ASYMMETRIC EFFECTS OF OIL PRICES AND EXCHANGE RATES ON SECTORAL STOCK INDICES IN SOUTH ASIAN COUNTRIES

MUHAMMAD ASIM

UNIVERSITI SAINS MALAYSIA

2024

ASYMMETRIC EFFECTS OF OIL PRICES AND EXCHANGE RATES ON SECTORAL STOCK INDICES IN SOUTH ASIAN COUNTRIES

by

MUHAMMAD ASIM

Thesis submitted in fulfillment of the requirements
for the Degree of
Doctor of Philosophy

June 2024

ACKNOWLEDGEMENT

I would like to express my gratitude to a multitude of people, who gave me the possibility to complete this thesis. First and foremost, I would like to express my sincere gratitude to my supervisor, Dr. Chan Tze Haw, for his patience, encouragement, stimulating suggestions, and unconditional support through every stage in the creation of this thesis. Dr. Chan has been a constant inspiration and a good role model to me. Under his supervision and influence, I feel to have accomplished more than I could imagine over the past years, both academically and personally. I would like to extend my thanks to all the staff at the Graduate School of Business for their trust in my abilities. Lastly, and most importantly, I would like to acknowledge the contribution of my parents, the Late Manzoor Ali Shaikh and Late Zareena Manzoor Shaikh without their continuous support throughout my life this endeavor would not have been possible.

TABLE OF CONTENTS

LIST OF TABLES

Page

LIST OF FIGURES

Page

LIST OF ABBREVIATIONS

ADF	Augmented Dickey Fuller
APT	Arbitrage Pricing Theory
BSE	Bombay Stock Exchange
CSE	Colombo Stock Exchange
CUSUM	Cumulative Sum of the Recursive Residuals
CUSUMSQ	Cumulative Sum of Squared Recursive Residuals
CV	Coefficient of Variation
EMH	Efficient Market hypothesis
EPS	Earnings Per Share
ER	Exchange Rate
GDP	Gross domestic product
IPI	Industrial Production Index
KSE	Karachi Stock Exchange
MPT	Modern Portfolio Theory
MSCI	Morgan Stanley Capital International
NARDL	Nonlinear Autoregressive Distributed Lag
OLS	Ordinary Least Square
OP	Oil Price
OTC	Over The Counter
PP	Phillip-Perron
PSX	Pakistan Stock Exchange
SEBI	Securities and Exchange Board of India
SEC	Securities &Exchange Commission of Sri Lanka
SECP	Securities &Exchange Commission of Pakistan
SIC	Schwartz information criterion

USD	United States Dollar
VAR	Vector Autoregressive
VECM	Vector Error Correction Models
WTI	West Texas Intermediate
ZA	Zivot Andrew

LIST OF APPENDICES

KESAN ASIMETRIK HARGA MINYAK DAN PERTUKARAN ASING KE ATAS INDEKS SEKTOR SAHAM DE NEGARA ASIA SELATAN

ABSTRAK

Globalisasi telah berkembang tetapi proses peningkatannya ketidaktentuan. Oleh itu, penularan dan kesan limpahan dalam pasaran kewangan telah menjadi pusat penyelidikan bidang kewangan beberapa dekad yang lalu. Kebanyakan kajian lepas mengenai pasaran saham terutamanya terdiri daripada dua bidang kajian iaitu, kajian kesan ke atas saham dan kajian terhadap limpahan. Kajian impak sedia ada terutamanya mengkaji hubungan antara saham dengan faktor utama seperti harga minyak dan kadar pertukaran, tetapi tidak mengambil kira kesan asimetri dan kesan sektor. Kajian ini menggunakan indeks agregat yang biasanya mengalami bias agregat. Selain itu, banyak kajian yang menilai penghantaran saham kewangan tertumpu kepada pembangunan negara maju tetapi kurang perhatian diberikan kepada rantau Asia Selatan yang sedang membangun. Setakat ini, penulis mendapati, tiada kajian terdahulu yang mengukur kesan limpahan pada peringkat sektor di negara Asia Selatan. Dengan mengambil perhatian terhadap isu-isu yang dinyatakan, kajian ini direkabentuk kepada dua bahagian. Bahagian pertama, kajian ini menilai kesan asimetri bagi pergerakan naik turun dalam harga minyak dan kadar pertukaran ke atas harga sektor saham India, Pakistan dan Sri Lanka (IPS). Untuk tujuan ini, kajian mengguna pakai *Nonlinear Autoregressive Distributed Lag* (NARDL) oleh Shin et al. (2014). Bahagian kedua, kajian ini mengkaji keterkaitan antara pulangan minyak, forex dan sektor saham daripada IPS. Rangka kerja indeks limpahan oleh Diebold and Yilmaz (2012)dan Barunik dan Krehlik (2018) digunakan untuk analisis limpahan domain masa dan frekuensi. Sampel bulanan kajian ini (2009-2022) termasuk wakil

sektor saham berprestasi terbaik dalam IPS masing-masing. Secara keseluruhannya, kajian ini mendapati terdapat perbezaan tahap sensitiviti merentas ufuk masa dalam kesan asimetri harga minyak, dan kadar pertukaran ke atas harga sektor saham. Kesan asimetri lebih ketara dalam jangka panjang daripada jangka pendek. Selanjutnya, Sri Lanka dan Pakistan menunjukkan tindak balas asimetri yang lebih tinggi dari segi bilangan sektor berbanding India. Di samping itu, hasil penemuan mendapati keterkaitan antara pulangan saham turun naik terpengaruhi dari semasa ke semasa. Faktor keterkaitan ini semakin kukuh dalam fasa peristiwa tempatan yang berlaku di negara-negara ini. Penghantaran turun naik adalah paling jelas dalam kalangan sektor budi bicara Pengguna dan Industri di India dan Sri Lanka, dan antara sektor Perindustrian dan bahan Asas di Pakistan. Keputusan domain frekuensi selanjutnya menunjukkan bahawa keterkaitan meningkat apabila kekerapan meningkatkan lebih banyak limpahan dalam jangka panjang berbanding dalam jangka pendek Selanjutnya, India menunjukkan tahap keterkaitan yang lebih tinggi berbanding dengan Pakistan dan Sri Lanka di bawah kedua-dua domain masa dan domain kekerapan. Penemuan mendapati pembangunan rangka kerja dasar yang kukuh dapat mengurangkan ketidakseimbangan sektor dan menggalakkan pertumbuhan seimbang di Asia Selatan. Berdasarkan penemuan itu, bank pusat negara-negara ini harus mengambil tindakan, seperti melaraskan kadar faedah, untuk memerangi kadar inflasi yang disebabkan oleh kenaikan harga minyak, bertindak sebagai kuasa inflasi. Selanjutnya, pelabur boleh mengambil kedudukan kukuh dalam sektor saham dengan keterkaitan yang paling sedikit untuk mendapatkan pelbagai faedah.

ASYMMETRIC EFFECTS OF OIL PRICES AND EXCHANGE RATES ON SECTORAL STOCK INDICES IN SOUTH ASIAN COUNTRIES

ABSTRACT

Globalization has grown but at accelerating uncertainties. Therefore, contagion and spillover effects among financial markets have become the center of research in finance in the past decades. Most of the past studies on stock market mainly consisted of two streams first one is the impact studies on stocks and another one is spillover studies. Existing impact studies mainly examine the relationship between stocks and key factors such as oil price and exchange rate but do not account for asymmetric effects and sectoral effects. These studies utilize aggregate index which normally suffers from aggregation bias. Secondly, apart from that, numerous studies that assess the financial shock transmissions mainly focus on developed nations but less attention was given to the emerging South Asian region. So far, to the best knowledge of the author, none of the previous studies measure directional spillover at the sectoral level for South Asian countries. Taking note of the issues mentioned, the present study is designed into two parts. First part of this study evaluates asymmetric impacts of both up-down movements in oil prices and exchange rates on sectorial stock prices of India, Pakistan, and Sri Lanka (IPS). For this purpose, this study adopts the Nonlinear Autoregressive Distributed Lag (NARDL) given by Shin et al. (2014). Second, this study examines the connectedness among the oil, forex, and sectoral stock returns of IPS. The Spillover index framework given by Diebold and Yilmaz (2012) and Barunik and Krehlik (2018) are used for respective time-domain and frequency-domain spillover analysis. The monthly sample of this study (2009-2022) includes the representative best-performing sectoral stocks in respective IPS. Overall, this study

found there are differences in level of sensitivity across the time horizon in asymmetric effects of oil price, and exchange rate on the sectoral stock prices. The asymmetric effect is more pronounced in long-run than short-run. Further, Sri Lanka and Pakistan show higher asymmetric response in terms of number of sectors in comparison to India. In addition, the connectedness among the sectoral returns fluctuates over time, according to the findings. Connectedness strengthens in the phase of local events that happened in these countries. Transmissions of volatilities are most evident among Consumer discretionary and Industrials sectors for India and Sri Lanka, and among Industrials and Basic materials sectors for Pakistan. In addition, frequency domain results suggest that connectedness increases with the increase in frequency so there is more spillover in long-run than in short-run. Further, India shows higher level of connectedness in comparison to Pakistan and Sri Lanka under both time-domain and frequency domain. Findings are insightful in developing a sound policy framework that helps to attenuate sectoral imbalances and encourage balanced growth in South Asia. Based on the findings, the central banks of these nations should take action, such as adjusting the interest rate, to combat the inflation rate brought on by rising oil prices, which themselves serve as an inflationary force. Further, investors can take positions in the sectoral stocks with the least connectedness to get diversification benefits.

CHAPTER 1

INTRODUCTION

1.1 Introduction

During the previous couple of decades, South Asian economies turn out to be the most dynamic economic regions. South Asian region is expanding at the fastest rate and it is anticipated that it lead over East Asia and Pacific (World Bank, 2018). It is expected that the financial system and especially stock market appears as an important player in the region's future economic stability by providing necessary resource to maintain high GDP growth rate. The entire financial system and economic development depend on a stable stock market. On the one hand, changes have occurred in the world's financial markets in the past decades such as deregulation, globalization, and the proliferation of communication networks that have lowered restrictions to capital flow (Kumar & Dhankar, 2017). In addition, the events like Asian currency crisis of 1997–1998 along with the global financial turmoil of 2007–2008 had disastrous effects on stock markets(Vo & Ellis, 2018), and of recent, the corrosion in global stock markets in 2022 due to monetary tightening and supply chain disruptions (Bao & Wang, 2022). These disasters result in decreased corporate profitability, business collapse, stock market downfall, and economic growth reduction (Avcı, 2017). All these changes and incidents contribute to the systemic risk of the stock market which makes managing the stability a daunting task for authorities. In order to entice investors, the stability of the stock market is necessary indicators and is equally important for firms who raise capital which is crucial to foster growth in the economy.

The dynamic mechanism of stock market and economic sectors has drawn the interest of many diverse communities of study given its extensive impacts and implications. The mainstream of practitioners and scholars have worked to determine the channels that impact stock market dynamics. In this context, some scholars have observed that macroeconomic factors play a critical role in driving stock values (Barakat et al., 2016; Chandrashekar et al., 2018; F. Chen et al., 1986; Fama & French, 1989). However, Cheung and Ng (1998) and lately Khoury (2015) asserts that economic theories do not state explicitly what variables and how many factors may be used to determine stock prices. Furthermore, some earlier empirical studies, such as Wasserfallen (1989) conclude that macroeconomic factors have a minor effect in explaining the variation in stock price. Therefore, it is still an area of concern in the literature to determine the factors that determine stock prices.

On the other hand, studies also regard the market linkages as a basis of stock return volatility (Choudhry & Jayasekera, 2014; Engle et al., 1990; Finta et al., 2019). These studies, provide valuable information that benefits all scholars and finance professionals, aid policymakers modify financial policies, and help investors make smarter financial choices in a better understanding of the stock market dynamics. Moreover, greater price linkages among assets lead to a greater tendency to move together. It is a concern for investors because diversification is beneficial when assets do not move together closely, according to the portfolio investment theory (Withanage & Jayasinghe, 2017). Linkages and volatility spillover between markets are central issues in the finance literature. These are related in a way that higher price linkages lead to volatility spillover among assets. It is possible to measure price linkages with volatility transmission among the related markets (Forbes & Rigobon, 2002). In order to determine these linkages, several authors have examined whether a given shock on

stock returns and volatility in one market is transmitted to other markets or not (Belhassine, 2020; Choudhry & Jayasekera, 2014; Finta et al., 2019; Gahlota, 2013; Hammoudeh et al., 2009). But the size of the net spillover receipt or contribution of one asset class (or market) to another asset class (market) in portfolio construction is unknown in the literature. Hence the concern for stakeholders is the size and direction of the spillover shock from one market to another.

Based on the aforementioned overview of stock market dynamics, the following section will begin with background of study.

1.2 Background of Study

A stock market is a platform for the issuance and trading of a wide range of financial products, including shares, bonds, and their derivatives either through stock exchanges or brokerage setups. All financial stakeholders in share market, ranging from small investors to institutional investors, and ultimately the entire economy gain from it in many ways. Stock markets offer the chance of liquidity to investors by providing them an avenue to buy and sell securities. The equity market serves as a productive venue for organizations to raise fresh funds to develop and grow their operations. A company's public listing on the equity market not just improves its reputation in the public (via increased information closing transparency and higher firm valuation), but it also makes it easier for the company to grow (via merger and acquisition (M&A)).

Numerous empirical studies have demonstrated the stock market's significance for the larger economy, highlighting its numerous advantages for both businesses and individuals. For example, Arestis et al. (2001) demonstrated the power of stock

markets and financial institutions by applying vector auto-regression approach and found that both of these are essential for economic growth. In addition, When Ake (2010) examined the relationship between capital market development and economic expansion for five European countries, similar findings were found, and the long-term causation for advanced bourses was reaffirmed (i.e. the UK, France, and the Netherlands).

Another similar finding is in the case of developing economies which supports the earlier studies; Awais and Rehman (2017) empirically describe how South Asian local stock markets are expected to develop as an important component of ongoing economic reform, economic liberalization, and trade facilitation. Due to the stock market's enormous impact on the economy, it makes sense to look into the causes of stock price fluctuations or the volatility of return for the sake of informed investment decisions and reliable projections. Numerous studies have focused on the variables that influence stock returns and then looked at the macroeconomic and spillover implications.

On the macroeconomic side number of empirical studies acknowledges the importance of macroeconomic elements for the development of emerging markets. Amid numerous macroeconomic variables, the oil-stock association, in particular, is of paramount importance for scholars and practitioners alike. This is mainly because oil has a significant function of energy generation in the production and consumption processes of both individuals and businesses. There is compelling evidence from these researches linking changes in oil prices to slower macroeconomic growth in output, sluggish performance of the financial markets, increased inflationary pressures, depreciating currencies, and deteriorating unemployment rates (Hamilton, 1983; Jones & G. Kaul, 1996; Kilian & Park, 2009; Lee & Zeng, 2011; Sadorsky,

1999). While X. Wen et al. (2018) and Jones et al. (2004) argue that oil has direct and indirect bearing on upcoming cash flows, firm returns, and dividends paid on stock.

In earlier researches, the impact of oil prices on the stock market as a whole in aggregate terms is the primary concern. This practice obscures the sectoral or firm-level heterogeneity in the link between the price of oil and equity prices. A wave of recent studies ponders the divergent effects of oil price changes on different sectors (Al-hajj et al., 2020; Anderson et al., 2018; Arouri, 2011; Badeeb & Lean, 2018; Bahmani-Oskooee et al., 2019; Caporale et al., 2015; A. Dutta, 2018). Typical findings show that different sectors react differently to oil price changes given the different level of dependency and hedging cover by firms in these sectors. Some other studies suggest that oil price increase inflicts a different effect on the stock price than the oil price decrease hence pointing towards the asymmetric effect. In this context, Sadorsky (1999) discovered that the economic effects of positive oil price shocks are greater than those of negative shocks while Ono (2011) discovered a significant asymmetry between the price of oil and real stock yield in developing economies of China, India, and Russia.

As prior research shows that oil price is an important factor that affect equity prices in oil-dependent economies. Its significance for any economy hinges on two primary factors: the volatility of oil prices and the extent of oil consumption. During the financial crisis of 2008, crude oil prices exhibited extreme volatility. In the middle of that year, prices soared continuously, reaching a record high of nearly $140 per barrel. However, in the latter half of 2008, they plummeted rapidly to as low as $40 per barrel. This drastic fluctuation presented a dire situation by increasing the import bill of many fold for countries heavily reliant on oil. To illustrate the dependence of South Asian economies on oil table 1.1 shows the oil consumption of South Asian countries. Oil is

a critical component for developing South Asian economies to meet their growing energy needs. Industrial growth is vital for economic growth for which oil a basic input (Chen et al., 2019). All these factors lead to increasing dependency on oil which can be seen in consumption. For instance, India is the third-largest consumer of oil (Energy Information Administration, 2022) while Pakistan and Sri Lanka are also consuming a significant portion of oil in energy mix. Further, South Asia relies on oil imports as they do not have enough reserves to meet domestic demands therefore, oil imports constitute a substantial portion of the import bill. This reliance underscores the vulnerability of these economies to external factors, necessitating strategic measures to diversify energy sources and mitigate the risks associated with oil dependency. The value oil consumption in table 1.1 is given in thousands of barrels daily.

Table 1.1 Crude oil consumption in South Asian countries

	Consumption of oil (Thousand of barrels daily)									
	2013	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**
India	3716	3832	4147	4233	4337	4441	4547	4669	4878	5185
Pakistan	442	458	505	561	572	582	594	437	503	489
Sri Lanka	94	106	111	124	137	150	164	161	118	98

Source: Energy Information Administration (2022)

The studies related to oil-stock nexus at sectoral level has some limitation as these are related to developed countries. Another major limitation of the present set of studies on this topic is that their focus has been limited to examining the linear relationship between stock prices and oil prices. In reality, such relation a is nonlinear which arises due to economic condition[1]. However, for South Asian countries the oil-

[1] Such Economic crises may be among these macroeconomic circumstances (for example, the 1970s crisis, the currency crisis 1997, collapse of the dot-com boom 2001, and the recent 2008 financial turmoil), wars and other dramatic geopolitical incidents involving other includes oligopolistic conduct in oil extraction and distribution, or the competitive structure of the crude oil market.

stock studies are mainly focused on aggregate stock index. Given the increasing oil consumption it is necessary to understand the impact of this commodity on sectors in South Asia.

Another important factor to consider is Exchange rate which got attention during Asian currency crisis[2]. This is important because it is linked to international incidents, global trade, and cash flows movements across borders which are the main drivers of economic growth, notably in the stock market (Aggarwal, 1981). The importance of exchange rate has also increased largely in today's globalized world for transfer of capital among countries which has influenced on stock prices as well. Because of the sheer importance and role in prompting the advancement of economies, many academicians, economists, professionals, policymakers, and researchers pay great attention in determining the association between stock price and exchange rate. Changes in exchange rates will have an impact on multinational corporations' profit margins, which will have an impact on their stock prices (Chkili & Nguyen, 2014). The impact on profit or loss margins will determine the direction of the shift. A company's stock price may be impacted even if it is a domestic, but export-oriented business, because exchange rate fluctuations typically have an impact on exports.

Earlier studies of stock price-exchange rate focus primarily on the aggregate level of market. This practice obscures the sectoral or firm-level heterogeneity in the link between the exchange rate and equity prices. A wave of recent studies ponders the divergent effects of exchange rate changes on different sectors (Fasanya, 2022; Ogunjimi, 2020; Oyelami, 2021). Some other studies suggest that an exchange rate increase inflicts a different effect on the stock price than the exchange rate decrease

[2]The Asian financial crisis in 1997–1998 was marked by a series of currency devaluations and massive capital outflows were sparked when Bangkok decoupled the Thai baht from the US dollar.

hence pointing towards the asymmetric effect (Bahmani-Oskooee & Saha, 2016b; Demian & di Mauro, 2018; Luqman & Kouser, 2018).

Liberalization in South Asian markets has brought international trade and capital inflows as well as the trade-off from fixed exchange rate regime to floating rate regime. The economies of South Asia shifted away from a fixed exchange rate system after 1980. Pakistan is the first regional economy that adopted market-based floating exchange rate system in 1982, India in 1992 and Sri Lanka in 2001. According to International Monetary Fund report the exchange rate of India is floating, while in Pakistan it is stabilized arrangement, and in Sri Lanka it is described as a 'crawl-like arrangement'. India, Pakistan, and Sri Lanka experienced a decline in exchange rates after switching to a floating exchange rate system see figure 1.1. The transition to floating exchange rate regimes reflects a commitment to market-oriented policies and greater integration into the global economy, but it also exposes these economies to the risks and volatility of international financial markets. Exchange rate in figure 1.1 is expressed in terms of dollar per rupee for the three countries to show the declining trend.

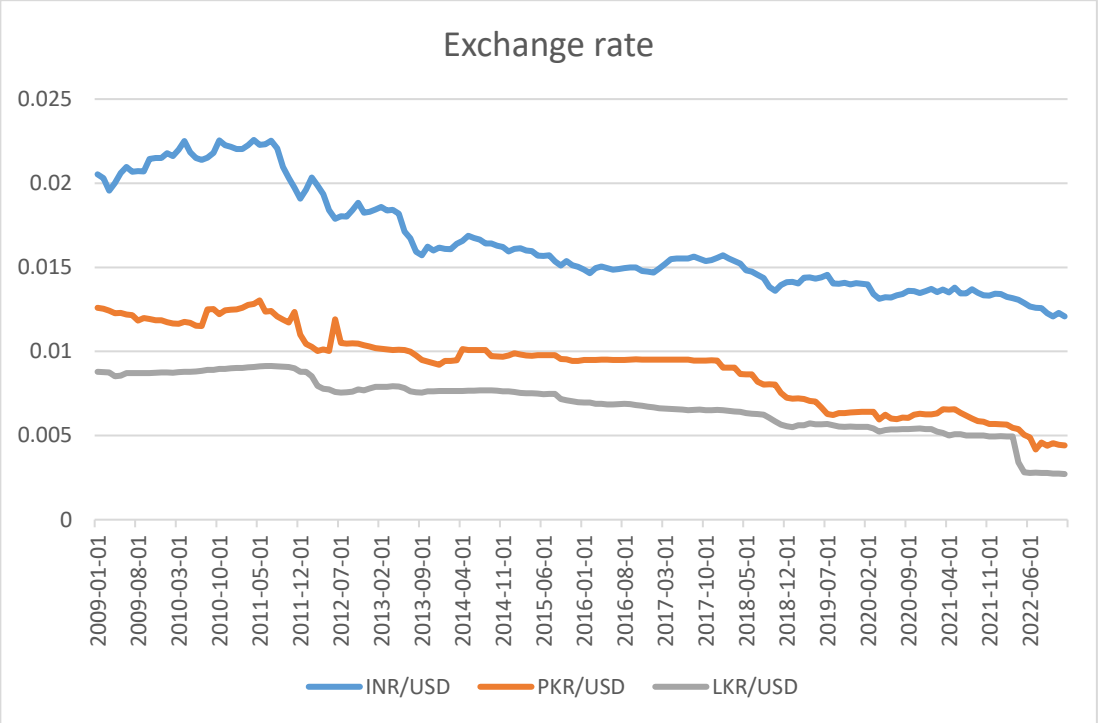


Figure 1.1 Exchange rate movement of South Asian countries

Source: (Asian Development Bank, 2022)

The majority of South Asia's emerging nations are experiencing a current account balance deficit. In case of South Asian countries, the imports are higher in comparison to exports. Additionally, this deficit strains foreign exchange reserves, which are insufficient to keep currencies stable. In the last eight years, the current account deficit ratio has fluctuated for instance in Pakistan it increased by more than 144 percent in 2022, India up to 361 percent while Sri Lanka 88 percent. Exchange rate in India, Pakistan and Sri Lanka shows a constant decline against US dollar see table 1.2. This decline in exchange rate shows the relative weakness of regional currencies which is a threat to economic stability. Among the three the weakest currency is of Sri Lanka followed by Pakistan. Both of these currencies lost up to 33 percent and 55 percent in value just in the period of eight years while India lost up to 8 percent for the same period. During the financial crisis, South Asian countries experienced significant depreciation of their currencies against the US dollar. For

instance, India's currency depreciated by one-fifth, while Pakistan's and Sri Lanka's currencies depreciated by nearly one-third. The depreciation of the exchange rates of India, Pakistan, and Sri Lanka against the US dollar could be attributed to various factors including economic instability, political uncertainty, high inflation rates, trade imbalances, fiscal deficits, and external debt burdens.

Table 1.2 Current account deficit and Exchange rate

	Current account deficit as % of GDP							
	2015	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**
India	-0.5819	-0.48814	-0.52889	-1.43907	-2.4128	-2.1411	-1.1012	-3.0811
Pakistan	-2.1147	-2.8147	-2.5458	-5.5577	-6.1004	-5.9345	-3.5405	-1.2014
Sri Lanka	-2.1574	-2.0145	-2.11454	-2.62327	-3.16497	-3.97434	-1.301	-1.9011
	Exchange rate/USD							
India	60.9190	64.9190	67.9190	63.8751	69.6330	73.0574	73.92	81.1622
Pakistan	98.813	101.813	104.813	110.4328	138.8701	159.831	162.91	223.1011
Sri Lanka	122.914	134.914	149.9	153.4	182.6	186.18	198.76	367.9551

Source: World Bank (2022)

Despite the fact that developing markets are becoming increasingly important to the global economy through trade and investment, (Sui & Sun, 2016), the literature on these markets is comparatively limited. Also, existing studies suggest mixed results (Afshan et al., 2018; Mikhaylov, 2018; Sui & Sun, 2016). The paucity of conclusive proof about the relation between stock and foreign exchange markets for investors and global corporations can be confusing. Recently (Bahmani-Oskooee & Saha, 2016b, 2018) established that accounting asymmetries in exchange rate-stock relationship further clarify the association between the two variables and leads to better estimation. Overall, these studies are related to developed countries however, South Asian literature has not mentioned the potential non-linear dynamic relationship at the sectoral level. Given the unstable exchange rate coupled with increasing current account deficit and dearth of

studies it is important to understand asymmetric effect of exchange rate on sectors of South Asia.

The asymmetric effect refers to a situation where the impact or response of a variable to a change in another variable is not the same in both directions. In other words, the effects are different depending on whether the change is positive or negative. This phenomenon can manifest differently in the short-run and the long-run. Asymmetric effects are common in both the short-run and the long-run, the extent and nature of these effects can differ significantly between the two-time horizons. Short-run asymmetries are often driven by rigidities and frictions in markets, leading to sharp and uneven adjustments, whereas long-run asymmetries tend to be more muted as markets adapt and equilibrium is restored through investment, innovation, and structural changes.

Connectedness or volatility spillover by definition is an issue that the volatility shock of an asset propagates to another asset[3]. It reflects the transfer of information across markets or assets, which is an important factor when assessing portfolio risk. Assessment of degree of spillover is an essential component of risk assessment and risk management (Arouri et al., 2012; Baele, 2005; Belhassine, 2020; Chakrabarty et al., 2015; Y. Chen et al., 2019; Choi et al., 2021; Choudhry & Jayasekera, 2014; Finta et al., 2019). Finding the network of connectedness facilitates comprehension of the volatility shocks' movement across financial markets during difficult times (Costa et al., 2021; Sobti, 2018; Wu et al., 2019). Furthermore, quantifying connectedness can help track the development of ongoing crises and be used as part of a "early warning system" for approaching financial crises (Diebold & Yilmaz, 2012). Connectedness

[3] Connectedness or volatility Spill over are used interchangeably

measures signify the characteristics of financial system linkages, their direction, and strength while also serving as an appropriate framework to capture systemic risk (Baruník & Křehlík, 2018; Diebold & Yilmaz, 2012).

A growing literature examines the role of spillover between macroeconomic factors and stocks as a potential mechanism for shock propagation across the whole economy with the goal to identify and measure possible sources of systemic risk. Insights into connectedness and information spillovers among macroeconomic factors and stock market can direct efficient portfolio management, Investment decision, economic research, and policy making. Further using the evidence on connectedness, the authorities and policymakers can recognize factors that are leading in risk transmission. Due to trade and investment linkages as well as rapid transmission of information various macroeconomic factors and financial market exhibits simultaneous movement. This was evident during the Global financial crisis event. South Asian markets were also not spared during this turmoil period.

In addition to conducting sectoral spillover analysis, it is crucial to investigate spillovers from factors such as oil and foreign exchange (forex), as investors increasingly view these as investable assets owing to the financialization of commodities. Forex markets are often sensitive to risk sentiment, which can also spill over into the stock market. For instance, during times of economic uncertainty or geopolitical tensions, investors may seek safe-haven currencies like the US dollar, leading to a strengthening of the dollar and potentially impacting stock prices negatively. Further Oil is typically priced and traded in U.S. dollars. Therefore, fluctuations in oil prices can impact currency markets, particularly the value of the U.S. dollar. Changes in currency values can have implications for multinational corporations' revenues and profits, which can, in turn, affect their stock prices.

It is noted that during the financial crisis, the valuations of the equity markets in India, Pakistan, and Sri Lanka all experienced a severe fall same was with oil prices. Stock indices in these nations suffered a loss, with the Nifty falling by 56 percent, KSE falling by 58 percent, and CSE falling by 40 percent. On the other side, the price of oil falls by 75% while Sri Lanka, Pakistan, and India all see their currencies depreciate by 25%, 33%, and 19%, respectively. Further in the post-crisis period during the plunge of oil prices a substantial simultaneous upward movement can be seen in the stock indices of three countries see figure 1.2. Similarly, an opposite and simultaneous movement can also be observed in the exchange rates and stock indices of India, Pakistan, and Sri Lanka. The condition demonstrates simultaneous changes in the stock market, exchange rate, and oil price, which is in direct opposition to the production channel effect (Costa et al., 2021; Sobti, 2018; Wu et al., 2019). Condition refers to the phenomenon wherein macroeconomic factors and stock prices exhibit simultaneous movements, often influencing each other in complex ways. This interplay reflects the interconnected nature of financial markets and broader economic conditions. As a result, this market behavior suggests that there is a spillover impact between the oil, Forex, and local stock markets.

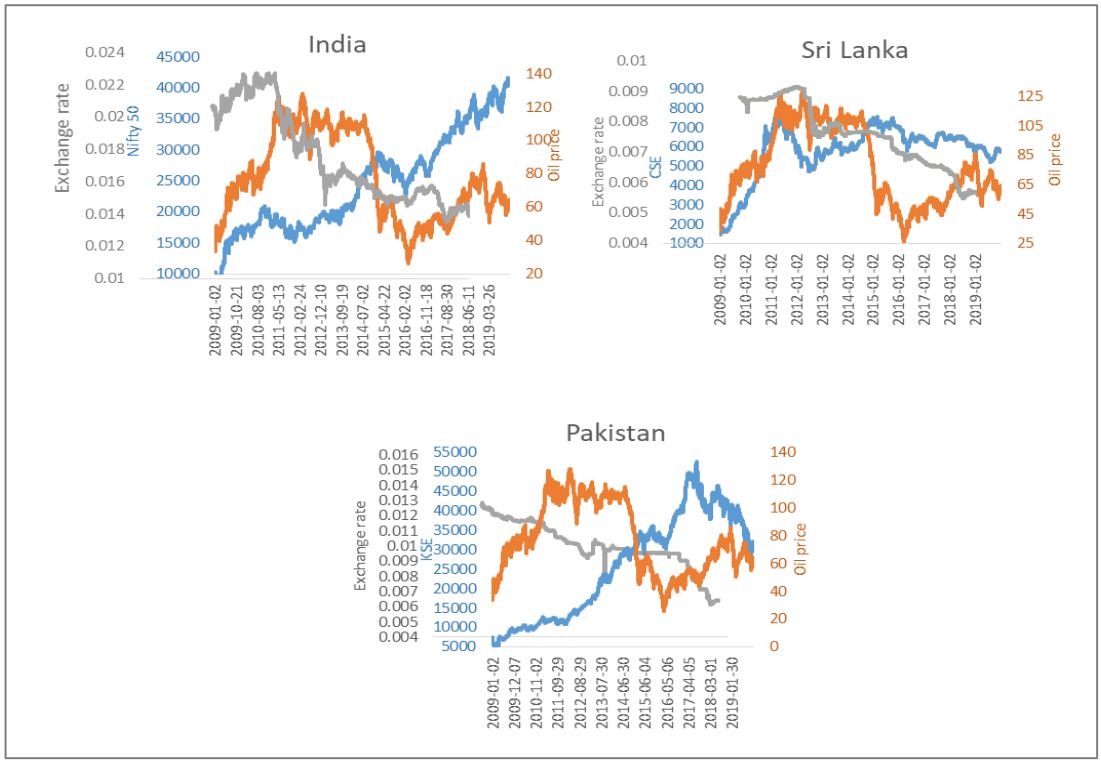


Figure 1.2 Trend in selected South Asian indices, oil price and exchange rate

Source: (Energy Information Administration, 2020; Federal Bank of St Louis, 2020)

Recently spillover among stock sectors, oil, and exchange rate is the focus of many studies. This is because spillover among oil price, exchange rate and sectors is of practical importance for portfolio managers and institutional investors. As crude oil is relevant from portfolio investment perspective due to its financialization in recent years (Antonakakis et al., 2017). According to some researchers, the financialization of the oil market is due to increased hedging and speculative activities by investors (Basak & Pavlova, 2016; I.-H. Cheng & Xiong, 2014; L. Liu & Zhang, 2019). Additionally, oil and its contracts are sold in the denomination of US dollars (USD), thus the currency rate is important from an investment point of view. Also, the weakening of the US dollar increases demand for oil products, causing a rise in the price of oil (Sadorsky, 1999), It contributes to an adverse situation by lowering the country's equity values (Basher et al., 2012). Spillover among sectoral stocks oil and

exchange rate is obvious as many portfolios apart from sectoral stocks also hold oil futures.

In addition, precise characterization of connectedness is important for understanding the source of systematic risk. To understand the sources of connectedness in an economic system, it is crucial to understand the frequency dynamics of the connectedness, as shocks to economic activity impact variables at various frequencies with various strengths (Baruník & Křehlík, 2018). The frequency distinction, thus, allows to analyze whether shocks transmit happen in short-term moves or one in the long-term moves. The importance of the distinction between the short-term and the long-term parts of the system became evident even earlier with the dawn of co-integration (Engle & Granger, 1987). Subsequent literature builds a preliminary notion of disentangling short-term from long-term movements in connectedness (Blanchard, 1989; Gonzalo & Ng, 2001; Quah, 1993). In the case of stock markets, long-term shocks may be attributed to permanent changes in expectations about future dividends (Gonzalo & Ng, 2001) while transitory changes point out to speculative moves. The decomposition is also economically intuitive in the sense that it provides a direct link between priced shocks and their dynamic effects on the economy.

The notion is that the connectedness among the price of crude oil, the exchange rate, and specific sectors of the stock market may change in frequency bands. The foundation of these frequency bands is the heterogenous behavior of economic agents that deal in these markets. More specifically, market participants operate over a range of time horizons (also referred to as frequencies) that can last anywhere from a few seconds to several years. Individual differences in principles, objectives, and priorities, along with the institutional constraints, levels of knowledge assimilation, and risk

tolerance are the main causes of this varying horizon. As a result, different levels of market reactions to financial and economic shocks might lead to heterogenous frequency responses. Day traders and hedge funds are examples of agents with short investment horizons who are more focused on the short-term performance of the markets and rely much of their decisions on transient phenomena like occasional events and psychological considerations. As a result, their responses to shocks primarily take place in the short term. On the other hand long-term market success is more important to other agents, including major institutional investors so most of their reactions to financial and economic shocks appear in long run. Therefore, it is reasonable to believe that there are connections between the oil, exchange rate, and stock market sectors across frequencies, with varying degrees of persistence and, consequently, diverse sources of connectedness.

Spillover effects are often associated with short-run impacts, they can also manifest as long-run issues depending on the nature and persistence of the underlying shocks or news events. The spillover effects are often associated with short-term dynamics, the way in which economic agents respond to positive and negative news can have significant and enduring implications for the economy over the long-run. These implications arise from the persistence of behavioral changes, the impact on investment and capital allocation, the influence on market expectations and confidence, policy responses, and structural changes triggered by news events.

Finally identifying the connectedness of intense upward or downward oil prices and currency movements on stock sectors performance and evaluating the transmission effect of fluctuating sectoral prices on exchange rate and oil price has imperative implications concerning trading and hedging tactics for portfolio management. The interrelation of the oil, exchange rate, and industrial stocks is valid due to the industrial

differentiations and applicable exposure (Alexakis & Pappas, 2018; Arouri, 2011; Balli et al., 2013; Belhassine, 2020; Dogah & Premaratne, 2018; Dutta, 2018). Given the importance of linkage among oil, exchange rate, and stock sectors it is relevant to identify the spillover effect to have a proper understanding of systemic risk.

Existing studies on connectedness between oil price, exchange rate, and stocks are very limited and are for focused on developed economies. However, for South Asia spillover studies mainly focus on composite index (Akhtar & Khan, 2016; Awais & Rehman, 2017; Chowdhury, 2018; Gahlota, 2013; Malik & Rashid, 2017; Sehgal et al., 2018b) and none of these consider spillover among sectors, oil price, and exchange rate. Similarly, the spillover from frequency distinction is not available. One drawback of current research is that it focuses predominantly on broad trends in movements between stock markets or asset classes[4]. South Asia is particularly interesting because here 70 percent of oil demand is met through imports which is dollar-denominated and most of the sectors are affected by this commodity.

1.2.1 Overview of South Asian stock markets

Stock markets of South Asian countries differ in terms of their size and the level of their market activity. The first is the Indian stock market, which was established in 1875 and is the oldest in the world. Besides the Indian stock market is also10th largest market worldwide in terms of market value (Bondia et al., 2019). There are two active and well-known stock markets of India named Bombay Stock Exchange (BSE) and National Stock Exchange (NSE) where most of the trading take place. The corresponding indices are BSE and NSE where majority of shares are listed. Another

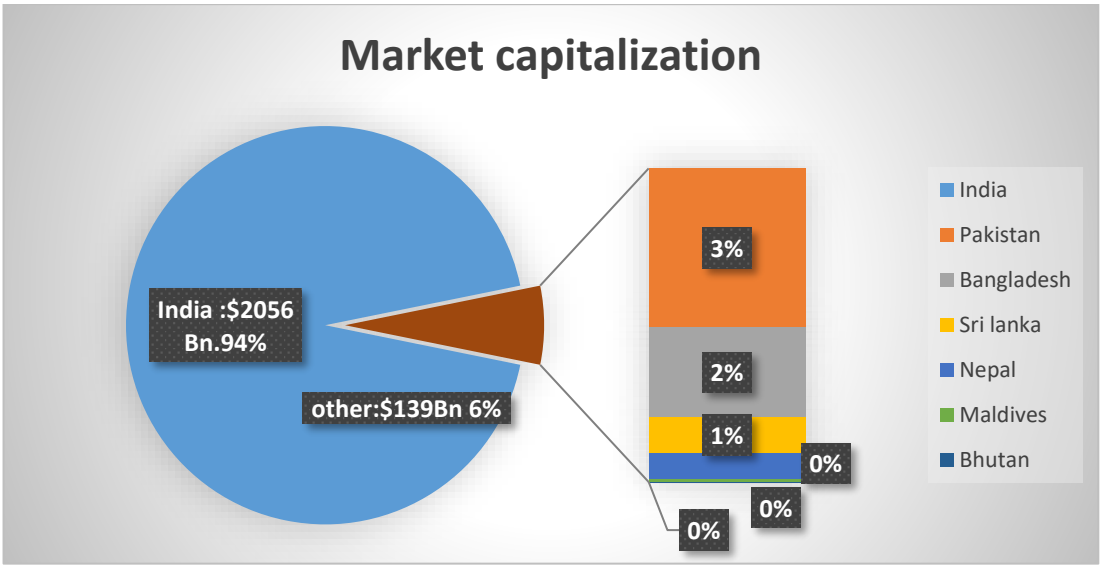
[4] Diebold and Yilmaz (2009) suggest that despite the earlier introduction of the methodologies, most software applications lack systematic procedures to estimate these models, which is one reason why there is a dearth of research in this field.

stock market is of Sri Lanka which is second oldest in region as well, it has been operating since 1896. Colombo Stock Exchange (CSE), which was founded in 1985, it is Sri Lanka's primary equity market. Despite being small, it works hard to make improvements to its regulatory system to help investors. These actions allowed it to join the United Nations Sustainable Stock Exchange Project (Singh & Shrivastav, 2016).

There are relatively newer stock markets in South Asia first is the stock market of Pakistan which was established in 1947. The Pakistan Stock Exchange, which has trading floors in Islamabad, Karachi, and Lahore, is the country's major equity market. The main index in Pakistan is the Karachi Stock Exchange (KSE) index, which includes 100 corporations and accounts for 85% of market value. In May 2017, the Pakistani stock market was reclassified as an emerging market by Morgan Stanley Capital International (MSCI) (Shafique et al., 2019). Another well-known market in the region is Bangladesh's stock exchange, which was founded in 1954 as the East Pakistan Stock Exchange Association Ltd. The Bangladeshi stock market had a severe collapse at the end of 2010, which caused the index to fall by 6.7%. After this downfall stock prices cannot improve and all initiatives failed to boost performance (Rahman et al., 2017). This stock market is undeveloped, and banks are primarily responsible for creating liquidity by investing up to 25% of their liabilities in stocks to keep it going (Alo & Tuhin, 2019). Bangladesh's stock market is not developing as quickly as it could, and its governance structure and regulatory framework are out of date (Hossin & Islam, 2019). Stock markets in countries such as Bhutan, Maldives, and Nepal have relatively smaller capitalization and trading volumes compared to more established markets. These markets have commenced operations relatively recently and are less active in comparison to their counterparts.

Apart from studying larger markets like India and Pakistan in region including smaller and active stock markets like Sri Lanka in research on South Asian stock markets is crucial for several reasons. Firstly, it contributes to a more comprehensive understanding of regional economic dynamics, offering insights into the performance and behavior of diverse markets within the South Asian context. Secondly, smaller markets often exhibit unique characteristics and vulnerabilities that may not be apparent in larger, more prominent markets, thus providing valuable data points for risk assessment and portfolio diversification strategies. Additionally, studying smaller markets can shed light on the regional dynamics of South Asia as well as difference in stock market performance between larger and smaller markets, which can have significant implications for investors operating in the region. Overall, incorporating Sri Lanka and similar smaller markets enriches understanding of the broader South Asian financial landscape.

Despite the fact that there are seven stock exchanges in the South Asian region, it is evident from the discourse that just three of them—India, Pakistan, and Sri Lanka—are active and account for 98% of the region's capitalization. Additionally, given that these three nations have the highest market capitalization to GDP ratios and the highest number of businesses listed, it is fair to take them into account for regional representation.



Data compiled 31st December 2020
Total market capitalization value for region is $2.195 trillion. Here 0% shows capitalization less than 1% of overall regional market capitalization.

Figure 1.3 Market capitalization in South Asian countries

Source: World Bank (2020)

The equity markets of South Asia have developed in all ways to interest foreign investors. The Stock market of India is leading in South Asia given its relatively higher trading volume and market capitalization (Malakar et al., 2020). The Second major stock market of South Asia is Pakistan which is the best performing in Asia in terms of return and therefore it is ranked 5th worldwide (Arifeen, 2017). Another, appealing market for investors is the Colombo All-share Index, which ranked second in the world for performance based on yield. (Jahfer & Tohru, 2014).

Table 1.3 describe the traits of South Asian equity markets, highlighting their top indices, governing bodies, and trading platforms. A Securities and Exchange Commission agency oversees market activity in every South Asian nation. These nations have an automated trading system, but their settlement mechanisms differ. This table also displays the demutualization of exchanges for these countries, with Pakistan having finished the process after India but before Sri Lanka.

Table 1.3 Development of South Asian Stock Markets

Leading Exchange	**Bombay Stock Exchange (BSE)**	**Pakistan Stock Exchange (PSX)**	**Colombo Stock Exchange (CSE)**	**Dhaka Stock Exchange (DSE)**	**Nepal stock Exchange**	**The Royal Securities Exchange of Bhutan (RSEB)**	**Maldives stock Exchange**
Year of commencements	1875	1947	1896	1954	1994	1993	2002
Liberalization	1992	1992	1991	1992	1996	N/A	N/A
Leading Index	S&P CNX 500	KSE 100	CSE Milanka	DSEX	NEPSE Index	Bhutan Stock Index (BSI)	MASIX
Trading system	BSE On-line Trading (BOLT)	Karachi Automated Trading System (KATS)	CSE Automated Trading System	DSEX Automated Trading System	NEPSE Automated Trading System '(NATS)	Bhutan Automated Trading System	N/A
Settlement time	T+2	T+2	T+3	T+2	T+2	T+2	T+2
Regulatory Authority	Securities and Exchange Board of India (SEBI)	Securities & Exchange Commission of Pakistan (SECP)	Securities & Exchange Commission of Sri Lanka (SEC)	Bangladesh Securities & Exchange Commission (BSEC)	Securities Board of Nepal (SEBON)	Royal Monetary Authority (RMA)	Capital Market Development Authority (CMDA)
Demutualization	2007	2012	N/A	2013	N/A	N/A	N/A

Sources: Securities and Exchange Commission of Pakistan (2019) ,Securities and Exchange Board of India (2019), Securities and Exchange commission of Sri Lanka (2019)

Some of the bigger and active South Asian countries started the process of liberalization in 1990 to boost the foreign inflow in particular and bring efficiency to markets in general. At the time of liberalization, foreign equity investments in two bigger markets were $283 million in India, and $240 million in Pakistan (Kumar and Dhankar, 2017). After the liberalization, the number of listed companies, and market capitalization have grown in these markets. For instance, by the end of 2022, international equity investment in India soared by $57 billion from its fairly impressive level of $18.759 billion in September 2010. Similarly, in June 2018, foreign equity investment in Pakistan reached lowest with the outflow of 1198 million, but it was only $328 million towards the end of 2021. Due to political instability capital markets of Pakistan cannot attract investors much. Sri Lanka, which joined liberalization move in 1991, has the smallest stock market of the three its ability to draw foreign portfolio investment was hampered by its lower market capitalization, which reached an all-time high of $1.943 billion in September 2017. Maldives and Bhutan have smallest stock market in regions.

Table 1.4 Summary Statistics of South Asian Stock Markets 2017-2022

	2017	2018	2019	2020	2021	2022
	Market Capitalization (USD Billion)					
India	1516.2112	1566.7113	2331.6	2083.5178	2179	3413
Pakistan	66.1124	91.9211	78.1158	71.0114	50.117	52.2114
Sri Lanka	20.8123	18.7654	19.0114	15.6123	15.7147	15.9123
Bangladesh	74.1803	77.3905	64.4165	89.7736	88.7407	42.8948
Nepal	1.9105	2.1391	2.5670	2.9520	3.2471	3.5721
Maldives	1.0251	1.1154	1.1015	1.1587	1.2101	1.2514
Bhutan	0.3818	0.4391	0.5049	0.5807	0.6678	0.7681

Table 1.4 *Continued*

	2017	2018	2019	2020	2021	2022
Turnover ratio						
India	50.9124	51.2475	50.9145	58.1745	53.3475	74.9145
Pakistan	41.0314	29.9817	15.4751	24.4714	23.8547	16.4454
Sri Lanka	18.6214	16.5015	14.4575	17.0515	15.8545	NA
Bangladesh	13.754	15.7474	11.7851	12.1754	13.8141	12.181
Nepal	11.6065	13.5999	9.6376	10.0279	11.6666	10.0335
Maldives	NA	NA	NA	NA	NA	NA
Bhutan	NA	NA	NA	NA	NA	NA
Stock traded (USD Billion)						
India	77.2112	80.2257	118.6658	125.9114	108	159
Pakistan	27.1311	27.5457	12.1451	17.5741	18.7485	17.5145
Sri Lanka	12.7921	14.2014	14.7611	15.1011	14.0214	15.0424
Bangladesh	14.5030	12.1421	13.1267	14.9201	14.3321	13.7893
Nepal	9.1975	9.9946	10.9792	12.772	12.1846	11.6418
Maldives	NA	NA	NA	NA	NA	NA
Bhutan	NA	NA	NA	NA	NA	NA
Market capitalization as % of GDP						
India	72.1452	68.4145	87.9541	76.6145	75.4518	97.3147
Pakistan	24.4147	33.0145	26.8541	23.247	19.745	19.145
Sri Lanka	25.8147	22.7154	21.5251	17.5178	18.7157	18.3145
Bangladesh	19.3369	18.0807	18.3398	17.0099	16.1229	9.3208
Nepal	15.8147	12.7154	11.5251	13.5178	14.7157	15.3145
Maldives	NA	NA	NA	NA	NA	NA
Bhutan	NA	NA	NA	NA	NA	NA
Listed companies						
India	5835	5820	5615	5065	5600	6740
Pakistan	558	558	559	546	534	533
Sri Lanka	294	295	296	297	289	290
Bangladesh	572	593	611	628	660	354
Nepal	245	235	217	255	265	249
Maldives	10	10	10	10	10	10
Bhutan	19	19	19	19	19	19
Net foreign portfolio investment (USD Million)						
India	-9,487	4,725	-30,638	9,598	-24540	5718
Pakistan	-909	-154	-1,198	288	328	-284
Sri Lanka	-689	-993	-1,772	-129	-366	238
Bangladesh	178	-22	386	190	313	386
Nepal	NA	NA	NA	NA	NA	NA
Maldives	NA	NA	NA	NA	NA	NA
Bhutan	22	NA	NA	12	15	38

Source: World Bank (2022)

Table 1.4 shows the statistics of South Asian stock markets for last six years. Figures suggest that India is the principal stock market of South Asia as it is having the highest number of companies listed on it as well as the value of market capitalization. The value of these measures varied in these years, for example, the market capitalization was highest in 2022 and lowest in 2017 for India while number of listed companies was highest in 2022 and lowest in 2020. Pakistan stock market measures are the second-highest in the region. The turnover ratio reveals that investors are active in the share markets of India, Pakistan and Sri Lanka in comparison and to all other markets in the region. In fact, the turnover ratio of Bangladesh was relatively lower in comparison to the India Pakistan and Sri Lanka. On the market capitalization to GDP percentage also Bangladesh is lagging behind the India Pakistan and Sri Lanka. These three stock markets—India, Pakistan, and Sri Lanka—stand out as the most active within the region, making them suitable representatives of South Asia.