The predictive power of oil and commodity prices for equity markets: Evidence from rolling Granger causality tests

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MENA Energy Economics Conference
Beirut, Lebanon

December 6, 2018
A large literature on the relationship between oil and equity market has emerged since the early 2000 and gained momentum following the 2008-2009 financial crisis.

First strand of literature uses the first moments of the equity market (i.e., returns): The literature uses Vector Autoregressions (VARs) and Vector Error Correction Models (VECMs) (Hammoudeh and Choi, 2006; Jones and Kaul, 1996; Kilian, 2009; Kilian and Park, 2009; Miller and Ratti, 2009; Sadorsky, 1999)

Following Kilian (2009), several studies employed a Structural VAR models to decompose oil-price changes into three components recursively. The theme of these studies is to gauge the effect of an oil-price shock (Apergis & Miller (2009), Kang, Ratti, & Yoon (2015a), Broadstock and Filis (2014), Gupta and Modise (2013) among others)
Another strand of literature uses second moments i.e., volatilities and correlations: In which, volatility transmission between equity and oil prices is studied using multivariate Generalized Autoregressive Conditional Heteroskedasticity (GARCH) models (Arouri, Lahiani, Nguyen, 2011; Arouri, Jouini and Nguyen, 2011; Malik and Hammoudeh, 2007; Guesmia and Fattoum, 2014 among others).

A parallel literature investigates forecasting the equity returns using oil and commodity price changes following Jones and Kaul (1996); Huang et al. (1996); Black et al., 2014; Cassassus and Higuera, 2011, among other.

These studies were motivated by the fact that Granger causality tests are tests are of predictive ability as documented in (Swanson et. al., 2003).
Goals & Contributions

Goal

The goal of this study is to examine the predictive ability of oil and commodity prices for the equity markets in four countries using rolling Granger causality test.

Contributions

We study the predictive power of oil price movements while accounting for changes in the prices of other important commodities, global economic activity, and changes in exchange rates.
Contributions

That is, in this paper we address:

1. The oil and stock market nexus.
2. The inter-linkages between equity and commodity prices.
3. The relation between equity markets and exchange rates.
4. The fact that, commodity and equity prices are driven by a common economic activity factor (Black, Klinkowska, McMillan & McMillan, 2014; Dbouk & Jamali, 2018), commodity and oil price changes can be useful predictors of equity returns.
Methodology

- Our seven-variate VAR model include stock market returns, Brent oil price changes, gold price changes, copper price changes, silver price changes, Baltic Dry Index, and exchange rate changes.
- The inclusion the aforementioned variables in our VAR is motivated by the criticism of bi-variate models in the literature, especially in the causality testing context.
- Tang and Yao (2017) consider bivariate Granger causality studies as incomplete systems due to the omission of important variables.
- Phylaktis and Ravazzolo (2015) also cautioned against the use of bivariate VARs to test for Granger causality.
- Lutkepohl (1983, 2006) shows that the omission of an important variable leads to invalid inferences about the causality structure of the bivariate system.
- Countries under consideration in this study are: France, Italy, Kingdom of Saudi Arabia (KSA), and the United Arab Emirates (UAE).
Granger causality is expected to be time-varying. Studies which employ the entire sample (as one period) do not account for varying Granger causality across time.

This is why the use of rolling Granger causality especially given the evidence in literature that the relationship between oil-prices and stock markets is time variant as documented in the work of Blanchard and Gali (2009) and Blanchard and Riggi (2013) who argued that there been a change in the relationship between oil price and the economy among others (Degiannakis et al., 2014; Basher et al., 2012; Kilian and Lewis, 2011)
Data & Variables

- Daily data on the nearest Brent crude oil (OIL), gold (GLD), silver (SIL), and copper (CPR) futures from Datastream.
- Our data samples span the period May 31, 2005 to April 27, 2018. Total of 3369 observations. Prices are denominated in USD.
- Continuous futures price series by rolling over from the nearest (or front) to the next-to-nearest (or second) contract on the first day of the expiration month.
- We employ nearest futures prices as a proxy for the spot (or cash) prices since spot prices in commodity markets are not accurate (Fama and French, 1987; 1988; Gospodinov and Ng, 2013).
Data & Variables

- The price of oil is the price of Brent oil given that this is a better proxy of the global price of oil since the U.S. shale oil revolution (Baumeister and Kilian, 2017; Kilian, 2016).
- We obtain data on the exchange rate (XR), expressed in units of the foreign currency per US Dollar (USD), for each of the countries.
- The MSCI index, expressed in USD, is the measure of aggregate equity prices in each of the countries.
- We control for global economic activity using the Baltic Dry Index (BDI).
- All variables are expressed in difference except MSCI is expressed in log difference.
- All series exhibits stationary process using ADF & PP tests (Augmented Dickey-Fuller (ADF) (1979), Phillips and Perron (PP))
As Kilian & Lutkepohl (2017) noted that $y_{2t}$ is said to granger cause $y_{1t}$ if $y_{2t-1}$ improves forecasting/predicting $y_{1t}$. In other words, when information on $y_{2t}$ lowers Mean Square Prediction Error of $y_{1t}$.

A bivariant VAR(p) is given by:

$$
\begin{bmatrix}
  y_{1t} \\
  y_{2t}
\end{bmatrix}
= 
\begin{bmatrix}
  \mu_1 \\
  \mu_2
\end{bmatrix} + 
\sum_{i=1}^{p} \begin{bmatrix}
  a_{11i} & a_{12i} \\
  a_{21i} & a_{22i}
\end{bmatrix}
\begin{bmatrix}
  y_{1t-1} \\
  y_{2t-1}
\end{bmatrix} + 
\begin{bmatrix}
  \varepsilon_{1t} \\
  \varepsilon_{2t}
\end{bmatrix}
$$

Where $y_{2t}$ is said not to granger cause $y_{1t}$ if and only if $a_{12i} = 0$ for $i = 1, 2, ..., p$. This restriction using Wald F–test, if the restriction is rejected $y_{2t}$ is said to granger cause $y_{1t}$. 
Fixed Window size of 600, resulting in 2769 windows.

In each and every window, the code selects optimal lag length using AIC, fits the models, and the conduct Granger Causality test based on selected lag length.

Heteroscedasticity and Autocorrelation consistent (HAC) standard errors (Newey-West 1987) with automatic lag selection (truncation lag) for inference was employed.
Results and Discussion

Exchange Rate Changes Granger Causing MSCI Returns for Italy

Exchange Rate Changes Granger Causing MSCI Returns for France
Results and Discussion
Results and Discussion

![Graph showing Oil Price Changes Granger Causing MSCI Returns for Italy and France](image-url)
### Panel A: Granger Causality from Commodity Price Changes, Exchange Rates and Baltic Dry Index Changes to Stock Returns

<table>
<thead>
<tr>
<th></th>
<th>Oil</th>
<th>Gold</th>
<th>Silver</th>
<th>Copper</th>
<th>Exchange Rate</th>
<th>Baltic Dry Index</th>
</tr>
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<td>474</td>
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<td>203</td>
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<tr>
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<td>259</td>
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</tr>
</tbody>
</table>

### Panel B: Granger Causality from Stock Returns to Commodity Price Changes, Exchange Rates and Baltic Index Price Changes

<table>
<thead>
<tr>
<th></th>
<th>Oil</th>
<th>Gold</th>
<th>Silver</th>
<th>Copper</th>
<th>Exchange Rate</th>
<th>Baltic Dry Index</th>
</tr>
</thead>
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<tr>
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<td>281</td>
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<td>21</td>
</tr>
</tbody>
</table>
Results and Discussion

➤ With the exception of copper, our findings indicate very weak evidence of any causality between metals and stock returns.

➤ Similarly, the BDI which proxies for global economic activity, seems to lack any predictive power for stock returns.

➤ The evidence for gold and silver are consistent with safe haven and hedging properties of the precious metals (Baur and Lucey, 2010; Baur and McDermott, 2010; Ciner, Gurdgiev and Lucey; 2013; Lucey and Li, 2015).

➤ Exchange Rate does not predict stock returns, but some evidence in the opposite direction for France and Italy.
Since 2014, there is strong evidence of oil price changes Granger causing returns in all markets, but especially in the Arab countries. There is commonality in the periods in which oil price changes Granger cause stock returns. This might imply that there is a common factor driving equity returns and oil price changes.
Concluding Remarks

- We examine Granger causality between price changes of copper, silver, gold, exchange rate returns, BDI changes, and equity returns in a seven-variate VAR.
- Our testing methodology relies on a rolling window approach.
- Our findings indicate that copper is an important predictor of stock market returns in the two Arab countries, but not in the European countries.
- Our results also indicate that oil prices Granger cause equity market across all four countries starting in 2014 (and until the end of the sample). This corresponds to a period of declining oil prices.
- Our findings corroborate previous results showing that stock returns Granger cause exchange rate returns for the developed markets (France and Italy).
- Our findings imply that oil price changes are imperative in any stock return forecasting exercise since 2014.
THANK YOU FOR YOUR ATTENTION!