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Research article

The effects of oil prices on confidence and stock return in China, India and Russia

Melike E. Bildirici[1,*] and Mesut M. Badur[2]

[1] Yildiz Technical University, FEAS, Department of Economics, Davutpasa Campus, Istanbul/Turkey
[2] Yildiz Technical University, Social Sciences Institute, Davutpasa Campus, Istanbul/Turkey

* **Correspondence:** Email: melikebildirici@gmail.com; Tel: +902123836717.

Abstract: This study aims to investigate the relationships between oil price, business confidence and stock return for China, India and Russia by employing the Markov Switching Vector Auto Regressive(MS-VAR) and MS-Granger Causality(MS-GC) methods. For China, the causality relationship between business confidence and stock return differ from the results of Russia and India. For China, while there is unidirectional causality from stock return to business confidence for all regimes, in India there is the evidence of bidirectional causality in all regimes. For Russia, there is the evidence of a bidirectional causality between business confidence and stock return in the first regime, while there is none causality in the second regime. In all regimes for the selected countries, there is the evidence of a unidirectional causality from oil price to stock return. But there are different results between oil price and business confidence. The different results obtained for the selected countries are explained by the three different factors. One of the reasons is that the differences in oil reserves of the countries. The other one is the differences in oil demand of the countries' economies. The last one is that the selected countries have different business confidence that can be affected by various parameters of the economy.

Keywords: consumer confidence; economic confidence; oil price; gasoline price; stock return

JEL codes: Q43, G12, E70

1. Introduction

The economic confidence and expectation are very important to explain the behavior of investors in financial markets. Investor's expectation is one of the most important dynamics in economic theory since the animal spirit concept suggested by Keynes (1936). Although the opinions about uncertainty of future asset returns in perspective of a probability distribution can be observed in Fisher (1906), the popularity of uncertainty increased after Keynes's (1936) the animal spirit concept. Before Keynes (1936), Hicks (1934a, 1934b) explained the preferences for investment and showed that the preferences of investment can be characterised by the moments of the probability distributions.

In explanation of the effects of human behaviors to economies, the economic confidence index became crucial in economic analysis. The confidence has dominant effect on financial preferences of economic agents because they have difficulty in their decisions by the reason of uncertainity and complexity (Zak and Knack, 2011).

There are two different approaches to explain the behaviour of investors in financial markets. The first one is the traditional approach which emphasizes behaviors of the investors by determining macroeconomic indicators of the countries and financial statements of companies. The other one is the behavior-based approach. Accordingly, the investors take investment decision by not only by the impact of cognitive and sentimental perceptions as well as by making profit-loss accounts (Zak and Knack, 2011). Psychology of investors in their financial decision-making process is an important tool for the policy makers. The developed models accept that economic agents do not have a uniform financial behaviors because they have different sentiments and different characteristic features.

In the related literature, the relationship between financial markets and business confidence has generally not been analysed. However, as mentioned above, the level of business confidence may affect financial markets. The factors affect the degree of confidence in economics related with financial market variables. Furthermore, financial markets may affect the behaviors of all economic actors and, the degree of the confidence index which is one of the main determinants of current situation of the economy. There is a complex interaction between these two variables.

Further, oil prices have impact on the other variable such as confidence and stock return. In this paper, it is purposed to specify the relationship between oil price and business confidence and stock return in the different stages of the economies by using Markov Switching Vector Auto Regressive (MS-VAR) methods in China, India and Russian.

There are two reasons why these three countries were chosen. The first one is to examine the impact of the analysed variables on the three emerging countries The selected countries have different degree of economic confidence index. The second aim is to determine this impact in the context of the different business confidence index. The similarities and differences were determined for these countries which are important for policy recommendations. Two different models such as MS-VAR(X) and MS-Granger Causality(MS-GC) were used. MS-GC method allowed to analyze the causal relation between oil price, stock return and business confidence index. MS-VAR(X) model was used to determine oil price volatility in the oil exporting countries. Besides Russia which is an important oil exporter country, there are many others country that have influence on the price determination process in the economy. For these reasons, in MS-VARX model, oil price considered as an exogenous variable.

The contribution of this paper is to analyse the relationship between oil price, stock return and business confidence index by MS-VAR(X) and MS-GC methods in context of the different stage of the economies of the selected countries.

In this paper, the second section of the study includes literature review, the third one consists of data and econometric methodology, the fourth one includes econometric results, the fifth of it covers the other macroeconomic policy results while the last section contains conclusion part of the study.

2. Literature review

Literature is given in the context of the relation between oil prices and stock return, and the relationship between confidence, investor sentiment and stock return.

The papers analysed the relation between oil prices and stock return obtained the different results such as negative and/or positive relation, none causality, unidirectional causality and bidirectional causality etc.

The earliest studies suggested a negative relationship between oil prices and stock return are the research of Kling (1985), Jones and Kaul (1996) for Canada and the US, Sadorsky (1999) for the US and Papapetrou (2001) for Greece. Kling (1985) concluded that increases in crude oil prices are related to stock market declines. Jones and Kaul (1996) reported a stable negative relationship between oil price changes and aggregate stock returns. On the other side, Chen et al. (1986) suggested that oil price changes have no effect on asset prices. Miller and Ratti (2009) found that the stock market indices of the six OECD countries negatively related with the increases in the oil price in the long run, particularly before 2000. On the other hand, Huang et al. (1996) found no negative relationship between stock returns and oil price changes. Cong et al. (2008) investigated the relationship between oil price and stock return for the period of 1986:1–2005:12 for China. According to their findings, there is no important relationship between oil price shocks the real stock returns in China. Chen (2010) determined that an increase in oil prices leads to a higher probability of a declining in S&P index. Kang et al. (2015) investigated the effects of oil price on stock return for the period from January 1973 to December 2013. According to the result of the study, the positive shocks oil-market are associated with negative effects on stock return.

Some papers focused on sectorial effects. Faff and Brailsford (1999) investigated the relation between oil price and stock price for Australia. According to their study, oil price has an effect on stock prices, and the oil and gas industry. The other some industries has positive sensitivities, but papermaking, packing, and transportation industry had negative sensitivities. Nandha and Faff (2008) reported a negative connection between oil prices and global industry indices. Malik and Ewing (2009) investigated the relationship between oil price and stock market in the US by using sectorial analysis. According to the paper, there is an important volatility between oil and some sectors in the US stock market.

On the other hand, Campbell (1991) explained the impact of oil price shocks on Canadian and US stock prices, and the impact of these shocks on real cash flows. Wei (2003) concluded that the decline in U.S. stock prices in 1974 cannot be explained by the 1973–1974 oil price increases. Ewing and Thompson (2007) researched the relationship between oil price shocks and stock market returns. Their results showed that changes in crude oil prices were significantly effect. Kilian and Park (2009) emphasized that in analyzing the influence of oil prices on the stock market, it is essential to identify the causes of the oil price shocks and it was determined that oil price increases are driven by aggregate demand. Vo (2011) found inter-market dependence in volatility of stock and oil markets in the US. Degiannakis et al. (2014) found that the increase in oil prices is associated significantly with the volatility of the stock market.

The papers tested the relation between confidence, investor sentiment and stock return are so scarce. Brown and Cliff (2005) found a strong relationship between investor sentiment, asset pricing models and market bubbles. They also accented the effects of irrational sentiment on asset prices. Lemmon and Portniaguina (2006) determined that the confidence index is a potential indicator of optimism. Baker and Wurgler (2007) researched the relationship between stocks and sentiments. Schmeling (2009) discussed the reason behind of the relationship between sentiment and structure of the countries by using monthly data in the period of 1985–2004 for the U.S., Japan, Australia, NZ, and 14 European countries. And they determined that sentiment is a significant predictor of expected returns. The impact of sentiment on returns is higher for countries that are more prone to herd-like investment behavior and have less efficient regulatory institutions or less market integrity. Anderson et al. (2010) noted that after an information technology (IT) bubble, the investors transferred their capital. Beckmann et al. (2011) investigated the effects of economic confidence on financial markets in Central and Eastern European countries in the period of 1997–2008. They determined there is a strong link between economic confidence and stock return in the short term. According to another result of the study, global trends has influence on the stock market more than the domestic factors. Moreover, global sentiments and stock return have impact on indigenous variables in the domestic economies integrated with global markets.

Baker et al. (2012) showed that global and local behaviors may differ and global behaviors are more important than local behaviors. They explained the impact of sentiment on returns which show an alteration according to optimism and pessimism and it was found that investor sentiment plays a crucial role in international market volatility.

In table 1, it was presented the results determined by the literature.

Table 1. Literature review.

	oil price fluctuations and financial market		
Kaul and Seyhun (1990)	1947–1985	oil price and stock return	negative relation between stock return and oil price
Huang and Masulis (1996)	US	oil price and stock return	oil returns had an impact on stock returns.
Faff and Brailsford (1999)	1983–1996 Australia	oil price, stock return	oil price had an effect on stock prices, while papermaking, packing, and transportation industry had negative sensitivities
Sadorsky (1999)	1947 to 1996 US	oil shocks, stock returns	oil shocks have impact on stock returns
Malik and Ewing (2009)	from January 1, 1992 to April 30, 2008 US	oil price and stock market	significant transmission of volatility between oil and some sectors in the US stock market
Vo (2011)	January 06, 1999 to July 26, 2009 US	oil price and stock market	inter-market dependence in volatility between stock and oil markets
Ciner (2001)	1986:1 –2010:12 US	stock returns and oil price futures	Oil price shocks have a negative impact on stock returns, while shocks with persistency between 12 and 36 months are associated with positive stock returns.
Papapetrou (2001)	1989:1 to 1999:6 Greek	oil price, stock returns, and real economic variables.	oil price has an important effect on stock price movements

Continued on next page

oil price fluctuations and financial market			
Ewing and Thompson (2007)	1982:1 to 2005:11 US	oil price and stock returns	crude oil prices are procyclical.
Park and Ratti (2008)	1986:1–2005:12 US and many European countries	oil price and stock returns	oil price shocks have an negative impact on stock markets except Norway.
Cong et al (2008)	1996:1–2007:12 China	oil price and stock returns	Oil price have statistically insignificant impact on the real stock returns.
Miller and Ratti (2009)	1971 to 2008 for six OECD countries	stock return and oil prices	stock return does not respond to oil prices as expected
Apergis and Miller (2009)	1981 to 2007 for the eight countries	stock return and oil prices	idiosyncratic demand shocks affect stock market returns, conversely, oil supply and aggregate demand shocks do not have affect on stock market returns
Arouri et al. (2012)	from January 01, 1998 to December 31, 2009 eighteen countries of the European region	oil price and stock market	volatility transmission from oil to stock markets
Kang et al. (2015)	1973:1 to 2013:12 US	stock return and oil prices U.S. stock market indices	Positive shocks to aggregate demand and to oil-market specific demand are associated with negative effects on the covariance of return and volatility. Oil supply disruptions are associated with positive effects on the covariance of return and volatility.
Wei and Guo (2017)	1996 to 2015	stock return and oil prices	changes in oil prices are more influential on stock return than stock volatility
Ding et al. (2017)	2005 to 2015 China	crude oil price fluctuations, financial market	unidirectional causality from the fluctuations of crude oil price to the tendency of the investors
Qadan and Nama (2018)	1986 to 2016	oil prices and investor sentiment	unexpected oil price shocks significantly affect investor sentiment.
Investor Sentiment and Financial Markets			
Brown and Cliff (2005)	1963 to 2000	investor sentiment and asset valuations	1-strong relationship between investor sentiment, and market bubbles. 2-the effects of irrational sentiment on asset prices
Beckmann et al. (2011)	1997 to 2008 Central and Eastern European	economic confidence on financial markets	In short-term, a strong relationship between economic confidence and stock return. And a long-run relation was found for the Czech Republic. Global sentiments and stock return have impact on domestic variables.
Zouaoui (2011)	1995 to 2009 15 European countries and the US	investor sentiment, the international stock market	the investor sentiment is an important tool to predict the crises

3. Data and econometric methodology

3.1. Data

In this study, the relationship between oil price (op), business confidence index (bc) and stock exchange (sr) were analyzed for the period from May 2000 to September 2017 by using monthly data. Closing prices of crude oil (in Dollar per Barrel) on the New York Mercantile Exchange (NYMEX) were used for Russia, China and India. To measure consumer sentiments, the Business confidence index from OECD Database was employed. To measure stock return, stock Moscow Exchange, Shanghai Stock Exchange Composite Index and S&P Bombay Stock Exchange Sensitive Index were used. The stock return data of China and India were obtained from Yahoo Finance Database. The stock data of Russia were obtained from Moscow Exchange Database.

All variables were converted as

$$x = \log\left(x_t\right) \quad (1)$$

for the MS-VAR and MS-VARX models.

3.2. Econometric methodology

The Markov-Switching variance autoregressive (MS-VAR), MS-VARX and MS-Causality approaches were used to determine characteristic of the economy and the direction of causality under different regimes. The MS-VAR and MS-VARX models allowed analysis of the characteristic of the economy under different regimes. Furthermore, MS-Causality helped to determine the direction of the causality under different regimes.

3.2.1. Markov Switching- VAR

Krolzig (1997) extented Markov-Switching- AR model developed by Hamilton(1988, 1989, 1990) to MS-VAR case. To capture nonlinear dynamics or asymmetry in the business cycles in many paper was intensively utilized.

The basic assumption of MS-VAR models is that the parameters of a K-dimensional macroeconomic time series vector (*y_t*) based on a stochastic, unobservable regime variable $s_t \in \{1,\ldots,M\}$ which represents the state of the business cycle (Krolzig, 2001).

The unobservable regime variable also specifies the probability of the business cycle in a given situation and the conditional probability density of y_t is described by

$$P(y_t|Y_{t-1}, s_t) = \begin{cases} f(y_t|Y_{t-1}, \Phi_1) & if\ s_t = 1 \\ \vdots & \\ f(y_t|Y_{t-1}, \Phi_M) & if\ s_t = M \end{cases} \left[f(y_t|Y_{t-1}, \Phi_1\right] \quad (2)$$

where Φ_M symbolizes the VAR parameter vector in regime m=1,…,M and Y_{t-1} is the history of y_t (Krolzig, 1997a, 1997b, 1998, 2000, 2001). In this model, the regime-producing process is constituted by an ergodic Markov chain defined by transition possibilities:

$$P_{ij} = \Pr(s_{t+1} = j|s_t = i),\ \sum_{j=1}^{M} p_{ij} = 1 \quad \forall i, j \in \{1,\ldots,M\} \quad (3)$$

If we take two-regime business cycle model, there are two transition probabilities: p_{12}=Pr (recession in *t* | expansion in *t-1*) and p_{21}=Pr (expansion in *t* | recession in *t-1*) (Krolzig, 2001; Krolzig et al., 2002). For this reason, the current regime is based on the regime one period ago and p_{ij} symbolizes the probability of being in regime j following of regime i.

The estimation procedures discussed in Krolzig (1997b) accepted that estimation procedures have capture these degenerated circumstances, for example if there is a single jump or structural break.

Markov switching vector autoregressions of order p and M regimes was given as follows:

$$y_t - \mu(s_t) = A_1(s_t)(y_{t-1} - \mu(s_t)) + ... + A_p(s_t)(y_{t-p} - \mu(s_{t-p})) + u_t, \qquad u_t \mid s_t \sim NID\left(0, \sum(s_t)\right) \quad (4)$$

where u_t ~NID(0, $\sum(s_t)$) and $\mu(s_t),\ A_1(s_t),...,A_p(s_t),\ \sum(s_t)$ are parameter shift functions defining the dependence of the parameters $\mu,\ A_1,...,A_p,\ \sum$ on the realized regime s_t.

$$\mu(s_t) = \begin{cases} \mu_1 & \text{if } s_t = 1 \\ \vdots & \\ \mu_M & \text{if } s_t = M \end{cases} \quad (5)$$

The model shows a change in the regime cause to an immediate one-time jump in the process mean. That is, the mean reach a new level after the transition from one stage to other one.

In the MS-VAR model, a number of special situations allowed that the autoregressive parameters, the mean or the intercepts are regime-dependent and that the error term is heteroskedastic or homoskedastic. So it was obtained various model such as MSA-VAR, MSH-VAR, MSI-VAR, MSM-VAR, and MSMH-VAR, MSMA-VAR, MSIH-VAR, MSIA-VAR MSMAH-VAR,MSIAH-VAR. For example when the regime shifts affect the intercept of the VAR, the model is named as a MSI(S)-VAR(p) process (Krolzig, 1997, 2000). MS-VAR models are showed in Table 2.

Table 2. MS-VAR Models.

		MSM μ varying	MSI μ invariant	MSI *v* varying	MSI *v* invariant
invariant	*Aj* invariant	MSM-VAR	Linear MVAR	MSI-VAR	Linear –VAR
varying		MSMH-VAR	MSH-MVAR	MSIH-VAR	MSH-VAR
invariant	*Aj* varying	MSMA-VAR	MSA-MVAR	MSIA-VAR	MSA-VAR
varying		MSMAH-VAR	MSAH-MVAR	MSIAH-VAR	MSAH-VAR

Note: the general MS(M) term the regime-dependent parameters can be determined as: I Markov-switching intercept term, M Markov-switching mean, H Markov-switching heteroskedasticity and A Markov-switching autoregressive parameters. Source: Krolzig, 1997.

The general form of a Markov-switching VAR model with order p and S regimes is given by:

$$y_t = v(s_t) + A_1(s_t)\, y_{t-1} + ... + A_p(s_t)\, y_{t-p} + u_t, \qquad u_t \mid s_t \sim NID\left(0, \sum(s_t)\right) \quad (6)$$

where $y_0,...,y_{1-p}$ are fixed, all parameters are regime (s_t) dependent, $v(s_t)$ shows shift functions (mean or intercept), $A_1(s_t)\, y_{t-1} + ... + A_p(s_t)\, y_{t-p}$ symbolizes the coefficients of the lagged values of the variable, $\sum(s_t)$ represents variance of the residuals.

The conditional probability density function of y_t is denoted by $p(y_t \mid s_t, Y_{t-1})$. Normal distribution of the error term u_t can be described as follows

$$p(y_t \mid s_t = t_m, Y_{t-1}) = \ln(2\pi)^{1/2} \ln\left|\sum \right|^{-1/2} \exp\left\{(y_t - \bar{y}_{mt})' \sum_m^{-1} (y_t - \bar{y}_{mt})\right\} \tag{7}$$

The unconditional density of Y is showed with movement from marginal density as follows $p(Y) = \int p(Y,\xi)\, d\xi$ of the unobserved states.

The conditional distribution of the all regime vector is described by

$$pr(\xi|Y) = \frac{p(Y,\xi)}{p(Y)} \tag{8}$$

The time path of the regime under alternative information sets:

$\hat{\xi}_{t|\tau,}$ $\tau < t$ predicted regime probabilities

$\hat{\xi}_{t|\tau,}$ $\tau = t$ fitered regime probabilities

$\hat{\xi}_{t|\tau,}$ $t < \tau \le T$ smooted regime probabilities

Mainly the one-step predicted regime probabilities are $\hat{\xi}_{t|t-1}$, the filtered regime probabilities are $\hat{\xi}_{t|t}$ and all sample smoothed probabilities, $\hat{\xi}_{t|T}$.

3.2.2. Markov-Switching VAR Granger Causality

Markov Switching VAR Granger Causality(MS-GC) models can be applied to MSIA(.)-VAR(.) and MSIAH(.)-VAR(.) models (see Fallahi (2011) and Bildirici (2012, 2013) for detailed information). The MSIA(.)-VAR(.) is stated as:

$$y_t = \mu_{(s_t)} + \sum_{i=0}^{i} A_{i(s_t)} x_t + u_{t(s_t)} \tag{9}$$

where $u_t / s_t \sim N(0, \delta^2(s_t))$ and $\boldsymbol{A_i}$ **(.)** represents the coefficients of the lagged values of the variables in the different regimes. Also, according to these models, where $\delta^2(s_t)$ describes the variance of the residuals in each regime. $\mu(s_t)$ symbolizes the dependence of mean μ of the k dimensional time series vector. In addition, (s_t) can be defined as the regime variable. In this study, three input variables are used. These variables are innovations of oil price, the innovations of business confidence index, and innovations stock return symbolised by $dlop_t$, $dlbc_t$, and $dlsr_t$, respectively. We can define these input variables in matrix form as

$$x_t = \left[x_t^{'} \right]^{'} = \left(dlop_{t-1}, ..., dlop_{t-p}, ...dlbc_{t-1}, ..., dlbc_{t-p}, ..., dlsr_{t-1}, ..., dlsr_{t-p} \right)'' \quad (10)$$

The p is the optimum lag length and varies according to the information criterion. Additionally, the regimes here have varying characteristics. That is, the regime varies according to its previous value and probabilities (Chang and Li, 2009), and it can be defined as

$$\Pr = \left(s_t = j \middle| s_{t-1} = i \right), P_{ij} \geq 0 \quad (11)$$

where P_{ij} represents the probability of transition from regime i to regime j. It can also be shown as,

$$\sum_{j=1}^{k} P_r \left(s_t = j \middle| s_{t-1} = i \right) = 1 \quad (12)$$

where $i, j = 1,2....,k$ shows k different possible regimes. The transition between regimes is determined by Markov model. This model can be defined as,

$$P = \left[a \prec y_t \leq b \middle| y_1, y_2, y_3, ..., y_{t-1} \right], P\left[a \prec y_t \leq b \middle| y_{t-1} \right] \quad (13)$$

It can be shown in matrix form as following,

$$P = \begin{bmatrix} p_{11} & p_{12} \\ p_{21} & p_{22} \end{bmatrix} \quad (14)$$

The Markov chain is ergodic and can irreducible. The ergodic probability vector can be expressed as the unconditional probability of each regime. When the Markov chains are accepted as ergodic, unconditional probabilities can be used as initial values (Fallahi, 2007). They are given by

$$\xi_j = P_r[s = j] = \frac{1 - p_{ii}}{2 - p_{ii} - p_{jj}} \quad (15)$$

Optimal prediction probabilities are found by

$$\varepsilon_{t|t} = \frac{\varepsilon_{t|t-1} \phi_t}{1^{'} \left(\varepsilon_{t|t-1} \phi_t \right)}, \quad (16)$$

where $\varepsilon_{t+1|t} = P^{'} \varepsilon_{t|t}$ and ϕ_t symbolizes the vector of conditional densities, 1 symbolizes a unit column vector. The estimation is made using the following equation

$$E_t(y_{t+1}) = \sum_{j=1}^{s}\sum_{i=1}^{s} \Pr_t(S_t = j) P_{ij} \, (w_0^{(j)} + \sum_{l=1}^{p(j)} \beta_l^{(j)} y_{t-l+1})$$

The approach is described as following (Fallahi, 2011; Bildirici, 2012a, 2012b, 2013):

$$\begin{bmatrix} ly_t \\ lx_t \end{bmatrix} = \begin{bmatrix} \mu_{1,st} \\ \mu_{2,st} \end{bmatrix} + \sum_{k=1}^{q} \begin{bmatrix} \phi_{11,st}^{(j)} & \phi_{12,st}^{(j)} \\ \phi_{21,st}^{(j)} & \phi_{22,st}^{(j)} \end{bmatrix} \begin{bmatrix} ly_{t-k} \\ lx_{t-k} \end{bmatrix} + \begin{bmatrix} \varepsilon_{1t} \\ \varepsilon_{2t} \end{bmatrix} \tag{17}$$

The direction of the Granger causality can be found by depending upon the coefficients of the lagged values of *ly*, *lx* in the equation for each variable. For example, if any of the coefficients of $ly_{t-1},...,ly_{t-q}$ in any regime is significantly different from zero in the equation for lx_t, *ly* is Granger cause of *lx* in that regime. When the coefficients mentioned above are insignificant, there is no Granger causality running from *ly* to *lx*. Similar method can be employed for the coefficients of $lx_{t-1},...,lx_{t-q}$ in the equation for *ly*. In other words Granger causalities can be detected by testing H_0:$\phi_{12}^{(j)}$= 0 and H_0:$\phi_{21}^{(j)}$= 0. The methodology requires the estimation of either an MSIA(.)–VAR(.) or an MSIAH(.)–VAR (.) model.

4. Empirical results

In In this section, firstly, Philips Perron (PP) and Elliott, Rothenberg and Stock (ERS) unit root tests for integration order of the variables were carried out. Secondly, the Johansen cointegration test was applied as a pre-test to determine the direction of causality based on the MS-VAR models. If no cointegration relation exists among the variables, the first differenced or the innovation of variables were used for MS-Granger causality analysis. Thirdly, to determine the number of regimes, traditional VAR model was tested against a MS-VAR structure with two regimes and with two regimes against three regimes. Lastly, it was compared the potential similarities with differences of causality results determined by two different methods: traditional linear Granger causality and MS-Granger causality.

4.1. Unit Root and Johansen Cointegration results

At the first stage, the results of Philips Perron (PP) and Elliott, Rothenberg and Stock (ERS) unit root tests were exhibited in Table 3. PP's results indicated that the lop_t , lbc_t , and lsr_t variables are integrated of order one and follow I (1) processes. At the second stage, Johansen's maximum likelihood procedure is utilized to determine the possible existence of cointegration between lop_t , lbc_t and lsr_t.

The results determined that the null hypothesis of no cointegration was not rejected for the three-variable system under the analysis. Since no cointegration relation exists among the variables, the first differenced or innovation variables, lop_t , lbc_t, lsr_t can be investigated with MS-Granger causality.

Table 3. Unit Root and Johansen Cointegration Test Results.

Unit Root Tests for China			
Variables	PP	ERS	Johansen Cointegration Test
lop_t	-1.369	0.1169	r=0 18.04
$dlop_t$	-10.856	7.856	r≤ 1 9.55
lbc_t	-1.023	0.0389	r≤ 2 1.67
$dlbc_t$	-4.856	5.896	
lsr_t	-1.236	0.304	
$dlsr_t$	-8.369	6.896	
Unit Root Tests for India			
Variables	PP	ERS	Johansen Cointegration Test
lbc_t	-1.496	0.6141	r=0 27.96
$dlbc_t$	-4.986	7.012	r≤ 1 14.23
lsr_t	-2.085	0.945	r≤ 2 2.788
$dlsr_t$	-11.326	6.056	
Unit Root Tests for Russian			
Variables	PP	ERS	Johansen Cointegration Test
lbc_t	-2.012	0.212	Model 1
$dlbc_t$	-10.856	5.236	r=0 28.11
lsr_t	-1.896	0.0459	r≤ 1 11.08
$dlsr_t$	-11.569	4.996	r≤ 2 2.11

4.2. MS-VAR Results and MS-Granger Causality Results[1]

To determine the number of regimes, traditional VAR model was tested against a MS-VAR structure with two regimes. To analyze the relationship between oil prices, business confidence index and stock return, the MSIAH(3)-VARX(3) model for China and India, and MSIA(3)-VARX(3) model for Russia were selected as the optimal model. According to the results, the total durations of the high volatility regimes are lower than the other periods. The duration of the low volatility regimes (regime 2 and 3) are higher than the high volatility regimes.

In MSIAH(3)-VARX(3) and MSIA(3)-VARX(3) models, oil price was accepted as exogenous variable. Accordingly, by depending upon the statistical tests and information criteria, the optimum model was selected as MSIAH(3)-VARX(3). The results of the MSIAH(3)-VARX(3) model for China and India, and MSIA(3)-VARX(3) model for Russia were given between table 4–6.

In all regimes, the dependent variable of the first equation in all regimes is lbc, that is, innovations of business confidence index. In the first vector, the majority of the parameters are statistically significant at the conventional levels. The effects of oil price on innovation of business confidence index and innovation of stock return cannot be rejected. Once the parameter estimations and their statistical significances are evaluated, the overall effect of stock return and oil price on business confidence index is statistically significant, in all regimes.

For China, in Table 4, the obtained results from the computed regime probabilities are Prob(st=1|st−1=1)=0.6262, Prob(st=2|st−1=2)=0.9032, and Prob(st=3|st−1=3)=0.8844. The computed probability of Prob(st= 2|st−1=1)=0.01217 reflects a low probability high volatility regime is followed by moderate volatility regime period. If the conditions described above are considered, the existence of asymmetry cannot be rejected.

[1] The variables in MS-VAR model are innovations of the variables and/or first differences. Ox 3 Software and MS-VAR130 packages were used.

The dependent variable of the second equation is lsr, the innovations of stock return. The overall effects of oil price on stock return are statistically significant. Standart error in regime 2 is differentiated from the others. Standart error of lbc is higher than lsr. But the other regimes exhibit different results. In these regimes, standart error of lbc is smaller than lsr. The dependent variable of the first equation is dlbc which is the innovations of business confidence index. In regime 1, the parameter estimates of the dlsr(-2) in the lbc vector is 0.009406 and statistically significant at 5% significance level.

The MS-VAR model for India has three regimes. Additionally, by depending upon the statistical tests and information criteria, the selected model has three regime with MSIAH(3)-VAR(3) model. The results of the MSIAH(3)-VAR(3) model for India are given in Table 5. The computed regime probabilities are Prob(s_t=1|s_{t-1}=1)=0.8698, Prob(s_t=2|s_{t-1}=2)=0.9793, Prob(s_t=3|s_{t-1}=3)=0.8104. Standart error of dlbc is lower than dlsr in all regimes.

For lsr in regime 1, the sign of coefficients of oil price is comparatively larger than regime 2 and 3. In the first equation for lbc, the majority of the parameters are statistically significant at the conventional levels, the effects of oil price and stock return innovations on confidence index cannot be rejected.

The results for Russia in Table 6 determined the computed regime probabilities are Prob(st=1|st−1=1)=0.6492, Prob(st=2|st−1=2)=0.9125, and Prob(st=3|st−1=3)=0.6854. The computed probability of Prob(st= 3|st−1=1)=0.02501 reflects a low probability that high volatility regime is followed by low volatility regime period. The computed probability of Prob(s_t= 2|s_{t-1}=1)=0.101 reflects probability that high volatility regime is followed by moderate volatility regime period. Considering the conditions described above, the existence of asymmetry cannot be rejected.

Both in regime 1, the overall effect of stock return innovations on business confidence index is statistically significant at 5% and 1% significance levels. In regime 1, the overall effect of oil price on business confidence index is statistically significant for lopt(-1) and lopt(-3).

Table 4. MSIAH(3)-VARX(3) Model for China.

	Regime 1		Regime 2		Regime 3	
Variables	dlbc	dlsr	dlbc	dlsr	dlbc	dlsr
c	0.00018(0.7715)	-0.04801(-6.1919)	0.000015(0.5602)	0.002560(1.0485)	0.000015(0.1268)	0.012881(2.898)
dlbc(-1)	1.389809(9.0535)	0.700727(0.1386)	1.691963(0.000240)	0.899149(0.2151)	1.519793(11.9288)	5.072676(1.1798)
dlbc(-2)	-1.32651(-6.8094)	-1.52701(-0.2397)	-1.400750(0.5602)	-2.811166(-0.4432)	-1.126094(-6.4556)	-5.433918(-0.933)
dlbc(-3)	0.930116(4.746)	6.173444(1.1009)	0.493194(4.4746)	5.039736(1.1097)	0.303518(2.4927)	4.598403(1.1121)
dlsr(-1)	0.005517(1.1292)	-0.63734(-3.9563)	0.000407(-22.0435)	0.080672(1.0126)	0.001844(2.4734)	0.238836(1.8604)
dlsr(-2)	0.009406(1.954)	-0.03222(-0.215)	-0.001582(10.765)	0.013497(0.1806)	0.002334(0.6352)	-0.021380(-0.1738)
dlsr(-3)	0.001208(1.884)	-0.01172(-0.575)	-0.003622(7.115)	0.022275(0. 8776)	0.011375(2.052)	-0.012633(-0.2453)
dlop(-1)	0.015738(2.3338)	-0.07309(-0.3355)	0.001741(2.0352)	0.068126(1.9888)	-0.001557(-0.4902)	0.131689(2.2116)
dlop(-2)	-0.02807(-4.0515)	-0.04881(-2.2249)	-0.000746(-2.3557)	-0.191293(-2.6967)	0.004737(1.3862)	-0.080023(-0.7108)
dlop(-3)	-0.00658(-0.9025)	0.40431(1.8087)	0.000298(-1.0434)	-0.144265(-2.0262)	-0.000487(-0.1615)	-0.194447(-1.8584)
se	0.001988	0.032292	0.3858	0.023923	0.001792	0.026031

Matrix of Transition Probabilities		Contemporaneous Correlation	Regime 1		Regime 2		Regime 3	
		Variables	dlbc	dlsr	dlbc	dlsr	dbc	dlsr
Pp0	0.6262							
Pp1	0.9032	dlbc	1		1		1	
Pp2	0.8844	dlsr	0.3206	1	0.0462	1	0.2674	1

log-likelihood: 1704.7785 linear system: 1596.6021; AIC criterion: -15.9588 linear system: -15.3717; HQ criterion: -15.5064 linear system: -15.2340; SC criterion: -14.8403 linear system: -15.0313 LR linearity test: 216.3529 Chi(42) =[0.0000] ** Chi(48)=[0.0000] ** DAVIES=[0.0000] **

StdResids: Vector portmanteau(12): Chi(36) = 46.8466 [0.1065] , Vector normality test : Chi(4) = 2.7351 [0.6031] , Vector hetero test: Chi(48) = 61.6074 [0.0897] F(48,530) , Vector hetero-X test: Chi(132)=167.3003 [0.0204] * F(132,450), *PredError:* Vector portmanteau(12): Chi(36) = 94.8802 [0.0000] ** , Vector normality test : Chi(4) = 38.1937 [0.0000] **, Vector hetero test: Chi(48) , = 92.3063 [0.0001] ** F(48,530) PredError: Vector hetero-X test: Chi(132) =208.6341 [0.0000] ** F(132,450).
VAR Error: Vector portmanteau(12): Chi(36) = 82.5645 [0.0000] ** , Vector normality test : Chi(4) = 62.5719 [0.0000] **, Vector hetero test: Chi(48) =117.4571 [0.0000] ** F(48,530), Vector hetero-X test: Chi(132) =274.9059 [0.0000] ** F(132,450)

Table 5. MSIAH(3)-VARX(3) Model for India.

	Regime 1		Regime 2		Regime 3	
Variables	dlbc	dlsr	dlbc	dlsr	dlbc	dlsr
c	-0.000019(-0.2573)	-0.042428(-4.4091)	-0.000007(-0.7286)	0.005250(2.7354)	0.000229(4.5667)	0.025038(4.8947)
dlbc(-1)	2.229636(17.6746)	27.025355(4.6861416)	2.082449(3.57163)	2.486088(11.022)	1.407974(2.14505)	4.69911(6.734)
dlbc(-2)	-2.334248(-10.2439)	-0.75331602(-12.809)	-1.744459(-1.81504)	-0.226998(-0.1688)	-1.054091(-11.0979)	-0.889873(-8.911)
dlbc(-3)	1.067992(6.0964)	0.41193782(8.588)	0.566004(10.9922)	-2.693326(-1.9628)	0.353757(6.5266)	4.17073(3.9634)
dlsr(-1)	0.003435(3.2816)	-0.287668(-1.5116)	-0.000297(-0.9327)	-0.043902(-0.5821)	0.002970(3.0566)	-0.090878(-0.7677)
dlsr(-2)	0.001203(0.9835)	-0.660432(-3.1621)	0.000147(2.4732)	-0.065353(-0.8764)	0.000221(0.1741)	0.490987(3.0971)
dlsr(-3)	0.003515(3.0228)	-0.373903(-1.7914)	0.000433(1.4188)	0.134859(1.8246)	0.004276(4.4171)	-0.313602(-2.3142)
dlop(-1)	0.000135(2.1155)	0.291169(2.3836)	0.000158(1.7083)	-0.024006(-0.4396)	0.004655(4.7678)	-0.094720(-0.7823)
dlop(-2)	-0.001189(-0.9314)	0.102625(0.5406)	0.000196(0.8845)	0.013128(2.2398)	-0.000310(-0.3428)	0.023387(2.1973)
dlop(-3)	0.001745(2.5507)	0.310009(2.1536)	0.0014486(1.883)	-0.041236(-0.4685)	0.045361(4.7811)	-0.092117(-1.7887)
se	0.000179	0.035289	0.000093	0.022828	0.000131	0.017039

Matrix of Transition Probabilities		Contemporaneous Correlation	Regime 1		Regime 2		Regime 3	
Pp0	0.8698	Variables	dlbc	dlsr	dlbc	dlsr	dlbc	dlsr
Pp1	0.9793	dlbc	1		1		1	
Pp2	0.8104	dsr	0.5121	1	0.1052	1	0.7648	1

log-likelihood: 2054.3273 linear system: 1950.5208; AIC criterion: -19.3690 linear system: -18.8246; HQ criterion: -18.9166 linear system: -18.6869; SC criterion: -18.2506 linear system: -18.4842 LR linearity test: 207.6130 Chi(42) =[0.0000] ** Chi(48)=[0.0000] ** DAVIES=[0.0000]**

StdResids: Vector portmanteau(12): Chi(36) = 62.5281 [0.0040]**, Vector normality test: Chi(4)=7.2953 [0.1211], Vector hetero test: Chi(48)=39.6083 [0.8004] F(48,530), Vector hetero-X test: Chi(132) =126.1108 [0.6281] F(132,450) *PredError:* Vector portmanteau(12): Chi(36) = 81.6130 [0.0000]**, Vector normality test: Chi(4) = 20.2064 [0.0005] **, Vector hetero test: Chi(48) =120.9946 [0.0000]** F(48,530), Vector hetero-X test: Chi(132)=272.7212 [0.0000] ** F(132,450)

VAR Error: Vector portmanteau(12): Chi(36) = 85.8260 [0.0000]**, Vector normality test: Chi(4) = 45.6596 [0.0000]**, Vector hetero test: Chi(48) =152.0039 [0.0000]** F(48,530), Vector hetero-X test: Chi(132) =338.4949 [0.0000]** F(132,450)

Table 6. MSIA(3)-VARX(3) Model for Russia.

Variables	Regime 1 dlbc	 dlsr	Regime 2 dlbc	 dlsr	Regime 3 dlbc	 dlsr
c	-0.001297 (-4.3162)	-0.088656(-6.7326)	-0.000038(*-0.5799*)	0.003599(1.1972)	0.000044(0.5001)	0.018201(3.9975)
dlbc(-1)	-0.146022(-0.2926)	2.605803(1.8271)	1.097910(*12.3636*)	-0.168417(-0.0422)	1.136220(9.7254)	-1.5495236(-2.825)
dlbc(-2)	0.216201(0.4735)	-6.455709(-3.5553)	-0.734922(*-6.0578*)	-6.408451(-1.1427)	-0.318614(-1.8104)	2.707893(2.8501)
dlbc(-3)	-0.246033(-0.8717)	2.155987(1.8535)	0.242846(*2.5578*)	2.830235(0.7189)	-0.071881(-0.7243)	-1.2616269(-2.8029)
dlsr(-1)	0.008439(1.7201)	-0.380105(-1.7624)	-0.000832(*-0.3839*)	-0.157830(-1.685)	0.001856(0.9504)	0.015165(0.1671)
dlsr(-2)	0.012563(2.915)	-0.068682(-0.3602)	-0.001797(*-0.8602*)	-0.113603(-1.2302)	0.000527(0.2886)	0.093232(1.1347)
dlsr(-3)	0.018431(3.497)	-0.11385(-0.5185)	-0.001532(*-0.8004*)	0.277036(2.8601)	0.002023(1.199)	-0.245226(-3.0971)
dlop(-1)	0.036943(2.8399)	0.336683(0.8042)	0.003365(*1.2948*)	0.342113(3.7902)	0.001784(0.7007)	0.445668(4.3061)
dlop(-2)	-0.001151(-0.1058)	1.250838(2.8225)	0.000593(*0.2742*)	0.282696(2.9619)	0.001838(0.8112)	-0.287767(-2.7525)
dlop(-3)	0.01143(2.1919)	0.38773(0.44427)	0.010768(*1.4448*)	0.55233(2.0211)	0.011568(0.5963)	0. 56113(4.5251)
se	*0.000611*	0.02731	0.000611	0.027310	0.000611	0.027310
Matrix of Transition Probabilities		Contemporaneous Correlation	Regime 1		Regime 2	Regime 3
		Variables	dlbc	dlsr	dlbc dlsr	dlbc dlsr
Pp0	0.6492					
Pp1	0.9125	dlbc	1		1	1
Pp2	0.6854	dlsr	-0.5013	1	0.1492 1	0.5917 1

log-likelihood: 2070.0258 linear system: 1975.0766; AIC criterion: -19.0832 linear system: -18.9178; HQ criterion : -18.3357 linear system: -18.6818 SC criterion: -17.2353 linear system: -18.3343; LR linearity test: 189.8984 Chi(72) =[0.0000]** Chi(78)=[0.0000]** DAVIES=[0.0000]**. StdResids: Vector portmanteau(12): Chi(81) =103.2590 [0.0483]*, Vector normality test: Chi(6)=9.1410 [0.1658], Vector hetero test: Chi(108)=94.7195 [0.8153] F(108,992), StdResids: Vector hetero-X test: Chi(324)=317.9332 [0.5846] F(324,820), *PredError:* Vector portmanteau(12): Chi(81) =100.9987 [0.0656] , Vector normality test : Chi(6) = 39.6366 [0.0000] ** , Vector hetero test: Chi(108) =164.1054 [0.0004] ** F(108,992) , Vector hetero-X test: Chi(324),=469.4786 [0.0000]** F(324,820), *VAR Error:* Vector portmanteau(12): Chi(81)= 95.2465 [0.1332], Vector normality test: Chi(6)= 41.0304 [0.0000]**, Vector hetero test: Chi(108) =144.5896 [0.0108]* F(108,992), Vector hetero-X test: Chi(324)=433.3302 [0.0000] ** F(324,820)

4.3. *Traditional and MS-Causality Results*

In this section, it will be compared the potential similarities and differences of causality results determined by two different methods because the determination of the direction of causality offers important visions about the policy suggestions. The traditional linear Granger causality results are exhibited in Table 7.

According to the test results in Table 7, there is an unidirectional causality from oil price to stock return in China but an unidirectional causality from stock return to oil price in Russia and India. According to the traditional Granger Causality results, there is an unidirectional causality from innovations of business confidence index to oil price in the selected countries.

Table 7. Traditional Granger causality results for China, India and the Russia.

	China		
	Δ lop→ Δ lsr Δ lsr → Δ lop	Δ lbc→ Δ lsr Δ lsr→ Δ lbc	Δ lop→ Δ bc Δ bci→ Δ lop
F stat.	7.31 1.79	13.82 1.97	0.785 7.511
Direction of causality	dlop→dlsr	dlbc→ dlsr	dlbc→dlop
	India		
F stat.	0.6625 8.0495	7.12 2.288	0.607 7.699
Direction of causality	dlsr →dlop	dlbc↔dlsr	dlbc→dlop
	Russia		
F stat.	0.308 15.47	2.97 2.86	0.604 11.4784
Direction of causality	dlsr →dlop	dlbc↔dlsr	dlbc→dlop

The results of an unidirectional causality from innovations of business confidence index to oil price in all countries and unidirectional causality from stock return to oil price in Russia and India is unexpected ones. Russia is an important oil exporter but it is not the sole country that has influence on the price determining process. Moreover, India has not any effects on oil price.

The MS-Granger causality test results are exhibited in Table 8 for China, India and Russia. For China, the MS-GC results were found as the evidence of unidirectional causality from stock return to business confidence index and from oil price to stock return in all regimes. Besides, there is an unidirectional causality from oil price to confidence index in regimes 1 and 2.

For India, the MS-GC results found the evidence of bidirectional causality between confidence index and stock return in all regimes. The findings of MS-GC for India indicated that there is an unidirectional causality from oil price to stock return, and oil price to confidence index in all regimes.

According to the Table 8, it is said that there is an unidirectional causality from oil price to stock return in all regimes for China, India and Russia. Besides, there is the evidence of an unidirectional causality from oil price to confidence index in all regimes in India, in Regime 1 and 2 in China, and in regime 1 in Russian, but the evidence of none causality in Regime 2 and 3 in Russia and in regime 3 in China.

Table 8. MS-Granger causality results for China, India and the Russia.

	Regime 1	Regime 2	Regime 3
China			
Direction of causality	dlsr→ dlbc	dlsr→ dlbc	dlsr→ dlbc
Direction of causality	dlop→dlbc	dlop→dlbc	dlop ≠ dlbc
Direction of causality	dlop→dlsr	dlop→dlsr	dlop→dlsr
India			
Direction of causality	dlbc↔dlsr	dlbc↔dlsr	dlbc↔dlsr
Direction of causality	dlop→dlbc	dlop→dlbc	dlop→dlbc
Direction of causality	dlop→dlsr	dlop→dlsr	dlop→dlsr
Russia			
Direction of causality	dlbc↔dlsr	dlbc ≠ dlsr	dlbc→ dlsr
Direction of causality	dlop→dlbc	dlop ≠ dlbc	dlop ≠ dlbc
Direction of causality	dlop→dlsr	dlop→dlsr	dlop→dlsr

The results of unidirectional causality from oil price to stock return in all countries are similar to Ding et al (2017) and Qadan and Nama (2018)'s one.

5. The macroeconomic policy results

There are unidirectional causality from oil price to confidence index in regime 1 and regime 2 in China, in all regimes in India, and only in regime 1 in Russia. On the other side, there is an unidirectional causality from oil price to stock returns for China, India and Russia in all regimes. According to our results, changes in oil prices significantly affect business confidence index and stock return, although one way causality from oil price to confidence index is only valid in regime 1 in Russia. The changes in oil prices have a real impact on the economy over the confidence index and on inventory turnover for all of the analyzed countries.

In India, the bidirectional causality between the business confidence index and stock return is also valid in the three regimes, but for Russia, bidirectional causality is valid only in the first regime. Moreover, for Russia, there is a none causality between business confidence and stock return in the second regime and the unidirectional causality from business confidence index to stock return in regime 3. In Russia, the different policies were applied for different regimes. There is the evidence of undirectional causality from stock return to business confidence in all regimes for China; there is the evidence of a bidirectional relation between business confidence to stock return for India. The traditional causality has determined that the bi-directional causality between business confidence index and stock return in India and Russia, and unidirectional causality from business confidence index to stock return in China.

The different empirical results may be explained by the three different factors. The first of them is that the countries' oil necessitates differ from each other. The other reason is that the countries differentiate from each other by their oil demand. For instance, China and India are the largest oil consumer in the world and their oil demand is more than the rest of the world. The last one is that, by having a diversified business confidence index, the countries vary with oil demand.

6. Conclusions

The main aim of this study is to analyze the relation among oil price, business confidence and stock return. The findings verify that business confidence has a prominent role in determining structures of stock returns and oil prices for the analyzed countries.

On the other hand, the common feature of the analyzed countries is that the change in oil prices has a real effect on inventory turnover in China, India and Russia which is a remarkable point for investors. Additionally, according to the emprical findings of the study, the policy makers of China, India and Russia should carefully analyze the impact of oil prices on the countries' macroeconomic variables. Further, traditional method findings instead of MS-Granger Causality model may cause to the wrong policy applications. Thus, the analysis results of MS-Granger Causality for the three countries and the policy recommendations based on these results should be taken into consideration. It is important to use the MS Causality method to provide more accurate policy recommendations at this point.

Conflict of interest

All authors declare no conflicts of interest in this paper.

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