HOW TO MEASURE OIL MARKET UNCERTAINTY? AN APPLICATION OF GOOGLETRENDS

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Overview

This paper, first, proposes a measure for oil market uncertainty and, second, analyses the relationship between this newly proposed measure and important oil market variables. The new uncertainty measures are based on a more refined selection of Google search terms. The measure is carefully compared to already existing measures of economic and policy uncertainty (see, e.g., Jurado, Ludvigson, and Ng, 2015; Baker, Bloom, and Davis, 2016). Using standard time series models, the paper also analyses how existing uncertainty measures and the newly proposed measure affect oil exploration activity and the oil price. Oil exploration activity is generally considered a better indicator of oil market sentiment than oil production as the latter is determined mainly by geological and technical factors. In addition, current exploratory efforts determine future oil discoveries and, thus, also future oil production.

This paper builds on several recent proposals for how to measure economic uncertainty. Jurado, Ludvigson, and Ng's (2015) uncertainty indices (hereafter as the JMU index) are based on forecasting exercises for macroeconomic and financial indicators. JMU finds a strong negative relationship between the JMU index and real activity (proxied by industrial production, working hours, and employment). The economic policy uncertainty (EPU) index put forward by Baker, Bloom, and Davis (2016) is based on newspaper coverage frequency of economic uncertainty. Their finding also supports the view that increases in uncertainty negatively affect industrial production, representing countries' economic activity.

As an alternative to newspaper-based uncertainty indices, a number of papers propose Google Trends-based Uncertainty (hereafter GTU) indices. The main motivation is that when individuals are unsure about future circumstances, they will search for relevant information through the internet. This means the more individuals try to find the information, the greater the uncertainty is. Castelnuovo and Tran (2017) construct the GTU index for monetary policy in the U.S. and Australia and, subsequently, investigate how the uncertainty affects several macroeconomics variables. Their finding concludes that a GTU shock leads to a temporary downturn in some of the variables under consideration.

The advantage of Google Trends is that this tool is free and easy to access and has the flexibility to be applied in various sectors, including crude oil markets. The GTU index application that currently focuses on analysing macroeconomic conditions is the motivation to investigate the effects of uncertainty in the oil market, particularly oil exploration and crude oil price. Some existing papers use crude oil price as the investor sentiment indicator (Qadan and Nama 2018). Their uncertainty index considers a single search term which is too restrictive to measure uncertainty. This paper explicitly considers search terms related to oil investment, oil supply, oil demand, and oil market-specific. In addition, this study contributes to the literature by investigating the uncertainty effect on oil exploration activity.

Methods

In the first section, the new-developed GTU index for the oil market is constructed following Castelnuovo and Tran (2017) procedure. The correlation between the GTU oil market and other uncertainty benchmark indices is then examined. In the second part, the relationship between uncertainty indices, both existing index and GTU oil market index, oil exploration, and crude oil price are analysed by applying Vector Auto Regressive (VAR) framework.

1. GTU oil market index construction

GTU index is constructed based on the frequency of the search terms, which represents oil investment, oil supply, and oil demand. The search terms are based on the essential keywords that are relevant to those three categories. This study constructs four GTU indices; GTU oil investment, GTU oil supply, GTU oil demand, and GTU oil market specific indices (the aggregates of those three components).

Table 1. Base Search Terms for GTU Oil Market Construction

Category	Search terms			
oil investment	oil investment	oil exploration	oil project	drilling
oil supply	oil supply	oil production	shale oil	OPEC
oil demand	economic growth	industrial production	global economy	recession

The numbers generated by Google Trends are the relative frequencies to the highest search terms point for the specific region and period; the value of 100 is the most popular term. We use "oil price" as the benchmark used in every round of the category and "worldwide" as the region chosen for the Google Trends search.

$$y_i = y_{i,j} \frac{y_b^*}{y_{b,j}} \quad (1)$$

$$gtu_m = \sum_{i=1}^{N} y_{i,m} \quad (2)$$

Refer to equation (1) which is proposed by Castelnuovo and Tran (2017), $y_{i,j}$ is the frequency of search term i in round $j = 1$ for oil investment, $j = 2$ for oil supply, and $j = 3$ for oil demand with y_b^* is the frequency of "oil price" as the benchmark and $y_{b,j}$ is the frequency of "oil price" in round j. The maximum number of search terms in every round is five terms. The monthly GTU oil market index is obtained by summing up the relative frequencies of the search term to the oil price in every round for each category.

2. VAR

A VAR framework is applied to estimate the relationship between GTU, oil exploration, and crude oil price. The sample period is from January 2004 to May 2021. The world rig count is the proxy for global oil exploration, and real Brent oil price is the proxy for the crude oil price. The rig counts and crude oil price are in log-differences, and the uncertainty index is in level. This study applies a VAR*(p)* process with y_t is the vector of endogenous variables; the GTU (and other uncertainty benchmark indices), the world rig count, and the real crude oil price as written in equation (3),

$$y_t = A_0 + \sum_{p=1}^{q} A_1 y_{t-p} + \varepsilon_t \quad (3)$$

where y_t is a 3x1 vector of endogenous variables; rig counts, oil price, and uncertainty; A_0 is a 3x1 matrix of intercept terms cointegrating vectors; A_1 are 3x3 matrices of lagged coefficients, p is the lag of endogenous variables, and q is the maximum lag; and ε_t is a 3x1 matrix of white noise disturbances.

Results

Four GTU indices for the oil market have a positive correlation with the existing benchmark indices; oil volatility index (OVX), Jurado's macroeconomy index (JMU), global economic policy uncertainty (GEPU), and Geopolitical risk index (GPR). GTU indices are highly correlated with the OVX index; 0.63-0.83, with the JMU index; 0.38-0.72. Impulse response functions show that uncertainty shocks cause a decline in the world rig counts and crude oil price. The shocks caused by the GTU indices on the global oil market give consistent behaviour compared with the shocks caused by the uncertainty benchmark indices. The empirical evidence shows that Google Trends can measure public awareness when there are significant events occurred.

Conclusions

This research contributes to the literature by proposing a more refined GTU oil market specific index. The index considers the global oil market components such as oil investment, oil supply, and oil demand. The relationship between the newly proposed uncertainty measure, global oil rig count, and crude oil price shows that a shock in GTU decreases world rig count and crude oil price. The results are consistent with the existing JMU and GEPU indices that the higher the uncertainty, the lower the real activity. The higher uncertainty represents the more volatile market that causes lower demand and lower real crude oil price. Otherwise, the paper finds that crude oil price shocks positively affect the rig count, a finding consistent with the extant literature.

References

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