

CADET NOTE

Fuel to the Fire: The Relationship Between Oil Prices and Exchange Rates

The price of Brent oil has declined by over 55 per cent since its peak in late June 2014. While this decline would, in the first instance, be expected to have an adverse impact on net oil exporters and a beneficial impact on net oil importers, exchange rate movements could potentially provide a buffer against this shock. As a result, it is worth examining the nature of the relationship between oil prices and exchange rates in more depth. This note investigates the relationship between the price of Brent oil and a selection of bilateral exchange rates against the US dollar over the period 2000 to 2014, and documents a number of key findings:

- *Since 2005, the currencies of major oil **exporters** have been strongly correlated with the oil price.*
- *This strong correlation is not necessarily symmetric for oil **importers**. In part, this asymmetric response could reflect the dominance of the negative relationship between the oil price and the US dollar.*

Introduction

The price of Brent oil has declined by around 55 per cent since its recent peak in June 2014, and fell below US\$50 per barrel for the first time since 2009 in January 2015 (Graph 1). Recent market reports suggest that the decline in oil prices will have a net positive effect on global growth, albeit with a lag.¹ This positive prediction is based on the assumption that at least part of the oil price decline reflects supply-side factors, rather than a negative demand shock.² The latter would be predicted to have more widespread negative impacts. Even if the net effect on global growth is positive, there will clearly be 'winners' and 'losers' at the individual country level, with net oil exporters experiencing a negative terms of trade shock and net oil importers experiencing a positive terms of trade shock. These terms of trade shocks could be expected to be reflected, to varying degrees, in these countries' exchange rates and therefore potentially provide a buffer against the initial shock.

As movements in the oil price can have a marked effect on different countries' economic outlook, it is also expected that movements in the oil price could exhibit a strong relationship

Graph 1
Brent Oil Price



Sources: Bloomberg; RBA

¹ On balance, it has been estimated that a \$20 per barrel price decline will add 0.26 per cent to world GDP after the first year (Societe Generale Cross Asset Research 2014, p. 42), while a 20 per cent oil price spike is projected to cause a 0.5 per cent decline in world GDP (IMF 2014, p. 16).

² It has also been partially attributed to net oil importers having a higher marginal propensity to consume than net oil exporters (World Bank 2015, p. 157).

with exchange rates.³ Indeed, the majority of the research on this topic posits that oil prices can be a determinant of exchange rates, and that this is especially true of countries with a high dependence on oil, and other 'commodity currencies' (currencies of countries dependent on raw material exports).⁴

The positive and negative effects on different economies, and as an extension their currencies, can occur through different relationships. First, movements in the oil price can have a significant effect on the terms of trade. Second, that oil is traded in US dollars may present another relationship between oil prices and exchange rates. Third, oil prices and exchange rates may be linked more generally because oil price moves can be seen as a proxy for global risk sentiment and the outlook for global growth. The strength of these mechanisms may vary across countries, and also over time.

This note will first discuss in more detail these mechanisms, before providing results of a correlation analysis between the oil price and selected exchange rates. It will then posit some explanations for the observed relationships, with the caveat that the oil price is just one of many factors said to exert some influence on exchange rate movements. Finally, the note will conclude and outline some possible extensions.

Mechanisms contributing to the relationship between oil prices and exchange rates

Terms of trade

The primary channel through which the oil price is related to the exchange rate is via the terms of trade (Backus & Cruchini 2000, Amano & van Norden 1998). Oil exports or imports can contribute a large part of some countries' terms of trade, so oil price fluctuations may have important implications for these economies as a whole. For countries that export (import) a significant amount of oil, it is often argued that a rise in the price of oil will have a positive (negative) effect on their terms of trade, which will put upward (downward) pressure on their exchange rate.⁵

For oil-exporting nations, an oil price rise would increase their export earnings (and, to the extent that the government is reliant on revenue generated from oil exporters, a higher government budget balance).⁶ This can result in an improved economic growth outlook, increased foreign demand for the countries' assets and an appreciation of the currency.⁷ There may also be a second-round effect of an oil price shock through an investment channel: if the positive terms of trade shock is expected to persist for some time, it may be expected to improve the outlook for investment and contribute to greater economic growth.

³ A broad range of literature has found empirical evidence to support the theory that oil price movements influence exchange rates. See, for example: Golub 1983; Amano & van Norden 1998; Chaudhuri & Daniel 1998; Benassy-Quere 2007; Chen & Chen 2007; Lizardo & Mollick 2010; and Oriavwote & Eriemo 2012.

⁴ Other studies have posited that there is a bidirectional relationship. Evidence for this theory is mixed.

⁵ There is a lack of literature discussing whether rises or falls in the oil price result in a symmetrical effect on exchange rates. Akram (2004) discusses the asymmetric effects of oil price shocks on the Norwegian krone.

⁶ In oil-exporting countries where oil companies are not state-owned, or where the government is not very reliant on revenue from taxing oil companies, the oil price decline will mainly affect the private sector's income. Where the converse is true, the impact will be primarily on government income.

⁷ Some of the literature explains the appreciation with respect to the fact that oil is denominated in US dollars: as oil is sold in US dollars, there would be an increase in the supply of US dollars relative to the exporter's own currency and so the exporter's currency would be pressured upward (Golub 1983; Chaudhuri & Daniel 1998; Lizardo & Mollick 2010). However, a weaker US dollar may tempt exporters to limit supply (see next section), resulting in a rising oil price and leaving the local currency to remain unchanged.

For oil-importing nations, an oil price rise results in rising import costs, as well as decreasing competitiveness in production for which oil is an input. Moreover, if the government plays a role in subsidising the cost of oil imports, an oil price rise could place pressure on the government's fiscal position. The combination of these factors can, in turn, lead to a depreciation of the currency. If these negative pressures are expected to continue for some time, the outlook for investment may fall, contributing to lower economic growth of the country.

Table 1 shows the top exporting and importing nations, along with Australia for comparison. Through this argument we would expect for freely floating currencies to see, for example, that the Canadian dollar, Norwegian krone and Russian rouble would be positively correlated with the oil price, while the Indian rupee and South Korean won would be relatively negatively correlated.

Table 1 : Export and Import Volume of Crude Oil (2013)*

Exporters		Importers	
Country	World exports (%)	Country	World imports (%)
Saudi Arabia	19.0	United States	18.0
Russia	11.8	China	13.2
U.A.E.	6.8	India	8.8
Iraq	6.0	Japan	8.0
Nigeria	5.5	South Korea	5.7
Kuwait	5.2	Germany	4.3
Canada	5.1	Italy	2.8
Venezuela	4.9	Spain	2.7
Angola	4.2	France	2.6
Mexico	3.2	UK	2.4
Iran	3.1	Netherlands	2.2
Norway	3.0	Thailand	2.0
Australia	0.5	Australia	1.1

Source: OPEC 2014

* Shaded countries have fixed or managed exchange rates, which will not be considered.

Global growth and other commodity prices

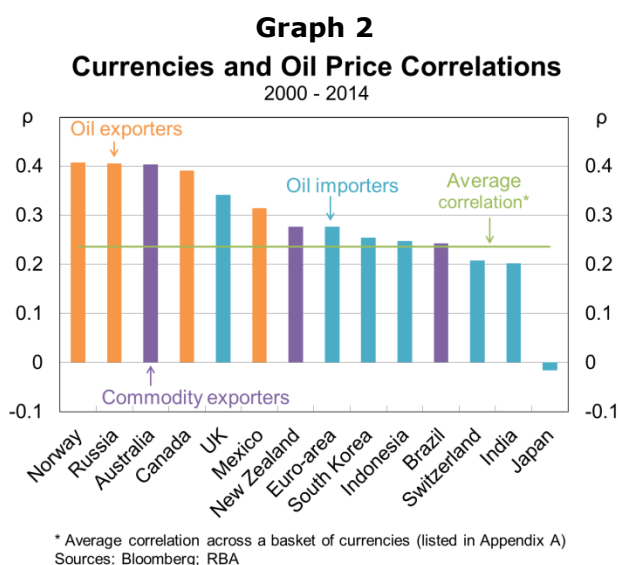
Oil price shocks can be driven by, at different times, supply-side or demand-side factors which will influence how the effect of the shock is distributed across countries. Changes in the oil price which reflect demand shocks may be a sign of changes in the outlook for global growth and can therefore be seen as a barometer for global risk sentiment. For example, a fall in the oil price may be a signal of global growth decline, or interpreted as such, and result in flight away from emerging market or risky currencies towards safe haven assets such as US treasury

securities, Japanese bonds, or the Swiss franc. This may cause an appreciation of these countries' currencies, while more 'growth sensitive' currencies such as the Brazilian real, Indonesian rupiah or Australian dollar may decline.

Analysis and Results

Across countries

To assess the extent of the relationship between the oil price and exchange rates, the average correlation between the monthly returns on oil prices and each bilateral exchange rate against the US dollar was calculated over the period January 2000 to November 2014.⁹ Bilateral exchange rates were quoted against the US dollar such that an increase (decrease) in the exchange rate represents an appreciation (depreciation) of the local currency against the US dollar.¹⁰ Monthly returns on the oil price were calculated using the month-end value of Brent oil, measured in US dollars per barrel (USD/bbl) based on the one-month futures contract.¹¹



While the correlation was calculated for a broad range of currencies (Appendix A), the results for only a selected number are shown (Graph 2). The currencies were selected to represent the world's largest non-OPEC exporters (Russia, Canada, Mexico, Norway), some of the world's largest importers (India, Japan, South Korea, Europe, United Kingdom), and other known commodity exporting economies (Australia, Brazil, New Zealand). The selection also includes Indonesia (known for its fuel subsidy program, recently ended) and the Swiss franc (a known safe haven currency).¹²

⁹ A list of currencies can be found in Appendix A.

¹⁰ Fixed or managed exchange rate regimes (as described by IMF 2013) are excluded from discussion in this note. A consequence of this is that no currencies of OPEC members were investigated. The Russian rouble was however included due to evidence of strong correlation after the currency gradually became more freely floating from 2009.

¹¹ The Brent oil price is used in this note as it is used as the benchmark for over two thirds of the world's oil supplies. Crude oil is not a homogeneous commodity and so varieties will be priced at a premium or discount relative to physical benchmark oils, including Brent and WTI (Dunn & Holloway 2012, p. 68).

¹² While the fact that the Swiss franc was for some time pegged to the euro may make it less relevant, it has been included in this note because the peg has rarely needed to be defended. The rouble was also included due to its high correlation to the oil price after it was gradually allowed to float more from 2009.

The world's largest non-OPEC oil exporters are Russia, Norway, Canada and Mexico. It is unsurprising therefore that the countries' currencies are highly correlated with the oil price. Mexico's correlation may be lower due to fact that oil exports account for a lesser share of the country's GDP compared to the other oil exporters. Contrary to expectations, all importers except Japan also have a positive correlation between their currencies and the oil price. That the correlation for the United Kingdom is relatively strongly positive may be due to the fact that the United Kingdom is also a significant oil producer, although not net-exporter.

To abstract from the common US dollar influence, focus can instead be shifted to the individual countries' correlations relative to the average, rather than the level of correlation in absolute terms. As can be seen in Graph 2, the average correlation across all currencies in the period 2000-2014 was 0.24. Therefore, the Norwegian krone, Russian rouble, Australian and Canadian dollars, and Japanese yen are furthest from the average correlation; the United Kingdom and Mexico are also moderately closer to the average, though still of note. This suggests that these currencies are relatively more influenced by the oil price than others.

Over time

Average correlations were then calculated for three five-year blocks: 2000-2004, 2005-2009, and 2010-2014 (Table 2). The correlation coefficients were negligible for most currencies in the first period, even for the large oil exporters. While the correlation increased over time for most currencies, it remained relatively weak for Japan, India and Indonesia. The fact that the correlation for most countries increases notably from period one to period three, with the significant increases in period two, suggests that the way in which oil prices interact with exchange rates differed between these periods in some way.¹⁴ The next section of the note will address this.

Table 2 : Correlation with the Oil Price

Country	Correlation over period		
	2000-04	2005-09	2010-14
Australia	0.07	0.58	0.56
Brazil	-0.11	0.53	0.49
Canada	0.02	0.51	0.64
Euro-zone	-0.05	0.41	0.43
India	-0.18	0.36	0.29
Indonesia	0.16	0.36	0.26
Japan	0.09	-0.19	0.06
Mexico	-0.20	0.55	0.54
New Zealand	-0.03	0.43	0.43
Norway	0.00	0.61	0.67
Russia	-0.07	0.44	0.73
South Korea	0.00	0.27	0.59
Switzerland	-0.06	0.25	0.51
United Kingdom	-0.13	0.66	0.47

Given that Europe, India, Indonesia, Japan, South Korea, Switzerland and the United Kingdom are significant net oil importers, it was expected that their currencies would show a negative correlation with the oil price. However, these currencies experience positive correlations in most periods. Although some currencies experience moments of both positive and negative correlation, the moments of negative correlation were less common than the moments of positive correlation, and generally smaller in absolute magnitude. The note has already discussed that the US dollar correlation is one potential reason for this. Of note, the relationship between the yen and the oil price is complicated by the yen's status as a highly-traded speculative currency.

¹⁴ When the correlations were calculated using an alternative sample period (2003-2007), it appears that many of the correlations in period two (2005-2009) were inflated due to the effects of the GFC.

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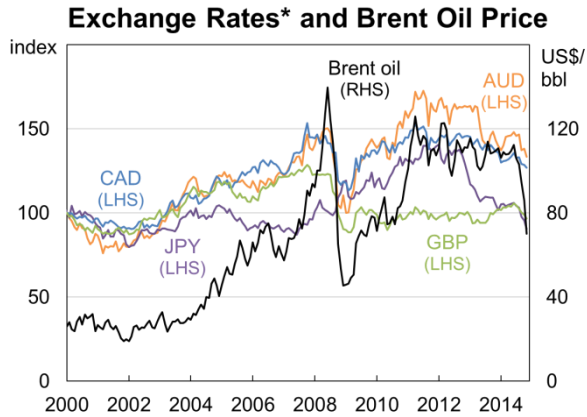
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Appendix A: List of Currencies Evaluated

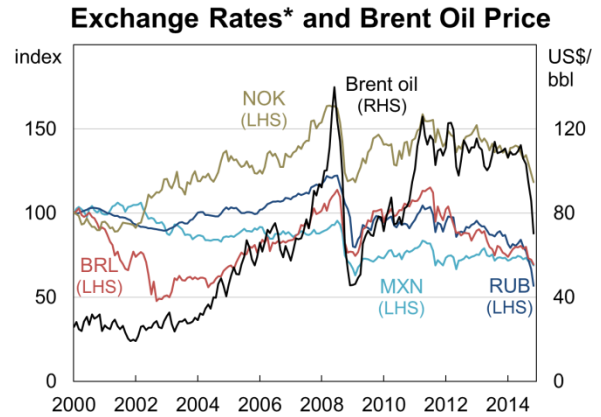
Currency	Quote	Currency	Quote	Currency	Quote
Algerian dinar	USD/DZD	Indonesia rupiah	USD/IDR	Romanian leu	USD/RON
Australian dollar	AUD/USD	Israeli shekel	USD/ILS	Russian rouble	USD/RUB
Brazilian real	USD/BRL	Japanese yen	USD/JPY	Serbian dinar	USD/RSD
Canadian dollar	USD/CAD	Mexican peso	USD/MXN	South African rand	USD/ZAR
Chilean peso	USD/CHP	New Taiwan dollar	USD/TWD	South Korean won	USD/KRW
Colombian peso	USD/COP	New Zealand dollar	NZD/USD	Sri Lankan rupee	USD/LKR
Euro	DEM/USD EUR/USD	Norwegian krone	USD/NOK	Swedish krona	USD/SEK
Great British pound sterling	GBP/USD	Pakistani rupee	USD/PKR	Swiss franc	USD/CHF
Hungarian forint	USD/HUF	Peruvian new sol	USD/PEN	Thai baht	USD/THB
Icelandic krona	USD/ISK	Philippine peso	USD/PHP	Turkish lira	USD/TRY
Indian rupee	USD/INR	Polish zloty	USD/PLN	Uruguayan peso	USD/UYU

Appendix B: Exchange Rates and the Brent Oil Price, and the Correlation

Exchange Rates and the Brent Oil Price

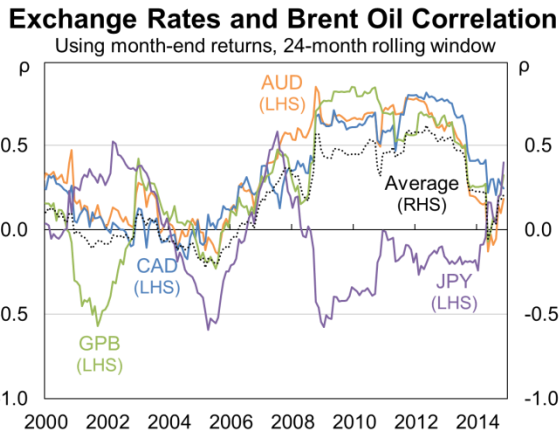


* US dollar per currency; January 2000 = 100
Sources: Bloomberg; RBA

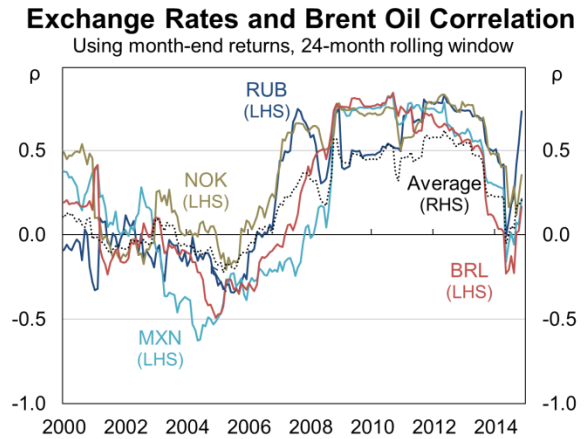


* US dollar per currency; January 2000 = 100
Sources: Bloomberg; RBA

Correlation between the Exchange Rates and the Brent Oil Price



Sources: Bloomberg; RBA



Sources: Bloomberg; RBA