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What determines the long-term correlation between oil prices and exchange rates?

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ABSTRACT

In this study, we obtain the long-term correlation between oil prices and exchange rates by employing the dynamic conditional correlation-mixed data sampling (DCC-MIDAS) model. We then identify the factors that influence the long-term correlation using panel data analysis. We find that the long-run correlations between oil prices and exchange rates are negative for all oil-exchange rate markets except Japan. We also find that both inflation and term spread have negative effects, while the risk-free interest rate has a positive effect on the long-term correlation between oil prices and exchange rates. Importantly, the empirical results show that an increase in inflation will significantly damage the real value of the currency itself.

1. Introduction

Oil is one of the most important commodities in the world. It is widely accepted that oil is not only an energy product, but also a financial asset. Thus, it is essential to understand how oil prices are related to economic conditions and financial markets, and how they can also affect the world economy. Over the last few decades, researchers have found oil price dynamics to be responsible for economic recessions, inflation, trade imbalances, and low equity values. At the same time, oil price changes have been considered a key factor in the exchange rate fluctuations experienced by oil importers and exporters. This has driven many researchers to investigate the relationship between oil prices and exchange rates (Akram, 2009; Basher, Haug, & Sadorsky, 2016; Ding & Vo, 2012; Reboredo, 2012; Tiwari, Mutascu, & Albulescu, 2013).

Theoretically, the link between the two is well established by the early studies of Golub (1983) and Krugman (1983). According to these authors, while an increase in oil prices first causes a country's currency to appreciate, it decreases the real value of the currency in the long term. Generally, oil prices influence exchange rates through two channels: supply and demand. On the supply side, oil is the basic input in industrial production, and consequently, an increase in oil prices raises the cost of production. This leads to a reduction in demand for non-tradable goods, which drives down their prices. Consequently, the real exchange rate depreciates. The reasoning is similar for the demand channel. Relevant empirical studies in this line include Chen and Chen (2007), Cologni and Manera (2014) and Lizardo and Mollick (2010).

However, these studies primarily focus on the dependence between oil prices and exchange rates at the same frequency, such as daily or monthly, ignoring the distinction between short- and long-term co-movements between the two assets. In this study, we use a novel mixed data sampling (MIDAS) approach to investigate the long-term correlation between oil prices and USD exchange rates in

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the major international foreign markets; the JPY, GBP, CAD, and EUR. More specifically, we research the long-term correlation of oil prices–exchange rates by linking it with the monthly smooth component and employing the dynamic conditional correlation-MIDAS (DCC-MIDAS) model (Colacito, Engle, & Ghysels, 2011). This model is a combination of the DCC model (Engle, 2002) and the generalized autoregressive conditional heteroskedasticity-MIDAS (GARCH-MIDAS) specification (Engle, Ghysels, & Sohn, 2006). The GARCH-MIDAS model consists of short- and long-term components, which measure the long-run volatility by realizing volatility over a monthly horizon, while the DCC-MIDAS model replaces the unconditional correlation with a slow dynamic long-term component as a weighted sum of the lagged monthly realized correlations between the volatility-adjusted residuals.

Moreover, the literature generally concentrates on the oil prices–exchange rates relationship after excluding macroeconomic factors from the analysis. In fact, the link between oil prices and exchange rates is influenced by domestic variables—macroeconomic variables, financial factors, and US variables such as the US stock market—as they refer to the channels through which oil shocks may be transmitted to exchange rates. This has important implications for both the real economy and financial markets. Hamilton (1983) provides evidence of a significantly negative relationship between oil prices and output. Since then, research in this area has extended to other macroeconomic variables, such as GDP and inflation (Bachmeier & Cha, 2011; Bachmeier, Qi, & Liu, 2008), the financial asset interest rate, credit risk, and holding periods, etc. (Alsakka & Gwilym, 2012; Engel, 2014; Joseph, Lambertides, & Savva, 2015). In addition to these domestic economic and financial variables, we also consider US factors in our study because both crude oil prices and exchange rates of the four countries are based on US dollars.

In the first part of this study, we consider daily frequency data to capture the long-term component in dynamic conditional correlations between oil prices and exchange rates. In the second part of the study, we employ panel analysis to identify the domestic macroeconomic and financial factors and US factors that can affect the long-term correlation between oil prices and exchange rates. While there are many studies on the endogeneity of monthly or quarterly oil prices with respect to macroeconomic conditions (Eika & Magnussen, 2000; Kilian, 2008, 2009; Tiwari, 2012), we contribute to the literature by providing new evidence regarding the domestic macroeconomic variables and financial factors, and US factors that comprise the channel that affects the long-term correlation between oil prices and exchange rates.

The remainder of this paper is organized as follows. In Section 2, we review the previous literature on the topic. In Section 3, we introduce the methodology used in the study. Section 4 presents the data analysis and empirical results. Section 5 provides the policy implications and concludes this paper.

2. Literature review

In this section, we discuss the relevant literature on the relationship between oil prices and exchange rates. We refer to two categories of studies in this regard. The first category studies trade balances by referring to the law of one price. According to Amano and Van Norden (1998, 2010), domestic currency experiences a real appreciation in the case of an increase in oil prices if the non-tradable sector is more dependent on oil than the tradable sector. Chen and Chen (2007) provide additional evidence that real oil prices may be the dominant source of real exchange rate movements. Though this kind of transmission does not directly affect the nominal exchange rate, the resulting impact on inflation may have long-run implications for the nominal exchange rate path according to purchasing power parity. Moreover, many studies also investigate the causalities between US dollar exchange rates and oil prices (Beckmann & Czudaj, 2013a; Chen, Calrson, Genio, & Bosilovich, 2008). Beckmann and Czudaj (2013b) document that depreciation of the dollar triggers an increase in oil prices. Therefore, it is reasonable to assume a long-term relationship between nominal oil prices and nominal exchange rates (Atems, Kapper, & Lamc, 2015; Basher, Haug, & Sadorsky, 2012; Beckmann & Czudaj, 2013b; Brahmasrene, Huang, & Sissoko, 2014; Ferraro, Rogoff, & Rossi, 2015). For example, Beckmann and Czudaj (2013b) provide evidence about the causality relationship between oil prices and exchange rates in both short-term and long-term dynamics by treating oil-importing and oil-exporting countries differently. Specifically, they find nonlinearities in the relationship between exchange rates and oil prices are an important issue to consider when doing research. All these studies thus provide evidence of a strong relationship between oil prices and nominal exchange rates.

The second category deals with the study of dependence or co-movements between oil prices and exchange rates by considering oil and currency as separate financial assets. Such studies are useful in obtaining effective portfolio allocations. Generally speaking, this issue can be studied using one of two approaches. The first approach is based on the multivariate GARCH model. Though the empirical results are derived from different model types, they show that the conditional correlation between oil price and exchange rates is negative (Cifarelli & Paladino, 2010; Ding & Vo, 2012; Reboredo, Rivera-Castro, & Zebende, 2014; Turhan, Sensoy, & Hacihasanoglu, 2014; Turhan, Sensoy, Ozturk, & Hacihasanoglu, 2014). The other approach focuses on the dependence structure by employing nonlinear dependence models such as copula- or wavelet-based models. Such studies explore the dependence structure between oil prices and the USD exchange rates (Aloui & Aïssa, 2016; Aloui, Aïssa, & Nguyen, 2013; Beckmann, Berger, & Czudaj, 2016; Reboredo & Rivera-Castro, 2013; Wu, Chung, & Chang, 2012). For example, consistent with the previous literature, Wu et al. (2012) find an increase in oil prices accompanies depreciation of the USD. In addition, using the copula-GARCH approach, Aloui et al. (2013) find significant and symmetric dependence for almost all oil price-exchange rate pairs, except that of JPY and West Texas Intermediate (WTI) crude oil prices.

In contrast to these previous studies, we employ the DCC-MIDAS model to explore the long-term correlation between oil prices and exchange rates by linking them with a monthly smooth component. Moreover, we investigate the effects of both macroeconomic and financial factors on the long-term dynamic conditional correlations between oil prices and exchange rates. Therefore, our contribution to the literature is threefold. First, we distinguish the long-term component in the volatility of both oil prices and exchange rates, using short-term volatility based on the GARCH-MIDAS model. Second, employing the DCC-MIDAS model, we