



# Crude oil price behaviour before and after military conflicts and geopolitical events



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## ABSTRACT

Crude oil price behaviour depends on all the events that have the potential to disrupt the flow of oil. We understand that these causes could be geopolitical issues and/or military conflicts in/with the producer countries and a problem relating to demand and supply. In the paper we first investigate the statistical properties of the real oil prices as well as its log-transformation, along with the absolute and squared returns values. Then, we also address the following issue: Does the crude oil price behave in the same way before and after a military conflict or geopolitical problem in the producer countries? To answer this question we analyse the real oil prices of West Texas Intermediate (WTI) before and after the different military conflicts and political events that occurred after World War II. For this purpose we use techniques based on unit roots and fractional integration. The empirical results provide evidence of persistence and breaks in the oil prices series and stationary long memory in the absolute returns. However, we do not observe significant differences before and after the conflict and geopolitical events.

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## 1. Introduction

According to U.S. Energy Information Administration (EIA), much of the world's crude oil is located in regions that have been prone historically to political upheaval or have had their oil production disrupted due to political events. Since the Second World War there have been several military conflicts around the world that have been associated with significant changes in the price of oil. According to [54] and [65]; the seven most important conflicts have been the Suez Crisis of 1956–1957, the oil embargo implemented by Arab members of OPEC, the Iranian revolution in 1978,<sup>1</sup> the Iran-Iraq War initiated in 1980, the first Persian Gulf War in 1990–1991, the Second Persian Gulf War and strikes in Venezuela, and the Libyan Revolution in 2011.

Each conflict analysed in this paper, has the peculiarity of having occurred in an oil producing country. This has clearly negatively affected the production of this commodity in the daily flow of oil. During the last decade, many researchers have questioned the long-held beliefs about the causes and consequences of oil price behaviour and the oil price shocks. According to [65]; traditionally, the real oil price was to be determined primarily by political events in the Middle East that were outside of the confines of macroeconomic models and could simply be taken as given when conducting policy analysis. Nowadays, there is no consensus on whether oil price changes are due to fundamental shifts in supply and demand or speculation [101]. For example, the prominent study by Ref. [61] using Granger causality between spot and forward oil prices found that the rise in crude oil prices through March 2008 was driven in part by market fundamentals which support the arguments for the importance of demand growth in developing economies.<sup>2</sup>

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<sup>1</sup> The Iran Revolution and the Iran and Iraq War have been considered as the same conflict [54], considers the two events as two separate shocks, while others as a single prolonged episode, with the real price of oil doubling between 1978 and 1981.

<sup>2</sup> For example [36], considers some forward oil markets are dominated by physical traders rather than financial players suggesting that the dichotomy between spot- and futures markets as a tool to identify the role of financial speculation versus the role of fundamentals is not well founded.

Alternatively [53], studies the causes and consequences of the oil shock of 2007–08 obtaining that speculation played some role in the price increase in the summer of 2008.<sup>3</sup>

Kilian [65] argues that in the past, it was thought that the oil price shocks caused recessions for reasons unrelated to the state of the economy, but we are now aware that they were merely symptoms of a booming world economy. This was evident after 2005. Economists for many years have tended to confound the recessionary effects of oil price shocks with other causes of those earlier recessions (e.g. those in the 70s and 80s). Unexpected oil price increases sometimes may be associated with strong recessionary effects, but also, many of them can coexist with strong domestic economic growth at other times. Alluding to the issue of military conflicts [50,54], argued that oil price increases are responsible for almost every post-war recession, except 1960.

This paper also relates with the literature that analyses asymmetric responses of macroeconomic variable to oil price shocks [21,24,51,52,75,78]. Previous papers found that oil price increases tend to generate recessions while oil prices decreases do not stimulate real economic activity. In order to test the asymmetric dynamics of oil prices [75] and [51,52] propose alternative oil price specifications such as “oil price increases” and “net oil price increases” respectively.

In this paper we examine the time series properties of real oil prices (i.e., log of oil prices and squared and absolute returns) before and after six military conflicts and political events that occurred after World War II. The contributions of the paper are twofold. First, to our knowledge this is the first paper that instead of using long span oil price data (see, for example [87], proposes to study time series properties before and after over six military conflicts and political events using monthly data. As we mentioned before, the six selected military conflicts have been previously identified by Refs. [54] and [65]. Second, in this paper we use some recently developed methods based on the concepts of long run dependence and long memory using fractional integration techniques [44], including structural breaks [43] and non-linearities [23]. These techniques are relevant because depending on the order of integration of the series we can determine if the effect of the shocks is going to be transitory or permanent, and this is crucial when implementing policy measures.

The results obtained can be summarized as follows: performing standard unit root methods (ADF, PP and ERS) on the original and log-transformed oil prices series the results indicate non-stationarity I(1) while stationarity I(0) for the first differences. However, extending this approach to the fractional case, the order of integration of the WTI series was found to be fractional and significantly below 1 meaning that the series is mean reverting with the shocks disappearing by themselves in the long run. Moreover, allowing for structural breaks, still in the context of fractional integration, two significant breaks were detected, one at October 1973 and the other one at October 1980. The results on the volatility (measured in terms of the absolute and squared returns) indicate evidence of stationarity and long memory in case of the absolute returns. We also observe several outliers, corresponding to different episodes of violence, and removing these outliers, the same results were obtained in terms of the estimates of  $d$ . Finally, in the second part of the empirical work, we focus on the subsamples according to the different conflicts, examining if there is a different degree of integration before and after the breaks. Our results indicate that there is no any systematic pattern before and after the conflicts.

The rest of the paper is structured as follows. Section 2 reviews the behaviour of crude oil prices from the point of view of flow supply shocks. Section 3 focuses on the behaviour of the crude oil prices from a demand shocks viewpoint. Section 4 reviews the literature on modelling oil prices. Section 5 presents the methodology applied in the paper. In Section 6 we discuss the empirical results, and Section 7 concludes.

## 2. Crude oil price behaviour from a flow supply shocks viewpoint

Hamilton [54] and Kilian [65] identified different military conflicts and political events that could directly affect the oil prices due to flow supply disruption. Such political events were the 1973 Yom Kippur War followed by the Arab oil embargo in 1973/74, the Iranian Revolution of 1978/79, the Iran-Iraq War of 1980–1988, the Persian Gulf War of 1990/91, the Venezuelan crisis of 2002 and the Iraq War of 2003, and the Libyan uprising of 2011.

Fig. 1 shows the comparison between the real crude oil price and the U.S. crude oil production. It is possible to distinguish between the different military conflicts and geopolitical events and the behaviour of crude oil production.

Hamilton [52] suggested that all major fluctuations in the price of oil could be attributed to disruptions of the flow of oil production caused by political events in the Middle East. Kilian [65] identifies three problems relating to this explanation. The data frequently does not fit. Second, more formal regression analysis confirms that quantitative measures of exogenous oil supply shocks associated with political events in the Middle East invariably have little predictive power for the percent change in the real price oil [62,63]. Third, numerous subsequent empirical studies have shown that most major oil price increases since late 1973 have had an important endogenous component associated with the global business cycle. Hamilton [52] and Kilian [62] proposed measures of exogenous oil supply shocks, however, they only explain at most 25% of the observed oil price increase in 1973–1974. In accordance with [65]; the answer to the question of what explains the remaining oil price increase, is that at least, 75% of that oil price increase must be attributed to shifts in the demand for oil. Barsky and Kilian [7] proved that there was a global demand boom in the early 1970s in all industrial commodity markets across the board, reflecting that, for the first time in post-war history, there was a simultaneous peak in the business cycle in the U.S., in Europe and in Japan.

## 3. Crude oil price behaviour from a flow demand shocks viewpoint

Referring to the definition of [65]; flow demand is the demand for oil to be consumed immediately in the process of producing refined products such as gasoline, diesel, heating oil, kerosene, or jet fuel. Kilian [65] argues that the flow demand shocks associated with the global business cycle were a primary determinant not only of the 1973–1974 oil price increase, but of most of the major oil price increases. Thus, when the global economy increases, flow demand increases. At the end of 2014 crude petroleum represented, according to U.S. EIA, 44% of fossil fuel consumption, clearly thus, an important component of the modern economy.

Barsky and Kilian [7] arrived at the conclusion that the role of flow demand for the real price of oil remained unappreciated for a long time. They also demonstrated co-movement fluctuations related with oil and other commodity prices in the 1970s and early 1980s that appear associated with fluctuations in the global business cycle.

Kilian [64] proposed a Structural Vector Autoregressive (SVAR) model of the global market for crude oil since 1973 that enables a

<sup>3</sup> For a recent survey on the determinants of oil price increases and the possible role of speculation see Ref. [37].

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