ARTICLE IN PRESS
GLOFIN-00361; No of Pages 13
Global Finance Journal xxx (2016) xxx–xxx

Contents lists available at ScienceDirect

Global Finance Journal

journal homepage: www.elsevier.com/locate/gfj

Oil price shocks and exchange rate movements☆

Nikanor I. Volkov [a,*], Ky-hyang Yuhn [b]

[a] Stetson School of Business and Economics, Mercer University, United States
[b] Department of Economics, College of Business, Florida Atlantic University, United States

ARTICLE INFO

Available online xxxx

JEL classification:
F-31

Keywords:
Exchange rates
Oil prices
Conditional exchange rate volatility

ABSTRACT

This study investigates the effects of oil price shocks on exchange rate movements in five major oil-exporting countries: Russia, Brazil, Mexico, Canada, and Norway. The R^2 of the fundamental model doubles in Russia and Brazil, but increases slightly in Canada and Norway when oil prices are added to it. The volatility of exchange rates associated with oil price shocks is significant in Russia, Brazil, and Mexico, but weak in Norway and Canada. It takes much longer for the exchange rate to reach the initial equilibrium level in Russia, Brazil, and Mexico than in Norway and Canada. The asymmetric behavior of exchange rate volatility among countries seems to be related to the efficiency of financial markets rather than to the importance of oil revenues in the economy.

1. Introduction

The recent dramatic decrease in the prices of oil and the subsequent reduction in the value of the currencies of several oil-exporting countries have once again revived an interest in the interdependence between major commodity prices and exchange rates. The nearly 50% drop in the oil prices that occurred between June and December of 2014 was accompanied by a reduction in the value of the Russian ruble almost by half[1]; the Brazilian real lost about 20% of its value; the Mexican peso was trimmed over 15%. Oil exports are an important source of the government revenues of these countries, and the drop in the prices of oil puts a pressure on the countries' budgets, thus increasing the uncertainty about the ability of the countries to meet their spending obligations (see for example the December 26th, 2014 issue of the Wall Street Journal).

Oil prices can affect exchange rates through multiple channels. First, oil price fluctuations affect domestic economic activity such as GDP, inflation, and interest rates for both oil-exporting and oil-importing countries. Any change in market fundamentals amplifies the volatility of exchange rates. Second, the large portion of the international transactions of crude oil is denominated in U.S. dollars. Thus, oil price changes induce the inflow (or outflow) of oil dollars, which will directly affect the exchange rate of an oil-exporting or oil-importing country with the U.S. dollar. Oil prices are also heavily affected by the behavior of speculators (see Kaufmann & Ullman, 2009). Oil prices could be much more volatile than the prices of assets such as equities and bonds. International oil prices rose from $42 per barrel in early 2005 to $147 per barrel in July 2008, and many experts blamed such oil price

☆ We would like to thank Manuchehr Shahrokhi, the editor of the journal, and the anonymous referee for their comments which helped to improve the paper. We are also grateful to Jeff Madura, Marek Marciniak and the participants of the 2013 Southern and the 2013 Midwestern Finance Association Meetings for their valuable comments and suggestions on the earlier versions of the paper. Any remaining errors are the responsibility of the authors.

* Corresponding author at: 3001 Mercer University Dr., Atlanta, GA 30341, United States.
E-mail address: volkov_ni@mercer.edu (N.I. Volkov).

[1] Note that the period is also associated with the sanctions that were placed on Russia by the United States and the European Union. It is likely that the drop in the value of the ruble is at least in part attributed to the geopolitical landscape.

http://dx.doi.org/10.1016/j.gfj.2016.11.001
1044-0283/© 2016 Published by Elsevier Inc.

hikes on international speculations in crude oil. This kind of speculative behavior inevitably brings about wide fluctuations in exchange rates.

Several studies, including Aloui, Ben Aissa, and Nguyen (2013) and Chen, Choudhry, and Wu (2013) have discovered extreme co-movements between crude oil prices and dollar exchange rates on the basis of copula-distributional families. A close relationship between crude oil prices and dollar exchange rates makes it realistic to assume that the exchange rate depends on conditional volatility represented by the conditionally heteroskedastic variance.

To investigate the relation between oil price shocks and exchange rate movements, we focus on the monthly bilateral exchange rate between the U.S. dollar and the currencies of major oil-exporting countries that operate under a floating exchange rate system for the period of September 1998 to August 2012: Russia, Brazil, Mexico, Canada, and Norway. Out of 18 major oil-producing countries, only these five countries operate under a market-determined exchange rate system. On average, the proportion of oil revenues as a percentage of GDP in these countries is sizable. The ratio is 25.8% in Norway, 11.6% in Russia, 6.2% in Canada, 5.3% in Mexico, and 4.6% in Brazil. Thus, it is highly likely that the prices of oil play a crucial role in these economies, and their exchange rates. Furthermore, we observe that higher oil prices tend to appreciate the currency of an oil-exporting country, and lower oil prices tend to depreciate the currency, suggesting that exchange rate volatility may be asymmetric between increases and decreases in oil prices.

As a main analytical tool, we utilize a GARCH-M framework in which the mean equation includes the oil prices together with other fundamental determinants of exchange rates as explanatory variables, and the variance equation includes the oil prices. This framework used by Nam and Yuhn (2001) allows one to investigate the volatility of exchange rates conditional on the direction of oil price changes. Additionally, we use the VECM framework, utilizing the Toda and Yamamoto (1995) methodology to test for the causality between the exchange rates and the prices of oil.

Our main results are as follows: The behavior of exchange rates differs between advanced markets (Canada and Norway) and emerging markets (Russia, Brazil, and Mexico) in a model where oil prices are incorporated as an explanatory variable. The volatility of exchange rate (measured by the variance of exchange rates) associated with an oil price shock is significant in Russia, Brazil, and Mexico, but weak in Norway and Canada. Furthermore, it takes much longer for the exchange rate of Russia, Brazil, and Mexico to reach the initial equilibrium level following a shock to the oil prices than for the exchange rate of Norway and Canada.

The paper is organized as follows: Section 2 briefly reviews the related literature, Section 3 discusses the methodology employed. Section 4 presents the empirical results and their implications. Section 5 provides concluding remarks.

2. Literature review

The theories of exchange rate determination state that the equilibrium exchange rate is determined by fundamental macroeconomic variables such as the money supply, inflation, output, and interest rates. It is widely maintained, however, that empirical models based on market fundamentals have limited success in explaining exchange rate movements (see Cheung, Chinn, & Pascual, 2005; Meese & Rogoff, 1983). The main argument associated with this skeptical view is that since floating exchange rates between countries follow a random walk, fundamental variables do not help predict future changes in exchange rates (see Engel & West, 2005).

However, several studies have found that market-fundamental models with commodity prices added perform better. For instance, Golub (1983) develops a stock/flow model of the effect of oil price increases on exchange rates. The model focuses on the wealth transfer effects, which results from oil price increases, and on the implications of these wealth transfers for a portfolio equilibrium. Lizardo and Mollick (2010) add oil prices to the basic monetary model of exchange rate determination proposed by Rapach and Wohar (2002). They find that oil prices significantly explain movements in the value of the U.S. dollar against major currencies from 1970 to 2008. They report that an increase in real oil prices leads to a significant depreciation of the U.S. dollar in the developed net oil-producing countries.

The existing literature mainly focuses on examining the stationarity properties of commodity prices and exchange rates between major currencies. Amano and Van Norden (1998a, 1998b) find that the price of oil and the real effective U.S. exchange rate are cointegrated and that the price of oil Granger-causes the exchange rate, but not vice versa. Likewise, Chaudhuri and Daniel (1998) examine the effect of oil price movements on the nonstationary behavior of monthly real U.S. dollar producer price exchange rates with 16 OECD countries during the post-Bretton Woods period. They find that most of the real exchange rates and real oil prices are cointegrated and show that the direction of causality runs from real oil prices to real exchange rates. They also observe that the behavior of oil prices appears to be responsible for the nonstationary behavior of U.S. dollar real exchange rates during the sample period. Chen and Chen (2007) examine a sample of G7 countries for the period of 1972–2005 and use panel data techniques to test for cointegration of real exchange rates and oil prices. Using the Pedroni (2004) test, they find that there is a long-run equilibrium relationship between real oil prices and real exchange rates.

Several studies have recently argued that the relationship between the U.S. dollar and the price of oil is non-linear. A number of studies use vector autoregressive (VAR), vector error correction (VEC), and ARCH-family models to study the dynamic relationship between commodity prices and U.S. dollar exchange rates (Aloui et al., 2013; Amano & Van Norden, 1998a, 1998b; Basher, Haug, & Sadorsky, 2012; Golub, 1983; Wu, Chung, & Chang, 2012). These studies report conflicting results. Amano and Van Norden (1998a, 1998b) and Basher et al. (2012) show that the oil prices and the exchange rates exhibit a positive long-run equilibrium relationship, i.e., an increase (decrease) in the oil price is associated with the U.S. dollar appreciation (depreciation). Other studies, such as Akram (2009) and Lizardo and Mollick (2010), show a negative relationship between the price of oil and the U.S.

Please cite this article as: Volkov, N.I., & Yuhn, K., Oil price shocks and exchange rate movements, *Global Finance Journal* (2016), http://dx.doi.org/10.1016/j.gfj.2016.11.001