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Asymmetric Causality Relationship between Oil Prices and Inflation in BRIC Countries

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ABSTRACT

Sharp and persistent increases in oil prices continue to attract the attention of policy makers and economists, and many studies are conducted on the inflationary effects of oil price shocks. Knowledge of the inflationary effects of oil price increases will help monetary authorities adopt appropriate policies to meet these shocks. In this study, the asymmetric relationship between inflation rates and oil prices in the BRIC countries, which alone consumes approximately 28% of the world's total oil consumption in 2020, has been examined. In this context, the relationship between the variables was investigated with the asymmetric causality analysis method developed by Hatemi-J and Roca (2014) using monthly data for the period January 2001 to September 2021. As a result of the analysis applied in the study, different results were obtained for the BRIC countries.

Keywords: Asymmetric Causality Relationship, BRIC Countries, Inflation, Oil Prices
JEL Classifications: C23, G15, Q40

1. INTRODUCTION

Oil is one of the most important energy sources for all countries in the world. Oil has the power to affect all export and import balances at the global level (Syzdykova, 2018a; 2018b). Energy use is one of the important factors affecting economic growth. On the other hand, the increase in oil prices, which is one of the main inputs of energy and economies, causes an increase in input costs in oil importing countries and a deterioration in the balance of payments. With the increase in costs, inflation rates increase and economic growth slows down (Ahmad, 2013). Conversely, oil producing and exporting countries can increase their growth rates by being positively affected by the increase in oil prices, as they will increase their incomes (Azretbergenova and Syzdykova, 2020). The effect of oil prices on inflation is not actually a direct effect. The importance of this effect is due to the high tax on fuel products. Especially in periods of economic recession and high unemployment, governments can prevent the reflection of increases in oil prices on domestic inflation by reducing taxes on fuel. For this reason, the use of energy resources and the energy policies to be implemented are of vital importance for countries. Today, OECD countries are the leading countries in energy production and consumption, while rapidly growing and developing BRIC countries are partners in this consumption.

BRIC countries are among the countries whose economies are growing and developing rapidly. The common features of these countries are that they have a wide geography in the world, large population and very rich underground resources. BRIC countries have 25% of the world's surface area, 40% of foreign currency and gold reserves, 41% of the world's population and 44% of the workforce (Syzdykova, 2018). The BRIC countries lead the world economy in many respects. In particular, China has become one of the largest economies in the world with its economic performance

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since the early 2000s. In terms of oil production and consumption, these countries direct the global economy and oil prices. In 2020, BRIC countries alone accounted for 28% of the world's total oil consumption. Among these countries, India (5.3%) and China (16.4%) stand out as the countries with the highest consumption shares (BP, 2021). Because these countries are in the position of countries with rapidly changing economic and high population.

Having oil reserves or importing oil significantly due to the country's structure is of great importance for countries in the global economic system. In this study, the selection of BRIC countries is particularly important in this respect. Because these countries have important similarities, but they also have various distinctions. Russia, one of the BRIC countries, is the third largest oil producer after Saudi Arabia and the USA (BP, 2021). On the other hand, the economy of Russia, which is one of the countries that cannot diversify sufficiently in the economy, is very sensitive to oil prices. Brazil is one of the most important countries in Latin America in terms of its oil reserves (11.9 thousand million barrels). In India, oil is the second largest tradable energy source after coal, and more than 70% of its crude oil needs are imported. China seems to be the determinant of world oil prices. India and China have an important place in the ever-increasing need for oil and the formation of oil demand (Kim, 2018). As a result, Russia and Brazil, the world's major oil exporting countries, China and India as important oil importers, have to be closely concerned with changing oil prices. It is important for policy makers to examine the effects of oil price shocks on the macroeconomic factors of countries.

The fluctuations in international oil prices have been caused by different reasons over the years (Dey et al., 2020). Since 1970, four major oil shocks have occurred in the world economy. The first shock came in 1973 when OPEC decided to cut oil supply, oil prices rose from 11.24 USD per barrel in 1972 to 20.18 USD in 1975 (80% increase). The second shock occurred in 1980 due to the Iran-Iraq war, oil prices rose from 19.67 USD to 53.74 USD (173% increase). The third shock occurred 10 years later, due to Iraq's intervention in Kuwait, and oil prices rose from 16.62 USD to 24.55 USD (48% increase). The fourth shock occurred as a result of the USA-Iraq war in 1999–2000 and the increase in geopolitical tension in the Middle East; Oil prices rose from 11.27 USD in 1998 to 15.90 USD and in 2000 to 26.72 USD. The price of Brent oil, which was 25–30 USD per barrel in the early 2000s, and the increase in demand due to the growth in the global economy after 2002 led to a rapid increase in oil prices. This upward trend continued until the 2008 crisis. In this period, the price of oil per barrel increased up to 132 USD (Figure 1). Then, right after the global crisis in the world, oil prices dropped sharply and fell to 39.9 USD in December 2008. Oil prices, which rose again in 2010–2014, in the fourth quarter of 2014, global oil prices again dropped sharply and have remained low since then. The energy market has also been affected by the radical changes experienced by the COVID-19 pandemic. Comprehensive measures implemented due to the global epidemic triggered an unprecedented collapse in oil demand in March 2020. On the other hand, oil stocks increased, creating a downward pressure on prices. Therefore, as of 2020, demand-driven collapses have occurred in oil prices (Jia et al., 2021).

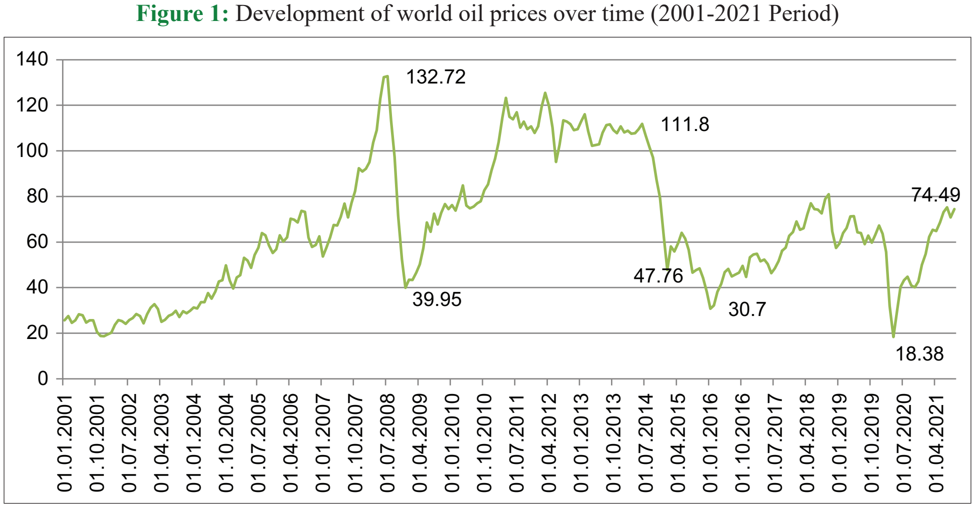
In this study, the relationship between international oil prices and inflation rates in BRIC countries is examined. It has been extensively studied in the literature that positive and negative shocks in oil prices have different effects on the economy. For this reason, the effects of positive and negative oil price shocks on the inflation rate in BRIC countries were investigated using the asymmetric causality analysis method developed by Hatemi-J and Roca (2014).

The study consists of four parts. In the section following the introduction, the studies in the literature are summarized, and in the third section, the data set and econometric method included in the analysis are explained. In the fourth chapter, the obtained findings are evaluated. The study ended with the conclusion part.

2. LITERATURE REVIEW

Sharp and persistent increases in oil prices have attracted the attention of policy makers and economists, and many studies have been conducted on the inflationary effects of oil price shocks. Although there is no consensus on whether oil shocks cause economic recession, it is one of the generally accepted facts that oil prices at least partially affect inflation. The successive rises

Figure 1: Development of world oil prices over time (2001-2021 Period)



Source: U.S. Energy Information Administration (EIA), 2021. (https://www.eia.gov/)

in inflation indicators, especially following the increases in oil prices in the 1970s, have made the relationship between oil price increases and inflation an important research topic. The moderate course of oil prices in the 1980s removed the current issue from the agenda. However, the rising trend of oil prices, which started in the early 2000s, has made the issue one of the current research topics again. Studies conducted after 2000, examining the relationship between oil price shocks and inflation in the context of oil prices' pass-through to inflation, seem to provide a consensus that the pass-through of oil prices to inflation has decreased over time. Knowledge of the inflationary effects of oil price increases will help monetary authorities adopt appropriate policies to meet these shocks.

LeBlanc and Chinn (2004) examined the transition of changes in oil prices to inflation and determined that increases in oil prices in the USA, Japan and European countries affect inflation. De Gregorio et al. (2007) examined the inflationary effects of oil prices for thirty-four developed and developing countries with the VAR method and found that this effect was low. Blanchard and Gali (2007) investigated the effects of oil shocks on inflation and economy in different periods, before 1983 and after 1984, using the data of six industrialized countries, using the VAR method. According to empirical evidence, the dynamic impact of oil shocks has decreased significantly.

In contrast, Jacquinot et al. (2009) investigated the effect of oil prices on inflation in the Eurozone with the Dynamic stochastic general equilibrium (DGSE) model. Within the scope of the research, the inflationary effects of oil prices in the short and medium terms were pointed out. According to the results, it has been determined that the changes in oil prices are more effective for the short term. Ito (2012) analyzed the effects of oil prices on inflation, real effective exchange rate and real GDP in Russia for the period 1995:Q1-2009:Q3 using the VAR model. According to the findings, it has been determined that a 1% change (increase and decrease) in oil prices causes a change of 0.44% in real GDP. In the short term, it has been determined that rising oil prices have a negative effect on inflation and a positive effect on economic growth. In addition, it is concluded that oil prices cause an increase in the real effective exchange rate. Cavalcanti and Jalles (2013) examined the effects of oil prices on growth and inflation in the 1975–2008 period in Brazil and the USA. As a result, oil prices in the USA are negative on growth; It has been concluded that it has positive effects on inflation and these effects decrease over time. Bass (2019) investigated the relationship between oil prices (Brent), exchange rate and consumption price index for Russia based on the data for the period 2010–2017 with the VEC model. According to the results of the research, it has been found that oil prices, exchange rate and consumer inflation in Russia are cointegrated in the long run, and there are significant relationships between the variables in the short run. Sultan et al. (2020) investigated with the Johansen cointegration method whether the changes in oil prices in India for the period from 1970 to 2017 affect the inflation level in the country. They found that the oil price in India affects the inflation level both in the short run and the long run. In addition, the authors argue that the government should encourage the development of alternative energy source and technology to save energy use.

Many studies confirm that the transmission of global crude oil prices to domestic prices is asymmetrical and non-linear, and that the impact of rising and falling global crude oil prices on domestic prices is different. First, Mork (1989) identified the asymmetric and nonlinear responses of inflation to oil price changes in the USA. Later, Hamilton and Herrera (2004) found similar results and determined that there were nonlinear and asymmetrical relationships between oil prices and US inflation. Kilian (2008) stated that the inflationary effect of exogenous oil price shocks for G7 countries was quite low, and even that the effect was negligible in the 2002–2003 period. He stated that the effect of the shock is even less when the GDP deflator is used instead of the consumer price index. In addition, the authors made two caveats for researchers who want to work on this issue. First, it should be noted that there is a non-linear relationship between oil prices and macroeconomic variables. The other stated that although geopolitical risks cause the oil price to increase, these shocks will not cause oil shortages. He stated that it should be noted that geopolitical risks create temporary panic and cause oil prices to increase.

Zhao et al. (2016) examined the effects of oil price shocks on output and inflation in China using the DGSE model. They determined that oil supply shocks as a result of political events have short-term effects on output and inflation, while the effects of other shocks are seen in the long-term. Choi et al. (2018) analyzed the effects of fluctuations in world oil prices on domestic inflation using the data of 72 developed and developing countries in the period 1970–2015. According to the results of the analysis, 10% increase in global oil prices increases domestic inflation rates by 0.4% on average, and this effect ends at the end of 2 years. They also determined that the effect is asymmetrical and the effect of positive oil price shocks is greater than negative ones. Using ARDL and NARDL models, Long and Liang (2018) determined that the transmission of changes in oil prices to China's producer and consumer price indices is asymmetric in the long run, and the effect of oil price increases is greater than the effect of the decrease. Chen et al. (2020) in their study for China, oil shocks; They divided them into four groups: oil supply shocks, global demand shocks, domestic demand shocks and oil-specific demand shocks. Using monthly data from January 1999 to December 2016, they analyzed the time-varying effects of these oil price shocks on inflation during China's import, production and consumption phases. He argues that the effects of oil shocks on China's inflation differ at each stage. While the increase in oil prices caused by oil-specific demand shocks was the most important cause of Chinese inflation in import and production stages during the entire sampling period, China's consumption inflation is largely affected by domestic demand shocks. In addition, the authors argue that the inflationary effects of oil price shocks have weakened significantly since the international financial crisis compared to the pre-crisis. A summary of empirical studies on the subject is given in Table 1.

3. DATASET AND METHOD

3.1. Data

In this study, the asymmetric causality relationship between global oil prices and inflation rates for BRIC countries was analyzed using

Table 1: Studies on the effect of oil prices on inflation

Author	Country/Country group	Method	Result
Volkov and Yuhn (2016)	Russia, Brazil, Mexico and Norway	Toda and Yamamoto	There is a relationship dec the exchange rate, inflation and oil prices. The change in one of them affects all of them
Trang and Hong (2017)	USA and OECD	VAR Model	The increase in oil prices leads to an increase in inflation rates. However, it also reveals unemployment and budget deficits in developing countries
Choi et al., (2018)	Developed and Developing Countries	Literature Review	The increase in the global oil price is increasing inflation rates. Inflation, on the other hand, should be controlled by monetary policy instruments
Hammoudeh and Reboredo (2018)	USA	ARDL (Auto Regressive Distributed Lag) Regression Model	Oil prices positively affect inflation expectations. Changes in oil prices shape inflation expectations
Meo et al., (2018)	Pakistan	Non-Linear ARDL Model	Changes in oil prices affect inflation rates. Depending on this issue, the tourism sector is also adversely affected
Nasir et al., (2018)	BRICS	TV-SVA	Each nation reacted in various ways in regards to the link between oil price and inflation prices
Kartaev and Medvedev (2019)	11 developed and 27 developing countries	Dynamic Panel Model	There is a relationship between oil prices and inflation. This relationship can be controlled by monetary policy
Istiak and Alam (2019)	USA	VAR Model and Survey Method	Expectations in oil prices affect inflation rates
Cerra (2019)	Venezuela	General Equilibrium model	Inflation rates increase when oil revenues decrease. Devaluations reduce inflation rates
Wen et al., (2021)	G7 countries	SVAR	The biggest impact of oil price shocks is on US inflation. Each country's response to oil price shocks is different. The impact of supply shocks before the financial crisis is very strong. The impact of demand shocks increases sharply during the financial crisis
Oloko et al., (2021)	top ten (10) oil-exporting and oil-importing countries	Fractional cointegration vector autoregressive (FCVAR) approach	The results show that the persistence of oil-exporting and oil-importing countries in inflation rates did not increase due to oil price shocks

Source: Created by the authors

monthly data from January 2001 to September 2021. Global oil prices are taken into account as Brent type. Data on oil prices have been obtained from the US Energy Information Administration. Inflation data for the countries (2010 = 100) were obtained from the International Bank of Settlements database. Table 2 includes some descriptive statistics of the variables.

According to the results of Table 2, the average price of Brent oil in the period included in the analysis is 65 dollars, the highest price is 132 dollars and the lowest price is 18 dollars. The date of the lowest price is the price decrease due to the Covid-19 pandemic. In addition, it is seen that the oil price is skewed and oblique to the right. When the inflation rates of the BRIC countries (2010 = 100) are evaluated, we see that China is the most stable country in terms of inflation compared to other countries. Compared to 2010, the highest and lowest levels of the inflation rate are seen in Russia. Therefore, the country with the highest standard error indicator of the variable is Russia. This means that inflation rates in Russia have a wide range; Inflation series in other BRIC countries have low standard deviations compared to Russia. The highest level of the inflation rate corresponds to September 2021 and the lowest level to January 2001. The inflation rate in Brazil is 113% on average compared to 2010, and it is seen that the price increase in this country is higher than the price increase in other BRIC countries except China.

Table 3 shows the correlation relationship of the variables. Accordingly, there is a positive and low correlation between oil prices and inflation rates in BRIC countries. The correlation between inflation rates and oil price in Russia and Brazil, which are oil exporters, is lower than the correlation coefficients found for oil importers, China and India.

Table 2: Descriptive statistics of variables

	Brazil	Russia	India	China	Op
Mean	113.0279	111.3034	112.6564	103.7812	65.30554
Median	106.4240	108.5708	109.1232	104.9242	62.47000
Maximum	190.8563	201.2713	185.7763	131.0416	132.7200
Minimum	54.36082	34.41660	61.20725	79.71273	18.38000
Std. Dev.	38.08171	50.23136	38.06702	15.96217	28.89955
Skewness	0.303686	0.167307	0.253953	0.017926	0.393388
Kurtosis	1.840077	1.691070	1.705376	1.655060	2.192729
Jarque-Bera	17.78611	18.93711	20.06545	18.78030	13.18355
Probability	0.000137	0.000077	0.000044	0.000084	0.001372
Observations	249	249	249	249	249

Table 3: Correlation matrix of variables

	Brazıil	Russia	India	China	Op
Op	0.1837	0.2128	0.2202	0.3059	1

3.2. Method

In the study, the asymmetric causality analysis method developed by Hatemi-J and Roca (2014) is used on the idea that the effects of positive and negative shocks experienced in variables may be different from each other. There are three important elements in the method developed by Granger and Yoon (2002) on the idea that positive and negative shocks can be different from the relationship between the variables: Determining the lag length in the created

VAR model, determining the number of additional delays to be added to the model, and determining the critical values for the Wald test statistic. The results obtained from the analysis help to understand the dynamics of the series. Thus, it is aimed to find the hidden structure that will allow to develop predictions for the possible future.

The basis of the asymmetric causality test is to determine whether the causality relationships vary in the presence of different shock types. This process unfolds as follow:

P_{1t} and P_{2t} being two co-integrated variables (Hatemi-J and Roca, 2014: 7)

$$P_{1t} = P_{1t-1} + \varepsilon_{1t} = P_{1,0} + \sum_{i=1}^{t} \varepsilon_{1i}^{+} \quad (1)$$

$$P_{2t} = P_{2t-1} + \varepsilon_{2t} = P_{2,0} + \sum_{i=1}^{t} \varepsilon_{2i}^{+} \quad (2)$$

t is $t = 1,2,\ldots T$; $P_{1,0}$ and $P_{2,0}$ the constant terms are ε_{1i} and ε_{2i} $iid(0, \delta^2)$. Positive and negative changes in each variable, respectively $\varepsilon_{1i}^{+} = \max(\varepsilon_{1i}, 0)$, $\varepsilon_{2i}^{+} = \max(\varepsilon_{2i}, 0)$; $\varepsilon_{1i}^{-} = \min(\varepsilon_{1i}, 0)$ and $\varepsilon_{2i}^{-} = \min(\varepsilon_{2i}, 0)$ will be. The results are estimated as follows: $\varepsilon_{1i}^{+} = \varepsilon_{1i}^{+} + \varepsilon_{1i}^{-}$ ve $\varepsilon_{2i}^{+} = \varepsilon_{2i}^{+} + \varepsilon_{2i}^{-}$. Thereby

$$P_{1t} = P_{1t-1} + \varepsilon_{1t} = P_{1,0} + \sum_{i=1}^{t} \varepsilon_{1i}^{+} + \sum_{i=1}^{t} \varepsilon_{1i}^{-} \quad (3)$$

$$P_{2t} = P_{2t-1} + \varepsilon_{2t} = P_{2,0} + \sum_{i=1}^{t} \varepsilon_{2i}^{+} + \sum_{i=1}^{t} \varepsilon_{2i}^{-} \quad (4)$$

The sum of the positive and negative shocks in each variable is $P_{1t}^{+} = \sum_{i=1}^{t} \varepsilon_{1t}^{+}$, $P_{1t}^{-} = \sum_{i=1}^{t} \varepsilon_{1t}^{-}$, $P_{2t}^{+} = \sum_{2t}^{t} \varepsilon_{2t}^{+}$, $P_{2t}^{-} = \sum_{2t}^{t} \varepsilon_{2t}^{-}$ respectively. The vector $P_t^{+} = (P_{1t}^{+}, P_{2t}^{+})$ is used to test the causality relationship between positive shocks. In a VAR (L) model with k delay, the vector is defined as shown below.

$$P_t^{+} = v + A_1 P_{t-1}^{+} + A_2 P_{t-2}^{+} \ldots + A_L P_{t-k}^{+} + u_t^{+}$$

In the above equation, v is the vector of constant variables of dimension 2×1. u_t^{+} is a vector of error terms that occurs when positive shocks with a size of 2×1 occur. A_r is a 2×2 parameter matrix and $r = 1,2,\ldots,k$. The optimal delay length is defined by the test statistics developed by Hatemi-J (2003; 2008).

$$HJC = In\left(\left|\bar{\Omega}_f\right|\right) + k2T^{-1}(m^2 InT + 2mIn(InT))$$

$\left|\hat{\Omega}_f\right|$ the error terms for each k-length delay length show the covariance matrix. m shows the number of equations in the VAR model, and T is the number of samples (Hatemi-J and Roca, 2014:9). The null hypothesis is that the matrix A_r is k. column and j. is defined as the line being equal to zero. For detailed Wald statistics, Lütkepohl (2005) can be examined. If the test statistics are greater than the critical values, the null hypothesis that there is no causality is rejected.

3.3. Analysis Results

The data to be used in time series analysis must first be stationary. The raw data of time series are generally not stationary and the use of non-stationary series in econometric models causes some problems. In the analysis part, the stationarity of the series was investigated with Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) unit root tests and the results are shown in Table 4. The optimal number of lags in unit root tests was determined according to the Akaike information criterion.

According to the results in Table 4, according to the ADF and PP tests, the oil prices variable has a unit root in the level value both with and without a trend. When the first order difference of the variable is taken, it becomes stationary when both ADF and PP tests are applied. It was found that the inflation rates calculated for all BRIC countries have a unit root at the 5% significance level. If the ADF test is applied with a trend to the inflation series calculated for China, the 1st order difference also includes a unit root. According to the PP test result, the inflation series in China is stationary when the 1st rank difference is taken. As a result, oil prices and inflation series of BRIC countries do not have a unit root in the 1st order difference.

After applying the unit root test to the series, the asymmetric causality test developed by Hatemi-J and Roca (2014) was conducted using the optimal lag length obtained from the VAR model. As a result of the stationarity analysis, since the series were not stationary at the level, the maximum degree of integration was considered as one in all causality tests. The causality test results for Brazil are presented in Table 5. Accordingly, the null hypothesis of asymmetric causality test results stating that there is no causality relationship between oil prices and inflation could not be rejected. This result shows that oil prices and oil price shocks in Brazil are not directly related to inflation in the period under consideration.

According to the causality results for Russia in Table 6, it is seen that Brent oil prices are the Granger cause of inflation. The causality relationship exists from negative oil price shocks to positive inflation shocks, but the same situation is not seen in positive oil price shocks. This gives the conclusion that the change in oil prices only affects the inflation rate in case of decrease, but does not affect the rate of increase.

According to the causality test results for India in Table 7, there is a 90% confidence level of causality from positive oil shocks to positive inflation shocks. There is no causality running from negative oil price shocks to inflation shocks.

China is the world's largest oil consumer after the USA, and imports a significant portion of the oil it consumes. Therefore, theoretically, changes in oil prices are expected to affect inflation

Table 4: Results of unit root tests

Variables	Deterministic components	ADF		Philips Perron	
		Level	1^{st} difference	Level	1^{st} difference
Op	Intercept	–2.597180	–10.47756	–2.137374	–9.994405
		[–2.873045]	[–2.873045]	[–2.872998]	[–2.873045]
	Trend and intercept	–2.609762	–10.46270	–2.083180	–9.968708
		[–3.428123]	[–3.428123]	[–3.428049]	[–3.428123]
Brazil	Intercept	2.547099	–7.205808	2.687082	–7.324429
		[–2.873045]	[–2.873045]	[–2.872998]	[–2.873045]
	Trend and intercept	0.042855	–7.715626	–0.148420	–7.867539
		[–3.428123]	[–3.428123]	[–3.428049]	[–3.428123]
Russia	Intercept	1.178816	–7.409253	1.296286	–6.900545
		[–2.873093]	[–2.873093]	[–2.872998]	[–2.873045]
	Trend and intercept	–2.419977	–7.554676	–1.960023	–7.002962
		[–3.428123]	[–3.428198]	[–3.428049]	[–3.428123]
India	Intercept	2.973137	–8.579817	2.361258	–10.73996
		[–2.873289]	[–2.873289]	[–2.872998]	[–2.873045]
	Trend and intercept	–2.361842	–9.372239	–2.222736	–10.98320
		[–3.428503]	[–3.428503]	[–3.428049]	[–3.428123]
China	Intercept	–0.631058	–3.079724	0.314437	–11.70297
		[–2.873596]	[–2.873596]	[–2.872998]	[–2.873045]
Op	Trend and intercept	–4.189310	–2.992286	–3.804551	–11.69241
		[–3.428981]	[–3.428981]	[–3.428049]	[–3.428123]

Note: Values in parentheses show Mckinnon critical values at 5%, ADF: Augmented dickey-fuller

Table 5: Asymmetric causality results for Brazil

Direction of causality	MWALD	Bootstrap Critical value (1%)	Bootstrap Critical value (5%)	Bootstrap Critical value (10%)
$oilp^{+} \nrightarrow cpi^{+}$	2.091 (0.509)	9.012	6.013	3.093
$oilp^{+} \nrightarrow cpi^{-}$	1.023 (0.901)	6.592	6.093	3.120
$oilp^{-} \nrightarrow cpi^{-}$	2.027 (0.481)	9.993	6.231	3.015
$oilp^{-} \nrightarrow cpi^{+}$	0.936 (0.487)	8.906	6.012	2.997

Note: The notation□indicates the null hypothesis that there is no causality. The values in parentheses indicate the probability values asymptotoically. The number of bootstrap is 10,000

Table 6: Asymmetric causality results for Russia

Direction of causality	MWALD	Bootstrap Critical value (1%)	Bootstrap Critical value (5%)	Bootstrap Critical value (10%)
$oilp^{+} \nrightarrow cpi^{+}$	3.180 (0.563)	9.234	6.093	2.896
$oilp^{+} \nrightarrow cpi^{-}$	3.401 (0.876)	9.012	6.742	3.001
$oilp^{-} \nrightarrow cpi^{-}$	3.023 (0.129)	11.231	8.036	2.902
$oilp^{-} \nrightarrow cpi^{+}$	6.091** (0.03)	10.003	6.002	3.128

Note: The notation□indicates the null hypothesis that there is no causality. The values in parentheses indicate the probability values asymptotoically. ** indicates the causality relationship between the variables at the 5% significance level. Bootstrap count is 10,000

rates in China. According to the causality results in Table 8, no causality relationship was found from oil price shocks to inflation shocks. According to this result, it can be said that the increase or decrease in inflation rates in China is not caused by oil prices.

4. CONCLUSION

In this study, the asymmetric relationship between Brent oil prices and inflation has been examined within the scope of BRIC

Table 7: Asymmetric causality results for India

Direction of causality	MWALD	Bootstrap Critical value (1%)	Bootstrap Critical value (5%)	Bootstrap Critical value (10%)
$oilp^{+} \nrightarrow cpi^{+}$	7.023*(0.06)	10.003	7.213	4.290
$oilp^{+} \nrightarrow cpi^{-}$	2.003 (0.408)	10.127	7.018	3.024
$oilp^{-} \nrightarrow cpi^{-}$	3.092 (0.652)	11.023	6.563	5.930
$oilp^{-} \nrightarrow cpi^{+}$	0.823 (0.310)	10.902	7.720	6.346

Note: The notation□indicates the null hypothesis that there is no causality. The values in parentheses indicate the probability values asymptotoically. * indicates the causality relationship between the variables at the 10% significance level. Bootstrap count is 10,000

Table 8: Asymmetric causality test results for China

Direction of causality	MWALD	Bootstrap Critical value (1%)	Bootstrap Critical value (5%)	Bootstrap Critical value (10%)
$oilp^{+} \nrightarrow cpi^{+}$	0.902 (0.556)	10.231	7.092	3.678
$oilp^{+} \nrightarrow cpi^{-}$	0.345 (0.897)	10.743	7.005	3.920
$oilp^{-} \nrightarrow cpi^{-}$	4.092 (0.231)	12.389	9.034	6.826
$oilp^{-} \nrightarrow cpi^{+}$	4.098 (0.390)	11.978	8.703	6.037

Note: The notation $\nrightarrow$ indicates the null hypothesis that there is no causality. The values in parentheses indicate the probability values asymptotoically. The number of bootstrap is 10,000

countries. The country group in question has significant differences between oil exporting (Russia and Brazil) and oil importing (China and India) countries. In this context, the increase in oil prices has an impact on the markets, negatively affecting the importing countries in various aspects, and inflation comes first. Since oil exporting countries are positively affected by increasing prices, its impact on macroeconomic indicators including inflation is positive. On the other hand, it is known that oil importing countries struggling with inflation are adversely affected by increasing prices.

As a result of the analysis applied in the study, different results were obtained for the BRIC countries. When the results for Brazil and China are analyzed, no asymmetric causality relationship was found between oil price shocks and inflation shocks in these countries. While there is a causal relationship from negative oil price shocks to positive inflation shocks in Russia, the same situation was not observed in positive oil price shocks. According to the causality test results for India, there is causality from positive oil shocks to positive inflation shocks at the 90% confidence level. There is no causality running from negative oil price shocks to inflation shocks. The results of the study reveal that inflation rates in Brazil and China should be investigated with factors other than oil prices, and pointed out the importance of the effect on inflation for Russia and India. However, it is argued in the literature that the effect of oil prices on macroeconomic variables may change over time. Therefore, the result of the study may not mean that oil prices will never have an effect on inflation rates in Brazil and China, as well as the effect of oil prices on inflation in different time periods for Russia and India. For this reason, the scope of the study can be expanded and investigated with different analysis methods by taking these factors into consideration in future studies.

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