Impact of COVID 19 Virus Cases and Sources of Oil Price Shock on Indian Stock Returns. Structural VAR Approach

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Introduction

March 16th 2020 "The spread of the novel coronavirus has now turned into a disruptive financial contagion and demands quick action from India's policymakers and regulatory bodies." (Economic Times, Market).

April 14th 2020 "The impact of the coronavirus pandemic and the lockdown it triggered is clearly visible in financial markets" (Economic Times, Market). The above headlines from the popular financial press provide evidence that the outbreak of COVID 19 had a drastic impact on the Indian stock market. Although China (Wuhan) became epicentre of COVID 19, soon the disease affected around 2,00,000 and at least 100 countries. On 11th February 2020 World Health Organization (WHO) declared COVID 19 as pandemic. This triggered anxiety and stress in financial markets. Many European economies are severely affected. Although the number of cases has declined in China and lockdown has been relaxed in most of the provinces in China, there are many countries, which witnessed the disease by early March are yet to relax the lockdown. Similarly, Indian Prime minster, Mr Narendra Modi declared a national lock down effective from March 25th 2020 for three weeks. Following which Reserve Bank of India took monetary steps to mitigate corona virus crisis. It cut the repo rate and the reverse repo rate by 4.4% and 3.75%, respectively. Also, the decision of Saudi Arabia to increase the supply of oil lead to an oil crash. This has led to debate whether the impact of outbreak of corona virus has resulted in international oil price dip. Our study revisits the relationship between the sources of oil price shock and stock returns during corona virus spread. Moreover, India being oil importer, whether the drop in oil price has a positive influence on stock market or not? Will low oil prices benefit Indian economy?

By far, the existing literature is mainly concerned with a study of the impact of real oil price on stock returns, but there is no consensus in the literature. While Kling (1985) finds that real oil price increase results in stock market decline, Chen et al. (1986), and Jones and Kaul (1996) find no association between oil price and stock returns. Apergis and Miller's (2009) study found that oil price volatility had negative influence on stock returns. Other popular studies which concluded negative relation between real oil price and stock returns are Basher and Sadorsky (2006), Chen (2009), Jones and Kaul (1996). Kumar and Gupta (2014) found that the aggregate stock returns were more sensitive to negative change in oil prices than to positive change in oil prices. However, several studies have found positive relation between real oil price and stock returns (see for example, Zhu, Li & Li, 2014; Zhu, Li & Yu, 2011; Narayan & Narayan, 2010). Sadorsky (2008) concluded that oil price volatility positively affected the United States stock return. Managi and Okimoto (2013) also found positive relationship between oil prices and stock returns.

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In our study, we assess the impact of COVID 19 and different oil price shocks on Indian stock by using the methodology propogated by Kilian (2009). Extending the previous studies that considered oil price shock proxy for oil specific demand, we use oil inventories in our analysis for measuring speculative demand. While using oil inventories, we treat them as tool to identify the forward-looking component for oil price shocks. The idea of using speculative demand is to separate speculative component from demand and supply shocks of oil. According to our knowledge, this is the first study to assess how COVID 19 cases has changed dynamics between different global oil market shocks and Indian stock returns.

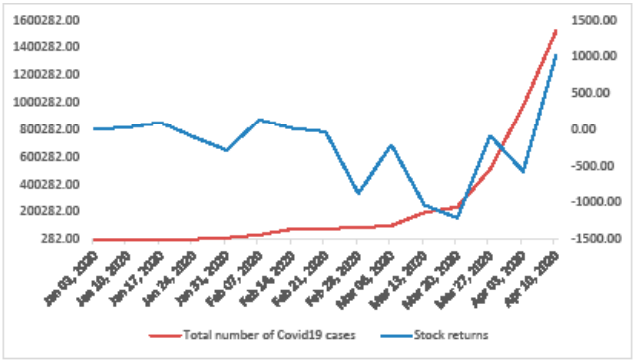

Fig 1. COVID19 cases and stock returns

The paper proceeds as follows: section 2 describe data. Section 3 deals with methodology, section 4 describes empirical results while conclusion is provided in section 5.

Data description

WHO data shows that worldwide COVID 19 cases (left hand scale) has been rapidly increasing from February 28th. Therefore, we are assuming that increase in COVID 19 cases may have drastic effect on financial markets. Figure 1 also shows that stock returns increases exponentially and seems to be positively correlated with COVID 19 cases. We extract weekly COVID 19 total confirmed cases data from WHO situation reports.

We estimate a two variable SVAR-X using weekly

data from January 3rd 2020 to April 10th 2020. As stock market is considered important component of economic and financial set up the present study considers the closing price of stock prices of companies listed in Nifty 50. The stock returns are obtained from the first difference of natural log of stock prices. We include the price of crude oil based on weekly Europe Brent spot price FOB (Dollar per Barrel) obtained from U.S. energy information adminstration (EIA). Following Kilian (2009a), the real price of oil is expressed in log-levels. We also obtain the weekly data for the global oil exports measure in millions of barrels of oil from U.S. Energy Information Adminstration. Following Killian and Murphy (2012), we extract data for petroleum inventories provided by the EIA.[1] We use OECD countries as proxy for global petroleum inventories. We use E-GARCH in order to measure the shock in inventories, referred to as 'speculative demand'.

Methodlogy

In order to capture oil price shock, previous studies have used the traditional method of modelling shock by taking standard deviation of the series. This concept was proposed by Ferderer (1996) who modelled oil price shock by taking the standard deviation of the oil price. Unlike other studies, we use Exponential-GARCH (E-GARCH) in order to capture the shock. Basically, the methodology used under GARCH and its family (T-GARCH, E-GARCH etc.) is to record shock from the residuals of the error term of the series. E-GARCH is stated in log form for variables, which means the model is free from parameter restrictions, and E-GARCH is specified as follows:

$$h_t = \alpha_0 + \sum_{i=1}^{\varphi} \alpha_i \varepsilon_{t-i}^2 + \sum_{j=1}^{\varphi'} \beta_j h_{t-j} + \sum_{k=1}^{\varphi''} \theta_k \ln(\sigma_{t-k}^2) \quad (1)$$

where h_t is specified as the conditional volatility of the oil price, and α_0 is the unconditional variance with constant mean. Hence, using E-GARCH methodology, we calculate different types of shocks pertaining to COVID19, oil export shock, and oil specific demand. Shock arising from total number of cases is referred as shocks in oil exports are denoted as global export shocks; and finally, any shock arising in inventories is represented as speculative demand shock in order to measure the forward-looking behaviour.

Econometric Analysis

Structural Vector Auto-Regressive (SVAR-X) Model

While following Kilian (2009), we represent the transmission of oil price shocks using our reduced-form structural VAR model for 24 months lags.

$$A_0 Y_{it} = L_{io} + \sum_i^k B_1 Y_{it-1} + B_2 Y_{it-2} + \ldots . B_n Y_{it-n} + \phi X_t + \varepsilon_{it} \quad (2)$$

In the equation, matrix specifying contemporaneous relationship among the variables is represented by A. Y_{it} is a (Kx1) vector of two endogenous variables such that $Y_{it} = Y_{1t}, Y_{2t,} \ldots Y_{nt}$ (stock returns and inflation). L_{io} is a (Kx1) vector of constants constituting firm-specific intercept terms. The matrix of coefficients with lagged endogenous variables (for every i=1....P) ø is represented by B_i. B_i is also polynomial in the lag operator, and restrictions are typically imposed on the coefficient matrices. In our model we impose restrictions on our endogenous variables such as stock returns. Vector of coefficients is represented by X_t. K is the number ε_{it} representing the vector of uncorrelated error terms. ε_{it} is categorised into two sections of which the first section consists of shocks related to sources of oil price shocks and COVID 19. While the second section captures the variable of interest- Indian stock returns. Hence, following Kilian and Murphy (2012)`s methodology, error term (ε_t) in the first section consists of shocks in oil exports (oil export shock). Any shock to the oil inventories arising from speculative behaviour regarding oil demand and supply flow (speculative demand shock) is employed to record innovations in oil inventories. In order to capture all structural shocks, we also consider residual shock in the first section of error term. In the second section, innovations to stock returns are captured.

Equation (3) can also be written as:

$$Y_{it} = Z_i + A(P)Y_{it} + H(P)X_t + \nu_{it} \quad (3)$$

Where specifications for Y_{it} and X_t are given as:

Y_{it} = *(Stockreturns)* (3.1)

X_t = Source of oil price shocks (3.2

Endogenous variables in the study are specified in equation (3.1). X_t in equation (18.2) represents vector of the innovations (shock). Equation (3.1) describes the vector of Firms' endogenous variables used in the study; equation (3.2) describes the vector of the exogenous variable that reflects shocks. Z_i stands for a vector of constants representing firm intercept terms. A(P) and H(P) specify the matrices of polynomial lags, which capture the relationship between the endogenous variables and their lags $v_t = I^{-1}\mu_{\varepsilon_{it}}$ is a vector of the error term. Following Amisano and Giannini (1997) ` method we impose 7 restrictions[2] on the A.

Based on economic theory, we impose restrictions, and discuss how each variable is placed for identification purpose. Here we are assuming that shock arising from outbreak of COVID-19 affects oil price, oil supply chain and economic performance of the country. We also assume that the real price of oil is explained by the current and future supply and demand conditions. Any disturbance in oil export will lead to increase in the price of oil. Any disruptions in oil export will lead to shock in inventories. That is why our model also assumes that any shock in oil export will lead to disturbance in inventories. Any speculation regarding oil demand or supply will impact the current volume of inventories, and successively, the current oil price. Finally, our model assumes that COVID-19 shock and all the sources of oil price shocks affect the stock returns. So, the focus of this study is to assess the impact of the COVID-19 shock together with sources of oil price shock on Indian stock returns

Estimated A_0 matrix				
	COVID19-Shock	Oil Price shock	Oil Export Shock	Speculative Demand Shock
Stock Returns	75.67***	215.97***	-279.58***	-63.10***
	(57.52)	(0.26)	(52.36)	(55.23)
Oil Price	-2.52***	1	-2.49***	3.62***
	(0.235)		(0.22)	(0.12)

Table 1 Estimated Matrix with impact of Covid19 and Sources of Oil Price Shock infection on Oil Price and Indian Stock Returns (SVAR- X)

Table 1 exhibits SVAR, *** indicates significance at 1% level, ** at 5% level and * at 10% level.

The restrictions imposed on two endogenous variables are reported in equation 4. All the dependent variables are placed in first row left hand side of the matrix (stock returns and oil price). whereas OPS, OES and SDS stand for Oil Price Shocks, oil export shock, and speculative demand shock respectively. Real oil price and stock returns are determined by these above-mentioned shocks. All NAs depict the variables to be estimated. For example, oil price can be determined by COVID19 shock, its own shock, oil export shock and speculative demand shock. Stock returns is determined by COVID19 shock, oil export shock and speculative demand shock.

$$\begin{bmatrix} & COVID19Shock & OPS & OES & SDS \\ Stockreturns & NA & NA & NA & NA \\ Oilprice & NA & 1 & NA & NA \end{bmatrix} \quad (4)$$

Empirical Results

The estimation results of the structural VAR model are presented in Table 1. Results present responses of the real oil price and Indian stock returns to outbreak of COVID 19 pandemic shock and various sources of oil price shock, viz oil export shock and speculative demand shock. The first row of table 1 shows the response of stock returns to COVID 19 pandemic shock and oil price shock and its sources. The sign of the COVID-19 coefficient is positive and statistically significant. Which means that there is positive influence of shock obtained from COVID-19 on stock returns. This indicates that COVID-19 shock may not have immediate negative impact on stock returns. The sign of coefficient associated with the oil price shock is also positive and statistically significant, indicating shock in spot oil price has positive influence on stock returns. On the other hand, shock obtained from oil exports has negative influence on stock returns. It implies that any disturbance in oil exports indirectly affects stock returns. These results are similar to those of the study done by Kilian and Park (2009): the study concluded that U.S. stock returns reacted similarly to oil supply shock. Similarly, Likewise, a study done by Ghorbel and Younes (2009) concluded that a negative oil supply shock has negative impact on stock returns of some of the importing countries. Similarly, shock arising from inventory oil also has negative impact on stock returns. These coefficients are statistically significant. These findings are similar to the findings of Guntner (2011), which concluded that stock returns are negatively impacted by a speculative demand shock.

Conclusion

Rapid increase in COVID-19 infection world wide did have negative repercussions on financial and commodity markets and economy as well. The magnitude of disturbance in economy due to outbreak of disease dependence upon monetary and fiscal policy response to COVID-19 outbreak. The present study analysis whether the COVID-19 number of cases has generated any shock in stock market. Our analysis reveals that there is no significant negative impact on Indian stock market. Hence, we can conclude that by far outbreak of COVID-19 has positive influence on stock market. The reason could be that there is no immediate impact on country`s economy. Also, the impact is for short-run, however, the long-term impact could be contrary.

Footnotes

[1] EIA includes crude oil as well as unfinished oils, natural gas..

[2] Based on calculation: 2n2-n(n+1)/2 (where n is the number of variables

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