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Cointegration test of oil price and us dollar exchange rates for some oil dependent economies

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ABSTRACT

This study examines the long-run dynamics between oil price and the bilateral US dollar exchange rates for a group of oil-dependent economies before and after the 2008–2009 Global Financial Crises. Exchange rates are for the euro, Indian rupee, Russian ruble, South African rand, Ghanaian cedi and the Nigerian naira. The dependence on crude oil of these economies is either because fiscal revenues are primarily reliant on oil export receipts or because industrial production is heavily dependent on petroleum. Empirical results show evidence of a long run equilibrium relationship between oil price and exchange rate, especially for currencies of the key oil-exporting countries. This relationship is more evident in the post crisis period, which is also the period when both exchange rate volatility and the inverse relationship between oil price and exchange rate experienced a significant increase.

1. Introduction

The inverse relationship between oil prices and the dollar exchange rates have received renewed attention, especially since the 2007–2008 Global Financial Crisis. Studies that investigate the persistence of this relationship include [Kisswani \(2016\)](#), [Novotny \(2012\)](#), and [Habib and Kalamova \(2007\)](#). Since the end of the Great Recession in 2010, the price of West Texas Intermediate (WTI), the North American crude oil benchmark, declined steadily, dipping to a low of \$28 per barrel in February 2016. Earlier in July 2008, it traded at more than \$142 per barrel. Over the same period, the US dollar rose sharply against most floating currencies including the euro, Ghanaian cedi, Indian rupee, Nigerian naira, South African rand, and Russian ruble. These are the six currencies utilized in this study.

In seeking to determine the existence and nature of a secular relationship between oil prices and exchange rates, this study utilizes the bilateral exchange rates between the US dollar and a specific currency. This approach is in contrast to the use of a currency index which tends to neutralize the idiosyncratic characteristics of a specific currency; one of which characteristics may be the level of economic development or the nature of dependence on petroleum of the specific county. Studies such as [Kaplan and Aktas \(2016\)](#) and [Beckmann et al. \(2016\)](#) present anecdotal evidence suggesting that the oil-currency inverse relationship appears to be more evident for oil-dependent economies than for countries with a strong diversified economy. Examining the existence of cointegration between oil prices and the dollar exchange rates for each of the named currencies should therefore reveal the degree of dependence of these economies on petroleum export or its consumption.

Outside of the United States and China, the European Union (EU) and India are two of the world's largest consumers of crude oil. But unlike the EU, India is a developing economy with a gross domestic product (GDP) per capita that is only one sixth of that of the

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European Union. Two other currencies whose dollar exchange rates are examined in this study are the Russian ruble and the Nigerian naira. Russia is known to have one of the largest crude oil reserves in the world with an estimated daily output of 11 million barrels. Nigeria is a member of the Organization of Petroleum Exporting Countries (OPEC) and is the world's 10th largest producer of crude oil, with an average daily production of 2.5 million barrels. Unlike Russia, a non-OPEC country, Nigeria's economy is significantly underdeveloped. However, similar to Russia, it relies on oil exports for a significant portion of its foreign exchange receipts and public finance. In recent years, Nigeria's petroleum has accounted for as much as 90% of its export earnings and about 75 percent of budgetary revenues.¹ The currencies of Ghana and South Africa are also included in the study because like Nigeria, these two Sub-Saharan African countries are resource rich. But unlike Nigeria, they are net importers of crude oil. For this reason, it is plausible to expect a different measure of relationship between oil price and the valuation of these currencies.

The immediate question examined in this study is whether oil prices are cointegrated with each of the currencies named in this study in both sample periods. The study seeks to unravel the answers to the stated question utilizing weekly data between 2000 and 2016. Based on our findings, reasoning, appropriate and universally accepted scientific approach, we hope to unravel the characteristic of the oil price-exchange rate relationship and to provide an intuitive explanation for it.

The paper is organised as follows. Literature review of related research is presented in the next section. In the data and methodology section we provide the source of the data and the techniques adopted in our analysis. The section IV presents and discusses the results. The last section concludes the work.

2. Literature review

In recent years, the relationship between exchange rates and various economic variables have been given much attention in the academic literature. These studies attempt to determine how currency valuation affects economic variables such as output, inflation, and international tourism flows (Obi et al., 2016). Dornbusch (1985) examined the relationship between exchange rate and the prices of commodity such as gold, cocoa, crude oil, and a number of other international assets. Exchange rate has also been associated with economic activities. For example, Kamin and Rogers (2000) showed that currency devaluations are associated nearly exclusively with economic contractions while real appreciations are followed by expansions.

In a free-floating currency regime, exchange rate is the price at which one currency is traded for another. In a fixed exchange rate system, as is the case for the six countries in the Gulf Cooperation Council (GCC), the government sets the exchange rate and then buys and sells the domestic currency in the foreign exchange market to maintain the peg. But in most other economies, demand and supply forces are allowed to determine the value of the currency.

Many economies, both developing and developed economies, depend on oil for a variety of needs. Most economies use oil in the production of many goods and services. Economies that are net oil exporters are able to generate revenue from the exportation of petroleum. For these economies, fluctuations in the denominating currency affect both their export earnings even with stable supplies. For oil importers, the cost of production rises and falls with exchange rate volatility. In its broad industrial applications, crude oil plays a significant role in the production of many goods and services. And although there are other energy sources, fossil fuel remains the most widely used, in large part, due to its abundance and low cost.

The U.S. dollar remains the most widely used international currency. It plays a key role in the valuation of crude oil and various other commodities (Linda, 2010). Crude oil trading invoices in international market are mostly expressed in dollars and as a result, fluctuations in the dollar exchange rate affect the price of oil (Coudert et al., 2007). A number of studies have highlighted how changes in oil price affect macroeconomic variables such as GDP growth, unemployment rates, inflation, and the stock values. These studies include Brown and Yücel (2002, 2010) Brown and Yücel (2002, 2010), Blanchard and Gali (2007), Bjørnland (2008), Wang et al. (2013), and Basher et al. (2012).

When the US dollar depreciates, the propensity for net importers of crude oil to increase their oil imports rises. The reason is because oil is viewed to be less expensive in terms of the domestic currency by consumers in oil importing countries with a floating exchange rate system. This has the possibility of increasing global oil demand and contributes to the buildup of current account surplus for the consuming countries (Brown and Phillips, 1984; Huntington, 1986; Coudert et al., 2007). Golub (1983) found that oil prices affect a number of macroeconomic flows such as income and savings.

Net exporters of oil are affected in specific ways when the dollar depreciates. For example, the exporters whose currencies are pegged to the US dollar may suffer a loss in oil revenues as the dollar depreciates (Coudert et al., 2008). Austvik (1987) argued that since oil prices are expressed in US dollars, a drop in the value of the dollar could influence the demand for crude oil. When oil price increases on account of increased demand, the oil exporting country gains. For the same supply level, the oil exporter also gains if the value of the dollar rises. The oil exporter suffers declining incomes when oil price falls. Bloomberg and Harris (1995) showed the reverse to be true for the oil importing countries.

The impact of the dollar exchange rate on oil price may be in the short run or long run. Benhabib et al. (2014) investigated if oil price has a long run cointegration with the nominal USD exchange rate for the Algerian dinar. The study found that a 1% increase in oil price would lead the Algerian Dinar to depreciate by 0.35 percent against the US Dollar. Zhang et al. (2008) found a significant long-run equilibrium relationship between the two variables.

While some evidence of cointegration has been identified between oil prices and exchange rates, evidence is inconclusive on the direction of causality between the two. For example, Habib and Kalamova (2007), Bénassy-Quéré and Coupet (2005), and Chaudhuri

¹ The World Bank, Nigeria Overview, www.worldbank.org/en/country/nigeria/overview (retrieved on June 15, 2016)

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