The nexus between the exchange rates and interest rates: evidence from BRIICS economies during the COVID-19 pandemic

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Abstract

Purpose – This paper aims to investigate whether the interest rate differentials Granger cause expected change in the exchange rate during the COVID-19 period. The study examines if the investors in the international assets and exchange rate markets take advantages of the relevant information obtained during the COVID-19 pandemic.

Design/methodology/approach – This paper used daily data ranging from January 31, 2020 to June 30, 2020 and considered BRIICS economies. The study implemented the Toda–Yamamoto's Granger causality approach to identify the causality between interest rate differentials and exchange rates. For robustness checks, the study used ARLD short-run dynamics to infer causal relations.

Findings – Overall, the results indicate that the interest rate differentials improve the predictability of subsequent exchange rate changes in all six BRIICS economies during the COVID-19 period wherein investors are forward-looking. The empirical results pass the robustness checks.

Originality/value – There is a lack of studies exploring the relationship between interest rate differentials and exchange rates in the presence of an unanticipated event such as the current pandemic. To the best of the authors' knowledge, this is the first study to explore the causal linkages between interest rate differentials and expected change in exchange rates, focusing on the COVID-19 outbreak period.

Keywords Uncovered interest rate parity, Granger causality test, Exchange rates, Pandemic, COVID-19

Paper type Research paper

1. Introduction

The coronavirus (COVID-19) pandemic – which started in the capital city of Hubei, Wuhan province – has affected more than 200 countries and territories worldwide. As of 4th December, it has affected more than 65 million people globally, with more than 1.5 million casualties [1]. The current pandemic has resulted in unprecedented disruptions to the World Economy and severely affected top emerging market economies (EMEs) such as BRIICS [2]. The IMF (2020) reports that the COVID-19 pandemic has led to a full-blown economic crisis and could end up far worse than the Global Financial Crisis (GFC) of 2008. One of the first impacts of the pandemic on the foreign exchange market is the drastic depreciation of the currencies of these EMEs against the US dollar

JEL classification – F31, F41, E43, C32

(Figure 1). The depreciation of these currencies can be attributed to the excessive demand for the US dollar due to the fear of global slowdown associated with the pandemic, wherein the global investors shift investment in these countries' currencies to US dollar as safe haven currency (Economist, 2020).

Many countries announced lockdown to prevent the spread of the infection associated with the COVID-19. The lockdown created significant liquidity crunch in these economies and induced the central banks to reduce the interest rate to supplement the liquidity in the market [3], and thus led to reduction in the interbank lending rates (Figure 2). As any reduction in the interest rate differential (between domestic and global) reduces the returns of the global investors who invest in these countries' currencies, demand for foreign currency increases, and thereby domestic currency depreciates. While some of the recent studies have highlighted how changes in interest rate can affect the international financial markets through foreign investment (Prabheesh, 2013; Ahmed and Zlate, 2014), economic activity and business cycle fluctuations (Prabheesh and Vidya, 2018; Padhan and Prabheesh, 2020), and effectiveness of monetary policy transmissions (Shareef and Prabheesh, 2020), the immediate effect is felt in the international exchange rates [4]. As the changes in interest rates by central banks globally during COVID-19 pandemic may have exerted influences on the exchange rates, it is imperative to analyze the link between the interest rates and exchange rates during the present pandemic period. Thus, in this paper, we examine if there exist any causal relations between interest rate differentials and foreign exchange rates.

Our study is motivated by the occurrence of the COVID-19 pandemic, a classic case of an unanticipated event. We test the hypothesis that investors are rational and consider all available information when trading in assets during the pandemic period. Recent studies by Narayan *et al*. (2018) and Sharma *et al*. (2019) find that unanticipated events like shutdowns and terrorism attacks contains valuable information that enhances exchange rate prediction. Along these lines, we test if the investors in the international assets and exchange rate markets takes advantage of the relevant information obtained during the COVID-19 pandemic. It is an important issue since the public health disaster has evolved into a full-blown global economic crisis wherein the investors worldwide have been severely affected by volatility in financial markets.

Our approach to answering the above question is as follows:

- We gathered data on daily interest rates and nominal exchange rates ranging from January 31, 2020 to June 30, 2020.
- We identify the unit root properties of the variables.
- Then, we implement the Granger causality procedure developed by Toda and Yamamoto (TY) (1995).
- Finally, we conduct robustness checks through ARDL short-run dynamics by adopting Wald tests.

Our findings are as follows.

- We find that there is a mix of I(1) and I(0) variables.
- The results indicate that the interest rate differentials cause subsequent movements in the exchange rates of all BRIICS economies.
- The empirical analyses pass the robustness checks.

The results show that in the short-run and during the current COVID-19 crisis period, investors are forward-looking and show rational behavior in their decision-making.
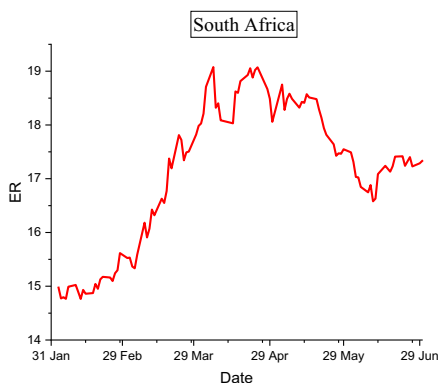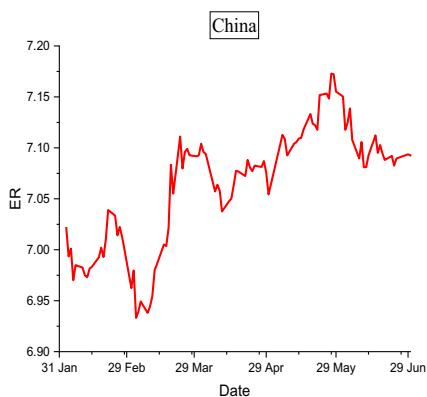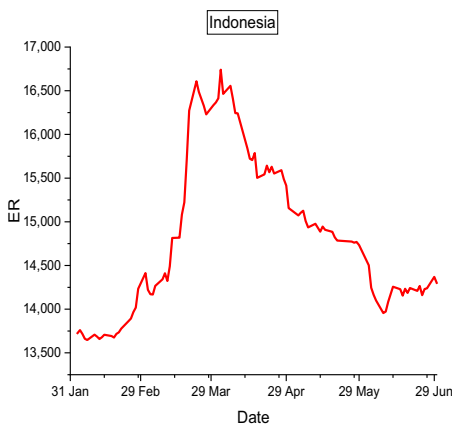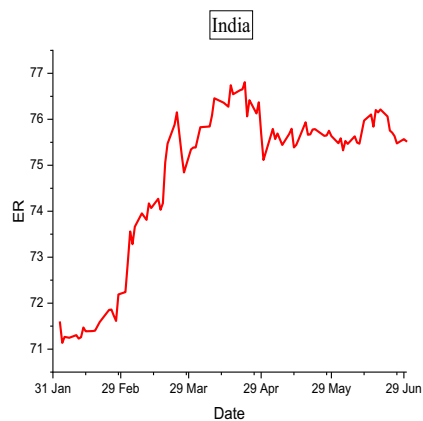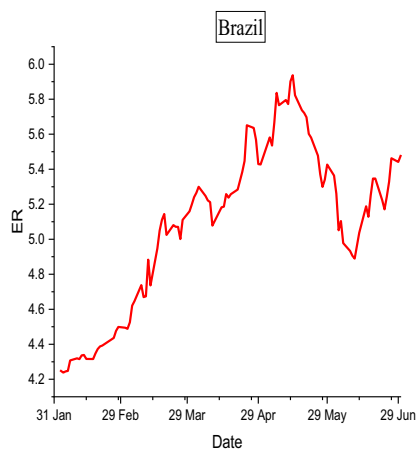
Figure 2.
Plots of daily interest rates

1.1 COVID-19 literature
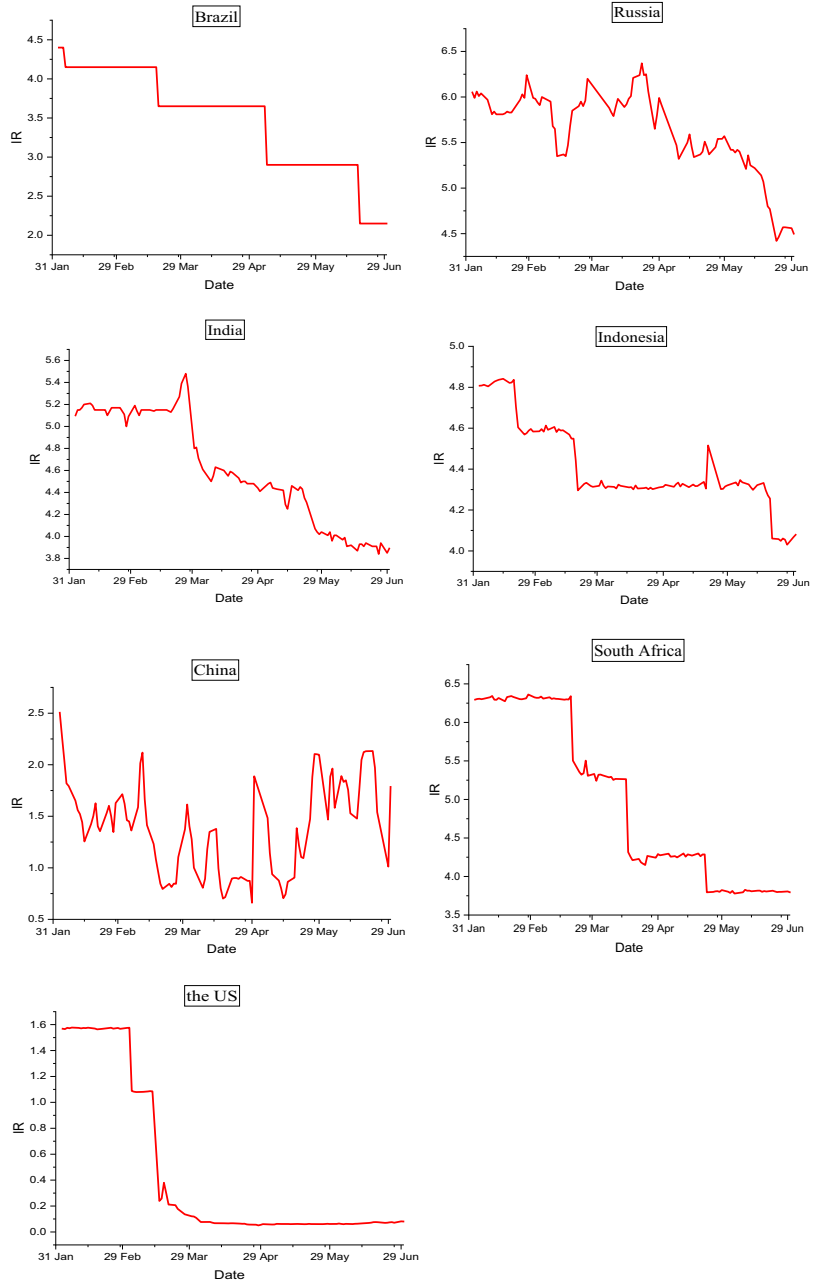It is worth noting that the literature on COVID-19 and its economic impacts can be classified into multiple strands. The rapidly evolving literature has examined the impact of COVID-19 pandemic:

- on foreign exchange market (Devpura, 2020; Iyke 2020a; Narayan, 2020a, 2020b; Narayan *et al.*, 2020a);
- on financial markets (Akhtaruzzaman *et al.*, 2020; Ali *et al.*, 2020; Haroon and Rizvi 2020a, 2020b; Narayan *et al.*, 2020b; Phan and Narayan, 2020; Zaremba *et al.*, 2020; Zhang *et al.*, 2020);
- Asian stock market (Gil-Alana and Claudio-Quiroga, 2020; He *et al.*, 2020a; Mishra *et al.*, 2020; Prabheesh, 2020; Salisu and Sikiru, 2020; Sharma, 2020);
- on role of fear sentiment and uncertainty (Chen *et al.*, 2020; Iyke, 2020c; Salisu and Akanni, 2020);
- on economic growth and trade (Baldwin and Freedman, 2020; Liu *et al.*, 2020a; Vidya and Prabheesh, 2020);
- on firm-level performance (Gu *et al.*, 2020; Han and Qian, 2020; He *et al.*, 2020b; Qin *et al.*, 2020a; Shen *et al.*, 2020; Xiong *et al.*, 2020); and
- on oil markets (Apergis and Apergis, 2020; Devpura and Narayan, 2020; Fu and Shen, 2020; Gil-Alana and Monge, 2020; Huang and Zheng, 2020; Iyke 2020b; Liu *et al.*, 2020b; Narayan 2020c; Prabheesh *et al.*, 2020a, 2020b; Qin *et al.*, 2020b; Salisu and Adediran, 2020).

However, none of these studies investigated the short-run behavior of investors with respect to taking advantage of any interest rate differentials. We attempt to fill this gap in our study. Of the above studies, this study is most closely related to the literature on COVID-19 and foreign exchange market and adds to the literature on how occurrence of unanticipated events affect the nexus between them. Further, none of the studies explore the causal linkages between interest rate differentials and expected change in exchange rates during the COVID-19, and hence novel. Moreover, our findings draw an interesting implication wherein the investors exhibit rational behavior in the short-run, while the literature suggest rational behavior mostly in the long-run. This finding can be attributed to the fact that an unanticipated event like COVID-19 contains valuable information that enhances exchange rate prediction. These results are similar to studies by Narayan *et al.* (2018) and Sharma *et al.* (2019) where unanticipated events in the form of shutdowns and terrorism attacks improves exchange rate predictability.

1.2 Economic theory and previous research
Our research question is motivated from the uncovered interest parity (UIP) hypothesis which postulates that spot exchange rates will adjust to any interest rate differentials as an adjusting mechanism for the international assets market equilibrium. Thus, the UIP hypothesis assumes that the investors have rational expectations and are risk-neutral in nature, there is absence of transaction costs, and the underlying assets possess the same default risk. Then, expected change in the spot exchange rates should, on average, correspond to the interest rate differential (Jiang *et al.*, 2013; Bhatti, 2014). The premise is that domestic currencies yielding lower interest rates will appreciate against foreign currencies that yields comparatively higher interest rates. Thus, the adjustment mechanism will eliminate any profitable opportunity from arbitrage.

However, the repudiation of the UIP is well-known phenomenon in the empirical literature. More so, the overall impression is that the UIP condition is more likely to hold in the long-run than in the short-run. The rejection of the UIP condition can be attributed to the irrational behavior of the investors, existence of transaction costs and risk premium, the possible effects of central bank interventions, limits to speculation etc. (Alper *et al.*, 2009).

Most of the empirical literature on the UIP hypothesis is concentrated in favour of developed economies (Chinn and Meredith, 2004, 2005; Engel, 2016; Ismailov and Rossi, 2018; Juselius and Assenmacher, 2017; Lothian, 2016; Golit *et al.*, 2019), with relatively scanty literature in case of emerging economies (Beng and Le Ying, 2000; Sanchez, 2008; Jackman *et al.*, 2013; Vithessonthi, 2014; Mladenović and Rašković, 2018). Further, one strand of literature has focused on examining the links between interest rates and exchange rates using wavelet transforms (Andrieș *et al.*, 2017; Hacker *et al.*, 2012; Hacker *et al.*, 2014; Saiti *et al.*, 2016) and DCC modelling (Bautista, 2003). Another strand of literature has considered the lagged relationships by implementing Granger causality models (Clarida and Gali, 1994; Cheng, 1999; Engel and West, 2005; Gumus, 2002; Si *et al.*, 2018).

The empirical evidence of UIP condition is mixed in the context of emerging economies [5]. Further, there is lack of studies exploring the relationship between interest rate differentials and exchange rates in the presence of an unanticipated event such as the current pandemic. Thus, we investigate UIP condition in the present COVID-19 pandemic period to get the better understanding of the behavior of the investors. We choose BRIICS economies for the analysis, as the group of six countries form an economic group of rapidly growing large EMEs since their liberalization policies were in effect. Further, about 45% of the global population resides in BRIICS economies, and account for about a quarter of the world GDP [6].

The rest of the paper is structured as follows. Section 2 outlines the testable empirical model. Section 3 presents the methodology used. Section 5 presents the data and discusses the empirical results. Section 6 concludes.

2. Empirical model

The UIP hypothesis postulates that any interest rate differential between similar assets will be adjusted by the expected change in the spot exchange rate, under the assumption of perfect capital mobility, to restore equilibrium in the international asset markets (Égert *et al.*, 2006). Therefore, the UIP hypothesis can be interpreted as an adjustment mechanism in the capital account. In a two-country model, the UIP condition is written in the following log-linear form:

$$s_{t+1}^e - s_t = i_t - i_t^* \tag{1}$$

where s denotes the natural logarithm of the nominal exchange rate; i and i^* denote the domestic and foreign interest rates, respectively. Mladenović and Rašković (2018) argue that in the absence of data availability of the time series of expected exchange rates and with the assumption of rational expectations, we can substitute the ex-ante exchange rates with the ex-post exchange rates.

$$s_{t+1} - s_t = i_t - i_t^* \tag{2}$$

The testable empirical model is expressed as:

$$\Delta s_{t+1} = \alpha + \beta \left(i_t - i_t^*\right) + \varepsilon_t \tag{3}$$

where α and β are parameters, Δ is a first difference operator and ε is an error term.

3. Methodology

First, we apply the conventional unit root tests of ADF and PP to test the stationary properties of the interest rate differentials and exchange rate changes. As the empirical literature exhibit that interest rate differentials are usually found to be nonstationary processes, we cannot implement the standard Granger-causality test. As a remedy, we conduct the Modified Wald (MWALD) Granger causality test proposed by Toda and Yamamoto (TY) (1995). The major reason for applying the TY method over the simple unrestricted VAR is that the TY method can be applied irrespective of the integration properties of the VAR model. That is, the TY test can be applied even if the VAR is stationary or cointegrated of an arbitrary order (Toda and Yamamoto, 1995; Garg and Prabheesh, 2015).

The first step in implementing the TY's MWALD Granger causality test requires the identification of the optimal lag length (m) and the maximum order of integration (d_{max}) and of the VAR model. Then, the test requires estimating the ($m + d_{max}$)th-order VAR model while also simultaneously imposing restrictions on the first m coefficient matrices and ignoring the last d_{max} lagged vectors in the model. The inference of the null hypothesis follows a χ^2 distribution and uses m degrees of freedom, instead of $m + d_{max}$.

$$\Delta s_t = \alpha_1 + \sum_{i=1}^{m+d_{max}} \beta_{1i} ird_{t-1} + \sum_{i=1}^{m+d_{max}} \gamma_{1i} \Delta s_{t-1} + \varepsilon_{1t} \tag{4}$$

$$\Delta ird_t = \alpha_2 + \sum_{i=1}^{m+d_{max}} \beta_{2i} ird_{t-1} + \sum_{i=1}^{m+d_{max}} \gamma_{2i} \Delta s_{t-1} + \varepsilon_{2t} \tag{5}$$

where is Δs_t is $(s_{t+1} - s_t)$, ird is the $(i - i^*)$, m is the optimal lag length, d_{max} is the maximum order of integration of the VAR model and ε is the serially uncorrelated random errors.

4. Data and results

4.1 Data and stochastic properties

To examine causal relationships between interest rate differentials and changes in exchange rate, we gathered daily data for the exchange rates and interest rates of BRIICS economies for the period January 31, 2020 – June 30, 2020 [7]. Following the standard literature, we use the USA as the centre country, given that most EMEs follow the US interest rate policy. s is the log of the daily nominal exchange rates which is defined as domestic currency per unit of the US dollar. As a proxy for the interest rates, we use overnight interbank offer rates for each country: Certificado de Depósito Interbancário (CDI) for Brazil, Moscow Interbank Actual Credit Rate (MIACR) for Russia, Mumbai Interbank Offered Rate (MIBOR) for India, Indonesia Overnight Index Average Rate (IndONIA) for Indonesia, Shanghai Interbank Offered Rate (SHIBOR) for China, South African Benchmark Overnight Rate (SABOR) for South Africa and London Interbank Offer Rate (LIBOR) for the USA. The details of the sample, interest rates, exchange rates, their construction and sources of data for the BRIICS economies is presented in Table 1.

Countries	Interest rates		Exchange rates	Source
	Proxy	Variable construction		
Brazil	CDI	$i = \log(1+R/100)$	Brazilian Real per US$	www.bcb.gov.br
Russia	MIACR	$i = \log(1+R/100)$	Russian Ruble per US$	www.cbr.ru/eng/
India	MIBOR	$i = \log(1+R/100)$	Indian Rupee per US$	www.fbil.org.in/
Indonesia	INDONIA	$i = \log(1+R/100)$	Indonesian Rupiah per US$	www.bi.go.id/
China	SHIBOR	$i = \log(1+R/100)$	Chinese Yuan per US$	www.chinamoney.com.cn/
S. Africa	SABOR	$i = \log(1+R/100)$	S. Africa Rand per US$	www.resbank.co.za/
USA	LIBOR	$i = \log(1+R*/100)$		www.theice.com/

Table 1.
Data description and
sources

Notes: The data on daily exchange rates is defined as domestic currency per unit of US dollar. For interest rates, different interbank offer rates are used. The data sources are mentioned as URLs in the table. Our sample period runs from January 31, 2020 to June 30, 2020. R and R* denote the BRIICS economies and US overnight interbank offer rates, respectively

Figures 3 and 4 present the plot of interest rate differentials and exchange rates changes of all six BRIICS economies during the COVID-19 period, respectively.

4.2 Results
The descriptive statistics of expected change in exchange rates and interest rate differentials for all six BRIICS countries are reported in Table 2. It can be seen that the standard deviations for expected change in exchange rates in case of all six BRIICS countries are higher than their mean, indicating a higher level of risk in exchange rate markets. Further, exchange rates are more volatile than interest rates. The descriptive statistics from skewness and kurtosis statistics suggesting a leptokurtic distribution Russia, Indonesia, China and South Africa, which was further supported by Jarque–Bera test which indicates rejection of the normality for these countries.

Table 3 reports the results of ADF and PP unit root tests. The results suggest that expected change in the exchange rates, Δs_t, is stationary at level while the interest rate differentials, ird_t, is stationary at first difference for all six BRIICS economies. The unit root results are in line with the previous literature that interest rate differentials exhibit non-stationary properties at levels (Juselius and MacDonald, 2004). The stationary properties of the variables indicate that we have a mix of I(1) and I(0) series and therefore the standard Granger causality test cannot be implemented.

Thus, we apply the TY's MWALD Granger causality test, as the method can be implemented irrespective of the integration properties of the VAR model. The unit root test results indicate that the maximum order of integration is 1, hence, in the subsequent analysis $d_{max} = 1$. Once we have identified the maximum order of integration, the appropriate lag lengths are selected such that the VAR model is stable and residuals is free from any autocorrelation. Table 4 reports the TY's MWALD Granger causality test results.

The MWALD Granger causality tests indicate evidence of causal relationships between interest rate differentials and expected change in exchange rates are found in all six BRIICS economies. More specifically, the MWALD Granger causality test results suggest that there is evidence of unidirectional causality running from interest rate differential to expected change in the exchange rate in five out of six BRIICS economies, except Brazil. Further, the results suggest bidirectional causality in case of Brazil, indicating that both exchange rate changes and interest rate differentials help in improving the predictability of future changes in the other variable. Thus, the findings imply that the interest rate differentials are followed
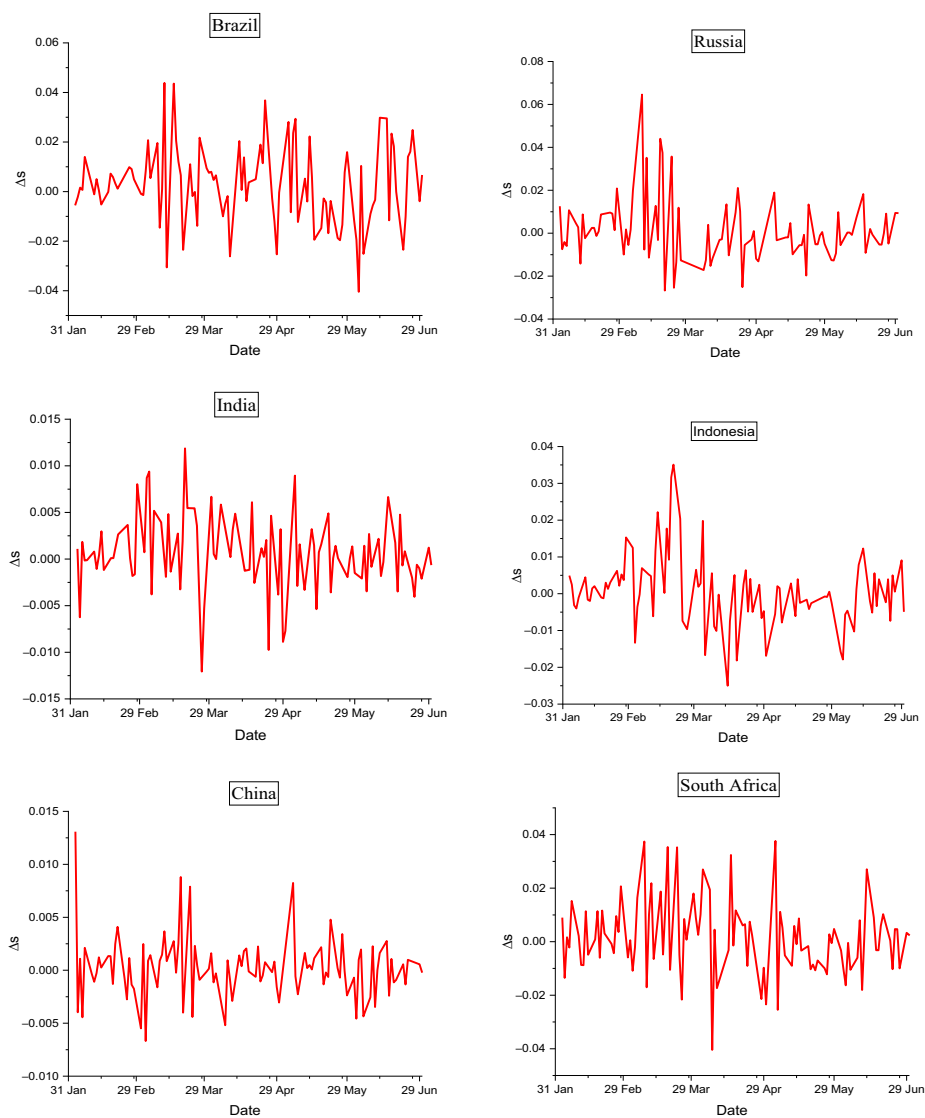
by subsequent exchange rate changes during the COVID-19 crisis period wherein the investors seem to have rational expectations and are forward-looking as they take advantage of any arbitrage opportunities created due to interest rate differentials.

4.3 Robustness checks

Finally, we conduct the robustness checks to confirm if the causality results from TY's MWALD procedure is not sensitive to the choice of estimation approach. Fatai *et al.* (2002) and Narayan and Smyth (2005) have argued that the ARDL framework can be used to infer
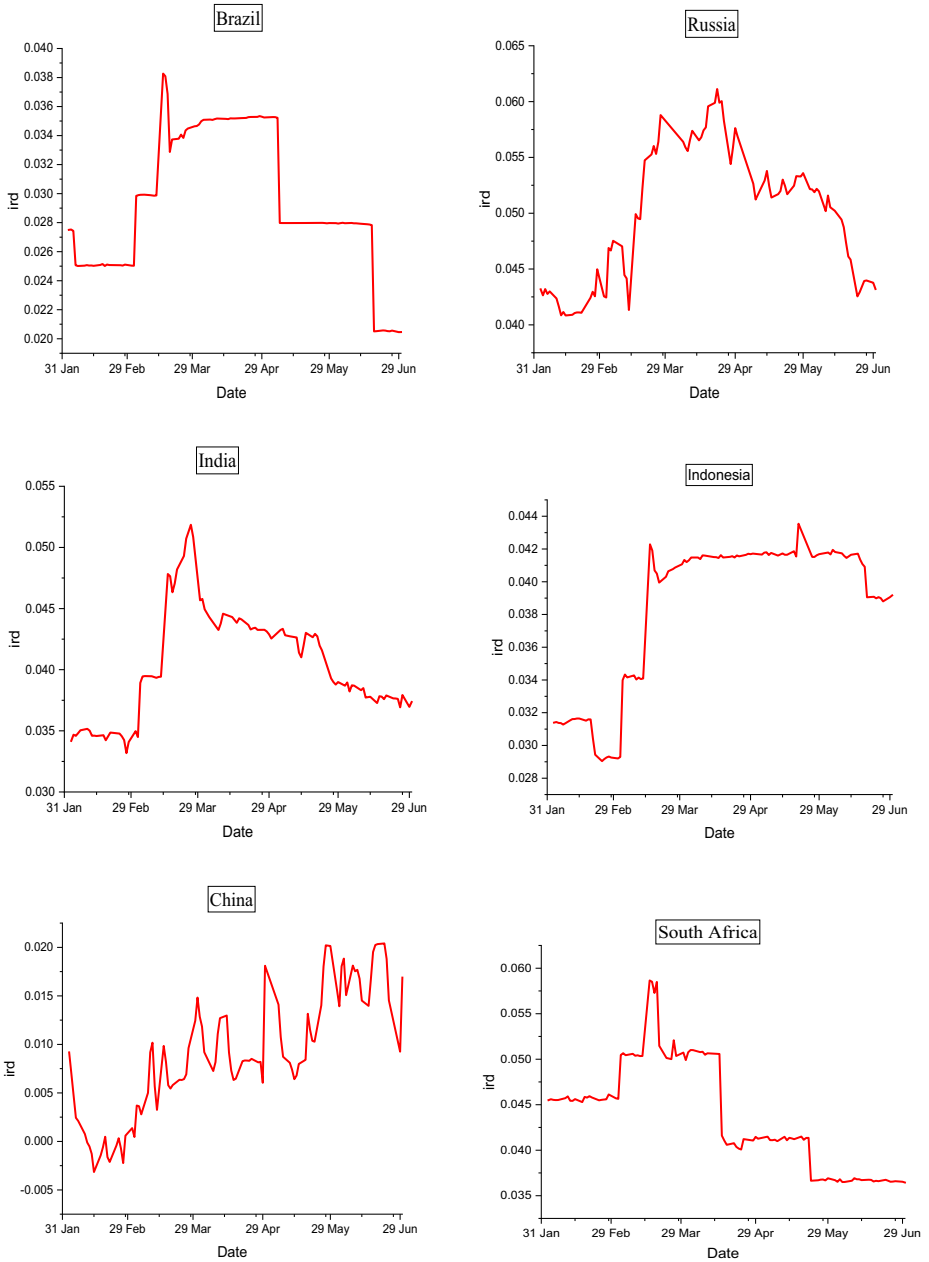
Figure 4.
Plots of interest rate
differential

Country	Mean	Maximum	Minimum	SD	Skewness	Kurtosis	Jarque–Bera
Brazil							
Δs	−0.002	0.043	−0.040	0.016	0.133	3.195	0.474
ird	0.029	0.038	0.020	0.004	−0.072	2.083	3.729
Russia							
Δs	0.001	0.064	−0.026	0.014	1.408	6.809	87.930[*]
ird	0.049	0.061	0.040	0.006	−0.016	1.708	6.537[*]
India							
Δs	0.001	0.011	−0.012	0.004	−0.118	3.927	3.624
ird	0.040	0.051	0.033	0.004	0.420	2.549	3.597
Indonesia							
Δs	0.000	0.035	−0.025	0.009	0.715	5.413	32.151[*]
ird	0.038	0.043	0.029	0.005	−0.903	2.098	16.638[*]
China							
Δs	0.000	0.012	−0.006	0.002	1.055	6.957	84.655[*]
ird	0.008	0.020	−0.003	0.006	0.069	2.165	3.013
South Africa							
Δs	0.001	0.037	−0.040	0.013	0.344	3.881	5.366***
ird	0.043	0.058	0.036	0.006	0.454	2.371	5.242***

Notes: This table presents a summary of the descriptive statistics of expected change in exchange rates and interest rate differentials for all six BRIICS economies. Our sample period runs from January 31, 2020 to June 30, 2020. [*]and [**]represents the 1 and 10% significance level, respectively. Δs and ird denote the expected change in exchange rates and interest rate differential, respectively

Table 2.
Summary of
descriptive statistics

| Country | ADF | | PP | |
	Level	First difference	Level	First difference
Brazil				
Δs	−9.427[*]	NA	−9.425[*]	NA
ird	−0.630	−9.990[*]	−0.649	−10.036[*]
Russia				
Δs	−10.179[*]	NA	−10.199[*]	NA
ird	−0.152	−10.233[*]	−0.136	−10.270[*]
India				
Δs	−10.335[*]	NA	−10.320[*]	NA
ird[a]	0.075	−9.195[*]	0.075	9.195[*]
Indonesia				
Δs	−6.917[*]	NA	−6.943[*]	NA
ird[a]	0.551	−10.044[*]	0.651	−10.071[*]
China				
Δs	−14.838[*]	NA	−13.818[*]	NA
ird[a]	−0.831	−8.768[*]	−0.502	−10.456[*]
South Africa				
Δs	−11.466[*]	NA	−11.466[*]	NA
ird	−0.698	−10.103[*]	−0.761	−10.179[*]

Notes: The table reports the results of the unit root based on Augmented Dickey–Fuller (ADF) and Phillips–Perron (PP) tests. The null hypothesis and the alternative hypotheses for ADF and PP tests are that the series is non-stationary (contains unit root) and series is stationary (no-unit root), respectively. The calculated test statistic of ADF and PP tests are compared with the critical values by MacKinnon (1996). [*]denotes rejection of unit root at the 1% significance level. Our sample period runs from January 31, 2020 to June 30, 2020. Δs and ird denote the expected change in exchange rates and interest rate differential, respectively

Table 3.
Results of unit root
tests

Country	m	$m+d_{max}$	ird does not Granger-cause Δs	Δs does not Granger-cause ird
Brazil	VAR(2)	VAR(3)	6.145**	11.491*
Russia	VAR(7)	VAR(8)	32.138*	10.673
India	VAR(8)	VAR(9)	13.913***	12.692
Indonesia	VAR(4)	VAR(5)	13.118**	2.389
China	VAR(1)	VAR(2)	2.761***	0.044
South Africa	VAR(4)	VAR(5)	11.403**	6.837

Notes: The table shows the TY's MWALD Granger causality results between Δs and ird for BRIICS countries. $m + d_{max}$ is the specified VAR models in conformity with the TY approach where m and d_{max} denote the optimal lag length and highest order of integration of the variables, respectively. *, ** and *** represents rejection of the null hypothesis of Granger non-causality at the 1, 5 and 10% significance level, respectively. Our sample period runs from January 31, 2020 to June 30, 2020. Δs and ird denote the expected change in exchange rates and interest rate differential, respectively

Table 4.
Causality tests between Δs_t and ird for BRIICS countries

causal relationships. We follow these studies and implemented ARDL error correction mechanism to infer short-run Granger-causality and provide robustness checks to our TY's MWALD Granger-causality results. More specifically, we applied the Wald test wherein we assumed, under the null hypothesis, that the lagged independent regressors of the short-run dynamics are equal to zero. Hence, if the joint value of the F-statistics rejects the null hypothesis, we confirm the presence of causal relations. Table 5 reports the causality results examined through the ARDL framework.

The results from the causality test implies that interest rate differentials Granger-causes exchange rate changes in all six BRIICS countries. Further, we find that there is existence of bidirectional causality in case of Brazil. Hence, the results are quite robust to the TY's causality results reported in Table 4. Overall, the causality results from both TY and ARDL procedure suggest that interest rate differentials do improve the predictability of subsequent changes in spot exchange rates. Our results are in line with the arguments made in Narayan *et al.* (2018) and Sharma *et al.* (2019) on how unanticipated events that contains valuable

Country	Null hypothesis	F-statistic
Brazil	Δird does not Granger-cause Δs	2.643**
	Δs does not Granger-cause Δird	4.337*
Russia	Δird does not Granger-cause Δs	3.789*
	Δs does not Granger-cause Δird	0.429
India	Δird does not Granger-cause Δs	3.322**
	Δs does not Granger-cause Δird	0.561
Indonesia	Δird does not Granger-cause Δs	2.788**
	Δs does not Granger-cause Δird	1.777
China	Δird does not Granger-cause Δs	2.671***
	Δs does not Granger-cause Δird	1.849
South Africa	Δird does not Granger-cause Δs	2.866**
	Δs does not Granger-cause Δird	0.985

Notes: The table shows the short-run Granger causality results between Δs and Δird for BRIICS countries from ARDL short-run dynamics. *, ** and *** represent rejection of the null hypothesis of Granger non-causality at the 1, 5 and 10% significance level, respectively. Our sample period runs from January 31, 2020 to June 30, 2020. Δs and Δird denotes the expected change in exchange rates and interest rate differential, respectively

Table 5.
Robustness checks

information improve exchange rate predictability. Further, our causality results are similar to Cheng (1999), Gumus (2002) and Si *et al.* (2018) wherein lagged interest rate differentials Granger cause exchange rate changes, but deviates from Clarida and Gali (1994).

5. Conclusions

The COVID-19 has caused severe economic slowdown in the world economy. More so, the BRIICS economies are also not insulated from this public health crisis. In this paper, we examined the impact of COVID-19 on assets markets and foreign exchange markets to better understand the response of investors. We tested whether the interest rate differentials cause expected change in the exchange rate during COVID-19 period, using daily data ranging from January 31, 2020 to June 30, 2020. Overall, we found that interest rate differentials Granger cause exchange rate changes in all six BRIICS economies during the COVID-19 period. Our findings imply that policymakers can use interest rate policies to promote exchange rate stability in BRIICS economies in the short run. Further, evidences that interest rate differentials improve the predictability of future changes in exchange rates indicates that investors seem to show rational behavior as the foreign exchange market efficiently incorporates information about interest rate differentials.

Notes

1. www.worldometers.info/coronavirus/

2. BRIICS is an acronym used for a group of EMEs, namely, Brazil, Russia, India, Indonesia, China and South Africa.

3. The central banks of these economies reduced the policy rate in response to COVID-19 during Feb-June 2020. Where, Brazil (Selic rate from 4.5 to 2.15%); Russia (key rate from 6.1 to 4.5%); India (repo from 5.15 to 3.9%); Indonesia (Indonesia rate from 4.8 to 4%); China (repo from 2.5 to 1.8%); South Africa (repo from 6.3 to 3.8%).

4. However, Padhan and Prabheesh (2019) in their review study argue that huge volatility and prolonged uncertainty can lead to excessive exchange rate pressure.

5. See Alper *et al.* (2009) for an excellent survey of the empirical literature of UIP testing in EMEs.

6. A latest study on BRICS economies by Prabheesh and Garg (2020) found that the UIP condition is strongly rejected in case of all five BRICS economies. Thus, we do not test for the long-run relationship as most of the studies found similar results. Rather, we focus on Granger causality between the two variables.

7. On January 30th, the World Health Organization declared the COVID-19 outbreak a "Global Public Health Emergency" as well as India officially reported its first COVID-19 case. Thus, we take the data from the next business day, January 31st, onwards.

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