Volume and Issues Obtainable at Center for Sustainability Research and Consultancy

Journal of Business and Social Review in Emerging Economies

ISSN: 2519-089X (E): 2519-0326

Volume 7: No. 1, March 2021

Journal homepage: www.publishing.globalcsrc.org/jbsee

Bidirectional Relationship between Stock Market Decline and Liquidity: A Study of Emerged & Emerging Economies

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ARTICLE DETAILS**History**

Revised format: Feb 2021

Available Online: Mar 2021

Keywords

Stock Market Decline, Liquidity, Autoregressive Distributed Lag (ARDL) Model, Bi-directional Causality, Emerged & Emerging Economies.

JEL Classification

M0, M1

ABSTRACT

Purpose: This study intends to examine the nature & direction of relationship between stock market movements, particularly market decline, and its liquidity in 14 selected emerged and emerging economies (G8+5 and Pakistan) for January 2001 through December 2017 by applying Autoregressive Distributed Lag (ARDL) Bounds test and Granger-causality test. Trading value and turnover ratio are employed to measure market liquidity.

Methodology: The study is conducted on a sample of 14 economies (G8 + 5 emerging economies, and Pakistan) for January 2001 through December 2017. Daily basis data for all variables is collected from data stream and Economic Indicator website. Market Liquidity is measured by trading value and turnover ratio

Findings: Results of trading value Granger-causality test highlight the evidence of no causality in Germany & India. Bi-directional causality exists in Pakistan only. Uni-directional causality subsists only in Russia at 10% significance level from trading value to market return. However, from market return to trading value, results demonstrate the presence of uni-directional causality at 5% significance level for Brazil, Japan, Canada, China, France, Italy, UK, USA, South Africa and Mexico. Negative returns are used to represent the notion of market decline.

Implications: Study summarizes the stock market movements of emerging and emerged countries which will be helpful for future researchers and policy makers in their projects.

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Recommended citation: Khakwani, M. S., & Kouser, R. (2021). Bidirectional Relationship between Stock Market Decline and Liquidity: A Study of Emerged & Emerging Economies. *Journal of Business and Social Review in Emerging Economies*, 7(1), 81-94.

Introduction

During the global financial crisis period (2007-09), the equity market is believed to have been severely affected, losing over \$30 trillion worldwide. On average major stock markets have lost between 40% and 60% during the period from September 2008 to March 2009 (Sornette, 2009). Liquidity has emerged

as one of the crucial financial issues since the Russian debt crisis in 1998, further aggravated by the recent global financial crisis of 2007-9. These eras have been associated with a widespread deterioration in liquidity across countries and markets (Marozva, 2019). Although the connection between return and liquidity has been quite old yet the knock on worldwide stock markets lately motivated researchers to vigorously investigate the role of liquidity in financial markets, predominantly the connection between liquidity and returns when the market is moving down.

Theoretically, illiquidity imposes some cost to the investor, thus liquidity affect returns. Intuitively, there should be an inverse relationship between liquidity and stock returns. Since liquidity impacts returns, therefore from an investors' perspective liquidity risk must to be priced. Datar, Naik, and Radcliffe (1998) argue that liquidity is central in clarifying the cross sectional disparity in stock returns. Moreover, finance professionals (see Amihud & Mendelson, 1986; Datar et al, 1998; Pastor & Stambaugh, 2003) generally agree to the fact that liquidity as measured by transaction cost and assets marketability are important elements in the determining expected stock returns. Investors need higher expected holding period returns minus any illiquidity and/or any trading cost meaning that illiquid assets are expected to produce higher gross margins as compared to liquid assets. Liquidity has so far proved to be an important characteristic of assets that influence investors' portfolio development decisions. The drivers of illiquidity include the exogenous trading costs, symmetric information, inventory risk, demand pressure, and search frictions in line with Amihud, Mendelson and Pedersen (2005). Investors' goal is maximizing their returns from the investments net of liquidity & trading costs, indicating that less liquid assets should at least yield higher gross margins as compared to more liquid assets.

The notion of market decline causing asset illiquidity has grasped a lot of attention in the contemporary theoretical financial research. Due to the market participants' behavior of engaging in panic-selling (creating demand effect), or when financial intermediaries get reluctant to provide funds (resulting in supply effect), or may be both, liquidity dry-ups are believed to occur. The nature of private and hence asymmetric information is a neutralizing fact of the liquidity: either or both sides of market participators are afraid of being exposed to the risk of losing money due to the private information the other side may possess, thereby reluctant to trade (Yuping, 2015). A logical investor would usually choose to trade liquid assets and therefore studies suggest persistent evidences correlating hefty trading volume and uprising market liquidity (Pereira and Zhang, 2010). Contrary to that, low liquidity generally indicates towards lower asset prices that is unfavorable for investors who particularly demand higher returns to pay off for holding low liquid assets. Constantinides, in 1986, describes liquidity premium as the compensation to investors to make them indifferent between an asset with high liquidity and an asset with some degree of liquidity risk.

Literature Review & Theoretical Linkage between Variables

The association between equity market returns and market liquidity has been explored and investigated in different past studies, however the results or inferences drawn from those studies are inconclusive. Chordia, Roll & Subrahmanyam (2001) used overall market spreads, trading activity and depth as liquidity proxies in their study and established that market returns & the volatility of returns impact market liquidity and trading activity as well. They suggested that liquidity must drop when the market moves in the downward direction.

The phenomenon of illiquidity after the market declines has been justified by theoretical models in different ways. In view of collateral-based models, temporary liquidity tremors are absorbed by market makers in the process of making markets. Though, they confront financing constrictions and usually obtain funding through posting margins and by pledging securities held as collateral. However, large market declines enforce the intermediaries to liquidate as they strike their margin limits (Hameed, Kang & Viswanathan, 2010). In case of huge market shocks, an illiquidity spiral is created as a result of high margin requirements, which further limits market makers to provide liquidity in market. Thus, low liquidity levels are switched on by big market shocks (Brunnermeier and Pedersen, 2009). This

relationship is described by Pedersen (2007) that institutions in reaction to greater volatility resulting from market downturns develop strict risk management policies and this reduces market liquidity by constricting their risk absorbing capacity.

Bernardo and Welch (2003) present coordination failure based model describing that market traders face different trading limits which trigger them to make selling decisions. When one trader hits his limit, this hitting may bring the price down and cause other market traders' limits be struck. It enables early liquidation to give superior price than that of late liquidation. Therefore, in times of negative shocks, traders hurry to liquidate and finally liquidity black-holes appear when prices have fallen enough (Morris and Shin, 2004).

The justification to check whether the liquidity of stock market can function as the prominent indicator or predictor for stock market activity is based on two main reasons. The first rationale is grounded in "flight to quality" hypothesis presented by Longstaff in 2004, and suggests that investors are inclined to adjust their portfolios by adding more liquid assets when economic activity gets turbulent. This adjustment leads to a sort of panic among the investors leading to the stock market decline. The next rationale documented by Brunnermeier and Pedersen (2009) explains the formation of liquidity spirals during stock market downturn due to reduction in market liquidity and shrunken funding provided by financial intermediaries.

Hameed, Kang and Viswanathan (2010) study the influence of market decline on different dimensions or measures of stock liquidity through both time-series and cross-sectional disparity in liquidity and phenomenon of commonality in market liquidity. They document that there are asymmetrical variations in liquidity in response to ups and downs in security market prices. Moreover, their results depict that shrinkage in liquidity due to negative returns is considerably more than upsurge in liquidity because of positive returns. This impact is observed to be resilient for firms facing high volatility and specifically during times when financial intermediaries counter with capital tightness. Their research provide evidence of collateral-based approach of stock market liquidity.

Previous research studies on equity markets in Japan (Faff, Chang, & Hwang, 2010) and in China (Narayan & Zheng, 2011) reflect an inverse link between stock liquidity and return. In 2011, Narayan and Zheng put forwarded that the strength of this relationship fluctuates across different markets because their results showed stronger association on Shanghai stock exchange than that of in Shenzhen stock exchange. Petkova, Akbas, & Armstrong (2011) studied US equity market and favored positive relationship between liquidity variations and anticipated returns. Their results are in contradiction to the results given by Chordia et al. (2001).

According to the liquidity-shock-hypothesis, a quick or unexpected fall in asset markets' liquidity leads stock prices to drop and consequently the price of more liquid assets increases (Kiyotaki & Moore, 2008). Investors, in addition to dealing with the issues of limited funds & financing restrictions while making their investment portfolios, this drop in stock prices puts additional burden on their capacity to raise further capital by using the option of stock issues. Decreased stock market prices also diminishes the chance of keeping this stock as security against borrowing. The whole of this process results in drop of both investments' value and further options, causing lower output and that initiates a recession. The liquidity-shock-hypothesis has gained extensive attention due to its practical strategic inferences (Apergis, Artakis & Kyriazis, 2015).

Bhattacharya, Bhattacharya & Basu (2019) studied the connection between stock market movements and its liquidity using ARDL-Bounds Testing Approach. They suggested that market liquidity and equity market are in a long-run relationship. Different measures of liquidity gave different direction of relationship with returns. When spread is used as proxy for liquidity, then inverse relation is being observed between liquidity and equity market. However in case of measures such as trading activity and

market efficiency coefficient, the results showed direct impact on equity market. Liquidity proxies affect market return both in short run as well long run. The influence of the turn over rate on equity market is -ive in short-term but +ive in the long-term.

In general, existing studies find a positive return-illiquidity relation in both developing and emerging markets. However, there other empirical studies that attests to a negative relationship, their argument being that if liquidity is systematically determined then securities with returns positively correlated with market liquidity should have high expected returns. This nature of relationship is confirmed by Fama and French (1992), and Eleswarapu and Reinganum (1993). This has motivated the carrying out of this research especially on set of emerged (G8- USA, UK, Russia, Germany, Italy, Canada, France & Japan) and 6 emerging economies (China, India, Mexico, South Africa, Brazil & Pakistan) as it is ideal testing ground for the comparative connection between stock market negative returns and liquidity by means of dynamic co-integration bounds test using daily data for period of 17 years.

In view of the theoretical linkage developed above and by reviewing the previous studies, the following hypothesis are forwarded for examination in this paper:

- H₁: Stock market decline leads to lower stock liquidity.
- H₂: Lower stock liquidity leads to stock market decline.
- H₃: There is a causal relationship between stock market decline and stock liquidity.
- H₄: There is a causal relationship between stock liquidity and stock market decline.

Research Models & Methods

The study is conducted on a sample of 14 economies (G8 + 5 emerging economies, and Pakistan) for January 2001 through December 2017. Daily basis data for all variables is collected from Datastream and Economic Indicator website. Market Liquidity is measured by trading value and turnover ratio (Korajczyk and Sadka, 2008). Market decline is represented by negative returns.

Granger-causality test is utilized to assess the causal nature of relationship among the variables of study and then to further investigate whether one variable may be used to project the other variable. The essential requirement before using Granger causality is that all the series of variable under consideration are stationary. After testing for stationarity, the next pattern of the research methodology that needs to be followed is provided in figure 3.1 below. Main equations that form the baseline of this causality test are given as:

$$y_t = \alpha_0 + \sum_{i=1}^m \alpha_i y_{t-i} + \sum_{j=1}^n \beta_j x_{t-j} + \varepsilon_t$$

$$x_t = \omega_0 + \sum_{i=1}^m \gamma_i y_{t-i} + \sum_{j=1}^n \theta_j x_{t-j} + \varepsilon_t$$

where it is supposed that ε_t of both equations should not be correlated.

ARDL (Autoregressive Distributed Lag) method has been established by Pesaran and Shin (1999) and Pesaran et al. (2001); and is regarded as a dynamic approach employed in time series based research to determine co-integration, error-correction models and to assess the existence of any symmetric relation between market decline & liquidity, both in short and long terms. This methodology has been selected because this model generates consistent and asymptotically normal estimates of long-term coefficients regardless of integration order I (0) or I (1) of underlying regressors. However, for integration order I (2), this model is not applied because then its F test critical values no more remain valid (Tursoy, 2019). Following models are employed to test the two-way impact of stock market decline and liquidity.

$$\Delta NegR = \alpha + \sum_{i=1}^n \beta_i \Delta NegR_{t-i} + \sum_{i=0}^n \delta_i \Delta LnLnTV_{t-i} + \lambda_1 NegR_{t-1} + \lambda_2 LnLnTV_{t-1} + \mu_t \quad (1)$$

$$\Delta NegR = \alpha + \sum_{i=1}^n \beta_i \Delta NegR_{t-i} + \sum_{i=0}^n \delta_i \Delta TO_{t-i} + \lambda_1 NegR_{t-1} + \lambda_2 TO_{t-1} + \mu_t \quad (2)$$

$$\Delta LnTV = \alpha + \sum_{i=1}^n \beta_i \Delta LnTV_{t-i} + \sum_{i=0}^n \delta_i \Delta NegR_{t-i} + \lambda_1 LnTV_{t-1} + \lambda_2 NegR_{t-1} + \mu_t \quad (3)$$

$$\Delta TO = \alpha + \sum_{i=1}^n \beta_i \Delta TO_{t-i} + \sum_{i=0}^n \delta_i \Delta NegR_{t-i} + \lambda_1 TO_{t-1} + \lambda_2 NegR_{t-1} + \mu_t \quad (4)$$

In above equations, *NegR* shows the negative return, *LnTV* measures the log of trading value and *TO* denote the turnover ratio.

Empirical Results & Analysis

When dealing with time series, the process of empirical analysis generally starts with finding out the integration order (at level or first difference) and stationarity of all variables of study, whether dependent or independent. To test the stationarity of variables, unit root tests are performed based on Dickey and Fuller (1979), Phillips and Perron (1988) and KPSS (1992) tests. Unlike most of unit-root tests, the alternative hypothesis in KPSS test is based on the presence of a unit root whereas null hypothesis indicates non-stationarity of data. Returns for the stock indices for 14 sample countries are found stationary at level. Trading value for all 14 sample countries are non-stationary at level but stationary at 1st difference. Turn over ratio is stationary at level for some countries and for others, it is stationary at 1st difference.

For the granger-causality test, results are provided in Table 1. The results of this study have illustrated that unidirectional causality subsists among all countries except Germany & India; wherein no causal association exists between market return and trading value in these two countries. There is a confirmation of bi-directional causality in Pakistan only. Uni-directional causality subsists only in Russia at 10% significance level from trading value to market return. However, from market return to trading value, results demonstrate the presence of uni-directional causality at 5% significance level for Brazil, Japan, Canada, China, France, Italy, UK, USA, South Africa and Mexico.

Table 1: Results of Causality Analysis--Market Return (R) & Trading Value (LnTV)

<u>Country</u>	<u>Pairwise Granger-Causality Tests</u>		
	<u>Null Hypothesis: (does not Granger Cause)</u>	<u>F-Statistic</u>	<u>Prob.</u>
France	LNTV → R	2.23372	0.1072
	R → LNTV	6.89072	0.001
Canada	LNTV → R	0.32721	0.7209
	R → LNTV	3.01760	0.049
Germany	LNTV → R	0.76280	0.4664
	R → LNTV	1.47239	0.2295
Italy	LNTV → R	0.96202	0.3822
	R → LNTV	5.98802	0.0025
Japan	LNTV → R	0.48446	0.6161
	R → LNTV	4.40433	0.0123
Russia	LNTV → R	2.82356	0.0595
	R → LNTV	1.32175	0.2668

UK	LNTV $\rightarrow$ R	1.67722	0.187
	R $\rightarrow$ LNTV	7.80240	0.0004
USA	LNTV $\rightarrow$ R	0.54625	0.5792
	R $\rightarrow$ LNTV	13.5363	1.00E-06
Brazil	LNTV $\rightarrow$ R	0.21039	0.8103
	R $\rightarrow$ LNTV	4.25986	0.0142
China	LNTV $\rightarrow$ R	0.29877	0.7417
	R $\rightarrow$ LNTV	108.115	1.00E-46
India	R $\rightarrow$ LNTV	1.93700	0.1443
	LNTV $\rightarrow$ R	0.95612	0.3845
Mexico	LNTV $\rightarrow$ R	0.14304	0.8667
	R $\rightarrow$ LNTV	6.72218	0.0012
South Africa	LNTV $\rightarrow$ R	0.90549	0.4044
	R $\rightarrow$ LNTV	2.81269	0.0601
Pakistan	LNTV $\rightarrow$ R	3.89877	0.0203
	R $\rightarrow$ LNTV	41.1305	2.00E-18

(1% level is identified by ***, 5% level by ** and 10% by *)

($\rightarrow$ denotes does not Granger Cause)

For the granger causality test between market return & turn over ratio, results are provided in Table 2. The results of this study have illustrated that unidirectional causality subsists among all countries except Mexico & India; wherein no causal association exists between market return and turn over ratio in these two countries. There is a confirmation of bi-directional causality in Pakistan only. Uni-directional causality subsists only in Italy from turn over ratio to market return. However, from market return to turn over ratio, results demonstrate the presence of uni-directional causality for Brazil, Japan. Canada, China, France, Germany, UK, USA, South Africa and Russia.

Table 2: Results of Causality Analysis--Market Return (R) & Turn Over Ratio (TO)

Pairwise Granger Causality Tests

<u>Country</u>	<u>Null Hypothesis: (does not Granger Cause)</u>	<u>F-Statistic</u>	<u>Prob.</u>
Canada	TO $\rightarrow$ R	0.12575	0.8818
	R $\rightarrow$ TO	19.3772	4.00E-09
France	TO $\rightarrow$ R	0.92087	0.3982
	R $\rightarrow$ TO	33.7522	3.00E-15

Germany	TO $\rightarrow$ R	0.15094	0.8599
	R $\rightarrow$ TO	6.93063	0.001
Italy	R $\rightarrow$ TO	12.3572	4.00E-06
	TO $\rightarrow$ R	1.21143	0.2979
Japan	TO $\rightarrow$ R	1.95957	0.141
	R $\rightarrow$ TO	5.58933	0.0038
Russia	TO $\rightarrow$ R	0.43524	0.6471
	R $\rightarrow$ TO	2.52188	0.0804
UK	TO $\rightarrow$ R	1.38238	0.2511
	R $\rightarrow$ TO	18.5188	1.00E-08
USA	TO $\rightarrow$ R	0.51271	0.5989
	R $\rightarrow$ TO	44.4349	8.00E-20
Brazil	TO $\rightarrow$ R	0.82501	0.4383
	R $\rightarrow$ TO	11.9107	7.00E-06
China	TO $\rightarrow$ R	1.16939	0.3106
	R $\rightarrow$ TO	22.2884	2.00E-10
India	TO $\rightarrow$ R	0.89644	0.4081
	R $\rightarrow$ TO	0.08950	0.9144
Mexico	TO $\rightarrow$ R	0.31311	0.7312
	R $\rightarrow$ TO	1.41924	0.242
South Africa	TO $\rightarrow$ R	0.52918	0.5891
	R $\rightarrow$ TO	6.76181	0.0012
Pakistan	TO $\rightarrow$ R	2.90731	0.0547
	R $\rightarrow$ TO	44.6643	6.00E-20

(1% level is identified by ***, 5% level by ** and 10% by *)

($\rightarrow$ denotes does not Granger Cause)

The ARDL Bounds is applied to examine the cointegration between negative return & trading value. Table 3 presents daily bounds test results of the estimated F-statistics for all the 14 countries in the sample. The first column presents F-statistics of the model F_{LnTV} ($LnTV/NegR$) where negative return is the independent variable and trading value is the dependent one. The second column presents F-statistics of the model F_{NegR} ($NegR/LnTV$) where trading value is the independent variable and negative return is the dependent one. Null hypothesis for bounds test is that long-run relationship does not exist. The p-values of all estimates are lesser than 0.01 so null hypothesis is rejected indicating the existence of long run association between variables in both models. Moreover, for co-integration to exist, the F-value must lie above the upper bound. Therefore, it is empirically tested that bidirectional relationship exists between stock market decline & liquidity (measured by trading value) in long-run as their co-integration

in both models is proved using bounds test.

Table 3: ARDL Bounds Test Results (daily)--Negative Return & Trading Value

Category	Countries	$F_{LnTV} (LnTV/NegR)$		$F_{NegR} (NegR/LnTV)$	
		F-statistics	Cointegration	F-statistics	Cointegration
Emerged	Canada	16.36***	Yes	268.33***	Yes
	France	52.79***	Yes	413.75***	Yes
	Germany	14.27***	Yes	378.62***	Yes
	Italy	23.88***	Yes	409.49***	Yes
	Japan	11.90***	Yes	422.72***	Yes
	Russia	15.46***	Yes	243.38***	Yes
	UK	57.27***	Yes	147.89***	Yes
	USA	14.34***	Yes	157.70***	Yes
Emerging	Brazil	8.27***	Yes	375.09***	Yes
	China	112.10***	Yes	388.74***	Yes
	India	10.52***	Yes	287.09***	Yes
	Mexico	19.27***	Yes	218.83***	Yes
	South Africa	20.23***	Yes	455.22***	Yes
	Pakistan	30.03***	Yes	171.25***	Yes
Critical Values		1 Percent	2.5 Percent	5 Percent	10 Percent
Lower Bounds I(0)		6.84	5.77	4.94	4.04
Upper Bounds I(1)		7.84	6.68	5.73	4.78

(1% level is identified by ***, 5% level by ** and 10% by *)

The ARDL Bounds is applied to examine the cointegration between negative return & turn over ratio. Table 4 presents daily bounds test results of the estimated F-statistics for all the 14 countries in the sample. The first column presents F-statistics of the model F_{To} (TO/NegR) where negative return is the independent variable and turn over ratio is the dependent one. The second column presents F-statistics of the model F_{NegR} (NegR/TO) where turn over ratio is the independent variable and negative return is the dependent one. Null hypothesis for bounds test is that long-run relationship does not exist. The p-values of all estimates is lesser than 0.01 so null hypothesis is rejected indicating the existence of long run association between variables in both models. Moreover, for co-integration to exist, the F-value must lie above the upper bound. Therefore, it is empirically tested that bidirectional relationship exists between stock market decline & liquidity (measured by turn over ratio) in long-run as their co-integration in both models is proved using bounds test.

Table 4: ARDL Bounds Test Results (daily)--Negative Return & Turn Over Ratio

Category	Countries	$F_{To} (TO/NegR)$		$F_{NegR} (NegR/TO)$	
		F-statistics	Cointegration	F-statistics	Cointegration
Emerged	Canada	118.29***	Yes	295.35***	Yes
	France	98.37***	Yes	438.92***	Yes
	Germany	13.88***	Yes	399.28***	Yes
	Italy	418.77***	Yes	418.77***	Yes
	Japan	20.32***	Yes	426.14***	Yes
	Russia	30.50***	Yes	247.94***	Yes
	UK	88.23***	Yes	260.69***	Yes
	USA	98.25***	Yes	172.06***	Yes

Emerging	Brazil	16.47***	Yes	379.61***	Yes
	China	127.79***	Yes	379.83***	Yes
	India	17.34***	Yes	304.13***	Yes
	Mexico	213.38***	Yes	437.65***	Yes
	South Africa	116.95***	Yes	481.86***	Yes
	Pakistan	25.39***	Yes	126.35***	Yes
<hr/>					
	Critical Values	1 Percent	2.5 Percent	5 Percent	10 Percent
	Lower Bounds				
	I(0)	6.84	5.77	4.94	4.04
	Upper Bounds				
	I(1)	7.84	6.68	5.73	4.78

(1% level is identified by ***, 5% level by ** and 10% by *)

On the basis of all the results exhibited by both proxies of liquidity that two-way association exists between stock market decline and liquidity in the long term. Thus co-integration in long-run is suggested by ARDL bounds test at 1% significance level for all the emerging and emerged countries in the sample.

Conclusion

This study intends to explore the nature and direction of relationship between stock market movements, particularly market decline, and its liquidity in 14 selected emerged and emerging economies (G8+5 and Pakistan) for January 2001 through December 2017 by employing Autoregressive Distributed Lag (ARDL) Bounds test and Granger-causality test.

The results of trading value Granger-causality test highlight the evidence of no causality in Germany & India. There is an evidence of bi-directional causality in Pakistan only. Uni-directional causality subsists only in Russia at 10% significance level from trading value to market return. However, from market return to trading value, results demonstrate the presence of uni-directional causality at 5% significance level for Brazil, Japan, Canada, China, France, Italy, UK, USA, South Africa and Mexico. The results of turnover ratio Granger-causality test show that uni-directional causality subsists among all countries except Mexico & India; wherein no causal association exists between market return and turnover ratio in these two countries. There is an evidence of bi-directional causality in Pakistan only. Uni-directional causality subsists only in Italy from turnover ratio to market return. However, from market return to turnover ratio, results demonstrate the presence of uni-directional causality for Brazil, Japan, Canada, China, France, Germany, UK, USA, South Africa and Russia.

Trading value and turnover ratio are employed to measure market liquidity. Negative returns are used to represent the notion of market decline. The results of ARDL bounds test exhibited by both proxies of liquidity demonstrate that two-way association exists between stock market decline and liquidity in the long term. Thus co-integration in long-run is suggested by ARDL bounds test at 1% significance level for all the emerging and emerged countries in the sample.

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Appendix I

Graphical Representation of Data for Market Returns (2001-2017)

Appendix II

Graphical Representation of Data for Trading Value (2001-2017)

Appendix III

Graphical Representation of Data for Turn Over Ratio (2001-2017)