Determinants of Stock Market Indices: An Analysis of Emerging Markets of Brazil, Mexico, Russia, and Turkey

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Volume 12 No 1 (2022) | ISSN 2158-8708 (online) | DOI 10.5195/emaj.2022.257 | http://emaj.pitt.edu

Abstract

This paper investigates the dynamic relationship between the stock market index and a set of macroeconomic variables in four emerging countries. The dependent variable measures monthly stock exchange points of respective markets from January 2010 to March 2021. Independent variables consist of the 5-Year bond yields, CDS Premiums, VIX Futures, gold price, MSCI Emerging Market Index, and Oil Prices. Since the dependent and independent variables have a cointegrating relationship, we conducted our analyses in both the short and long term. Findings indicated that CDS premiums, oil and gold prices have a negative, while VIX and MSCI have a positive effect on the stock index in the long term. On the other hand, bond yields and the COVID-19 have a negative while MSCI has a positive effect in the short term. In addition, the long-term effects are much evident in Brazil and Russia. The speed of adjustment to the long-term equilibrium in the stock market index is much higher in Turkey and Mexico.

Keywords: Stock Markets, Emerging Markets, Speed of Adjustment, Efficient Market, Covid-19

Volume 12 No 1 (2022) | ISSN **2158-8708** (online) | DOI 10.5195/emaj.2022.257 | http://emaj.pitt.edu

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I. Introduction

It is known that there are many internal and external determinants affecting the stock markets of countries. Interest rate, inflation, unemployment, industrial production, energy prices, gold prices, CDS premium, developments in international financial markets, political events, management risk, sectoral risk, and many other variables are defined in systematic and non- systematic risk groups. Studies in the literature generally focus on different variables. It is seen that past research analyze the relationship among stock returns and CDS premium, bond yield, gold and oil prices, exchange rates, and some other variables, usually two or three of these variables.

The difference of this study is that, it analyzes together more independent variables that may have different determinants on stock markets in selected developing countries and it investigated to what extent the results may differ between countries as well as interpreting the findings. For this reason, it is aimed to contribute to the literature with different observations and findings. In the first part, the studies reached by the literature review about the relationships between the dependent and independent variables in the study are included. In the second part, dependent and independent variables used in the analysis and their definitions are given, and descriptive statistics are explained. The dependent variables are the stock market indices of the 4 countries covered in the study, the independent variables are 5 years bond yield and CDS premium (5 Year BPS) of countries, S&P 500 VIX futures, gold prices (Ounce/$), MSCI emerging markets change and future crude oil prices. The analysis covers the period from January 2010 to March 2021 (t=135). In the third part, to determine the most appropriate panel data analysis method, cross-section dependency, unit root, and cointegration tests were applied, and then a model definition was made explaining the short- and long-term relationships. Then, findings related to empirical analysis were obtained.

To make a conceptual explanation about the importance of CDS premium, bond yield, gold and oil prices in terms of macroeconomic structures of countries and their effects on financial markets, it will be wise to express that there are various types of credit derivative contracts. A widely known type is the credit default swap (CDS). In this contract type, the protection seller asks for a premium periodically from the protection buyer and pays a one-time payment in case of default. CDS is accepted as one of the main determinants which measure the credit risk of countries and investors' risk perception towards the stock markets of relevant countries. The CDS premium is the insurance premium paid by bond issuers in case of default in international markets and is an indicator that determines firm and country risk. Therefore, it is included in the study to investigate its relationship with stock market indexes. It is stated that a CDS default might include some or all of these risks (Blanco et al., 2005): i) Failure to pay, ii) Bankruptcy, iii) Restructuring, iv) Rejection or moratorium, v) Obligation default

Two main approaches to credit default modeling are presented: The first is the structural approach discovered by Merton (1974). Accordingly, if the debtor's assets fall below its obligations, it triggers default. The second is the reduced form approach proposed by Jarrow and Turnbull (1995), which suggests that default is directly modeled as an unexpected outcome.

Central banks usually adjust policy rates downside when their macroeconomic indicators are weak and upside when faced with inflationary pressures. According to Taylor's rule (1993), these policy rate adjustments become more necessary for some countries than others. Other (possibly external) factors may also determine the central bank's decisions. In any case, the financial markets of developed and emerging countries will likely react differently to monetary policy practices. Because of their need for foreign capital inflow, emerging countries may not be willing to lower interest rates as it will reduce demand for fixed income financial instruments issued in local currency (Swanson and Williams, 2014). On the other hand, developed economies may face other problems as interest rates fall excessively and hence the effectiveness of monetary policy decreases. Therefore, it is an important research topic whether fluctuations in policy rates as a result of monetary policy practices affect the stock market. After the 2008-2009 global financial crisis, it gained more and more importance as it led to the decline in world economic growth and supported monetary policies that tried to regain economic stability.

Today, oil ranks first among the world's energy resources with a share of approximately 33% in primary energy consumption and maintains its importance as a unique and non- renewable natural resource that provides economic and political power to countries with abundant oil reserves (Çevik et al., 2020). The theoretical relationship between oil prices and stock returns can be positive or negative. According to the cash flow hypothesis, a positive or negative relationship can exist between oil prices and stock returns, and it expresses a negative relationship through two channels. Since oil is an important raw material for most industrial firms, higher oil prices increase the production cost and affect future cash flows, profits, dividends and ultimately stock returns negatively. In addition, higher oil prices can result in expectations of higher inflation and interest rates. This puts downward pressure on expected profits, dividends and therefore stock returns. Another proposition is in terms of a positive or negative relationship. Sensitivity to oil prices may affect stock prices up or down, depending on the risk premium, which varies greatly with companies and over time (Smyth and Narayan, 2018).

Crude oil prices can affect national economies in three ways: First, the impact of changes in oil prices on inflation due to changes in production costs is significant. The second effect, especially for oil importing countries, is the serious effects of changes in oil prices on the balance of payments and therefore on exchange rates. Third, the effects of price changes on the total consumption of households, that is, increasing oil prices cause a downward shift in demand or vice versa (Kayalar et al. 2017).

Historically, gold has always been seen as a unique raw material and investment tool, especially in times of trouble, thanks to its ability to store value. Gold prices seem to have reached historic highs since the 2008 subprime crisis. Therefore, it has become attractive to investigate the effect of such events on gold prices. Gold market traders consider gold to be a safe investment and the increased demand for gold is a result of the risk of excessive losses in other investment instruments.

The Chicago Board Options Exchange Volatility Index is an index that measures the degree of fear in the markets. Using S&P 500 stock option prices, VIX determines the "expected volatility" of option prices. It expresses the 30-day forward volatility projection.

The reason why it is called the fear index is due to the fact that investors in the market express their hesitation from investment because of fear of volatility (https://www.investopedia.com/terms/v/vix.asp). Values between 20-30 in the fear index were accepted as normal values. If the value is above 60% in the Vix index, it causes great turmoil in the market. The lowest value of the index was 9.31 in December 1993 and the highest value was 80.86 in November 2008.

iShares MSCI Emerging Markets ETF is a fund that aims to track the investment results of an index composed of large and mid-sized companies in emerging markets. The fund was launched on 07/2003. The benchmark of the fund is MSCI emerging markets and diversifies its portfolio internationally and aims for long-term growth (https://www.ishares.com/us/).

II. Literature Review

Studies in the literature generally focus on different variables. It is seen that past research analyze the relationship among stock returns and CDS premium, bond yield, gold, and oil prices, exchange rates and some other variables, usually two or three of these variables. The related literature concerned with this research is discussed below.

Acharya and Johnson's (2007) study was run on 79 corporate assets by analyzing CDS premium and stock market daily data in their sample for the period of 2001-2004. They provided empirically an information flow relationship from CDS to equity markets. Norden and Weber (2004) analyzed the relationship among CDS premium, bond, and stock markets empirically from 2000 to 2002. Their observations indicated that changes in CDS premiums and bond spreads are led by stock returns and the CDS market's role is more significant for price-determining than the bond market.

Similarly, analyzing the relationship between CDS spreads and stock markets, Forte and Pena (2009) also observed that stock markets lead in explaining CDS spreads. Benkert's (2004) study on 120 firms for the period of 1999-2002 determined that volatility is more significant as an explanatory factor in CDS premia variation than historical volatility. Dupuis et al. (2009) empirically found that the relationship between stock returns and CDS can be quite variant and responsive to the content of portfolios. Fung et al. (2009) investigated the relationship between credit default swap and stock markets. Their observation is that, the CDS markets are led by stock markets only for the high-yield and investment-grade firms.

Naifar (2012) studied the dependency relationship among equity volatility, CDS premium, and jump risk before and during the 2008 global financial crisis. It was detected that, the dependency between the stock market and CDS is asymmetrical and directs towards the upside. Longstaff et al.(2003) presented a different finding. They argued that, there is not any clear result that either of the two markets is the leader.

Narayan et al. (2014) discovered that, the stock market dominates in the price determination process where both the stock market and the CDS market contribute. Park et al. (2019) studied the domestic and foreign components affecting the basis between sovereign CDSs and equities index options in Korea. They observed that, shocks have an important role in determining CDS-options during the crisis, but the exchange rate's role is greater in normal terms.

Chan-Lau and Kim (2004) analyzed the relationship and price exploration process in the bond, CDS, and equity markets for 8 emerging countries; Bulgaria, Brazil, Colombia, Mexico, Russia, the Philippines, Turkey and Venezuela. In most of these countries, they did not observe any relationship among CDS markets, bond, and the equity markets. They obtained mixed results in terms of price discovery. The results indicated a significant correlation between bond spreads and CDS in most of them except Mexico, the Philippines and Turkey. Adler and Song (2010) tested whether credit risk is priced equally in CDS and bond markets for emerging countries. Findings did not point out a parity in Latin American countries.

Öcal and Kamil (2021) analyzed the effects of CDS and S&P VIX and exchange rate volatility on stock market indices as well as sustainability indices of Germany, France, Indonesia, and Turkey. The findings are: i) Unlike other countries, companies in the BIST Sustainability index are more affected by shocks than companies in the BIST All index. ii) According to the causality analysis for all countries, the VIX is more determinative on national and sustainability indices than CDS and currency volatility indices.

Sarıgül and Şengelen (2020) investigated the relationship between Turkey's CDS premiums and bank stock prices, also analyzed the effects of country risk perception. It was determined that, Turkey's CDS premium has an impact on the BIST bank index and five banks in the long run. Başarır and Keten (2016) analyzed the short-term and long-term relationship between CDS premiums and stock indices of 12 developing countries for the period of 2010-2016. According to the results of the Granger causality test for the short term and the Johansen cointegration test for the long term, they observed a bidirectional causality relationship between CDS premiums and stock indices. Hancı (2014) analyzed the return volatility of CDS premium and BIST100 index with GARCH modelling and concluded that the relationship between CDS premium and stock returns is inverse.

Historically, stock and bond yields have tended to move in the same direction, but sometimes, even for a long time, they can move in the opposite direction. In particular, they moved in a different correlation during crisis periods compared to non-crisis periods. It is widely accepted that stock-bond correlations change over time.

Using a stochastic volatility model, Johansson (2010) investigated the relationship between stocks and bonds in 9 Asian countries, observing that there are significant volatility spillover effects between stock and bond markets in many countries. According to the findings, the relationship between stock and bond markets in all countries changed significantly over time, and the correlation increased in some countries during turbulent periods. Li (2004) empirically examined the relationship between stock-bond returns for the G7 countries for the period of 1961-2001. It was found out that, the stock-bond correlation is primarily determined by the uncertainty in expected inflation.

Assefa et al. (2017) analyzed quarterly stock returns of 21 developed and 19 emerging economies (including Brazil, Mexico, and Turkey) for the period of 1999-2013, using dynamic panels, and found that interest rates have a statistically negative effect on stock returns in developed countries. It was concluded that the, world market portfolio is the only determinant of stock returns in developing economies. Also, the opposite effect of change in interest rates on stock returns may be partly related to the divergent monetary policies of advanced economies and their mature capital markets.

Anderson et al. (2008) investigated the effect of inflation, economic growth, and the uncertainty of the stock market on the correlation between bond and stock returns. Their results indicated that stock and bond prices move together in periods when inflation expectations are high, while the negative stock-bond yield correlation coincides with declining inflation expectations. Additionally, stock-bond return correlation was not affected by economic growth expectations.

Many researchers have attempted to analyze the correlation between stock and bond returns. Using the dynamic present value approach, Shiller and Beltratti (1992) showed that the correlation between stocks and bonds is too high to be supported by the theory in their study for the USA and the UK. However, from a theoretical point of view, Barsky (1989) considered that, the correlation in stock and bond yields is situational and pointed out that, lower growth in productivity and higher market risk probably reduces both corporate profits and interest rates, causing stock and bond prices to behave in opposite directions.

In their study by analyzing macroeconomic and financial variables as the determinants of US stock-bond correlations, Allard et al. (2020) observed that, the daily correlation is more affected by financial market variables and the monthly component is more affected by macroeconomic variables, while the annual is affected by the funding possibilities. Baele et al. (2010) concluded that, the correlation between stock and bond yields in the USA in the second half of the 20th century was positive and ranged from zero to sixty percent. However, the correlation dropped to slightly below zero at the end of the 20th century, and it was quite negative at the beginning of the 21st century.

Lin et al. (2018) examined the time-varying relationship of stock-bond returns between 1988 and 2014 in relation to basic economic variables and uncertainty of the stock market. According to the empirical results, the short-term and long-term relationship between stock and bond yields changed over time, and this relationship was positively sensitive to the slope of the short-term interest rate and maturity structure, while it was negatively sensitive to stock market volatility. The relationship between oil prices and stock markets is also an important research topic in the literature. From the supply side, oil is a raw material that affects companies' earnings and thus their stock returns. It also affects the income of consumers, therefore the demand for goods and the services supplied by companies on the demand side. Oil continues to be a systematic driving force of economic and financial variables (Balcılar et al., 2019). For this reason, oil prices are also included in the study as an independent variable to analyze its effect on stock market indices.

Demirer et al. (2019) analyzed the impact of oil demand and supply shocks on stock and bond markets in 21 developed and developing countries. The study revealed that, the reactions of stock and bond markets differ depending on the character of the shock. Oil price shocks affect bond market yields, but the effect is highly variable and substantially based on demand shocks.

According to the analysis of Kayalar et al. (2017), stock indices and exchange rates are more dependent on oil price in most oil-exporting countries, whereas in developing oil- importing countries, on the contrary, the markets are less vulnerable to price fluctuations. According to Gauss copula results between 2005 and 2016, the dependency on crude oil prices is 46% for the Brazil stock index, 43% for the Russia index and 20% for Turkey index. By using the EGARCH process, Çevik et al. (2020) examined empirically the relationship between crude oil prices and stock market returns in Turkey. The results indicated that, crude oil prices are significantly determinant on stock market returns in Turkey.

Singhal et al. (2019) investigated the relationship among crude oil prices, exchange rate, gold prices and stock market returns in Mexico for the period 06/2006-04/2018. According to the findings of the study, while international gold prices affected Mexican stock prices positively, they affected oil prices negatively. Fang et al. (2014) analyzed the effect of changes in oil prices on stock market returns in the three major newly industrializing countries, Russia, China and India. They observed that, the effect of oil price shocks on stock prices in these three countries is partially mixed, unlike the effects on the stock markets of the USA and developed countries. According to the results, i) Oil prices had a negative effect on the Indian economy, ii) Only oil supply shocks affected Russia's stocks positively, iii) Global oil demand shocks had an insignificant impact on Chinese stock market yields.

Lee et al. (2012) investigated the relationship between oil prices and sectoral stock prices for G7 countries for the period of 1991-2009. They observe that, oil price shocks do not affect the composite indices in all these countries and a negative causality relationship exists between oil prices and sectoral stocks. It is known that, gold prices generally have a negative correlation with stock returns, and gold comes to the fore as an important hedging tool, especially during periods of high volatility and negative returns in stock markets. Triki and Maatoug (2020) studied the relationship between the S&P500 index and the gold prices for the period of 1985-2018, together with the Geopolitical Risk Index, within the scope of the existence of geopolitical tensions and conflicts. They concluded that, gold is a good diversification tool and provides significant hedging against the volatility of the S&P500, especially during high tensions.

In similar studies, Smith and Cohen (2002) stated that, gold prices increase in uncertainty associated with political events that cause the stock market to depreciate or with increasing financial risk. Supporting the idea that there is a highly significant indirect relationship between political crises and the volatility in the gold price in response to stock market volatility, Draper et al. (2006) stated that gold has a higher negative correlation in periods of high volatility and negative stock market returns. Hillier and Robert (2006) indicated that, the gold market is crucial for economic and political crisis periods when combined with periods of crisis and stress, and high stock market volatility. With a different approach, Christie-David et al. (2000) examined many macroeconomic effects that affect the gold price and interest rate futures in the period 1992-1995 with 15-minute frequencies. They observed that, news releases on macroeconomic indicators have a significant impact on interest rate contracts, but have a smaller impact on gold yields.

When the findings obtained in this study are compared with other results obtained in the literature, they generally do not show significant similarities. The reasons for this may be that this study includes both long-term and short-term periods, and that many variables are included in the model. According to the results of this study, it is seen that the effects of most variables on stock market indices both in terms of countries, direction and size are different in the long-run and short-run.

III. Data and Methodology

Data Collection

This study analyzes the dynamic relationship among the stock market indices of four emerging countries (n=4) and a set of macroeconomic regressors. The complexity of financial markets in general and stock markets, in particular, begs for an in-depth analysis of the variables, which may have an impact on these markets. We collected the related data from the website of a well-known global financial data provider, https://tr.investing.com/.

Table 1: Dependent and Independent Variables

Variables	Definition	Source
Dependent V.		
STOCK	Stock Exchange Index (Monthly)	Turkey BIST-100 Mexico BSE Sunsex MOEX Russia (IMOEX) Brazil BOVESPA
Independent V.		
BOND	5-Year Bond Yields (Monthly)	Investing.com
CDS	Credit Default Swaps-CDS Premiums (Monthly)	
VIX	S&P500 VIX Volatility Index (Monthly)	
GOLD	Gold Ounce Prices ($) (Monthly)	
MSCI	MSCI Emerging Markets (Monthly)	
OIL	Crude Oil Prices (Monthly)	
ECT	Error Correction Term	Calculated by authors
COVID-19	COVID-19 Dummy	Created by authors

Source: Authors' own compilation

Table 1 presents the operational definitions and sources of dependent as well as independent variables. The dependent variable measures the stock exchange points of the respective markets at the beginning of each month from January 2010 to March 2021 (t=135). Independent variables consist of the 5-Year Bond Yields, CDS Premiums, VIX Futures, the price of Gold Ounce in USD, MSCI Emerging Market Index, and Oil Future Prices in USD in the same period. While the first two predictors are country-specific, the last four are cross-sectionally invariant and do not vary across countries. We used the natural logarithm of the variables in the analysis.

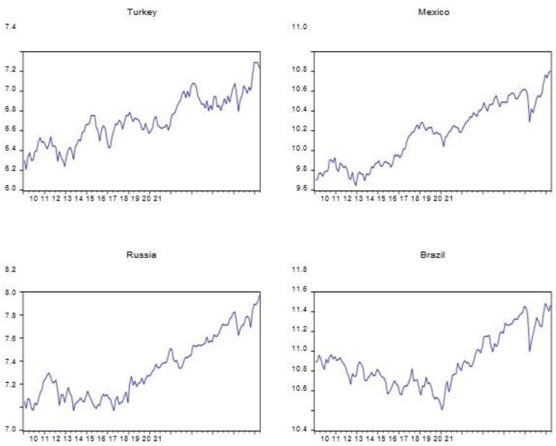

Figure 1. Stock Indices by Country

Source: Authors' own compilation

Figure 1 shows the line charts of the stock markets of Turkey, Mexico, Russia and Brazil for the given period. As seen in the figure, all stock series have upward trends, and the fluctuations in Turkish and Brazilian markets are much more visible than the fluctuationsin Mexican and Russian markets. The biggest plunge in the Turkish, Mexican and Brazilian markets occurred in the same period by 15.4%, 26%, and 29% in March 2020 in all three markets, respectively.

Table 2: Descriptive Statistics

	LNSTOCK	LNBOND	LNCDS	LNVIX	LNGOLD	LNMSCI	LNOIL
Mean	8.878125	2.118873	5.149592	2.901839	7.254444	3.715490	4.178840
Median	8.909025	2.115653	5.118652	2.832036	7.213474	3.721105	4.170225
Maximum	11.68702	3.228826	6.405212	3.845456	7.593828	3.983972	4.735584
Minimum	6.208691	1.430311	4.000217	2.423031	6.987490	3.405853	2.935982
Std. Dev.	1.835249	0.332025	0.429297	0.289610	0.139302	0.109842	0.358972
Skewness	0.028428	0.215873	0.462711	0.810682	0.517423	-0.228112	-0.525378
Kurtosis	1.292189	2.589422	3.030105	3.250144	2.465467	3.367621	3.097293
Jarque-Bera	65.69667	7.987035	19.28955	60.55636	30.52422	7.723917	25.05499
Probability	0.000000	0.018435	0.000065	0.000000	0.000000	0.021027	0.000004
Sum	4794.187	1144.191	2780.780	1566.993	3917.400	2006.364	2256.573
Sum Sq. Dev.	1815.427	59.41953	99.33567	45.20812	10.45937	6.503218	69.45614
Observations	540	540	540	540	540	540	540

Source: SPSS Software Output

Table 2 shows the summary statistics for 540 observations for each variable with no missing values. Jarque-Bera statistics of normality suggest that variables do not have normal distributions.

Methodology

The data set consists of 135 time-series (t=135) of four cross-sections (n=4), which needs several diagnostic analyses before specifying a model. We tested the data for cross-sectional independence, stationarity and cointegration before estimating the model for the data. After fitting the model, we tested for cross-sectional dependence again to confirm the reliability of the model coefficients. We also tested variance ratio of the cointegrating residuals to understand whether the present stock exchange points follow the past stock exchange points.

Cross-sectional Dependence

Panel data analysis assumes that errors of cross-sectional units are independently distributed. This is an assumption that should be satisfied before making an unbiased prediction of population parameters. In case of cross-sectional dependence, which is endemic to panel data, we need to determine an appropriate unit root test and an analysis method that is robust to homogeneous panels. We conducted a baseline regression analysis to detect the presence of a possible cross-sectional dependence between the panels. The model is a simple multivariate regression model that is estimated by ordinary least squares (OLS) method. The residuals from the estimation were tested for cross-sectional dependence using Pesaran's (2004, 2015) CD test. Pesaran CD statistic tests the null hypothesis of cross-sectional independence (2004) or weak cross-sectional dependence (2015).

Table 3: Pesaran CD Test for Baseline Regression Model for LNSTOCK

Variable	CD-test	Probability	average joint T	mean ρ	mean abs(ρ)
RESID02	15.989	0.000	135.00	0.56	0.56

Source: SPSS Software Output

As seen in Table 3, the Pesaran CD value (*CD*=15.989) is statistically significant (*p*<0,001), which shows that the null hypothesis that cross-sectional independence or weak cross-sectional dependence can be rejected. Despite having commonly observed variables like LNVIX, LNGOLD, LNMSCI and LNOIL in the dataset, the observed cross-sectional dependence can be attributed to the unobserved variables common to all countries. To mitigate the effect of cross-sectional dependence, some other common factors can be identified in the model either by observing them later or by finding them in the existing dataset. Another method for mitigating the effect of cross-sectional dependence is to specify dynamic panel models in which variables are included with their lagged values. This study controls the cross-sectional dependence by using both dynamic models in the analysis and dummy variables of some factors common to all cross-sectional units.

Unit root Tests

Apart from cross-sectional dependence, another issue common to most panel data is series with unit root or non-stationarity. Model estimations with non-stationary time-series may result in spurious regression or false relationship between the variables that do not exist in real world (Yule, 1926; Granger & Newbold, 1974; Phillips, 1986). There are several unit root tests used in the time-series and panel data analysis. This study employs a variant of Breitung (2005) and Hadri (2000) unit root tests that are robust to cross-sectional dependence. While the Breitung test assumes unit root in all panels, the Hadri test assumes stationarity of all panels under the null hypothesis. DeJong and Whiteman (1994) suggest performing unit root tests of these two types together in time-series analysis. Unit root tests were performed with time-trend and without time-trend options using lagged (4) version of the series.

Table 4: Unit Root Test-1

Variable	*Breitung*		*Hadri-LM*	
	Intercept	*Intercept &Trend*	*Intercept*	*Intercept &Trend*
LNSTOCK	1,867	0,244	139,05	62,911
	(0,969)	(0,597)	(0,000)	(0,000)
LNBOND	-2,143	0,163	60,70	72,532
	(0,016)	(0,565)	(0,000)	(0,000)
LNCDS	-2,343	-1,784	47,00	48,990
	(0,010)	(0,037)	(0,000)	(0,000)
LNVIX	-0,978	-0,205	18,37	64,400
	(0,164)	(0,419)	(0,000)	(0,000)
LNGOLD	-0,456	-0,379	22,19	70,732
	(0,324)	(0,352)	(0,000)	(0,000)
LNMSCI	-1,251	0,001	11,52	42,178
	(0,105)	(0,500)	(0,000)	(0,000)
LNOIL	-1,358	-0,531	98,22	26,238
	(0,087)	(0,298)	(0,000)	(0,000)

Source: SPSS Software Output

Breitung H0: Panels contain unit roots.
Hadri-LM H0= All panels are stationary

As seen in Table 4, the results of Breitung's (2004) unit root test show that series, except LNCDS and LNBOND, contain unit root in all panels. LNOIL also contains unit root at the 10% level, together with LNCDS and LNBOND. On the other hand, the results of the Hadri- LM (2004) test show that series contain unit roots in some panels. The results remained the same when the tests were performed with the time-trend option.

Table 5: Unit Root Test-2

Variable	*Breitung*		*Hadri-LM*	
	Intercept	*Intercept &Trend*	*Intercept*	*Intercept &Trend*
LNSTOCK	-6,141	-6,038	-1,09	-2,062
	(0,000)	(0,000)	(0,861)	(0,980)
LNBOND	-6,928	-1,882	-0,41	1,013
	(0,000)	(0,030)	(0,658)	(0,155)
LNCDS	-4,086	-3,310	-1,56	-1,683
	(0,000)	(0,001)	(0,941)	(0,954)
LNVIX	-2,764	-2,609	-1,56	-2,574
	(0,004)	(0,005)	(0,941)	(0,995)
LNGOLD	-2,950	-2,517	-0,41	3,126
	(0,003)	(0,006)	(0,658)	(0,001)
LNMSCI	-3,898	-3,951	-1,58	-1,368
	(0,000)	(0,000)	(0,943)	(0,914)
LNOIL	-5,568	-3,479	-1,60	-1,305
	(0,000)	(0,000)	(0,945)	(0,904)

Source: SPSS Software Output

Breitung H0: Panels contain unit roots.
Hadri-LM H0= All panels are stationary

Breitung and Hadri-LM tests were reperformed using the first differences of the series. As seen in Table 5, the results show that series are stationary in all panels. The only exception is LNGOLD, which contains unit root when tested with the intercept and trend option. Overall, the results of all unit root tests indicated that the panel dataset consists of a dependent variable that is stationary at order one (I(1)), and independent variables that are both stationary at level (I(0) and order one (I(1)).

Panel Cointegration Test

The results of the root test shows that, most of the series in the panel are not stationary. This also suggests that there may be a long-term equilibrium relationship among these series. Such a relationship results when the combination of two or more non-stationary variables is stationary. Panel data cointegration test examines whether there is a balanced, long-term relationship in the panels with two or more non-stationary series. This study utilizes Kao (1999), Pedroni (1999, 2004) and Westerlund (2005) cointegration tests to analyze whether there is a cointegrating relationship among the series. While the null hypotheses of these three cointegration tests check for no cointegration; Kao test analyzes the alternative hypothesis that all panels are cointegrated where cointegrating vectors are homogeneous; Pedroni test, which consists of seven test statistics, analyzes the alternative hypotheses that (a) all panels are cointegrated where cointegrating vectors and autoregressive parameters are panel specific, (b) all panels are cointegrated where cointegrating vectors are panel-specific, but autoregressive parameters are the same for all panels; Westerlund test analyzes the alternative hypotheses that (a) some panels (at least one) are cointegrated where cointegrating vectors and autoregressive parameters are panel specific, (b) all panels are cointegrated where cointegrating vectors are panel-specific, but autoregressive parameters are the same for all panels.

Table 6: Cointegration Tests

Pedroni Cointegration Test		*t-Statistics*	*Probability*
	Panel v-Statistic[a]	0,4300	0,3336
	Panel rho-Statistic[a]	-1,3708	0,0852
	Panel PP-Statistic[a]	-2,0134	0,0220
	Panel ADF-Statistic[a]	-2,1923	0,0142
		t-Statistics	Probability
	Group rho-Statistic[b]	-2,3247	0,0100
	Group PP-Statistic[b]	-3,1609	0,0008
	Group ADF-Statistic[b]	-3,3769	0,0004
Note1: Deterministic intercept and trend Note2: Automatic lag length selection based on SIC Note3: Newey-West automatic bandwidth selection and Bartlett kernel [a]Ha: All panels are cointegrated (Same AR-between dimension tests) [b]Ha: Some panels are cointegrated (Same AR-within dimension tests)			
KAO Cointegration Test		*t-Statistics*	*Probability*
	ADF [c]	-5,03793	0,0000
	Residual variance	0,00176	
	HAC variance	0,00137	
Note1: No deterministic trend Note2: Automatic lag length selection based on SIC Note3: Newey-West automatic bandwidth selection and Bartlett kernel [c]Ha: All panels are cointegrated			
Westerlund Cointegration Test		*Statistics*	*Probability*
	Variance Ratio[d]	3,7859	0,0001
Note: No time trends [d]Ha: Some panels are cointegrated (Same AR)			
	Variance Ratio[e]	1,2095	0,1132

Source: SPSS Software Output

Note: No time trends
eHa: All panels are cointegrated (Same AR)

As seen in Table 6, the results of the Kao test show that, the null hypothesis of no cointegration can be rejected in favor of the alternative hypothesis that all panels are cointegrated. The results of Pedroni test, as indicated by the five test statistics out of seven, show that the null hypothesis of no cointegration can be rejected in favor of the alternative hypotheses that (a) all panels are cointegrated where autoregressive parameters are panel-specific and (b) all panels are cointegrated where autoregressive parameters are the same for all panels (see ADF-t and PP-t tests for (b)). The results of the Westerlund test show that the null hypothesis of no cointegration (a) cannot be rejected in favor of the alternative hypothesis that all panels are cointegrated where autoregressive parameters are the same across panels, but (b) can be rejected in favor of alternative hypothesis that some panels are cointegrated where autoregressive parameters are panel specific. Overall, all three tests suggest that the null hypothesis of no cointegration can be rejected at least for some, if not for all, panels.

Model Specification

The results of cointegration tests imply a long-term relationship among the series. In other words, there is enough evidence showing that stock indices of countries in the panel are in a long-term equilibrium with the regressors. The relationship of this type has long been analyzed through error correction models (ECM) in most fields (Sargan, 1964; Engle & Granger, 1987; Pesaran & Shin, 1995). ECMs can measure the long and short-term effects of instantaneous shocks in time series, making it tested in two consecutive steps. First, series are added to the model with their optimal lags to estimate the long-term effects of regressors on the outcome variable. Second, series are added to the model with their first differences to estimate their short-term effects. The first differences of series are used to remove the long- term effects that occur due to non-stationary movements of series in time. The short-term model also includes the first lag of the residuals of the first model to estimate (a) the short- term effects of the deviations from the long-term equilibrium and (b) the speed of the dependent variable to adjust for the long-term balance.

The long-term model is expressed as follows:

$$lnstockit = \propto i + \delta it + \beta 1 lnbondit + \beta 2 lncdsit + \beta 3 lnvixt + \beta 4 lngoldt + \beta 5 lnmscit + \beta 6 lnoilt + eit (1)$$

Where i denotes individual cross-sectional unit (country), t denotes time, $\propto i$ and δi are individual and trend effects, β is coefficient for independent variable, and eit is the residual. The null hypothesis states that dependent (y) and independent (x) variables are integrated at order one, I(1). Under the alternative hypothesis of cointegration, eit equals to I(0).

The short-term equation is as follows:

$$d.\ lnstock = c + \beta 1 d.\ lnbond + \beta 2 d.\ lncds + \beta 3 d.\ lnvix + \beta 4 d.\ lngold + \beta 5 d.\ lnmsci + \beta 6 d.\ lnoil + ECT(-1) + e(2)$$

Where d denotes first difference, c denotes constant, β is coefficient for independent variable, ECT(-1) is first lag of the error correction term or residuals from the cointegrating (long-term) model, and e is the error.

IV. Empirical Analysis and Findings

The long-term effects of macroeconomic regressors on the stock index points were estimated by dynamic ordinary least squares (DOLS) estimator (Table 7). The optimal lags of variables were determined by the DOLS estimator automatically using Akaike informational criteria. The explanatory power of the model is quite high, with 99.8 percent. Pesaran CD statistics value of -1.502 is not statistically significant, which indicates no cross-sectional dependence between the units. The long-term variance score is the highest for Brazil, suggesting that the long-term effect is stronger for Brazil compared to other countries in the panel.

Table 7: LNSTOCK Long-term Model

Variables	*Panel*	*Turkey*	*Mexico*	*Russia*	*Brazil*
LNBOND	0,0064	-0.0869	0.0966	0,4843**	-0,3138
	(0,0886)	(-1,5346)	(1,3438)	(3,1787)	(-1.4459)
LNCDS	-0,2893***	-0.2660***	-0.2234**	-0,4225***	-0,3024**
	(-5,6582)	(-4,6952)	(-2,8627)	(-5,0436)	(-2,1824)
LNVIX	0,1671***	0.1158**	0.1063**	0,1918***	0,2981***
	(4,4800)	(2,7894)	(2,4634)	(3,6066)	(3,9560)
LNGOLD	-0,2098**	-0.0970	-0.4296***	0,0491	-0,5365**
	(-2,4448)	(-1,1761)	(-4,7672)	(0,4647)	(-2,6549)
LNMSCI	0,5344***	0.4857***	0.5588***	0,2094	0.8760***
	(4,1875)	(3,8689)	(3,6814)	(1,2776)	(3.0207)
LNOIL	-0,1254**	0.0080	-0.1787***	-0,1841***	-0,1652*
	(-2,8047)	(0,1916)	(-3,5236)	(-2,9036)	(-1.7175)
R-squared	0,9983	0.9707	0,9780	0,9596	0,9234
Adjusted R-squared	0,9982	0.9670	0,9752	0.9541	0,9196
Long-term Variance	0,0216	0,0039	0,0061	0,0089	0,0187
Pesaran CD	-1,502	NA	NA	NA	NA

Source: SPSS Software Output

t statistics are in parentheses,

***p<0,01, **p<0,05, *p<0,1

For the entire panel, all variables, except LNBOND, have a statistically significant long- term effect on LNSTOCK. The direction of effect is negative for LNCDS, LNGOLD, and LNOIL, and positive for LNVIX and LNMSCI. A 1% increase in the mean value of LNCDS and LNOIL is associated with a 0,29% and 0,13% decrease in the mean value of LNSTOCK, respectively. On the other hand, a 1% increase in the mean value of LNVIX and LNMSCI is associated with a 0,17% and 0,53% increase in the mean value of LNSTOCK, respectively. While the size of the effect differs between the units (country), the direction of the effect remains the same in most cases. As seen in the coefficient values, the long-term effect of independent variables is much more evident for Brazil than for any other country in the panel. The effect of LNCDS and LNOIL is the highest for Russia, which is the only country in the panel that MSCI has no significant long-term effect. Russia is also the only country where the effect of LNBOND is statistically significant in the long term. On the other hand, Turkey is the only country where LNGOLD and LNOIL have no significant long-term effect.

Table 8: Stationarity Test for the Residuals of Long-term Model

Variable	*Breitung*		*Hadri-LM*		*LLC*		*IPS*	
	Int.	Int. &Trend	Int.	Int. &Trend	Int.	Int. &Trend	Int.	Int. &Trend
RESID02	-4,969	-3,618	15,761	60,722	-6,718	-6,710	-4,257	-4,238
Probability	(0,000)	(0,000)	(0,000)	(0,000)	(0,000)	(0,000)	(0,000)	(0,000)

Source: SPSS Software Output

Breitung H0: Panels contain unit roots

LLC H0: Panels contain unit roots

Hadri-LM H0= All panels are stationary

IPS H0: All Panels contain unit roots

Table 8 presents the results of the stationarity test for the residuals of the long-term model. Since Breitung and Hadri-LM tests generated contradictory results on the stationarity of the residuals, these tests were followed by Levin, Lin, and Chu (2002) and Im, Pesaran, and Shin (2003) unit root tests. The results indicated that the null hypotheses of the Breitung and LLC test that panels contain unit roots and the IPS test that all panels contain unit roots can be rejected. Overall, the findings of Breitung, LLC, and IPS unit root tests validate the cointegration hypothesis that the combination of non-stationary variables is stationary.

Table 9: Variance Ratio Test of Cointegration Residuals

Statistics (Max |z|)	*Panel*	*Turkey*	*Mexico*	*Russia*	*Brazil*
Fisher Combined	30,389***	3,5576**	3,8022***	2,3064	2,7888*
Df	8				

Source: SPSS Software Output

Null: Resid02 is a martingale

***p<0,001, **p<0,05, *p<0.1

We also conducted a variance ratio analysis on the cointegrating residuals to test the null hypothesis that residuals follow a random walk (Table 9). If the null hypothesis holds, then the value of the error sequence of the dependent variable in the future periods is considered equal to the value of the errors sequence in the present period. The equality of error sequence means that stock exchange points follow a random walk and that the future stock exchange points do not reflect the current points. Random walk residual is considered a sign of a weak-form efficient market (Fama, 1970). Max |z| statistics of the Fisher Combined test show that the null hypothesis of random walk residuals does not hold for the panel as well for Turkey, Mexico, and Brazil. Overall, the findings of the variance ratio test suggest that all countries in the panel, except Russia, show signs of weak form of inefficient market.

Table 10: LNSTOCK Short-term Model

	Panel[a]	Panel[b]	Turkey	Mexico	Russia	Brazil
Variables						
D(LNBOND)	-0,2106***	-0,2157***	-0,2396***	-0,0854	-0,1800**	-0,2914***
	(-6,9787)	(-7,3001)	(-4,3543)	(-1,5649)	(-2,6160)	(-4,7416)
D(LNCDS)	-0,0498***	-0,0422**	-0,0993***	-0,0281	0,0108	-0,037
	(-3,2391)	(-2,7929)	(-2,8906)	(-1,1386)	(0,3715)	(-1,2616)
D(LNVIX)	-0,0298**	-0,0257*	-0,0176	-0,0505**	-0,0294	-0,0116
	(-2,1629)	(-1,9025)	(-0,6031)	(-2,2963)	(-1,1250)	(-0,4757)
D(LNGOLD)	-0,0614	-0,0524	-0,1586*	-0,0756	0,0474	-0,0158
	(-1,4487)	(-1,2609)	(-1,7459)	(-1,1126)	(0,6049)	(-0,2072)
D(LNMSCI)	0,4465***	0,4576***	0,4315***	0,4664***	0,3119***	0,6437***
	(8,5075)	(8,8998)	(3,8984)	(5,6224)	(3,1616)	(6,7569)
D(LNOIL)	0,0281	-0,0126	-0,0117	-0,1025***	0,0524	0,0247
	(1,6210)	(-0,6648)	(-0,2859)	(-3,2694)	(1,4317)	(0,7325)
COVID-19	NA	-0,1174***	-0,0977*	-0,2458***	0,0021	-0,1649***
	NA	(-4,8965)	(-1,8931)	(-6,2562)	(0,0441)	(-3,7713)
ECT (-1)	-0,1304***	-0,1340***	-0,3242***	-0,1771***	-0,1029**	-0,073**
	(-5,6033)	(-5,8810)	(-4,8318)	(-4,2564)	(-2,3267)	(-2,2915)
C	0,0060***	0,0067***	0,0096**	0,0088***	0,0061*	0,0032
	(3,3720)	(3,8504)	(2,5619)	(3,1433)	(1,8409)	(1,0249)
R-squared	0,5255	0,5464	0,6111	0,6287	0,4243	0,7275
Adjusted R-squared	0,5192	0,5394	0,5861	0,6048	0,3869	0,7097
F-statistic	82,5969***	78,4504***	24,361***	26,248***	11,33***	41,039***
Pesaran CD	2,417*	1,133	NA	NA	NA	NA

Source: SPSS Software Output

t statistics are in parentheses

***p<0,01, **p<0,05, *p<0,1

a Panel without COVID-19 Dummy

b Panel with COVID-19 dummy

The short-term models for the entire panel and individual country were estimated using the least square (LS) estimator (Table 11). The model for the panel (Panela) can explain the 52% of the variations in LNSTOCK, which is statistically significant as seen in the F statistic and its respective probability. However, the Pesaran CD statistic of the model shows that the model suffers from cross-sectional dependency. We created a new dummy variable to account for some of the variations common to all units and to mitigate the effects of cross- sectional dependence. The new dummy variable has two values that represent "1" for March 2020 and "0" for otherwise. From the descriptive statistics, one can see that the highest drop in the stock markets of Turkey, Mexico and Brazil occurred in March 2020. This period coincides with the end of February 2020, when the COVID-19-related deaths broke out in many countries. Therefore, we named the new variable COVID-19, assuming the drop in stock exchange markets in March 2020 is due to the COVID-19 outbreak.

The short-term model for the panel was reestimated (Panelb) with the COVID-19 variable. Pesaran CD statistics of the new model show no cross-sectional dependence between the units. The adjusted R2 value of 0.539 indicated that the COVID-19 increased the explanatory power of the previous model by 2 percent. The coefficient value of 0,117 for COVID-19 implies that the mean value of LNSTOCK in the COVID-19 period is almost 12% less than the mean value of LNSTOCK in the non-COVID-19 period. The reestimation of the short-term model yielded no significant change in the estimated coefficients of other variables. The short-term effects of LNBOND and LNMSCI are statistically significant at the 1% level, and the effects of LNCDS and LNVIX are significant at the 5% level. A 1% increase in LNBOND, LNCDS, and LNVIX is associated with a 0,22%, 0,04%, and 0,03% decrease in LNSTOCK, respectively. The same amount of increase in MSCI, however, is associated with a 0,44% increase in LNSTOCK. LNGOLD and LNOILD seem to have no significant short-term effect on LNSTOCK. The coefficient value of the error correction term (ECT) indicates that 13% of the deviations from the past periods are corrected in the present period. The statistical significance of the error correction coefficient confirms the findings of the panel cointegration test that all panels are cointegrated.

There are significant differences in the explanatory powers of individual models. The independent variables, combined, explain almost 39 percent of the variation in stock prices for Russia, which is almost half the explanatory power of the model for Brazil. The relatively low explanatory power of the Russian model implies that MOEX Russia has different dynamics compared to other stock markets. The low R-squared confirms the findings of the variance ratio analysis that the Russian market is a weak-form efficient market in which future stock points reflect current stock points. Other than bond yields, which is a country-specific variable, the only variable that has a significant short-term effect is MSCI, which affects BOVESPA more than two times it affects MOEX Russia. Further, the Russian model is the only model that COVID-19 seems to have no significant effect.

Despite differences in the size of effects, bond yields and MSCI, like in the Russian model, are two variables, along with COVID19, with a significant effect on Brazil's stock prices. The model estimated COVID-19-effect in the Brazilian model is almost half the exact drop in March 2020. The difference may be due to the difference between the direct and indirect effects of the COVID-19.

The short-term dynamics for the Mexican stock market seem to have a different pattern than those of Brazil despite their geographic proximity. Country-specific variables of bond yields and CDS premiums have no significant short-term effect on BSE SUNSEX. Further, Mexico is the only country in the panel that bond yields neither have a long nor a short-term impact. On the other hand, Mexico is the only country that VIX and Oil prices have a significant short-term effect on stock prices. Model estimated COVID-19-effect is also very close to the actual drop in March 2020.

Unlike Mexico, country-specific variables have a significant impact on Turkey. Further, Turkey is the only country in the panel that gold prices have a significant short-term effect. Model estimated COVID-19-effect equals almost half the actual drop in March 2020. As seen in the long-term variance score and speed of adjustment, in Turkey, variables are much more effective in the short term than they are in the long term. Throughout the panel, one can see that a high long-term variance score is associated with a low speed of adjustment. The ECT coefficient of -0,32 indicates that one-third of any deviation from the long-term equilibrium in the present period is corrected in the next period. Error correction or the speed of adjustment is much slower for Mexico, Russia, and Brazil in line with their long-term variance scores. The speed of adjustment is almost six months for Mexico, ten months for Russia, and fourteen months for Brazil.

V. Conclusion

According to the analysis results, the effect of bond yields on stock market returns is negative for each country in the short term, higher for Brazil and Turkey, and statistically significant at 1% probability level. However, this effect is only significant for Russia in the long term, in a high and positive direction, at the 5% probability level. The effect of CDS premiums on stock market returns is significant only for Turkey and higher than other countries in the short term. The long-term effect is high and negative on each country (especially on Russia), significant at 5% and 1% probability levels. The effect of VIX on stock market returns is low and negative on all 4 countries in the short term, but this effect is positive on each country in the long term and is higher and more significant for Brazil and Russia. The effect of gold is negative, high, and significant at 10% probability level only for Turkey in the short term, but while the effect on Turkey decreases in the long term, it is negative, high and statistically significant for Mexico and Brazil. The relationship between MSCI and stock market returns is the highest, positive, and significant for each of the 4 countries in the short term. While this effect on Russia decreases in the long term, it increases on other countries, especially on Brazil. It is observed that the effect of crude oil is negative only on Mexico and significant at 1% probability level in the short term, insignificant on Turkey, and negative and high on other countries in the long term. It is seen that the effect of COVID 19 on stock market returns in the short term is negative in other countries except for Russia, low in Turkey, and high in Mexico and Brazil.

Consequently, to summarize the effects of independent variables on stock markets of the countries analyzed in this study, the effects of variables other than MSCI and VIX index on the stock market indices of countries differ in terms of both size and direction. The relationship between stock market indices and MSCI is positive and significant both in the short and long term for each of the 4 countries. While the effect of the VIX index is low and negative in the short term, it is seen to have a high positive effect in the long term. The effects of other variables are briefly observed as follows:

In the short-term model, the bond interest and the COVID 19 negatively affect the Brazilian stock market index, while the gold prices, bond yields, CDS premiums and crude oil prices have a negative effect in the long-term model. Mexico stock market index is affected negatively by COVID 19, crude oil prices and bond yields, in the short term, while it is affected positively by bond yields, negatively by gold prices, CDS and crude oil prices respectively in the long term. On the Russian stock market index, bond yield has a negative effect in the short term. Bond yield has a positive, CDS premium and oil prices have a negative effect in the long term. It is observed that bond yields, gold prices and CDS premiums have negative effect on the Turkish stock market index both in the short term and in the long term. Additionally, the ECT that indicates the speed of adjustment obtained for Turkey is much higher compared to Mexico, Russia and Brazil in line with the long-term variance scores.

The results of the panel analysis consisting of Brazil, Mexico, Russia and Turkey indicate that, the effects of independent variables on stock market indices are as follows: i) While the bond yield has no significant effect in the long term, it has a negative and high effect in the short term. ii) The effect of CDS premium is negative and high in the long-term, and negative and low in the short-term. iii) VIX has a positive and significant effect in the long term, but a negative and very low effect in the short term. iv) The long-term effect of gold prices is negative and high, but insignificant in the short-term. v) MSCI is in a significant, positive and high relationship with stock market indices both in the long and the short term. vi) The effect of crude oil prices is significant and negative in the long term and insignificant in the short term. vii) COVID 19 impact is negative and significant in the short term.

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