COVID-19 AND ITS IMPACT ON RETURN AND VOLATILITY OF CHINA, PAKISTAN, INDIA AND SRI LANKA FINANCIAL MARKETS

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CERTIFICATE

This is to certify that this thesis entitled: **"Covid-19 and its Impact on Return and Volatility of China, Pakistan, India and Sri Lanka Financial Markets."** submitted by Fahim Ullah Khan is accepted in its present form by the PIDE School of Social Sciences, Pakistan Institute of Development Economics (PIDE), Islamabad as satisfying the requirements for partial fulfillment of the degree in Master of Philosophy in Management Sciences.

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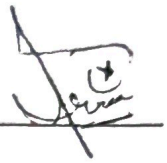
Signature of Student 

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Dedication

I am dedicating this thesis to my parents and siblings for their continuous support and unconditional love through out this completion period. I regard their patience, moral and financial support during my thesis.

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In the name Allah who is most gracious and Merciful, All praise to Allah for completion of my thesis. I would like to express my feelings and gratitude for those people who helped me in completion of this research work. I highly appreciate their sincerity and support.

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ABSTRACT

This study examines the return and volatility spillover effects from Chinese financial markets to Pakistan, India and Sri Lanka financial markets before and after the COVID-19 outbreak. The sample used in this study is from July 2012 to June 2021. The methodology used for data analysis is by applying the econometric models of ARMA(1,1) and GARCH-M(1,1). COVID-19 is used as a dummy variable to check the impact of the pandemic on the mean and volatility of Chinese markets and the spillover from China to Pakistan, India and Sri Lanka during the sample period. The daily closing indices of the stock exchanges of China, Pakistan, India and Sri Lanka are used for data collection. The results show that there is an impact of COVID-19 on the return and volatility of Chinese markets and the volatility spillover from China to South Asian countries including Pakistan, India and Sri Lanka financial markets. The statistics show that the volatility coefficient is positively significant for Pakistan and India but negatively significant for Sri Lanka. This indicates that with the increase in volatility in China financial markets, the increase in volatility of Pakistan and India financial markets are observed. In a conclusion, the COVID-19 has an impact on the return and volatility of Chinese financial markets and a spillover effect from Chinese markets to the south Asian financial markets during the sample period. The Government and policy makers should announce economic packages and monetary aids for general public and industries, which will help running the economic activities during the pandemic in a country.

Keywords: Return and Volatility Spillover, Financial markets, Chinese Markets, South Asian financial markets, COVID-19

TABLE OF CONTENTS

LIST OF TABLES

Number *Page*

LIST OF ABBREVIATIONS

AAR	Average Abnormal Return
AC	Autocorrelation
ARCH	Auto-regressive Conditional Heteroskedasticity
BSE	Bombay Stock Exchange
CSE	Colombo Stock Exchange
EMH	Efficient Market Hypothesis
GARCH	Generalized Auto-regressive Conditional Heteroskedasticity
GCC	Gulf Cooperation Council
GFC	Global Financial Crises
GSIC	Government of Singapore Investment Corporation
KSE	Karachi Stock Exchange
SAL	Security Access Level
SSE	Shanghai Stock Exchange
MSO	Mean Spillover
NASDAQ	National Association of Securities Dealers Automated Quotations
PAC	Partial Autocorrelation
VSO	Volatility Spillover

CHAPTER 1

INTRODUCTION

1.1 Introduction

Uncertainty is an unavoidable feature of the world. It primarily refers to an exclusive situations that might not be predicted beforehand and the global pandemic COVID-19 is quite an uncertain event. The economic impact of COVID-19 has been markedly striking its presence all over the world. This unanticipated disease called corona virus originated from the Wuhan province of China in late 2019 and has made a disastrous impact around the globe within a very short period. The economic and financial consequences of COVID-19 and its precautionary impositions have been visibly detrimental for the most goods and service industries globally. This economic downturn is far worse than that of the financial crisis in 2008 and it can be the worst recession since the Great Depression.

As a response, many countries have enacted quarantine policies. This has led to the disruption of business activities in many economic sectors such as retail, transportation and tourism, and food and beverage industries among others. As investors are increasingly concerned over the negative shock from the COVID-19 on firms' profitability, global stock markets plunge severely. During 12 February – 23 March 2020, major developed markets including Australia, Japan, the United Kingdom and the United States have lost from 29.2 per cent (Nikkei 225) to 37.1 per cent (Dow Jones Industrial Average Index). Regarding the case of China, during Q1, 2020, its retail sales contracted 19.0 per cent (year-over-year), and fixed asset investment dropped 16.1 per cent. As the result, China's economic output shrank 6.8 per cent (year-over-year) in Q1, 2020. All of these indicators are recorded as the worst in history. The stock markets also responded to the negative shock from the economic fundamentals. The benchmark Shanghai Stock Exchange Composite Index suffered large volatility and dropped as large as 13.4 per cent during February – March 2020. It is widely believed that the COVID-19 together with oil price crash is the main causes of the 2020 stock markets crash (CNN, 2020). It is argued by Baker et all., (2020) that no previous infectious disease outbreak, including the Spanish Flu, has impacted the stock markets as powerfully as the COVID-19 pandemic. However, very

few studies have examined how the COVID-19 has affected stock markets. Using a hybrid of dynamic stochastic general equilibrium models and computable general equilibrium models, McKibbin and Fernando (2020) simulated a global economic model to explore seven scenarios regarding the spread of COVID-19 but with almost no discussion on stock markets. Baker et al., (2020) quantified the contribution of COVID-19 to U.S. stock market volatility by designing a newspaper-based equity market volatility tracker, i.e., calculation of the monthly fraction of articles in 11 major US newspapers that contain terms related to the economy, terms related to equity markets, and terms related to market volatility, and / or terms related to COVID-19. Ramelli and Wagner (2020) discussed the importance of trade and financial structure for firm value. Specifically, they focused on within-industry differences by considering international trade factor, i.e., export or supply chain exposure to China, and also examined firm characteristics relate to when and how managers and analysts discussed COVID-19 during conference calls.

All countries including India were under lockdown and are continuing social distancing with limited economic activity to avoid the spread of this deadly disease. India recorded the first case of the disease on January 30, 2020. Since then, the cases have increased rapidly and significantly. India has recorded significant growth in the number of cases (approximately 9,500,000 total confirmed cases and 138,000 deaths as on 30 Nov. 2020) and placed at 2nd position after the United States (Total cases 14,100,000). To study the economic effects of COVID-19, researchers have looked toward previous literature that suggests extreme events from the past can significantly affect the stock market (Al-Awadhi et al., 2020; Papakyriakou et al., 2019). Events such as infectious disease epidemics can make negative changes in investors' sentiment that intensely affect their investment decisions and, consequently, stock market prices (Liu et al., 2020). Indian financial market volatility breached the circuit two times in March 2020 alone; this has not happened in the last 12 years. It indicates that the stock market has witnessed panic sell-off of stocks as the country has confirmed COVID-19 cases. In the above context, we can simply conclude that the market is very much reactive, and it is affected by the new piece of information.

COVID-19 disease has jolted the global economy and financial markets since the great depression. The preventive measures like social distancing and lock-downs have proved their essence to a greater extent but they have a cost in the form of reduced business sales and even the permanent closure of various entities. The economic

losses due to COVID-19 have also affected the global stock markets. The contagion effect of the pandemic on global stock markets have been observed in almost every continent and Pakistani stock market is also one of the exchanges that have been influenced as a result of COVID-19.

The spread of COVID-19 puts additional strain on Sri Lanka, a small open economy with limited fiscal scope to combat the pandemic. The CSEALL Price Index, Sri Lanka's leading stock market index, fell to its lowest level in eight years on 12th May. Previously, trading had been suspended to restrict panic selling. Ever since, the market has increased 13.1%, leading to a Year-To-Date return of -21.6%.

The motivation behind to explore the spillover from China to south Asian markets is because as in his 19th Party Congress speech in October 2017, Chinese President Xi Jinping stated that "China will deepen relations with its neighbors in accordance with the principle of amity, sincerity, mutual benefits, and inclusiveness, and the policy of forging friendship and partnership with its neighbors." As neighbors of China, South Asian countries including India, Pakistan, and Sri Lanka have increasingly come into contact with Beijing in the diplomatic, economic, and security domains. These interactions demonstrate that China is not simply appealing to the better angels of South Asian neighbors. Rather, Beijing has crafted a Geo-strategic approach to the region that assiduously seeks to secure its own national interests. South Asian countries, therefore, will have to deeply consider the long-term implications of China's growing presence and activities in their region.

The volatility from Chinese market hit the Pakistani market under different scenarios. As Pakistan is geocentrically very important for china and China has made a huge investment in Pakistan in the form of CPEC as an infrastructural development mega projects. Stories in the media is playing a vital role in volatility transfer from china to Pakistan markets as the COVID-19 outbreak. The forecasts of the analysts also play a role in volatility transfer from china to Pakistan as analysis by those analysts affect the market performance of one market transfer to the other market as they are strategically important. Political situations also affect the performance of one market for example if there is any stressful political situation in China which will create volatility in Chinese markets and will result in volatility of Pakistan Markets.

Change in earnings of listed companies also causes volatility as the COVID-19 out broke in China, a great changes in earnings of listed companies were witnessed as the pharmaceutical industry and mask producers were inclining and the hotel,

transportation and tourism industries were on decline. This created volatility in China and transferred to Pakistani markets. Government policies also play in important role in volatility of the markets as the government decided to implement lockdown and restrictions in order to curb the COVID-19 spread. Those restrictions causes volatility in China markets which eventually hit the Pakistani and other South Asian markets through spread of information.

In this study we used the long term return and volatility spill over effects emanating from China financial markets, on three south Asian markets, India, Pakistan and Sri Lanka, in order to measure the influence of China Financial Market during the period of COVID-19.

1.2 Theoretical Background

1.2.1 Efficient Market Hypothesis

Efficient market hypothesis (EMH) talks about the precise reflection of information from the prices at any point of time in the same way. If the efficient market theory holds accurate, it would prohibit investors from making extra returns by using the intrinsic knowledge on equity stocks. By adding the extra risky stocks in their portfolios they will gain additional returns.

An efficient market is one in which prices reflect fully the available information, according to the Fox and Opong (1999). An implication of an efficient market is that it is impossible to make excess returns from this information, as current prices already reflect the information. Excess returns (if any) should not, however, be statistically significant from null. Market performance depends on the traders' ability to devote time and energy to collecting and distributing knowledge. More efficient markets attract more investors which lead to higher market liquidity (Osei, 1998). Investors are concerned with market volatility, since the movement of stock prices affects their income.

Theory suggests that the expected returns from investments in emerging markets should reduce following greater integration of the emerging market within the world economy (Bekaert and Harvey 2002). The stock market's reaction in response to pandemic is highly heterogeneous across and within nations. Recent research by Capelle-Blancard and Desroziers (2020) reveals that stock prices are reflective of publicly available information. However, the impact is not homogeneous and thereby, high volatility has been observed. They have also concluded that pandemic effect has

been coupled with structural economic fragility of the respective country and thereby the effect varies in different countries despite of being more vulnerable to current pandemic. At first instance, the reaction of stock market toward pandemic looks abrupt, irrational, and highly unsystematic. But a closer analysis reveals that financial markets have discounted most vulnerable sectors. The sectors that are less resilient, unable to follow social distancing norms and affected by disruption in global supply chain have experienced a hard hit and therefore, markets have observed instability. The ancillary industries are also leading the list among most suffered industries due to pandemic. Krugman (2020) has also illustrated the relation between economy and stock markets. He stated that due to pandemic economies are worsening because of corrections in their fundamental values whereas stock markets after experiencing a downturn are witnessing upward trends. However, the question of stability is still pertinent. The argument concludes that it is not easy to beat stock markets for any investors and possibility of leveraging abnormal returns is very limited or zero. Therefore, markets seem to deceptively irrational rather than inefficient. The literature on the economic effects of COVID-19 is rapidly growing.

1.3 Problem Statement

Historically many disasters, contagious diseases and some other pandemic events have severely affected the economies and financial markets globally as well some regions. Some of those events like plagues, Spanish flue, 9/11 great depression and swine flu which hit the economies and financial markets hard. Currently COVID-19 is identified and this study examines that what is the impact of the pandemic on the economies and financial markets since the time of it's out break. Specifically, this research focuses the return and volatility for long term of Chinese markets and the spillover from China to Pakistan, India and Sri Lanka financial markets during the COVID-19 Pandemic.

1.4 Gap Analysis

Number of studies has been conducted which explains the effect of pandemic events on return and volatility of international markets and the spillover from developed markets to emerging or developing markets, but no specific study has been conducted yet which explains the long run return and volatility of Chinese market during COVID-19 and the return and volatility spillover from Chinese market to the financial markets of Pakistan, India and Sri Lanka.

Most of the studies illuminate on analyzing the impact on return and volatility of same markets. However, there exists a gap that the researchers have not yet touched these markets together in the form of China, Pakistan, India and Sri Lanka during COVID-19. In this research we have studied the impact of COVID-19 on Chinese stock market and the spillover from Chinese market to the South Asian financial markets.

This research study examines the impact of COVID-19 on Chinese market and the spillover from China to South Asian financial markets, which has been not done before. In the future, further research can be done by exploring the impact of COVID-19 on Chinese markets and the spillover to Pakistan, India and Sri Lanka with different dynamics. So, this research will be the gateway for upcoming researchers to work on this domain.

1.5 Research Significance

Currently the problem of the COVID-19 is identified and it impacted the economies and financial markets since the time of it's out break very hard. As this pandemic has pushed millions of households into poverty and substantially increased income and wealth inequality across the globe. This situation poses a serious near term challenge for policy makers. Previously studies are conducted in the developed economies to analyse the relationship between pandemic and stock exchanges. But this research examines the impact of COVID-19 on the return and volatility of china, Pakistan, India and Sri Lanka Financial markets. In this study we checks long term return and volatility of china financial markets and it's influence on south Asian financial markets return and volatility during the pandemic of COVID-19. It is important to study the dynamics of stock markets during COVID-19 for number of reasons, a) it provides the insight of investors behavior in developing economies, b) how the lockdown and government intervention reflects in stock market, c) which necessary actions are needed to retain the investment in developing stock markets.

In this research, we investigate that how the volatility from China financial markets during COVID-19 transfer to three South Asian markets I.e India's Bombay (BSE), Pakistan's Karachi Stock Exchange(KSE), Sri Lanka's Colombo Stock Exchange (CSE). This study aims to explore the impact of COVID-19 on the return and volatility of South Asian financial markets using econometric methodologies.

This study will contribute to the financial markets related literature during the pandemic of COVID-19. This will be helpful for all the financial market stakeholders including investors, firms and government policy makers to have a layout and enriched literature in order to deal with situations created during the period of COVID-19 globally or region wise efficiently and on time. It will highlights that what governments need to be aware that in addition to a vast detrimental economic impact, the COVID-19-related restrictions may adversely influence the trading environment in financial markets.

Our results will encourage governments and policy makers to engage in public information campaigns, which are instrumental in greater trading activity and consequently the cost of equity capital will be reduced. This study can be helpful for the investors as the investors can take precautionary steps before trading in stocks during the period of any such pandemic events. Risk averse investors can avoid trading during such events restrictions to avoid the risk linked with volatility of stocks during the lockdown period.

1.6 Research Questions

1. What is the impact of COVID-19 on return and volatility of financial markets of China , Pakistan, India and Sri Lanka?

2. How volatility in China financial markets transmit to the financial markets of Pakistan, India and Sri Lanka?

1.7 Research Objective

1. To examine the effect of COVID-19 on the return and Volatility of financial markets of China to Pakistan, India and Sri Lanka.

1.8 Thesis Structure

First Chapter explains introduction, problem statement, research questions, and research objectives. Second chapter comprises of literature review. Third chapter consists of data and methodology. Fourth chapter comprises of results and findings. Fifth Chapter explains conclusion, key findings and future implications.

CHAPTER 2
LITERATURE REVIEW

2.1 Introductory Background

The impact of COVID-19 on the financial market as well as the stock market has been subject to many empirical studies both in advanced and emerging economies. Existing literature found diverse results in these regards. Ozili and Arun (2020) have conducted an empirical study on the effect of social distancing policy that was adopted to prevent the spread of the Corona virus, based on four continents: North America, Africa, Asia, and Europe. The study found that 30 days of social distancing policy or lockdown hurts the economy through its negative impact on stock prices. Azimili (2020), also researched on understanding the impact of corona virus on the degree and structure of risk-return dependence in the United States using quantile regression. The results indicate that following the COVID-19 outbreak the degree of dependence between returns and market portfolio has raised in the higher quantiles that lowering the benefits of diversification. The author also studied the GSIC and stock return relationship and found that the GSIC return relationship revealed an asymmetric pattern, lower tails influenced negatively almost twice as compared to the upper tails.

Shehzad et al. (2020) conducted a study to analyze the nonlinear behavior of the financial market of the United States, Italy, Japan, and China market return by applying the asymmetric power GARCH model. The study confirmed that COVID-19 harm the stock returns of the S&P 500. However, it revealed an inconsequential impact on the NASDAQ composite index. An empirical study conducted by Cepoi (2020) on the relationship between COVID-19 related news and stock market returns across the topmost affected countries. By employing a panel quantile regression this study found that the stock market presents asymmetry dependence on COVID-19 related information.

Osagie et al. (2020) by applying quadratic GARCH and exponential GARCH models with dummy variables found that the COVID-19 hurts the stock returns in Nigeria and recommended that a stable political environment, incentive to indigenous companies, diversification of economy, and flexible exchange rate regime be implemented to improve the financial market. Baker (2020), in his study, found that there is a dramatic fall in oil prices by 70–80%. It is severe than the financial crisis of

2008/2009. This is a serious issue for the economy as the country is highly dependent on oil revenue. There is a huge gap between the depreciated exchange rate, that is, 20% and the fall in oil prices, that is, 70–80%. According to Herrero (2020), the third wave of the COVID-19 pandemic has hit the emerging economy worst resulting decrease in business activities. Latin America is affected worst because of its much dependency on external financing. Due to the restriction on transport, export has declined. Restriction in the international movement has hampered the tourism sector leading to a fall in revenue.

HyunJung (2020) has made a study on the stock market of South Korea, another leading country of the emerging economies. In his analysis, it was found that the economy has shown a roller-coaster ride. The monthly export shows a downtrend in January, improved in February, then again dipped down in March and June. The country's export volume has come down to 11.2% point in comparison to the previous year.

Topcu and Gulal (2020) have made regional classification of the impact of COVID-19 on the stock market of emerging economy. Their findings reveal that the impact of the outbreak has been the highest in Asian emerging markets whereas European emerging markets have experienced the lowest. The emerging market economies face a credit crunch, also referred to as capital flows (Ahmed et al., 2020). Goldberg and Reed (2020) discussed the negative effect of COVID-19 on the trade of emerging economy. Consequently, the interest rate on emerging market sovereign debt spiked. Frankel (2020) analyzed the economic effect of the pandemic on the emerging economy. COVID-19 has reduced the revenue of those economies by restricting export, tourism receipts, and remittances of migrant workers. Raja Ram (2020) in his study has found that COVID-19 crashes the entire global share. Indian stock market also experienced sharp volatility due to the collapse of the global financial market. Again fall in foreign portfolio investments also reduces the return of the Indian stock market. By analyzing the history of all unexpected events the author has considered COVID-19 also a “black swan” event. He has further analyzed the history of the crash and recovery of the Indian stock market and concluded that the economist cannot predict the recovery of the economy until a stable public health system.

Ravi (2020) has compared the pre-COVID-19 and during COVID-19 situation of the Indian stock market. His findings revealed that before COVID-19, that is, at the beginning of January, trade of NSE and BSE were at their highest levels hitting peaks

of 12,362 and 42,273, respectively showing favorable stock market conditions. After the outbreak of the COVID-19, the stock market came under fear as BSE Sensex and NSE Nifty fell by 38%. It leads to a 27.31% loss of the total stock market from the beginning of this year. The stock of some other sectors such as hospitality, tourism, and entertainment has been dropped by more than 40% due to transport restrictions.

Mandal (2020) has rigorously analyzed the agony of the deadly pandemic on the Indian stock market. Findings reveal that BSE Sensex has witnessed the biggest single-day fall of 13.2% that has surpassed the infamous fall of April 28, 1992. Nifty also has a steep dive of 29%, overtaking the disaster of 1992. As people have compressed their consumption only to necessary products only the FMCG Company has shown a positive return whereas other companies face a sharp decline (Rakshit & Basistha, 2020). There is various literature available on the impact of COVID-19 on different sectors such as health, agriculture, industry, trade, and commerce, but a limited specific study has been conducted on its impact on the stock market of the emerging economy. The stock market plays an important role in the economy.

2.2 China Stock Market Response to COVID-19

As an on-going global public health crisis, the COVID-19 pandemic has brought both supply and demand shocks to the world economy. As of the end of July, the global spread of the virus has yet to be effectively contained, and the ensuing economic chaos and financial market turmoil persist. Centering on the impact of pandemics on economies and financial markets, scholars at home and abroad have already carried out quite a number of studies.

First, the pandemic has caused a significant shock at the macroeconomic level. Ludvigson et al., (2020) estimate that COVID-19 could lead to a fall of 12.75% in industrial production, 17% loss in service sector employment, sustained reductions in air traffic, and heightened macroeconomic uncertainty for up to five months. According to Mulligan, shutdowns in the US during the pandemic has reduced market production by 25–28% in the short run, incurring an economic loss of $7 trillion and an employment loss of 28 million. Baker et al., (2020) suggest that the pandemic has substantially increased uncertainty in the economy, likely causing a year-on-year contraction of 11% in real GDP in the US, half of which can be attributed to pandemic-induced uncertainty. Based on UnionPay daily transaction data at city level, Chen et al., (2020) find that offline consumption has slumped by 42% as a result of

the pandemic, of which products and services consumption dropped by 44% and 43%, respectively. When further disaggregated, catering and entertainment consumption plunged by 72% and tourism by 64%. China is estimated to have suffered a loss in offline consumption totaling over 1 trillion yuan, equaling 1% of GDP in 2019, within two months after the outbreak.

Baker et al., (2020) point out changes in the consumption habits of American households as the pandemic crisis gets worse: initial quick rise in consumption expenditure, mainly in retail, credit card spending and food items, was followed by a sharp decline in overall spending; this pattern was most prominent in states imposing shelter-in-place orders; moreover, social distancing measures were the main reason behind the decrease in restaurant and retail spending. Based on a survey of over 5800 small businesses, Bartik et al., (2020) find that the pandemic has led to large-scale temporary closures and layoffs, with the number of employee counts down by 40% relative to January; many businesses have also suffered financial distresses—the median business with monthly expenses over $10,000 has less than one month of cash on hand; moreover, 43% of businesses have suspended their operations. In terms of policy effect, the measures implemented did not completely meet firm needs. Coibion et al., (2020) find that employment loss caused by COVID-19 was significantly larger than officially reported: the number of jobs lost is estimated to reach 20 million, far greater than the number over the entire Great Recession; what's worse, many of those losing jobs were not actively looking for new ones, and labor force participation fell by 7 percentage points during the period of investigation, outstripping the 3 percentage point decline that occurred cumulatively over 2008–2016.

Also looking at the labor market in the US, Forsythe et al., (2020) find that nearly all industries and occupations (excluding essential retail and nursing) saw contraction in postings and spikes in unemployment insurance initial claims. The authors further point out that the broad-based deterioration of the labor market is more closely related to the spread of the virus itself than to stay-at-home policies. Research from a gender perspective by Alon et al., (2020) further show that the employment drop related to social distancing measures had a large impact on sectors with high shares of female employment. On the other hand, Aum et al., (2020) find that low-skilled workers and the self-employed suffered the most from the pandemic and also from government policies forcing people to work from home.

Second, the impact of the pandemic on various industries has also drawn considerable research attention. Wu et al., (2020) find that at industry level, the COVID-19 pandemic has the greatest short-term impact on consumer- and labor-intensive industries in China. For example, the output value of the service industry fell 6.3% compared to normal. Fu and Shen (2020) find that the pandemic has had a significant and negative effect on the performance of energy companies. When goodwill impairment was introduced as a moderating variable, companies with goodwill impairment were more strongly affected by the pandemic. Focusing on China's insurance market, Wang et al., (2020) find that income from commercial insurance premium, monthly year-on-year growth rate of premium, insurance density, and insurance depth have all decreased due to COVID-19. The negative impacts on property and personal insurances are both statistically significant. And the adverse impact of the pandemic on the insurance market can be alleviated by raising the level of social security and digital insurance. Using input-output analysis, Duan et al., (2020) find that China's response measures and suppressed demand elasticity can limit the long-term impact of the pandemic on the economy, but in the short term, service industries such as transportation, tourism and entertainment could decline by as much as 18%.

Gunay and Kurtulmus (2020) investigate the impact of social distancing on the US service sector. Their findings show that the pandemic initially affected mainly the entertainment and airline industries, with gradual deterioration in the hotel industry, led by small-market-cap companies. However, the authors find no evidence of a negative impact on the restaurant industry from the pandemic in their analysis period. Gunay et al., (2020) investigate the impact of the first wave of the COVID-19 pandemic on various sectors of the Australian stock market, as well as the financial contagion between the Chinese stock market and Australian Stock market. Results show high time-varying correlations between the Chinese stock market and most of the Australian sector indices, with the financial, health care, information technology, and utility sectors displaying a decrease in co-movements during the pandemic. When the firm size is considered, smaller companies in the energy sector exhibited gradual deterioration, whereas small firms in the consumer staples sector experienced the largest positive impact from the pandemic.

Furthermore, a vast number of studies find that financial market did not escape the shock caused by the pandemic. Alfaro et al., (2020) predict the change in the number

of COVID-19 infections for any given trading day based on the changes in infection cases in the previous two trading days, and estimates that a doubling of projected infections corresponds to a decrease in market value of 4 to 11%. The authors have also shown that fluctuations in the market become less volatile when the trajectory is more predictable. In the study by Baker et al., (2020) the authors use text-based methods to look for potential explanations for major stock market jumps since 1900. They find that no previous infectious disease outbreak, including the Spanish Flu, could parallel the shock on the US stock market from the COVID-19 pandemic. The reason for this enormous stock market reaction, much more so than to previous pandemics in 1918–19, 1957–58 and 1968, can be attributed to government restrictions on commercial activities and voluntary social distancing, which caused huge damage to the US economy dominated today by service industries.

Focusing on stock market reactions in China, Yang et al., (2020) note that under the shock of the COVID-19, China's A share market opened on February 3 with a nosedive after being closed during the Spring Festival holiday: as panicked investors rushed to sell, nearly 3000 shares listed on Shanghai and Shenzhen stock exchanges plunged to their limit-down level. Liu and Wang discuss irrational factors that characterize the outbreaks of infectious disease, and under- and over-reactions to such extreme events. Distinguishing between the direct impact of outbreaks and the indirect effects resulting from irrational factors, the authors provide ideas for future research on epidemics from an economic or financial point of view and suggestions for possible policy responses.

Fahlenbrach et al., (2020) document the impact of firms' financial flexibility in the face of pandemic-induced revenue shortfalls on their stock returns, pointing out that less financially flexible firms had significantly lower returns on their stocks and saw smaller rebound in their stock prices after the government announced the lifting of lock downs. Ramelli et al., (2021) find that firms more exposed to trade with China under performed in the US stock market at the initial stage of the COVID-19 outbreak. However, as the virus spread to Europe and the US, corporate debt and cash holdings emerged as important value drivers, relevant even after the Fed intervened in the bond market. The phenomenon of high market correlations and financial contagion during different type of crises has also attracted many scholars' attention. Kenett et al., (2010) find that the high degree of coupling between global financial markets has made the financial village prone to systemic collapses.

Kenett et al., (2010) also find that while the developed “western” markets (US, UK, Germany) are highly correlated, the inter dependencies between these markets and the developing “eastern” markets (India and China) are volatile and with noticeable maxima at times of global world events. Vidal-Tomás et al. propose an early warning indicator based on the collective movement of stock prices in a given market, investors can reduce the risk of their portfolio while policy-makers can set more efficient policies to avoid the effects of financial instability on the real economy. Ali et al. investigate the reaction of financial markets globally in terms of their decline and volatility as coronavirus epicentre moved from China to Europe and then to the US. Their findings suggest that the earlier epicentre China has stabilized while the global markets have gone into a freefall especially in the later phase of the spread. Even the relatively safer commodities have suffered as the pandemic moves into the US. Grilli et al. review the literature on credit market models by emphasizing the mechanisms able to generate financial crises and contagion.

In sum, existing research typically explores the impact of the COVID-19 pandemic at macroeconomic level, focusing on a specific country or region. Studies quantifying its shock on China’s financial market are few and far between, let alone ones that look at the heterogeneous effects across industries and firm types and seeks to provide an explanation. Therefore, this paper will enrich and complement previous works in relevant areas by adopting GARCH-based event study to analyze daily transaction and quarterly financial statement data of firms listed on SSE, SZSE and ChiNext.

2.3 Pakistan Stock Market Response to COVID-19

In Pakistan, the first case of COVID-19 is reported on February 26, 2020 which has crossed the figure of 13,000, till conducting the study. However, the recovery rate is better as compared to the developed countries, like Italy, France, and United States. The impact of this pandemic situation on Pakistan's economy depends on the time taken in taking preventive measures and the intensity of spreading the disease. According to the Asian Development Bank (ADB), this pandemic situation can cost the Pakistan economy approximately $16.38 million to $4.95 billion, nearly 1.57% of the overall GDP.

The report also mentioned that this pandemic cost more than 946,000 job losses. In this way, a country that is at the recovery stage, in the last 2 years, is affecting badly. Trade is considered as the backbone of every economy as it brings the foreign

reserves in the country to support the balance of payment and control exchange rate, etc. After this pandemic hitting Pakistan, authorities decided to close the industry which caused to shrink the economy. Previously, the stock markets reflect the changes when a major event or problem hits the country. In the same way, as the infected cases reported in Pakistan, the stock market starts declining; on March 19, it hits its lowest value in the last 5 years. The main cause of this sudden decline is the pandemic situation which urges the foreign investors to withdraw their foreign portfolio investments.

Due to COVID-19, industries are affected by the lockdown and this pressure build on the stock market. Resultant, the stock market has shown a declining trend in start of this uncertain situation, as indicated in Figure 1. Later when IMF and other countries extend the dates of the loan payment, IMF approval of $1.4 billion grant to Pakistan to cope with this pandemic and the funding from the world bank, help indirectly to recover the stock market and business activities in the country. In turn of these efforts, the KSE-100 index has shown a significant surge in, which moved from 39,382 on March 5 to 44,960 on March 26, respectively (News Desk, 2020).

By using quantile-on-quantile based coefficients, we examine the relationship between the spreading of COVID-19 and KSE index in Pakistan, mention in Figure 2. The findings argue that stock market has reported mix evidence with COVID-19. As in the figure, we can see that it starts declining at the start of March. However, in March, the trading has stopped in KSE due to sudden downfall in KSE-100 index. It has been observed that the KSE index start declining which turn to its historic lowest point of the last 5 years. One of the reasons for such decline is the drawing of foreign investment; in the last 2 years, there were $3.5 billion of foreign portfolio investments in the stock market of Pakistan which started withdrawing.

Resultantly, within 2 weeks, $2 billion has withdrawn from Pakistani stock market. At the same time, cases started increasing in Pakistan and at the end of March, this figure is close to 5,000 cases. Moreover, this relationship is significant and positive on quantile 0.2 of COVID-19 and 0.3 of Karachi stock exchange, mentioning that on upper quantiles the situation is turning better. At the end of March, the market starts recovering due to number of reasons: firstly, the decline in interest rate motivates the investors to turn back and invest in Pakistani economy. The significant reduction in interest rate boosts the investors' confidence to take a loan and invest, which deliver a

positive signal to investors. The second reason for increment in stock index is the economic package from the government of Pakistan to help the public and small businesses.

The government has announced the economic package of Rs. 900 billion which is equal to $5.66 billion (Haris, 2020). From this package, the government has fixed Rs. 100 billion for exporters to enhance the exports and economic activity in the country. In turn of these significant and timely measures, the stock market is now booting up. The forecasting based analysis shows that within the period of the next 2 months, the situation is going to be normal, as indicated by Figure 3. It has been analyzed that due to the steps taken by the Pakistani government, especially economic package and interest rate announcements, stock market index is showing the significant surge in index point.

In Figure 4, we can see the forecasted trend of KSE in three scenarios of COVID-19: low growth in cases, average growth in cases and high growth in cases. Figure 4a indicates the low case scenario, which mentions less cases in May and June. Figure 4b,c indicates the scenario of average growth and high growth in COVID-19 cases, respectively. In all three scenarios, it seems clear that the performance of Karachi stock exchange is stable. Remarkably, the performance of stock market is higher in high growth scenario. However, we can conclude that COVID-19 have not documented adverse effect on KSE- 100 index.

Similarly, Figure 5 reveals that in Pakistan, which is a developing country, the situation is opposite to the stock markets of developed countries, like Europe and United States, where the stock index has hit hard (Al-Awadhi et al., 2020).1 According to the predicted data, the KSE-100 index is moving upward in May and June. The main cause for such surprising response of Karachi stock exchange are the economic support packages to industries, economic aid to general public to maintain their consumption of industrial goods and the increase in business activities due to the special month and the Muslim festival ahead. In this month economic activity remain more as compared to other months (Haris, 2020).

The coefficients of quantile-on-quantile approach of predicted data reflects the optimistic behavior of investors toward stock market; around 0.15th quantile the response of stock market turn to be positive. Moreover, the timely intervention and packages by government of Pakistan has provided a positive signal in stock market. In turn, the KSE-100 index is reporting positive returns.

2.4 India Stock Market Response to COVID-19

This Pandemic COVID-19 affected the economies of the world and India was also among those nations. Due to the lockdown ordered by the government of India, everything came to halt in this busiest country. The crashing of the global market economy, major drop in oil prices, and increasing unemployment are some of the impacts of the pandemic COVID-19 that affected almost all countries in the world. India was also not far behind to get the impact of COVID-19 on their economic growth, development, economy and stock market.

India has a robust stock market that reacts and responds well to the global situation. The first case was reported in India on 30th January and the lockdown ordered on 24 March, 2020, that was a gap of almost 53 days that was also a matter of concern; what if the Government had ordered the lockdown earlier? It may have slowed the spreading of the virus in the population. How did the stock market respond to this nationwide lockdown? In this event study, the influence of the lockdown due to COVID-19 on the stock market is explained with the semi-strong form of market efficiency hypothesis (Fama, 1970). They are called event studies (Fama, 1991). This event study measured how rapidly security prices respond to announcements of the lockdown due to COVID-19.

According to semi-strong Efficient Market Hypothesis, current market prices not only reflect information about historical prices of stocks, but also reflect information, which is publicly available. In semi-strong form of market efficiency, there can be some lag time before the price fully reflects all available information. This time lag can vary depending on the market, on the individual security, and the way in which information is shared. The present study attempts to gather evidence in support (if any) of the semi-strong form of EMH in the Indian stock market. (Foster, 2012).

The authors of this study made an effort to examine the impact of the lockdown on the stock market and its effect on the Average Abnormal Return of various stocks. The COVID-19 pandemic has affected the global economy of which India is a big participant. India is the country with the second largest population in the world, so the pandemic is especially dangerous for India. The COVID-19 affected almost all stock markets around the world. The world stopped due to the virus outbreak and it pushed the world into the great crisis of the century. The total lockdown and social distancing is the only solution for preventing the spreading of the virus until a vaccine is

available. India also announced the lockdown as a protective measure, but India announced a little bit late and this is evident through the pre-lockdown period where AAR was negative.

The announcement of the lockdown was taken positively by the stock market that was reflected in the stock market response; this is not an ideal situation, but still there is a chance when the lockdown is lifted and COVID-19 is eradicated from the country, the stock market will recover. The study finds the evidence of a positive AR around the present lockdown period and confirms that the lockdown has a positive impact on the stock market performance until the situation improves in the Indian context.

However, the result holds true for the select sample of BSE-listed companies and during the period considered for the study. It cannot be generalized for other traded stocks, nor in other periods in the future or in a different market environment. The implications of this study are that investors can take precautionary steps before trading in stocks during the period of a lockdown. Risk averse investors can avoid trading around the lockdown to avoid the risk linked with volatility of stocks in the lockdown period. The result of this study will benefit investors as it may help them better understand and evaluate the impact of the lockdown on stock markets caused by COVID-19 19.

The study shows that NSE-listed firms negatively responded to the COVID-19 outbreak, with more than 6% negative CAAR in 10-day event windows. Next, the price response of various sectors to the outbreak of the pandemic is analyzed. The highly negatively affected sectors have experienced a negative abnormal return of more than 10% in 10-day event windows, including financial services, metal, automobile, transportation services, construction sectors, and rest. In addition, moderately negatively affected sectors have seen negative CAAR of 5% to 10% in the 10-day event window, including electricity, textile, plastic, chemical, Fast Moving Consumer Goods (FMCG) sectors, and others. However, few sectors are slightly negatively affected with a negative abnormal return of less than 5% in 10-day event windows, and these sectors are media and drug & pharma sectors. Also, the findings revealed that the COVID-19 outbreak impacted larger firms more negatively than smaller firms in each event window, which is contrary to the findings of prior literature.

To a large extent, the stock market reflects the economic condition of a large number of companies, whereas the capital market represents a complete state of a country's

economy. Therefore, any fluctuation in economic activities can be analyzed through the movement of the stock market. In India, about 43 percent of the stock market participants are retail investors, which sets India apart from other emerging markets. Hence, this study better reflects investor behavior during extreme events.

2.5 Sri Lanka Stock Market Response to COVID-19

The market worth of all finished products and services generated within a country in a year is referred to as GDP .Gross Domestic Product(GDP) is an important indicator of a country's economic, health and strength. The bilateral economic connections between Sri Lanka and China, in particular, have greatly improved during the recent decade. Bilateral commercial and investment agreements ,as well as tourism links, are stronger than they have ever been. Although China is not a big export destination for Sri Lanka, it is the country's second largest source market in terms of imports and tourist arrivals. As a result, the slowdown in China caused by COVID-19 could have a severe influence on the Sri Lankan economy.COVID-19's economic impact on selected economies was recently calculated by the Asian Development Bank(ADB) using best case, moderate case, and worst case scenarios.

In the best, moderate, and worst hypothetical scenarios, Sri Lanka's GDP may drop by 0.119 percent, 0.179 percent, and 0.358 percent, respectively. Similarly, under the same situations, job losses might range from 0.205 percent to 0.617 percent. Hotel, restaurant, and other personal services suffer the most negative consequences, followed by transportation services. However, because these calculations are based only on China's domestic demand and travel limitations, the estimations may grow once the present situation in Sri Lanka is factored in. The island-wide curfew imposed as a result of COVID-19 greatly affected economic activity, while the closure of airports and seaports severely disrupted export and import procedures. As a result, COVID-19 could have a bigger impact on Sri Lanka's GDP and employment than the Asian Development Bank predicted. Decreased tourism income, reduced export income, and outstanding external debt payments substantially boost foreign currency pressure. Furthermore, the pandemic is severely affected by a considerable number of Sri Lankan workers in the Middle East, South Korea and Italy. Foreign transfers to Sri Lanka are therefore expected to fall by $2.7 billion this year (gunadasa 2020). Throughout the first week of March 2020, the Sri Lankan rupee began to depreciate against major currencies.

The latest figures in the history of depreciation were, in particular, against the US dollar, which reached Rs 198.46 (as of 30 May 2021). The current depreciation of the rupee substantially increases the national import expenditure and the external debt burden. Therefore, some measures1, like suspending imports of motor vehicles, non-essential goods and acquiring Sri Lankan international sovereign bonds by licensed banks, were immediately taken by the Central Bank of Sri Lanka. But no immediate reaction at the exchange rate can still be seen.

The global financial turmoil of COVID-19 has now also become more visible in many countries around the globe through collapsing stock market. Indeed, the crisis in Sri Lanka has left no escape and Sri Lanka has also been badly affected by the Colombo stock exchange (CSE). On 10 March, the CSE fell to a low of 8 years, one of the biggest fall times of one day, as foreign funding was released (News First, 2020a). A considerable volume of foreign investor treasury bills and treasury bonds has decreased by 9,03% (Rs 8,236 billion), totaling, Rs 19,6 billion in foreign outflows in the first two weeks of March 2020 (News First, 2020b). As a result, CSE closed in its first two weeks, with the All share price index (ASPI) decreasing 4.47 percent and the S&P Sri Lanka 20 index decreasing 5.79 percent as compared to the end of February 2020. (News First 2020b).

In addition, CSE has declined by 16% since January 2020 and by 8.4% in February itself out of 16% in 2012 (News First 2020a). In addition, the CSE has dropped by 16% since January 2020 and by 8,4% in February itself, out of 16% (News First 2020a). There are more possibilities to further undermine the stock market by rapidly spreading corona virus globally as well as in Sri Lanka, damaging the country's financial stability.

On 31 December 2019, Chinese health officials reported multiple cases of pneumonia caused by a virus unknown in Wuhan Province of Hubei to the World Health Organization (WHO). Since the global recession of the 1930's, this epidemic has erupted in the world with the worst recession of the global economy. These include a decline in the tourism industry, the decline of foreign exchange and slower exports and services, depreciation of goods and service, rupee devaluation, the weakening of everyday employment opportunities and increasing poverty. This research will be carried out on the economic sectors of the economy and on the tourism sector. While China is not a major export destination for Sri Lanka, it is the second-largest import- and touristarrival market for the country. This may have a serious effect on the Sri

Lankan economy due to the COVID-19 slowdown in China. In January 2019, 224.239 were the biggest number of tourists arrived. The number of tourists visiting the country fell dramatically because of the violence in the country in March. The house effects have a significant impact on households and have forced many people, including job stability in Sri Lanka, to change their lifestyles for poverty. The Government has also implemented programs to support jobs and public-sector training so that safe-income workers can continue to work.

The pandemic was a major financial shock, reversing past progress towards reducing poverty. Sri Lanka's economy has grown on average by 5.3% annually since the civil war ended in 2009.The poverty rate dropped from 16.2% in 2012/13 to 11.0% in 2016 (in 2011 the purchasing power equity) whereas growth was inclusive and poverty reduction was strong. In recent years, relocation and growth in nonfarm incomes have been the main driving forces behind poverty reduction. The economy in Sri Lanka is expected to grow by 3.3% before the pandemic in 2020.Therefore, foreign transfer to Sri Lanka is expected to decrease this year by $2.7 billion (gunadasa, 2020).

The Sri Lankan rupee began to depreciate against major currencies during its first week in March 2020.The crisis in Sri Lanka has not escaped, and the Colombo stock exchange has also severely affected Sri Lanka (CSE).The CSE was down to eight years on 10 March, one of the largest times when foreign funds were released (News First, 2020a).In the first couple of weeks of March 2020 a considerable volume in foreign investor treasury bills and treasury bonds decreased by 9.03% (Rs 8236 billion) (News First, 2020b).

2.6 Spillover between Stock Markets

Several studies have investigated the association between different stock markets during the last four decades. Neal (1987) finds that London and Amsterdam stock markets are well-integrated from the second quarter of eighteen century. Eun and Shim (1989) investigate the transmission between stock markets of Japan, Australia, France, Hong Kong, Germany, Switzerland, UK, Canada, and USA during 1979 to 1985. It finds that integration between all these stock markets are found to be significant. The results of both above-mentioned studies are different regarding the integration between US, Germany, Japan, and UK stock markets, suggesting a time varying integration in equity markets.

Hamao et al. (1990) examine the interdependence between Japan, UK, and USA stock markets. It finds a significant volatility spillover from UK to Japan, US to Japan, and US to UK stock market for the pre-October 1987 period. Mathur and Subrahmanyam (1990) investigate the interdependencies between USA and Nordic stock markets during 1974 to 1985. The causal association from US to Danish stock market is evident, but not to the Finish, Norwegian or Swedish stock markets. Cheung and Mak (1992) estimate the causal links among USA , Japan and Asia Pacific stock markets during 1977-1988. It provides an evidence of the significant and dominant impact of USA on Asia Pacific stock markets as compared to the impact of Japan on Asia pacific. Theodossiou and Lee (1993) investigate the mean and volatility transmission between stock markets of USA, Japan, UK, Germany, and Canada. It finds a positive mean transmission from the US to Germany, UK and Canada, whereas negative return spillover from Japan to German stock market. Moreover, volatility is transmitted from the US to all four stock markets, from Germany to Japan, and from UK to Canada stock markets.

Palac-McMiken (1997) examines the association stock markets of ASEAN stock markets (Malaysia, Philippine, Thailand, Indonesia, and Singapore) by using data from 1987 to 1995. It finds a significant link between ASEAN stock markets except for Indonesia. Booth et al. (1997) look at the return and the risk transmission between the Norwegian, Swedish, Danish and Finnish stock markets. This study finds that the spillover effect is asymmetric and spillover being more pronounced for bad news as compared to the good news. Furthermore, there is a presence of spillover between these markets. Janakiramanan and Lamba (1998) investigate the associations between developed (Australia, Singapore, Hong Kong, Japan, US, the New Zealand) and the developing stock markets (Thailand, Indonesia, and Malaysia) during 1988 to 1996. It finds a significant affect of US on other stock markets except Indonesia.

Wu and Su (1998) examine the association between stock markets of US, Hong Kong, Japan and UK during 1982 to 1991. It finds that the association between these markets become stronger after the 1987 market crash. It suggests that financial crises may influence the integration between markets. Liu et al. (1998) estimate the return transmission between stock markets of US, Singapore, Hong Kong, Japan, Taiwan, and Thailand during 1985-1990. It finds that US significantly influences the five Asia Pacific markets, and return transmission between stock markets becomes stronger after 1987 market crash.

Christof and pericli (1999). estimate the mean and volatility transmission between stock markets of Latin America (Brazil, Chile, Colombia, Argentina, and Mexico). It finds a significant return and volatility transmission between these Latin American stock markets. Moreover, the volatility transmission is stronger as compared to the return spillover effect in these markets. Masih and Masih (1999) examine the interdependencies between US, UK, OECD, and emerging Asian markets. It finds a significant impact of US and UK on OECD and emerging Asian stock markets. Ng (2000) compares the volatility transmission from the equity markets of USA and Japan to the Pacific Basin. It finds a significant volatility transmission from the stock markets of US (global) and Japan (regional) to Pacific Basin and reports the strong impact of US on Pacific Basin markets as compared to the impact of Japan.

Darrat et al. (2000) examine the global and regional integration of three Middle East stock markets. It reports a significant influence of US on Middle East stock markets. Huang et al. (2000) investigate the link between US, South China, and Japan growth triangle during 1992-1997. The return of US market significantly and dominantly influences the south Chinese growth triangle as compared to the influence of Japan on Chinese stock market. The return transmission is significant from US to Taiwan and Hong Kong, and from Hong Kong to Taiwan stock market. In et al. (2001) study the interdependence between the Korea, Hong Kong and Thailand stock markets in Asian financial crises of 1997-1998. This study finds a bidirectional volatility transmission between Korea and Hong Kong, and unidirectional from Korea to Thailand in Asian crises. Overall, these three markets are highly integrated during crises.

Scheicher (2001) finds a limited integration between Poland, Hungary, and Czech Republic stock markets. Chen et al., (2002) investigate the spillover between Brazil, Mexico, Venezuela, Columbia, Chile and Argentina stock markets from 1995 to 2000. It finds an insignificant volatility spillover between Latin American stock markets. Moreover, the dependencies between Latin American stock markets are not found different during the dramatic shortfall between 1997-1998. Yang et al. (2003) investigate the long and short run relationship between USA, Japan and ten Asian equity markets particularly focusing on financial crisis of Asia during 1997-1998. This study reports a strengthen long run co-integration among these stock markets during Asian financial crises period. Post-crises integration is higher than the Pre-crises integration between equity markets. The degree of integration is found to be changed during all crises and non-crises periods.

Miyakoshi (2003) estimates the mean and volatility transmission between the stock markets of US, Japan, and Asia (Thailand, Korea, Indonesia, Singapore, Taiwan,and Hong Kong) from 1998 to 2000. The return spillover is found to be significant from US to Asian markets, whereas no return spillover is found from Japanese to Asian markets. Moreover, volatility transmission from Japan to Asian stock markets is evident to be dominant as compared to the volatility transmission from USA to Asian markets. Balasubramanyan (2004) estimate the volatility transmission between US, UK, and Japan. It finds a significant volatility transmission between the stock markets of US, UK, and Japan. Choudhry (2004) examines the risk and return transmission between the stock markets of friends and foe countries. In foe countries, the return and volatility spillovers are found to be significant. The return spillover is dominant from the small to large stock markets, while volatility transmission is found from large markets to small markets. In friendly countries, the mean and volatility transmissions are also evident between the US and other six stock markets. Moreover, the returns spillover is significant from US to other six stock markets, but six stock markets are not significantly impacted the US stock market. Shik Lee (2004) examines the spillover between US and Korea stock market and find a significant unidirectional spillover from US to Korean stock market.

Kim (2005) reports a significant spillover from US to Asia pacific stock markets, whereas the spillover effect from Japan to Asia Pacific stock markets is found to be relatively weaker than US. Sharkasi et al. (2005) estimate the spillover between US, Brazil, Hong Kong, Japan, UK and Irish and Portugal stock markets. This study finds an intra-Asian and intra-European co-movements of stock markets. Moreover, comovements between stock markets of the US and Brazil are also found significant. Egert and Kocenda (2005) examine the link between the central and eastern European countries' stock markets. It reports a significant return and volatility transmission between European stock markets. Hiang Liow et al. (2005) estimate the short and long run linkages between the property stock market of four European markets (Germany, France, UK, Italy), four Asian stock markets (Japan, Singapore, Hong Kong, and Malaysia). This study reports a weak return transmission, whereas insignificant volatility spillover between property stock markets.

Chancharoenchai and Dibooglu (2006) estimate the volatility transmission between emerging stock markets of south Asia during Asian crisis of 1997. It finds a significant volatility spillover from Thailand to Malaysia and Korea; Philippine to

Thailand, Taiwan, and Korea; Taiwan to Indonesia and Philippine stock markets during 1997 Asian crisis period. Al-Deehani and Moosa (2006) examine the spillover between three stock markets of Saudi Arabia, Bahrain and Kuwait. First, it finds that Kuwait market transmits strong volatility effect in Bahrain and Saudi Arabia. Second, Saudi Arabia transmits a volatility effect to the Kuwait stock market. Third, Bahrain stock market significantly transmits a positive volatility effect on the Kuwait stock market.

Egert and Koˇcenda ´ (2007) estimate the short run spillover between the western and eastern European stock markets from 2003 to 2005. It finds a significant return and volatility transmission between the western and eastern European stock markets. Qiao et al. (2008) find that China and Hong stock markets are fractionally integrated. Johansson and Ljungwall (2009) analyse the association between China, Thailand, and Hong Kong stock markets by using data from 1994 to 2005. It finds a significant return spillover from Taiwan to Hong Kong, and China stock market, whereas volatility effect run from Hong Kong to Taiwan and Taiwan to China stock market. Li and Majerowska (2008) examine the volatility transmission between Poland, Hungary, Germany, and US stock markets. It finds that volatility transmission run from stock markets of developed countries to emerging countries.

Yu and Hassan (2008) estimate the volatility spillover between US and MENA markets, and find a significant influence of US on MENA stock markets. Koulakiotis et al. (2009) estimate volatility spillover between Scandinaviaan, German and French stock markets during 1987 to 2006. It finds an insignificant bidirectional volatility transmission accross these three European markets. Hammoudeh et al. (2009) investigate the shock and volatility transmission across three sectors of Saudi Arabia, UAE, Qatar, and Kuwait stock markets. It finds that not past own-shocks, but past own-volatility significantly impact the current conditional volatility of four gulf stock markets. Nath Mukherjee and Mishra (2010) estimate the integration and volatility transmission between India and its 12 Asian counterparts during 1997 to 2008. First, it finds a bidirectional return transmission between India and majority Asian counterparts stock markets. Second, the majority Asian markets strongly transmit the volatility effect to the Indian stock market. Third, India stock market significantly influences the Pakistan and Sri Lanka stock market.

Nishimura and Men (2010) investigate the risk spillover between the stock markets of China and G5 countries from 2004 to 2007. It finds a significant short run risk

transmission from China to US, UK, French and German stock markets. Singh et al. (2010) analyse the spillover between 15 Asian, European and North American stock markets during 2000 to 2008. This study reports a significant return and volatility transmission from US to Japan and Taiwan to Hong Kong and Korea to Singapore and Hong Kong to Europe and Europe to US stock market. Yilmaz (2010) investigate the return and risk transmission between 10 east Asian markets of Indonesia, Japan, Hong Kong, Malaysia, Korea, Singapore, Philippine, Australia, Thailand, and Taiwan from 1992 to 2009. It finds that return and volatility spillovers are different between stock markets during the periods of crisis and non-crisis.

Beirne et al. (2010) estimate the spillovers from global and regional to local stock markets. It uses 41 markets from the regions of Latin America, Europe, Asia, and Middle East. It finds a significant spillover from global and regional to the majority local stock markets. However, these linkages vary across regions and countries. Moreover, return spillover is dominant in Latin American and Asian region, whereas volatility spillover is dominant in European region. Regional spillover is found to be dominant in Latin American and Middle East, whereas global spillover is found to be dominant in Asia. Moon and Yu (2010) estimate the risk spillover between US and China stock markets from 1999 to 2007. After the structural break of December 2005, asymmetric and symmetric volatility spillover is significant from US to Chinese equity market, whereas the asymmetric volatility effect is also run from China to US stock market. Abou-Zaid (2011) investigates the volatility spillover from US and UK to the MENA (Turkey, Israel, and Egypt) stock markets during US financial crisis of 2008. It finds that US significantly transmits the volatility effect to the Israel and Egypt stock markets during US financial crises of 2008.

Joshi (2011) examines the mean and volatility transmission between six Asian stock markets (China, Korea, Hong Kong, India, Indonesia, and Japan). It finds a bidirectional mean and volatility spillover between majority pairs of stock markets. Sakthivel et al. (2012) empirically estimate the volatility spillover between five stock markets of US, India, UK, Australia, and Japan. It provides evidence of bi-directional volatility spillover between US stock and Indian stock markets. Moreover, volatility also transmitted from stock markets of UK and Japan to India. Korkmaz et al. (2012) examine the causal link between the Indonesia, Columbia, Egypt, Vietnam, South Africa and Turkey stock markets. It provides an evidence causal link between 10 pairs

out of 30 pairs of stock markets. Moreover, inter regional and infra-regional spillover effects are also observed.

Zhou et al. (2012) estimate the spillover between Chinese and international (US, France, UK, Germany, Hong Kong, Japan, India, Taiwan, Korea, and Singapore) stock markets from 1996 to 2009. Before 2005, Chinese stock markets are affected by the spillover from other international markets. After 2005, volatility spillover is significantly transmitted from China to majority other international stock markets.

Li and Zhang (2013) analyse the risk spillover between the US and Chinese stock markets and find no risk transmission between both markets. Moreover, US returns significantly influence the returns of the Chinese equity market. Beirne et al. (2013) examine the mean and volatility transmission from developed to emerging stock markets during turbulence in mature stock markets. It reports that volatility in mature markets affects the conditional variances in emerging stock markets. Moreover, the spillover effect from developed to emerging markets is also changed during time of turbulence in mature markets. In most of emerging markets, the conditional correlation between mature and local markets increases during the time of turbulence. Further, conditional variance also increases in local markets during turbulence episode.

Sugimoto et al. (2014) examine the global, regional, commodity, exchange rate spillover effect on the African counties during European debt crisis and the US subprime crisis of 2008. The study finds that the spillover effect from the global market to African financial markets is significant. And regional spillover effect to African countries is weaker as compared to Global markets. So, the Global crisis affects a lot to the African financial markets. Further, spillover from European markets to African markets is stronger as compared to the effect from US to African Markets. Majdoub and Mansour (2014) test the volatility transmission between US stock market and sharia-compliant Islamic equity markets (Pakistan, Malaysia, Qatar, Indonesia, and Turkey). This study reports an insignificant spillover from US to sharia compliant markets.

Tsai (2014) investigates the spillover effect between the US,France, UK, Japan, and Germany. It estimates the spillover indices of these major stock markets; and finds that transmission of information is significantly increased after 1998. Germany mainly influences the UK stock markets and US largely effects the other stock markets. The net spillover of US stock market is exceeded zero during three periods:

before 1997, from 2000 to 2002 (the dot com bubble) and during subprime crisis from 2007-2008. Ta¸sdemir and Yalama (2014) investigate the spillover effect between Brazil and Turkey. The results reveal that there is a presence of spillover effect from stock market of Brazil to Turkey. Moreover, the spillover effect also exists from Turkey to Brazil during financial crises. Jin (2015) examines the mean and the volatility transmission among China, Taiwan, and Hong Kong. The study finds that financial crises have a large and positive effect on expected conditional variances, but the size and dynamics of influence vary from market to market. Hwang (2014) provide the evidence of stronger connection between US and Latin American markets in US financial crisis of 2008.

Alotaibi and Mishra (2015) investigate the mean spillover effect from US and Saudi Arabia to GCC (UAE, Qatar, Kuwait, Oman and Bahrain) stock markets. The study finds that the return spillover effect from US and Saudi Arabia to GCC stock markets. Abbas et al. (2013) investigate the volatility spillover between regional equity markets to India, Theoretical Background and Literature Review 26 China, Pakistan, and Sri Lanka. This study also chooses some countries of USA, UK, Japan, and Singapore for spillover analysis. These results reveal a significant presence of volatility spillover between friendly countries of different regions. Kumar and Kamaiah (2017) examine the mean and the volatility transmission across Asian equity markets including India, Japan, Hong Kong, Amman, Korea, and Singapore. The study finds a significant integration among markets in long run. Moreover, the spillover effect across these markets is relatively low at the high frequency, so the possibility of diversification is existed at daily to intra week scale.

2.7 Policy related Literature

In an attempt to curb the spread of the disease, governments around the world have taken unprecedented radical steps (Hale et al.,2020). Policy responses such as school and workplace closings and restrictions on internal movement aim at constraining social interactions. Since economic activity relies on such interactions, the measures dramatically affected markets and countries around the world. Studies of the governments' non-pharmaceutical interventions pointed to sizable economic and social costs, including unemployment, a decline in wealth, and loss of income (Chen et al., 2011; Epstein et al., 2007; Pike et al., 2014).

A UNCTAD report asserts that Pakistan will be hardest hit by the global pandemic of COVID-19 in the latest report of the United Nations Conference on Trade and Development (UNCTAD, 2020). Kotishwar (2020) investigated the impact of the COVID-19 19 outbreak on the stock market of six countries positively affected by the pandemic, including the USA, China, Italy, Spain, France, and India, and found evidence of a long-running negative association between the outbreak and the stock market. He et al. (2020) discussed the direct and indirect effects of COVID-19 on the financial markets through a mixed sample of Asian and European economies. The empirical findings show that COVID-19 has a negative but short-term impact on the affected countries' stock markets. The stock market impact of COVID-19 has bidirectional spill-over effects between Asian countries and European and American countries. However, there is no evidence that COVID-19 affects these countries' stock markets more negatively than the global average does. Waheed et al. (2020) conducted a study for Pakistan considering the Karachi stock exchange. They found a result contrary to other studies with a positive impact on the KSE-100 index stock return during COVID-19 19. Erdem (2020) aimed to explore a connection between how stock market indices' returns differ concerning COVID-19 news from different regimes, such as free and not-free countries, and found a significant negative impact of the pandemic on stock market returns i.e., declining return and high volatility.

While earlier studies focused primarily on the impact of the policy responses on the economy, the influence on financial markets is largely an unchartered territory. To fill this gap at least partially, this study focuses on one key feature of global markets: liquidity. We aim at answering the question of whether and, if so, how the non-pharmaceutical interventions impact upon liquidity in stock markets. Equity market liquidity is essential for financial stability and economic growth, especially during extreme events. Importantly, higher liquidity leads to a reduction in the cost of equity capital (Butler et al., 2005), which can a) alleviate a company’s funding constraints, and b) contribute to a company’s financial resilience to the coronavirus pandemic. Since liquidity allows the immediate realization of a loss or gain, the importance of exploring its features in such an extreme event cannot be overestimated. Also, liquidity is monitored by a wide range of decision-makers such as portfolio and fund managers, as well as policymakers and regulators who seek to safeguard financial stability amid the coronavirus pandemic. The current unique circumstances provide a

fertile soil for investigating the degree to which liquidity changes in response to different government interventions in times of crises.

There are at least three channels of how COVID-19-related policies may impact the stock market liquidity. The first channel could be described as the "infrastructure channel". Workplace closing may disturb decision-making processes in many financial institutions, which disallows swift reactions and quick trading. Some financial institutions may be even physically closed, so—in the case of a lack of proper electronic infrastructure and policy regulations—traders may be unable to conduct transactions. Naturally, the role of these factors would be at least partly diminished if a large part of trading is automated and the economy is digitally advanced; hence, the potential impact may be stronger in emerging markets rather than in developed countries (Glantz and Kissel, 2013; Ersan and Ekinci,2016). Notably, even if workplaces are not explicitly closed, other "softer" measures may have an indirect impact. For instance, internal travel restrictions may result in disruptions for commuters, and school closures require parents to stay home, which gives rise to significant absenteeism (Epstein et al., 2009; Chen et al., 2011).

The second channel can be described as the "portfolio channel". The policy responses signal changes in the future economic environment, so they may lead to portfolio restructuring. On the one hand, worsening economic conditions may result in changes in cashflow expectations for companies and, thus, portfolio re allocations. On the other hand, investors may be less willing to allocate their money to risky assets, such as stocks. School or workplace closures may signal a deterioration of future household cash flows (Epstein et al., 2009; Chen et al., 2011), which increases the risk premium.

Third, investors can be also influenced by behavioral and psychological factors. Galai and Sade (2006); Karlsson et al. (2009), as well as Sicherman et al. (2016), document the "ostrich effect", which implies that investors are reluctant to monitor their portfolios when bad news is likely to come. In other words, investors may prefer to simply "put their head in the sand" rather than trade when confronted with a stream of negative news on government restrictions. This may be also amplified by the "information overload" effect (Agnew and Szykman, 2005). This contention underlies the idea that when a problem is loaded with information and thus is too hard to understand, an easy solution is just doing nothing. In addition, Thaler and Johnson (1990) show that individuals who experience several consecutive periods of losses

become more loss-averse and avoid taking additional gambles. Pursuant to this line of thinking, trading activity decreases. However, the combination of an increase in loss aversion and information overload may result in an opposite outcome. Information overload may create a divergence of opinions, which manifests increased activity (Harris and Raviv, 1993; Banerjee, 2011). Also, the "flight to liquidity" phenomenon (Ben-Rephael, 2017) behavior may temporarily increase the trading activity, hence, contributing to liquidity. Consistent with this, Hoffmann et al. (2013) show that trading activity increased during the peak of the Global Financial Crisis of 2008–2009. Also, Yeyati et al. (2008) demonstrate that trading volume increases during financial turmoil.

To study the role of non-pharmaceutical interventions in equity market liquidity, we examine daily stock data from 49 developed and emerging countries during the most recent COVID-19 period that runs from January to April 2020. We consider seven different policy responses: school closures, workplace closures, canceling public events, closing of public transportation, public information campaigns, restrictions on internal movement, and international travel controls.4 We estimate several different two-way cluster-robust regression models with an array of control variables to evaluate the influence of non-pharmaceutical interventions from the effect of the pandemic and the market crash.

2.8 Research Hypothesis

H1: There exists a Return spillover from China financial markets to Pakistan, India and Sri Lanka financial markets during COVID-19.

H2: There exists a volatility spillover from China financial markets to Pakistan, India and Sri Lanka financial markets during COVID-19.

CHAPTER 3
DATA AND METHODOLOGY

3.1 Qualitative Analysis

The qualitative research is based on some discussion with experts and interviews of the brokers of Islamabad Stock exchange to shed light on the impact of COVID-19 on the financial markets and how it responded through out the pandemic.

3.1.1 Discussion

The market had witnessed impressive rebound of 362 points on Thursday after Asad Umar, federal minister and the head of National Command and Operation Centre (NCOC), said in no uncertain terms that the "closing down entire cities for weeks was not the solution to curb the spread of the corona virus." The investors thought that it suggested that the centre had prevailed over the Sindh government's plans of a lockdown. Therefore, throwing caution to the wind, the investors started to lap up under-valued stocks and shares of companies anticipated to show strong earnings and dividends in the upcoming financial results.

The index started to rise and by the close of the first half it surged 220 points after touching the intraday high by 330 points. The outbreak of pandemic recording 86 deaths and 4,537 new positive cases on Thursday July 2021 at national average of 7.79pc and one-in-four sick in Karachi, was scary which prompted the Sindh government to declare strict lockdown until Aug 8. When the market opened for second session, investors went into panic selling, ditching stocks at whatever was the available price. It saw erosion of all the gains as the index plunged into the red by 391 points dragging it to 46,921 points, though it managed to crawl slightly up over the 47,000 level before the end of trading.

Foreign investors sold shares worth $0.97m. Individuals dumped stocks valued at $3.57m which were picked up mainly by the mutual funds amounting to $3.92m. Sector-wise, banks, O&GMCs, cement, chemical, refinery and technology bore the brunt of the blow. Steel sector was about the lone good performer due to announcement of price increase by flat steel manufacturers. Stocks that were the worst performers included TRG down by 47 points, FFC (44 points), HBL (39 points), Lucky Cement (23 points) and PPL (17 points). The trading volume edged higher by 5pc to 399m shares.

3.1.2 Interviews

The interviews conducted with the brokers of SAL Securities (Private) Limited and Spinzer Equities (Private) Limited at Islamabad Stock Exchange. The whole interviews are briefly highlighted in a nutshell.

Mr. Mudassar Minhas highlighted that the stock markets of the developed economies were struggling a lot during the pandemic. The stock markets of the developed economies have faced circuit breaks several times during this period. On the other hand, the stock market of developing economies have reported opposite trend. It has a dip at the start but after taking preventive measures by the government, the situation is turning better. These preventive measures, such as relief package for public, industries, small businesses, decline in the interest rate have a positive impact on the stock market. As it becomes easy for the businesses to take loan for operational activities. On other hand, the government has attempted to maintain the industrial consumption through dispersing money to the jobless persons. In a nutshell, the authorities have to foresee the COVID-19 trend, stock market and economy, etc. to take preemptive measures on timely basis. In such scenarios, it is more than important to provide the economic relief to general public and business diaspora. These economic packages help the local community to maintain their demand for industrial goods which trigger the economic activity and attract the investment opportunities.

Mr. Jibran Ali Khan shed light during the discussion that Many businesses just might endure the crisis, while a few might even profit, and clearly, many sectors will suffer greatly. The types of examples include transportation, leisure, hoteling and airlines, which will be definite losers, and home distribution providers as possible winners as will be facemask manufacturers. The unfavorable raw returns generated by all companies but one Goods and Services Second, Power, Transportation, Chemical, Banks and Automobiles suffered especially throughout the pandemic. The petroleum market, for example, is made up of several oil firms that will fail in a crisis, and transport corporations are reducing both human traffic and transportation. Companies related to the medical field have been clear winner in other countries but not in Pakistan. The Goods and Services and utility sectors are the only sectors in Pakistan, which performed well as compared to other industries, as demand for facilities that help jobs at home have skyrocketed. Utilities have benefited significantly, probably because these companies, which are largely local, depend less on foreign markets and competition.

He further highlighted that the effect of policy responses is rather small and limited in scope. Workplace and school closures may limit stock market liquidity, while public information campaigns facilitate additional trading. All these effects, however, are driven solely by emerging markets and play no role in developed countries.

He further highlighted that governments need to be aware that in addition to a vast detrimental economic impact, the COVID-19-related restrictions may adversely influence the trading environment in financial markets. Specifically, the governments need to engage in public information campaigns, which are instrumental in greater trading activity and, consequently, a lower cost of equity capital.

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3.2 Quantitative Analysis

The quantitative analysis will explain the data sample and the econometric methodologies that will be used for data analysis to get the required results.

3.2.1 Data and Sample

This study examines the Return and volatility of stock market indices of China (SSE composite Index), India (Bombay stock exchange), Pakistan (Pakistan stock exchange) and Sri Lanka (Colombo stock exchange) using daily closing indices prices for the period of July 2012 to June 2021 for long term. Specifically to determine the impact of COVID-19 we will use the time period of January 2020 to June 2021.

$$\text{Daily Index return} = \ln(p/p_{t-1}) \qquad (3.1)$$

3.2.2 Methodology

To analyse the Return and volatility from China to South Asian markets, ARMA (p,q) and GARCH-M (p,q) model is used. The necessary conditions are fulfilled before using ARMA (p,q) and GARCH(p,q) model, firstly see the behaviour of data and secondly stationarity and thirdly heteroscedasticity tests of financial series by using descriptive statistics, unit root tests and ARCH effect. Because, financial data must be stationary to apply regression otherwise results will be spurious and auto-regressive moving average (ARMA) models also assume financial series must be stationary. Daily Index return is the first difference of log of stock prices, by definition it would be a stationary series and unit root test in the analysis is just for the confirmation of

stationary series. Covid-19 occurs as a break in the series therefore unit root test with break will be used just for the confirmation of stationerity.

The mean equation of ARCH model explains that whether today's return depends on its lag value or not while variance equation explain that whether previous day's return has effect on today's volatility or not. The econometric equation of mean is as follows.

$$\mathrm{rt} = \beta \circ + \beta 1 \mathrm{rt} - 1 + \varepsilon \mathrm{t} \quad (3.2)$$

Where,

rt = Today's Return

rt-1 = Previous day's Return

The econometric equation of Variance mean is as follow,

$$\sigma_t^2 = r \circ + r1 U_{t-1}^2 + \varepsilon \mathrm{t} \quad (3.3)$$

Where,

σ_t^2= Today's Volatility

U_{t-1}^2= Past Behaviour

Liu and Pan (1997) and Bhar and Nikolova (2007) methodology is used to estimate the effect of volatility from China to South Asian markets. Firstly, ARMA (1,1) and G ARCH (1,1) model is applied on index return of China. The econometric equation is below,

$$r_{j,t} = \lambda \circ + \lambda 1 r_{j,t-1} + \lambda 2 v_{j,t} + \lambda 3 \epsilon_{j,t-1} + \epsilon_{j,t}\ ,\ \ \epsilon_{j,t} \sim N(0, v_{j,t}) \quad (3.4)$$

$$v_{j,t} = \psi \circ + \psi 1 v_{j,t-1} + \psi 2 \epsilon_{j,t-1}^2 \quad (3.5)$$

Where, $r_{j,t}$ is the daily stock index return of index j for China at time t, and $\epsilon_{j,t}$ is the residual (or unexpected return) which is normally distributed with mean zero, time varying conditional variance $v_{j,t}$ and subscript j is used for China. To adjust the possibility of serial correlation in mean equation index is structured by inclusion of ARMA (1,1) model.

Secondly return and volatility spill over effects across South Asian markets are estimated by attaining the standardized residual and its square in the first stage and substituting them in to return and volatility equations of other market indices as follows,

$$r_{m,t} = \lambda \circ + \lambda 1 r_{m,t-1} + \lambda 2 v_{m,t} + \lambda 3 \epsilon_{m,t-1} + \phi 1 \epsilon_{j,t} + \epsilon_{m,t}, \epsilon_{m,t} \sim N(0, v_{j,t}) \quad (3.6)$$

$$v_{m,t} = \psi \circ + \psi 1 z_{j,t-1} + \Psi 2 \epsilon_{m,t-1}^2 + \psi 3 DM * e_{j,t}^2 + \phi 2 e_{j,t}^2 \quad (3.7)$$

Where, the subscript m is used in each equation refer to one of the South Asia market. $\epsilon_{j,t}$ is the standardized residual series to capture the effect of China's index to each of the country from South Asian indices. $\psi 3DM$ is the dummy variable used for COVID-19. To check the volatility spillover effect $e_{j,t}^2$ is the exogenous variable, which is the square of the standardized residual series and is included in conditional volatility equation. $e_{m,t}$ is calculated as ($\in_{j,t} / v_{j,t}$^.5).

CHAPTER 4
RESULTS AND FINDINGS

In this chapter the descriptive statistics, unit root tests, ARCH effect and the mean and volatility spillovers from China to Pakistan, India and Sri Lanka are explained along with numerical values in the tables and interpretations of the results.

4.1 Descriptive Statistics

The descriptive statistics and the behaviour of all indices return including mean, Standard deviation, Kurtosis, Skewness, Minimum value and Maximum value in a day is given in table 4.1. The graphical representation of Descriptive statistics are given in the appendix A.

From the table 4.1, it shows that mean return for all indices are positive. From the above statistics it can be observed that Chinese market has maximum standard deviation of 1.1114 percent which reflects that Chinese market is more volatile and Sri Lankan market has standard deviation of 0.6860 percent which shows that Sri Lankan market is less volatile as compared to other South Asian markets. The skewness results from the table show that indices returns of South Asian markets are negatively skewed, which indicate that there is a large negative returns i.e minimum extreme values. On contrary we can observe from the same table that Sri Lanka market is positively skewed and specifies the higher positive returns i.e maximum extreme values dominate in Sri Lanka. The values of the kurtosis from the table 4.1 which are greater than 3, it means that the distributions of the returns are leptokurtic indicating higher peaks than expected one from the normal distribution. In short we can conclude from the descriptive statistics table that, as Sri Lankan market is less volatile but the minimum value and maximum value per day is also reported by the same Sri Lankan market.

Table 4.1: Descriptive Statistics for the period of 2012-2021

	China	**Pakistan**	**India**	**Sri Lanka**
Mean	0.0145	0.0367	0.0335	0.0180
Std. Deviation	1.1114	0.8572	0.8928	0.6860
Kurtosis	15.229	11.262	35.160	176.58
Skewness	-1.2523	-0.7144	-1.5488	4.6473
Minimum	-8.8729	-7.1024	-14.101	-7.9611
Maximum	5.6036	4.6839	8.5947	18.400

4.2 Unit Root Tests

The unit root test results of Zivot-Andrews unit root test are given below in Table 4.2. The Table 4.2 shows that tests statistic results are less than critical values, which means that the reported values show that data is stationary. P values for all series are also significant. However, the null hypothesis has been rejected in all series which shows that all series are stationary. Hence it gives the evidence that stationarity condition for ARMA(1,1) and GARCH-M(1,1) is fulfilled.

Table 4.2 Zivot-Andrews Unit Root Test

	T- Statistics	**P Values**
China	-32.73	0.0013
Pakistan	-27.98	0.0117
India	-57.37	0.0001
Sri Lanka	-24.60	0.0156
1% Critical.Value	-5.57	0.05
5% Critical.Value	-5.08	0.05
10%Critical.Value	-4.82	0.05

Note: *The significance level is 95%.

4.3 ARCH Effect

The Table 4.3 presents the results of ARCH effect in which the values of Observed R squared are statistically significant for China, Pakistan and India but insignificant for Sri Lanka and similarly the Null Hypothesis of no heteroscedasticity is rejected for China, Pakistan and India which means that heteroscedasticity is there in the form of ARCH(p,q) effect. However, the rejection of null hypothesis in the series of China, Pakistan and India shows that variance is not constant and is varying through out the series, so in this case we can go for the GARCH family of models to check the impact on returns and volatility and the spillover from China financial markets to the financial markets of south Asian countries during COVID-19.

Table 4.3 Diagnostic Test (ARCH Effect)

	China	**Pakistan**	**India**	**Sri Lanka**
Obs*R-squared	87.7895	67.3622	14.9939	1.0038
Prob. Chi-Square(1)	0.0000*	0.0000*	0.0001*	0.3164*

Note: * Indicates 1% Significance level.

4.4 Mean and Volatility Spillover effects

The estimated results of mean spillover and volatility spillover effects as modeled by ARMA (1,1) and GARCH-M(1,1) from China to South Asian markets are drafted in table 4.4. The Graphical representation of GARCH-M(1,1) is given in the appendix A. The results of table 4.4 indicate that both ARCH and GARCH coefficients are statistically proven significant. The significance of ARCH effect indicates that past price behaviour significantly influences the volatility of the markets. As far as small shocks create less volatility and large shocks create high volatility. The GARCH term is also significant which indicates that there is persistence of volatility within the market. The ARCH and GARCH coefficient is near to one in case of China, Pakistan and India which specify and explains that the persistence of volatility is long term in these markets. The coefficients of $\phi 1$ and $\phi 2$ are also significant, which reports that there is a presence of mean spillover effect and volatility spillover from Chinese financial market to South Asian financial markets. We observed from the results that

the magnitude of the coefficients related to volatility spillover is higher for Pakistani stock market. The coefficient of COVID-19 dummy indicates that there is a volatility spillover during the COVID-19 period from China to the the South Asian financial markets. The magnitude of the coefficient for the dummy of COVID-19 is greater for India which means that more volatility spillover was observed in Indian financial markets followed by Pakistan financial market. Indicating that impact of COVID-19 shocks in Chinese financial market to the South Asian financial markets.

The Chinese market influence return of Pakistan and Indian market during the period of COVID-19. Consequently we can say that positive shocks increase returns and negative shocks decreases returns in these markets. So far as volatility spillover is concerned, it is evident from the results and stats as well that shock in China financial market increases volatility in Pakistani and Indian markets. The results show that the coefficient of Chinese market shock is positive which indicates that the effect will be positively increasing on the financial markets of South Asian countries. As far as the case of Sri Lankan market is concerned, where different behaviour is observed as the volatility reduces on arrival of unexpected information from Chinese market. There is a possibility that news of the shock is positive due to some developments agreements between Sri Lanka and China specifically in Infrastructure development in the previous decade.

Table 4.4 Mean and Volatility Spillovers from China to South Asian Indices Estimated from ARMA (1, 1)-GARCH (1, 1) on Daily Stock Return for the Period of 2012-2021

	China	**Pakistan**	**India**	**Sri Lanka**
λo	0.0271 (0.0007)	-0.0146 (0.0553)	-0.0317 (0.0502)	
λ1	0.0132 (0.0280)	0.6752 (0.1075)	0.6023 (0.8711)	
λ2	0.6055 (0.0236)	-0.6010 (0.1157)	-0.5923 (0.8806)	
λ3	-0.7997 (0.0531)	0.1277 (0.0786)	0.1220 (0.0741)	
ϕ1		0.0520*** (0.0079)	0.1416*** (0.0067)	
Ψo	0.0055 (0.0006)	0.0175 (0.0017)	0.0094 (0.0012)	
Ψ1	0.0869 (0.0059)	0.0706 (0.0043)	0.0460 (0.0032)	
Ψ2	0.9071 (0.0055)	0.9041 (0.0052)	0.9370 (0.0046)	
Ψ3		0.0057*** (0.0025)	0.0140*** (0.0026)	
ϕ2		0.0120*** (0.0014)	0.0087*** (0.0011)	

Note: *** indicates the significance at 99%. And the values in parenthesis represent Standard Error.

4.5 GARCH Diagnostics

In the table 4.5 below shows that the prob. Chi-square(1) values for all the countries GARCH tests are not significant which means that the GARCH tests have passed the residual test of heteroskedasticity.

Table 4.5 GARCH Diagnostics(ARCH LM)

	China	**Pakistan**	**India**	**Sri Lanka**
Obs*R-squared	1.3936	0.0860	2.5375	
Prob. Chi-Square(1)	0.2378	0.7693	0.1112	

In table 4.6 the Correlogram of standardized residual the Autocorrelation and partial Autocorrelation both lies in the confidence intervals level. As the P values for Q-Stat are above 5% which means that the P values are not significant. This indicate that there is no serial correlation.

Table 4.6 GARCH Diagnostics(AC and PAC)

Autocorrelation	**Partial Autocorrelation**	**Q-Stat**	**Prob***
-0.02	-0.02	1.39	0.23
-0.02	-0.02	2.73	0.25
0.03	0.03	7.32	0.06
0.01	0.01	7.71	0.10
-0.02	-0.02	10.5	0.06
-0.01	-0.02	11.6	0.07

CHAPTER 5
CONCLUSION

5.1 Key Findings

This research fundamentally examines the mean and volatility spillover effects from China financial markets to South Asian financial markets i.e Pakistan, India and Sri Lanka for the period of July 2012 to June 2021 by using ARMA(1,1) and GARCH-M (1,1) Model. If we look into the history then U.S. has been observed quite influencing in this region. Because this belt has always been a potential of economic integration but due to protectionist policies and political tensions and some other factors the regional trade agreement failed to break down the trade barriers for years. But for the last two decades of period China has significantly emerged as a potential economic partner of the South Asian belt and its significance presence is also visible due to a leading role in infrastructural developments.

Consequently,the results also provide the evidence of that Chinese financial market shocks transmit to South Asian financial markets. As the coefficient of Chinese financial market influence on returns of South Asian financial markets is positive, which specifies and explains itself that positive shocks increase returns and negative shocks decrease returns in these markets. As far as the coefficient of volatility spillover is concerned, it is significant and positive in Pakistani and Indian financial markets that indicate that positive and negative news has the same effect, which results in increase of volatility in Pakistan and Indian financial markets. The magnitude of the coefficients related to volatility spillover is higher for Pakistani stock market. In case of Sri Lanka, different behaviour is observed for Sri Lankan financial market as volatility is being noted as reduces on arrival of unexpected information from China financial market. In this research specifically the effect of shocks of COVID-19 on volatility of Pakistan and India financial markets are significantly different from previous years and lower volatility shocks are observed. Hence it can be concluded that economic integration of China with Asia is playing a significant and vital role in financial markets of the South Asian region. The same pattern is observed for other markets. These dynamics provide the evidence that each market of the south Asian region is influenced by Chinese market in some direction and economic linkages are now transforming into somehow financial linkages.

The findings of these results are consistent with those provided by Fraz and Hassan(2006) and supported this study as they worked on CPEC and return and volatility spillover effect of China financial markets over the South Asian belt including Pakistan, India and Sri Lanka.

5.2 Policy Implications and Recommendations

This research investigated that how the volatility from China financial markets during COVID-19 transfer to three South Asian markets I.e India's Bombay (BSE), Pakistan's Karachi Stock Exchange(KSE), Sri Lanka's Colombo Stock Exchange (CSE). This study aimed to explore the impact of COVID-19 on the return and volatility of South Asian financial markets using econometric methodologies.

This study will contribute to the financial markets related literature for any such unpredictable and drastic events which may happen in the future. This will be helpful for all the financial market stakeholders including Investors, firms and policy makers to have a layout and enriched literature in order to deal with such unpredictable situations globally or region wise efficiently and effectively. It will highlights that what governments need to be aware that in addition to a vast detrimental economic impact, the COVID-19-related restrictions may adversely influence the trading environment in financial markets.

Our results encourage governments and policy makers to engage in public information campaigns, which are instrumental in greater trading activity and consequently, a lower cost of equity capital. This study can be helpful for the investors as the investors can take precautionary steps before trading in stocks during the period of any such pandemic events. Risk averse investors can avoid trading during such events restrictions to avoid the risk linked with volatility of stocks in the lockdown period.

Firstly, the Government must facilitate the investors in monetary terms as it will boost the investors confidence to take loans and make their investments in the market during such Pandemics or unpredictable events. This will deliver a positive signal to the investors.

Secondly the Government and concerned ministries should announce the economic packages for general public and small businesses. The exporters must be the part of those economic packages in order to enhance the exports and economic activities in

the country. As a result of such significant and timely measures the stock market will start booting up.

Thirdly, the government policy makers must make a policy for such events in future that there must be economic packages for the industries and economic aid to general public which will help to maintain their consumption of industrial goods and the increase in business activities. The results will be in the form of trading in the financial markets.

5.3 Future Research and Limitations

This study explores the pairs of financial markets to financial markets return and volatility spill during the full sample period from 2012 to 2021 specifically to check the impact of COVID-19. This study can be extended in various ways, Like

1. This study focuses on the spillovers from Chinese Stock market to the South Asian stock markets (Pakistan, India and Sri Lanka) during COVID-19 pandemic. Further studies can be conducted on spillovers from the US stock, Chinese Stock, crude oil, and gold markets to the emerging (Europe, Middle East, and Africa) and frontier (Asia, Europe, Middle East, and Africa) stock markets during the global pandemic of COVID-19.
2. Several other pairs of markets are also recommended to explore during COVID-19, i.e., stock-bond, stock-real estate, stock-industrial metals, metals energy, stock-exchange rate, metal-exchange rate, and energy-exchange rate, etc.
3. This study just apply the ARMA(1,1) GARH-M(1,1) model to examine the spillover between financial markets. However, several other techniques can be applied to examine return and volatility spillover between markets during the COVID-19, i.e., BEKK-GARCH, DCC-GARCH, Diebold and Yilmaz approach, and Copulas methods, etc.
5. This study calculates the return and volatility spillovers. In addition, it is also suggested to explore the determinants of return and volatility spillovers during the pandemic and non pandemic periods.
6. Two big events (Chinese market crash of 2015 and the COVID-19 outbreak) were emerged from China, so it is also suggested to examine the differences in spillovers during both crisis.

7. This study uses the daily data, it is suggested to explore the spillovers between markets using intraday data during the pandemic of COVID-19. Overall, the COVID-19 pandemic provides the huge room for further analysis, because this crash is not fully explored in literature yet.

8. As this study uses the COVID-19 as dummy variable, the infectious disease uncertainty index (policyuncertainty.com) could be used in the future studies.

9. In future the connectedness approach based on TVP-VAR models can be used for this purpose.

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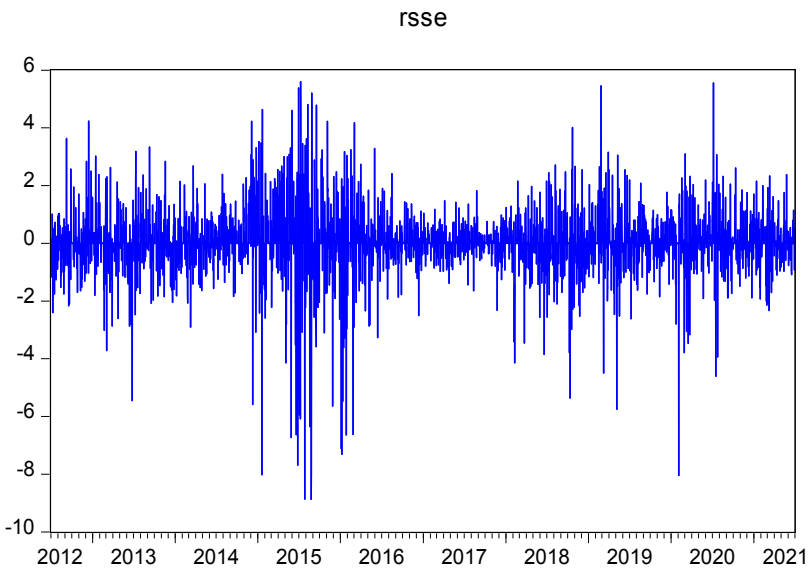
APPENDICES

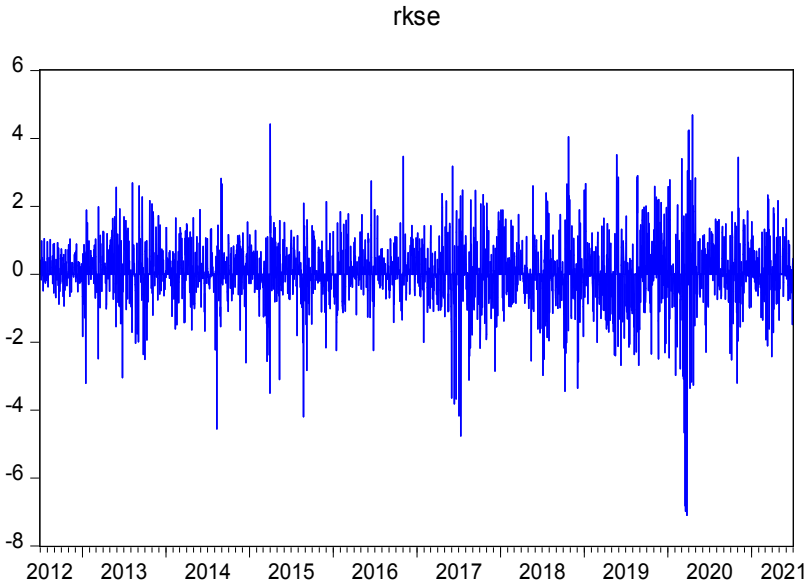
Appendix A

The graphs are given below for each country separately based on the their daily return series data.

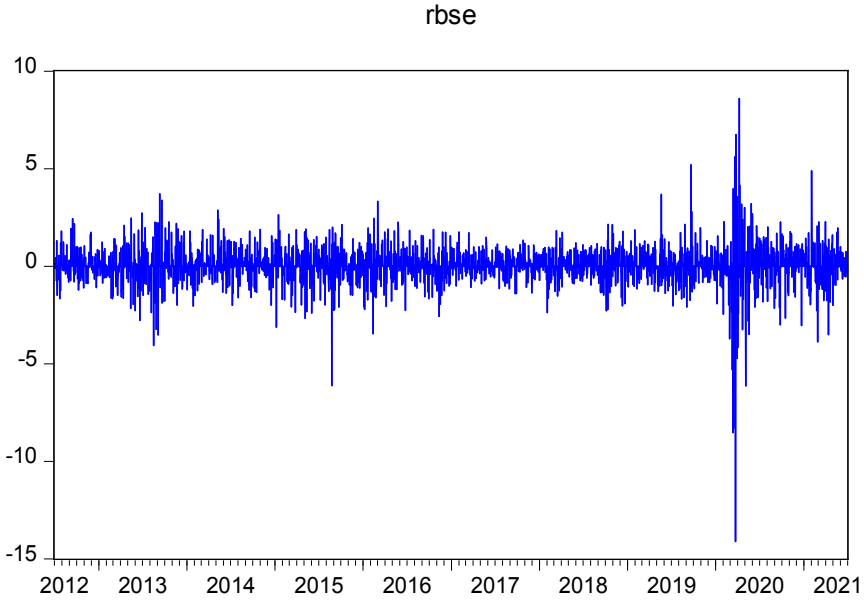
China (RSSE)



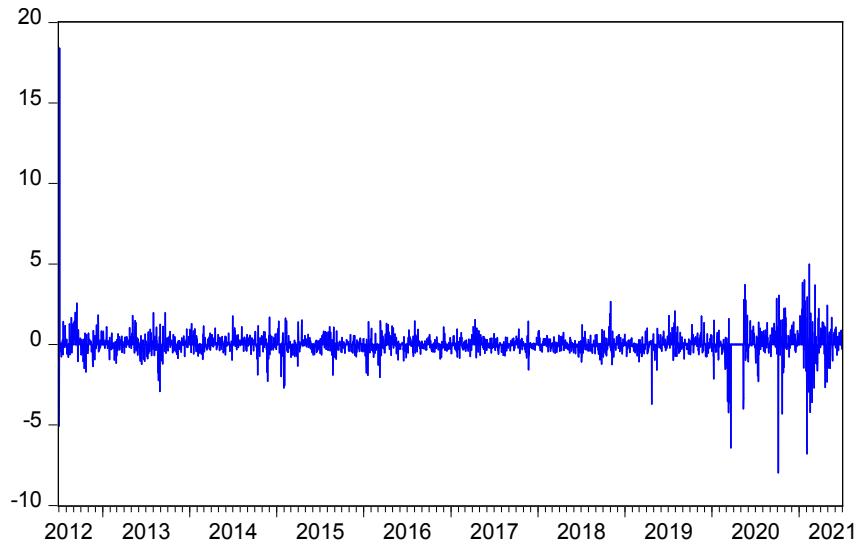
Pakistan (RKSE)



India (RBSE)



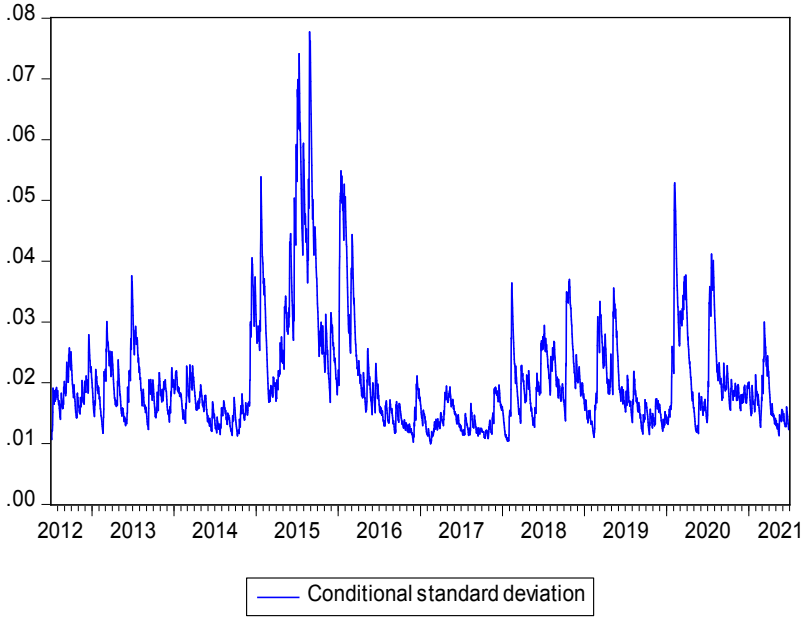
Sri Lanka (RCSE)



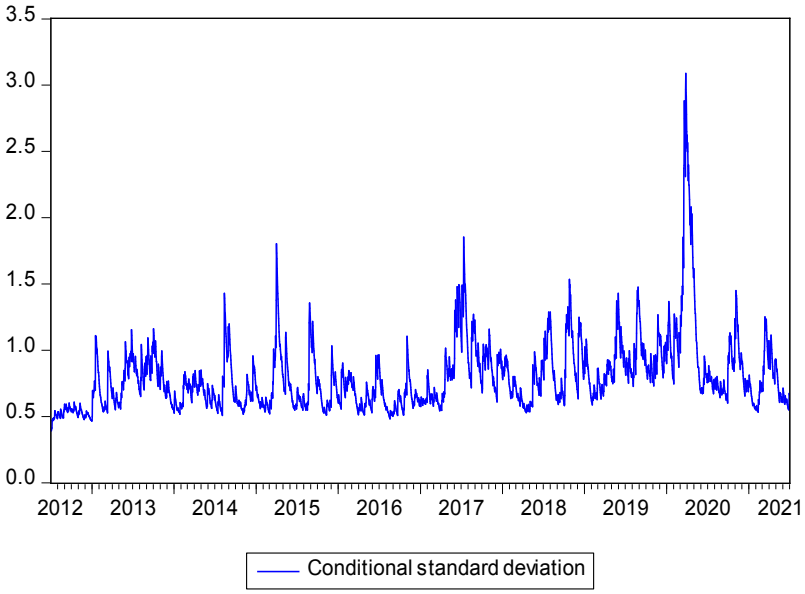
1. GARCH Graphs

Following graphs show the GARCH effect of the returns series of each country with conditional Standard deviation.

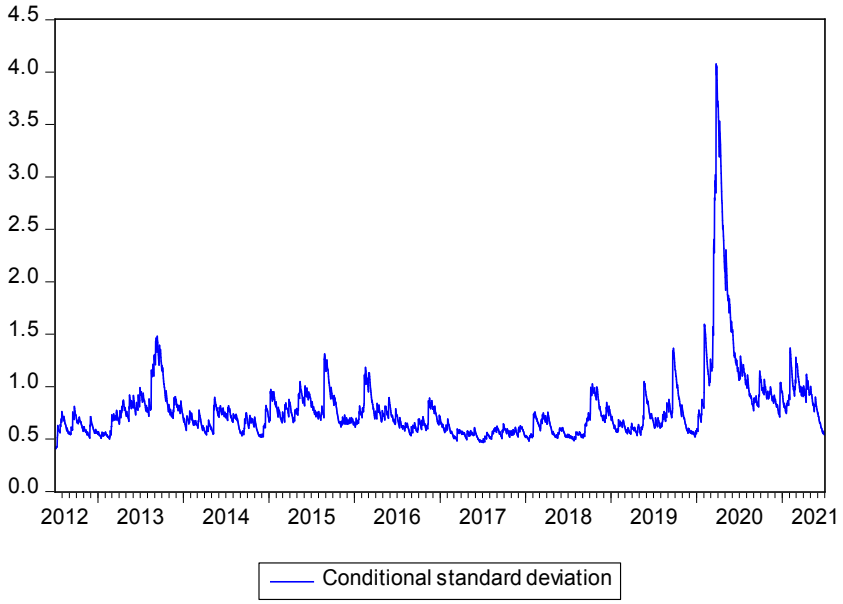
GARCH for China (RSSE)



GARCH for Pakistan (RKSE)



GARCH for India (RBSE)



GARCH for Sri Lanka (RCSE)