and the associated impact on US terms of trade, is likely exerting stronger (and causally determinative) pressure on dollar movements. This is a significant development that warrants further monitoring.

We also examine the implications of this dynamic becoming structural for fiscal and monetary policy of oil-importing economies and, importantly, for client portfolios with exposure to oil-importing economies. Finally, we suggest ways in which clients can seek protection against this unpriced risk.

Introduction

The relationship between oil prices and the US dollar (USD) exchange rate is important as it governs the economic and fiscal fortunes of many countries, particularly those in emerging markets.

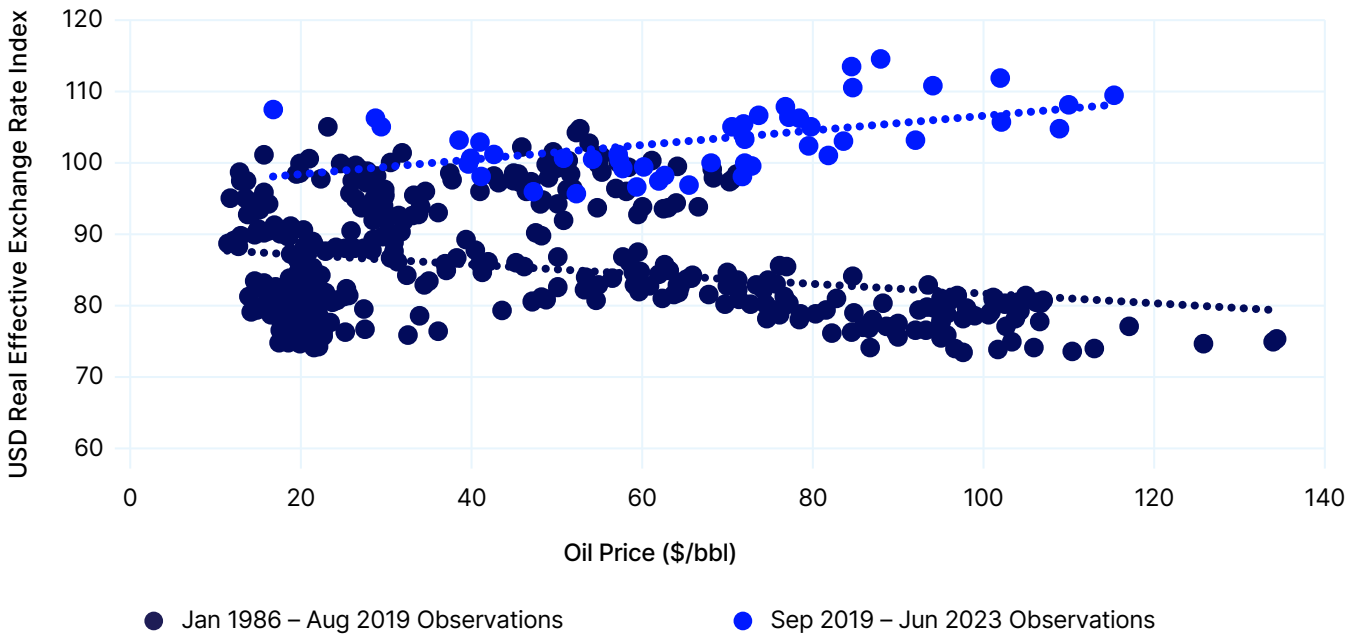
This relationship is a complex one due to the interplay of multi-faceted drivers of oil prices and dollar movements — with endogeneity playing an important role.

Over the last few decades, co-movements in oil prices and USD strength have always been negative, i.e., spikes in oil prices have been historically accompanied by a softening of the dollar, and vice versa. This inverse correlation could be viewed as a relief valve that eased fiscal pressures on global finance, particularly for emerging markets that are oil importers.

Recently, however, a peculiar trend of positive co-movement between oil prices and the USD exchange rate has emerged. As Figure 1 shows, oil prices and USD real effective exchange rates (REER) are moving together in unprecedented ways.[1]

Figure 1: Changing oil-dollar relationship[2]

Oil price versus USD REER

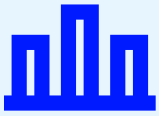


Source: Refinitiv Datastream, FRED, BIS

This co-movement of oil prices and USD value can have major macroeconomic implications for both advanced economies (AEs) and emerging market economies (EMEs). In particular, positive oil price shocks that impose price pressures on importers could get compounded with positive dollar movements as most non-commodity imports are also invoiced in USD.[3] As we examine in section three, the co-movement of higher oil prices and USD appreciation could exert unprecedented pressures in global finance, particularly on oil importers in EMEs.

This paper explores the ramifications of this shift for global finance. We believe that the transition of the US from an oil importer to an oil exporter plays an important role in this change in direction of oil prices and dollar movements. Given that the US is likely to remain an oil exporter — thanks to the shale revolution — we believe that a continuation of this trend, and the possibility of it becoming a structural factor, creates a dimension of fiscal risk that is currently not fully priced in financial markets.

In this paper, we also:



Analyze the drivers of the oil-dollar relationship and the recent change in correlation **(Section 1)**

Examine important factors responsible for the change **(Section 2)**

Identify the potential economic, policy and portfolio implications of the shifting oil-dollar relationship **(Section 3)**

SECTION 1

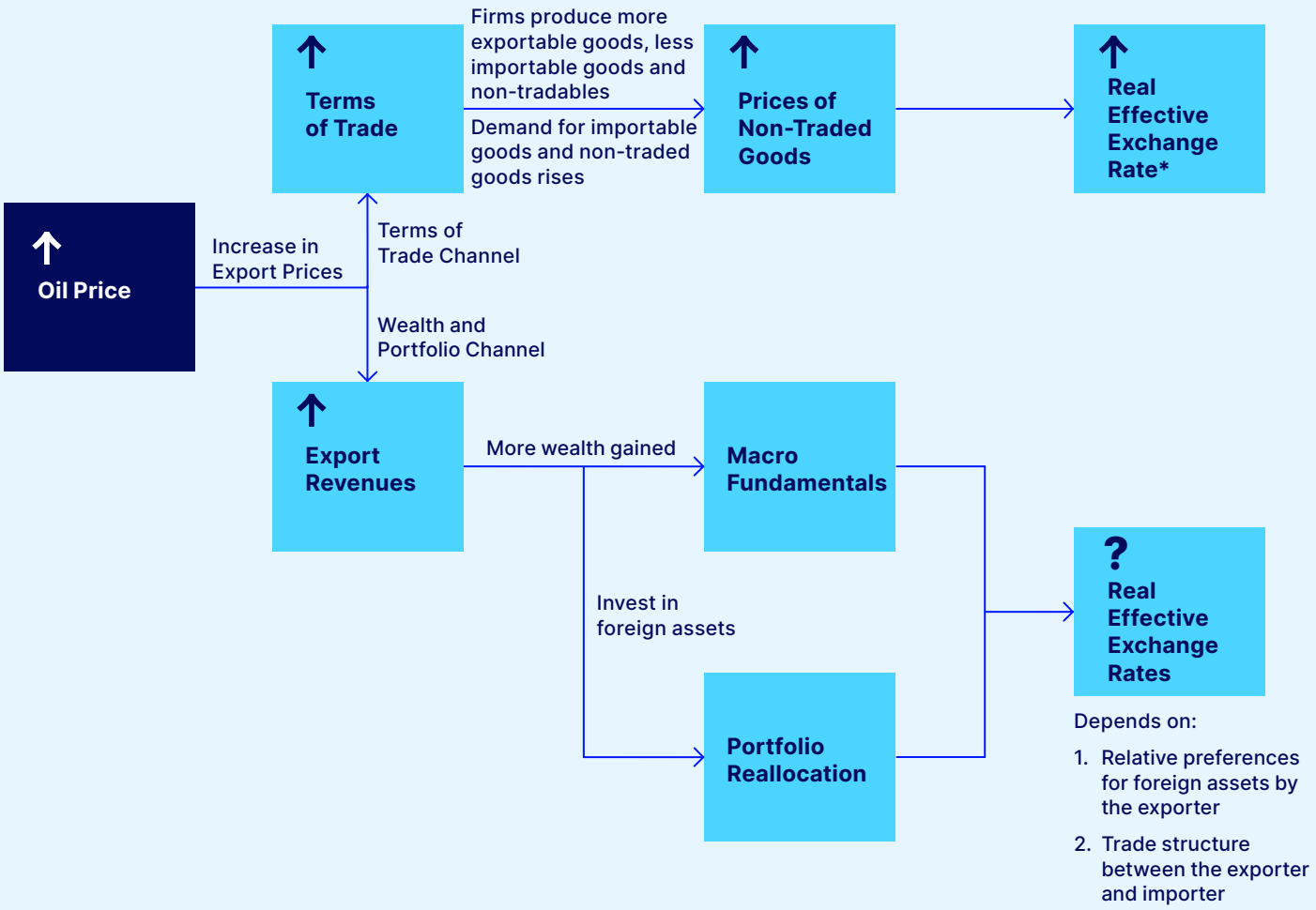
Drivers of the oil-dollar relationship and the recent change

What are the drivers of the oil-dollar relationship?

Before exploring the reasons for the changing oil–dollar relationship, we briefly outline the different channels through which oil prices and exchange rates impact each other and how such interactions have changed over the years.

In Figure 2, we visualize how oil price shocks affect exchange rates of oil-exporting countries.

Figure 2: Oil – exchange rate transmission channels



*Increase in exchange rate represents an appreciation of domestic currency

Oil price shocks and their impact on FX

Oil price shocks can affect foreign exchange (FX) rates through two major channels

Terms of trade (ToT)

Wealth and portfolio

These channels are interrelated, and the economic effects vary depending on the time horizon. ToT, which is the ratio between a country's export prices and its import prices, have a straightforward effect on FX rates, as the net export/import position directly impacts the trade balance of an economy.

An improvement in the trade balance depends on the share of traded goods (oil and other commodities) versus non-traded goods (domestic manufactured goods). Given higher prices, firms are incentivized to produce more traded goods and less non-traded goods leading to improvements in real income and macro fundamentals.

An increase in the real income leads to more demand for imports and non-traded goods, which, in turn, leads to higher prices and real appreciation of the domestic currency. Thus, positive oil shocks help support the appreciation of the currency of the oil-exporting country.

The wealth and portfolio channel works in a slightly different manner. Positive oil price shocks first increase the wealth of an oil-exporting country, which improves the country's current account balance and leads to the terms of trade effect. Stronger macro fundamentals generally cause currency appreciation. The net impact on the exchange rate for the exporting country, however, is a function of current and capital account flows. If, for example, the oil-exporting country reinvests some of its wealth in the assets of a foreign country, the exporting country's currency may not appreciate as much due to potentially opposing effects from capital account versus current account.[4] In fact, if the additional revenues from higher oil prices were to remain invested abroad, the exporting country's currency may actually depreciate. Thus, while the near-term effects on FX from ToT are clear, the longer-term impact from portfolio reallocations and wealth effects may go either way depending on the trade structure and allocation decisions of the exporting country.[5]

FX shocks and their impact on oil

While oil shocks impact exchange rates, the reverse effect has also been observed. Exchange rate shocks can affect oil prices as well. Further, since oil contracts are specified in USD, the impact of FX shocks on oil needs to be studied in that currency.

Any change in the dollar exchange rate affects ToT between the two economies. The magnitude of this effect depends on the proportion of "dollar goods" versus "non-dollar goods."[6]

Since the share of dollar goods for oil-exporting countries is generally greater than that of oil-importing countries, oil-exporting countries are incentivized to increase oil prices when the USD depreciates (Breitenfellner and Cuaresma, 2008). This gives rise to a lagged negative correlation.

Research has shown that the real price of oil increases at least six months following an exogenous real depreciation of the USD.[7]

What happens to oil prices when the USD appreciates? The lagged negative correlation between exchange rate shocks and oil prices has been shown to be present in both directions, though it is asymmetric.

De Schryder and Peersman (2015) found that the magnitude of oil price impact during USD appreciation is greater than that during USD depreciation.

The changing oil-dollar relationship

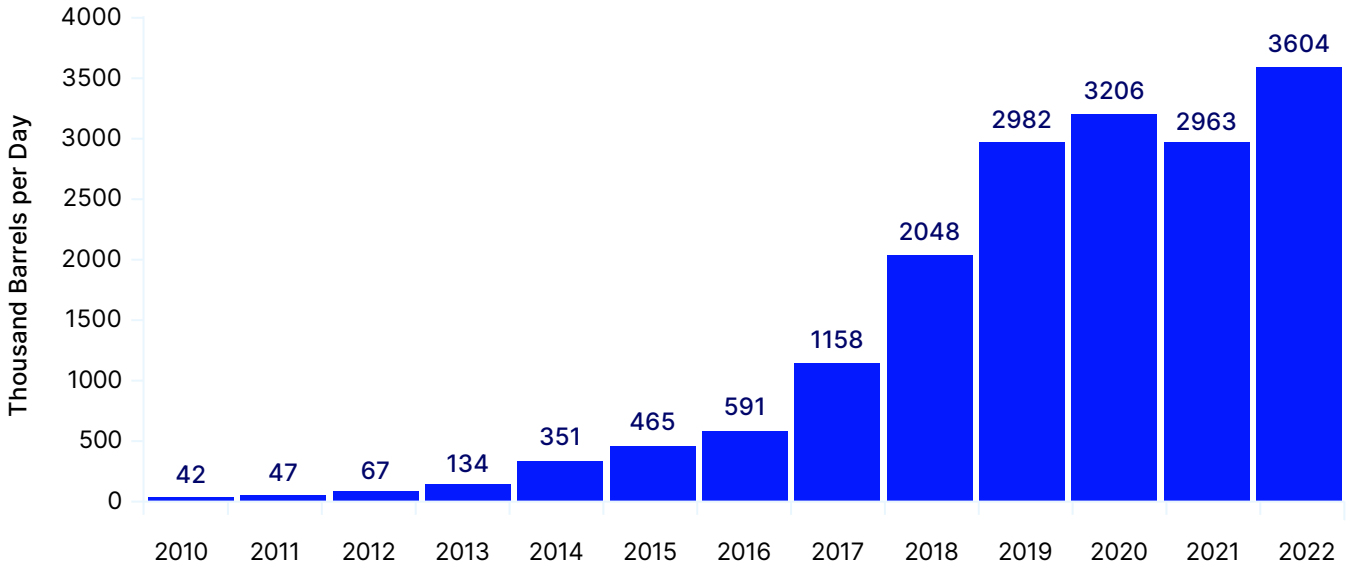
Arguably the most important event affecting the oil-dollar relationship is the US Congress' repeal of the crude oil export ban in December 2015, spurred by the rapid growth in US shale oil production since around 2009.[8]

As shown in Figure 3, US exports of crude oil exponentially grew since 2016 following the repeal of the ban, and the US became a net exporter of petroleum products in September 2019.[9]

As is now well known, the US ranks third in the world in oil exports after Saudi Arabia and Russia, and US oil exports are expected to reach 4.5 million barrels per day by the end of 2023.[10] The co-movement of oil prices and dollar strength is completely different between pre- and post-2019 periods.

It is clear that the historically negative relationship between oil prices and the USD real exchange rate has reversed in recent years. This change appears to have coincided with the shift in the role of the US from a net oil importer to a net oil exporter. Next, we examine the factors impacting the recent change in correlation between oil prices and the USD exchange rate and consider whether the shift is structural or cyclical.

Figure 3: US exports of crude oil



Source: US Energy Information Administration

SECTION 2

Factors driving the changing oil-dollar relationship

Cyclical factors

Two recent macro events have contributed to positive co-movement of oil prices and dollar strength – Russia's invasion of Ukraine and high inflation rates across the globe.

Russia's war against Ukraine has contributed to negative supply shocks, spikes in commodity prices[11] and macro-financial instability. The onset of war on the heels of the global COVID-19 pandemic caused structural changes in the labor market, as explored in Thiagarajan et al. (2023a).

Unabating inflationary impulses worldwide compelled central banks to respond with interest rate hikes. The rapid monetary policy tightening led by the Federal Reserve has resulted in the strengthening of the USD. Over the last 10 interest hikes by the Fed, the USD has strengthened by 5.9 percent (as of June 2023). These concurrent developments of supply shocks leading to commodity price hikes and monetary policy tightening may explain the recently observed change in correlation between oil prices and the USD — from negative to positive.

With inflation on the path to abatement and the easing of supply chain pressures, it is likely that the positive co-movement will revert, unless the underlying forces giving rise to such co-movement are structural and not merely cyclical.

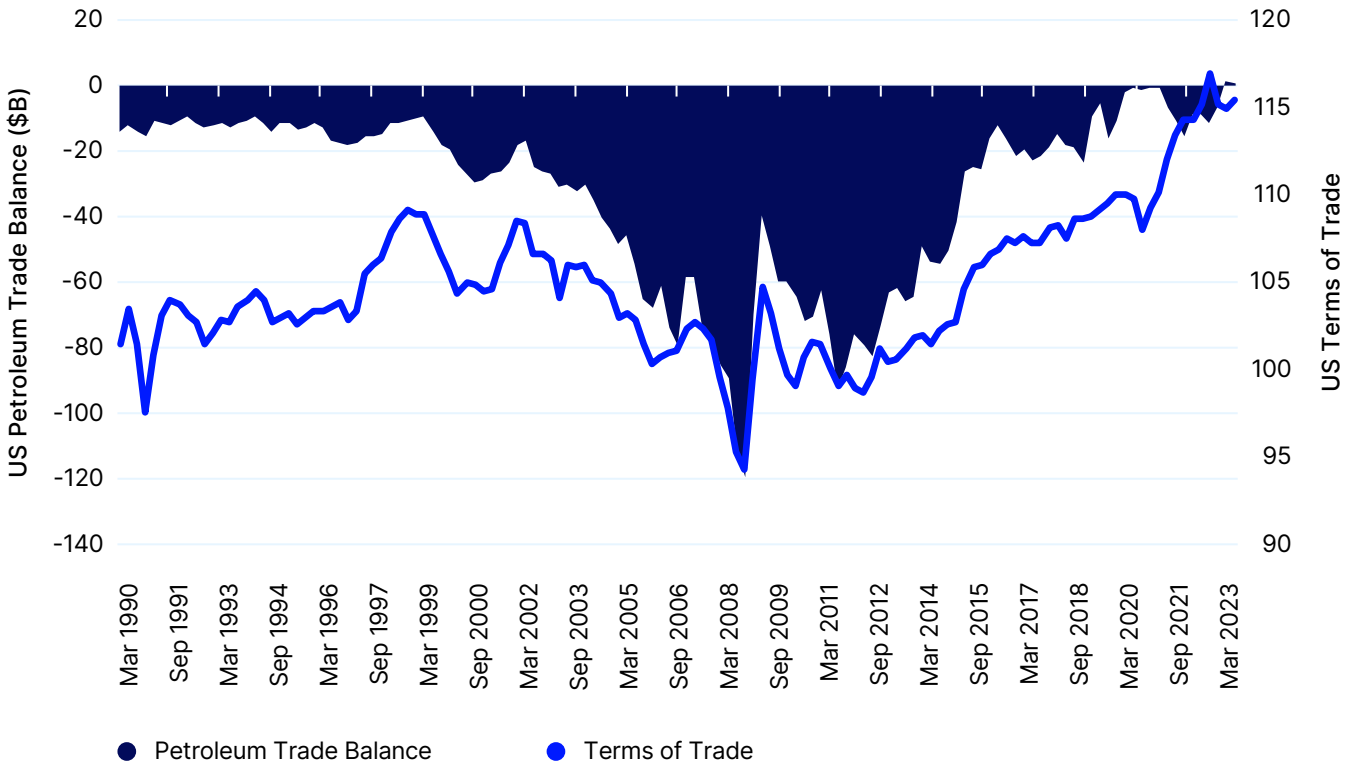
We next explore whether the transition of the US from a net oil importer to a net oil exporter triggered a structural shift, which accounts for the change in correlation between oil prices and the USD.

Structural factors

The alteration in US trade composition represents a potentially more determinative driver of the change in the oil-dollar relationship. The US has been a net importer of oil throughout the 20th century and into the new millennium. However, the shale oil discovery in the early 2010s led to a significant boom in US energy production, and the US became a net oil exporter in 2019 following the end of the crude oil export ban in 2015.

According to the US Energy Information Administration (EIA), the US exported close to 50 percent of its production of petroleum-based products in 2022.[12] This number was approximately 12 percent in the 2000s. Such a drastic change in trade composition had a material impact on the US ToT. As Figure 4 illustrates, the improvement in US petroleum trade balance over the last few years has strengthened the US terms of trade.

Figure 4: US petroleum trade balance and US terms of trade



Source: Federal Reserve Economic Data (FRED), EIA

Our analysis implies that we can reasonably use the impact of ToT on dollar value to changes in oil prices on dollar value.[18] Put differently, by analyzing the changes in relationship of ToT on USD, we can draw meaningful inferences about the relationship between oil prices and USD.

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The change in US trade composition implies that the ToT channel that has historically benefited oil-exporting countries may have started working for the US as well, as an increase in oil prices now leads to an appreciation in USD.[13] We explore this channel empirically.

If the economic driver of the relationship were ToT, we should find that changes in oil prices have a positive beta (correlation) with changes in ToT.

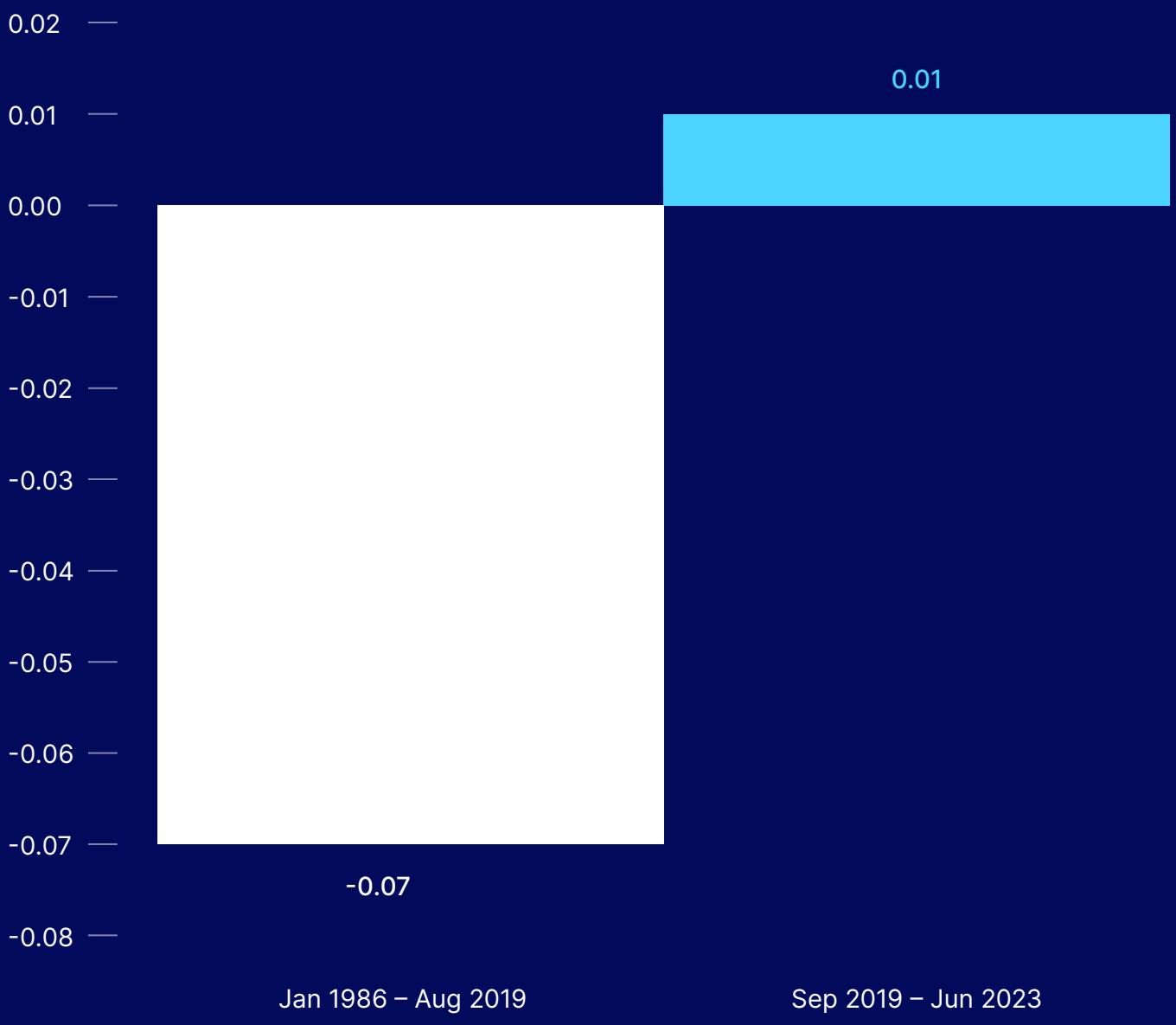
To examine this, we first ran a regression between oil prices and the US ToT using monthly Western Texas Intermediate (WTI) oil prices and US terms of trade[14] data from January 1986 to June 2023, dividing the periods into before and after September 2019, in line with our previous analysis.[15]

Figure 5 shows the beta coefficient of the independent variable (WTI) in our regression model, which measures the sensitivity of oil price changes on US ToT.

This sensitivity dramatically changed from negative to positive in recent periods. As the magnitude of US oil exports have increased, our analysis showed that, starting September 2019, oil prices have become a positive contributor of the US trade composition.[16]

Figure 5: Changing relationship between WTI oil prices and the US ToT

Impact of WTI Price (log changes) on US ToT (log changes)



Source: Refinitiv Datastream, FRED, Authors' estimates

Notes: The equation used for the analysis is: $\Delta \log(ToT) = \beta_0 + \beta_1 \Delta \log(WTI) + \varepsilon$[17]

Relationship between ToT and REER

Since oil shocks have been shown to positively comove with ToT (as represented in Figure 5), we study the relationship between ToT and REER. This relationship is a complex one that needs to account for multiple factors such as monetary policy regime (which we proxied by the real interest rate differential between the US and the United Kingdom) and risk sentiment (proxied by the CBOE Volatility Index (VIX) in our analysis), along with our variable of interest, ToT.

To allow for lagged effects in this complex relationship, we use an Autoregressive Distributed Lag (ARDL) model, a framework that analyzes long-run relationships and short-term dynamics between variables in a time series. The ToT channel (as detailed in Figure 2) predominantly reflects the long-term effects of oil price changes on REER. As oil prices drive ToT and become a positive contributor to it, we expect ToT to positively covary with REER and, importantly, for the relationship to have strengthened after 2019. Since our dependent variable, REER, is driven by both short-term and long-term variables like ToT, we include short-term variables as control variables in our ARDL model specification along the lines of Rees (2023).[19] The attractiveness of the ARDL model is that it allows for lagged as well as short-term effects as controls while studying the impact of any long-term equilibrium variables.[20]

Following Rees (2023), we estimate Equation 1 below using monthly data from January 1986 to June 2023.[21]

$$\Delta \log(REER)_t = \theta_0 + \theta_1 \Delta \log(REER)_{t-1} + \theta_2 \Delta \log(ToT)_t + \theta_3 \Delta \log(VIX)_t + \theta_4 TREND + \delta[\log(REER)_{t-1} - \beta_1 \log(ToT)_{t-1} - \beta_2 RIR\ Diff_{t-1}] + \varepsilon_t$$

Our hypothesis is that if ToT have become a more important determinant of REER after the US became a dominant oil exporter, we expect its effect to have strengthened after 2019.

To test whether the long-run relationship between ToT and REER strengthened after 2019, we divide the periods into pre- and post-September 2019.

Table 1 shows the short- and long-run effects of the macroeconomic variables on US REER in the two referenced periods. First, similar to Rees (2023), we find that ToT has a statistically significant positive influence on REER in the short- as well as long-run in the full sample. Notably, when we divide the sample pre- and post-September 2019, we find the long-run impact of ToT to be statistically significant and stronger only during the post-September 2019 period.[22]

These results support our conjecture that the ToT channel has started to play a larger role in impacting US REER, as US exports of crude oil exponentially increased over the past few years. This dynamic may persist as long as the US remains a net oil exporter.

Admittedly, the time period for the post-2019 analysis is short, and the results obtained based on this analysis require further monitoring.

We also acknowledge that this was a tumultuous time across all global markets, given the massive fiscal stimuli and monetary accommodation by central banks globally.

However, our results suggest that there may be a structural effect at play in the relationship between ToT and REER, a link driven by the increasing role of the US as an exporter of oil. While the overall magnitude of such effect will ultimately be determined by how much oil trade accounts for the overall US trade and GDP, the directional change in the co-movement of oil price and USD strength warrants continued attention.

As this directional change can substantially alter the economic fortunes of importing economies in a number of dimensions, further study of the oil-dollar relationship is highly indicated.

Table 1: Autoregressive Distributed Lag (ARDL) model for ToT channel[23]

Variable	Full Sample	Jan 1986 – Aug 2019	Sep 2019 – Jun 2023
Constant	-0.02***	0.009	-1.30**
Error Correction Term	-0.39***	-0.32***	-0.28***
Long-Run			
$log(ToT)_{t-1}$	1.02**	0.81	2.38*
Real Interest Rate $Diff_{t-1}$	-0.01	-0.01	0.009
Short-Run			
$\Delta log(ToT)_t$	0.26***	0.28***	0.13
$\Delta log(REER)_{t-1}$	0.32***	0.30***	0.23*
$\Delta log(VIX)_t$	0.007**	0.006*	0.02**

Source: Refinitiv Datastream, BIS, FRED, Authors' estimates

Notes: *, **, *** represent 10 percent, 5 percent, and 1 percent levels of significance.

SECTION 3

Implications of the changing oil-dollar relationship

In this section, we explore the implications for growth, policy and investment portfolios should the positive co-movement of oil prices and the USD exchange rate persist.

Economic implications

In general, countries with higher reliance on oil imports and a higher share of USD-denominated debt will be most adversely impacted from the change in the oil-dollar relationship. This adverse impact works through higher inflation and tighter financial conditions, likely resulting in stagflation for these countries (Hoffman et al. 2023a). These channels function in a manner detailed below.

First, a rise in oil prices will drive headline inflation higher, especially for net oil importers. As the USD is the dominant trade invoicing currency, inflationary effects from a rise in oil prices have historically been partially offset by the depreciation of the USD, which helped lower prices for other imports for importing countries.[24] However, a positive relationship between oil price and USD strength implies that this offset is no longer in place, which may lead to higher and stickier inflation. In fact, the major oil importers have felt adverse impacts of this positive relationship in recent years.[25]

In the case of India, from September 2019 to June 2023, oil prices in Indian rupee (INR) increased by 47 percent, whereas the increase in the USD was only 28 percent. Given that the real interest differential between the US and India moved favorably for INR over the same period (around 2 percent), we can approximate that some or most of the 19 percent net difference can be attributed to the positive co-movement between oil price and the USD. The additional cost of 19 percent coming from dollar appreciation has been quite onerous to the consumer and for economic growth.

Second, financial conditions for oil-importing countries can tighten further as:

- Monetary authorities increase their policy rates to fight inflation
- Global credit supply is reduced due to a stronger dollar
- The creditworthiness of these countries may be negatively impacted as their debt repayment capacity weakens

Thus, both higher inflation and tighter financial conditions may imply higher likelihood of stagflation during periods of exogenous oil shocks.

The reverse will also hold true when both oil and the dollar depreciate, i.e., oil importers will likely simultaneously experience magnified boom periods through cheaper imports and easier financial conditions. Therefore, oil importers will likely encounter extreme procyclicality irrespective of the direction of oil prices and the USD exchange rate. These countries will need to implement fiscal and monetary policies to counter this enhanced procyclicality.

Policy implications

The changing oil-dollar relationship has significant policy implications for both monetary and fiscal authorities, especially in oil-importing EMEs. On the fiscal front, these countries face increased pressures as their ability to provide fiscal support during positive oil price shocks are bound further as the USD appreciates at the same time. Hoffman et al. (2023a) find higher risks to growth and inflation for commodity importers over the past two years compared to historical patterns.

On the monetary front, fiscal-monetary coordination should be prioritized as fiscal dominance can lead to de-anchoring of inflation expectations, especially for countries with high debt and weak macroeconomic fundamentals.

How can oil importers — EMEs in particular — mitigate the volatility and adverse effects resulting from this changing oil-dollar relationship? On the real economy front, governments can either directly or indirectly reduce oil consumption through curbing imports and curtailing supply, or by passing on the increased prices to consumers. However, these actions can hamper growth, and spike political risk in the long run.

Countries with large FX reserves (like India) can adopt certain intervention measures to avoid their domestic currency depreciating beyond fixed levels. To some extent, moving away from USD invoicing, as has increasingly been done in recent years,[26] can also help such countries avoid the double-whammy effect of higher oil prices and a stronger dollar. However, non-dollar invoicing for oil products at scale is non-existent.[27]

Lastly, some oil importers may be compelled to reduce their increased vulnerabilities from a positive oil-dollar relationship via a faster transition to a non-oil energy system, i.e., renewable energy.

Portfolio implications

How should investors reposition their portfolios in light of the changing oil-dollar relationship? Country risk premia for oil importers will have to be reassessed. The positive co-movement of oil price and the USD exchange rate increased both fiscal and monetary risks from currency and commodity channels. In particular, this co-movement increased the procyclicality of these economies. As a result, investors will seek higher compensation for exposure to commodity importers, potentially leading to a repricing of risks. We believe these higher risks are not currently priced into the risk premia of commodity importers.

In addition to demanding a higher risk premium, investors may need to hedge these risks. As oil-importing countries can suffer when there are positive oil shocks, investors may opt to hedge these risks with increased exposure to oil exporters or the USD or both.

The flight-to-quality feature of the USD combined with its positive relationship with oil prices make the USD a suitable hedge in such times. On the other hand, during negative oil price shocks, investors should seek to add exposures to assets that can diversify the additional risk coming from positive co-movement between oil prices and the USD.

Currencies with sufficient liquidity and the opposite characteristics to the USD in terms of their relationship with oil prices — such as the euro (EUR), Swiss franc (CHF) and British pound sterling (GBP) — are potential candidates. Broadly speaking, hedging the risk in either the commodity or, more importantly, the currency market, can be productive, particularly should the recent trend in positive co-movement between oil prices and USD strength prove structural.

Conclusion

The historical negative relationship between oil prices and the USD exchange rate reversed in recent years.

While negative supply shocks from the Russian invasion of Ukraine and rapid monetary tightening of the Fed certainly impacted this relationship, we conjecture that there may exist structural reasons propelling this change, namely the alterations in US trade composition.

The positive impact of oil prices on US ToT, together with the strong relationship between US ToT and USD REER, imply that this positive oil-dollar link may persist as long as the US remains a net oil exporter.

We acknowledge that global oil supply dynamics are rapidly changing. The International Energy Agency (IEA) estimates that about a quarter of the additional oil supply between now and 2028 will come from Latin American countries like Argentina, Brazil and Guyana, while oil supply from other regions will decline.[28]

This shift in supply dynamics may fundamentally impact the relationship between oil prices and US ToT, which can once again flip the oil-dollar relationship.

Given this uncertainty and the substantial economic, policy and portfolio implications at stake, the oil-dollar relationship warrants continued monitoring and further research.

Acknowledgements

The authors would like to thank Jessica Donohue, Andrew Conn, Aaron Hurd, Elliot Hentov and particularly Eric Garulay for productive discussions and comments on earlier versions of this paper.

Endnotes

Introduction

1. Recent studies conducted by the Bank of International Settlements (BIS), amongst others, have raised concerns about this change in the "commodity-dollar nexus" and its probable persistence over the next few years (Hofmann et al., 2023a; Hofmann et al., 2023b; Rees, 2023; Hofmann et al., 2022).

2. We performed the Bai-Perron structural break test which showed the breakpoint as 2016, which is shortly after the US lifted its crude oil export ban. We chose September 2019 as a break date because that is when the US became a net petroleum exporter for the first time since 1973. https://www.eia.gov/todayinenergy/detail.php?id=42176.

3. Please refer to Gopinath et al. (2016) for more details.

Section 1: Drivers of the oil-dollar relationship and the recent change

4. Krugman (1983) notes that if such capital flows are sufficiently large, this could even lead to an appreciation of the oil importer's currency. For example, consider what happened to the euro (EUR) prior to 2010. At that time, oil prices were rising rapidly, the US was a big oil importer, and USD oil revenues to the Middle East were reinvested in Europe. This led to an appreciation of the EUR despite the negative terms-of-trade shock for the euro area.

5. Bodenstein et al. (2011) show, in the context of a dynamic stochastic general equilibrium (DSGE) model, that a positive shock in oil results in exchange rate appreciation.

6. Schulmeister (2000) defines dollar goods and non-dollar goods as follows:
   Dollar Goods: The pricing and trading of almost all standard commodities, including crude oil, are carried out in dollars. Standard commodities can therefore be called "dollar goods."
   Non-Dollar Goods: The prices of manufactures are (mainly) determined by production costs in the countries of their origin and are therefore denominated in the currencies of the respective countries. These goods are referred to as "non-dollar goods."

7. These phenomena are empirically tested in Killian and Zhou (2022) in which the authors build a structural vector autoregressive (SVAR) model consisting of oil demand, oil supply, US real interest rate and USD real exchange rate.

8. "Crude Oil Markets: Effects of the Repeal of the Crude Oil Export Ban." U. S. Government Accountability Office. https://www.gao.gov/products/gao-21-118

9. "U.S. petroleum exports exceed imports in September." U.S. Energy Information Administration. https://www.eia.gov/todayinenergy/detail.php?id=42176

10. "Top 10 Oil Exporting Countries in 2023." Seair Exim Solutions. https://www.seair.co.in/blog/top-10-oil-exporting-countries-in-2023.aspx

Section 2: Factors driving the changing oil-dollar relationship

11. Within the first six months of 2022, coal prices went up by 69 percent, wheat prices went up by 60 percent, natural gas prices went up by 55 percent, and oil prices went up by 43 percent. Commodity price growth due to Russia-Ukraine war 2022 | Statista

12. "Oil and petroleum products explained." U.S. Energy Information Administration. https://www.eia.gov/energyexplained/oil-and-petroleum-products/imports-and-exports.php

13. Hofmann et al. (2023b) find that the relationship between oil prices and ToT, which was negative historically, has flipped since 2018. These authors also show that the relationship between ToT and the dollar is significantly positive.

14. Similar to Rees (2023), we calculate US ToT as the ratio of Export and Import indices deflated using implicit price deflator.

15. Both the dependent and explanatory variables are converted to monthly log differences.

16. According to the World Bank data, fuel exports as a percentage of total merchandise exports in the US have increased from 8 percent in 2015 to 21.4 percent in 2022, while fuel imports as a percentage of total merchandise imports have remained in the range of 8.5 percent to 9.5 percent over the same period.

17. We also performed the same analysis removing top and bottom 5 percent of samples for robustness check. The results are similar.

18. We recognize that the beta between ToT shocks and oil shocks is not 1 and hence the relationship between ToT and oil shocks is not one-to-one. We are, however, more interested in the directionality of the relationship compared to its magnitude.

19. In the event of insignificance of long-run equilibrium relationship, we can comment only on the short-term relationships between the real exchange rate and its explanatory variables. In other words, lack of a substantial evidence to support the long-run structural relationship (ToT channel) suggests that only the temporary factors dominate. An existence of significant long-run and short-run relationship of the explanatory variables with the real exchange rate indicates that both temporary and structural factors are at play.

20. The model also accounts for short-run deviations of REER from the long-run equilibrium by estimating the speed of error correction. δ is the coefficient of the short-term error correction, which shows the speed of reversion of the deviations in the dependent variable on the long-run equilibrium path.

21. We source monthly ToT data from Refinitiv Datastream, monthly USD REER data (narrow) from BIS, daily VIX (VXO prior to 1990) data and monthly inflation data from FRED, nominal interest rates data from BIS. We construct real interest rates by applying a one-side HP filter technique as in Rees (2023).

22. As a robustness check, we also ran the analysis using January 2019 as the break date and found the results to be similar.

23. This model has the following set of test statistics: Bounds test for cointegration, ARCH LM test for heteroscedasticity, Jarque-Bera test for normality and Ramsey RESET test for omitted variable bias. The results are not presented here on account of brevity.

Section 3: Implications of the changing oil-dollar relationship

24. This is part of the reason why central banks generally considered energy-led inflation as transitory.

25. From September 2019 to June 2023, oil prices in terms of INR, ZAR and JPY terms have increased by 47 percent, 59 percent, and 74 percent, respectively, while increasing by 28 percent in USD terms.

26. For example, India established direct rupee trade with 18 nations in 2022. Please refer to Thiagarajan et al. (2023b) for more details.

27. For more details, refer to Thiagarajan et al. (2023b).

Conclusion

28. Economist, "The New Geography of Oil," July 11, 2023

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