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# International Dynamics of Oil Prices in Four Dimensions: An Analytical Investigation

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**ABSTRACT** *This article presents an analysis method for oil price movements that tries to combine different factors such as technology, economics, fear, and temporal relations, which are illustrated by fundamental indicators. Analysis method also allows the visualization of these relations with system dynamics figures. It aims to propose a set of these macro factors based on fundamental indicators to improve future forecasts. The vantage point is more of a practitioner's reference point, since theory generally follows practice. By grouping the effects in categories, it tries to guide the reader to understand the "nuts and bolts" of oil price dynamics. While illustrating the points, practical examples are associated with the explanations. The ideas presented are categorized in an analytical manner to help the reader find his/her way. At the end of the article, the possible major events that could trigger the next oil crises are listed.*

## Introduction

**O**il is considered the world economy's bloodline. It is both an indicator and the determinant of economic growth. It is a curse and a necessity blended into a single commodity. It is a source of evil and a source of good, as prices oscillate between peaks and pits, providing new insights in every cycle. Oil price hikes and crashes are different every time and rarely anyone predicts a hike or a crash with correct timing. For the experts "it is different this time," for the ignorant "it was obvious". This eccentric nature of oil dynamics is the subject of thousands of studies. Still this very commodity is the quintessential example for those seeking to understand complex interactions between economy, finance, and geopolitics.

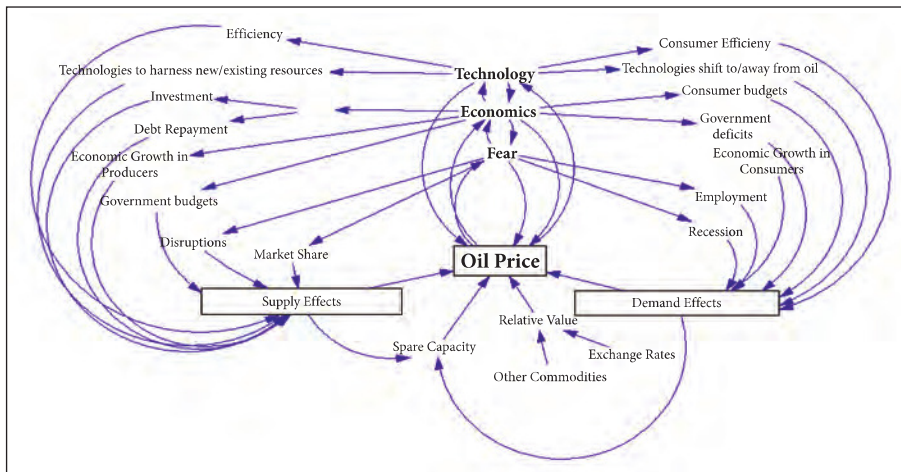
The subject is "as deep as the rabbit hole goes." But there is a possibility for abstraction. Through this process I will try to subset the major determinants of oil prices in four categories. These four categories are technology, economy, fear, and temporal effects. In this article, these relations will be explained and

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different for supply and demand, where traders are the agents that evaluate the impact of such parameters instantaneously (or close to real time). They also value the oil relative to exchange rates and the values of other commodities such as gold, silver, etc.

Figure 1. System Dynamics of Oil Price Dynamics



The figure above starts with technology followed by economics, and fear. Technology is the main parameter since energy is always associated with a technology in order to be utilized. This utilization produces an economic activity or necessitated by economic activities. In addition, there is a behavioral aspect throwing off these mechanics. All these factors are two sided: supply and demand. While consumers can get more efficient, so does the oil production. Economics may provide more credit to new oil producers or it may decrease consumption due to high prices. Fear is a human element that may be associated with all parameters but the parameters portrayed above are sufficient for the purpose of this analysis.

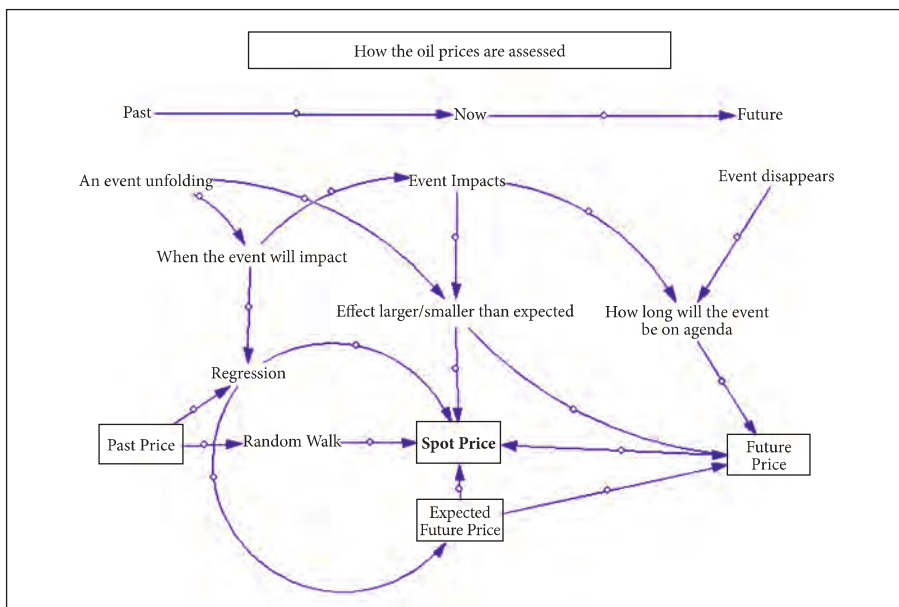
The foremost factor is technology. Oil is not a recent invention. Its properties have been well known for centuries. According to the Old Testament “Noah’s Ark” was pitched with bitumen.<sup>19</sup> Oil was the secret ingredient of “Greek fire.”<sup>20</sup> However, the real commoditization of crude oil started with refining technology, as it allowed the production of a much higher quality product; “rock oil” replaced sperm whale oil for illumination. Since the beginning of the 20<sup>th</sup> century, when the internal combustion engine was invented, oil became the enabler for mobilization.

Technology and the resource relationship are like the chicken and egg problem. One thing leads to progress in the other one. For example, higher oil prices paved the way for large-scale commercialization of shale technologies,

gold, oil, and other metals move together, whereas the U.S. dollar moves in an opposite direction but with relative strength.<sup>21</sup>

The temporal effects of these parameters are also non linear. For example, an agreement with Iran is good news and lets the price discount immediately for a bit, although the real impact of such a deal needs at least 2-3 months to physically affect oil markets. The name given to such action is “buying forward,” in other terms pricing a future event. Most of the parameters that impact oil prices occur with a delay. Monthly data is published at least 15 days after the last day of the relevant month. There are also temporal differences in publication periods between parameters, such as weekly oil stock levels, monthly car sales, and quarterly economic growth. All these parameters are a summary of a past period. Traders assess the future prices depending on the published data and reflect them on to the spot prices. For example, if stock levels in the U.S. are increasing, there will be an expectation that there will be a surplus in the future, so this surplus is priced into the spot prices.

Figure 2. Temporal Effects of Events on Oil Prices



The figure above displays such a relationship. As an event unfolds in the past, it can already start to impact today's prices. Mathematically today's prices is a "random walk" (a random distance) away from a past price. But as more information is gathered the initial assumption is corrected by recent information. Then this information projects the effect of the price into the future. Let's assume that there is ongoing sectarian violence in Iraq. There is a possibility that there may be an attack on major energy infrastructures. Despite the fact that